Performance and Design Criteria for Effective Stormwater Control Measures

CAFM 2025

Dana Stayer – Regulatory Specialist

StormTrap®

Flooding + Stormwater

Flooding: Occurs when water overflows onto land that is normally dry; can be coastal, riverine, or localized.

Stormwater Management: Systems and practices designed to control runoff from precipitation to prevent flooding, erosion, and water pollution.

Causes of Flooding Relevant to Stormwater

Heavy Precipitation

- Increased frequency and intensity of rainfall events overwhelm drainage systems.

Coastal Flooding

- Sea level rise, storm surge, and tidal variations impact stormwater infrastructure.

Urbanization

- Impervious surfaces reduce infiltration, increasing runoff and flood risk.

Stormwater Management's Role in Flood Mitigation

Infrastructure Design

- Storm drains, retention basins, and culverts manage runoff but can fail during extreme events

Green Infrastructure

- Rain gardens, permeable pavements, and bioswales reduce localized flooding by enhancing infiltration

Modeling and Planning

- Tools like EPA's SWMM and NOAA's coastal flood assessment help predict impacts and design resilient systems

Types of Stormwater Control Measures

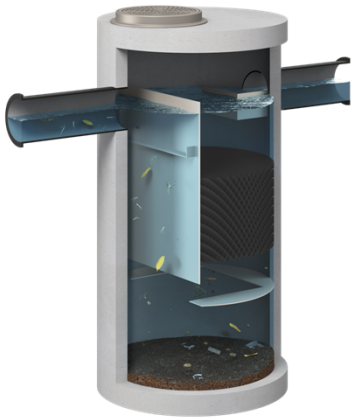
- Low Impact Development and Green Infrastructure are preferred methods
- LID typically results in a larger solution footprint, compared to manufactured systems

Types of Stormwater Control Measures

- Green Infrastructure SCMs
  - Bioretention Areas
  - Green Roofs
- Traditional SCMs
  - Detention/Retention Ponds
  - Constructed Wetlands
  - Infiltration Trenches
- Manufactured SCMs

Manufactured Treatment Devices

- MTDs are a type of SCM that provide water quality treatment with verified performance in compact footprints
- Various technologies commonly utilized across the country depending on the pollutant removal targets
  - Gross solids, sediments, nutrients
  - Trash capture, hydrodynamic separation (HDS), and filtration



Integration and Compatibility with Detention

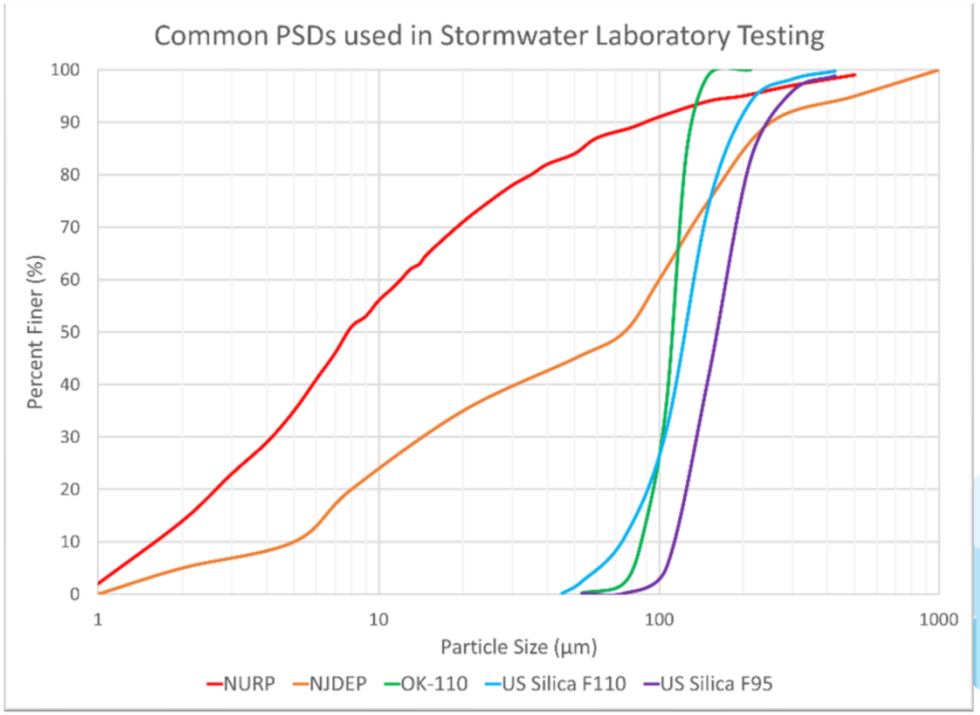
- Reduces need for external treatment device
- Maintenance Access
- System longevity
- Reduces footprint of system

