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Appendix B

Technical Memorandum 2—Pollutant Loading Model:
Mill River Watershed-Based Plan

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M E M O R A N D U M

TO: Nicole Davis and Gwen Macdonald, Save the Sound

FROM: Erik Mas, P.E, Julianne Busa, Ph.D., and Stefan Bengtson, MSc, Fuss & O'Neill, Inc.

DATE: May 16, 2018

RE: **Technical Memorandum 1 – Pollutant Loading Model**
Mill River Watershed-Based Plan

This memorandum summarizes the methods and results of a pollutant loading model that was developed for the Mill River watershed in support of a watershed-based plan. Pollutant loads characterize the amount or mass of a given pollutant delivered to a water body over a period of time. Estimation of pollutant loads from a watershed therefore provides insight into the relative contributions of pollutants from different land uses and land use practices within a watershed and is a key element of the EPA watershed-based planning process.

1. Introduction

The Watershed Treatment Model (WTM), developed by the Center for Watershed Protection, was used to estimate annual pollutant loads from the following subwatersheds, which are modified from the 14 Connecticut Local Drainage Basins that comprise the Mill River and Willow Brook Subregional Basins (**Figure 1**):

- Butterworth Brook and other Mill River Tributaries
- Eaton Brook
- Lake Whitney
- Lower Mill River
- Middle Mill River
- Shepard Brook
- Upper Mill River
- Willow Brook
- Willow Brook Tributaries

The WTM is a screening-level model that can be used to estimate the loading of pollutants to a waterbody based on land use and other activities within a watershed. Based on user-specified inputs describing characteristics of the watershed, the WTM estimates pollutant loads from various land uses and activities, as well as load reductions associated with structural and non-structural best management practices. While fecal indicator bacteria impairments are the primary focus of the watershed based plan, the WTM also provides loading estimates for other pollutants including total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). BMPs that will be

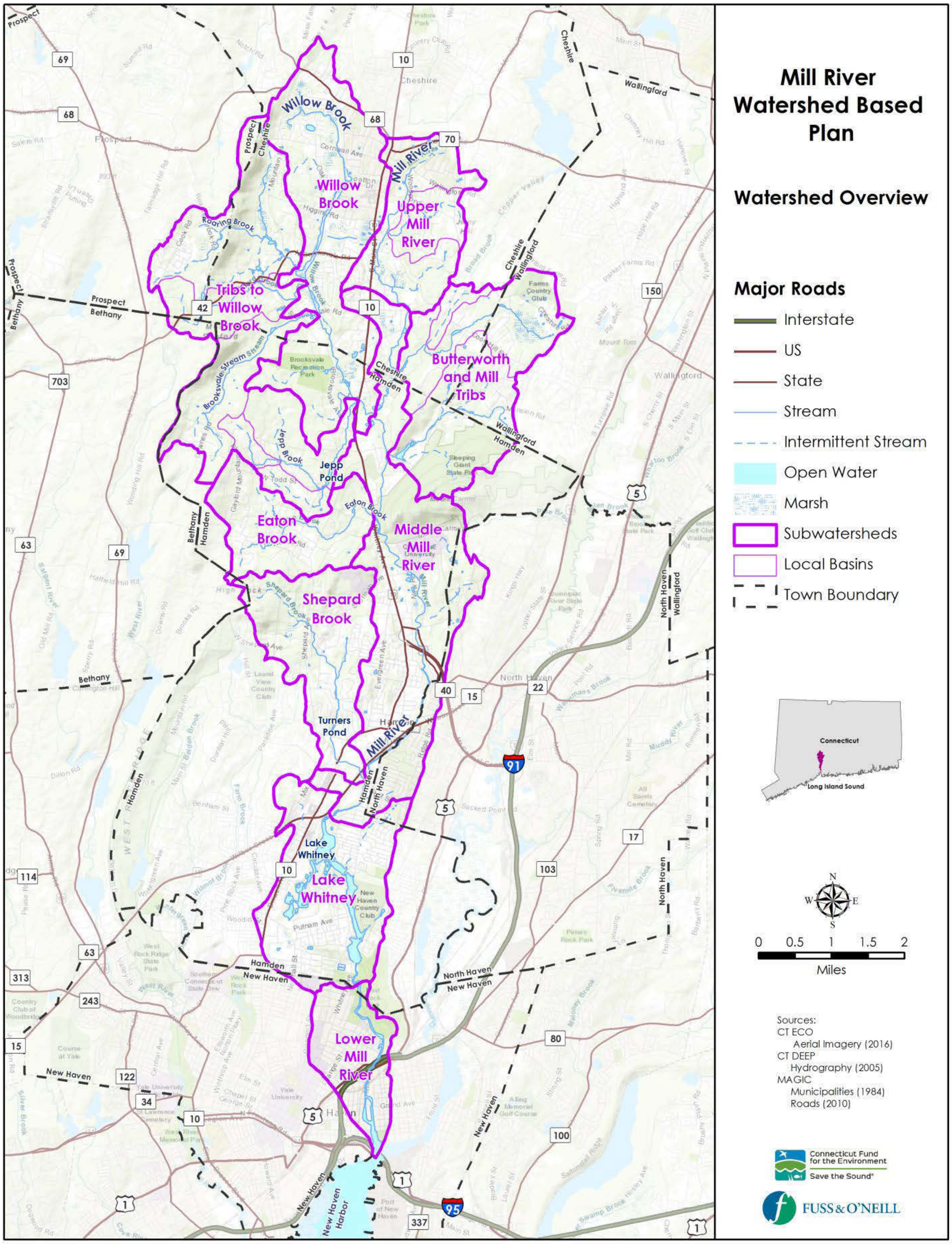

Figure 1: Mill River subwatersheds identified for use with pollutant load modeling

recommended in the watershed-based plan will not only help to reduce bacteria but may also help to reduce these other pollutants.

2. Model Inputs

Primary Sources: Land Use Nonpoint Source Runoff

Land use is considered a primary source of runoff pollutant loads in the WTM, which uses a loading calculation known as the Simple Method (Schueler, 1987) to calculate nutrient, sediment, and bacteria loads from urban land uses, and area loading factors to calculate loads from non-urban land uses. 2016 parcel-based land use data available from the Naugatuck Valley Council of Governments (NVCOG), aggregated land use data from the South Central Regional Council of Governments (SCRCOG), and U.S. Census Block-level data were adapted for use with the WTM. Impervious area for each land use category was calculated from the 2016 CTECO impervious cover dataset. **Table 1** in *Attachment A* summarizes the modeled land use category and impervious area for each land use classification and provides a breakdown of existing modeled land use by subwatershed. **Table 2** in *Attachment A* links land use categories from the COG data to the corresponding categories used in the model.

Model inputs were specified for each land use category, including area, impervious cover, runoff coefficient, and runoff pollutant concentrations or export coefficients. Literature-based event mean concentration (EMC) values (the mean concentration of a pollutant in stormwater runoff for each land use type) were used for all developed land use categories, while selected regional export coefficients were used for non-urban land uses. Available land use data largely did not distinguish among non-urban land uses. These were therefore aggregated into an "Open Space" category that included forested land, wetlands, and other similar land cover types. WTM default export coefficients were used for forest, utilities (i.e. electrical transmission lines), and open water land use categories. The export coefficients for agricultural land use were approximated as the area-weighted average of the export coefficients of row crop and pasture sub-categories, reflecting the different pollutant loads expected from these two types of agricultural use. Utilities were modeled under a "Rural" land use category, enabling the model to capture the impervious nature of land use in utility right of ways. **Tables 3 and 4** in *Attachment A* summarize the selected EMC and export coefficient values and associated references. Average annual precipitation for the watershed (49.22 inches) was estimated from the average precipitation recorded at the Mt. Carmel station in Hamden over the period of record (1936-2018) (Northeast Regional Climate Center http://www.nrcc.cornell.edu/).

Secondary Sources

In addition to pollutants generated from land uses, the WTM estimates pollutant loads from other activities or sources (secondary sources) that may be present, but are not necessarily associated with a particular land use. The following secondary sources were included in the WTM for the Mill River watershed; **Table 5** in *Attachment A* provides more detail on the corresponding model assumptions and **Table 6** in *Attachment A* lists the relevant model inputs for each source across the watershed.

- **Failing or Malfunctioning Septic Systems/Subsurface Waste Disposal Systems** – While much of the Mill River watershed is served by sanitary sewers, 11% of homes have septic systems. A septic system failure rate of 1% was assumed for residential areas throughout the watershed. This rate represents an estimate based on regional failure rates and information provided by Chesprocott and Quinnipiac Health Districts. Based on a review of aerial imagery, tax assessor's database information, and land use mapping, an estimated 3% of septic systems in the watershed are within 100 feet of surface water bodies, with the values for individual subwatersheds ranging from 0-10%.

- **Stream Channel Erosion** – Due to the limited data available on stream channel erosion loads in the watershed, a simplified approach was used in which stream channel erosion sediment loads were estimated as a fraction of total watershed sediment load, based on overall stream channel stability. Stream channel erosion sediment loads were assumed to be 50% of the total sediment load for the watershed (reflecting "medium" stream channel degradation and stability), consistent with the model guidance.

- **Livestock** – This secondary source accounts for pollutant loads from animals that are confined (e.g., feedlots, stables). In the model, pollutant loads associated with pastured animals are simulated as Primary Sources (i.e., cropland land use). Livestock in the watershed are largely horses in stables and are sparse throughout the watershed. There are small and large stable operations in the watershed, estimated to range from 15 to more than 40 horses (Giant Valley Polo Club). Estimates of head per subwatershed were based on 2016 3-inch resolution aerial imagery, which was sufficiently detailed to count individual grazing horses. **Tables 7 and 8** in *Attachment A* summarize livestock head counts and other model inputs for the Livestock Secondary Source.

  Note that pollutant loads from domestic animals and wildlife, which are potentially significant sources of bacteria and nutrients to the Mill River given the large amount of residential land use, open space, and parkland in the watershed, are accounted for in the modeled land use pollutant export coefficients.

- **Road Sanding** – Sediment loads from road sanding were calculated based on a 2015 CTDOT report entitled Winter Highway Maintenance Operations. The report includes a survey of 31 municipal public works operations and reveals an average annual application rate of 6.1 tons of sand per lane mile between 2009 and 2014. Lane miles were determined from the UCONN MAGIC roads dataset (2010), which indicates road jurisdiction. Municipal roads were assumed to be uniformly two-lane. Information from Public Works staff in the municipalities, in conjunction with their most recent MS4 Annual Reports, was used to determine the extent of road sanding. Some municipalities no longer use sand in de-icing operations, while others use a mixture of sand and salt. The exact ratio of sand to salt was not reported and was assumed to be equal portions of each. The Connecticut Department of Transportation does not apply sand to state roads, so state-maintained roads were not included in the calculation of lane miles.

- **Potential Illicit Connections** – In areas served by sanitary sewers, illicit connections were assumed for one in every 2,000 sewered connections and 5% of businesses, consistent with values reported in several national studies, modified to account for local conditions. Model default pollutant concentrations and daily flow values were used.

- **Point Sources** – Discharge Monitoring Reports obtained from the EPA's Integrated Compliance Information System (ICIS) website revealed two sites in the Lower Mill River subwatershed where water quality sample collection for bacteria or nutrients is required under a facility's NPDES permit. A number of other sites require only visual monitoring or sample collection for metals. Bacteria sampling is routinely required for wastewater treatment plants, but there are none in the watershed.

- **Combined Sewer Overflows (CSOs)** – Three CSOs exist in the Lower Mill River subwatershed. Since approximately 2012, the Greater New Haven Water Pollution Control Authority (GNHWPCA) has monitored these discharge locations to track when the overflows are activated and what volume is discharged. Sufficient data has now been collected by GNHWPCA that they estimated a "typical year" of discharges in the most recent Consent Agreement Annual Progress Update (GNHWPCA, 2017) to the CT Dept. of Energy and Environmental Protection (CT DEEP). These annual volume estimates are specific to each discharge location. Concentrations of bacteria, nutrients, and total suspended solids were taken from Technical Memorandum #6 of the approved CSO Long Term Control Plan (CH2MHILL, 2000) and are identical to those used in the West River Watershed Based Plan.

- **Sanitary Sewer Overflows (SSOs)** – SSOs occur when flow in the sanitary sewer system surpasses capacity. Discharge of untreated sewage then occurs, typically to the storm sewer system. Municipalities and/or water pollution control authorities (WPCAs) are required to report such overflows. None were reported from Wallingford, Cheshire, or North Haven sewer authorities. GNHWPCA estimated that over the past three years, some 150 gallons had been discharged from the sanitary sewer. This annual rate of 50 gallons per year was distributed equally among the four watersheds served by GNHWPCA (Middle and Lower Mill River, Lake Whitney, and Shepard Brook).

- **Catch Basin Cleaning** – Annual catch basin cleaning was assumed throughout the watershed, based on information provided in the most recent MS4 Annual Reports of several of the watershed communities, including Cheshire, Wallingford, Hamden, North Haven and New Haven. Catch basin capture area was based on the acreage of impervious surfaces within the watershed as calculated by the model, the percentage of the subwatershed serviced by storm sewers, and the reported proportion of catch basins cleaned.

- **Street Sweeping** – The watershed municipalities generally perform annual street sweeping in the spring after the winter deicing season. Annual street sweeping was assumed in the model. Mechanical sweepers and parking restrictions were also assumed.

- **Riparian Buffers** – The effects of riparian buffers on pollutant load reduction are calculated within the model based on the area of natural land between developed land (residential, commercial, industrial, roadway, etc.) and the stream in each subwatershed. The widths of riparian buffers were estimated from GIS-processed land cover data.

3. Model Results

Existing Pollutant Loads

Before load reductions are applied, nonpoint source runoff associated with land use alone accounts for approximately 79% of the total nitrogen (TN) load, 43% of the total phosphorus (TP) load, 70% of the total suspended solids (TSS) load, and 74% of the fecal coliform (FC) load for the entire watershed.

Annual loads of bacteria, TP, TN, and TSS were estimated for each subwatershed individually (**Figures 2, 3, and 4**) and are provided in **Tables 9.1 – 9.9** in *Attachment A*. The model results indicate that the three most densely developed subwatersheds, Middle Mill River, Lower Mill River, and Lake Whitney, also have the highest annual bacteria loads (**Figure 2**). This is unsurprising, as the primary land uses and activities in these subwatersheds have higher EMCs and pollutant loading factors (e.g., dense residential areas, industrial and commercial operations, and road sanding). TN and TP loads are highest in the Middle Mill River, Willow Brook Tributaries, and Willow Brook subwatersheds (**Figure 3**). TSS loads are highest in the Middle Mill River, Willow Brook, Lake Whitney, and Willow Brook Tributaries subwatersheds (**Figure 4**).

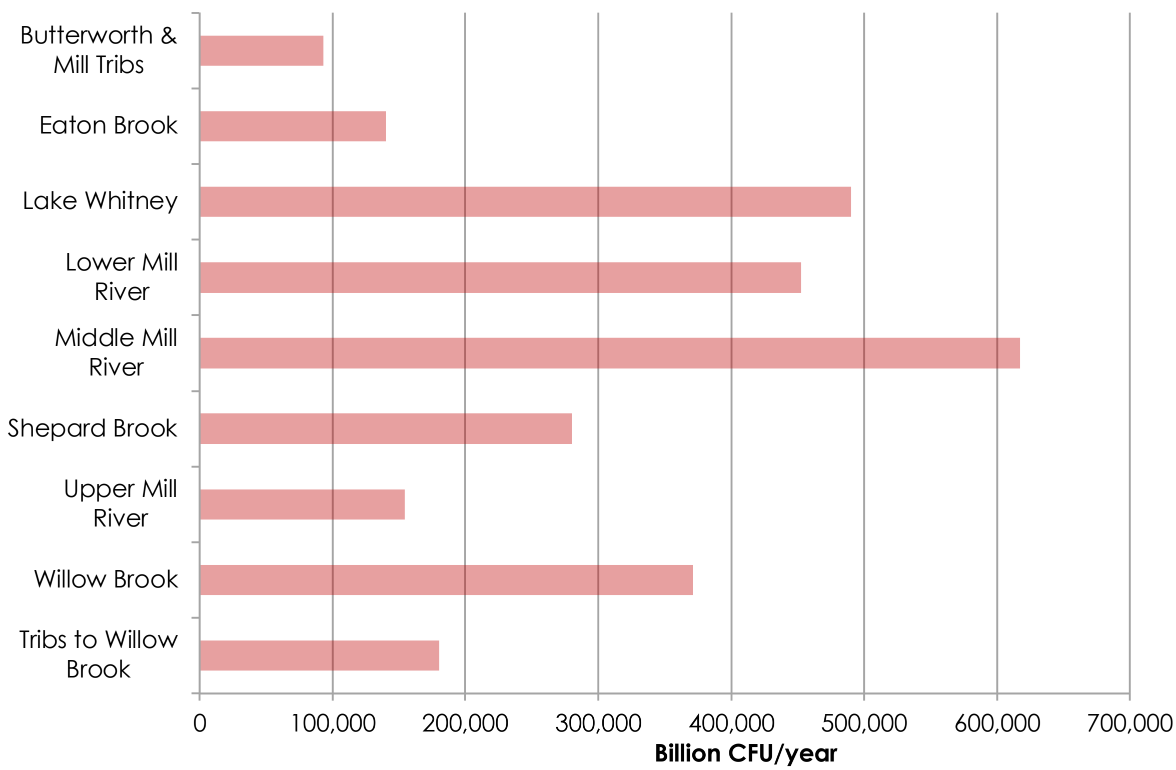

Figure 2: Modeled bacteria loads by subwatershed

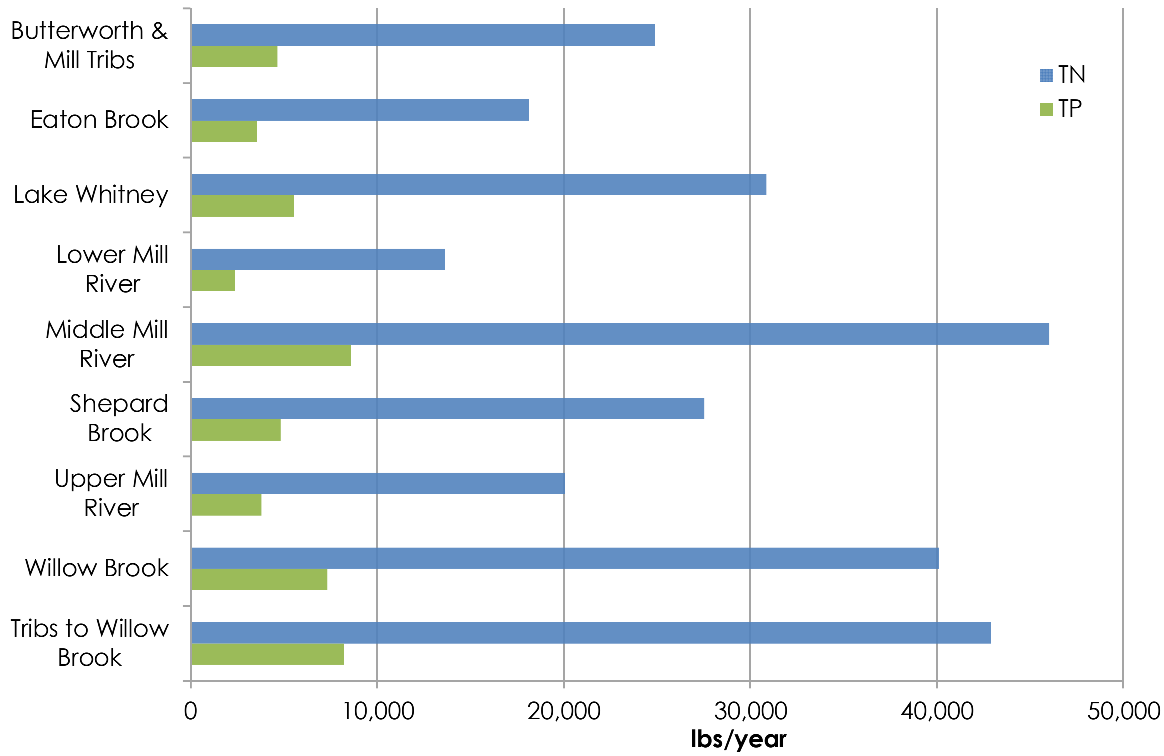

Figure 3: Modeled Total Nitrogen (TN) and Total Phosphorus (TP) loads by subwatershed

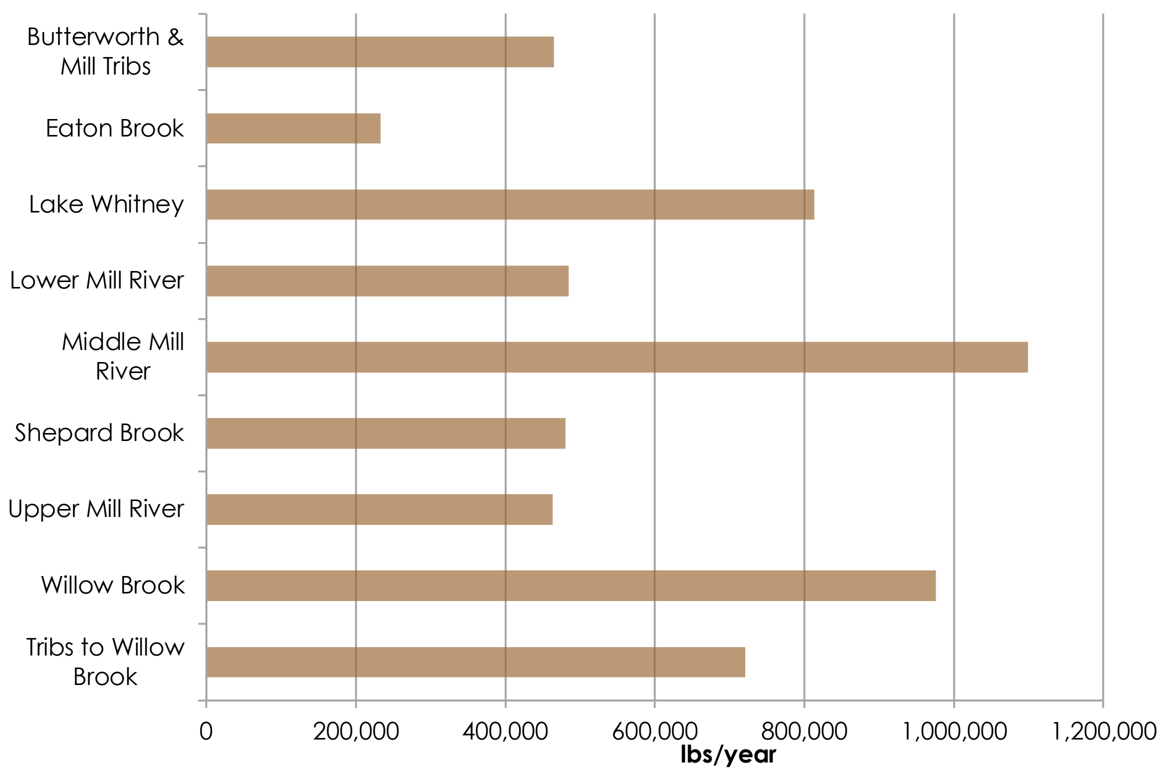

Figure 4: Modeled total suspended solids (TSS) loads by subwatershed

Existing Pollutant Yields

Watersheds differ in area, which directly influences pollutant loads – a larger watershed may have a higher load than a smaller watershed simply because it has a larger area. To remove this effect, pollutant loads were divided by the subwatershed area to derive a per-acre pollutant "yield," which provides a better comparison of pollutant contributions among subwatersheds of varying sizes (**Figures 5, 6, and 7**).

