United States Environmental Protection Agency | Office of Water Washington,D.C, | EPA 832-F-99-037 September 1999

Combined Sewer Overflow Technology Fact Sheet

Netting Systems for Floatables Control

DESCRIPTION

This fact sheet describes netting systems for controlling discharges of floatable materials from combined sewer overflows (CSOs). Control of floatable material is an important component of EPA's CSO Control Policy.

Combined sewer systems (CSSs) are wastewater collection systems designed to carry both sanitary sewage and storm water runoff in a single pipe to a wastewater treatment plant. CSOs occur during wet weather periods when the hydraulic capacity of the CSS becomes overloaded. Floatables control technologies are designed to reduce or eliminate the visible solid waste that is often present in CSO discharges. The Netting TrashTrap™ system is a modular floatables collection system located at the CSO outfall. It uses the passive energy of the effluent stream to drive the floatable materials into disposable mesh bags. These bags are suspended horizontally in the CSO flow stream within a support structure. Construction methodology and method of installation at the outfall is determined on a site by site basis. The demonstration projects in Newark, NJ, and New York City used floating Netting TrashTrap™ systems attached to the ends of the outfalls. Since then, end-of-pipe and in-line configurations have been developed and implemented. Figure 1 represents drawings of the floating, end-of-pipe, and in-line configurations of the Netting TrashTrap™ systems.

The standard nets used in the system are designed to hold up to 0.7 cubic meters (25 cubic feet) of floatables and a weight of 227 kilograms (500 pounds) each.

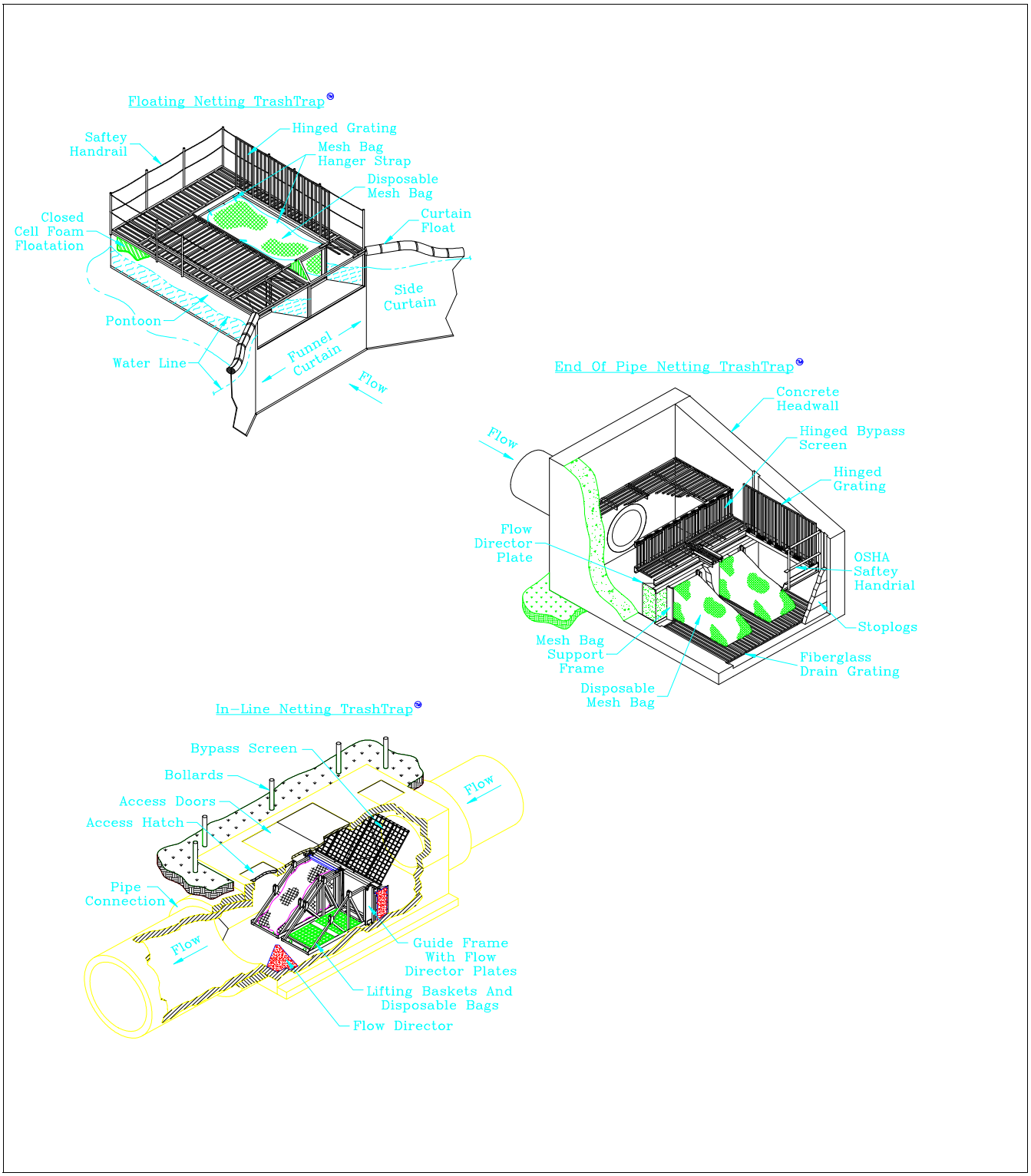
For the floating units, the effluent stream and entrained floatables are directed into the bags by two floating boom and curtains which run from the front corners of the pontoon to either side of the outfall where they attach to a vertical piling with a roller mechanism or a shoreline support. This design allows the boom to float and accommodate changes in the water level. The extended curtains are weighted to conform to the water bottom. Curtain depth is determined by the maximum high water level expected at the site.

