



# Integrated Planning Opportunities Alternatives Analysis – Street Sweeping

Springfield, Missouri

November 2019

## Introduction

The City of Springfield (City), Greene County, and City Utilities of Springfield have developed an approach for integrated planning to best protect local environmental resources in an evolving regulatory landscape. The Integrated Plan (IP), titled “A Citizen Focused Approach,” provides a holistic plan designed to prioritize investments based on the most effective solutions to address the most pressing problems that matter most to the community. Implementation of the IP includes a four-phased approach, which is designed to be iterative: 1) Assessment (What is the current status of the environment?), 2) Vision (Where do we want to be?), 3) Tactical (How will we get there?), and 4) Adaptive Management (What adjustments need to be made?).

Identifying and prioritizing the most effective solutions using the Sustainable Return on Investment (SROI) approach is a critical component of the tactical phase. The SROI process is an economic analysis method for analyzing triple bottom-line (i.e., economic, social and environmental) outcomes of investments and policies. This approach provides a comparison between the general cost of a solution to the benefits achieved so that a more informed investment decision can be made.

The SROI process was used here for estimating the sustainability value of street sweeping, including social and environmental benefits and financial costs. The methodology entailed projecting the value of impacts over a 25-year planning horizon and applying a discount rate to bring future values into today’s dollars. A description of this opportunity and details of the SROI analysis are provided below.

## Opportunity Description

The City of Springfield (City) currently maintains and operates a fleet of six street sweepers that includes a combination of regenerative air and vacuum sweepers. In total, the City sweeps 84 routes covering 1,311 curb lane miles an average of three times per year. For the July 2017-June 2018 reporting period, it was estimated that approximately 7,900 cubic yards of dirt and debris were removed from the City’s streets through its street sweeping program. Street sweeping helps keep roadways clean and safe, but also has a positive impact on water quality. For this reason, street sweeping is an important part of the City’s Stormwater Management Program as it contains sediment and other pollutants with the potential of washing into storm sewers and ultimately into area streams. In an effort to improve its existing program, the City is interested in evaluating these benefits as part of an SROI analysis.

## Environmental and Social Benefits

The primary benefit of street sweeping is improved water quality. Water quality improvements were determined using a water quality index (WQI) approach. The WQI is a composite scoring system that evaluates the conditions of a waterbody on a scale of 0 to 10 based on different community priorities and indicators. The economic value of a change in water quality is determined by the number of people that benefit and an individual’s “willingness-to-pay” for that change. A one point change to the WQI is worth about \$40 for a direct user and \$14 for in indirect user.

HDR evaluated the change in the WQI due to estimated reductions in debris from the City’s



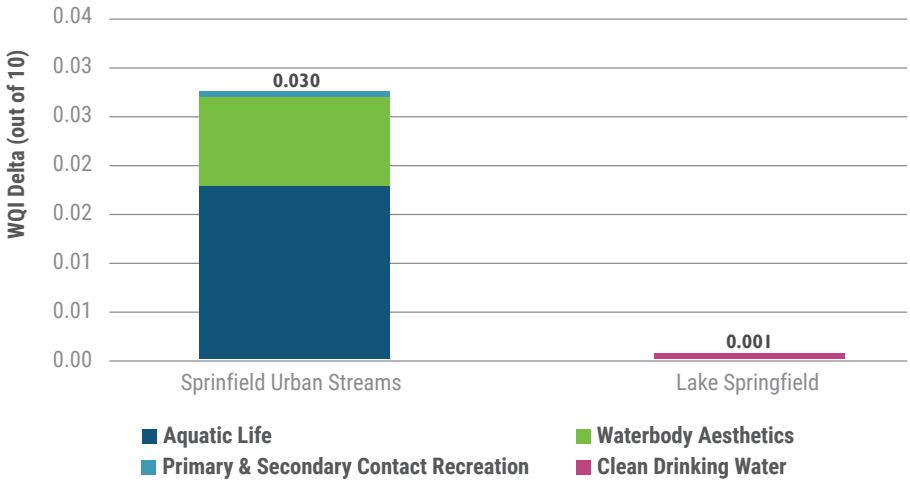
Street Sweeper

existing street sweeping efforts. Based on the City’s recent estimated annual debris removal rate of 1,871 tons per year, percent reductions in total loadings were estimated for a number of pollutant indicators including total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN), contaminated sediment, and toxicants (Table 1).