Whereas the Middle Mill River has the highest annual bacteria load, after adjusting for subwatershed size, the Lower Mill River has by far the highest bacteria yield (**Figure 5**). This result is attributable to the contribution of CSOs, which are present in only the Lower Mill River subwatershed, and which discharge substantial concentrations of bacteria during overflow events. The Lake Whitney subwatershed has the next highest bacteria yield, reflecting the high intensity of developed land use. In general, the Mill River subwatersheds can be grouped into three categories based on bacteria yield: lower development intensity (Butterworth Brook and other Mill River tributaries and Willow Brook Tributaries), higher development intensity (Lake Whitney, Middle Mill River, and Shepard Brook), and CSO-influenced (Lower Mill River), with the remaining subwatersheds (Eaton Brook, Upper Mill River, and Willow Brook) falling somewhere between the low and high development intensity groups. The higher development intensity subwatersheds are composed of relatively larger percentages of developed land uses with higher EMCs and greater commercial development with potential for illicit connections. In contrast, the Butterworth Brook and other Mill River Tributaries subwatershed, the fourth largest of the nine subwatersheds considered in this study, has among the lowest annual loads and yields for all pollutants considered. This reflects its more forested nature (e.g., it contains Sleeping Giant State Park) and somewhat limited development relative to other subwatersheds.

As a double check on the validity of the WTM results, the modeled pollutant yields were compared with those of the U.S. Geological Survey (USGS) SPAtially Referenced Regressions On Watershed Attributes model (SPARROW) for TN and TP for the overall Mill River watershed (Moore, Johnston, Robinson, & Deacon, 2004). Comparison of the yields in **Table 1** shows that there is good agreement between the two models. WTM results are within the same order-of-magnitude and slightly above the range of SPARROW values. This result is not surprising since the SPARROW results are based on data from 1993 and the intensity of development in the watershed has increased since that time.

Table 1: Comparison of TN and TP estimates

Parameter	TN	TP
WTM (lbs/acre/yr)	8.35 – 13.5	1.56 – 2.37
SPARROW (lbs/acre/yr)	>8.94	0.2 – 1.6

Most subwatersheds have similar modeled nutrient yields for TN and TP (**Figure 6**), though nutrient yields from Shepard Brook are slightly higher resulting from its combination of land use and relatively higher amount of turf area. As with bacteria yields, the Butterworth Brook and other Mill

River Tributaries subwatershed and Willow Brook Tributaries subwatershed have the lowest nutrient loads (**Figure 6**), owing again to their lower development intensity.

The Lower Mill River subwatershed has the highest modeled TSS yield (**Figure 7**), despite having a low suspended sediment load (a result of its being the smallest subwatershed). The variability in TSS yields across subwatersheds reflects the variability of pollutant sources and existing management practices among municipalities, but these relationships can be complex. In the Lower Mill River subwatershed, for example, the City of New Haven and CTDOT no longer use sand in their deicing practices, which reduces sediment loading, but this improvement is offset by the relatively greater concentration of impervious cover in the subwatershed, which increases sediment loading from other land uses. In subwatersheds like the Lake Whitney subwatershed, where much of the population resides in medium density single family homes, greater turf cover can have higher nutrient loads driven by turf management practices.

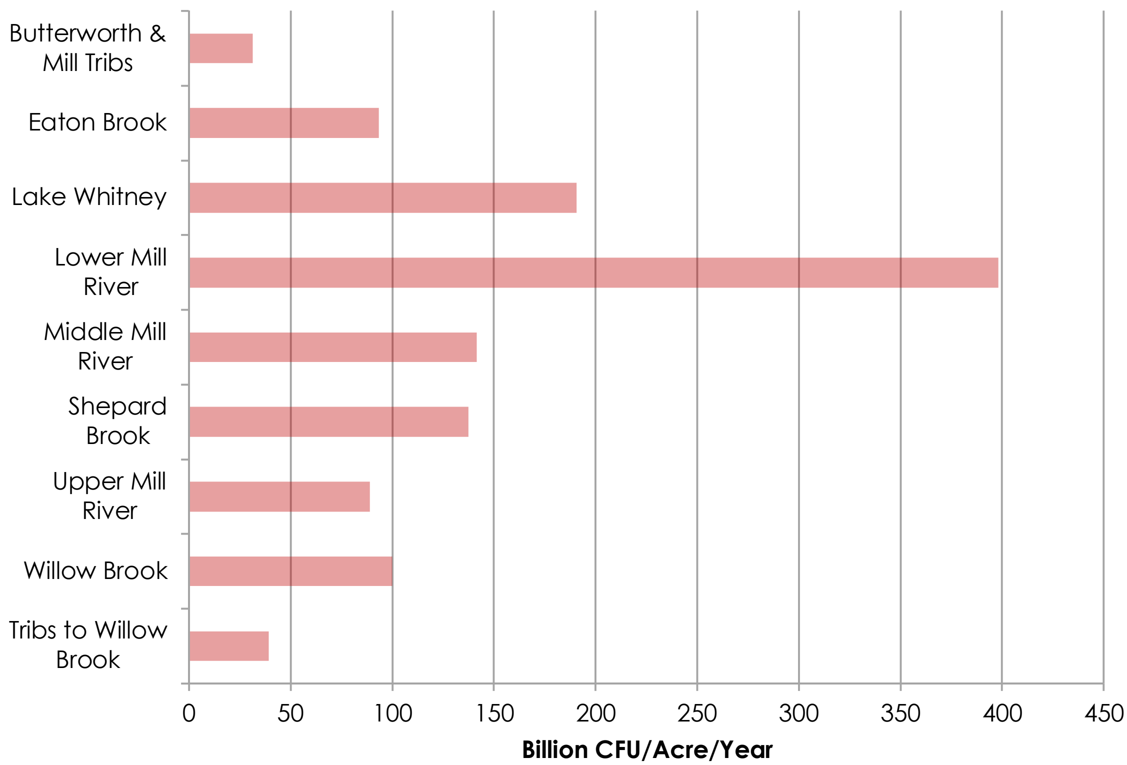

Figure 5: Modeled bacteria yields by subregional drainage basin

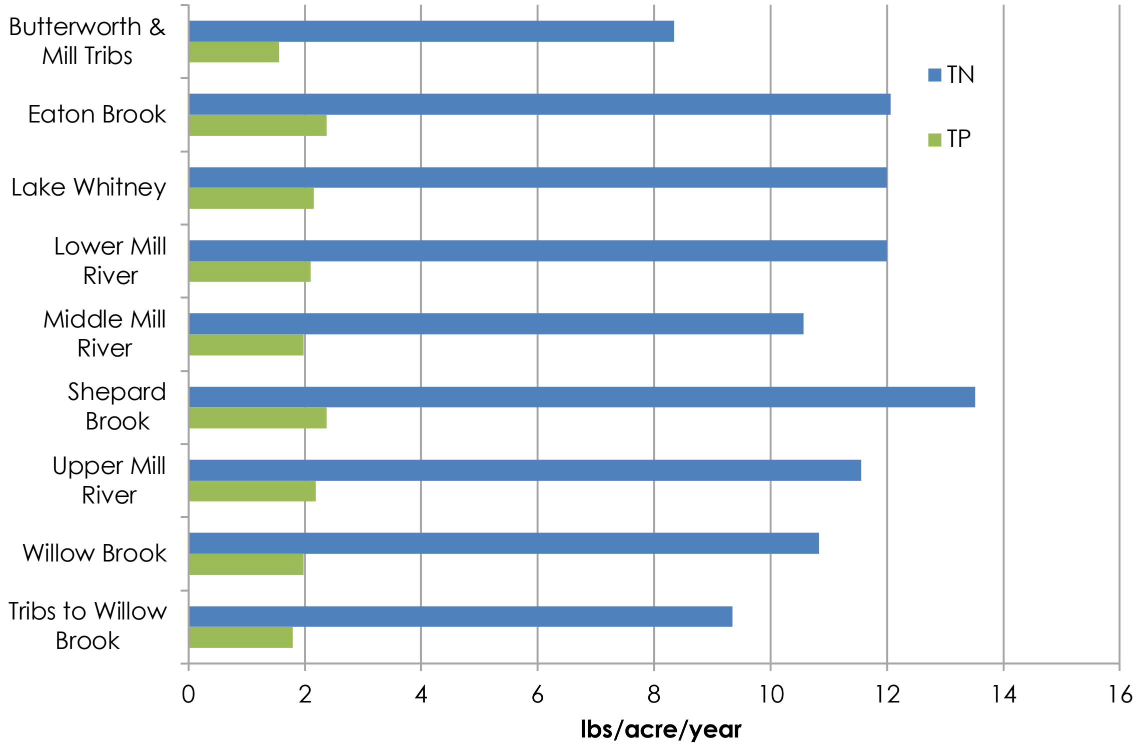

Figure 6: Modeled Total Nitrogen (TN) and Total Phosphorus (TP) yields by subregional drainage basin

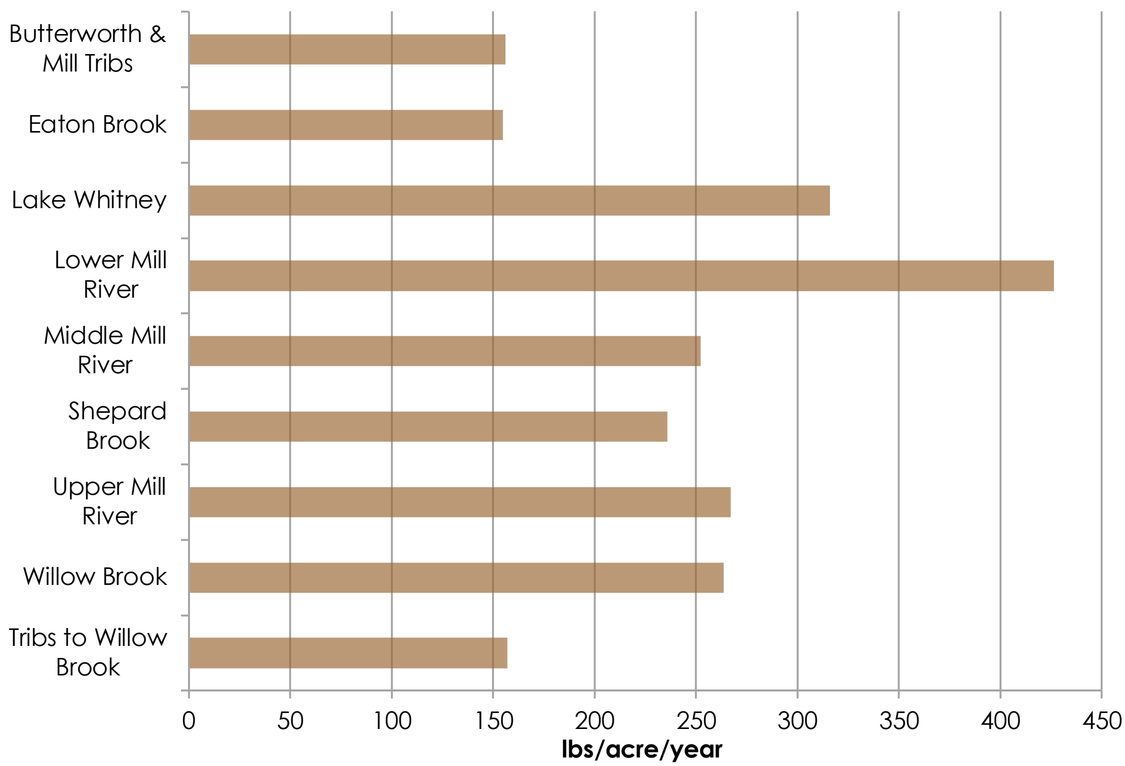

Figure 7: Modeled total suspended solids (TSS) yields by subregional drainage basin

4. Discussion

Bacteria sources in the watershed reflect both the underlying land use (e.g. residential, commercial, and industrial land) and specific activities that can result in bacteria loading to streams (e.g. CSOs, illicit discharges). The relative contribution of bacteria from different land uses and activities is well illustrated by a comparison of the modeled annual pollutant loads in the various subwatersheds (**Figures 8-16**). In the more-developed Lower Mill River, bacteria loading is largely driven by CSO discharges; around 40% of the annual load and yield stems from CSOs (**Figure 8**). Potential illicit connections contribute a further 24% of the annual bacteria load (the model generated values of 3 residential and 9 commercial or industrial illicit connections for this subwatershed based on known inputs). Urban land use contributes the rest, or roughly one-third, of the 452,000 billion CFU annual load. By contrast, in the more residential Butterworth Brook and other Mill River Tributaries subwatershed, residential land use contributes about 70% of the annual bacteria load, with forested areas contributing approximately 14% of the 93,000 billion CFU annual load (**Figure 16**).

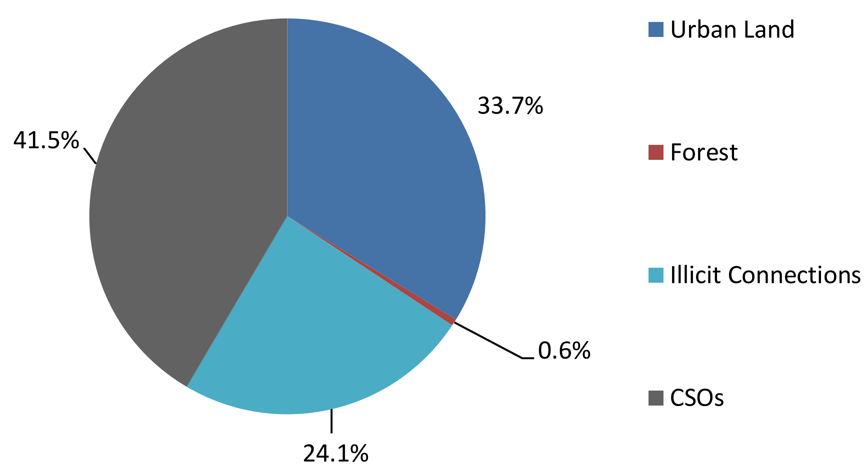

Figure 8: Relative contributions of various bacteria sources in the Lower Mill River subwatershed. Total annual load: 452,000 billion CFU

This comparison points out some of the opportunities and challenges in watersheds with mixed land use. The modeled bacteria loads in the Lower Mill River illustrate the benefits of management measures that focus on sources of fecal indicator bacteria associated with CSO abatement, and urban stormwater runoff, including source controls, structural stormwater BMPs, education and outreach, and illicit discharge detection and elimination (IDDE). The CSO abatement and sewer separation program already in place through GNHWPCA and CT DEEP will have a positive effect on reducing or eliminating the significant CSO contribution in the Lower Mill River. In addition, despite the modest estimates of illicit connections (0.05% of the subwatershed population and 5% of the businesses served by sewer), eliminating these discrete sources of bacteria could substantially reduce bacteria loadings where sanitary-related illicit connections are present (i.e., in areas served by sanitary sewers). Implementing or continuing to implement an IDDE program, as required under Connecticut's 2017 MS4 permit, in the municipalities that comprise the watershed can be effective at reducing bacteria loads.

In the more residential subwatersheds, structural stormwater BMPs to mitigate urban runoff from residential and commercial development can be effective in reducing the impacts of land use as the primary driver of bacterial loads. Non-structural BMPs such as pet waste cleanup, septic system management in non-sewered areas, and IDDE programs in sewered areas can help mitigate those contributions of bacteria. Where present in the watershed, agricultural and livestock sources of bacteria typically require a combination of structural and non-structural best management practices to reduce loadings, including identification of "hot spot" bacteria sources and site-specific management strategies to achieve load reductions.

Some impaired segments of Mill River and Shepard Brook are included in the Connecticut Statewide Bacteria TMDL (CTDEEP, 2012). The TMDL identifies percent reductions (**Table 2**) in geometric mean and single sample fecal indicator bacteria (*E. coli*) concentrations required to meet recreational water quality criteria. These percentages are for reducing fecal indicator bacteria concentrations as measured at ambient monitoring locations in each river segment (i.e., the percentages do not reflect required reductions at the end of stormwater outfalls or reductions of other pollutant loads to the river). It is also important to note that these impairments and percent reductions are based on a very limited data set consisting of a small number of samples collected at only 5 monitoring stations throughout the entire watershed, with the most recent samples dating

Table 2: Bacteria (*E. coli*) Percent Reductions to Meet TMDL

Impaired River Segment	Geometric Mean	Single Sample
Mill River (CT-5302-00_02)	74%	94%
Shepard Brook (CT5302-06_01)	77%	71%

to 2011. Given these caveats, if we assume that these percent reductions in *E. coli* concentrations translate to equivalent percent reductions in loads, then it is obvious that significant reductions in annual bacteria loads are necessary in the Mill River and Willow Brook subregional drainage basins for the impaired river segments to meet recreational water quality criteria. The pollutant loading model results provide an indication as to which sources have the greatest potential for load reductions in each subwatershed.

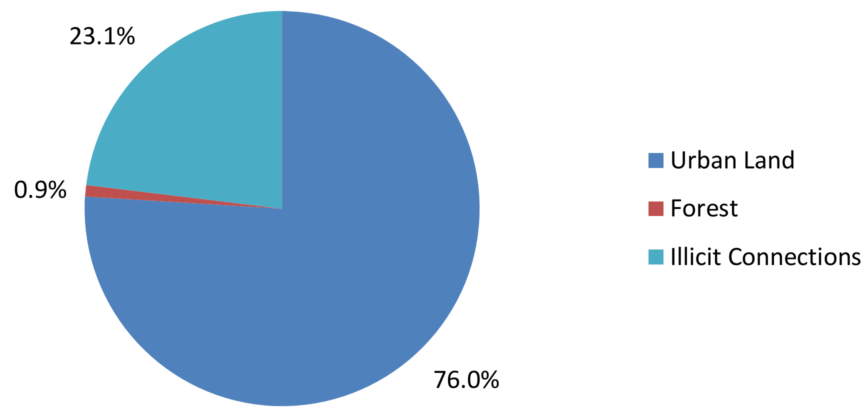

Figure 9: Relative contributions of various bacteria sources in the Lake Whitney subwatershed. Total annual load: 377,000 billion CFU

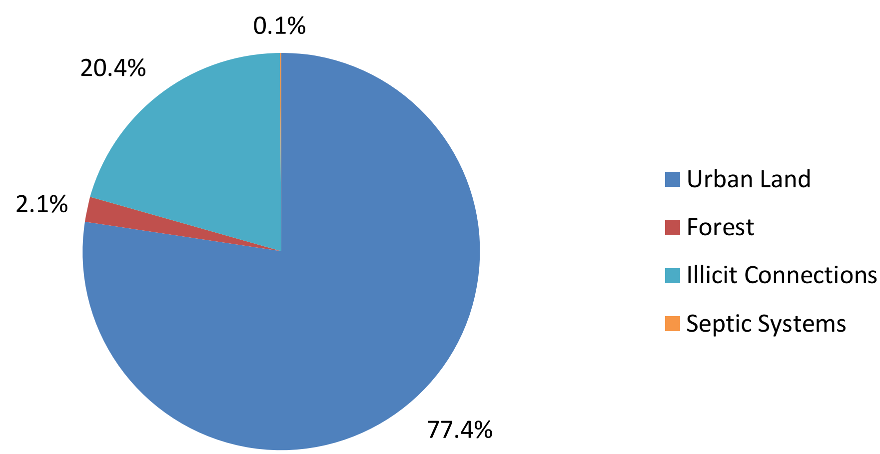

Figure 10: Relative contributions of various bacteria sources in the Middle Mill River subwatershed. Total annual load: 617,000 billion CFU

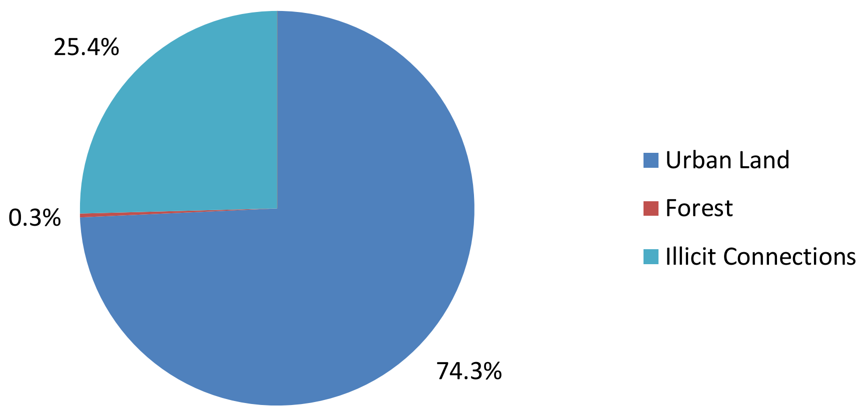

Figure 11: Relative contributions of various bacteria sources in the Shepard Brook subwatershed. Total annual load: 280,000 billion CFU

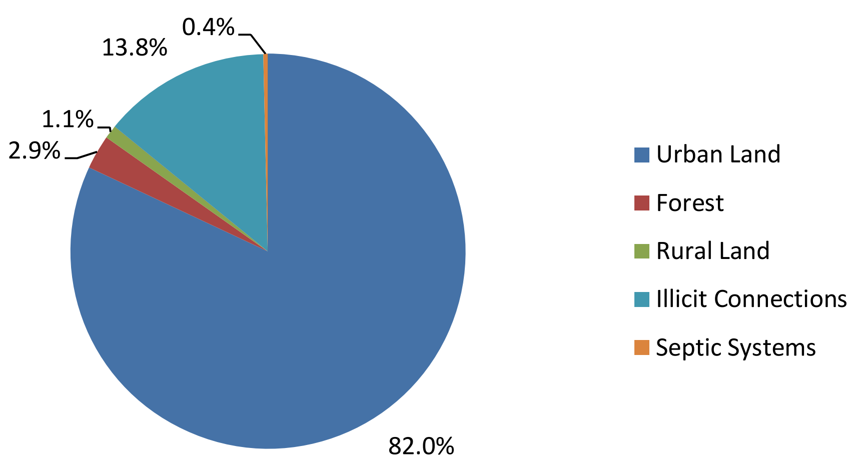

Figure 12: Relative contributions of various bacteria sources in the Willow Brook subwatershed. Total annual load: 371,000 billion CFU

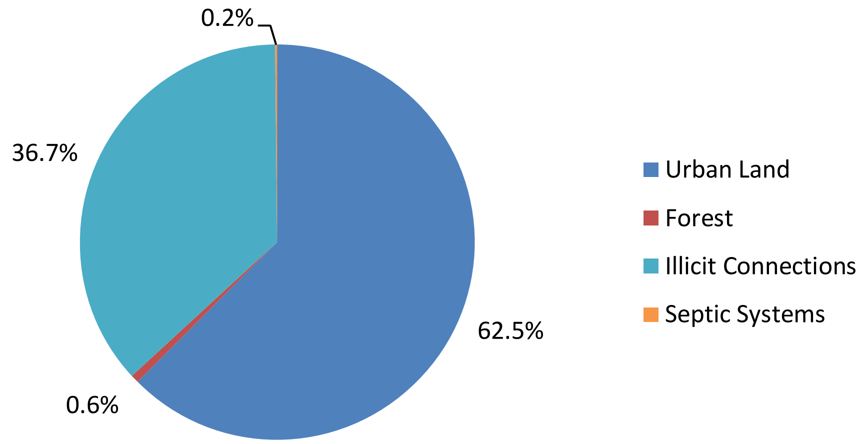

Figure 13: Relative contributions of various bacteria sources in the Eaton Brook subwatershed. Total annual load: 140,000 billion CFU

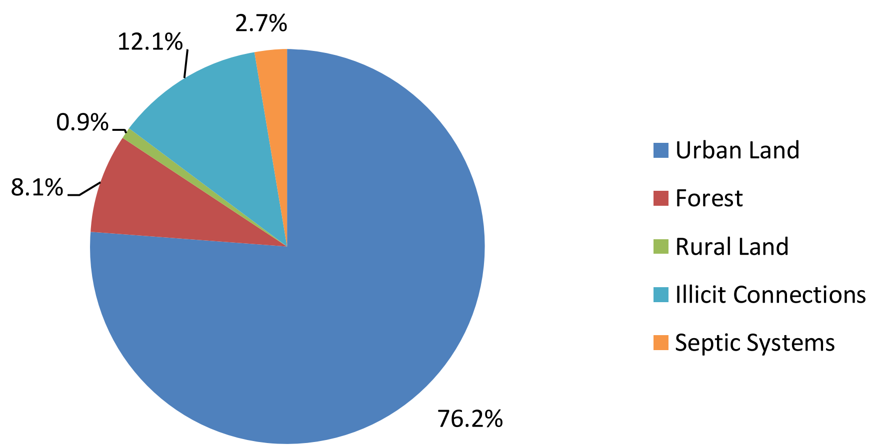

Figure 14: Relative contributions of various bacteria sources in the Willow Brook Tributaries subwatershed. Total annual load: 180,000 billion CFU

