

Clean Streets = Cleaner Waters Initiative Overview/Updates

Presentation to the Chesapeake Bay Stormwater Workgroup

— October 20, 2026 —

Seth Brown, PhD, PE | NMSA

Greg McPartlin | Urban Quarries

David Heigl | Alamo Group / Schwarze Industries

Andrew Sheerin, PhD | Fathom Solutions



Agenda



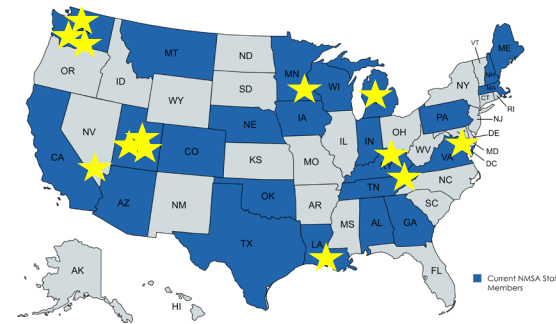
- **CS=CW Initiative Background and Phase I Updates**
 - Seth Brown, PhD, Executive Director, NMSA
 - Greg McPartlin, Principal Consultant, Urban Quarries
- **Help for Stormwater Managers**
 - David Heigl, Vice President, Schwarze Industries
- **CW=CW Initiative Future Activities**
 - Seth Brown, PhD, Executive Director, NMSA
 - Greg McPartlin, Principal Consultant, Urban Quarries
- **Technology Example: Overview of SWPT Tool**
 - Andrew Sheerin, PhD, Owner, Fathom Solutions
- **Wrap up / Discussion and Q&A**

NMSA Background & Overview

NMSA State of Membership



- **26 state groups currently members of NMSA**
 - Represents approximately 4,400 of the total 7,500 MS4s in the U.S.
 - Represents over half of the urban population in the U.S. subject to MS4 regulations
- **MS4, Affiliate, and Emeritus Members can join**
- **Mission, Vision and Action Areas**



To join NMSA online use this QR code or go to:

- <https://ms4nmsa.org/our-memberships/>



NMSA Activities/Services



- National Stormwater Policy Forum
- National Stormwater Day
- NMSA Stormwater Community Training Hub
- Stormwater Center of Excellence
- Stormwater Testing and Evaluation for Products and Practices (STEPP) Program



NMSA / STEPP
Membership

Seth Brown, PE, PhD

Executive Director, NMSA

Greg McPartlin

Principal Consultant, Urban Quarries, 1-800-SWEEPER

Overview of the CS=CW Initiative Phase I

Clean Streets = Cleaner Water Initiative *Leadership/Partnerships*



Leadership



National Municipal Stormwater Alliance (NMSA)

Seth P. Brown, PE, PhD (NMSA) — Executive Director, National Municipal Stormwater Alliance

- Developer of **STEPP** — *Stormwater Testing and Evaluation for Products and Practices*.

Gregory L. McPartlin, Progressive Sweeping / Urban Quarries

- Industry veteran leading coordination between manufacturers, contractors, and regulators to turn stormwater compliance into business growth.

Industry Partners

1-800-SWEEPER – Industry Network Leader
North American Power Sweeping Association
(NAPSA)

Manufacturing Partners

TYMCO

Elgin

Schwarze

Stewart-Amos

Clean Streets = Cleaner Water Initiative

Overview and Purpose

The CS=CW Initiative has been established to bridge the gap between research and policy and drive a broader adoption of power sweeper technologies to address stormwater pollution.

Phase I - Exploration

- Collecting and compile information on regulations and policy to capture the current status of street sweeping and stormwater treatment.
- Develop a pathway forward for the stormwater sector and power sweeper industry to use as a blueprint for the future.



CS=CW Steering Committee

CW=CW Steering Committee Function

Phase I of the CS=CW Initiative relied on the Steering Committee to guide direction and provide input in the analysis and findings outlined in the Phase I report.

CS=CW Steering Committee Members

- **Andrew Sheerin, PhD** – University of Rhode Island (**CHAIR**)
- **Cole Watts, MS** – NAPSA, More Clean of Texas
- **Dustin Moist** – NAPSA, Cantel Sweeping
- **Mike Trojan, PhD** – MN Pollution Control Agency (ret.), NMSA/STEP
- **Margaret Schneemann, PhD** – CMAP / IL-IN Sea Grant
- **Jamie Houle, PhD** – Univ of New Hampshire Stormwater Center
- **Todd Snyder** – City of San Diego
- **Paula Kalinosky, PhD** – Minnesota Pollution Control Agency
- **Bill Selbig, PhD** – USGS
- **Jane Clary** – Wright Water Engineers, Inc., International Stormwater BMP Database
- **Dylan Ahearn, PhD** – Herrera, Principal Scientist
- **Seth P. Brown, PhD PE** – NMSA (**Project Team**)
- **Gregory L. McPartlin** – Progressive Sweeping / Urban Quarries (**Project Team**)



