4 Pollutant Load Reductions

Pollutant load reductions were estimated for the following watershed management plan recommendations using the Watershed Treatment Model (WTM) pollutant loading model described in the baseline watershed assessment:

1. CSO Abatement. The MDC CSO Long Term Control Plan for the North Branch Park River drainage district is designed to eliminate CSOs during storms up to and including the typical one-year frequency event, which is defined as a storm total of 2.4 inches. This will essentially eliminate CSOs to the North Branch Park River on an annual average basis.

2. Green Infrastructure Retrofits. The watershed management plan promotes the use of green infrastructure approaches within the City of Hartford to augment traditional CSO control strategies such as sewer separation and to address municipal stormwater management requirements. The goal is to implement green infrastructure retrofits to reduce stormwater discharge volumes and associated pollutant loads to the North Branch Park River and other receiving water bodies.

   Potential load reductions were modeled for roof leader disconnections and green street retrofits, which are practices that could potentially be implemented in the Hartford portion of the North Branch Park river watershed. Conservative model assumptions were used to estimate the potential area (1.5% of the total impervious cover within the Hartford portion of the watershed) served by the retrofits given the challenges of implementing green infrastructure retrofits on private property, within the public right-of-way, and with other site constraints such as poor soils and limited land area.

3. Additional Stormwater Retrofits. Stormwater retrofits are also recommended in the other watershed communities. In these less densely developed areas, stormwater retrofits are most feasible at commercial, industrial, municipal, institutional and roadway land uses in the form of on-site or outfall retrofits. Potential load reductions were estimated for a variety of stormwater and LID retrofit practices (bioretention, infiltration, water quality swales, and stormwater basins) applied to these land uses throughout the watershed. Similar to the green infrastructure retrofits scenario, conservative model assumptions were used to estimate the potential area (between 0.04% and 1.9% of the total impervious cover within each subwatershed) served by the retrofits. The modeled effectiveness of the proposed retrofits was further reduced to reflect system maintenance and design (system bypass during larger storms) factors.

4. Stormwater Management for New Development and Redevelopment. The watershed management plan promotes effectiveness stormwater management for future development and redevelopment throughout the watershed through land use regulatory mechanisms and the local site plan review process. Potential load reductions were estimated for implementation of stormwater management practices (bioretention, infiltration, stormwater ponds, and water quality swales) for all future new development and redevelopment in the watershed, based on the watershed buildout presented in the baseline assessment report. The modeled effectiveness of the proposed stormwater

controls was further reduced to reflect system maintenance and design inefficiencies and assuming that 70% of new development has regulated stormwater management.

5. Riparian Buffer Restoration. Potential pollutant load reductions were estimated for restoration of impacted riparian buffers in the watershed. The total length of streams within each subwatershed with impacted buffers was estimated from aerial photography. Under the modeled restoration scenario, a 50-foot vegetative riparian buffer was assumed for those areas currently with impacted buffers.

6. Reforestation. The watershed management plan promotes preservation and enhancement of tree canopy through various urban watershed forestry approaches. Potential pollutant load reduction benefits were estimated for a watershed reforestation scenario, using the tree canopy goals presented in the baseline assessment report as a future target. Subwatersheds that are currently below their respective tree canopy goals (Beamans Brook East, Beamans Brook West, Tumbledown Brook, and Wash Brook West) were included in the analysis. The reforestation scenario also included the North Branch Park River subwatershed based on the more detailed tree canopy assessment performed by the City of Hartford, USDA Forest Service, and the University of Vermont (O'Neil-Dunne, 2010). For these subwatersheds, the amount of land conversion required to achieve the recommended tree canopy goal was modeled by converting existing institutional (including municipal) and commercial land use to forest.

7. Open Space Protection. Potential pollutant load reductions were estimated for an open space protection scenario consistent with the open space recommendations in *Section 3.2.8* of this plan. Parcels recommended for acquisition as protected open space were assumed to remain as forest or undeveloped open space under a future watershed buildout scenario. Parcels recommended for conservation restrictions were assumed to remain in their current land use under the future buildout scenario. Predicted future pollutant loads from these parcels under a "protection" scenario were compared to predicted future loads under a future buildout scenario in which the land is assumed to be developed as allowed by current zoning.

8. Public Education. Pet waste, lawn care, and other nonpoint source education programs can change behaviors that affect pollutant loads. Pollutant load reductions were estimated for pet waste and lawn care education programs based on the number of dwellings, average fraction of pet-owners, pet-owners who already clean up after their pets, and average fraction willing to change their behavior. Conservative model assumptions were used to avoid over-estimating the load reduction benefits of these programs.