SingleTrap®

DoubleTrap®

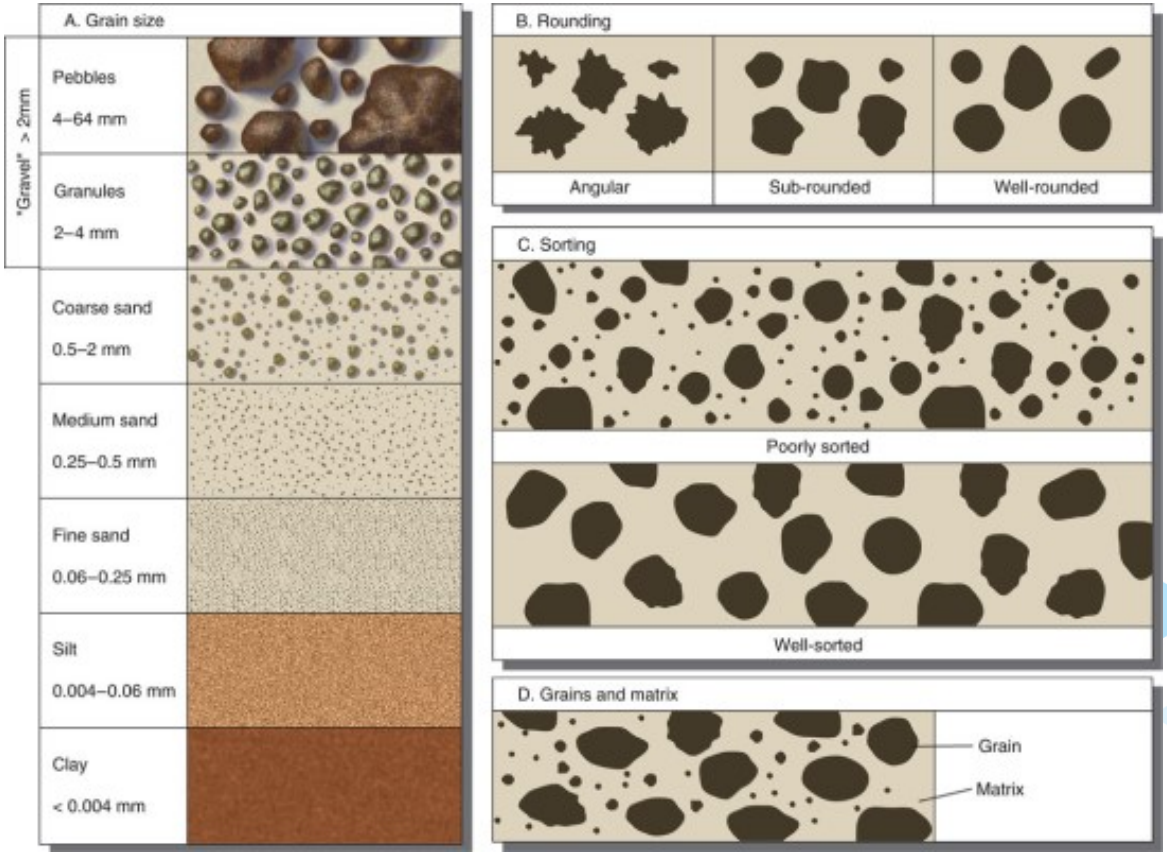
Effectively sizing an SCM

- Key factors for performance and sizing
- Performance targets
- Particle size distribution
- Pollutant concentration
- Water quality flow calculation



Looking at Particle Size

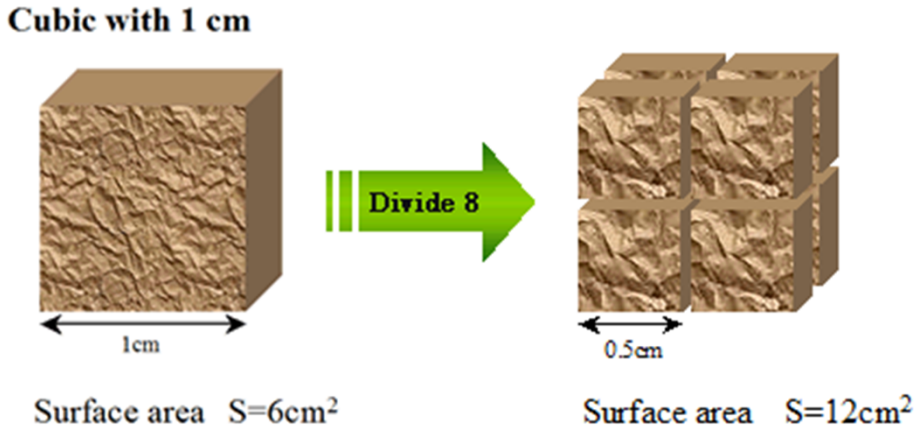
- Larger particles are easier to settle out
  - Coarse sediment to sand
    (> 100mm – 150um)
- Smaller particles are harder to separate, easily transported and carry more pollutants
  - Fine sediment to clay
    (< 150um)



https://www.nps.gov/teachers/classrooms/sediment-sorting.htm

Looking at Particle Size

- Omitted by most regulations, unless referencing NJDEP, OK-110, etc.
- Particle surface area and particle size are inversely proportional
- Larger surface area typically contain more dissolved pollutants per mass of sediment due to the increased surface area.