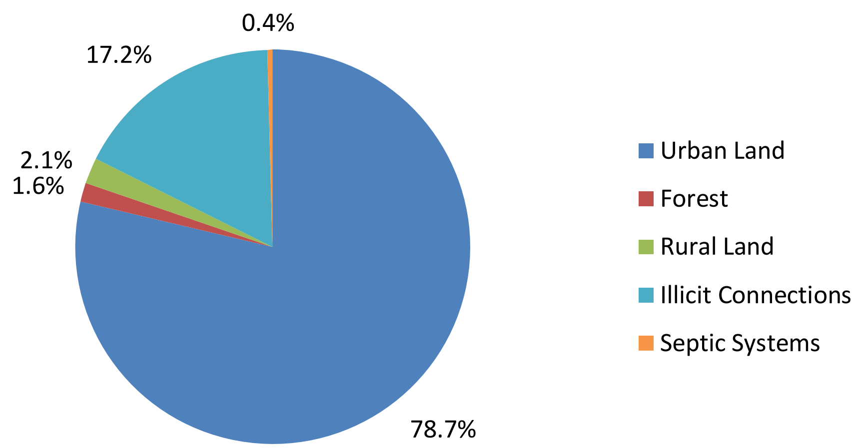

Figure 15: Relative contributions of various bacteria sources in the Upper Mill River subwatershed. Total annual load: 154,000 billion CFU

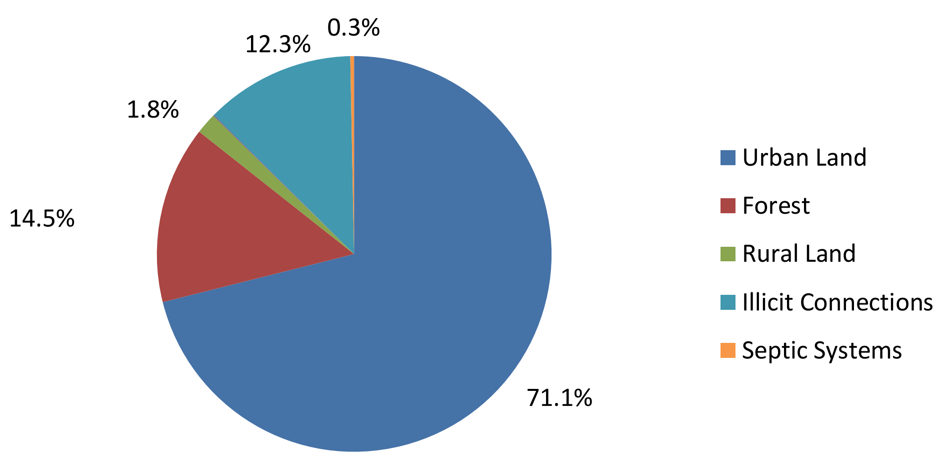

Figure 16: Relative contributions of various bacteria sources in the Butterworth Brook and other Mill River Tributaries subwatershed. Total annual load: 93,000 billion CFU

5. References

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CTDEEP. (2012). *Connecticut Statewide Total Maximum Daily Load (TMDL) for Bacteria-Impaired Waters.* Hartford: Connecticut Department of Energy and Environmental Protection.

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Appendix C

Technical Memorandum 3—Low Impact Development and Green Infrastructure Assessment: Mill River Watershed-Based Plan

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MEMORANDUM

TO: Nicole Davis and Gwen Macdonald, Save the Sound

FROM: Erik Mas, P.E, Julianne Busa, Ph.D., and Stefan Bengtson, MSc, Fuss & O'Neill, Inc.

DATE: June 28, 2018

RE: **Technical Memorandum 3—Low Impact Development and Green Infrastructure Assessment**
Mill River Watershed-Based Plan

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1. Introduction

Urban stormwater runoff is a significant source of pollutants and a leading cause of water quality impairments in the Mill River. Stormwater runoff from developed areas and other nonpoint sources of pollution in the watershed are major contributors of bacteria, sediment, and nutrients. Stormwater runoff collected by the combined sanitary and storm sewer system in the City of New Haven also contributes to three remaining Combined Sewer Overflow (CSO) discharges to the Mill River during periods of heavy rainfall, when the combined sewer system becomes overwhelmed. CSO discharges therefore contribute additional pollutant loads to the Mill River during wet weather.

Low Impact Development (LID) is a site design strategy that maintains, mimics, or replicates pre-development hydrology through the use of numerous site design principles and small-scale treatment practices distributed throughout a site to manage runoff volume and water quality at the source. Similarly, "green infrastructure" refers to systems and practices that reduce runoff through the use of vegetation, soils, and natural processes to manage water and create healthier urban and suburban environments (EPA, 2014). When applied to sites or neighborhoods, LID and green infrastructure (referred to hereafter as simply "green infrastructure") include stormwater management practices such as rain gardens, permeable pavement, green and blue roofs, green streets, infiltration planters, trees and tree boxes, and rainwater harvesting. These practices capture, manage, and/or reuse rainfall close to where it falls, thereby reducing stormwater runoff and keeping it out of receiving waters.

In addition to reducing polluted runoff and improving water quality, green infrastructure has been shown to provide other social and economic benefits relative to reduced energy consumption, improved air quality, carbon reduction and sequestration, improved property values, recreational opportunities, overall economic vitality, and adaptation to climate change. For these reasons, many communities are exploring the use of and are adopting green infrastructure within their municipal infrastructure programs.

An important objective of the Mill River Watershed Management Plan is to reduce runoff volumes and pollutant loads through the use of green infrastructure by building on the previous and ongoing

LID and green infrastructure initiatives in the watershed and region and targeting areas of known water quality impairments.

2. Assessment Approach

An assessment was performed to identify opportunities and develop concepts for site-specific green infrastructure retrofits in the Mill River watershed. The assessment consisted of four primary tasks:

1. Identification of existing green infrastructure practices in the Mill River watershed,
2. Screening evaluation to quickly identify areas of the watershed with the greatest feasibility for and potential benefits from green infrastructure retrofits,
3. Field inventories of the most promising green infrastructure retrofit opportunities in the watershed identified from the screening step,
4. Green infrastructure concept designs for selected retrofit sites.

3. Existing Green Infrastructure Practices

There are a number of ongoing green infrastructure initiatives in the greater New Haven area. Implementation of green infrastructure is a key objective of the Greater New Haven Water Pollution Control Authority (GNHWPCA) strategic plan (GNHWPCA, 2017). GNHWPCA requires the use of green infrastructure stormwater management practices (e.g., infiltrators and drywells, rain water storage tanks, bioswales and tree wells, water features) for development and redevelopment projects within combined sewer areas (*Table 1*) in accordance with the GNHWPCA Permitting and Design Criteria Manual. GNHWPCA and the City of New Haven, working with CFE/Save the Sound and other groups, are also installing bioswales at numerous locations throughout the City within the public right-of-w ay to reduce runoff to the combined sewer system and reduce pollutant loads to surface waters. The City of New Haven has also adopted regulatory requirements to reduce stormwater runoff from development projects contributing to the City's combined sewer system.

The Town of Hamden has also been active in pursuing green infrastructure projects. The Town has applied for 319 funding for a project at Town Center Park which would involve installation of a stormwater treatment wetland to manage runoff from 88 acres of surrounding commercial and residential land. The Town has also adopted regulations and practices that directly support LID, including stormwater regulations that reference the DEEP stormwater manual, parking regulations that require any parking areas above and beyond the required minimum to be created with pervious materials and aim, more generally, at reducing paved surfaces, and landscape regulations that directly address stormwater quality issues. The Town has established impervious cover maximums and works closely with the RWA to coordinate stormwater efforts.

Area universities and other key facilities serve as visible demonstration sites for green infrastructure practices in and around the watershed. Over the past decade, Yale University has incorporated infiltration and water reuse at a number of buildings that are either within the Mill River watershed or contributing to the sewershed of CSO #011 (which outfalls to the Mill River). These include the Yale School of Forestry and Environmental Studies, Greenberg Conference Center, Yale School of Management, Yale Divinity School, and several science buildings (*Table 1*).

Table 1. GNHWPCA Green Redevelopment Projects

Permit Approval Year	Description	Address	Components
2007	Yale School of Forestry & Environmental Studies	Sachem & Prospect Streets*	Storage Tanks, Water Feature
2008	Albertus Magnus College Parking Lot	900 Prospect Street	Infiltrators
2008	St. Donato's Expansion	501 Lombard Street*	Infiltrators
2008	Yale Greenberg Conference Center	Prospect Street	Infiltrators
2008	Yale Ingalls Rink Expansion	73 Sachem Street	Bioswale, Tree wells, infiltrators
2008	Yale School of Manage ment	155 Whitney Avenue	Irrigation Storage Tank, Infiltrators
2008	Yale Divinity School	409 Prospect Street	Drywells
2009	Yale Biology Building	230 Whitney Avenue	Rainwater Reuse Tank, Bioswale, Infiltrators
2011	Murray Place Housing	191 Saltonstall Avenue	Infiltrators
2012	Lovell House Apartments	45 Nash Street	Infiltrators
2012	Albertus Magnus College Drainage	700 Prospect Street	Drywells and curtain drain
2013	Yale Kline Chemistry Laboratory	285 Prospect Street*	Rainwater Reuse Tank, Infiltrators
2014	Community Building	72 James Street	Infiltrators
2014	315 Whitney Avenue	315 Whitney Avenue	Pervious Pavers, Infiltrators
2014	1040 State Street	1040 State Street	Infiltrators
2016	Yale Science Building	260 Whitney Avenue*	Infiltrators
2015	Esplanade Apartments	396 Prospect Street*	Perforated pipe, water quality chamber
2017	District NHV, LLC	470 James Street	Retention Basins
2017	Wright Lab Renovation	266 Whitney Avenue*	Rip Rap Swales
2017	Bender Showroom	335 East Street	Infiltrators
2018	New Haven Housing	703 Whitney Avenue	Infiltrators
2017	Apartments	245 Whitney Avenue*	Pavers, Rain Gardens, Infiltrators
Under Review	Unicast Development	620 Grand Avenue	Infiltrators
field visit 6/2018	St Joseph Church (St Mary's)	129 Edwards St	Infiltrators
field visit 6/2018	United Church of the Redeemer	185 Cold Spring Street	Infiltrators

* An asterisk after the address indicates sites which are outside the watershed, but inside the sewershed of CSO#11

Similarly, Quinnipiac University has incorporated permeable pavement into some of its parking areas, including an overflow lot on Sherman Avenue, and is actively exploring additional sustainability improvements. Throughout the South Central Basin, the UConn CT NEMO program is working on a pilot project focused on incorporating green infrastructure into local projects. The Regional Water Authority has been another advocate for water quality improvements in the watershed; the Whitney Water Treatment Facility features a 30,000 square foot extensive green roof that captures stormwater and reduces runoff.

During site visits, the field team also noted that Elim Park Retirement Community, one of the sites identified as a priority site during the green infrastructure screening process (described below), already managed stormwater using an existing treatment wetland and pond. There are likely other, scattered green infrastructure practices in use on private properties throughout the watershed.

4. Assessment Methods and Findings

The remainder of this technical memorandum documents the methods and findings of the green infrastructure screening evaluation, field inventories, and concept designs.

Screening Evaluation

A GIS-based screening evaluation was conducted to quickly identify specific parcel-based locations within the watershed where green infrastructure retrofits can be implemented that would provide water quality (i.e., pollutant reduction) and quantity (i.e., runoff reduction) benefits in the watershed. The types of green infrastructure retrofits with potential applicability in the Mill River watershed include:

- Permeable pavement
- Bioretention/bioswales
- Infiltration/filtration including tree box filters
- Green/blue roofs
- Tree planting
- Water harvesting/reuse

Green infrastructure retrofit opportunities exist on sites or parcels and within street rights-of-way, as evidenced by the ongoing “green streets” or “complete streets” retrofits by the City of New Haven and the GNHWPCA. Right-of-way projects were included in the screening process; however, the primary focus of the analysis was on parcel-based green infrastructure opportunities on publicly-owned land and privately-owned institutional properties.

The following screening criteria and data sources were used to create an initial list of the most feasible sites for green infrastructure retrofits in the target subwatersheds:

- **Target Subwatersheds** – Subwatersheds with impaired water bodies, as defined in the 2016 Integrated Water Quality Report were prioritized, since green infrastructure retrofits in these areas would have the greatest water quality benefits. The following subwatersheds were identified as target areas for further consideration:

    - Upper Mill River
    - Middle Mill River
    - Lower Mill River
    - Willow Brook
    - Shepard Brook

    The Lower Mill River subwatershed also encompasses those areas of the Mill River watershed with combined sewers, thereby providing additional benefits related to CSO discharges by reducing the amount of runoff entering the combined sewer system (*Figure 1*).

- **Land Ownership** – Publicly-owned (e.g., municipal) parcels are most favorable because they avoid the cost of land acquisition and provide direct control over green infrastructure construction, maintenance, and monitoring by the municipality. Other publicly-owned parcels such as schools, universities, state facilities, and federal facilities are also potential green infrastructure candidates. Certain types of private parcels (e.g., private universities, churches) may be suitable and were also included in the analysis. In the screening process, land ownership attribution was based on land use classifications from both the South Central Regional Council of Governments (SCRCOG) and the Naugatuck Valley Council of Governments (NVCOG). Approximately 489 parcels in the Mill River watershed were identified as possible sites given land use classifications of community facility, institutional, recreational, open space, or utilities. Of those parcels, 231 occur in targeted subwatersheds.[1]

- **Subsurface Conditions** – Subsurface conditions are key considerations for green infrastructure retrofits that rely on infiltration of stormwater runoff and where runoff reduction is desired. Soil infiltration capacity, depth to groundwater, depth to restrictive layers (bedrock, dense till), soil bulk density, and inundation of soils due to flooding are important soil-based characteristics that can affect the feasibility of infiltration-based green infrastructure retrofits.[2] For the purposes of this desktop screening evaluation, we used hydrologic soil groups (HSGs), as mapped by the Natural Resources Conservation Service (NRCS), to identify candidate sites for green infrastructure retrofits. HSGs provide an initial estimate of infiltration rate and storage capacity of soils on a site. Sites where mapped HSGs have high infiltration rates (A and B soils) are most suitable for infiltration stormwater practices. While soil maps provide initial estimates of infiltration potential, field investigations will be necessary to verify soil conditions for final feasibility determinations and design purposes. Note also that while the analysis generally focused on sites with A and B soils, input from the steering committee led us to include a number of sites in New Haven that are mapped as D soils, but where experience has shown that the soils in fact exhibit good infiltration characteristics.

Screening Results

The most feasible sites for green infrastructure retrofits were initially defined as those where all three screening criteria coincided, based on GIS analysis. Specifically, candidate sites for green infrastructure retrofits were identified as:

- Within impaired subwatersheds; and
- On publicly-owned land or higher-priority private institutional land (e.g., churches and private schools); and
- Having HSG A or B soils (or sites in New Haven, as described above).

[1] Note that, although given a lower priority here, private properties also offer considerable opportunities for GI/LID. Individual landowners should be encouraged to pursue green infrastructure, and municipalities can further encourage adoption of GI practices through review and revision of land use regulations.

[2] Other site-specific factors such as land area, impervious area, drainage area, subsurface utilities, subsurface contamination, and storm drainage system capacity are also important considerations for green infrastructure retrofits.

Candidate sites were then further screened for degree of impervious cover, such that open space areas that are essentially wooded conservation land with no existing buildings, roads, or parking areas (and therefore little expectation of generating pollutants) were considered lower priority and excluded from the list.

All sites meeting the above criteria were included on a list of potential sites (*Attachment A*). These sites were further divided into higher priority and lower priority sites, with public sites given priority due to the advantage conveyed by public ownership when actually trying to fund and implement retrofit projects. The list was further refined with input from Save the Sound staff and projects suggested by the Steering Committee. The final list of priority sites (*Attachment A*) included a total of 78 sites, 38 of which were identified as higher priority, and 40 of which were identified as lower priority.

Field Inventories

Site visits were conducted at 30 of the higher priority sites, as well as 6 of the lower priority sites, with visits attended by staff from Fuss & O'Neill, Connecticut Fund for the Environment/Save the Sound (CFE/STS), or a team consisting of representatives from both organizations. Most site visits were conducted on June 12 and 13, 2018, with some follow-up visits conducted by CFE/STS the following week. The sites and adjacent street areas were walked and visually inspected for potential green infrastructure retrofit opportunities (i.e., impervious surfaces connected to the on-site drainage system, available green space to accommodate new green infrastructure practices, existing drainage features that could be enhanced or improved) and physical site characteristics such as site configuration, drainage patterns, current use, slope, landscaping, subsurface utilities, design complexity, and maintenance access considerations. Notes were recorded and photographs taken at each site.

Sites Selected for Concept Designs

Based on the findings of the field inventories, green infrastructure retrofit opportunities were identified at the majority of the sites visited. The following 10 sites were selected for development of concept designs, as these sites are believed to (1) have the greatest feasibility for green infrastructure retrofits and the greatest potential pollution reduction impact, (2) represent a cross-section of common retrofit types and serve to demonstrate a variety of green infrastructure approaches, and (3) are distributed geographically throughout the targeted areas of the Mill River watershed (*Figure 2*):

1. Elm City College Preparatory Elementary School, New Haven
2. James Street, New Haven
3. John S. Martinez School and Exchange Street, New Haven
4. Wilbur Cross High School, New Haven
5. Livingston Street at East Rock Road, New Haven
6. Bartlem Recreation Area, Cheshire
7. Strathmore Drive, Cheshire
8. YNHH Outpatient Services, Hamden
9. Whitney High School North/West, Hamden
10. Counter Weight Brewery, Spring Glen Nursery, and Raccio Park Road, Hamden

5. Site-Specific Project Concepts

The site-specific green infrastructure retrofit concepts presented in this section are intended to serve as potential on-the-ground projects for future implementation. They also provide examples of the types of projects that could be implemented at similar sites throughout the watershed. It is important to note that the concepts presented in this section are examples of potential opportunities, yet do not reflect site-specific project designs. Individual project proponents (e.g., municipalities, private property owners, developers) are responsible for evaluating the ultimate feasibility of, as well as design and permitting for, these and similar site-specific concepts.

Preliminary, planning-level costs were estimated for the site-specific concepts presented in this section. These estimates are based upon unit costs derived from published sources, engineering experience, and the proposed concept designs. Capital (construction, design, permitting, and contingency) and operation and maintenance costs are included in the estimates, and total annualized costs are presented based on the anticipated design life of each green infrastructure practice. A range of likely costs is presented for each concept, reflecting the inherent uncertainty in these planning-level cost estimates. A detailed breakdown of these estimated costs is included in *Attachment C.*

In some cases, costs are presented for multiple alternative project approaches, for example, both a subsurface infiltration option and a pervious pavement option[3]. Subsurface infiltration chambers are a far more expensive option, but have the benefit of increased potential infiltration capacity in certain soils and the ability to accept stormwater that is already in an underground drainage system, whereas pervious pavement is limited to infiltrating surface flows. Pervious pavement also poses increased maintenance concerns over subsurface infiltration options, as the pavement can be damaged by snow removal operations and must be kept clean of silt and other fine materials that would clog the pavement and reduce its ability to infiltrate.

Where bioretention/rain gardens are recommended, pricing assumes the 'bioretention' rate (see Appendix C), which utilizes contracted labor for design and implementation. Simple raingardens can also be constructed using volunteer labor for hand-digging and planting at reduced costs that would be more in line with the 'raingarden' pricing rate (see Appendix C).

Preliminary sizing calculations are also provided for each practice and are based on the goal of capturing and treating/infiltrating the water quality volume (WQV), generally defined as the first one-inch of runoff from the contributing drainage area. Approximate drainage areas are provided for each practice within the designs, along with the expected WQV to be generated from that drainage area.

The table in *Attachment D* contains information on site characteristics and potential green infrastructure opportunities for the other sites visited during the field inventories that were deemed to have good potential for green infrastructure retrofits.

[3] Note that pervious pavement costs presented in the memo and in Appendix C are based upon a porous asphalt design. More decorative alternatives, such as pervious pavers, will have increased costs (see Appendix C).

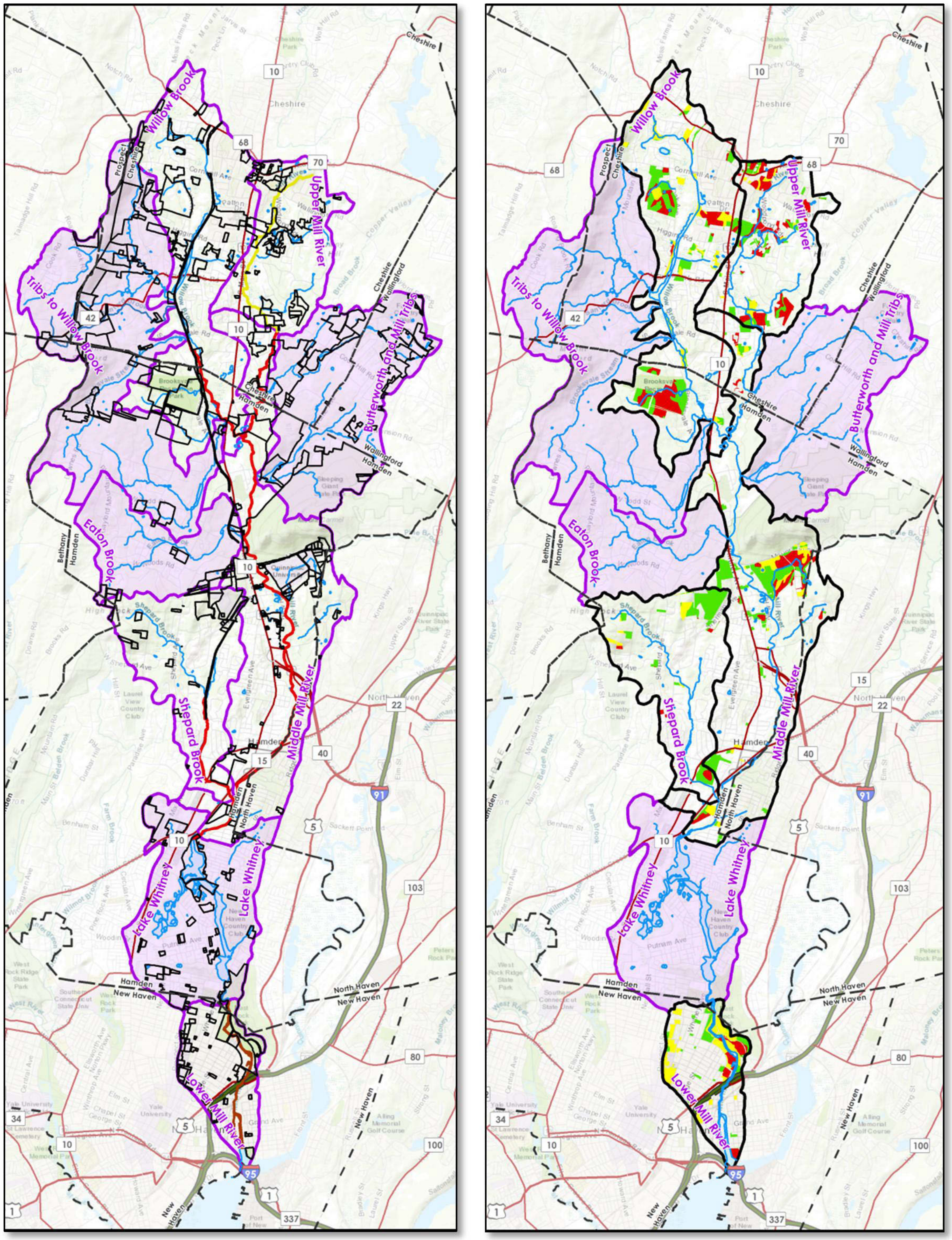

Figure 1. Maps of screening criteria. Impaired subwatersheds are outlined, while non-impaired subwatersheds are masked in purple. On the left, parcels meeting the land ownership are outlined in black. On the right, only the subset of parcels within impaired watersheds is depicted; parcel color reflects the subsurface conditions: green indicates A or B soils, yellow areas are labeled as D soils, but includes areas of urban soils known to have good infiltration, and red indicates areas of C soils or limited infiltration potential.