Clean Streets = Cleaner Water Initiative

Phase I Report Out - Research

Findings and Considerations

- Early research suggested that sweeping effectiveness reduce street/roadway particulates was limited (subsequent research has corrected the record on this).
- Research shows effectiveness to address both organic debris and non-organic particulates, and the level of effectiveness varies by a number of factors.
- Research showing downstream water quality improvements is limited, which is a significant gap in the literature.
- **No standardized protocol exists for assessing sweeping across technologies and operating conditions.**



Clean Streets = Cleaner Water Initiative

Phase I Report Out – Programmatic

Findings and Considerations

- Sweeping identified as second most developed aspect of municipal stormwater programs (WEF 2022 MS4 Survey).
- Municipal stormwater programs structure their sweeping programs **based upon state regulatory policies**.
- Limited funds identified as consistent top need for stormwater programs.
- Stormwater/water quality markets can catalyze sweeping/stormwater activities in stormwater programs – including for private properties.



Clean Streets = Cleaner Water Initiative

Phase I Report Out – Regulatory/Policy

Findings and Considerations

- *A plurality of states MS4 general permits (42%) contain no language of sweeping/stormwater nexus.*
- Performance varies by equipment, operator, conditions, pollutant type, and frequency.
- Evidence of downstream water-quality improvement remains limited.
- **Load-reduction crediting and standardized performance testing are still needed.**



Clean Streets = Cleaner Water Initiative

Funding and Financing

Examples of SRF Investments in Street Sweeping

- **Clayton County, Georgia:** In 2024, the Clayton County Water Authority secured a \$960,000 CWSRF loan through the Georgia Environmental Finance Authority (GEFA) to purchase a street sweeper and a vacuum truck. The project was aimed at preventing sewer spills and protecting local impaired streams, qualifying for a reduced interest rate of 1.24%.
- **Town of Exeter, New Hampshire:** The town utilized a \$219,823 CWSRF loan specifically for its Street Sweeper Purchase Project. The equipment was acquired to improve roadway runoff quality and maintain compliance with the town's NPDES Phase II MS4 stormwater permit. Notably, this agreement included 20% principal forgiveness under federal capitalization grant guidelines.



Clean Streets = Cleaner Water Initiative

Funding and Financing

Examples of SRF Investments in Street Sweeping

- **Barneget Bay, New Jersey:** The New Jersey Department of Environmental Protection and the New Jersey Infrastructure Bank (NJIB) allocated \$350,000 in CWSRF funding for a mechanical street sweeper. This was part of a targeted effort to reduce stormwater pollution and nutrient loading impacting the Barneget Bay watershed.
- **Arlington and Lacey, Washington:** The Washington State Department of Ecology frequently blends state grants with the federal State Revolving Fund to finance high-efficiency street sweepers. These high-efficiency vacuum units are specifically funded because they capture microscopic particulates that traditional brooms leave behind, preventing toxic runoff from hitting salmon-bearing streams.



David Heigl

Vice President at Alamo Group
Sweeper & Debris Collectors



HELP FOR STORMWATER MANAGERS

How advanced street sweeping can accelerate BMP implementation, TMDL reduction, and public support.

Chesapeake Bay Case Study – Washington County, MD

DAVID HEIGL

Stormwater Magazine | February 2020



CLEAN COUNTY INITIATIVE
Washington County, Maryland

Support for the stormwater managers

02

COMPLIANCE

Clear, specific, and measurable permit conditions for the state

ECONOMICS

Compare BMP cost and effectiveness on common units to protect taxpayer value

EXECUTION

Work with fleet and other departments to deploy practices quickly across a broad service area

