Final Report of the Town Owned Lands Improvement Project for the Town of Brentwood, NH

Project Background

In November of 2013 the Green Infrastructure for Sustainable Coastal Communities (GISCC) project authorized funding for the Town of Brentwood proposed Assistance with projects that apply low impact development (LID) methods on municipal lands project.

Figure 1: The Mary E. Bartlett Library in Brentwood, NH

The project had various components including an outreach and education campaign. Specifically the project team agreed to complete the following tasks:

1.) Evaluate municipal sites including the town shed, town office, library and school.
2) Develop a storm water management plan for each site that incorporates LID projects.
3) Make presentations to town boards of these storm water management plans to educate
and improve understanding and benefits of LID (the Selectboard, Highway Department, Planning Board and Conservation Commission).
4) Representatives from town boards would meet and pick two to three projects to implement.
5) Implement improvement projects on town-owned lands by September 2014
6) Conduct follow-up meetings with town boards after completion.

This hands-on-approach including implementation of direct improvements and education in the understanding of LID has led to increased awareness of incorporating LID strategies into development and redevelopment activities in town. Furthermore, having the town lead by example and having more actual examples of LID strategies in a small town will hopefully lead to increased utilization of LID strategies in other towns. Lastly, the management plans will provide an invaluable resource and roadmap for the town for future implementation of LID strategies at municipal sites which will lead to continued improvement in the water quality in the Exeter River.

Community Outreach and Engagement

Through this project numerous outreach and engagement strategies have been implemented. Individual tasks and related outcomes are listed below:

• Town staff engagement – A number of meetings were originally held with town boards and selectmen to describe Green Infrastructure (GI) approaches and overall project objectives. At these meetings it was determined that UNHSC would develop a pollutant load assessment model for the town to further prioritize activities in the town. From town meetings five municipal properties were selected for further review and prioritization.

1. Library
2. Town Hall
3. School
4. Fire station
5. Town Shed property

The project team including Geosyntec conducted field visits to all identified sights and developed concept designs for the five municipal sites identified above. These designs are included as an attachment to this report.

Project Results and Future Considerations

As part of the project included optimization modeling of updated, watershed-wide impervious area (IA) data used to target pollution hotspots based on land use, zoning, soils, proximity to a water body, and other common GIS data layers. Stormwater-derived loadings were modeled and classified to identify municipally owned hotspot locations for installation of cost-effective stormwater solutions that maximize pollutant load reductions.

Effective selection and siting of stormwater treatment practices is highly dependent on location, thus using optimization modeling to target specific management approaches can result in strategic water quality improvements. Because IA is strongly correlated with land use and municipal zoning, modeling can offer reliable forecasts of current and future (buildout) pollutant loads for engineers, planners, municipal officials, and others seeking to prioritize expenditures to control stormwater pollution with maximum results.

Additionally, optimization modeling results can be used to develop a preliminary evaluation of discharges to impaired waters, as part of a Water Quality Response Plan (WQRP) for the new MS4 permit, and aid in implementation and tracking of municipal stormwater management programs.
Figure 1 presents the overall hotspot modeling visual output from the analysis for the entire town.