https://www.microtrac.com/applications/knowledge-base/specific-surface-area/

Performance Criteria

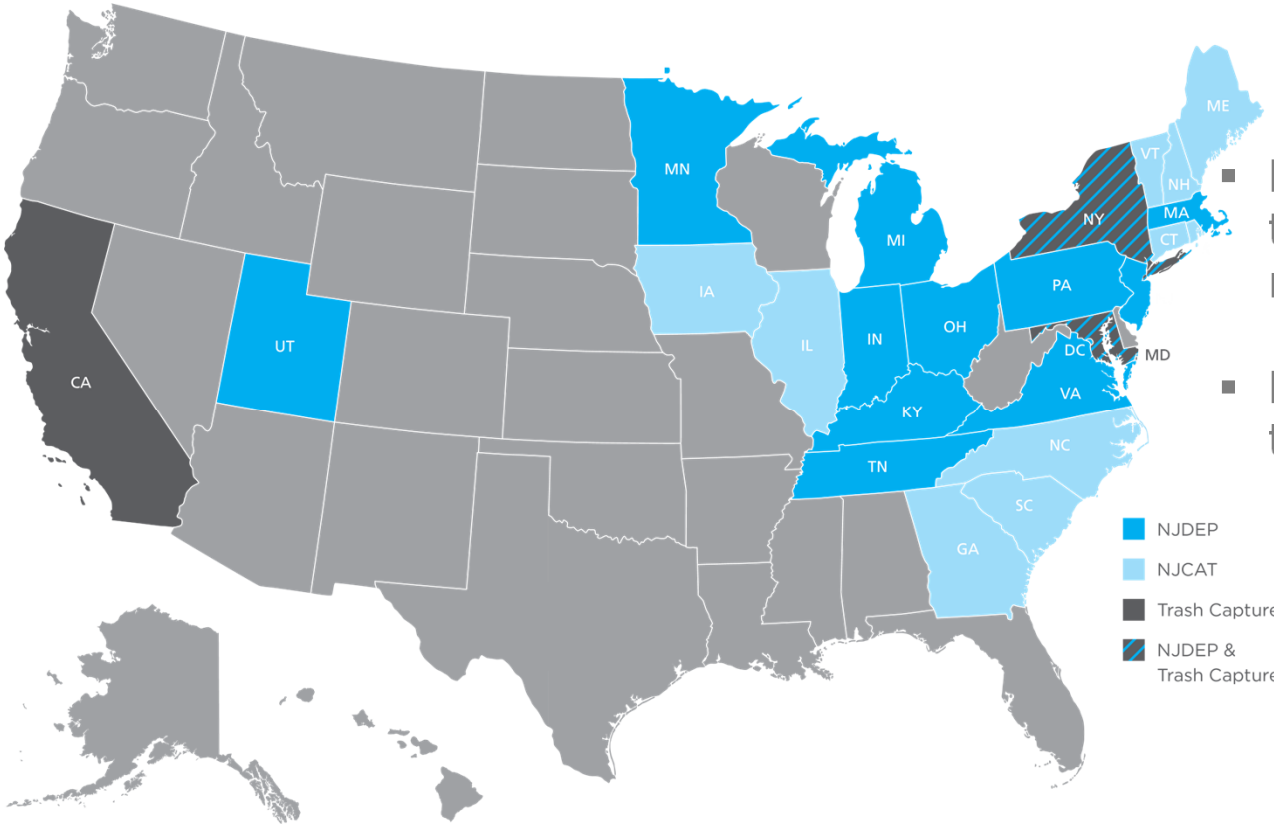
- More communities are beginning to discuss performance & design criteria for Stormwater Control Measures (SCMs)
- Ensures consistent effectiveness of SCMs
- Standardized design expectations for engineers and owners
- Simplifies review process for municipalities

DEPARTMENT OF ECOLOGY
State of Washington

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

STEPP
Stormwater Testing and Evaluation for Products and Practices

NJDEPs Influence



- NJDEP Certification is considered the ‘gold standard’ for sediment removal
- NJCAT Verification confirms testing data

NJDEP vs. NJCAT – What is the Difference?

NJDEP: New Jersey Department of Environmental Protection

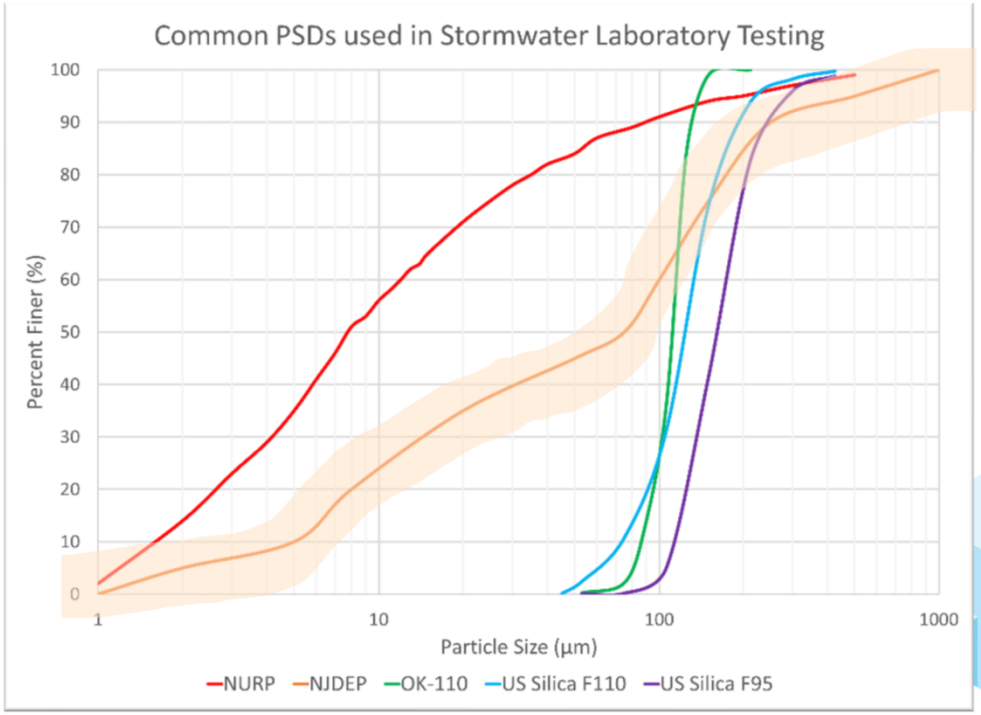
- Certification Agency
- Certification is the recognition that the testing claim meets the entity standard