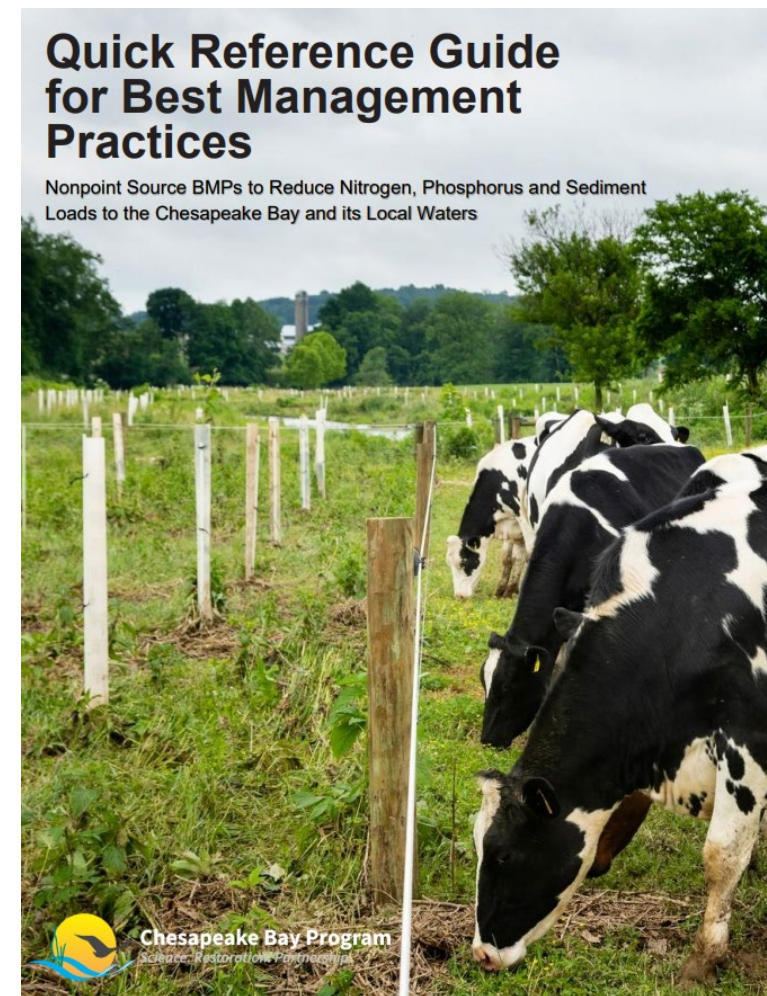
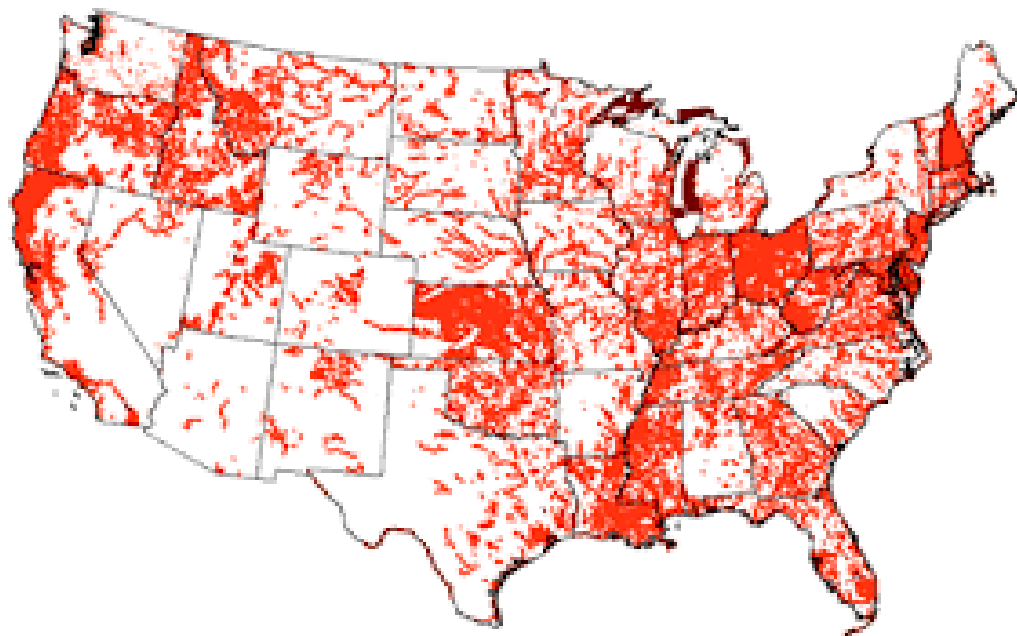
ENGAGEMENT

Make environmental investment visible to the public to build trust

In the Chesapeake Bay states, Chesapeake Assessment Scenario Tool (CAST) provides the decision framework. It allows Chesapeake Bay jurisdictions to model how different best management practices—such as street sweeping, catch-basin cleaning, bioretention, and stormwater ponds affect estimated sediment, nitrogen, and phosphorus loads.

The objective is not a single BMP. It is the most cost-effective portfolio that reaches the required load reductions.

MS4s that discharge to impaired waters must develop a total maximum discharge limit (TMDL) **strategy and plan** to reduce sediment, phosphorous, and nitrogen discharged into protected watersheds.



- Sweeping Section D9, P.134
- Catch Basin D10: P.137

Washington County, MD starting point

09

A permit obligation became an operating plan

22,162

acres in the county

150,926

residents

20%

required reduction by 2025

2017–2025 reduction responsibility

10,631 lb nitrogen

581 lb phosphorus

The county first screened BMPs near \$20,000 per acre of treatment. Advanced sweeping modeled far below that threshold and could begin quickly.

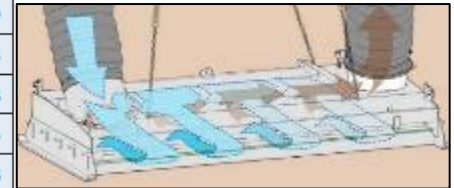
NPDES Phase II permit

Cost comparison for selected BMPs

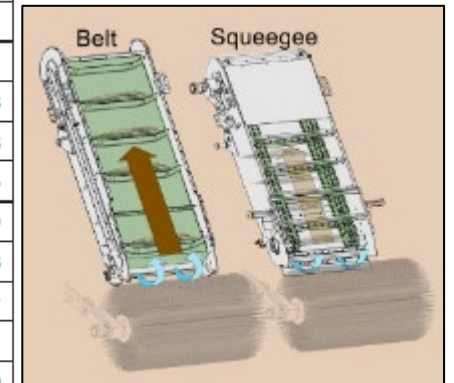
Table 3. Comparing the annual cost per pound of sediment, phosphorus, and nitrogen removal of various BMPs