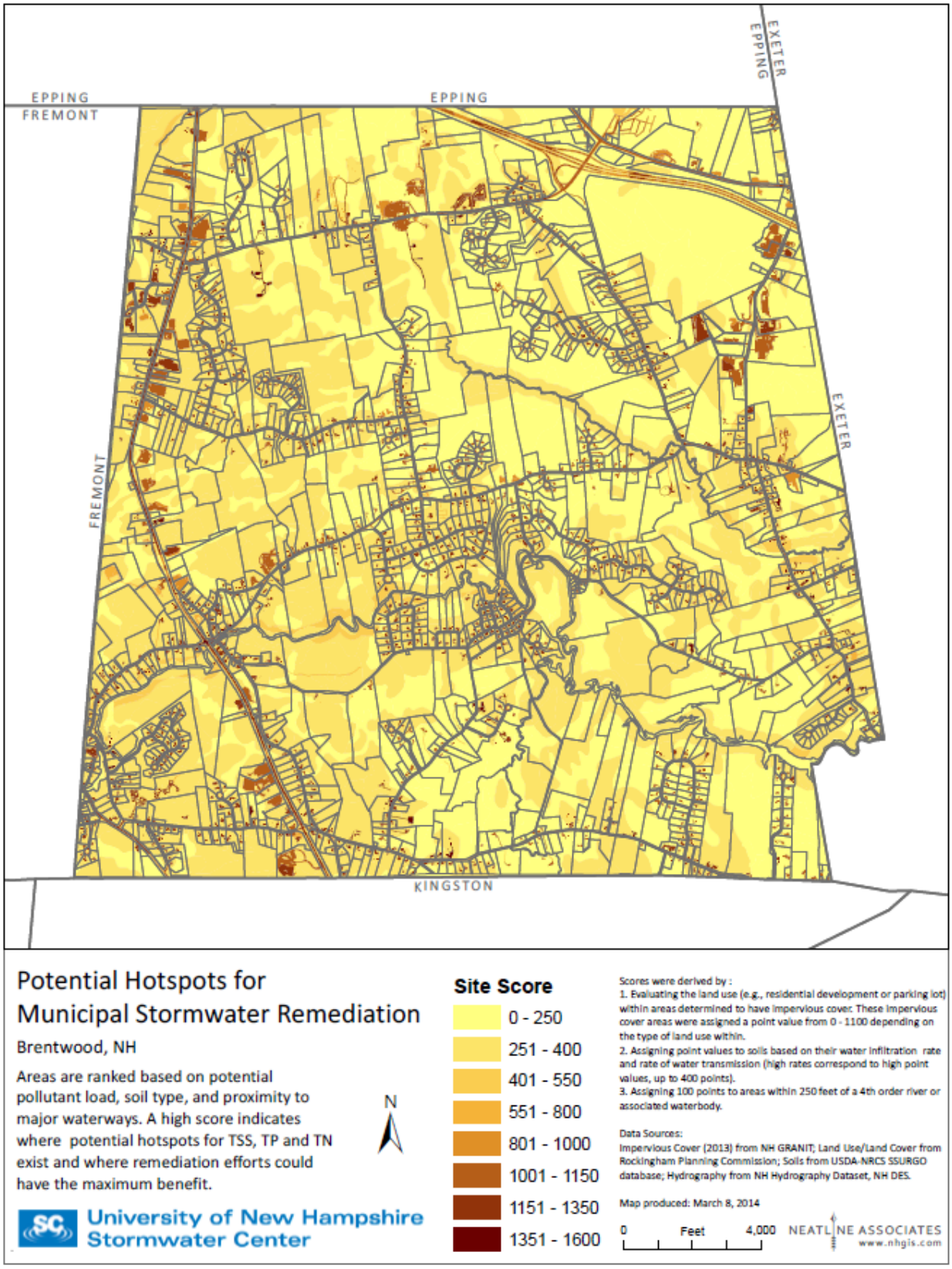

Figure 2: Visualization of results from UNHSC hotspot modeling for the town of Brentwood

Attribute tables generated by the modeling effort were then used to sort and filter results based on specific town official interests. Municipally owned lands were ranked by final modeling point total and then in descending order according to total parcel acreage. Final points indicate the pollutant potential of any parcel area with higher numbers indicating larger pollution threats. Secondary sorting by parcel size indicates opportunities where more can be done as larger parcels with higher potential for pollution indicate larger benefits from retrofit activities. This is a quick screening method to further investigate potential implementation sites. Results are presented in Table 1.

Table 1: Top ten municipally owned lands (Government) identified in the hotspot mapping.

Rank	Landuse_De	HSG	FinalPoint	Parcel_address	Location	FinalAcres	Notes
1	Government	A	1200	10 RT 125	Rockingham Superior Court	6.73	Not Considered
2	Government	A	1200	22 DALTON RD	Brentwood Library	0.71	Managed through GISCC
3	Educational	B	1100	355 MIDDLE RD	Swasey School	3.02	Partially Managed - Proposed
4	Government	B	1100	117 NORTH RD	Rockingham County Nursing Home	11.78	Not Considered
5	Government	B	1100	1 DALTON RD	Town Hall	0.81	No Managmenet - Proposed
6	Government		1050	NORTH RD	Property Not Located	3.22	Not Located
7	Educational	C	1000	79-113 RT 27	Seacoast Learning Collaborative	1.13	Not Considered
8	Institutional	C	1000	21 RT 27	Brentwood Congregation	1.12	Not Considered
9	Government	C	1000	207 MIDDLE RD	Brentwood Highway Shed	0.76	No Managmenet - Proposed
10	Institutional	C	1000	197 MIDDLE RD	Pilgrim United Church	0.68	Not Considered
					Total	**29.96**	