Modifications to the outfall may include: adding structural support, attaching structural struts and strut anchor support, and adding foundations.

APPLICABILITY

The Netting TrashTrap™ technology has proven to be applicable to a wide spectrum of weather conditions, including freezing conditions. In one case during the demonstration projects, the water surface froze, preventing the bags from being changed. During this period, CSO events occurred, and floatables were transported beneath the ice and into the bags. The entire system, including the bags, remained intact and held the floatables for 16 weeks until the ice thawed and the bags could be changed. High velocity nets, which are more expensive than standard nets, are necessary at outfalls where CSO discharge velocities exceed 2 meters per second (7 feet per second) because of the risk of tearing. The netting design is typically based on the peak flow and pounds of floatables per million gallons projected to be discharged from the outfall.

While one of the configurations of the Netting TrashTrap™ technology is applicable to most types of outfalls, certain parameters should be considered



Source: Fresh Creek Technologies, Inc., 1999.

FIGURE 1 CONFIGURATIONS OF THE NETTING TRASHTRAP™ SYSTEM.

when implementing such a system. The following criteria may help in determining the most cost effective locations for a Netting TrashTrap™.

- The location should be accessible by a road capable of accommodating medium sized trucks, and easily accessible to maintenance crews.

- Site topography should allow for placement of prefabricated structures by a crane.

- For the floating units, the water should be a minimum of 0.9 meters (3 feet) at low tide, although the system may sit on the bottom surface.

- The area around the net support structures and pontoon arrangement should be cleared of protruding rocks or debris.

- The system should not be situated where it would interfere with heavily navigated waterways.

- The system should be located where it is protected from extremely strong currents, severe wave action, and high winds.

ADVANTAGES AND DISADVANTAGES

The Netting TrashTrap™ technology can have a significant positive impact on the aquatic environment if several cautions are observed. The impact of construction activity should be minimized wherever possible. Nets should be changed regularly to prevent odors and other aesthetic impacts. Netting structures should be off-limits to the public in order to prevent health hazards from contact with floatables.

While the Netting TrashTrap™ is designed specifically to remove floatables and is not intended to remove other pollutants, preliminary data suggests that it does remove other pollutants (such as suspended solids), although this has not been quantified. This may limit its applicability in cases where implementation of the nine minimum controls entails removal of non-floatable objects. In addition, if the unit is suspended in the receiving water, it may be difficult to provide disinfection at the same location. However, the in-line configuration is capable of working with a disinfection system. The need for removal of submerged solids for disinfection to meet water quality standards should be evaluated during implementation of the nine minimum controls and during long-term CSO control planning studies.