NJCAT: New Jersey Corporation for Advanced Technology

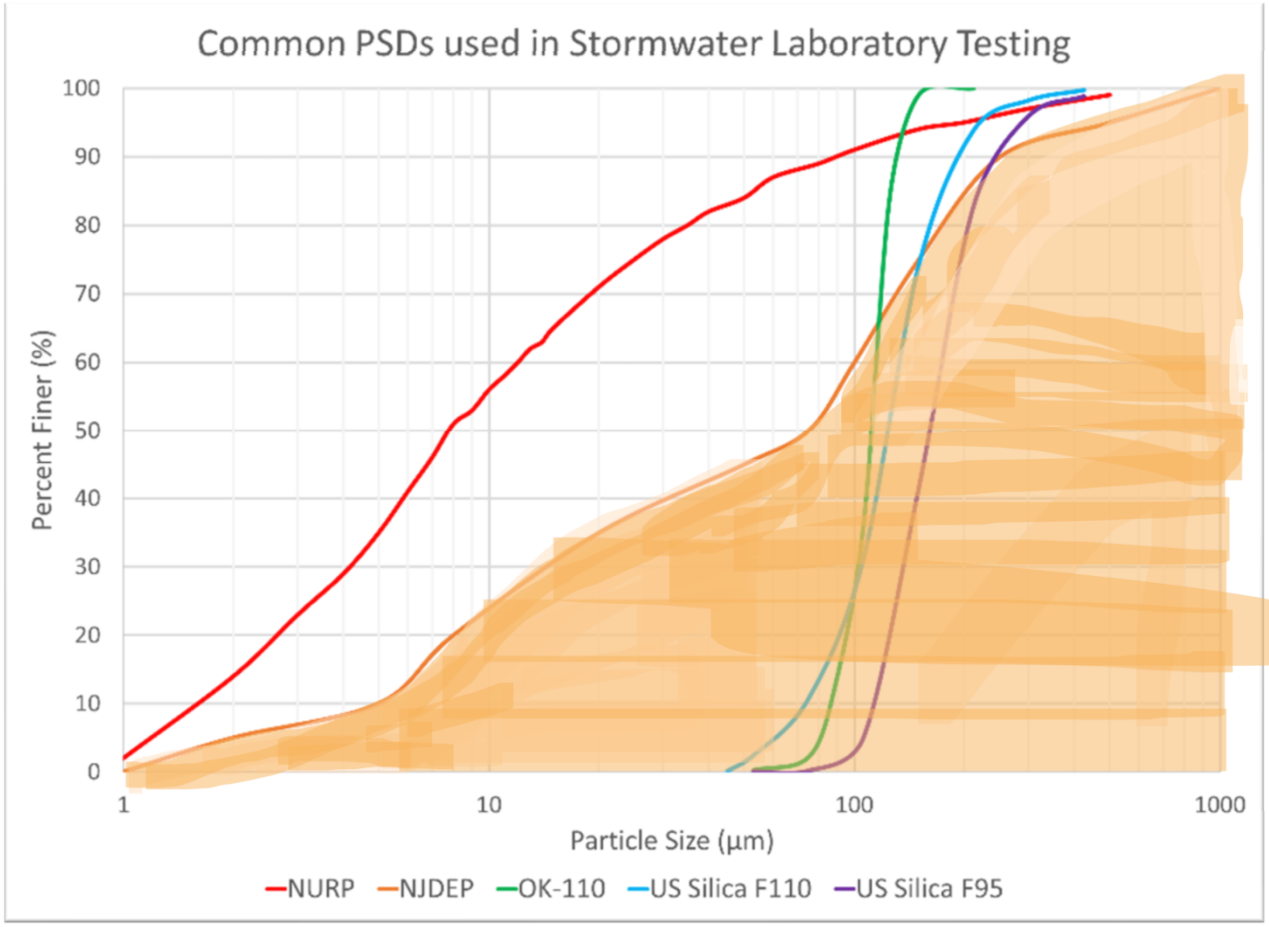
- Verification Agency
- Verification confirms the accuracy of a claim

NJDEP

- New protocol in 2021, updated testing performance and criteria
- Large updates to lab set up and configuration testing
- Multiple NJDEP Certified products have had their certification EXPIRE as of 12.31.2024
- Must test to New Jersey Stormwater design intensity and Particle Size Distribution (PSD)