It is important to note that municipal record keeping and parcel data are critical in the prioritization process. For instance land uses included in parcel data are filtered first. In this case town officials were specifically interested in municipally owned lands. The only land use representing that classification in the parcel data was “Government”. This land use included all government land uses from town owned resources to federal and state owned resources as well. Additional verification was necessary to come up with the relevant ranked list presented in table 2.

Table 2: Top 4 municipally owned land uses optimized for GI retrofitting.

Rank	Landuse_De	HSG	FinalPoint	Parcel_address	Location	FinalAcres	Notes
1	Government	A	1200	22 DALTON RD	Brentwood Library	0.71	Managed through GISCC
2	Educational	B	1100	355 MIDDLE RD	Swasey School	3.02	Partially Managed - Proposed
3	Government	B	1100	1 DALTON RD	Town Hall	0.81	No Managmenet - Proposed
4	Government	C	1000	207 MIDDLE RD	Brentwood Highway Shed	0.76	No Managmenet - Proposed
					Total	**5.30**	

Interesting all of the lands town officials identified as areas of focus for the project with the exception of the fire station were in the top ten ranked lands optimized for stormwater retrofitting. The fire station was not in the top ten largely due to the fact that that it was a new development and neither the parcel data nor the aerial imagery (both last updated in 2010) had record of the property.

Project Conditions

In general, the selected property was the town owned Mary E. Bartlett Library. The property consists of a 3.3 acre parcel with 0.71 acres of impervious cover. Project areas were divided into two separate watershed areas. The entire watershed associated with the library and its related IC was originally drained to a swale that discharged stormwater runoff to an outfall located on a steep slope on the eastern side of the property. The original swale had been completely bypassed and runoff was eroding a channel directly down the slope and was close to undercutting the parking area and drive lane adjacent to the outfall. The east side watershed area consists of approximately 0.43 acres at 83% IC (0.36 acres of IC) and now drains to a new vegetated swale installed parallel to the steep slope and to the north eastern lowlands of the parcel. The new configuration only drains the eastern subwatershed and a small untreated portion of parking area in between the two new subwatershed areas (see attached plans). The West side watershed area consists of approximately 0.3 acres at 92% IC (0.28 acres of IC). This area now drains to a new Bioretention system that underdrains to a 1,000 gallon cistern for use watering other enhanced landscape features. Of the 0.71 acres of pre-existing IC, 90% of it (0.64 acres total) now drains to appropriately sized and constructed stormwater management facilities. A pollutant load tracking spreadsheet was developed to highlight and track current and future project deliverables (provided as a separate file, a summary can be seen below).

Table 3: Pollutant load estimates based on the USEPA Simple Method for the town of Brentwood installations in 2014.

Town of Brentwood Pollutant Load Calculation per BMP														
Location (Land Use)	BMP Description	Upper Berry Brook Subwatershed parameters				TSS			TP			TN		
		Drainage Area 'A' Acre	Impervious Area 'Ia' %	Runoff Coefficient RV	Annual Runoff 'R' inches	Annual Load 'L_i' #/year	Effluent Load 'L_e" #/year	Annual PL Removed #/year	Annual Load 'L_i' #/year	Effluent Load 'L_e" #/year	Annual PL Removed #/year	Annual Load 'L_i' #/year	Effluent Load 'L_e" #/year	Annual PL Removed #/year
Baseline														
2014 Installs														
Library Swale		0.43	0.83	0.796	34.38	257	36	221	1.10	0.21	0.89	9.9	7.9	2.0
Institutional/Commercial														
Library Bioretention		0.30	0.92	0.880	38.01	199	6	193	0.85	0.14	0.71	7.7	0.6	7.1
Institutional/Commercial														
2014 Totals		**0.73**	**0.87**			**456**	**42**	**413**	**1.95**	**0.35**	**1.61**	**17.6**	**8.5**	**9.1**

As a result of this project, a majority of the Mary E. Bartlett Library IC has been disconnected via treatment through green infrastructure (GI) practices (90%). Two GI stormwater control

measures have installed that treat 0.64 acres of drainage area and annually reduce 413 lbs of TSS and 1.6 lbs of phosphorus and 9.1 lbs of nitrogen on an annual basis.