BMP	Unit	Cost (Unit/BMP)	Costs (\$ per pound reduced per year)		
			Nitrogen	Phosphorus	Sediment
Advanced Sweeping Technology: 1 pass/2 weeks	Acres	731.51	3,116.32	23,826.83	4.09
Advanced Sweeping Technology: 1 pass/week	Acres	1,462.17	4,152.67	29,688.92	5.63
Advanced Sweeping Technology: 2 pass/2 weeks	Acres	2,925.18	6,230.80	47,392.81	8.58
Advanced Sweeping Technology: fall 1 pass/1–2 weeks, else monthly	Acres	674.53	2,873.57	21,970.87	4.15
Advanced Sweeping Technology: spring 1 pass/1–2 weeks, else monthly	Acres	506.76	4,317.71	20,579.21	4.46
Mechanical Broom Technology: 1 pass/week	Acres	2,632.92	0	0	324.13
Mechanical Broom Technology: 2 pass/week	Acres	5,266.08	0	0	324.21
Permeable Pavement w/Sand, Vegetation: A/B soils, no underdrain	Acres Treated	14,214.02	2,134.42	25,092.14	18.21
Bioretention/rain gardens: A/B soils, no underdrain	Acres Treated	1,057.67	158.82	1,757.24	1.28
Filter Strip Stormwater Treatment	Acres Treated	4,481.08	0	0	22.18
Infiltration Practices w/Sand, Vegetation: A/B soils, no underdrain	Acres Treated	1,091.56	154.27	1,813.69	1.25
Bioretention/raingardens: C/D soils, underdrain	Acres Treated	1,057.67	508.23	3,319.41	2.09
Dry Detention Ponds and Hydrodynamic Structures	Acres Treated	758.93	1,823.30	10,720.68	8.26
Dry Extended Detention Ponds	Acres Treated	342.06	205.46	2,415.16	0.62
Filter Strip Runoff Reduction	Acres Treated	4,481.08	2,691.57	11,719.87	8.71
Wet Ponds and Wetlands	Acres Treated	329.91	198.16	1,035.39	0.60
Storm Drain Cleaning	Lbs of Sediment	0.62	291.14	1,310.11	0.79

Advanced Air



Mechanical



Sweeping offered a fast, low-cost path to begin earning credit. Structural BMPs remained important parts of the broader portfolio.

1 curb lane-mile swept = 1 impervious acre treated

The operating model protects productive sweeping time

Truck configuration and route design convert modeled credit into daily execution.