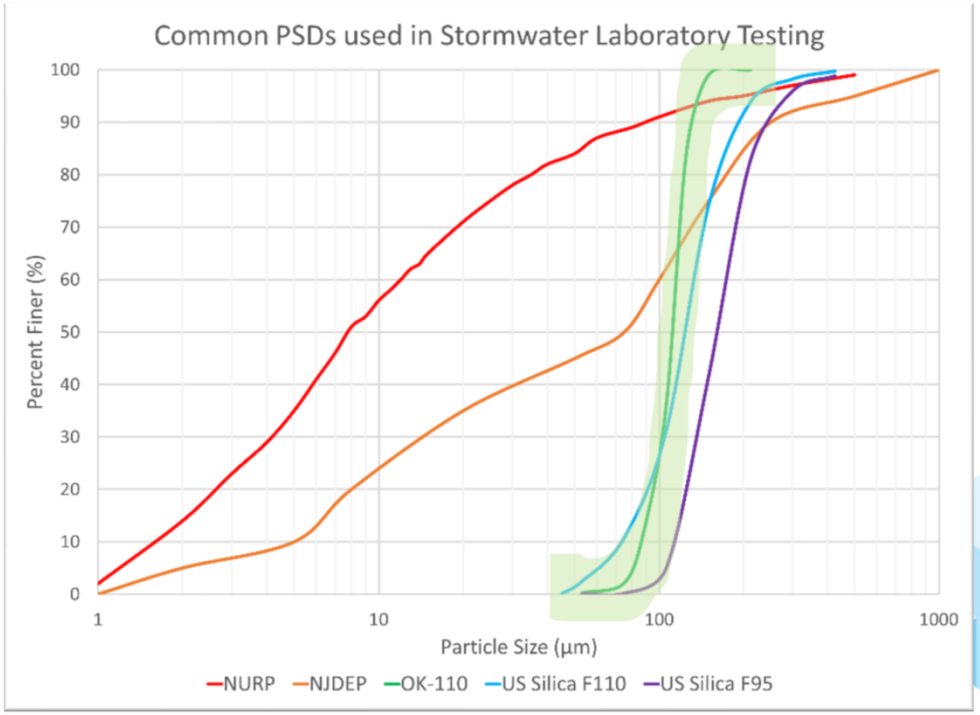
Performance Efficiency



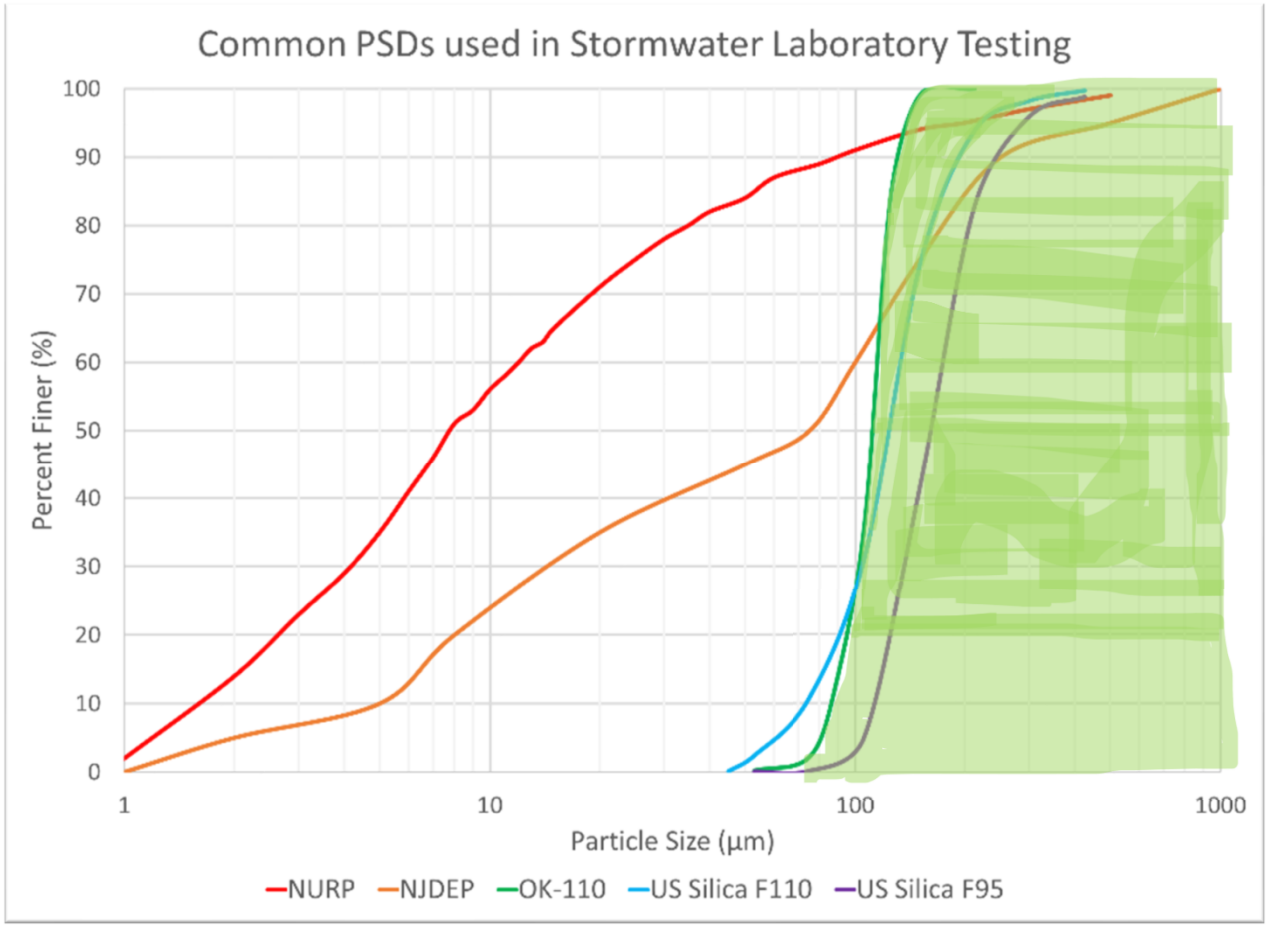
Almost an even split of fines to coarse material