**Table 1. Estimated Pollutant Reductions due to Street Sweeping Efforts in Area Waterbodies**

Indicator	Percent Reduction	
	Springfield Urban Streams	Lake Springfield
Total Suspended Solids	2.2%	0.1%
Total Phosphorus	1.1%	0.06%
Total Nitrogen	0.7%	0.04%
Contaminated Sediment	11%	0.6%
Toxicants	2.2%	0.1%

Estimated reductions to sediment and nutrients will positively impact a number of community priorities including aquatic life and waterbody aesthetics. In terms of the WQI, it was estimated that riparian restoration of undeveloped land will increase it by 0.030 points in Springfield urban streams and 0.001 points in Lake Springfield (Figure 1). While largely beneficial, street sweeping is also anticipated to have some negative benefits associated with increased air emissions, damage to pavement, and increased traffic congestion.



**Figure 1. Changes to the Water Quality Index from Street Sweeping**

### Cost Considerations

The City has a fleet of six street sweepers, but operates four at a given time. Additionally, the age, value, and operation and maintenance costs vary considerably among the different sweepers. For purposes of calculating life cycle costs, it was assumed that there were only four sweepers (two vacuum and two regenerative air) with a useful life of eight years. Each of the regenerative air and vacuum sweepers were assumed to have a cost of \$250,000 and \$280,000, respectively. Operation and maintenance costs were estimated from actual costs associated with salaries, maintenance, fuel, debris disposal, and other program costs. The total annual operation and maintenance costs for the four street sweepers was estimated at \$573,000 per year.

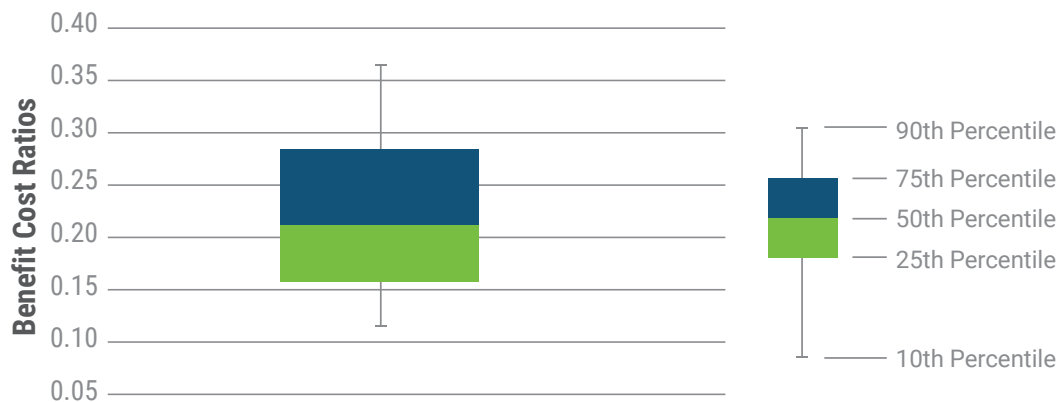
## SROI Results

**Table 2** presents final results of costs and benefits of street sweeping. The present value capital costs amount to about \$1.0 million. The total value of O&M costs are close to more than ten times that amount, at about \$9.7 million in present value terms. The total financial lifecycle cost of \$10.7 million exceeds the monetized water quality benefits, which are estimated at \$2.3 million resulting in a benefit-cost ratio of just 0.2.

**Table 2. Summary of Present Value Costs of Street Sweeping (\$2018, Millions)**

Types of Benefits and Costs	Present Value of Impact
<b>Environmental</b>	
Water Quality Improvements	\$2.3
<b>Social</b>	
Sweeper Trucking Impacts	(\$0.1)
<b>Costs</b>	
Capital Expenditures	(\$1.0)
Operations & Maintenance Impacts	(\$9.7)
<b>Totals</b>	
Financial Lifecycle Cost	(\$10.7)
Total Social, Environmental Benefits	\$2.2
Total Value - All Costs and Benefits	(\$8.5)
Benefit-Cost Ratio	0.2

**Figure 2** provides the best estimate of value created relative to cost by accounting for several uncertainties that can raise or lower the perspective on total value. However, even accounting for such uncertainty, there is only a 10% chance that the benefit-cost ratio exceeds 0.37.



**Figure 2. Range of Potential Benefit Cost Ratios for Street Sweeping**

## Summary

The financial lifecycle costs of the City’s street sweeping program likely outweigh the estimated monetized benefits. Benefits of street sweeping were monetized based on estimated reductions in pollutant loadings to area waterbodies. However, relative to total watershed loadings, reductions due to street sweeping are anticipated to be minimal with an estimated monetized value of \$2.2 million. Comparatively, the estimated total financial lifecycle cost of street sweeping is \$10.7 million with a median benefit-cost ratio of about 0.2.