9. Illicit Discharge Detection and Elimination and Septic System Repairs. Illicit stormwater connection removal and septic system repairs were considered in each subwatershed based on the existing estimated number of households served by septic systems and estimated numbers of illicit connections associated with commercial and residential land uses. The illicit connection removal scenario assumes that 20% of the existing illicit discharges are detected and eliminated. The septic system repair scenario assumes an 80% inspection rate and a 60% repair rate.

Annual average pollutant load reductions for bacteria, total suspended solids (TSS), phosphorus (P), and nitrogen (N) for the above scenarios were estimated for 1) existing conditions, 2) future buildout of the watershed without the proposed watershed management plan recommendations, and 3) future buildout assuming implementation of the proposed watershed management plan recommendations.

Table 4-1 summarizes the anticipated pollutant load reductions for the watershed-wide and targeted plan recommendations for which pollutant loads can be reasonably quantified. The load reduction values presented in *Table 4-1* are for the entire North Branch Park River watershed. Load reduction summaries by subwatershed are provided in *Appendix G*.

As indicated in *Table 4-1*, CSO abatement through implementation of the MDC LTCP is estimated to result in the most significant load reductions, particularly with respect to bacteria loads (approximately 94% reduction in fecal coliform loading within the North Branch Park River subwatershed and 86% reduction watershed-wide). Load reductions for the other watershed management recommendations listed in *Table 4-1* are expressed as a percentage of the remaining watershed pollutant loads following elimination of CSOs to the North Branch Park River consistent with the MDC LTCP. Of these recommendations, stormwater retrofits, open space protection, and illicit discharge detection and elimination and septic system controls are anticipated to result in the greatest reductions in bacteria loads. The effectiveness of the watershed management recommendations varies by pollutant, but is generally relatively low compared to CSO elimination.

Table 4-1. Anticipated Load Reductions of Watershed Management Recommendations

Watershed Management Recommendation	N (lb/yr)	P (lb/yr)	TSS (lb/yr)	Fecal Coliform (billion/yr)	N	P	TSS	Fecal Coliform
CSO Abatement	3,653	731	73,054	10,654,285	2.3%	3.6%	0.54%	86.1%
Load reductions for the following management recommendations are expressed as a percentage of the remaining watershed pollutant loads following elimination of CSOs								
Green Infrastructure Retrofits	256	38	18,182	585	0.17%	0.19%	0.14%	0.04%
Additional Stormwater Retrofits	1,750	302	88,060	32,523	1.1%	1.5%	0.66%	2.4%
Stormwater Management for New Development and Redevelopment	258	49	18,635	2,821	0.17%	0.25%	0.14%	0.21%
Riparian Buffer Restoration	64	3	5,345	0	0.04%	0.02%	0.04%	0.00%
Reforestation	88	12	1,416	220	0.06%	0.06%	0.01%	0.02%
Open Space Protection	4,230	538	340,049	54,081	2.8%	2.8%	2.5%	4.1%
Public Education	6,778	167	0	4,522	4.4%	0.85%	0.00%	0.34%
IDDE/Septic System Repairs	1,750	302	88,060	32,523	1.1%	1.5%	0.66%	2.4%

Table 4-2 summarizes the anticipated combined effectiveness for all of the watershed management recommendations considered. The pollutant loadings and load reductions

presented in *Table 4-2* reflect a comparison of modeled future pollutant loadings for the entire North Branch Park River watershed, with and without implementation of the watershed management recommendations. Overall, a significant reduction in bacteria loads is anticipated (87.1%), largely due to CSO abatement, with smaller reductions anticipated for nitrogen (12%), phosphorus (10.5%), and total suspended solids (4.7%).

Table 4-2. Summary of Existing and Future Pollutant Loads With and Without Watershed Management Recommendations

Pollutant	Existing Conditions	Future Buildout without Controls	Future Buildout with Controls	Load Reduction	Load Reduction (%)
Nitrogen (lb/yr)	136,389	156,673	137,847	18,827	12.0%
Phosphorus (lb/yr)	17,108	20,345	18,203	2,142	10.5%
TSS (lb/yr)	11,173,372	13,418,963	12,786,163	632,800	4.7%
Fecal Coliform (billion/yr)	12,054,165	12,376,811	1,595,252	10,781,558	87.1%

Figures 4-1 through *4-4* depict the existing and anticipated future pollutant loading rates for the watershed, with and without implementation of the watershed management plan recommendations. The pie charts in *Figures 4-1* through *4-4* show the relative contribution of the management plan recommendations to the predicted load reductions.