NJCAT Verification

- NJDEP Certifications have their respective NJCAT Verification Reports
- Verification does not guarantee Certification
- Manufactures can get ANY testing verified through NJCAT, even noncompliant NJDEP reports
- OK-110 is sometimes tested and verified through NJCAT
  - Coarse sediment. (e.g. >100-150um)
  - Typically see 80% TSS removal of OK-110 PSD

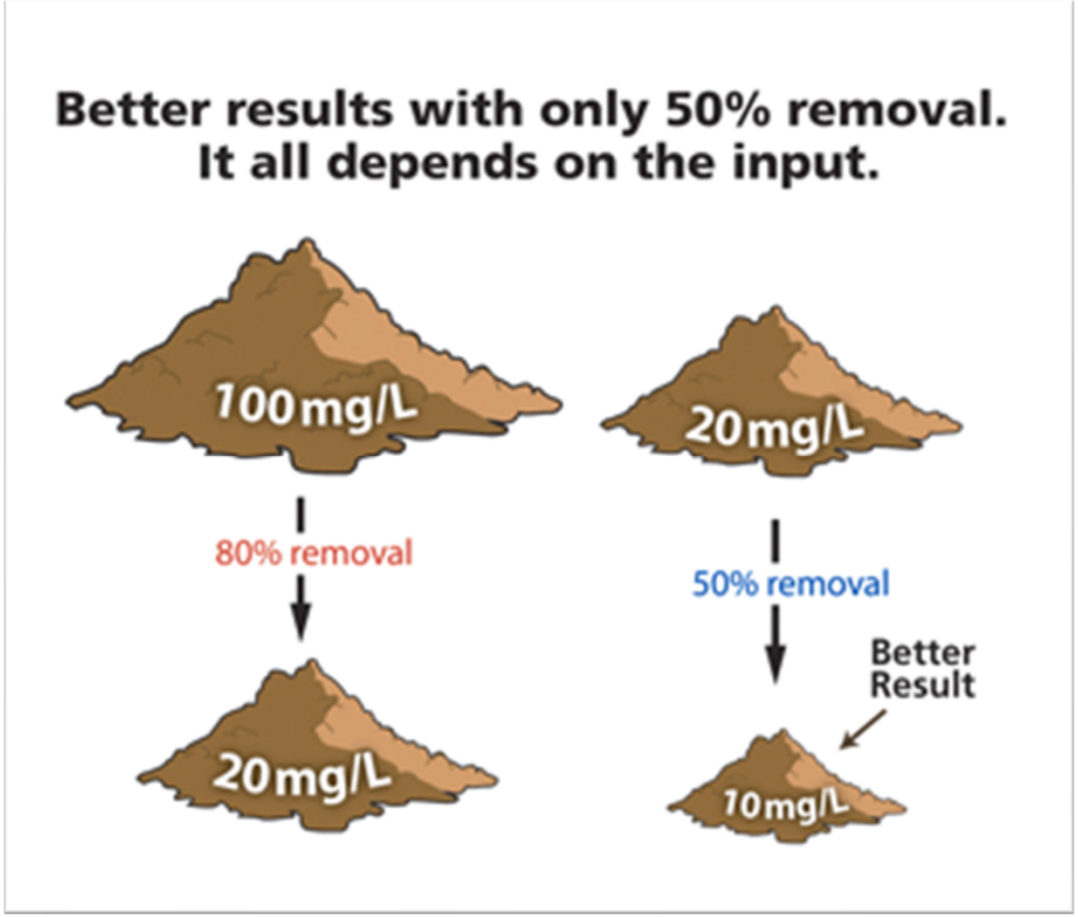


Performance Efficiency



Distribution is almost entirely coarse material, over ~100um

Performance Efficiency



https://www.epa.gov/npdes/three-keys-bmp-performance-concentration-volume-and-total-load

Where to Start

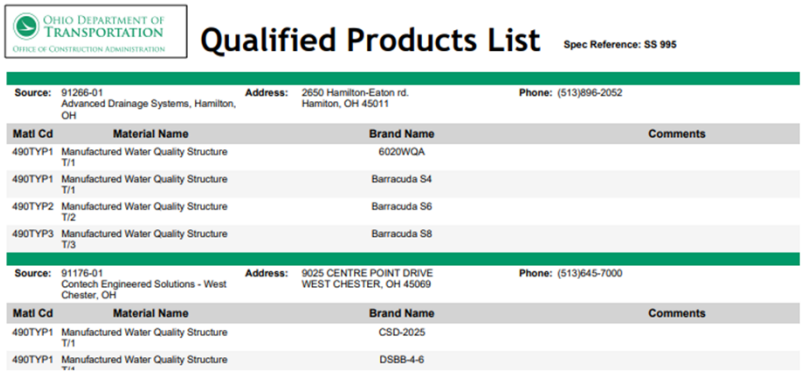
Regional Example

SS-995

- Establishes performance requirements for approved BMPs to be utilized on roadway projects

Performance Criteria

- Offline Configuration
- 80% TSS capture of water quality flow (third party testing)
  - Influent concentration of 450 mg/l or less
  - OK110 or F110 particle distribution
- Capture all floatable free oil



OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF CONSTRUCTION ADMINISTRATION

Qualified Products List Spec Reference: SS 995

Source:	91266-01 Advanced Drainage Systems, Hamilton, OH	**Address:**	2650 Hamilton-Eaton rd. Hamilton, OH 45011	**Phone:**	(513)896-2052

Matl Cd	Material Name	Brand Name	Comments
490TYP1	Manufactured Water Quality Structure T/1	6020WQA	
490TYP1	Manufactured Water Quality Structure T/1	Barracuda S4	
490TYP2	Manufactured Water Quality Structure T/2	Barracuda S6	
490TYP3	Manufactured Water Quality Structure T/3	Barracuda S8	