DESIGN CRITERIA

The Netting TrashTrap™ is supplied as a prefabricated unit which is delivered to the site and typically can be assembled and installed in less than two days. The system is fabricated from type 316 stainless steel. The floatation is provided by U.S. Coast Guard-approved closed-cell foam injected into the side chambers of the system. The hanging curtain is made of polyvinyl chloride (PVC) and is reinforced with polyester filament fabric. The curtain weighs 930 grams (30 ounces) per 84 square meters (1 square yard), has a minimum thickness of 30 mm and a tear strength of 992 kilograms (450 pounds). The seams of the curtain are heat-welded, and steel grommets are used to reinforce the points of attachment. The standard net mesh material is a knotless synthetic weave that produces a bar strength of 165 kilograms (75 pounds) with a square mesh aperture. The netting system design is flexible and can be modified according to site-specific conditions. The most common systems utilize two nets but can be expanded to accommodate larger outfall areas. The entire system is designed and manufactured to have a minimum life expectancy of at least 20 years.

Nets with captured floatables can be removed from the systems by several methods. Nets can be lifted by a boom truck crane and placed in a carting container for proper disposal. Alternatively nets could be floated out through the back of the pontoon structure and picked up by a skimmer or work boat. The City of New York has installed a rail mounted hoist and cart to facilitate placement of full nets in an adjacent dumpster at the Fresh Creek site. The crane used for changing the nets should be capable of lifting 2204 kilograms (1000 pounds) and have the reach to access nets from outfalls on a site specific basis. Depending upon the potential for vandalism, fencing may be needed to secure the area.

PERFORMANCE

Performance data collected for the Netting TrashTrap™ are based on demonstration projects at one location in New York and two locations in New Jersey. The goals of the demonstration projects were: to evaluate the technology for eliminating floatables during CSO events; to define conditions under which the technology should perform; and to

obtain capital and operation and maintenance (O&M) cost data.

New York City Demonstration Project

The first Netting TrashTrap™ system was installed at the Fresh Creek outfall, a tributary to Jamaica Bay in New York City. The outfall drains 880 hectares (2170 acres) and is one of the city's largest. During the two years of this study, flow volumes at the site ranged from 3,785 cubic meters (1 MG) to 264,950 cubic meters (70 MG). Flow rate averaged 4.25 cubic meters per second (150 cubic feet per second) and ranged from 0.6 to 40 cubic meters per second (21 cubic feet per second to 1412 cubic feet per second). While monitoring the collection system, 20 CSO events resulted in the discharge of 1.6 million cubic meters (423 MG) of wastewater. The system was installed on two of the four outfall barrel, and consisted of two 8 foot long, 1.3 centimeter (0.5 inch) mesh bags attached to each outfall barrel. Therefore, approximately half of the CSO volume passed through the netting system. From April to November, 1993, roughly 3,855 kilograms (8,500 pounds) of floatables were removed using the netting system. An average 295 kilograms (650 pounds) of floatables were removed per 37,850 cubic meters (10 MG) of CSO discharge. System efficiency for capturing floatables was determined by using a secondary boom with an attached curtain to capture all fugitive floatables. Total floatable discharge per event was determined by adding fugitive floatable weight to the weight of the floatables captured by the system. The efficiency of the nets ranged from 90 to 95 percent for floatable capture. All captured floatables and used nets were disposed as municipal solid waste by the City of New York. The system was subsequently expanded to eight bags spanning the entire outfall.

Newark, NJ, Demonstration Project

In the City of Newark, Netting TrashTrap™ structures were installed at two sites. The Peddie outfall by Newark Airport drains 635 hectares (1570 acres). It has four tide gate structures measuring 1.8 meters (6 feet) by 2.4 meters (8 feet) to accommodate the 166 MGD CSO design capacity. The outfall's four-net system includes a "curtain" under the front of the unit and two additional curtains at the sides from the headwall of the outfall to each corner of the unit. These curtains help funnel floatables into the unit, but during high flows (flows exceeding 1.06 meters per second (3.5 feet per second)), they "lift" from the bottom to prevent damage to the unit. By lifting from the bottom of the unit, this feature makes it unlikely that floatables will escape. Both 0.65 centimeter (0.25 inch) aperture nets and 1.3 centimeter (0.5 inch) aperture nets were tested at the site over a variety of flows.