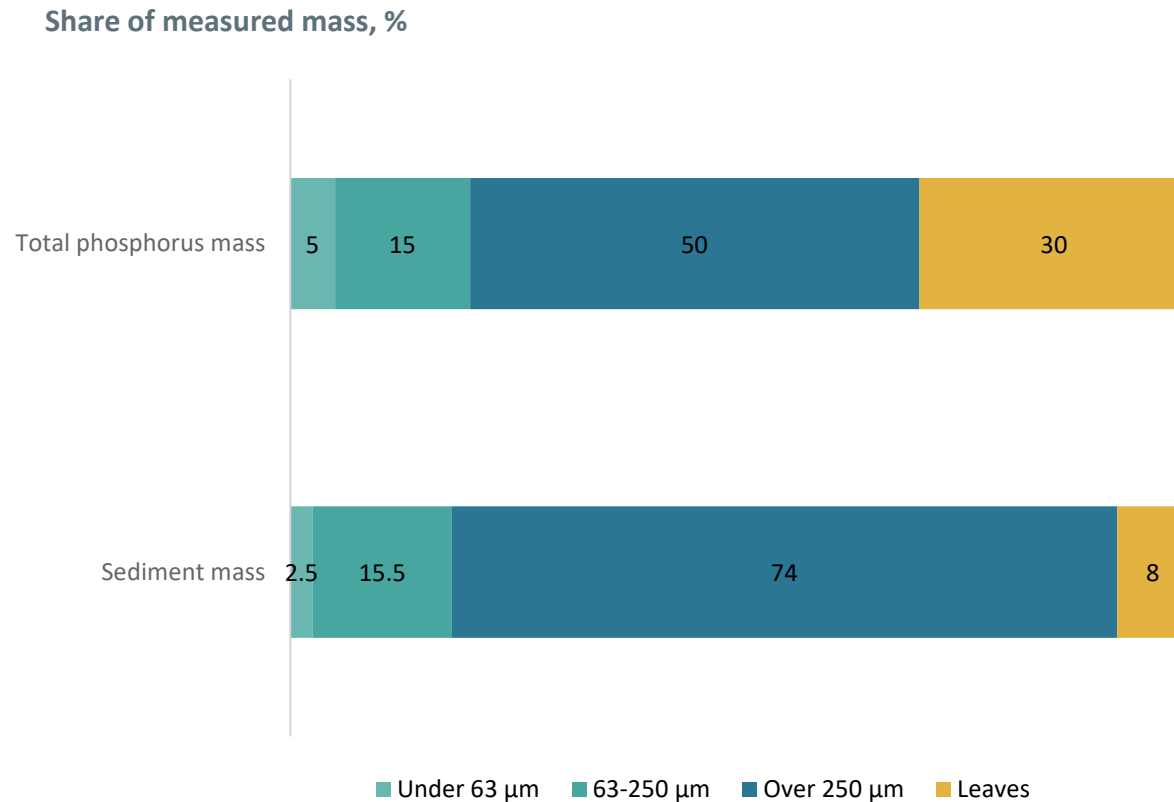
\$731

modeled cost per
acre for biweekly
advanced sweeping

The county selected a regenerative-air sweeper with a scissor lift to support productive routing and transfer to a staged dump truck.

Both coarse and fine street debris matter

06



80%

of phosphorus mass was associated with particles over 250 µm and leaves

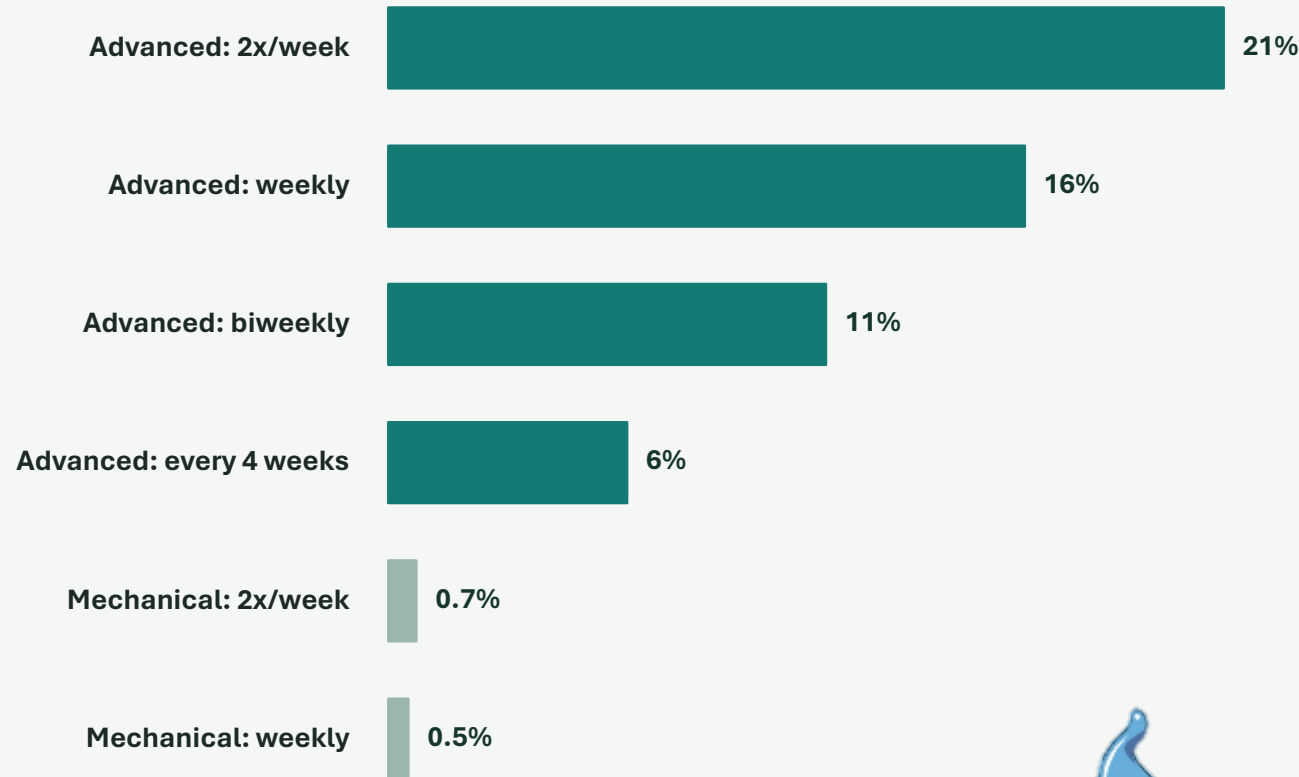
- **Coarse material carries mass**
Leaves and larger particles contained much of the measured nutrient load.
- **Fine material carries risk**
Smaller particles wash off more readily and are harder for mechanical brooms to capture.



Effective programs remove visible organic debris and the fine, mobile sediment that rainfall can carry into storm drains.

Technology and frequency determine the modeled street-sweeping credit

Advanced sweeping technology produces materially higher modeled reductions than mechanical broom technology.



Modeled sediment reduction



MAXIMUM MODELED CREDIT

21% Sediment

4% Nitrogen

10% Phosphorus

Advanced technology, two passes per week, approximately 100 passes per year.

Frequency is the operating lever: remove accumulated material before rainfall carries it into the drainage system.