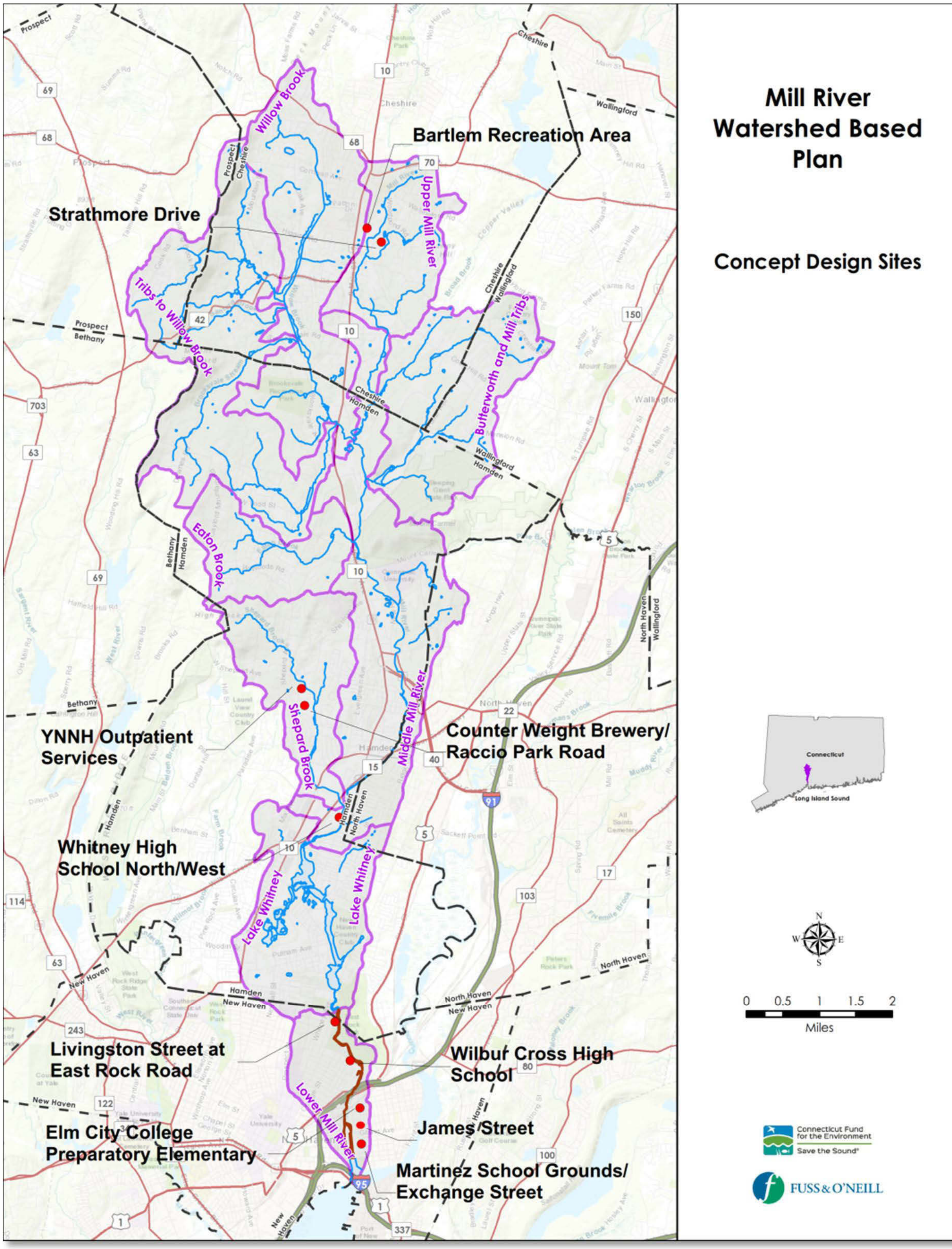

Figure 2. Locations of sites selected for concept designs.

Elm City College Preparatory Elementary School

Located at 407 James Street, New Haven, Elm City Preparatory Elementary occupies an approximately 1.5-acre site at the corner of James Street and Lombard Street, in a CSO area (CSO #009). With the exception of a 0.25-acre artificial turf field, the site is entirely impervious. Existing catch basins capture parking lot runoff along the western edge of the lot. Downspouts from the building appear to be internal and to tie in to the drainage system at the downgradient catch basin before connecting to the City's stormwater infrastructure running along James Street. A broken curb at the west edge of the parking lot is currently allowing runoff to bypass the catch basins and travel down a short embankment to the sidewalk.

The sidewalk in front of the school along James Street is approximately 11 feet wide in most places. Planters with trees are incorporated into the sidewalk at 50 foot intervals; however, there is a tree missing directly in front of the school parking area (*Figure 3*).

Space is the most significant constraint at this site, as parking is tight and there is little impervious area. Existing street trees, a fire hydrant/water lines, and other utilities pose additional constraints. A variety of BMPs are recommended for this site in order to best achieve the following goals: maximize enhancement of curricular value in a limited space, maximize infiltration/treatment potential, and keep implementation costs manageable. These elements could be implemented all at once, or installed gradually as funding permits (total project costs will vary widely depending on which components are chosen).

- **Tree Box Filter and Bioretention/Infiltration.** A tree box filter and replacement tree are proposed for the location where a tree is currently missing (*Figure 3*). A tree box filter design with additional subsurface infiltration capacity is recommended (*Figure 5*). A curb cut from James Street would channel runoff from the street into the filter and infiltration system. It is also proposed to convert five feet of sidewalk directly adjacent to the street to bioretention areas or rain gardens with native grasses and other plantings. Additional curb cuts would direct water into these bioretention areas, which would also serve to enhance the landscape around the school. These bioretention areas could be integrated into the curriculum as demonstration sites to supplement lessons on science and the environment, and, of the BMPs proposed, would likely offer the greatest opportunity for interactive lessons (planting, maintenance, etc.). For ease of implementation and consistency with the proposed James Street design concept, the City could choose to implement their standard 5 foot by 15 foot bioswale design along the sidewalk at this location (*Figure 6*). *Estimated Cost for Tree Box Filter: $9,000; Estimated Cost per Bioswale: $20,000*

- **Parking Lot Retrofits.** Subsurface infiltration and/or pervious pavement is proposed for the parking area (*Figure* 4, *Figure 6*) to manage stormwater falling on the parking area as well as roof runoff captured by the school's gutters and downspouts.

  - Based on available field data, using subsurface infiltration in the area adjacent to the turf play area would make it possible to intercept existing lines carrying downspout runoff and turf drainage without significantly reconfiguring these drainage systems (approximately 40,000sf of drainage area, and 3,200cf WQV). An 1,100sf practice underneath the six parking spaces adjacent to the turf field would potentially allow for treatment of up to 4,150cf WQV. The existing downgradient catch basin located in the school's driveway would serve as overflow to allow any excess water to be conveyed to the storm sewer in James Street, as is currently occurring. Note that site-specific soil drainage characteristics may allow for effective use of pervious pavement without additional subsurface infrastructure, for a significantly reduced project cost (although this would make it more difficult and costly to accept stormwater from roof and turf drains and would therefore likely result in treatment of a significantly lower percentage of total site runoff). *Estimated Cost: $108,000 (Subsurface infiltration); Estimated Cost: $5,000 (Pervious Pavement)*

- To minimize costs, and to increase the variety of BMPs demonstrated on site, pervious pavement is proposed as the preferred option for the parking spaces parallel to James Street. Converting these spaces to pervious pavement would remove 2,500sf of pervious surface from the lot, and depending on the infiltration capacity of the soils and precise slope of the site, may be sufficient area to effectively infiltrate the roughly 800cf WQV of stormwater runoff expected from the entire 10,000sf main parking area, as the remainder of the surface slopes slightly to the west. *Estimated Cost: $10,000*

- **Management of Dumpster Area.** The school's dumpsters are located in the southeast corner of the parking lot, at the top of a slope which drains to James Street. Dumpsters should always be kept closed to minimize exposure to stormwater. For additional protection, a containment system consisting of spill containment grooves could be incorporated into the pavement to further prevent pollutants from being carried into the storm drainage system (*Figure 6*). *Estimated Cost: $0-$1,000*

Total Estimated Cost: Variable, depending on components installed.

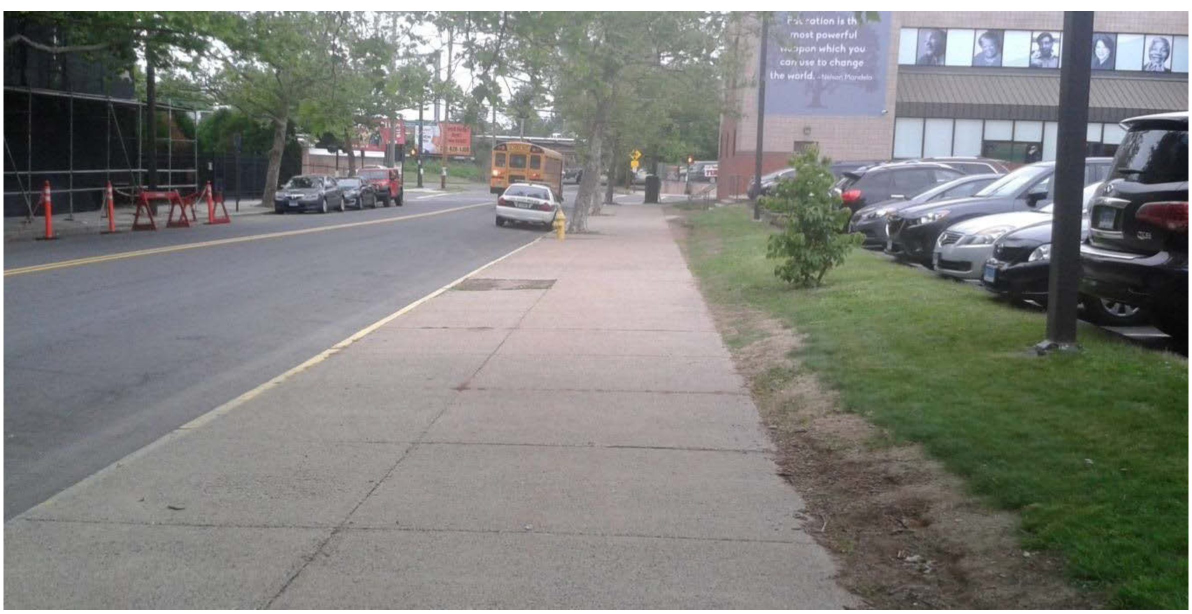

Figure 3 Sidewalk in front of Elm City College Preparatory Elementary School, with missing tree.

Figure 4. Parking lot at Elm City College Preparatory Elementary School.

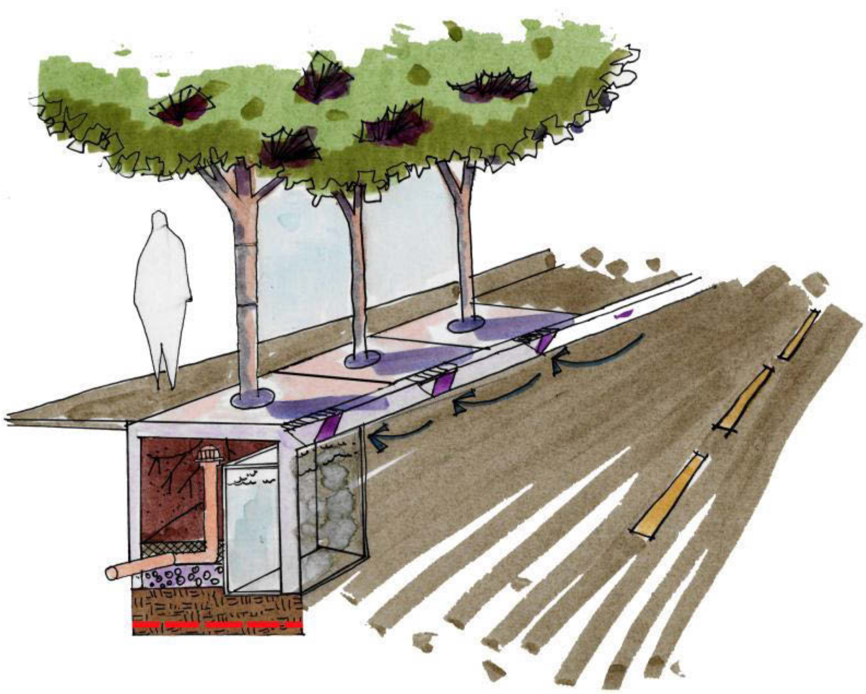

Figure 5. Schematic of a typical tree box filter with underground storage capacity.

Figure 6. Proposed green infrastructure retrofits for Elm City College Preparatory Elementary School. CB indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

James Street

James Street was identified as a potential demonstration site for a "green streets" approach to stormwater retrofits in the road right-of-way. The site is proposed to begin at Elm City College Preparatory Elementary School (at Lombard Street), and continue south to Chapel Street. This portion of James Street represents a typical residential street in the Fair Haven neighborhood (*Figure 7*), an underserved area of New Haven. The street is also within the area served by CSO #009. In addition to providing stormwater runoff reduction and pollution control benefits, the proposed retrofits for James Street would also provide green space in the neighborhood and yield aesthetic benefits for residents. Specific siting considerations along James Street include the feasibility of working around existing utilities while simultaneously selecting sites with sufficient catchment area to justify installation costs. Bioswales or bump-outs must also be sited appropriately relative to existing catch basin infrastructure (i.e., bioswales should be located 'downstream', ideally right before a catch basin) in order to maximize capture of stormwater and facilitate returning overflows to the existing drainage system.

- **Tree Box Filters.** Additional tree box filters of the type proposed for Elm City Preparatory School are proposed for various locations along James Street. Obvious sites are locations where street trees are missing; one such site exists on the east side of James Street, immediately south of the Elm City Preparatory School. *Estimated Cost: $9,000 per tree box filter*

- **Bump-Outs or Curbside Bioswales.** Two possible types of green infrastructure are proposed to provide bioretention along the length of James Street: bump-outs and curbside bioswales (*Figure 8*). Both are types of linear bioretention retrofit used alongside or within a public street, designed to collect and infiltrate/treat runoff from the adjacent roadway. These practices consist of a stone storage layer, a soil layer designed to filter runoff, plantings, and curb cuts to allow runoff to enter and exit the system. Both bioswales and bump-outs are sized to capture and treat/infiltrate the water quality volume.

    - Bioswales utilize space in the right of way, converting impervious area between the sidewalk and the street into bioretention. The City of New Haven is already installing bioswales throughout the downtown area and West River watershed, using a modified version of a bioswale design developed by New York City, which has a 5-foot by 15-foot footprint. At 75sf, this design can capture and treat approximately 276cf WQV. This is sufficient to capture the drainage from one side of an approximately 200ft stretch of road. *Figure 9* shows a typical bioswale that was installed in New Haven. As with bump-outs, bioswales would be designed to accept stormwater from the street, using curb-cuts as an inlet, with existing downgradient catch basins serving to receive excess water from the BMPs' overflows.

    - Bump-outs (*Figure 10*) would replace a portion of the existing road shoulder with bioretention areas, utilizing "No Standing" zones near intersections to intercept stormwater runoff from the road. Bump-outs serve a dual purpose as traffic calming features, which can make residential streets more friendly to pedestrians and bicycles.

Bump-outs and bioswales could be used in combination along the length of James Street, or a single practice type could be repeated for a more uniform design (*Figure 8*). Pervious pavement may again be a less expensive alternative option, but would offer far fewer aesthetic benefits to the neighborhood. Several specific locations along James Street were identified as potential sites for BMP implementation in the road right of way. In some instances, multiple potential addresses were noted in close proximity to one another (i.e., where drainage areas would overlap based on the 200 foot drainage area assumption). In these cases, the options should be evaluated during detailed site design to select the option with the least constraints or conflicts. Based on a preliminary assessment, locations shown in *Figure* 8 represent locations suitable for bioswales in the public right of way.

Two additional opportunities were identified along James Street for more extensive BMP installations:

- At the southeast corner of James Street and Market Street, there is a large green parcel adjacent to the Market and James Street Farms which is operated under the umbrella of New Haven Farms. The standardized BMPs described above could be implemented in the road right of way at this location; this site could also be proposed for a more extensive raingarden demonstration and education site.
- Raingardens could be implemented at the condominium complex at the northeast corner of James Street and Grand Avenue, particularly at the southwest and northwest corners of the complex, although existing trees may impose siting constraints. The catch basins in the approximately 8,500sf parking lot could also be converted to infiltrating catch basins, with overflows being returned to the stormdrain system via the existing infrastructure.

Estimated Cost: $20,000 per Bioswale or Bump-out (lower unit pricing may be available when multiple practices are installed together; see notes in Appendix C)

Total Estimated Cost Assuming 1 Tree Box Filter and 13 Bump-Out/Bioswale Practices: $263,000

Figure 7. Existing conditions along James Street, New Haven highlighting possible locations for bioretention practices in the right of way along James Street.

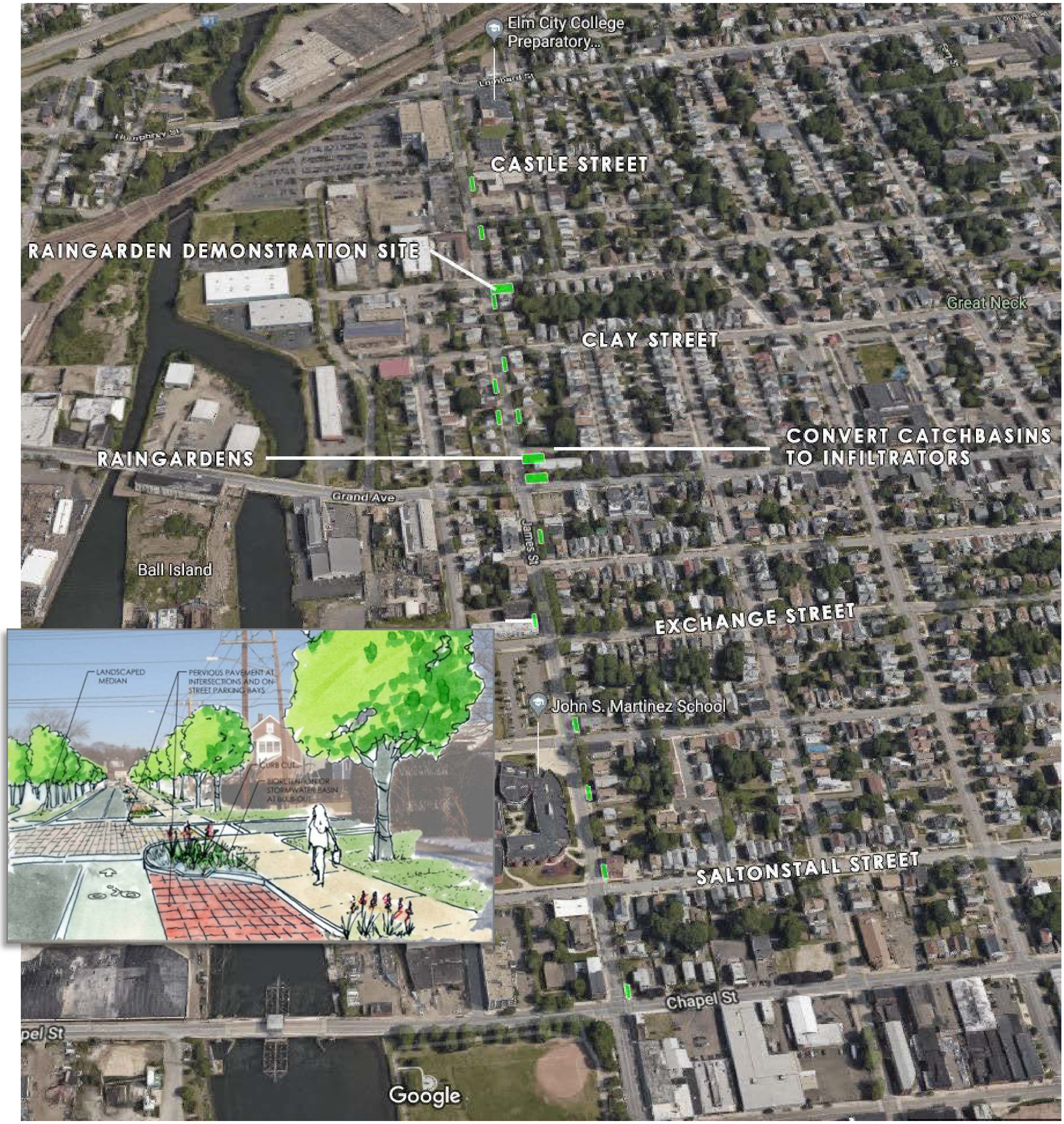

Figure 8. Proposed green infrastructure retrofits for the public right of way, community garden, and condos along James Street. Figure depicts the general concept design of repeating bioswales and/or bump-outs. Locations as marked represent the conceptual pattern, and are matched to suggested locations as much as possible given the scale, but do not necessarily match precisely to specific recommended sites . The inset image demonstrates a street-view rendering of the concept.

Figure 9. (above) Bioswale installed in the City of New Haven. Credit: Dawn Henning, City of New Haven Engineering

Figure 10. (left) Example Bump-Out bioretention planter installed by the City of New Haven on Clinton Avenue. Credit: Dawn Henning, City of New Haven Engineering.

John S. Martinez School Grounds and Exchange Street

The Martinez School building is located on James Street, in the block south of Wolcott Street, while the parking lot and athletic fields for the school are located in the block immediately north of the school, between Wolcott Street and Exchange Street. Like the previous two sites, the Martinez School and surroundings are in the area served by CSO #009. Stormwater designs for the school and parking area median have previously been developed[4], but the design proposed here focuses on the north end of the property, where the school grounds abut a proposed, future section of Mill River Trail and a mix of residential and industrial land uses to the north.

West of Haven Street, Exchange Street has been blocked off with several large boulders to prevent vehicle traffic from entering (*Figure 11*); this section of the roadway is proposed to become part of the Mill River Trail. At present, the pavement in this section is in disrepair and there is no drainage infrastructure located along this stretch of Exchange Street. Trash and water currently collect at the far west end of Exchange Street where the road terminates into a chain link fence with concrete barriers/wall beyond.

- **Trash Clean-up.** The first step to any improvement at this site should be the engagement of community volunteers in removal of trash and debris located at the west edge of the site. This opportunity could also be used to grow interest in the site and discuss further improvement options with local residents and potential project partners.

- **Pavement Removal.** Removal of pavement from the portion of Exchange Street west of Haven Street and permanent closure of the road would result in a nearly 9,000 square foot reduction of impervious surface, thereby reducing surface runoff and creating space for natural infiltration. Assuming pavement is not contaminated beyond typical road surface pollutants (e.g., petroleum products), this project could be conducted in partnership with the City of New Haven as a stand-alone action at relatively minimal expense.

