FIELD PERFORMANCE FOR UP FLOW FILTRATION DEVICE

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Overview

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- History
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- Location and Size of the Filter
- Full Scale Up-Flow Filter Components
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Introduction & Significance

- Many types of stormwater controls are available, but most are relatively large or insufficient in their treatment capacity.
- Adequate treatment of runoff requires the removal of many types of pollutants as well as large amounts of debris and floatable materials, over a wide range of flows.
- Traditional downflow filters, which can provide high levels of treatment, can quickly clog, reducing their treatment flow rate and overall treatment capacity. They also usually operate at a low treatment flow rate requiring a large area to treat substantial portions of the runoff from a site.

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History

- This stormwater filtration device was developed by engineers at the University of Alabama through a Small Business Innovative Research (SBIR) grant from the U.S. Environmental Protection Agency. The Up-Flow Filter was commercialized by Hydro International as part of this project.

Prototype Testing

- Installed in a 0.9ac parking lot.
- Maximum filtration rate at least 25 gal/min per sq ft of filter area.

Proto-Type Up-Flow Filter

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Up-Flo ® Proto-Type Filter

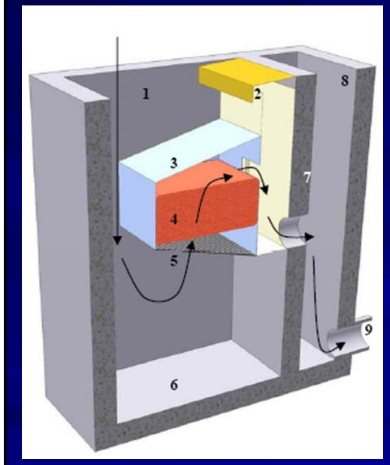

Illustration from Hydro International

- Sump can collect the heavy debris
- Small objects are filtered by screen and media
- During prototype field tests, measured:
  - 68-94% sediment removal
  - 70-90% reduction of typical stormwater pollutants

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Full Scale Up-Flow Filter Components

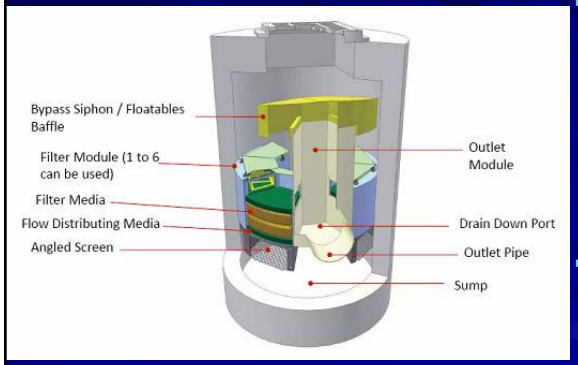

Illustration from Hydro International

- Buoyant trash is captured by flotation in the chamber and retained by the floatables baffle during high-flow bypassing
- Coarse solids and debris are removed by sedimentation and settle into the sump
- Dissolved pollutants are removed by sorption and ion-exchange in the media

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Current Full-Scale UpFlow Filter Testing

- A 7-foot tall 4-foot diameter standard inlet containing a six module filter unit.
- Installed at the Riverwalk parking lot near the Bama Belle on the Black Warrior River in Tuscaloosa, Alabama.

Land Use	Area (ft^2)	Area (acre)	% of Land Use
Parking Area	11,800	0.27	30.5
Other Paved	1,300	0.03	3.4
Sidewalks	2,100	0.05	5.4
Entrance Road	10,990	0.25	28. 5
Green Space	12,400	0.29	32.2
Total	**38,610**	**0.89**	**100.0**

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Installation of the Up Flow Filter

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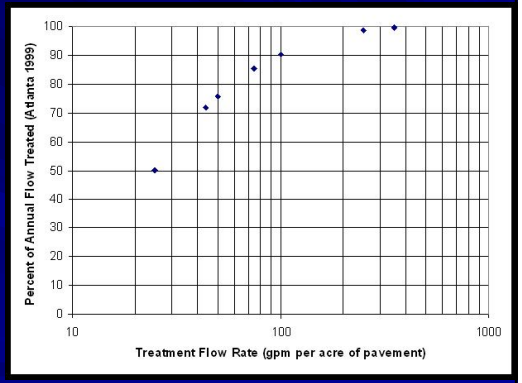
Treatment Flow Rate Requirements

The 100 gal/min filtration capacity of the full-scale filter is expected to treat about 90 percent of the annual flow for a typical rain year, with about 10 percent of the annual flow bypassing filtration.