Two BMP functions from one asset

Truck configuration and route design convert modeled credit into daily execution.

DUAL BMP FUNCTIONALITY

Street sweeping + catch basin cleaning



\$0.62

cost per pound of sediment removed under the referenced catch-basin-cleaning estimate

Nutrient enrichment factors for catch basin cleaning		
Nutrient Enrichment Factor	%P	%N
Catch basin collections of sediment	.06	.27
Leaves	.12	1.11
Local may take their own nutrient factor if they sample the catch basin cleanings for carbon content.		

- TMDLs under the Chesapeake Bay Program also account for catch basin cleaning.
- Take the wet mass weight in the hopper and multiply it by .7 for wet sediments and .2 for wet organic matter like leaves.

A visible BMP can build community support

Washington County paired environmental progress with a recognizable public-service identity.

CLEAN STREETS. CLEAN STREAMS. CLEAN COUNTY.

VISIBLE REACH

A sweeper can serve developed neighborhoods where space limits practices such as storm ponds.

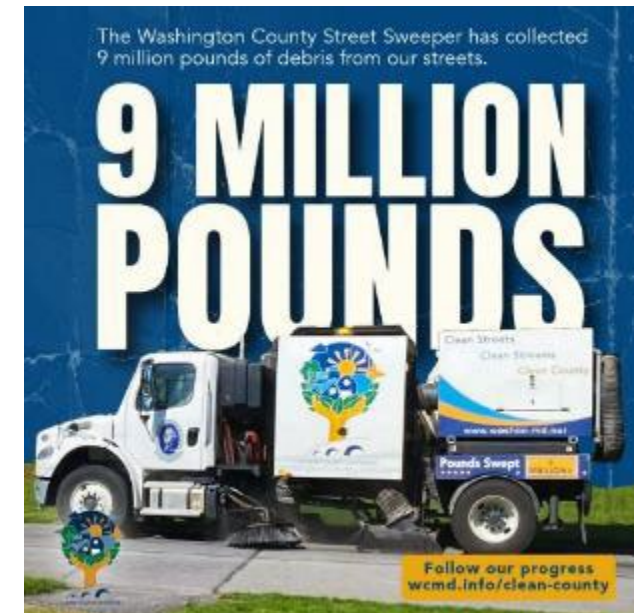
IMMEDIATE BENEFIT

Residents can see cleaner streets while the county works toward permit requirements.

BRAND MULTIPLIER

The county linked the sweeper to its Clean County Initiative and reported positive public response.

More than 9 million pounds of debris collected since the program began in January 2019.



Controlled testing in 2025 reinforced the importance of timing & frequency

Southern CA pilot used simulated rainfall to compare runoff from adjacent swept and unswept pavement.



55% lower total microplastic mass below 355 μm in runoff from swept pavement

TSS: 13% lower

PAHs: 30% lower

Coliform: 79% lower

PAHs: 30% lower

Coliform: 79% lower

Fipronils: 27-40% lower

References and video case studies



Seth Brown, PE, PhD

Executive Director, NMSA

Greg McPartlin

Principal Consultant, Urban Quarries, 1-800-SWEEPER

Andrew Sheerin, PhD

Owner, Fathom Solutions

The Future of the **CS=CW Initiative**

Seth Brown, PE, PhD

Greg McPartlin

Clean Streets = Cleaner Water Initiative

Phase I Report Out – Implications

Take Aways

- Link verified sweeping performance to **regulatory crediting**.
- **Standardize** performance metrics and verification through STEPP and ASTM E64.
- Open up **funding and financing** options for sweeping.
- Develop a performance-based, cost-effective **Enhanced Street Sweeping Program Framework**.
- Expand stormwater-focused **technical and operator training**.



Clean Streets = Cleaner Water Initiative *Phase I Report Out – Recommendations for the Future*

- Establish a Street Sweeping/Stormwater Nexus Community of Practice (CoP).
- Develop the Enhanced Street Sweeping Program framework.
- Collect, organize, curate, and share research/operational data on street sweeping for stormwater management.
- Create template language and a framework for regulatory crediting.
- Develop clearer and more practical metrics for quantifying pollutants removed from paved surfaces.



Clean Streets = Cleaner Water Initiative *Phase I Report Out – Recommendations for the Future*

- Explore and promote technologies that can optimize sweeping operations for stormwater outcomes.
- Initiate engagement with state regulators and EPA on the CS=CW framework and related concepts.
- Survey the MS4 sector on sweeping prevalence, activities, and technologies in use.
- Engage in high-profile stormwater and sweeping conferences to promote the initiative and its products.
- Initiate engagement with the STEPP program and begin planning for the identification and development of ASTM performance testing standards.





Technology Example: Overview of SWPT

Andrew Sheerin, PhD
Owner, Fathom Solutions

How do we measure what sweeping actually removes?

Today's credit is an estimate, not a measurement. Crediting methods generally assign a percentage of load reduction based on sweeper technology and frequency. They cannot see what a given program actually recovers, so they under-represent the better-run programs and give them no way to demonstrate it. Measuring the recovered material is what closes that gap.