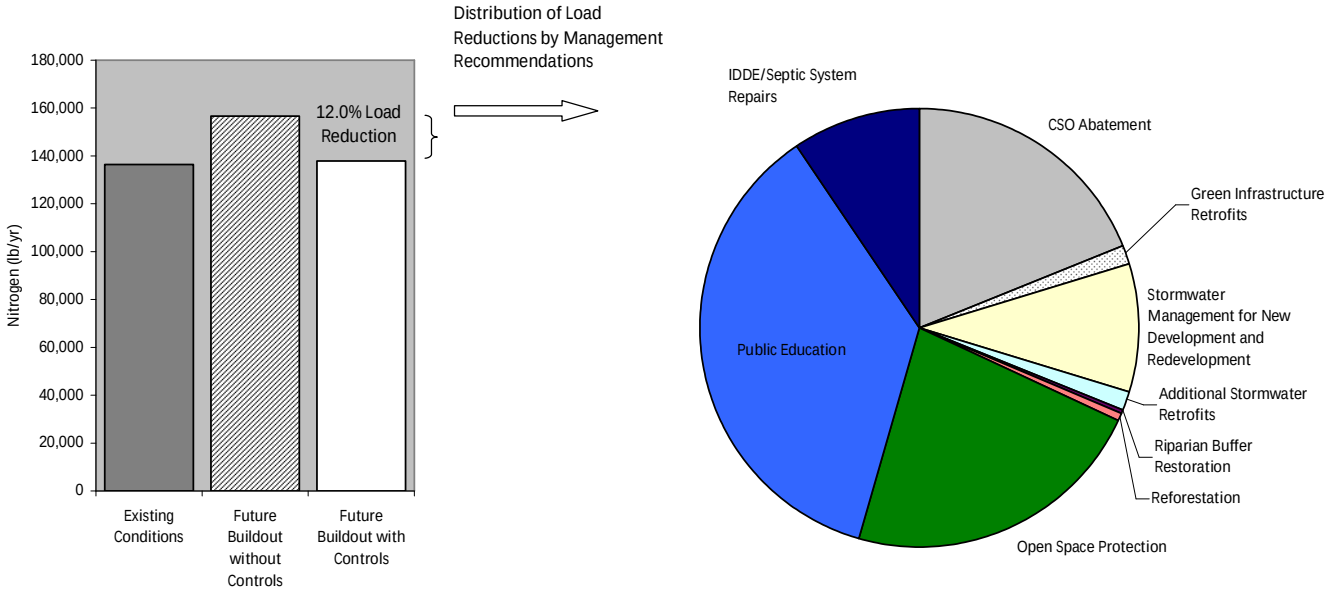

Figure 4-1. Anticipated Existing and Future Nitrogen Loads and Load Reductions With Future Watershed Management Implementation