- **Integrated Stormwater Treatment and Trail Improvements.** Once pavement is removed, bioretention areas and trail improvements are proposed to create an aesthetically pleasing entrance point for a future segment of the Mill River trail. A series of bioretention areas/rain gardens (*Figure 12*) with native plantings would be braided together with the trail, creating an urban oasis at the edge of the Martinez school athletic fields (*Figure 13*). Existing storm drainage from the northern edge of the school parking lot and the catch basin at the northeast corner of Exchange Street and Haven Street could be redirected to the bioretention cells. Overland sheet flow from the athletic fields would also be captured and treated. While water would be accepted along the east-west length of the system, water entering the up-gradient bioretention cells to the east would overflow into down-gradient cells further west in step-wise fashion. Preliminary information suggests that the system can be sized to accommodate typical precipitation events. Excess stormwater during extreme events could be allowed to flow overland, as is currently the case at the

[4] Save the Sound, Connecticut Fund for the Environment (2012). Green Infrastructure Feasibility Scan for Bridgeport and New Haven, CT.

site, or could potentially bedirected back into the existing storm drain system. *Estimated Cost: $90,000*

Figure 9. Existing conditions at the intersection of Exchange Street and Haven Street, New Haven.

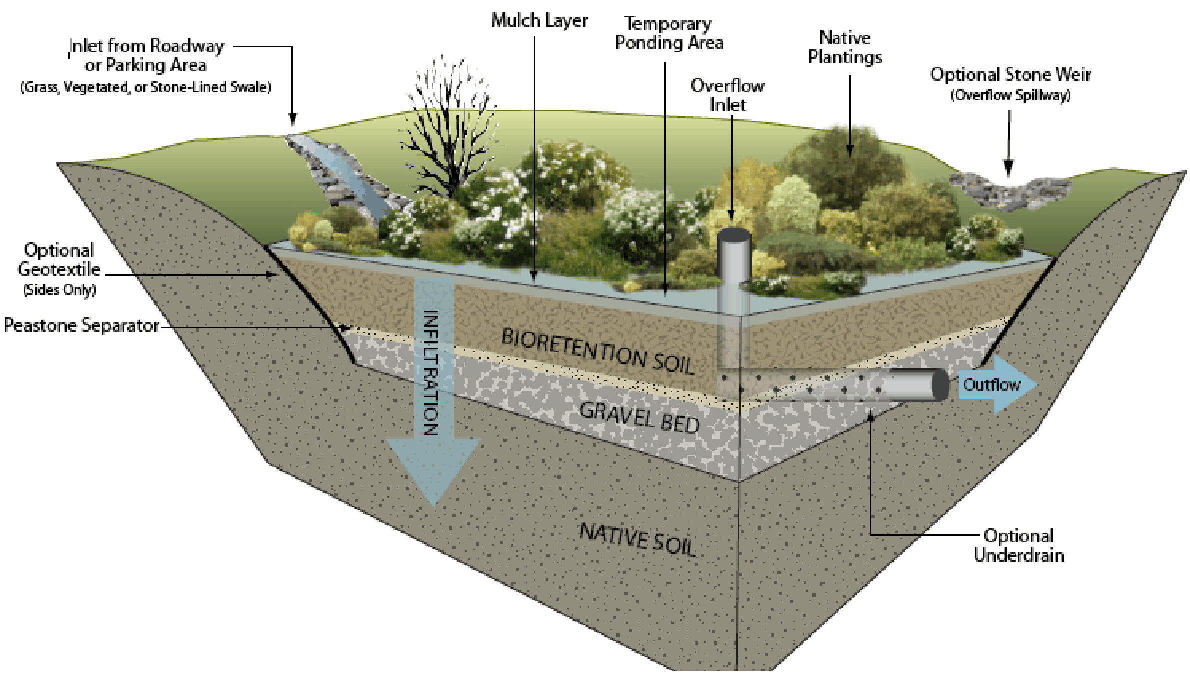

Figure 10. Bioretention schematic.

Figure 11. Proposed green infrastructure retrofits for the John S. Martinez School Grounds, Exchange Street, and Mill River Trail Site.

Wilbur Cross High School

Wilbur Cross High School is located in the East Rock neighborhood of New Haven, immediately west of the Mill River. Not including athletic facilities, the school and parking cover nearly 10 acres in the Lower Mill River subwatershed. The school lies immediately northwest of CSO #012, but the school building and parking areas addressed here are outside of the CSO area. The proposed concept design focuses on the approximately 2-acre parking lot on the southeast side of the site, along with drainage from the main portion of the high school building. It is likely that the proposed design would also intercept surface flow from the adjacent tennis courts further to the east.

The existing parking lot features extra-long, numbered bus parking spaces along the northeast and east perimeters of the lot. The parking layout maximizes available locations for bus parking, but in doing so, the layout creates two large dead spaces where parking is prohibited (*Figure 14*), both of which are located in the northeast corner of the lot. Each of these locations coincides with the location of existing catch basins. A double catch basin in the corner of the lot is the most downgradient collection point and outfalls directly to the Mill River approximately 10 feet below the parking lot grade. Roof drainage from the east side of the building appears to be connected into the drainage system at the catch basin located in the middle of the eastern edge of the parking lot.

- **Parking Lot Bioretention**. Proposed retrofits include the removal of pavement from the two 'dead spaces' (approximately 830sf and 870sf) in the northeast corner of the lot and conversion to bioretention to accept surface flows across the parking lot. Of the 6,900cf WQV anticipated from the approximately 87,000sf parking lot, the two bioretention areas would treat up to up to 6,200cf (90%) of WQV (*Figure 15*).
  Estimated Cost: $79,000

- **Subsurface Infiltration.** An additional 900sf of subsurface infiltration along the eastern edge of the lot would utilize the existing mid-lot catch basin as an inlet to intercept roof drainage from the approximately 44,000sf of building footprint, infiltrating up to 3,400cf WQV out of the approximately 3,500cf WQV expected . The next catch basin downgradient would serve as an outlet to channel excess water back into the drainage system, and the existing double catch basin would serve as an overflow outlet to the Mill River for the entire retrofit system.
  Estimated Cost: $89,000

Total Estimated Cost: $168,000

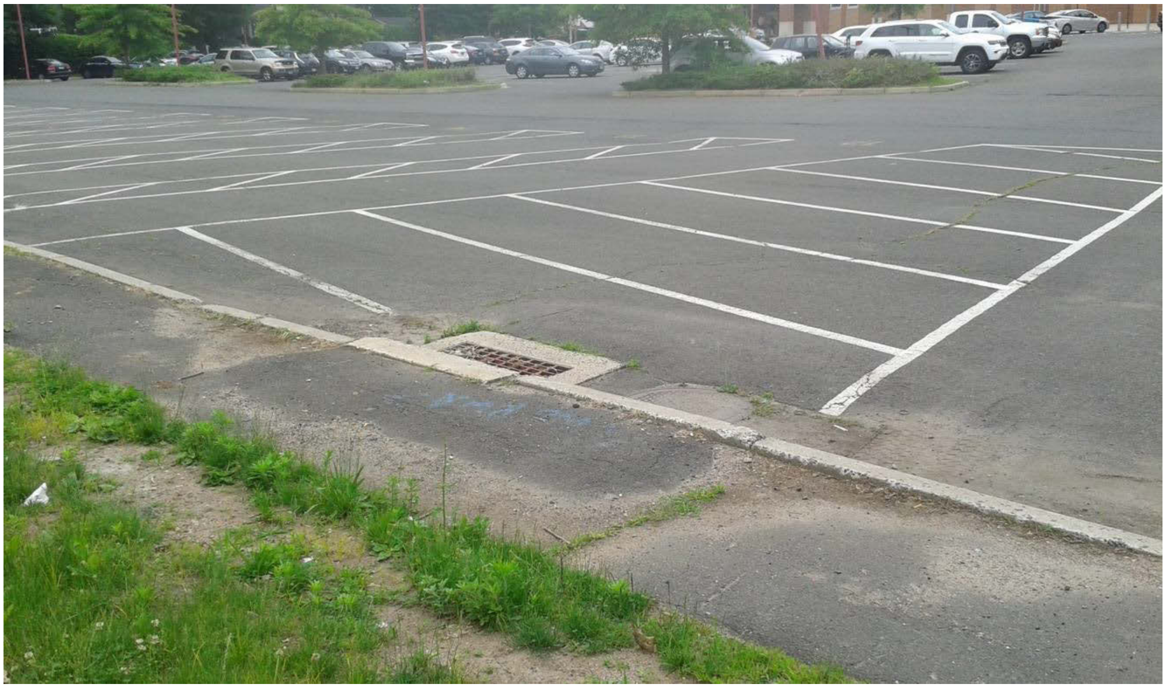

Figure 12. One of the two 'dead spaces' where parking is prohibited amidst bus parking spaces at the Wilbur Cross High School parking lot.

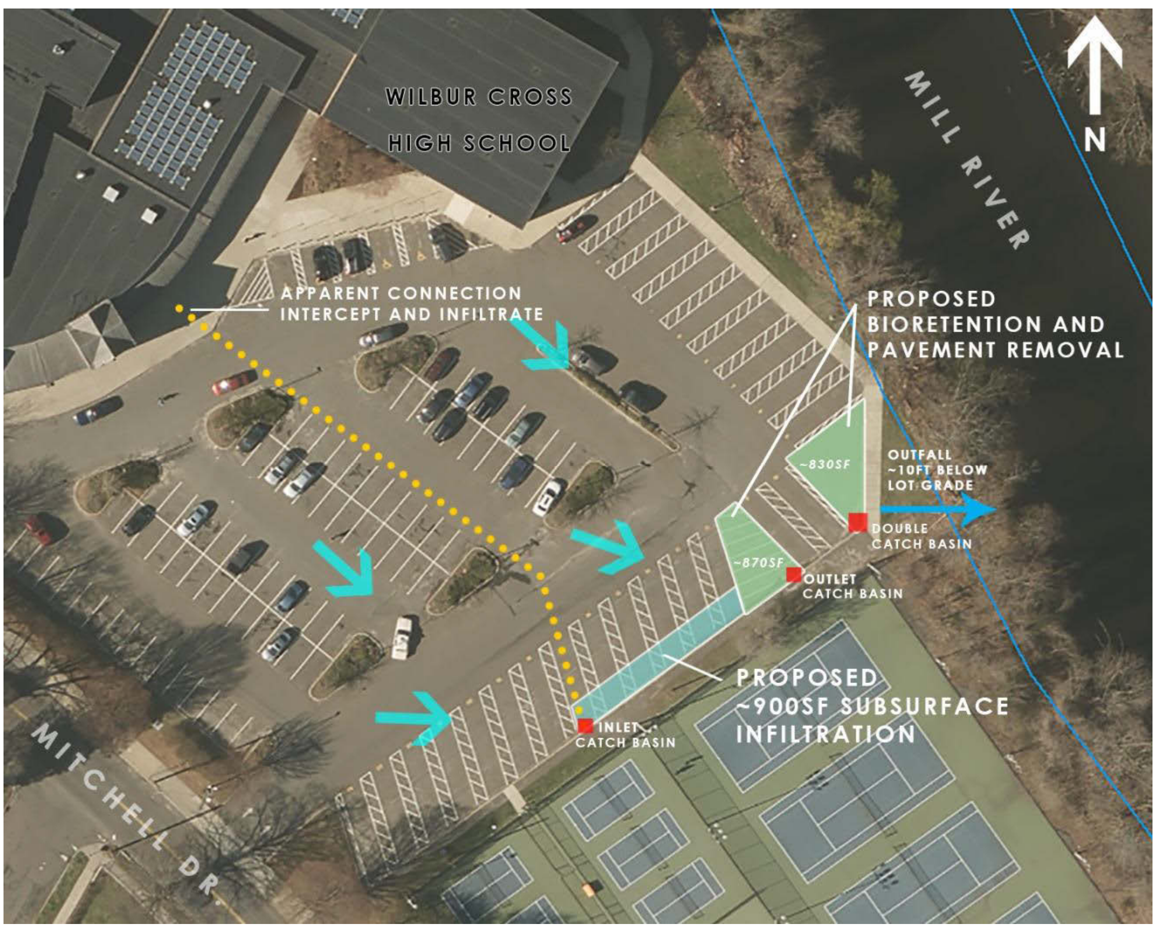

Figure 13. Proposed green infrastructure retrofits for Wilbur Cross High School. Red squares indicate existing catch basins. Blue arrows indicate existing surface flow patterns.

Livingston Street at East Rock Road

East Rock Park begins just south of Lake Whitney and follows the Mill River for over 1.5 miles. On the east side of the river, the park provides a buffer for the river that is generally wooded and at least 0.2 miles wide. On the west side of the river, the park is much narrower and less heavily wooded; the proposed concept design focuses on this side of the park, particularly the borders of the park that follow Livingston Street and East Rock Road.

An existing walking trail follows the park edge along Livingston Street (*Figure 16*). Scattered catch basins along Livingston Street intercept flow from the street and carry it north toward East Rock Road. At East Rock Road, storm drains from Livingston Street join with the storm drain under East Rock Road and carry runoff east to the Mill River. The outfall for this system is located north of the East Rock Road bridge.

While the park occupies the land east of Livingston Street, the west side of the street is residential. Many downspouts appear to be connected to the drainage system, though others were disconnected.

- **Vegetated Infiltration Swale.** A short wooden fence runs along the east side of Livingston Street beginning at the intersection with Cold Spring Street and following the road northward for approximately 850 feet. A vegetated swale is proposed to promote infiltration along this stretch of Livingston, using curb cuts spaced along the swale to accept approximately 1,200cf WQV of stormwater from approximately 15,000sf of drainage area consisting of the northbound lane of Livingston Street. *Estimated Cost: $61,000*

- **Bioretention Landscaping and Trail Enhancement.** A storm drain in the center of the intersection of Livingston Street and East Rock Road currently accepts stormwater flows from all four corners of the intersection, as well as flows from further west on East Rock Road. Two raingardens/bioretention areas are proposed to accept stormwater from Livingston Street, East Rock Road, and East Rock Park Road via curbcuts located just upgradient of the existing catch basins.
    - One raingarden/bioretention area would be located on the northwest corner of the intersection (with approximate area of 250sf and capacity to capture and treat approximately 900cf WQV). The northwest raingarden/ bioretention area would serve a drainage area of approximately 10,000sf (800cf WQV), consisting of the north side of East Rock Road between Livingston Street and Everit Street, as well as a portion of the south side of East Rock Park Road. The BMP is proposed with an overflow structure that would carry excess stormwater back to one of the existing catch basins.
    - A second raingraden/ bioretention area on the southeast corner of the intersection (with approximate area of 300sf and capacity to capture and treat approximately 1,100cf WQV) would be located in existing open green space among trees to minimize root and tree impacts (*Figure 18*). Stormwater would enter the BMP from a curbcut located just south of the existing fire hydrant and upgradient of the existing catch basin

on the east side of Livingston Road. The BMP would capture stormwater from the east side of Livingston Street from the mid-block catch basin to the curb cut, an area of approximately 14,000sf (1,100cf WQV). In order to preserve the existing trail, an ADA compliant boardwalk feature would allow pedestrians to connect from the corner sidewalk to the existing walking trail in the park, crossing over the raingarden/bioretention area (*Figure 17*). Additional interpretive signage would be added to the existing park sign already in place at the southeast corner of Livingston Street and East Rock Road to enable the stormwater features to serve as an education and outreach site. The raingarden/bioretention area is proposed to contain an overflow structure that allows excess stormwater to sheetflow across vegetated land to the south and east.

- *Estimated Cost: $31,000 (consisting of $26,000 for bioretention areas and* $5,000 for trail enhancement)

Figure 14. Existing conditions at Livingston Street (foreground) and East Rock Road, showing open space where bioretention is proposed and the existing walking trail.

Figure 17. Proposed bioretention area and trail improvements in East Rock Park.


N
BIORETENTION/ RAINGARDENS
CURB CUTS
OUTLET TO EXISTING CATCH BASINS
PROPOSED ACCESSIBLE BOARDWALK
FIRE HYDRANT
EVERIT STREET
LIVINGSTON STREET
EXISTING TRAIL
MILL RIVER
CB
VEGETATED SWALE
CURB CUT
CURB CUT
CB
ORANGE STREET
COLD SPRING STREET

Figure 18. Proposed green infrastructure retrofits for Livingston Street at East Rock Road. "CB" indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

YNHH Outpatient Services

The Yale New Haven Health System (YNHH) Outpatient Services facility is located on Sherman Avenue in Hamden, CT, on an approximately 2-acre site. Shepard Brook runs along the northeast edge of the property, and drainage from the site enters the brook approximately 2 miles upstream of its confluence with the Mill River.

The site is largely covered by impervious surfaces, including approximately 28,000sf of parking lot space spread between two lots, an approximately 8,000sf building footprint , and an additional 7,500sf of paved driveway. Most of the remaining space within the parcel is occupied by maintained lawn. Trees border the north and south edges of the site, forming a buffer with adjacent parcels. A few large trees line the west edge of the parcel, along Sherman Avenue. A parking lot island in the rear lot features mature trees and shrubs as well and provides some shade on the site. This island could potentially be converted to bioretention, however existing trees, sidewalks, and underground electrical located in the island would pose conflicts for such a conversion.

A series of catch basins are connected in the parking lot and carry stormwater away from Sherman Avenue and toward Shepard Brook. Downspouts from the YNHH Outpatient facility are also connected to this storm drain system. The most downgradient catch basin was clogged with silt and debris during the field visit, indicating high sediment loads. Pooling in the vegetated area east of the site suggests a possible high water table, which may be contributing to pooling in the vicinity of the downgradient catch basin. Because of this, proposed BMPs are focused higher in the landscape, to ensure successful infiltration of stormwater.

- **Parking Lot Retrofits.** Approximately 5,000sf of pervious pavement is proposed for the 23,000sf rear parking area, focusing on the spaces in the center of the parking lot, where stormwater runoff could be infiltrated before reaching the most downgradient catch basin in the northeast corner of the site (*Figure 19*). In addition to reducing impervious area on this portion of the site by approximately 20%, the pervious pavement will also accept stormwater flows from more westerly sections of the parking lot, as water flows to the northeast across the site. *Estimated Cost: $20,000*

- **Front Lawn Retrofits.** The approximately 5,000sf front parking lot slopes toward the front lawn area, between Sherman Avenue and the front parking lot. This lawn area also appears to receive stormwater flows from an approximately 3,000sf area consisting of the northbound travel lane of Sherman Avenue as it approaches the driveway from the south, and the front portion of the YNHH driveway. This yields a total WQV for this portion of the site of approximately 630cf. An approximately 200sf bioretention area (with approximate treatment capacity of 735cf WQV) is proposed for the bumpout portion of the front lawn, with curb cuts allowing stormwater to enter from both the parking area and the driveway. *Estimated Cost: $10,000*

- **Main Lawn Retrofits.** Approximately 600 sf of distributed bioretention/rain garden area is proposed for the main lawn. Approximately 400sf of linear bioretention (approximately 5 feet wide by 80 feet long) is proposed along the north edge of the lawn to capture stormwater from the approximately 4,500sf of driveway area between the two parking lots. An additional triangular raingarden/bioretention feature of approximately 200 sf is proposed for the area adjacent to the sidewalk leading from the rear parking lot to the building. Downspouts from the north side of the 8,000sf building would be disconnected from the storm drain system and redirected to this area. Developing the bioretention area as a rain garden would provide a landscape feature on the site, and could be supplemented with interpretative signage for public education and outreach. This area could potentially be utilized as an outdoor gathering space, either for patients waiting for appointments or for staff on break. Lower maintenance bioretention designs are equally feasible on the site, and would require only periodic cleaning in addition to mowing, which is already occurring at the proposed location (*Figure 19*). *Estimated Cost: $28,000*

Total Estimated Cost: $58,000

Figure 15. Proposed green infrastructure retrofits for YNHH Outpatient Services Facility. "CB" indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

Whitney High School North/West

Area Cooperative Educational Services (ACES) operates two special education programs out of its Whitney High School North and West campuses, located immediately west of the Mill River on Skiff Street in New Haven. The Whitney North/West campus is an approximately 5-acre site, which is nearly 100% impervious. Three buildings are located on the site, which slopes from Skiff Street down toward the south end of the site and also east toward the Mill River. Parking is terraced, creating three separate tiers along the north/south gradient (*Figure 20*).

Existing east-west oriented parking islands separate the tiers; these islands are narrow and steeply sloped, making them unlikely candidates for green infrastructure practices. Existing curb cuts at the ends of these islands carry water from one tier down to the next, with stormwater eventually flowing to catch basins along the southern edges of the parking areas. Downgradient catch basins are assumed to outfall directly to the Mill River, on the far side of a chain-link fence which follows the eastern edge of the parcel.

The southeast corner of the site, adjacent to the Staff Development Building, currently contains a raised bed garden area, picnic table, and composter. A gravel swale appears to carry excess stormwater from a low point in that area to the south edge of the site and toward the Mill River.

- **Parking Lot Retrofits and Bioretention.** A combination of subsurface infiltration, pervious pavement, and bioretention is proposed to reduce stormwater runoff from the extensive parking areas on the site and provide a variety of green infrastructure demonstration sites for curricular value.

    - Approximately 14,500sf of pervious pavement is proposed in the front parking lot and upper and middle tier parking areas of the main lot to reduce impervious cover on the site and infiltrate runoff from the upper two tiers of parking. *Estimated Cost: $58,000*

    - Approximately 500sf of subsurface infiltration is proposed to be located behind the Staff Development Building, intercepting flow from the existing catch basins at the low end of the parking lot, infiltrating approximately 1,800cf WQV, and returning excess stormwater to the existing drainage system at the east end of the practice (*Figure 21*). This practice would be designed to capture drainage from an approximately 20,000sf area including the parking area surrounding the Staff Development Building and redirected drainage from the building (approximately 1,600cf of WQV). *Estimated Cost: $47,000*

    - Approximately 800sf of bioretention is proposed in the southeast-most corner of the parking lot, requiring the removal of two parking spaces (*Figure 22*). Existing catch basins in this location would be raised to serve as overflow structures. A sediment forebay is proposed for the first bioretention cell (to be located in the existing parking area) in order to minimize required maintenance of the downgradient bioretention area. From the sediment forebay, water would flow to a landscape feature that winds through the existing picnic/garden area, avoiding existing trees, and connecting to the existing gravel swale (*Figure 23*). The bioretention area would accept water flowing down the campus driveway, as well as flow from the lower tier parking area, including any overflow from the upper tiers (approximately 1 acre of drainage area or 3,500cf of WQV). The bioretention system would be designed to capture approximately 3,000cf WQV. Building on existing uses in this area which appear to emphasize environmentally-friendly practices (e.g., composting, raised bed gardening), the bioretention system could provide educational opportunities for students and staff in the form of signage and/or curricular connections. *Estimated Cost: $38,000*

Total Estimated Cost: $143,000

Figure 16. Tiered parking, with existing conveyances that transport stormwater from the upper tiers to lower tiers.

Figure 17. Proposed location for subsurface infiltration behind the Staff Development Building. The downgradient catch basin (near the dumpster) would serve as an overflow for the system and outfalls to the Mill River.