TIER 1

Mass of pollutant recovered

Sweep, then sample and analyze the recovered material. Concentration averaged over random samples.

TO MAKE IT ROUTINE

Needs a written protocol: how many sub-samples, which constituents, how often.

TIER 2

Mass of material collected

Dry mass, with moisture content and particle size distribution characterized periodically.

TO MAKE IT ROUTINE

Needs onboard or scale-house weighing and one agreed moisture and particle-size method.

TIER 3

Curb-miles swept

An activity record. It carries meaning only alongside what kind of network was swept.

TO MAKE IT ROUTINE

Needs route attributes on every record: sweeper class, speed, passes, parking, land use, canopy, days since rain.

Four drivers, already in free national data

Land use

Industrial streets have averaged 1,313 lb of solids per curb-mile, against 1,050 commercial and 609 residential.

Tree canopy

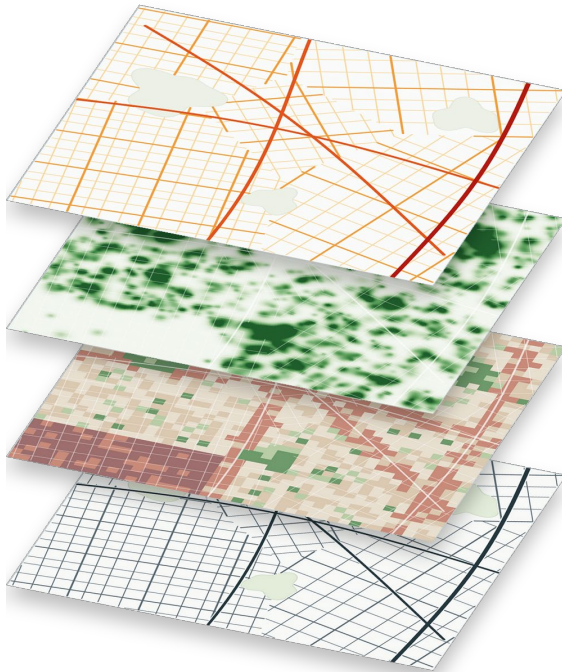
Phosphorus recovered rose from 4.1 to 9.8 lb per curb-mile, low- to high-canopy routes.

Traffic

Tire-wear particles run about ten times higher above 30,000 vehicles per day.

Season

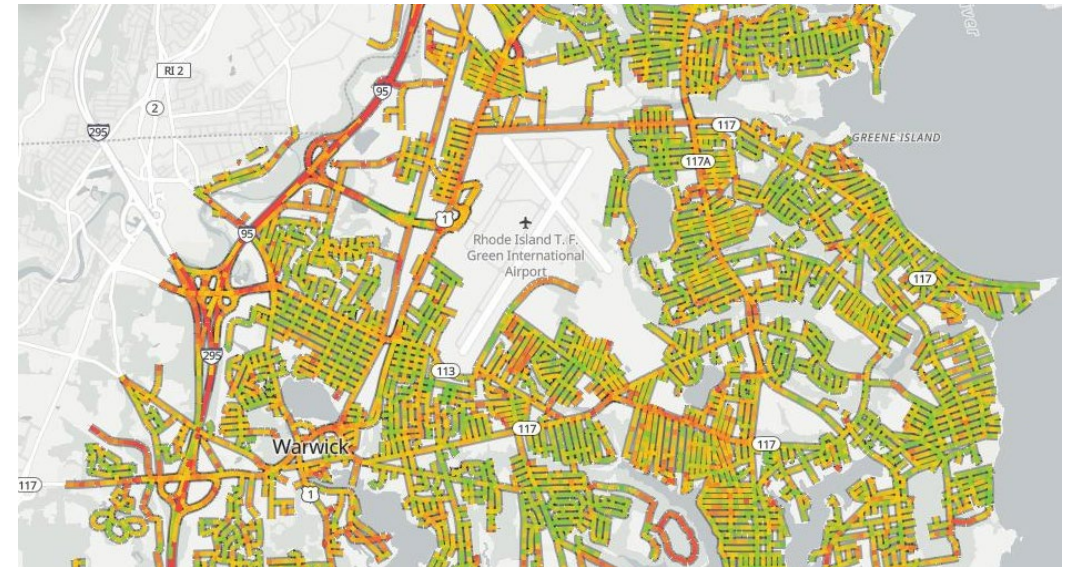
Timing of leaf and pollen drop, the rhythm of human activity, and winter de-icing application.