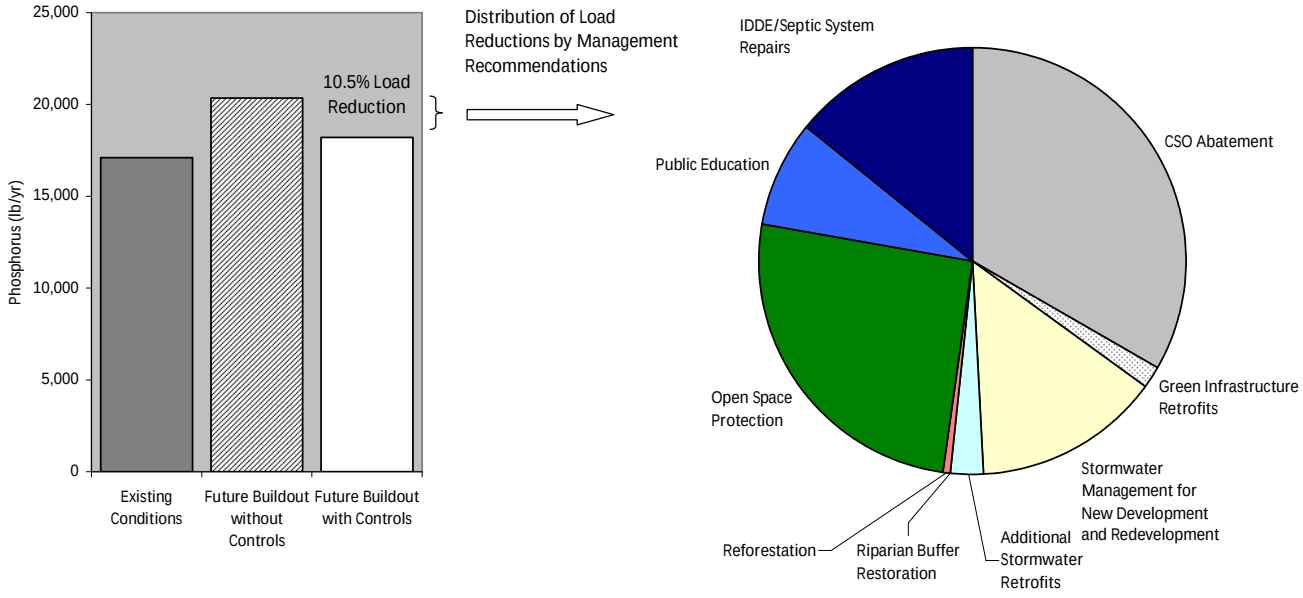

Figure 4-2. Anticipated Existing and Future Phosphorus Loads and Load Reductions With Future Watershed Management Implementation

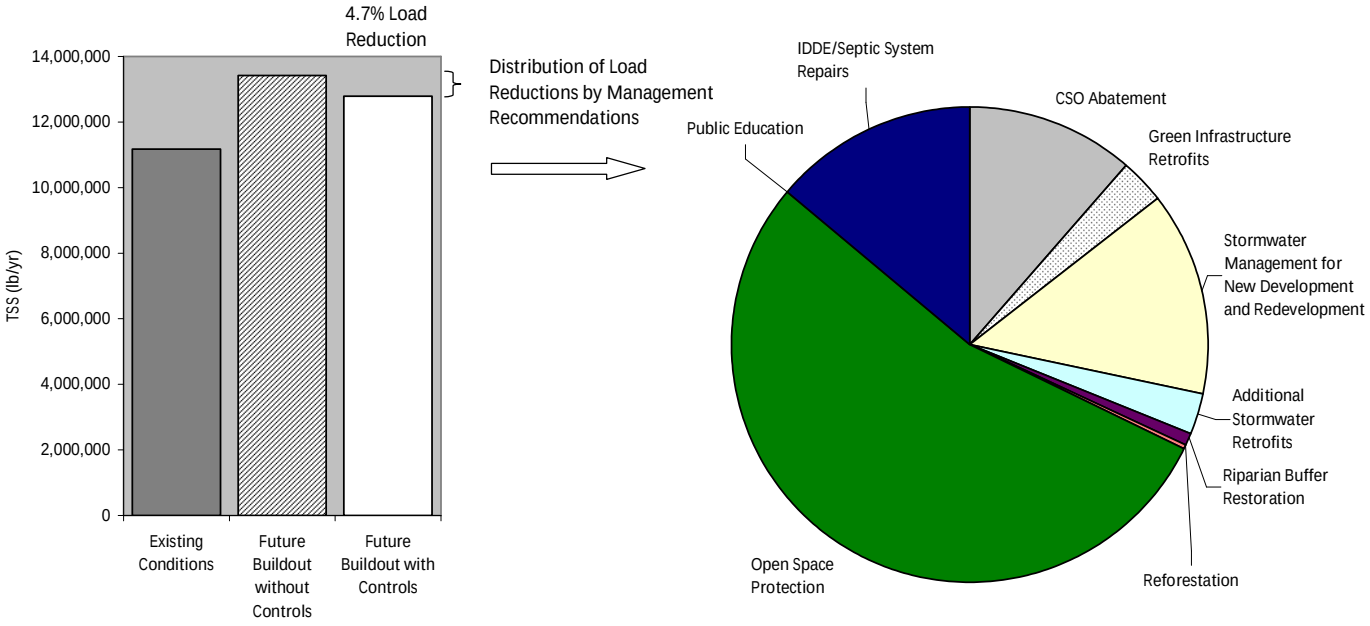

Figure 4-3. Anticipated Existing and Future Sediment (TSS) Loads and Load Reductions With Future Watershed Management Implementation