The other demonstration location was at the Saybrook outfall on the Passaic River, which drains 116 hectares (287 acres.) As with the Peddie system, the two net system used at this site was designed to lift during intense storm events when discharge flow velocity exceeded 2.13 meters per second (7 feet per second). Again, 0.65 centimeter (0.25 inch) aperture and 1.3 centimeter (0.25 inch) aperture nets were evaluated at the site over a variety of flow conditions. System efficiency for capturing floatables was determined in a similar way to the New York demonstration project.

Data collected on both 0.65 centimeter (0.25 inch) aperture and 1.3 centimeter (0.5 inch) aperture nets from both the Saybrook and Peddie outfalls in Newark, New Jersey, provided similar floatable removal efficiencies.

The 0.65 centimeter (0.25 inch) aperture nets at the Saybrook outfall were monitored during 10 CSO events. During this time, the 0.65 centimeter (0.25 inch) nets screened 93,508 cubic meters (3,302,456 cubic feet) of CSO discharge and were 93 percent efficient at removing 781 kilograms (1,723 pounds) of floatables. The 0.65 centimeter (0.25 inch) aperture nets removed an average 316 kilograms per 37,850 cubic meters (697 pounds per 10 MG) of CSO discharge. The 1.3 centimeter (0.5 inch) aperture nets experienced 18 CSO events at Saybrook treating 352,668 cubic meters (12,452,714 cubic feet) of CSO discharge. The nets were 94 percent effective and removed 2,074 kilogram (4,562 pounds) of floatables from the outfall during CSO discharges. The 1.3 centimeter (0.5 inch) aperture nets removed floatables at an average 289 kilograms per

37,850 cubic meters (637 pounds per 10 MG) of CSO discharge. The maximum flow and peak velocity experienced by both nets can be found in Table 1.

The four 0.65 centimeter (0.25 inch) aperture nets at the Peddie outfall captured 4,619 kilograms (10,184 pounds) during 10 CSO events. The 0.65 centimeter (0.25 inch) nets had a 97 percent floatables removal efficiency and removed 4,619 kilograms (10,184 pounds) of floatables from 206,967 cubic meters (7,309,504 cubic feet) of CSO discharge. The nets removed floatables at an average of 844 kilograms per 37,850 cubic meters (1,862 pounds per 10 MG) of CSO discharge. The 1.3 centimeter (0.5 inch) aperture nets were 97 percent effective and removed 8,742 kilograms (19,273 pounds) of floatables from 817,910 cubic meters (28,886,223 cubic feet) of CSO discharge. The nets removed floatables at an average 404 kilograms per 37,850 cubic meter (891 pounds per10 MG) of CSO discharge. Peak flow and peak velocity for these nets, as well as a summary of the data collected during the study can be found in Table 1.

OPERATION AND MAINTENANCE

Maintenance for a Netting TrashTrap™ is dependent upon the number and frequency of CSO events and the capacity of the system. Maintenance includes net removal, installation of new nets, trash cleanup, and boom/curtain inspections. Nets should be changed and disposed at approved facilities, on average, after three CSO events but never less than once a month. Inspection of booms and nets is important during the initial weeks of installation of the system to ensure that all equipment functions according to design. Any adjustments to the netting structure should be made during this time. Net inspections may be required after intense storms to check for damage.

COSTS

Costs for planning and construction of a Netting TrashTrap™ system are likely to range from $75,000 to $300,000, depending on site conditions. A typical two- net system with 1.4 cubic meters (50 cubic feet) capacity, handling about 227 kilograms (500 pounds) of damp weight per net and spanning 4.5 meters (15 feet) of CSO outfall, has an estimated capital cost of $125,000. This includes the cost of fabrication and installation, which can take three to six months. The land-based materials handling system (trash collection/disposal) associated with the system has an additional estimated capital cost of $25,000 to $75,000.