Free, nationwide

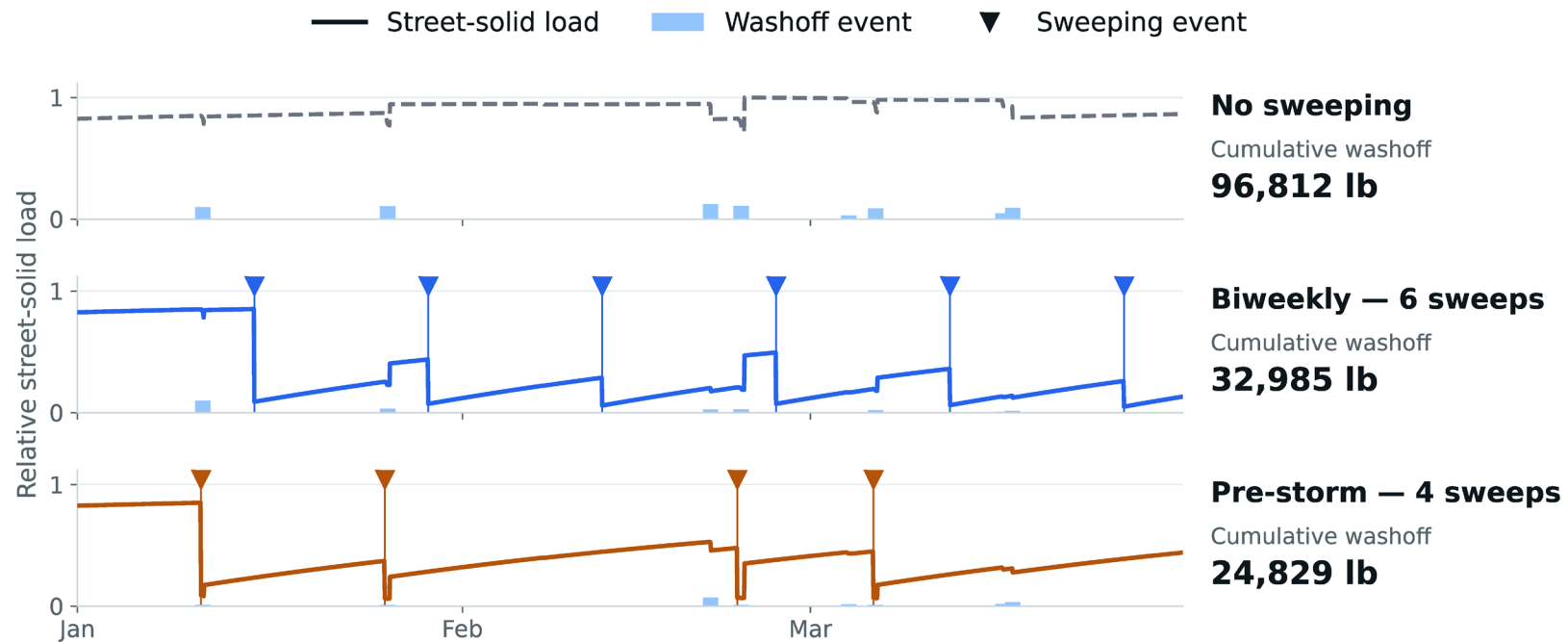
- **Traffic**
HPMS annual average daily traffic
- **Tree canopy**
1 m canopy height model
- **Land use and cover**
NLCD, 30 m raster
- **Road network**
OpenStreetMap, cut into 200 ft segments

Prioritize where to sweep



Models compare sweeping scenarios against a no-sweeping baseline

What a model does: simulate material accumulating between storms and washing off during them, then compare one sweeping schedule against another. It answers when and where to sweep — not how much a permit should credit.



SWPT and SIMPTM buildup–washoff simulation, municipal road network, January–March, observed hourly rainfall.

66%

less washoff from a biweekly schedule, against the no-sweeping baseline

74%

less washoff from pre-storm timing, against that same baseline

~40% cheaper

per pound removed. Pre-storm timing reached the larger reduction on four sweeps instead of six.

Models do not replace measurement. They need a continuous data stream off the sweeper — mass recovered, particle size, curb access — to stay calibrated. Building that stream is the technology gap.



Decision-support software for municipal sweeping programs

1

Build

your road network

2

Prioritize

where to sweep

3

Simulate

when to sweep

4

Report

defensibly

5

Optimize

your routes

In development and near-ready for pilot.

Want to learn more? Contact me or visit swpt.dev

What it All Means to the Stormwater Sector?

Bottom Line

- Sweeping is under-valued as a technology for stormwater.
- ...but sweeping is not the silver bullet.
- Holistic stormwater management is balanced and considers quantity as well as quality.
- MS4s need solid performance information.
- Sweeping is multi-beneficial – high value!
 - Safety, resilience, aesthetics – AND water quality
- Sweeping has immediate impacts/benefits.
- Sweeping is cost effective – and has funding/financing sources!



Sweeper Summit

Event Info

- Nov 3-4, 2026 – San Antonio
- www.sweepersummit.com
- Nov 3 – Workshop on Sweeping/Stormwater – 3.5 PDHs
- Nov 4 – Panel on Sweeping/Stormwater and a Fireside Chat on this Topic





Training Hub



NMSA / STEPP
Membership

Questions?

Visit the CS=CW webpage at <https://ms4nmsa.org/cs-cw/>

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[Need more information?](#)

Seth Brown, PhD, PE | NMSA Executive Director
seth.brown@nationalstormwateralliance.org



NMSA Newsletter



MS4 Permit
Improvement