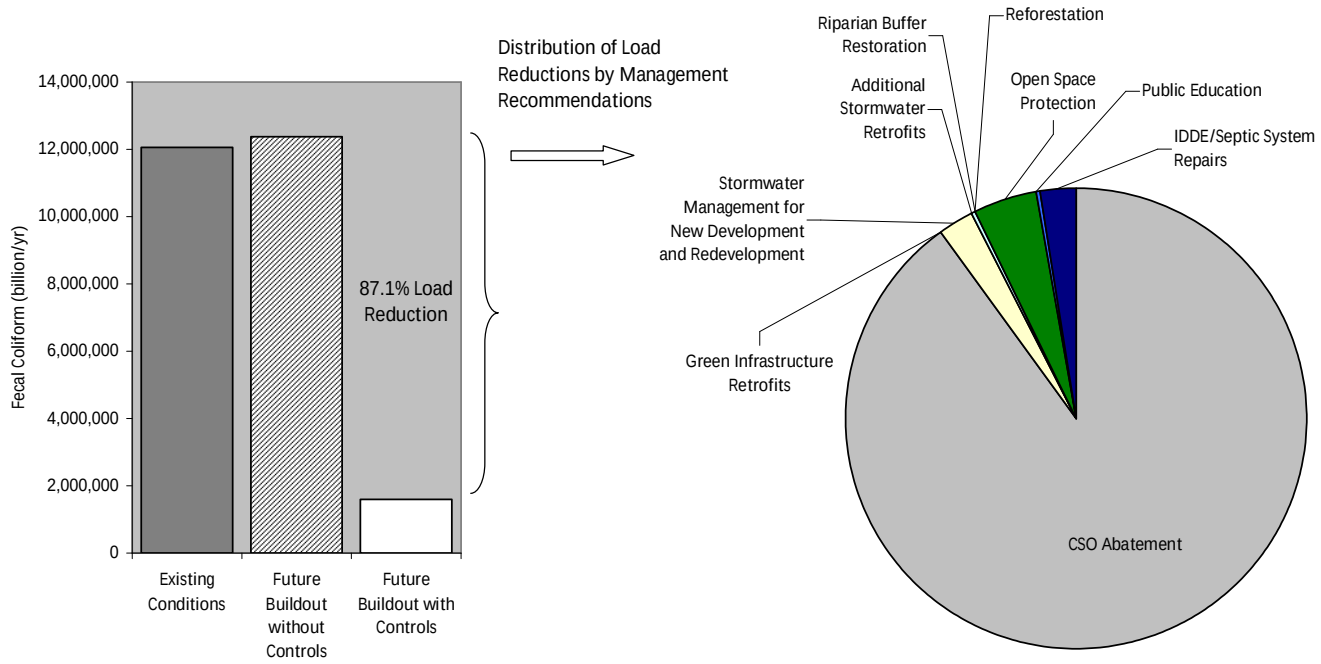

Figure 4-4. Anticipated Existing and Future Fecal Coliform Loads and Load Reductions With Future Watershed Management Implementation

5 Plan Implementation

5.1 Schedule and Milestones

Appendix H contains a proposed implementation schedule, including actions/milestones, anticipated timeline, products, and evaluation criteria. This table should be revised as necessary to reflect future changes to the watershed plan and implementation activities.

5.2 Funding Sources

A variety of local, state, and federal sources are potentially available to provide funding for the implementation of this watershed management plan, in addition to potential funds contributed by local grassroots organizations and concerned citizens. *Appendix I* contains a list of potential funding sources that has been developed by CTDEP and NRCS, and further refined through this planning process. The table is not intended to be an exhaustive list but can be used as a starting point to seek funding opportunities for implementation of the recommendations in this watershed plan. The information presented in this watershed management plan and the supporting study documentation will support future grant proposals by demonstrating a comprehensive, scientifically-based approach for addressing identified concerns consistent with EPA's recommended watershed-based approach. The table of potential funding sources is intended to be a living document that should be updated periodically to reflect the availability of funding or changes to the funding cycle, and to include other funding entities or grant programs.

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Appendix A

Baseline Watershed Assessment Report (on CD)

Appendix B

Watershed Field Assessment Report (on CD)

Appendix C

Land Use Regulatory Review Report (on CD)

Appendix D

Map of Targeted Recommendations

Appendix E

Open Space Priority Parcel Assessment

Appendix F

Site-Specific Project Cost Estimates

Appendix G

Pollutant Load Reduction Model Results

Appendix H

Implementation Schedule

Appendix I

Potential Funding Sources