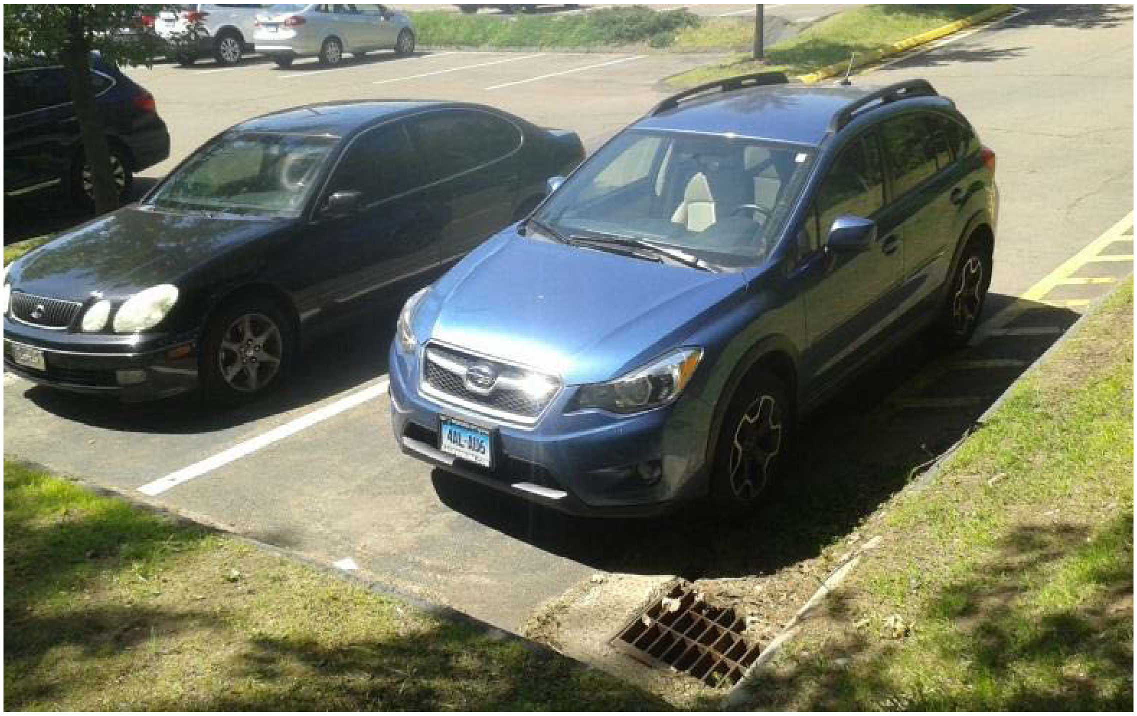

Figure 18. Proposed location of sediment forebay (top) and bioretention areas (bottom).

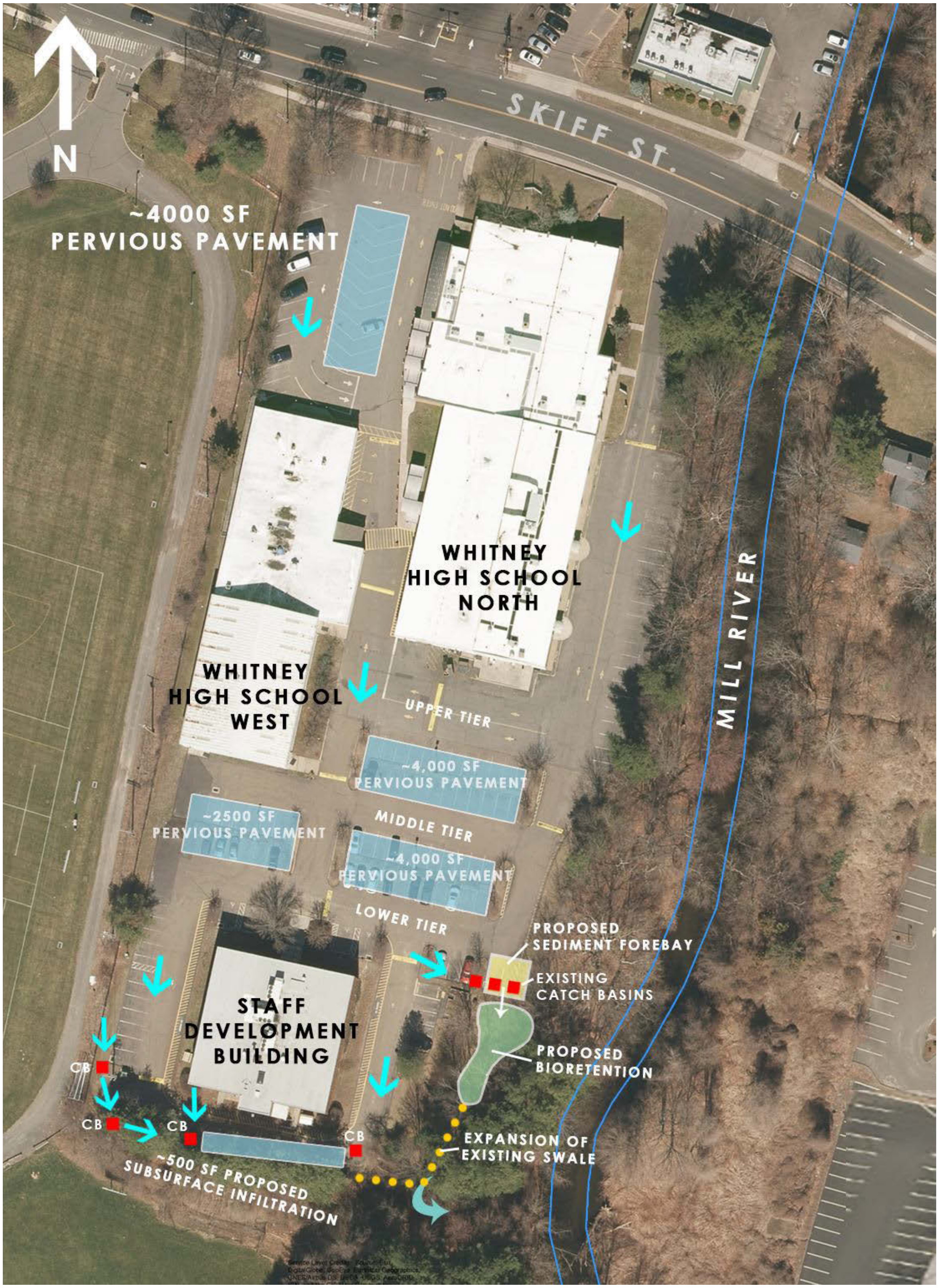

Figure 19. Proposed green infrastructure retrofits for Whitney High School North/West. "CB" indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

Counter Weight Brewery, Spring Glen Nursery, and Raccio Park Road

Counter Weight Brewery is located along the south side of Raccio Park Road, within approximately 500 feet of Shepard Brook. The building and lot occupy approximately 1-acre (*Figure 24, Figure 25*), with the adjacent portion of Raccio Park Road and circular turnaround adding 0.25-acres of additional drainage area. The parcel between the brewery and Shepard Brook is occupied by Spring Glen Nursery.

The roof drains on the brewery building are currently connected to the storm drainage system. A series of five catch basins in the circle and along the eastern and southern edges of the property transport stormwater away from the site, presumably to an outfall on Shepard Brook. Note that while most of this site is mapped as B soils (good infiltration), the southern edge of the site is indicated to be D soils, so additional soil testing will be especially necessary at this site in order to more precisely determine the infiltration capacity of the soils.

Existing parking lots are in poor condition, and catch basins on site were clogged with silt and debris. Existing vegetated areas and parking islands on the brewery property do not appear to receive regular maintenance, whereas planting areas on the nursery property were obviously receiving regular care.

- **Bioretention Area/Rain Gardens.** A series of bioretention areas/rain gardens are proposed for the site:
    - A series of three distributed bioretention areas/raingardens are proposed within Counter Weight Brewery's parking area. A 150sf bioretention area/rain garden is proposed in the existing island bumpout at the northeast edge of the front parking lot; this practice would accommodate capture of approximately 550cf of WQV and would accept stormwater flows from a portion of the 7,500sf front parking lot (with associated 600cf of WQV). A second 100sf bioretention area is proposed in the existing island bump-out at the southeast edge of the front parking lot; this practice would accommodate approximately 370cf of WQV. In addition to accepting surface runoff from the front parking lot, this practice could potentially receive flow from redirected roof leaders. A third 75sf bioretention area/rain garden is proposed for the existing vegetated bumpout at the southeast corner of the building. This practice could accommodate approximately 275cf of WQV and would be designed to accept flow from redirected roof leaders, with a potential roof catchment area of approximately 4,500sf (354cf of WQV). Overflow from this bioretention area would be directed overland toward the existing catch basin and proposed pervious pavement (see below). *Estimated Cost: $16,000 (assuming all three areas); costs for individual practices range from $4,000 to $7,000*
    - A 200sf linear bioretention area along the southern edge of Raccio Park Road would accept stormwater runoff from the road via a curb cut on the western end of the feature (*Figure 26*), with the potential to capture and treat approximately 735cf of WQV. To increase the drainage area, the upgradient catch basin west of the practice should be closed off; this would direct approximately 5,500sf of drainage area to the practice (with corresponding 435cf of WQV). While the green space between the brewery and nursery driveways and the bumpout areas mentioned

above are maintained with plantings (*Figure 24*), the existing green space between the road and the main brewery parking lot is unmaintained, so this feature could be designed either with landscape enhancement or minimal maintenance as the primary goal. The bioretention area would overflow to the existing downgradient catch basin adjacent to the Counter Weight Brewery driveway. *Estimated Cost: $10,000*

Figure 20. Existing conditions at Counter Weight Brewery, looking toward the brewery building from the circle on Raccio Park Road.

- **Parking Lot Retrofits.** Approximately 2,000sf of pervious pavement is proposed along the eastern edge of the parking lot to reduce impervious cover and intercept additional surface flows to the two existing catch basins at the edge of the lot. Approximately 28,000sf of impervious area drains toward this section of the parking lot, with corresponding 2,217cf WQV. The 7,500sf front parking area could also be converted to pervious pavement in the future if the lot is repaved. *Estimated Cost: $8,000 (assuming 2,000sf); an additional $30,000 would be required to convert the entire front lot to pervious pavement*

- **Maintain Existing Catch basins.** Some of the catch basins at the site were observed to be clogged with silt and other debris. Periodic clearing of this debris will maintain proper functioning of the existing system, decrease pollutant loads to the storm drain system, and reduce ponding in adjacent impervious areas. *Estimated Cost: minimal; use existing brewery staff labor or volunteers*

Total Estimated Cost: $34,000 ($64,000 including conversion of front lot to pervious pavement)

Figure 21. Existing conditions at Counter Weight Brewery, showing clogged catch basin (left) and degraded asphalt parking lot (right).

Figure 22. Proposed green infrastructure retrofits for Counter Weight Brewery and Raccio Park Road. "CB" indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

Bartlem Recreation Area

This large municipal park is located on CT 10 (South Main Street) in Cheshire, directly across from Cheshire High School. The site is owned by the Town of Cheshire and includes lacrosse, baseball, and soccer fields, as well as a covered swimming facility and multiple parking areas. Most of the stormwater from the site drains to an approximately 36-inch outfall at the southern end of the property. These parking areas and structures comprise approximately 5-acres of directly connected impervious cover on the site. An additional 1.75-acres of maintained athletic field area likely contributes surface flows to the storm sewer system during heavy rains.

Existing catch basins are located behind the swimming pool and appear to capture overflows from the pool decks as well as stormwater runoff. Additional catch basins are located in the northern parking lot, on either side of the driveway, and in the lawn between the baseball field and swimming pool parking lot *(Figure 27*). The catch basin located at the southwest corner of the swimming pool parking lot appears to be the most downgradient catch basin before stormwater outfalls into the Mill River. An existing gravel swale carries additional overland runoff from the baseball diamond, along the south edge of the ball field, into a catch basin located in the grass adjacent to the parking lot, and ultimately through the parking lot catch basin to the outfall.

- **Linear Bioretention**. An existing short fence runs along the north edge of the baseball field, creating a lawn area approximately 15 feet wide between the fence and the curbed driveway of the recreation area (*Figure 28*). This space is currently utilized for event parking. Approximately 300sf of linear bioretention is proposed toward the east end of this space to treat stormwater runoff from the driveway while preserving as much parking as possible (*Figure 29*). A curb cut will allow stormwater to flow from the road (approximately 14,000sf of drainage area, with 1,100cf WQV) into the proposed bioretention before reaching the existing catch basin. As the landscape slopes slightly to the east, check dams are proposed as part of the design to slow the movement of water through the bioretention feature. The bioretention area can be designed to overflow either to the existing catch basin or the proposed water quality swale (below). *Estimated Cost: $14,000*

- **Vegetated Water Quality Swale.** A second linear feature (2,500sf) is proposed between the baseball field and the swimming pool parking lot, on top of the existing storm drainage pipes. Existing catch basins would be raised to serve as overflow structures during heavy rains, and a vegetated swale is proposed along the length of the parking lot to infiltrate surface runoff from the 44,000sf of uncurbed parking lot (with accompanying 3,500cf of WQV) and adjacent ball field (expected to generate, at minimum, an additional 350cf or more of WQV) (*Figure 29*). Effectiveness of the swale could be further enhanced by re-grading the parking lot whenever it is next repaved to encourage stormwater to flow toward the swale. Drainage from the pool roof could potentially be directed toward the swale as well, although it was not clear from the site visit how pool roof drainage is currently handled. *Estimated cost: $36,000*

- **Pervious Pavement.** 15,000sf of pervious pavement is proposed for the middle two rows of parking in the north parking lot. This conversion to pervious pavement would reduce the impervious surface of the 50,000sf lot by nearly 30% and decrease the volume of stormwater inputs to the existing drainage system. *Estimated Cost: $60,000*

Figure 23. Existing catch basins at the edge of the swimming pool parking lot at Bartlem Recreation Area. The space between the parking lot and ball field is proposed for conversion to a vegetated swale.

Figure 24. Roadside area proposed for linear bioretention.

- **Bioretention/Rain Garden.** A bioretention area/rain garden and native planting area of up to 1,500sf is proposed for the lawn area between the circular drive in front of the swimming pool and the swimming pool parking lot. A curb cut in the circle would allow stormwater to flow into the rain garden, with the existing catch basin serving as an overflow to direct excess stormwater back into the drainage system. A 300sf bioretention area is proposed to capture and treat runoff from the approximately

12,000sf of impervious drainage area (approximately 950cf of WQV) that would connect to the BMP via the proposed curb cut in the circle. Remaining area in this planting island should be converted to native plantings. Due to its location near the pool entrance, this would likely be the most visible location at which to include educational information about the full suite of proposed green infrastructure components suggested for the site. *Estimated Cost: $14,000 (assuming 300sf of bioretention; additional funds (or plant donations) may be required for native plantings to fill the entire island)*

Total Estimated Cost: $124,000

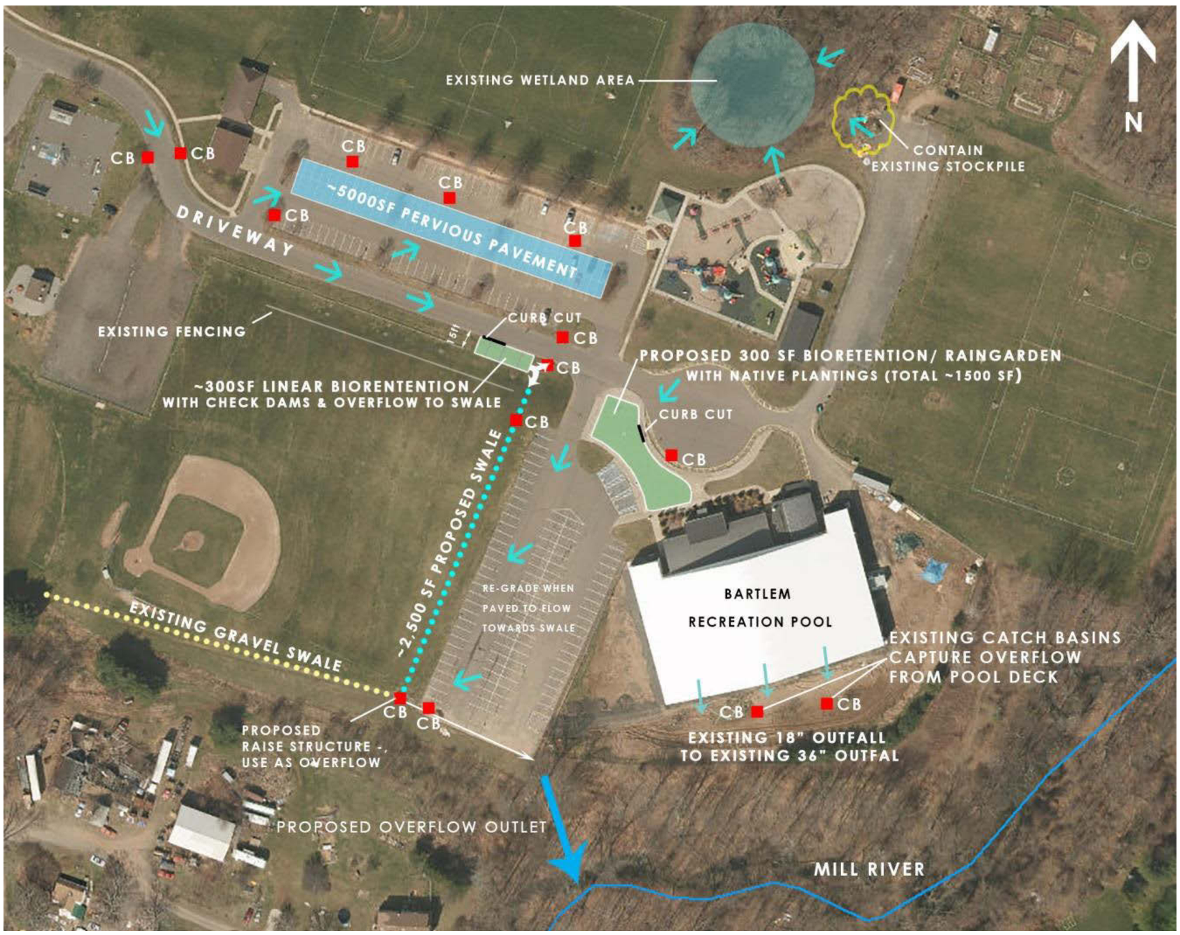

Figure 25. Proposed green infrastructure retrofits for Bartlem Recreation Area. "CB" indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

Strathmore Drive

Strathmore Drive is located in a residential subdivision in Cheshire that lies just east of the Mill River, across the river from the Bartlem Recreation Area and south of Wallingford Road. An unnamed tributary of the Mill River winds through the neighborhood.

Green spaces were required to be created during the development of the subdivision. Two such sites are located on Strathmore Drive, between the two ends of Buttonwood Circle. A playground occupies the green space to the west side of Strathmore Drive; on the east side of the street, the existing green space consists of a semi-circular lawn area bordered by bermed planting areas that include mature evergreen trees and shrubs (*Figure 30*). Beyond the berms is another area of lawn that backs up to residential lawns from homes on Buttonwood Circle. To the southeast, this area meets up with a wooded buffer through which the unnamed tributary stream passes through the neighborhood. The area, including the lawn and bermed planting areas, is currently maintained by the Homeowner's Association via a landscaping contractor.

- **Public Green Space Retrofit.** Although located adjacent to a high point on Strathmore Drive, the semi-circular lawn forms a natural bowl in the landscape, and could be converted to an approximately 500sf bioretention area to collect and infiltrate runoff from approximately 11,000sf of catchment area on Strathmore Drive and portions of Buttonwood Circle (with corresponding 900cf of WQV) (*Figure 31*). Water could be redirected from catch basins on Strathmore Drive that are located at each end of the green space and directed into the bioretention area to either infiltrate or ultimately be released back into the tributary stream via an overflow swale. More detailed site survey is necessary to confirm feasibility, but available contour/elevation data indicates between a 5% and 8% slope from the catch basin locations to the depression/proposed bioretention area. It may also be possible to direct roof leaders from houses that back up to the green space into the bioretention area. If desired, the bioretention area could be designed as a rain garden to enhance the existing landscape features of this space. *Estimated Cost: $24,000*

Total Estimated Cost: $24,000

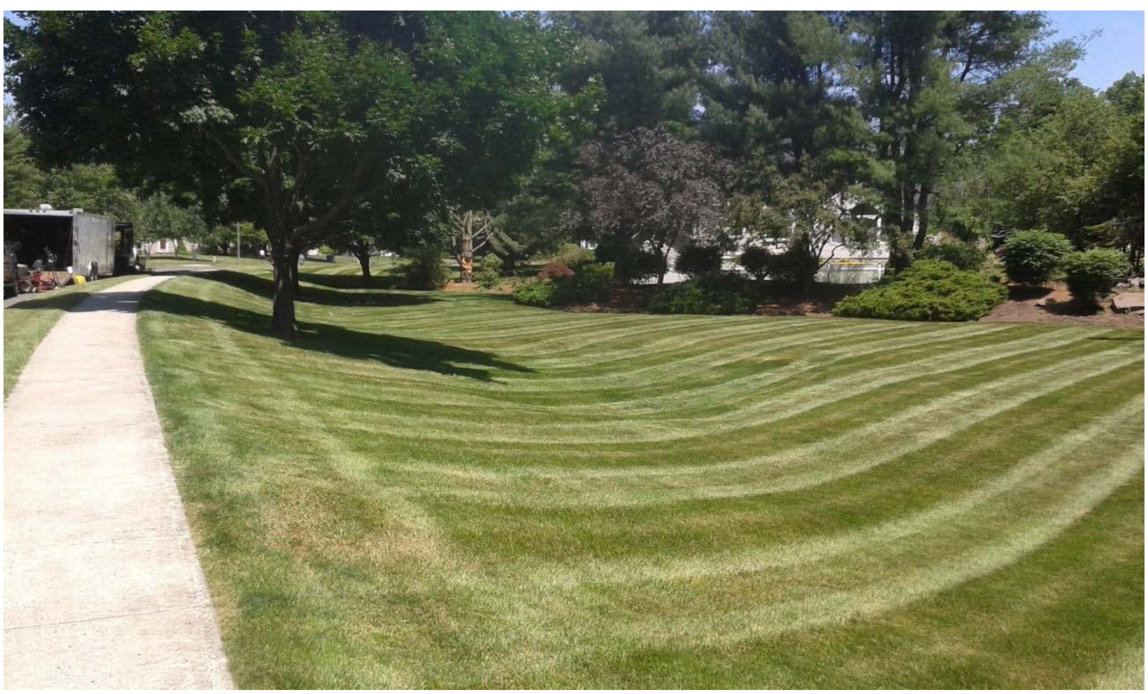

Figure 26. Sidewalk along Strathmore Drive and public lawn area, with bermed plantings in background.

Figure 27. Proposed green infrastructure retrofits at Strathmore Drive. "CB" indicates existing catch basin. Blue arrows indicate existing surface flow patterns.

Appendix D

Project Steering Committee Meeting Summaries

Mill River Watershed-Based Plan: Public Meetings and Presentations

3/1/2018 – Kick-off Meeting at the Eli Whitney Museum – Save the Sound presented an overview of the Mill River Watershed and types of impairments identified; the objectives for developing a watershed-based plan; and timeline of the planning process. Attendees divided into small groups and were invited to discuss their interests in the river and what was important for them to see in the plan. It was noted that the most important part of the planning process is to develop a document that can be moved forward into implementation. Meeting summaries are included in this appendix.

3/18/2018 – Save the Sound made a presentation to the Whitneyville Civic Association about the Mill River Watershed planning process and the objectives for developing a watershed-based plan soliciting input from the civic association.

4/10/2018 – Steering Committee Meeting at the Cheshire Senior Center – Fuss & O'Neill, Inc. made a presentation reviewing Technical Memorandum #1: The State of the Watershed; scope and timeline for the project; and the next steps in planning process. The steering committee expressed interest in self-organizing to conduct streamwalks that would not otherwise have been included in the project scope. Meeting summaries are included in this appendix.

5/1/2018 – Steering Committee Meeting at the Eli Whitney Museum – Members of the West River Watershed Coalition (WRWC) were invited to discuss successes and lessons learned from the West River Watershed Plan, and how the group functions as a watershed-based coalition. The steering committee discussed potential implementation projects for the Mill River Watershed-Based Plan and the opportunity to submit a proposal for Hamden Town Center Park to CTDEEP EPA 319 Program for consideration for the 2018 funding cycle. Meeting summaries are included in this appendix.

5/29/2018 - Steering Committee Meeting at the Cold Spring School- A section of the film *The Mill River – Water and Wildlife by* Florence S. McBride was previewed. Tech Memo #2: Pollution load model was reviewed and GNHWPCA and the Regional Water Authority discussed their respective activities in the watershed and how the watershed-based plan could compliment their efforts. Meeting summaries are included in this appendix.

6/6/2018 – New Haven Environmental Advisory Council (EAC) - A presentation was made to the EAC regarding the Mill River Watershed planning process; the objectives for developing a watershed-based plan; and how a watershed-based plan could compliment the council's and the city's initiatives in the Mill River Watershed.