Source:	91176-01 Contech Engineered Solutions - West Chester, OH	**Address:**	9025 CENTRE POINT DRIVE WEST CHESTER, OH 45069	**Phone:**	(513)645-7000

Matl Cd	Material Name	Brand Name	Comments
490TYP1	Manufactured Water Quality Structure T/1	CSD-2025	
490TYP1	Manufactured Water Quality Structure	DSBB-4-6	

odot
transportation.ohio.gov

Regional Example

1. Verification / Testing / Certification

The District will only accept units that have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) AND certified by the New Jersey Department of Environmental Protection (NJDEP). Only the NJDEP certified flow rates for 50% and 80% average annual sediment removal based on the current NJDEP protocol shall be accepted.

Manufacturers must submit for approval for their units. Units certified by NJDEP will **not automatically** be accepted for use in the District.

In addition, units will only be approved for installation in the configurations tested. Installation in configurations other than those tested (e.g. multiple inlets pipes or surface inlets) will not be approved.

City of Indianapolis BMP Testing Criteria:
https://us-east-1-indy.graphassets.com/ActDBC5rvRWeCZlNNnLrDz/4FgsvhuOQh6cNbTtYgxj

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

INDIANAPOLIS

City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide

Table 1. Approved Rate Based SQUs

Manufactured SQU	SQU System Model	Max Treatment Flow (cfs)	Max 10-yr On-Line Flow Rate (cfs)	Cleanout Depth (Inches)	Allowed for Use on City Projects
StormTrap StormSettler	SSet-3	0.79	1.58	7	No*
	SSet-4	1.41	2.83	7	No*
	SSet-5	2.19	4.4	7	No*
	SSet-6	3.17	6.36	7	No
	SSet-7	4.3	8.6	7	No
	SSet-8	5.63	11.26	7	No
	SSet-10	8.78	17.56	7	No
	SSet-12	12.7	25.4	7	No
Upstream Technologies Inc. SAFL Baffle	60 x36	0.27	2.74	18	Yes*
	72 x 36	0.39	3.96	18	Yes*
	84 x 46	0.53	5.38	18	Yes*
	96 x 46	0.69	7.00	18	Yes*
	108 x 46	0.87	8.83	18	Yes*
	120 x 57	1.08	10.96	18	Yes*
Hydro-Shield Advance Plus	HSA-4P	1.49	3.28	9	No
	HSA-6P	3.35	7.37	9	Yes
	HSA-8P	5.95	13.09	9	Yes
ADS Arcadia	Arcadia ARC3	0.95	1.91	9	No
	Arcadia ARC4	1.68	3.37	9	Yes
	Arcadia ARC5	2.63	5.28	9	Yes
	Arcadia ARC6	3.78	7.58	9	Yes
	Arcadia ARC8	6.72	13.48	9	Yes
	Arcadia ARC10	10.50	21.06	9	Yes
3P Technik Filetrsysteme Gmbh HydroShark / Xerxes HydroChain Prime Separator System	HydroShark/HCPS 3	0.60	1.2	12	No
	HydroShark/HCPS 4	1.07	2.14	12	No
	HydroShark/HCPS 5	1.67	3.34	12	No
	HydroShark/HCPS 6	2.41	4.82	12	No
	HydroShark/HCPS 8	4.28	8.56	12	No
	HydroShark/HCPS 10	6.69	13.38	12	No

*- See Specific Design Requirements for Specified Unit

Regional Example

Murfreesboro recognizes MTDs tested and approved by these programs, as follows:

- those that have a current certification through the New Jersey DEP; or
- hydrodynamic separator devices with previous certification through the NJDEP, per laboratory testing and the 2013 HDS protocol with sediment particles of mean <= 75 microns; see top table on NJCAT's archive page; City will recognize these for a time; see below; or
- that have been approved for Pretreatment or Basic treatment with General Use Level Designation by the Washington State TAPE program.

See the web sites (hyperlinked above) of these programs for lists of certified or approved devices.

Notes:

- Murfreesboro recognizes the hydrodynamic separator devices with NJ certifications and the TAPE Pretreatment devices at a 50% SSC/TSS removal effectiveness.
- The NJCAT/NJDEP revised its HDS test procedures in January, 2021 (updated April, 2023), to a mass capture test method, and so HDS certifications under the previous procedures have expired or will expire soon. The City will approve devices with previous certifications through September, 2025. A device to be approved must be substantially the same as it was certified.
- Along with the unit approvals, the City recognizes the construction and installation instructions, the configurations, the maximum treatment flowrates, and the maintenance requirements. Some details of approvals relate specifically to NJ or WA, such as the method to calculate runoff peak flow from a development site, and these are not important to Murfreesboro. See 2.2.25.4 below.

As a note for future reference, there are at least two efforts toward a national standard for MTDs:

- NMSA/STEPP, an initiative of the National Municipal Stormwater Alliance; and
- ASTM Technical Committee E64 on Stormwater Control Measures

The City is allowed to consider devices not on the New Jersey or Washington State lists. Generally, though, because of the difficulty of comparing performance to an industry-wide standard and limited staff time, staff cannot evaluate such devices.

ASTM E3373-23

Standard Test Method for Scour of Hydrodynamic Separators and Settling Devices

Significance and Use

5.1 This test method provides test results for evaluating the potential for scour of sediment captured within a MTD in online and offline configurations.