Table 4: Summary of annual pollutant load reductions estimated for the retrofits at the Library.

2014 BMPs	Annual Load 'L_i' #/year	Effluent Load 'L_e'' #/year	Annual PL Removed #/year
TSS #/year	456	42	413
TP #/year	1.95	0.35	1.61
TN #/year	17.6	8.5	9.1

Optimization

A pollutant load analysis was developed for the town of Brentwood. Areas were ranked based on potential pollutant load, soil type, and proximity to major waterways. A high score indicates where potential hotspots for TSS, TP and TN exist and where remediation efforts could have the maximum benefit (see Figure 2). The model was then used to prioritize and rank municipally owned properties for GI retrofitting potential.

The Impervious Cover Model and Future Permit Compliance

The Impervious Cover Model (ICM) was first proposed in 1994 by Tom Schueler and the Center for Watershed Protection. It was first introduced as a management tool to diagnose the severity of future stream problems in urban and urbanizing watersheds. Since its introduction the ICM has been adapted as a surrogate for impaired water attainment. Numerous watershed studies throughout the country have correlated the percentage of IC to the overall health of a watershed and its ability to meet designated uses. According to studies, it is reasonable to rely on the surrogate measure of percent IC to represent the combination of pollutants that can contribute to aquatic life impacts. Without a total maximum daily load assessment for a watershed a general target related to the ICM is 10 % Effective Impervious Cover (EIC). That is if IC in a watershed can be disconnected through treatment through an appropriately sized BMP it can be removed from the EIC.

While the town of Brentwood currently has no overriding water quality criteria it is reasonable that the ICM can serve as a guide for managing both future development and retrofitting of town owned properties. This approach can serve as a surrogate for water quality criteria in the absence of any other governing regulatory limits. It should be noted that the %IC data presented here is of higher resolution than the data that has historically been provided by PREP. Higher resolution data yields more accurate representation of directly connected IC. We have seen on average a 40% difference between the two numbers. The significance of the differences mean less than the data trends and methods to reduce the consequences of increases in IC.

Figure 3: Impervious and pervious land cover statistics for the town of Brentwood

Land Cover	Acres
Impervious	10,256
Pervious	607
Total	10,863
%IC	**5.6%**

For draft regulatory guidelines included in the 2013 draft MS4 Permit released by EPA Region 1 most regulations pertain to section 2.2.2 Discharge to an Impaired Water without an Improved TMDL. The primary related discharges that the town of Brentwood should be concerned with are with respect to nutrient related impairments due to nitrogen and phosphorus loading (i.e. low dissolved oxygen levels, chlorophyll-a, eel grass, etc).

Draft regulations state if there is a discharge from the MS4 to an impaired water without an approved TMDL, the permittee shall address in the SWMP and annual reports how the discharge of pollutants will be controlled such that they do not cause or contribute to the impairment. While the list of source categories is large and varies depending on the listed impairment stormwater is the major contributor associated with nutrients (phosphorus or nitrogen), bacteria, suspended solids, metals, or oil and grease. Within one year of the MS4 permit effective date the permittee is required to develop a water

quality response plan (WQRP) that identifies additional or modified BMPs the permittee will implement to ensure that its discharges do not cause or contribute to the impairment. The WQRP will likely be a separate section of the overall Stormwater Management Plan (SWMP) specifically designed to provide an iterative process for addressing discharges that have the potential to cause or contribute to impairments such as directly connected impervious cover (DCIA). The analyses performed in this project constitute major elements of any required WQRP and include the following elements:

1.) Preliminary source assessment with respect to potential stormwater sources
2.) Implementation of programs leading to the disconnection of DCIA
3.) Structural BMP retrofits

While additional analyses and comprehensive assessment of illicit discharge detection and elimination (IDDE) programs, and revision of good housekeeping and pollution practices such as catch basin cleaning frequency and leaf litter collection programs may be required, the analyses and action items embodied in this report represent a major contribution to any future WQRP or SWMP permit submission.