The cost for a sewage treatment plant staff to operate and maintain a typical two-net system during the Newark demonstration project was estimated at $1,500 per month. The cost for nets

TABLE 1 SUMMARY OF PERFORMANCE DATA FOR TRASHTRAP™ SYSTEM AT SAYBROOK AND PEDDIE OUTFALLS

	Peak Flow (m^3/s)	Peak Velocity (m/s)	Volume of CSO Discharge (m^3)	Total Weight of Captured Floatables (kg)	Floatables Caught (kg)/1.720 m^3 Discharge (lbs/MG)	Removal Efficiency (%)
Saybrook						
0.65 cm nets	6.29	3.40	93,508	781	3,898	93
1.3 cm nets	7.01	3.30	257,640	2,074	2,740	94
Peddie						
0.65 cm nets	28.07	0.94	206,967	4,629	10,424	97
1.3 cm nets	24.08	1.25	817,910	8,760	4,990	97

Source: Fresh Creek Technologies, Inc., 1999.

and labor for a two-net system, excluding floatables disposal costs, was approximately $570 per CSO event. Replacement nets designed to capture the high velocity discharge at Saybrook totaled $200 for two nets ($100 per net). Note that O&M at the Peddie and Saybrook site occurred under demonstration conditions; therefore, compared to normal operating conditions, more hours were spent on flow monitoring, data collection, miscellaneous adjustments, and repositioning equipment, as well as net changes after every CSO event, in order to obtain site-specific data.

The total cost per CSO event at Peddie under demonstration conditions (nets and labor) was $850. The replacement cost for four nets required at the Peddie site totaled $380 ($95 per net).

Disposal costs for captured materials and nets should also be considered when calculating O&M costs. The quantity of captured floatables will vary from site to site; during the 13-month Newark demonstration project, for example, approximately 2,800 kilograms (6,172 pounds) were captured at Saybrook and over 13,361 kilograms (29,455 pounds) at Peddie. Used nets, which are disposed with the captured floatables, add approximately 28 lbs wet weight per net. The city of Newark paid $109.85 per ton for disposal of nets and captured floatables, or approximately $2,270 over the 13-month demonstration project.

REFERENCES

1. Forndran, A., et al., 1994. "Trapping Floatables in a Combined Sewer Outfall Netting System." In *A Global Perspective for Reducing CSOs: Balancing Technologies, Costs, and Water Quality*. Proceedings Water Environment Federation Specialty Conference.

2. HydroQual, Inc., 1993. City-Wide Floatables Study. Draft Report to New York City Department of Environmental Protection, New York, NY.

3. Newark Floatable Flow Monitoring Report, 1995.

4. Parsons Engineering Science, 1994. *CSO Floatable Control Demonstration Project*. Revised Interim Report. City of Newark.

5. Parsons Engineering Science, 1995. Final Report, *CSO Floatable Control Demonstration Project*. City of Newark, NJ.

6. Sudol, F., 1995. "Newark Nets Floatables". *Water Environment and Technology*.

7. Turner, R., 1995. "Floatables Control and the New USEPA CSO Policy." In *A Global Perspective for reducing CSOs: Balancing Technologies, Costs, and Water Quality*. Proceedings Water Environment Federation Specialty Conference.

ADDITIONAL INFORMATION

City of Madison, Indiana
Wayne Turner
1213 West 1st Street
Madison, IN 47250

City of Nashville, Tennessee
Mrs. Lyn Fontana, P.E.
Metropolitan Government
1600 2nd Avenue North 4th Floor
Nashville, TN 37208

City of New York, New York
Eric Delva
Bureau of Clean Water
New York City Department of Environmental Protection
96-05 Horace Harding Express Way
Corona, NY 11368

City of Philadelphia, Pennsylvania
Gene Foster
Fox and Roberts Streets
Philadelphia, PA 19129

Fresh Creek Technologies, Inc.
Richard Turner
P.O. Box 1184

West Caldwell, NJ 07007-1184

The mention of trade names or commercial products does not constitute endorsement or recommendation for the use by the U.S. Environmental Protection Agency.

For more information contact:

Municipal Technology Branch
U.S. EPA
Mail Code 4204
401 M St., S.W.
Washington, D.C., 20460

OWM MTB
Excellence in compliance through optimal technical solutions
MUNICIPAL TECHNOLOGY BRANCH