6/20/2018 – Green Drinks New Haven - A presentation was made by Save the Sound to the community regarding the Mill River Watershed-Based Plan, the objectives and potential implementation projects. As the midpoint in the planning process, the community was asked for feedback and if there was additional items that should be considered going forward in the planning process.

7/10/2018 – Steering Committee Meeting at the Cheshire Senior Center - Fuss & O'Neill, Inc. presented on the screening-level model used to estimate pollutant loads within the watershed and the primary sources. Technical Memorandum #3: The State of the Watershed, was reviewed, which highlights the major tasks of the green infrastructure assessment and existing practices in the watershed. The steering committee reviewed the screening criteria used to prioritize potential project locations. The 10 sites for which concept designs were developed were discussed in detail. Meeting summaries are included in this appendix.

8/21/2018 - Steering Committee Meeting at the Eli Whitney Museum - The steering committee reviewed and discussed the draft Mill River Watershed-Based Plan and public outreach events to share the plan with the greater watershed community. Meeting summaries are included in this appendix.

9/5/2018 & 9/6/2018 - Two community meetings were held on September 5th and 6th, 2018. In order to accommodate residents from both ends of the watershed, the September 5 meeting was held at the Eli Whitney Museum, while the September 6 meeting was held at Cheshire Senior Center. Findings of the draft watershed-based plan were presented by Fuss and O'Neill. The presentation described the current watershed conditions and major issues facing the Mill River Watershed and recommendations included in the draft watershed-based plan. Questions and comments were received during and following the meeting. Public comments have been incorporated into the final watershed-based plan and a summary of comments received is included in *Appendix E*.

9/8/2018 - Information on the draft Mill River Watershed-Based Plan was made available at the CT Folk Festival & Green Expo held in Edgerton Park.

9/15/2018 - Information on the draft Mill River Watershed-Based Plan was also made available at the Whitneyville Fall Festival and the Cheshire Fall Festival.

Other related watershed activities:

7/21/2018 - Fuss & O'Neill, staff from the RWA, and CFE/Save the Sound conducted a streamwalk assessment training for Cheshire Land Trust, members of the Project Steering Committee, and volunteers. The training provided volunteers with basic information on how to complete a stream assessments of a segment of the Mill River or its tributaries following the Natural Resource Conservation Service protocols for performing visual stream assessments in Connecticut. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ct/water/?cid=nrcs142p2_011198.

Streamwalk assessments were conducted in August and September 2018 by volunteers for the entire mainstem of the Mill River, Shepard Brook, and Willow Brook. Additional information is included in *Appendix E.*

MILL RIVER WATERSHED

MANAGEMENT PLAN KICK-OFF MEETING

THURSDAY, MARCH 1ST
6PM

@ **ELI WHITNEY MUSEUM**
915 WHITNEY AVENUE, HAMDEN, CT

Free and open to the public

RSVP apaltauf@savethesound.org

Connecticut Fund for the Environment
Save the Sound®

Mill River Watershed Plan
Project Kick-Off Meeting - Summary

March 1, 2018

1. Welcome from Gwen Macdonald, with an overview of how Save the Sound became involve in the watershed plan for the Mill River and previous work that had been done in the West River Watershed.

2. A brief presentation was given by Nicole Davis, which provided a of summary of the Mill River watershed and identified impairments; the objectives for developing a watershed based plan; an overview of the planning process; the EPA's 9 Elements for watershed planning and the scope and schedule for the Mill River Watershed Plan. It was noted that the most important part of the planning process is to develop a plan that can be moved forward to implementation. Save the Sound is committed to moving beyond plan development and into implementation. A copy of the presentation will made available by request. A list of available studies and reports for the watershed was also shared and the stakeholders were asked to identify any existing information that may be missing.

3. Following the presentation, introductions of the group were made. Each person in attendance was asked to introduce themselves, who they are with and why they were interested in the Mill River Watershed (Please see attached list of attendees). Chris Malik with DEEP commented on the states desire to delist impaired water bodies and also shared the desire to support the plan. He indicated that they would like to see projects included that can be implemented.

4. Following introductions the stakeholders broke out into smaller groups to discuss
    a. What is important in the watershed?
    b. What do you want to see in the plan?
    c. What information is available?
    d. Anyone else who should be here?

    When discussing who else should be present in the planning process a concern was raised regarding municipal involvement. Most individuals present expressed the desire for municipalities to be involved in the planning process as well as staying involved to implement projects. (Below is a summary of the discussion from each group)

5. The stakeholders came back together to summarize what was important in each group. The conversations in each group we slightly different seemed to center around the same basic themes. There was a consensus that protecting the watershed was important and the more extensive public education opportunities were needed to expand connectedness to the river. The need for better access and opportunities to use the river recreationally were important along with expanding conservation and recreation opportunities. Clean drinking water was identified as an important use along with reducing storm water. The

need to address CSO's was discussed in every group along with the benefits of using measures to reduce runoff as a tool to reduce CSO inputs.

6. The meeting concluded with a What's Next for the watershed and the steering committee:

   The next Steering Committee meeting will be established via doodle poll https://doodle.com/poll/pttuu3hxn8ixc96q

   a. , with the intention of holding the meeting in Cheshire and then alternating meeting locations between the up and lower watershed.
   b. One of the desired outcomes of the plan is to form a steering committee that will hopefully evolve into a watershed coalition focused on plan implementation. Anyone interested in being a part of the steering committee for the plan was asked to let Nicole know. Kendall Barberry asked how often the steering committee was going to meet. The intention was to meet monthly or more often as needed during the planning process.
   c. A watershed questionnaire was developed by Fuss and O'Neil to help guide the plan. Copies of the survey were provided at the meeting and will be sent out by email.

Small Group Discussion

Group 1

- What is important in the watershed?
  - Want the shad back
  - Fishable
  - Clean drinking water
  - Access to the river
  - Mill river blue trail south of I-91
  - Increase Buffer
  - Reduce Runoff from Asphalt
  - Bird Corridor
    - East rock park is an Important bird area
  - Pervious surfaces
    - Incentivize Porous Surfaces
    - Guidelines for Porous surfaces
  - Recreational space
  - Swimmable
  - Education about Water Quality
- What do you want to see in the plan?
  - Presentations
    - Example projects
    - Presentations by municipal officials about how they intend to comply with storm water regulations and incorporate green infrastructure
  - Discussion and analysis of regulations
    - e.g. UCONN in West River

    - MS4 requirements for municipalities
  - Projects
    - Planting native trees and shrubs
    - Pollinators
    - Trash Clean up/how to change behavior/clean ups as a lesson
    - Use Social Media
  - Focused subcommittees, similar to west river watershed coalition
    - Access Committee
- Anyone else who should be here?
  - Trout Unlimited
  - Elected officials

Group 2

- What is important in the watershed?
  - Addressing the major problems
    - Storm water Runoff
    - CSOs
    - Golf Course Runoff
    - Leaking sewer pipes
    - Contaminated sites/sediment
    - Nutrients and contamination other than bacteria
    - Cause of pollutants
      - land use
      - Industrial runoff
      - Illegal dumping
    - RWA withdrawals
- What do you want to see in the plan?
  - Address heavily contaminated sites
    - English Station
    - New Haven Clock Factory
    - Gateway terminal
    - Simkin
    - Olin Powder Farm
  - Contributors of NPS
    - Schools
    - Gateway terminal
  - Public Education
    - Rain barrels
    - Schools
    - Canoe Trips
  - Access to the river
    - Mill River Trail
    - Access upstream
    - Recreation

- Anyone else who should be here?
  - Farmers

  - More residents across the watershed/ Fair haven residents
  - Fishermen

Group 3

- What is important in the watershed?
  - Trout stream at the head waters
  - There needs to be broader sense of connection to the river that will activate people to use the river and increase stewardship
  - Hamden has adopted use based codes, which helps to establish conservation and natural areas within a traditional residential or commercially zoned area: could that be expanded to Cheshire and other municipalities
  - The potential for source to sound trail.
    - Difficult landscape between Armory and Wait Street
    - Above Dixwell has potential to open up for trail
  - Concerns about trail and other problems associated with additional trail
    - RWA has actually seen a reduction of trash on recreational trails – police themselves
- What do you want to see in the plan?
  - Infiltration of storm water
    - Take advantage of CSO communities and the push for reduction
  - Municipalities involved long term
  - Evolving plan that people can continue to add projects too
  - Increased connectivity and access
    - Look to the River as a mode of transportation
  - A document that will add credibility to the river as a community asset
  - Concerns that the plan will focus on the lower watershed. Projects need to connect upper and lower watershed together
  - Signage for existing and built trails
- What information is available?
  - Several years ago there was an active Mill River Association, efforts seemed to diminish when the person who had taken the lead suddenly passed away. If someone were to take the lead the efforts are likely to revive
  - A lot of green initiatives in Hamden right now
  - SCRCOG - disaster mitigation plan, POCD
    - Open Space plan targeting land for conservation
    - Available as GIS resource
  - Cheshire land trust has some GIS data
    - 500' Buffer around river and impervious surface (~13% with in buffer)
  - Are there any successful watershed plan efforts that could be used as an example to help guide this group and this plan
- Anyone else who should be here?
  - The District
  - The Boat House
  - Civic associations

Kick Off Meeting Attendees	
Name	**Organization**
Aaron Goode	Green Fund
Aicha Woods	Mill River Trail
Anthony Allen	Tipping Point
Anthony Zemba	FHI
Arabelle Schoenberg	New Haven Land Trust
Bill Brown	Eli Whitney
Carl Amento	SCRCOG
Chris Malik	DEEP
Christina Kane	The Grove
Corrie Folsom-Okeefe	Audobon CT
Daniel Barvir	New Haven Parks
David Shimchichk	FERP
Dawn Henning	City Of New Haven
Eliza Valk	Reed Hilderbrand
Gary Zrelak	GNHWPCA
Joe Peters	
Joy Vanderlek	Cheshire Land Trust
JR Logan	Mill River Trail
Karolina Ksiazek	NH City Plan
Kendall Barberry	Former Watershed Resident
Kevin Mccarthy	Friends Of East Rock Park
Kim Digiovanni	Quinnipiac University
Lee Cruz	Community Foundation Of Greater New Haven
Mateo	
Mark Foran	Whitneville Civic Association
Nancy Rosembalm	Hamden Land Trust
Pamela Roach	Cheshire Land Trust
Ron Walters	RWA
Nisarg (Niz) Bharatkumar Vyas	UNH
Anna Marshall	Save the Sound
Kevin Dahms	Save the Sound
Annalisa Paltauf	Save the Sound
Gwen Macdonald	Save the Sound
Nicole Davis	Save the Sound

Whitneyville Civic Association Meeting

Thursday
March 15, 2018
7–9 pm

Hamden Board of Education
60 Putnam Avenue
(Parking is available in the lot behind the building)

Nicole Davis, Save the Sound
Committee Updates
New Business

Whitneyville Branch Library Fundraiser
April 27 at The Playwright

visit whitneyville.org to
sign up for our email list

Connecticut Fund for the Environment/Save the Sound

Mill River Watershed Based Plan

Steering Committee Meeting Notes

4/10/18 6-8pm at Cheshire Senior Center, Cheshire, CT.

Notes transcribed by Annalisa Paltauf and Julianne Busa
Presentation by Erik Mas, Fuss & O'Neill, Inc.

1. **Welcome**, introductions and review of agenda by Nicole; turned floor over to Erik Mas for presentation.
2. **Project Objectives and Planning Process**
    a. Erik Mas provided a brief review of the objectives of the planning process and the nine-elements of an EPA Watershed-Based Plan.
3. **Summary of the Watershed Survey**
    a. 7 responses total
    b. Top issues: education and outreach; stormwater runoff; open space, trails, and waterfront access; water quality and bacteria; CSO's; recreation; flooding and erosion
    c. Desired outcomes: clearly defining issues and priorities; site-specific projects; improve water quality; community engagement; residential education and outreach

    A question was asked regarding what was driving the schedule for the plan, which is the funding source and the expiration of funds. Chris Malik added that the state was fortunate to find 319 money available for planning and wanted to take advantage of the opportunity.
4. **Review of the Technical Memorandum #1: The State of the Watershed**
    a. Erik summarized the existing watershed conditions that are detailed in Technical Memorandum #1, including highlights of the mapping. The memo is an assessment of existing conditions and a review of available information that will help identify issues and prioritize goals.
    b. It was noted that additional data is needed, particularly for open space mapping and wastewater. Steering Committee members are asked to please help fill in these gaps—information is particularly welcome from those from the land trusts with access to open space parcel information.
    c. Findings include:
        i. The Mill River Watershed is 38 square miles; the river is 12.6 miles long. It includes the tributaries of Willow Brook, Shepard Brook, Butterworth Brook, Jepp Brook, Eatons Brook, and Brooksvale Stream.
        ii. The Mill River Watershed is a diverse urban watershed with different settings ranging from rural forested river to urban.
            1. Forested lands in upper parts of the watershed have a higher water quality than downstream.
            2. Downstream areas are impacted by development – both historic and current, including old mill dams and relics of industry, as well as impacts from urbanization.
            3. There are 2 sub-regional watersheds with 14 local basins, which span 7 municipalities. Most of the watershed is in the town of Hamden (50%), followed by Cheshire (30%), and the remaining in New Haven (5%), Bethany, North Haven, Prospect, and Wallingford.

iii. Land Use & Land Cover

1. Land use – what is on the ground, how it is being used. 57% of watershed land use is residential; 23% open space and forested areas; the rest a combination of commercial, institutional (i.e. Quinnipiac University), industrial, and agricultural.
2. Land cover – what is covering the land from an aerial perspective. 44% of watershed land cover is considered forested areas; about 47% is developed or paved; about 5% is wetlands/open water.
    - A question was raised regarding how forested lands were determined. Erik indicated that it was based on an analysis of aerial photographs by NLCD. Methodology and definitions are available on the NLCD website
3. On the map, red = hardscape, anything built or developed; green = forest; yellow = turf, grass, lawn, cemeteries, etc.
4. Impervious cover
    - Impervious cover is a good surrogate for measuring water quality and stream health.
        i. As imperviousness increases, the streams become more degraded. Pavement generates runoff during storms. Because the land is paved, the water can't soak up into the ground and usually ends up in a stream, which causes it to be flashy (or flood more quickly). When water can soak into the ground, it improves groundwater—which contributes to base flows in rivers, and reduces flashiness.
            - A discussion about how water quality was defined and the use of instream aquatic life (fish and macroinvertebrates) to identify poor water quality. The question of how flow impacted water quality monitoring was raised and Erik discussed how the reduction of impervious cover and increased infiltration can help ground water recharge and help reduce low flow events.
    - UCONN has done state-wide analysis estimating impervious cover.
        i. Stream water quality degrades as impervious cover increases.
            1. At 10% impervious cover you start to see impact to water quality and stream conditions.
            2. 25-60% - non-supporting range.
            3. In CT – the lower threshold to impact streams is 12%.
    - Willow Brook has about 10% impervious cover; 6 of the 14 local basins exceed the 12% threshold.
5. Riparian Corridor: 300 foot buffer on either side of stream centerline – filters runoff, provides shade and habitat, prevents flooding. Lower half of the watershed's riparian corridor is the most developed, also Cheshire center and Route 10 corridor.
6. Forests, Wetlands, and Critical Habitat.
    - Core Forest (highest value for habitat) includes Sleeping Giant State Park, Naugatuck State Forest). Edge Forest buffers the Core Forest and is a transition zone.
    - 12% of watershed is wetlands.

- Notable critical habitat: East Rock Park is important stopover area for migratory song birds.

iv. Pollutant loads – i.e. how much bacteria is getting to the Mill River annually.

1. How much bacteria are being loaded based on land use, CSO discharge, septic systems, etc.
    - Pollutant sources in the watershed include stormwater runoff, illicit discharges (i.e. sewer-related dumping), CSO's, septic systems (failing and malfunctioning systems), wildlife and pet waste.

v. Water quality monitoring

1. DEEP conducted water quality testing on Mill River, Shepard Brook, Willow Brook, and Sanford Brook (tributary of Willow Brook).
    - Several segments have high water quality, meaning they meet standards for recreation, support aquatic life (determined by macroinvertebrate sampling), and shellfishing.
    - Other segments are impaired for one or more of the standards.

vi. Geology and soils

1. This is important because it influences the river itself, but also because it will influence our ability to do green infrastructure and low impact development in different parts of the watershed, due to infiltration rates/ability.
    - A&B soils – high infiltration capacity; sandy; well-draining
    - C&D soils – less infiltration capacity; dense glacial till; ledge/rock
    - 50% of the watershed is A/B soil, therefore conducive to stormwater infiltration and green infrastructure projects.
        - i. Note: the map shows south of I-91 as having D soil, but per Dawn Henning the soil is actually very sandy like the rest of New Haven.

vii. Public Water Supply

1. RWA manages the public water supply in the watershed.
2. Surface water: Lake Whitney; groundwater aquifers: in Cheshire and Hamden

viii. Dams & Barriers to fish passage

1. 22 dams registered in the watershed; 5 on Mill River; 1 on Shepard Brook
2. Other barriers include remnant dams, the tide gates at I-91
3. Dams and impoundments can affect water quality, but also a habitat-related concern

ix. Wastewater

1. Large portion of the watershed is served by sanitary sewers, managed by the Greater New Haven Water Pollution Control Authority (GNHWPCA), although the northern portion of the watershed has septic systems.
2. CSO's are a problem in the lower watershed. CSOs that discharge to the Mill River remain active at three locations: 009, 011, 012.
    - CSO Long-Term Control Plan: separate the sewer system; flow-monitoring; upgrade systems; use green infrastructure BMP's.
3. New private development in areas served by the GNHWPCA combined sewer system must install stormwater infiltration systems or retain stormwater on-site as a permit requirement.

5. **Next Steps:**
    a. Once remaining data has been gathered, Fuss & O'Neill will begin work on the pollutant loading models for the watershed to simulate annual loads of pollutants: bacteria, sediment, and nutrients. They will also be beginning to develop more specific siting suggestions for LID and GI projects.
        i. Ultimately the plan will include numerous watershed-wide and site-specific recommendations, including design concepts for ten sites
    b. Steering Committee members are asked to please submit their project ideas as soon as possible so that these can be taken into consideration.
    c. Steering Committee members are also asked to assist in collecting information on existing practices/BMPs in the watershed
        i. Nicole will be reaching out to members about their ideas
        ii. NVCOG has done a review of regulations in their municipalities related to Green Infrastructure
    d. Steering Committee Meeting #2 scheduled for Tuesday, May 1. Location to be held somewhere in the Fair Haven section of New Haven.
    e. Both Erik Mas and Chris Malik (CTDEEP) emphasized the accelerated nature of the planning schedule, which is being driven by funding constraints.
        i. The DEEP 319 grant runs out at the end of September which is why we have a tight timeline.

6. **Additional Discussion Points:**
    a. Definition of what constitutes forest cover in the mapping and how this relates to residents' on the ground knowledge of cover and land types
    b. How water flow is reflected in and relates to impairment classification
    c. Concerns about issues such as CSOs and whether infiltration and inflow assessments of particular sewer lines have been performed and how this might impact the watershed planning work
        i. Erik Mas and Dawn (City of New Haven) noted that MS4 permit requirements require illicit discharges and other issues to be addressed by the municipalities over the next several years.
        ii. Chris Malik reiterated that the goal of the watershed plan is to address *non-regulated* (i.e. nonpoint sources) discharges
    d. Discussion of existing municipal requirements for reducing Directly Connected Impervious Area (DCIA) and recommendations for new or modified land use regulations as a potential outcome of the plan
    e. Members of the steering committee expressed interest in self-organizing to conduct stream-walks that would not otherwise be included in the project scope. Elsa/Cheshire Land Trust volunteered to lead this effort.
        i. The Cheshire Land Trust expressed interest in doing stream walks if they could find someone to do a training. Chris Malik mentioned that NRCS had done them in the past, but wasn't sure if they were able to conduct stream walk trainings at the moment.
    f. Discussion of the scope (financial and time-based) of the project and the need to limit the more detailed designs to 10 sites vs. the ability to include more sites in less detail.
        i. Chris Malik reiterated that while it helps to have sites in the plan for later funding, there can be language emphasizing the iterative nature of site-choice and that sites not included will not be preemptively excluded from funding opportunities
    g. The implementation timeline was discussed
        i. Plan should include some actions for immediate progress/support-building
        ii. Some implementation ideas will be on a 2-5 year timeline

    iii. Some with longer (5-10 year) horizons

h. Concern was expressed from several members of the group about the lack of representation from the Towns of Hamden and Cheshire. Many in the group felt this would be problematic going forward and agreed to reach out, as citizens, to encourage Town representation.

Connecticut Fund for the Environment/Save the Sound

Mill River Watershed Based Plan

Steering Committee Meeting Minutes

5/01/18 6-8pm at the Eli Whitney Museum, Hamden, CT.

1. **Welcome**, introductions and review of agenda by Nicole.

2. **West River Watershed Coalition (WRWC)**
   a. The Steering Committee was joined by Frank Cochran and Kathy Fay of the West River Watershed Coalition. Kathy and Frank both shared their descriptions of how the WRWC evolved. Frank discussed the group beginning as a resurgence around CSO's in the West River and through a number of smaller events, like educational walks in neighbor hoods, which turned into an active and continually growing email list that grew into an active group linked by the watershed. Kathy saw the group merge from activity in the Westville Village and water festivals for kids put together by Lynne Bonnett and her efforts to get people together around the sewage problem in the West River. There were lots of little events, everyone was invited and they started to see who was involved and who wasn't and began to think about how they could connect with the people who weren't at the table.

      Kathy, Frank and Chris all commented on how the negative impacts of CSOs have had a positive effect on polarizing the group and bringing together different partners to advocate for green infrastructure projects and Dam removals that have all had big impacts in the watershed.

   b. How the WRWC works: an active collaboration with member groups. Subcommittees meet and report back to the coalition at monthly meetings (committees include access, grants, and steering). They use the watershed plan as a reference and to guide meetings and activities. They had found referencing the plan and agenda items to be useful.

      The WRWC intentionally did not incorporate to keep partners engaged and eliminate turf wars or competition. Although the WRWC can't apply for funding, Coalition members come to ask for support from the WRWC and then either apply for funding or find a fiduciary as needed. The other benefit of not being incorporated is that it eliminates the complications of bylaws and simplifies dealing with tricky situations. Chris Malik added that it can make it easier for state and municipal employees to participate as a partner. Also having an approved plan makes it easier for the state and municipalities to advocate for projects as long as they are consistent with the plan. There were a number of questions regarding how other watershed groups operate including the pros and cons of being incorporate. Chris commented that he has seen both incorporated and non-incorporated groups be successful and there are a number of different structures throughout the state.

c. Success: WRWC has had a number of successful projects. They recently completed a greenway in which all five Mayors signed off. Frank commented that he's not sure how successful they have been, but the coalition continues to be there. They have several upcoming local events like a tour of the sewage treatment plant and their annual river festival, they held a Bring in the Rain Event and have partnered with the City of New Haven and GNHWPCA to install bioswales and rain gardens. The continued partnership with Neighborhood Housing Services and New Haven Green Fund and regular meeting have all helped. Kathy commented that there has been a lot of patience when things don't run smoothly and that it doesn't always feel like stuff is happening, but they have gotten feedback that the WRWC is making a difference.

   There were also discussions about how grant funding has worked, how different organizations have participated in the Coalition, including consistent relationships with local elected officials and municipal engineering departments.

3. **Save the Sound 319 grant submission for the Mill River**
   a. Hamden Town Center Park Stormwater Best Management Practice Implementation – Nicole and Kevin updated the group on the submission a FY2018 319 proposal for a project to reduce the impacts of stormwater using BMPs to slow, filter and retain run off from an 88 acre drainage area that flows into the Pardee Brook diversion channel and then into Shepard Brook

      Mark Austin discussed the town's interest in moving forward with the project in Town Center Park and hopes that it will be funded. He discussed the history of the project in the town and that they are committed to providing the required labor as a match for the grant.

   b. Nicole discussed another project that Save the Sound had begun to put together that would include stormwater disconnects in several locations throughout the Mill River, West River and Quinnipiac River. Although this project did not appear to work for this round of 319 funding they would be looking for other opportunities and ways to implement projects within the three watersheds.