5.2 This test method will determine if an MTD can meet the scour performance requirements prescribed by an associated verification protocol or local AHJ requirements.

The National Municipal Stormwater Alliance

- Central resource for stormwater professionals and provides a platform for members and affiliates to connect and collaborate.
- offers various resources, including sector-specific information and training courses to help professionals stay informed and skilled.
- NMSA advocates for both the stormwater sector as a whole and the specific interests of its members.
- Supports Centers of Excellence & STEPP

"NMSA is devoted to supporting MS4 communities, helping them tackle stormwater challenges so that together we can achieve our vision of providing clean water for the nation."

nmsa National Municipal Stormwater Alliance

Stormwater Testing and Evaluation of Products and Practices (STEPP)

Goal: Develop a national testing/evaluation and verification program for stormwater products **and** practices

- Increase overall performance
- Create level/higher playing field
- Provide greater confidence in performance of stormwater systems
- Improve water quality

STEPP
Stormwater Testing and Evaluation for Products and Practices

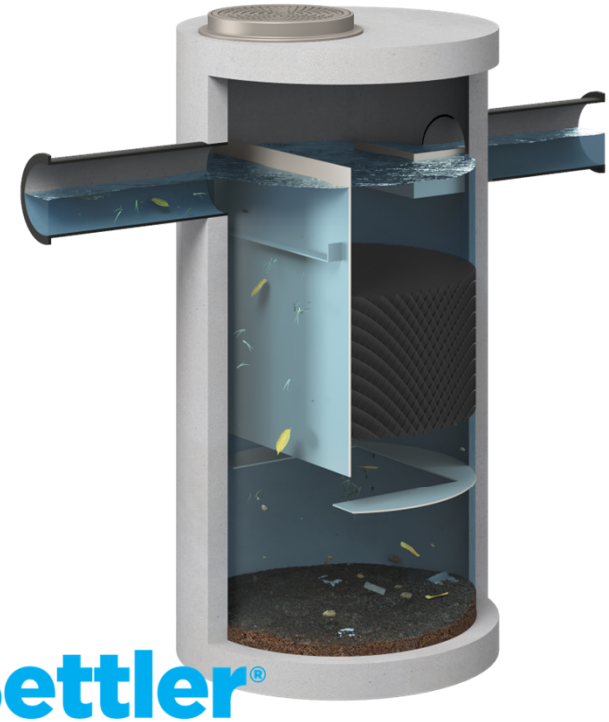
Why STEPP matters!

Although jurisdictions still must set the pass/fail criteria, if they specify that the ASTM standard be followed, they do not have to worry about data quality or different methodologies for different systems

- Less time
- Less money
- More innovation
- Less pollution

STEPP has begun verifying trash capture and HDS reports

Stormwater Solutions



StormSettler®

NJDEP Certified configurations available

Certified by the California State Water Resources Control Board as a full capture/high flow capacity trash device

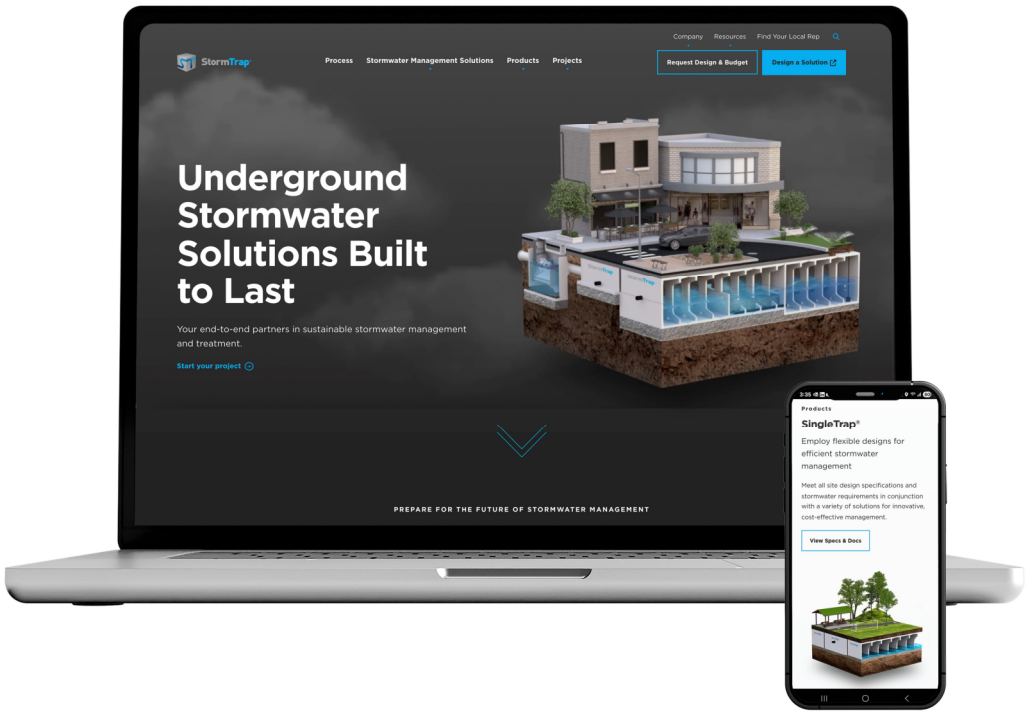
NJCAT Verified Test Data

TrashTrap®

ASTM INTERNATIONAL

Certified by the California State Water Resources Control Board as a full capture/high flow capacity trash device

StormTrap.com - Start Exploring Today



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