Treatment flow rate requirements for typical southeastern US conditions (Atlanta, GA), based on continuous long-term simulations (Pitt and Khambhammettu 2006)

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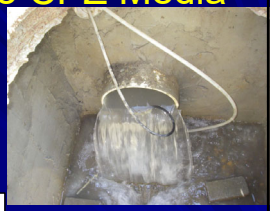
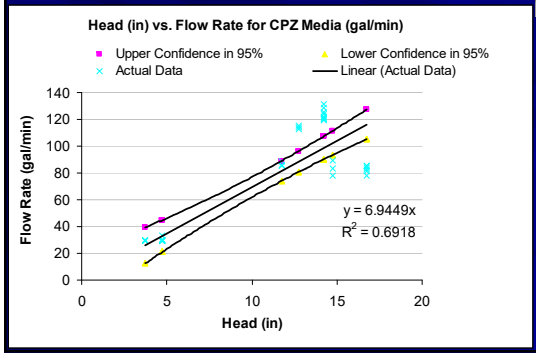
Controlled Flow Test for the CPZ Media

- Water flow rate was determined by measuring the time needed to fill a measured volume. This was also used to calibrate the flow sensor.





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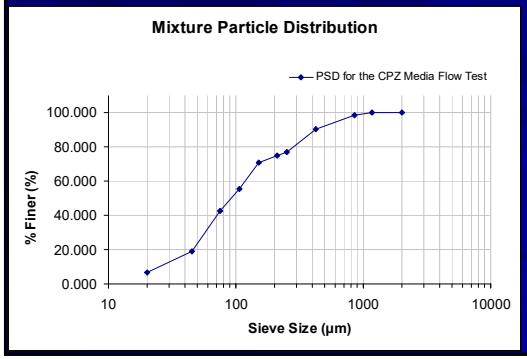
Controlled Test Sediments

- The test sediment in the stormwater stimulant used a mixture SIL-CO-SIL 250, SIL-CO-SIL 106 (both from U.S. Silica Co.), and coarse and fine concrete sands. The mixture was made by mixing the four components with different ratios to obtain a relatively even particle size distribution representing the complete range from about 20 to 2,000µm.



Sediment mixture was manually and consistently added to the influent water over the 30 minute test period.

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Features of Controlled Tests

- Flow rates of 24, 50, and 100 gallons/minutes were tested.
- Each experiment conducted over 30 minutes.
- River water was used as the "inflow" water.
- Effluent samples collected using a dipper grab sampler every 1 minute.
- During these tests, four different influent sediment concentrations were tested at each flow rate: 50 mg/L, 100 mg/L, 250 mg/L, and 500 mg/L.

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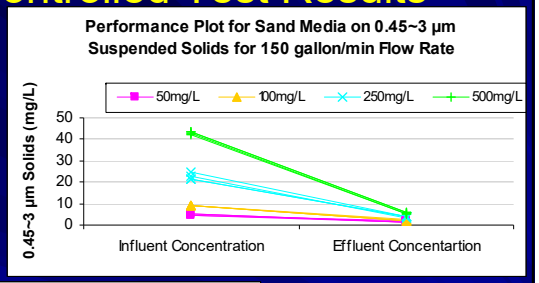
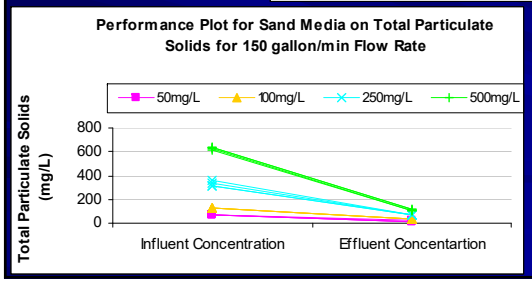
Initial Controlled Test Results

- These tests indicated a high level of treatment even for smaller particle sizes.





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Results Summary

150 gallon/min Flow Rate and 50 mg/L Concentration

Particle Size (µm)	Average Influent Concentration (mg/L)	Average Effluent Concentration (mg/L)	Average Reduction (%)
< 0.45	160	140	13
0.45 to 3	4.9	1.5	70
3 to 12	17	3.2	81
12 to 30	21	3.3	84
30 to 120	12.4	2.9	80
120 to 1180	7.7	0.12	99
> 1180	3.1	0	100
sum >0.45 µm	65.9	11.1	81

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Result Summary (cont.)

150 gallon/min Flow Rate and 500 mg/L Concentration

Particle Size (µm)	Average Influent Concentration (mg/L)	Average Effluent Concentration (mg/L)	Average Reduction (%)
< 0.45	170	110	37
0.45 to 3	43	5.5	87
3 to 12	160	29	82
12 to 30	200	44	79
30 to 120	123	28	79
120 to 1180	77	0	100
> 1180	32	0	100
sum >0.45 µm	635	106	82

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Current Full-Scale Tests

- Pollutant removal will be measured during actual storm events
- Rain gage triggers the two auto-sampler at the same time in order to collect influent and effluent water quality

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Acknowledgements

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- Small Business Innovative Research program, US EPA

References Describing Earlier Tests

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