4. **Potential Implementation Projects**
   a. The steering committee had been asked to provide project ideas they thought should be included in the plan. Nicole provided a table of potential project locations and described some of the ideas that had been shared. Elsa mentioned several locations including the old china buffet on Route 10. The site plan for a new bank had just been approved by Planning

and Zoning and potential development where the Arby's was. Chris mentioned that it was easier and cheaper to incorporate green infrastructure into the site plan. Also in Cheshire sections of the river are channelized near Ginny Hill and Mansion Rd as well as direct storm drain connections. Cheshire Land Trust is also interested in a parcel zoned as a garage, within the aquifer protection area, that is used to store construction equipment. Equipment is backed up almost directly to the river. The Elim Park retirement community was also mentioned.

Mark Austin commented that the town was working on design for bridges at Waite and Mathers St so the projects are ready to go if funding is restored to that transportation program. There is also a problem with scour at the Skiff St Bridge, which is being repaired through the federal local bridge program. Mark Foran mentioned the Olin powder ponds and that a group had looked at the possibility to turn it into a park. Aicha woods mentioned that the City of New Haven was moving forward with a section of the Mill River Trail north of Grand Avenue and that they were updating the Mill River redevelopment plan. (see the attached list of proposed projects)

5. Proposed Stream Walk – Cheshire Land Trust

a. Elsa brought up the idea of holding a volunteer stream walk to go along with the plan. She and the Cheshire Land Trust were interested in conducting the stream walk for Cheshire and would welcome additional volunteers to complete other sections of the river. She is proposing to do a phase 1 stream assessment and has initiated conversations with NRCS. They have provided her with the necessary materials to hold the training. Typically the training for a phase 1 assessment includes a 4 hour workshop followed by a 4 hour field session. Elsa felt that the training could be condensed into 3 hour sessions. She is targeting early June for the training and July and August to conduct the stream walks, although the Cheshire portions will likely be done on the early side because the river tends to dry up by July.

   The stream walk volunteers will each be assigned a sample reach and provided with data sheets to identify what they find. Elsa commented that it's a fairly simple processes but was trying to figure out the best way to store the data collected so that it could be accessed by anyone. Anthony Zemba suggested using Epi Collect, which acts as a data clearing house. Volunteers can download the app and directly enter the data from their phones. An email will go out looking for interest from the larger stakeholder group and Elsa will follow up with a doodle poll to set up a date. Save the Sound will help with outreach and circulating information. In the meantime Elsa is looking for help delineating sample reaches.

6. Other Business

a. June Green Drinks – Nicole proposed the idea of hosting a Green Drinks event in New Haven in June to serve as a mid-plan development public meeting and combined steering committee meeting. Kevin McCarthy mention that they usually take place on a Wednesday evening and he could help set that up.
b. The next Steering Committee Meeting will be May 29 to review the results of the next technical memo submitted by Fuss & O'Neill, which will include the pollution load models

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Mill River Watershed Based Plan - Steering Committee Agenda
May 29, 2018
6:00-8:00pm
Cold Spring School - 263 Chapel Street, New Haven, CT 06513

1. Watershed Movie - **The Mill River – Water and Wildlife** curtesy of Florence S. McBride. Anthony Zemba introduced the film. Anthony had the pleasure of meeting Flo while birding and was offered the use of her film for the watershed plan. Anthony introduced Flo: Flo is an active member of the New Haven Bird Club and a nature film maker. Flo was recently awarded the Mabel Osgood Wright Award from the CT ornithological Association and has generously provided a copy of her film. The first segment of the film was shown, which follows the course of the river from its origin in Cheshire to where it meets the Quinnipiac. The narration was provided by Anthony.

2. Welcome & Introductions - introductions and review of agenda by Nicole.

3. House Keeping
   a) Schedule for 2018
      i. The date for Tech memo #3, which is the Low Impact Development and Green Infrastructure Assessment, has been pushed back to 6/29 to allow for more time for Save the Sound and Fuss & O'Neill to spend in the field developing projects for the plan. Fuss & O'Neill will be looking at approximately 30-40 sites and will develop 10 projects for the plan. Additional project sites that seem to offer an opportunity for BMPs will also be included in the plan. Comments on Tech Memo #3 will be due no later than 7/5.

      ii. Dates and locations have been set for all 2018 steering committee meetings except November. The second Tuesday of the month at 6:00pm is what seems to work best for everyone. However, November 6 is Election Day. Nancy Rosenbaum indicated that was a conflict for her and possibly others so it was decided to meet on November 13. The list of meetings for 2018 is attached.

   b) Summer Festivals – the idea of hosting a booth at some of the festival in the watershed was proposed including the CT Folk Festival/Green Expo in Edgerton Park and the Whitneyville festival. East Rock Park, Brooksvale Park and the Cheshire Fall Festival were also mentioned. It was suggested that we try to coordinate with RWA and if they are not going to be there see if we can use some of their education materials. Several steering committee members also indicated that they would be interested in volunteering at the table for the festivals.

   c) Public meetings for the draft plan are scheduled for 9/5 & 9/6. Cheshire Senior Center and East Rock Nature Center had been offered as a possible venues. Nicole asked if the group saw any advantage to having an all-day open house. Dawn Henning asked who the target audience would be during the day, if it was schools than yes otherwise an evening would be fine. The group agreed that at that time of year it would be difficult to get school groups and it was decided the evening meetings would be fine.

d) Nicole asked who would need to be contacted or presented to in order to have each municipality sign a compact supporting the plan. In Cheshire it was recommended to try the Town Council since we have not been able to get active participation from the town. In Hamden it was suggested we try to get on the Inland Wetlands agenda for June or July. Any resolution in Hamden would have to start with the Mayor then go to P&Z and wetlands before going to the Legislative Council. In New Haven it would need to go to the Environmental Advisory Council and possibly the Alders. Attached is the compact that was included as part of the Five Mile River Watershed Plan as an example.

4. Water and Waste Water in the watershed – Gary Zrelak and Ron Walters were both present to talk about what each of the water organizations currently had going on in the watershed and how the plan could help their organizations

a) Gary discussed that at his "end of the pipe" the combined systems were a major focus for GNHWPCA. He brought a map of the New Haven service area and talked about the CSOs in the Mill River. Gary discussed the Long Term Control Plan and that current work is being done to capture a 2 year 6 hour storm. CSO #12 is effectively no longer active although it has not officially been closed. Work to close CSO #12 has been completed and is currently being monitored to ensure everything is functioning properly. The two other CSOs at Humphry St (#11) and Market St (#09) are still active. Currently, the Humphry St CSO contributes approximately 4.5 million gallons to the river throughout the year. A section of the contributing area is scheduled for separation in 2019 and should lower the discharges.

In Hamden GNWPCA work focuses on 'Inflow and Infiltration (I&I)', which separates the town into sewer-sheds and looks at water getting into the pipes. The I&I inspection evaluates the sewer-sheds and prioritizes them for additional work to reduce wet weather infiltration. Roof leaders connected to the sanitary sewer systems were discussed as well as separation work that was occurring before the Long Term Control Plan. Gary commented that overall they have seen a reduction in dry weather flow. He provided a description of the evolution of the different systems managed by GNHWPCA, stating that all grew from the prior attitude –"the solution, to pollution, is dilution."

There was also discussion about how projects are funded, green infrastructure in the West River Watershed, and how the Mill River Plan can be helpful. Gary emphasized that any green infrastructure projects would benefit the system, particularly upstream of the Humphry St and Market St CSOs.

b) Ron Walters began by describing the system that is managed by RWA, commenting that in CT it is illegal for waste water to be discharged into a drinking water supply basin. The Mill River Watershed is primarily an importer of water and the lower watershed primarily receives water from North Branford. From a drinking water perspective, the Mill River is probably the most developed watershed in New England. Most of the RWAs efforts are devoted to source protection, particularly along Route 10. The combination of source protection efforts, regulations and monitoring have led to an overall improvement in the watershed. Ron related a number of instances of shop drains leading directly to Mill River being identified and corrected. He commented that compliance has greatly improved and that no illegal storm drains have been found in the past 2 years. Cheshire was one of the first towns in CT to prohibit high risk uses within the aquifer protection area, prior to the state. Treatment of water has included the need to remove various pollutants from a variety of sources, including cars in the reservoir, contaminated land and aquifers.

   RWA has a management plan in place for the Mill River and Lake Whitney and conducted a number of separate studies of the lake. They have installed catch basins to help trap sediment after regular sediment monitoring in the lake the identified a need. Flow over the waterfall is monitored and if the water level falls water is pumped over the dam. RWA does have downstream requirements and tests for dissolved oxygen. RWA is looking into possibly rebuilding the dam, which would include changes to the intake system. The Lake Whitney Dam currently has an "Eelevator" to move eels over the dam, which consists of a bucket at the end of a ramp that catches the eels. DEEP then empties the bucket into the lake.

   Dawn asked if Ron had a measure of how the watershed has improved. Ron commented that RWA does regular water quality sampling from the lake. Although a trend may not necessarily be seen from that data, the improvements are obvious when looking at land use and compliance. There was a brief discussion of Olin Powder farm and why the contamination on the property is not a concern for the water company. When asked how the plan could benefit RWA, Ron commented that it will help expose the river as the resources that it is.

5. Tech Memo #2 – Pollution load model - there was brief discussion of the results of the pollution load model. Although interesting, the results of the pollution load model were pretty much what was expected based on the diversity of land use and how it is distributed throughout the watershed. Dawn questioned if there were assumptions in the model based on imperviousness and if there was a way to account for infiltration and headway made in disconnecting impervious areas. She also questioned if there was a sensitivity analysis could be done with the assumptions to see how they change the outcome. Nicole said she would pass these comments on to Fuss & O'Neill along with her request to break out the land use categories in the results that had been aggregated under the 'urban' category. Nicole requested that any additional comments be sent to her by May 30.

6. Additional Potential Implementation Projects – the updated project list is attached. Projects discussed included Mitchel St from Wilbur Cross High school to Willow St.; the United way office at 70 James St; and coordination with the Mill River Tail. It was noted that the City of New Haven has 20 foot easements from the top of the bank along the trail. Aicha Woods commented that the City was preparing to start work on a section of the trail north of Grand Ave. Mary Mushinski brought up a problem her group has encountered with parks departments removing riparian buffers for scenic purposes. She requested that a recommendation be made to keep working riparian buffers intact and to advocate for regulations of benefits for keeping buffers. In addition to recommendations in the plan Chris Malik recommended that she follow up with Paul Stacey. Mary also suggestion reaching out to the golf courses, especially at Sleeping Giant and recommend they become Audubon certified.

   The damage at sleeping giant as a result of the storms earlier in the month was discussed. As much of the damage was within the watershed a brief discussion about how to advocate for the consideration of incorporating Green Infrastructure and Low Impact Development as rebuilding begins in the park. It was recommended to make a request to the commissioner. Recommendations regarding improving the riparian buffer with dedicated access points along the river trail.

7. Proposed Streamwalk – Elsa Loehmann provided an update on the streamwalk. A doodle poll went out earlier this week with a number of potential dates, https://doodle.com/poll/9ifsu4kadi4tcspk. The training that will take place is a tier 1 assessment, which uses a physical based protocol. Tier 2 would include water quality testing and tier 3 would be a rapid bioassessment. The training is expected to last about 4 hours, with 3 hours in the class room and then an hour looking at field indicators. Elsa has been looking at Epi collect to record and store data. Several other online storage options were also discussed that may have an easier interface to set up. Mary offered the use of the River Advocates summer interns

8. Other Business – there was no other business.

Mill River Watershed Based Plan Schedule

SC - Steering Committee Meetings - 6pm

March		Location
1-Mar	Kick Off Meeting	
April		
4/10 6pm	SC Meeting Cheshire	Senior Center
May		
1-May	SC meeting	Eli Whitney
5/29/2018	SC meeting	Cold Spring School
June		
early June	Green Drinks/Public meeting	
TBD	Streamwalk Training	Quinnipiac Univeristy
July		
10-Jul	SC meeting Cheshire	Senior Center
	Streamwalks	
August		
21-Aug	SC meeting	Eli Whitney
September		
5-Sep	Public Meeting	East rock nature center
6-Sep	Public Meeting	Cheshire Senior Center
October		
TBD	Signing ceremenony/ Celebration	Eli Whitney
November		
TBD	SC - MS4 overview by municipalities/ future meetings and Watershed organization	TBD
December		
11-Dec	SC - implementation	Cheshire Senior Center

SC - Steering Committee

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Mill River Watershed Based Plan

Steering Committee Meeting Notes

7/10/18 6-8pm at Cheshire Senior Center, Cheshire, CT.

Notes transcribed by Julianne Busa
Presentation by Erik Mas and Julianne Busa, Fuss & O'Neill, Inc.

1. **Welcome and Housekeeping**
   a. Review of agenda by Nicole
   b. Discussion of upcoming meeting dates and summer festivals
   c. Brief review of goal to get municipalities to sign on to the plan
   d. Discussion of desire to keep the group going once the plan is complete to push for implementation
   e. Update on Sleeping Giant. STS will draft a letter to encourage incorporation of LID during rebuilding efforts.
   f. Stream Walk is planned for July 21
   g. Announcement that the CT Audubon/Army Corps of Engineers Wetland In-Lieu Fee program (ILF) has accumulated $142K for the South Central Coast basin and received no applications last year. This amount and any additional money that comes in during the interim will be available for the next grant round, which is expected to open in February 2019, with letters of interest due in Mid-April. There is an additional possibility of an OSWO grant match. The top priorities for the ILF funding are preservation, followed by restoration, and the money can be used for land acquisition.

2. **Pollutant Loading Model**
   a. Erik Mas provided a brief review of the objectives of the planning process
   b. Erik described the screening-level model used to estimate pollutant loads and determine how much bacteria comes from different portions of the watershed and what sources it comes from.
   c. Erik detailed the two different types of model inputs: primary sources—which capture pollutants associated with land use, and secondary sources—which include sewers, CSOs, etc. He also provided an explanation of the various assumptions and calculation factors (Event Mean Concentrations and Export Coefficients) that were used in the model to assign pollutant values to each of the sources and land use categories.
      i. Erik noted that assumptions related to septic failure were based on input from the two health districts in the watershed, and reflected fairly typical assumptions.
      ii. CSO discharge information input into the model was based on "typical year" estimates generated by GNHWPCA from their monitoring data.
   d. Erik presented the results of the model via a series of bar charts and pie charts.
      i. Bar charts were presented in pairs, demonstrating the estimated loads for each subwatershed, as well as the 'pollutant yields'. The latter values correct for the size of each subwatershed and allow for apples-to-apples comparisons of pollutant outputs from various subwatersheds. The Lower Mill River subwatershed exhibits the highest pollutant yields for bacteria and suspended solids, both of which are attributable in part to CSO contributions.

The data do not show substantial differences in nitrogen and phosphorus pollutant yields across subwatersheds.

ii. Erik presented paired pie charts that demonstrated the relative bacteria sources for each subwatershed. The first set of charts showed the percentage of bacteria attributable to: urban land, forest, rural land, illicit connections, CSOs and septic systems. The second set of graphs presented a more specific breakdown of the urban land category to show contributions from low, medium, and high density residential areas, as well as commercial, highway, industrial, and institutional categories.

iii. For the Lower Mill River subwatershed, Erik noted that the model estimates that 40% of bacteria load in that watershed comes from CSOs, but even if these were eliminated, there is still a significant load from land uses, particularly high density residential. The model also indicates that nearly 25% of the bacteria in that subwatershed comes from potential illicit connections. These findings (and the similarly high contributions from land use and potential illicit connections across all subwatersheds) underscore the message that stormwater runoff is a key driver of water quality impairments in the Mill River and highlight the important role that the MS4 regulations could play in alleviating both potential illicit connections and stormwater runoff as pollutant sources.

iv. Erik pointed out that, across subwatersheds, the model results indicate that septic system failure is not a major bacteria source relative to other pollutant sources.

3. Green Infrastructure Assessment

a. Julie Busa described the major tasks of the green infrastructure assessment and provided some examples of existing practices in the watershed, including GNHWPCA's implementation of their 2008 design guidelines.

b. Julie explained the various screening criteria that were used to develop a list of potential sites and included maps of all of the priority sites that were targeted for field visits.

c. Julie then walked through one-by-one the 10 sites for which concept designs were developed, providing some additional context for the various site photos and design concepts that were presented in Tech Memo 3.

d. Steering Committee Members participated in discussion of the sites and designs. Major discussion points included:

i. Noting that, at the Bartlem Recreation Area, the area along the driveway that was proposed for linear bioretention is used as vendor parking during the annual festival. This may pose a conflict for the design, or it may be feasible to relocate the parking to another location.

ii. It was also noted that the former farm parcel directly south of the baseball field at Bartlem Recreation Area is being developed as an open space and recreation parcel. Based on existing topography, the drainage from the two sites is likely isolated by a berm that runs between the two.

iii. The New Haven Parks Department has expressed reservations with the Livingston Street and East Rock Road concept because of the perceived level of maintenance involved relative to the current mowing practice. For this site, Julie also noted that new information about the drainage infrastructure at the east edge of this site would likely require some amendments to the design if it were to go forward into a next-level feasibility study.

iv. At the Counter Weight Brewery/Raccio Park Road/Spring Glen Nursery site, Nicole added additional information about the current conditions at the Spring Glen Nursery site that suggest potential for additional BMPs on the nursery property. It was noted that private partnerships would be vital to the success of that project.

v. Erik and others noted the ongoing bioswale project in which GNHWPCA and the City of New Haven are installing approximately 200 bioswales throughout the West River Watershed and in the downtown area, projects which were driven, in part, by work done as part of the West River Watershed planning process. The James Street project proposed for the Mill River Watershed would be an extension of that project that would bring it over into the Fair Haven neighborhood.

vi. Chris Malik (CTDEEP) noted that he was pleased to see a list of additional project sites and notes included as an Appendix to the plan, and he encouraged that any additional sites and ideas be referenced in the final plan. This led to some discussion of how to incorporate elements, like the Stream Walk, which might not be fully completed by the September deadline.

4. Next Steps:

a. Fuss & O'Neill will begin work on assembling all of the information gathered to date into the draft watershed plan. This should be available for review in mid-August.

b. There will be a 30-day public review period once the draft is prepared. The two public sessions on September 5th and 6th will fall in the middle of this comment period.

c. Once the comment period closes, Fuss & O'Neill will finalize the plan in advance of the late-September funding deadline.

Mill River Watershed Based Plan - Steering Committee Meeting Summary

August 21, 2018

6:00-8:00pm

Eli Whitney Museum

1. Welcome & Introductions - introductions and review of agenda by Nicole
2. House Keeping
    - SC Schedule - No September Meeting, next meeting 10/2
    - Public meetings to present the plan will be held at 6pm on 9/5 at the Eli Whitney Museum and on 9/6 at the Cheshire Senior Center.
    - Summer Festivals – a list of potential summer festivals where the plan could be made available for public comment were reviewed. CFE/Save the Sound would have a table at the CT Folk Festival and Green Expo. Nicole asked for volunteers to help with the other upcoming festivals. Joy VanderLek said she would be volunteering for the Land Trust at the Cheshire Fall festival, but thought we could share a table if there weren't enough people to man a table for the day. Connie Matheson said that there could also be an opportunity to share a table with the Civic Association at the Whitneyville Festival. Depending on the date there may be some availability for the East Rock Park Festival. Festivals include:
        i. CT Folk Festival/Green Expo – 9/8
        ii. Cheshire Fall Festival – 9/14 & 9/15 Bartlem Park
        iii. Whitneyville festival – 9/15 (rain date 9/16)
        iv. East Rock Park – date tbd
        v. Brooksvale Park – date tbd
    - Municipal Support – Nicole asked the group if there were any other commissions or boards that we should be reaching out to with the draft plan or any ideas get municipalities more involved. The Hamden Clean and Green Commission was suggested along with the Spring Glen Civic Association. The idea of holding a joint meeting with the Whitneyville and Spring Glen Civic Associations was also suggested.
    - Final Plan – The final plan will be available by 9/30. The one outstanding item is printing, which can get expensive. Nicole asked the group if anyone had the ability to print or fund a few copies for the plan. Ideally we would like to have 40 copies: a copy for each municipality and town library, for the steering committee, and DEEP. The cost to print and bind a plan is expected to be between $90 and $120 (based on a quick online search). If anyone has the budget or ability to print copies, please let Nicole know.

- Final Celebration
    i. No dates to avoid we identified looking at weeks of 10/15 or 10/22 for the final celebration.
    ii. When asked for Ideas for getting elected officials to attend. Gary Zrelak suggested trying to hold the celebration as part of the SCRCOG meeting, where many of the elected officials would already be present. Pam Roach stated the date of the October meeting would be 10/24 at 10am.

3. Draft Plan – The draft plan was circulated to the steering committee and they were asked to provide any comments to Nicole no later than 8/28 so that any substantive comments could be addressed prior to the public meetings on 9/5 and 9/6. The draft plan is mainly a composition of the three technical memos, comments and information provided by the steering committee and some additional information on watershed planning and the Nine Element process. The plan also added goals with a number of general recommendations. Goals include: Capacity building, Water Quality, Habitat protection and restoration, Sustainable Land Use and Open Space, and Education and Stewardship.

    Several of the concept designs were also modified based on feedback provided. The concept design for the John S. Martinez School and Haven and Exchange Streets, now Mill River Trail Park, Haven and Exchange Street Green Infrastructure, has been changed based on further design work completed as part of a grant application for this project (see Implementation below). The James Street project has been expanded to include Lombard through Chapel Street and specific locations have been identified that are suitable for bioswales, bump outs or other Green Infrastructure practices. Bartlem Recreation Area has also been modified based on feedback from the July Steering committee meeting. The bioretention area along the driveway has been reduced and pervious pavement has been added to the lot opposite the baseball fields. The design for the intersection of Livingston and East Rock Road was also changed, redirecting where captured stormwater will be diverted. The list of other potential LID projects has also been updated from what was provided in Technical Memo #3 to include some additional projects and images.

4. Implementation
    - Save the Sound has submitted a grant to the National Recreation and Parks Association's Great Urban Parks Campaign (GUPC) to fund the Mill River Trail Park, which includes the project for the John S. Martinez School and Haven and Exchange Streets. The focus of the GUPC is to increase access to green space in underserved communities and incorporate green infrastructure into new or existing parks. The proposal submitted included construction of a parklet on the end of Exchange Street, adjacent to John Martinez School playing fields, which would remove pavement at the blocked off end of the street and incorporate bioretention and a trail connecting through the playfields. The project would also incorporate green infrastructure on Haven Street and connect the Mill River Trail currently being constructed by the City of New Haven at Grand Avenue to Criscuolo Park via Mill Street.

Nicole commented that it was exciting to have two proposals for project out before the plan is completed and hoped that the momentum would continue. Gary asked if both grants were contingent on having a watershed plan. Nicole didn't believe that the GUPC required a watershed plan, but that having it the plan helped. She also said that for the 319 submission, Hamden Town Center Park had to be included in a watershed plan and that DEEP was willing to accept a draft plan.

- Nicole mentioned to the group that there is currently a grant available for projects in "healthy watersheds." If anyone had any thoughts or interested that she would share the announcement. A number of people were interested. http://www.usendowment.org/rfps/healthywatersheds.html

5. Stream Walk Update – the stream walk training was held 7/21 about 20 volunteers were present. The class room portion of the training was conducted by Fuss and O'Neill with support from RWA and Save the Sound. For the field portion we split into two groups with RWA and Save the Sound leading the in-stream training at one site and Fuss and O'Neill and Save the Sound at the second site. Nicole thanked the Cheshire Land Trust and Joy and Pam for all their work keeping the momentum going and for the delicious breakfast. She also thanked Sean Duffy for the use of the Albert Schweitzer center and hosting the training. Surveys are currently being conducted by the volunteers.

6. Other Business - no other business was discussed

The next meeting will be 10/2 at 6:00 at the Eli Whitney Museum.