

GUIDELINES AND EXPERIENCE OF STORMWATER TREATMENT IN EUROPE

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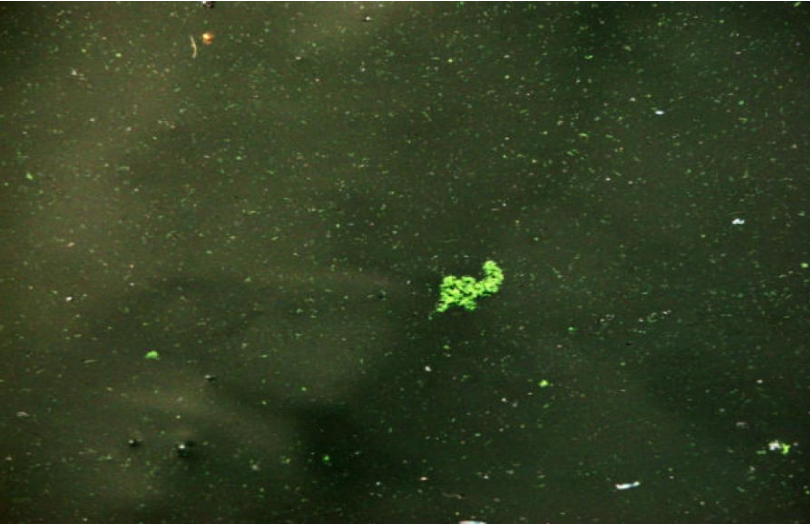
INTRODUCTION



With increasing urbanization, the problems of stormwater runoff from impermeable surfaces are becoming more apparent.

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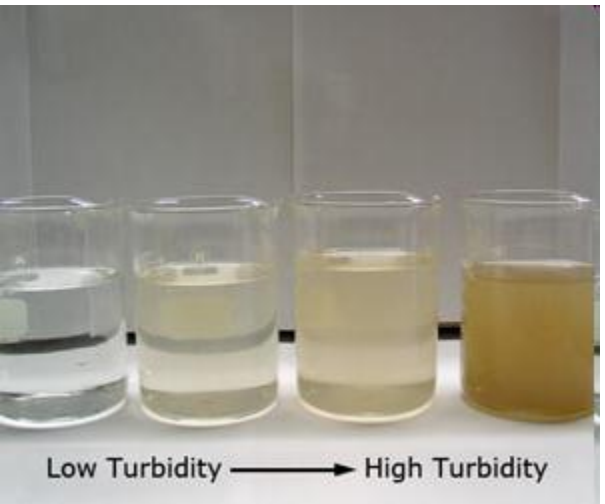
INTRODUCTION



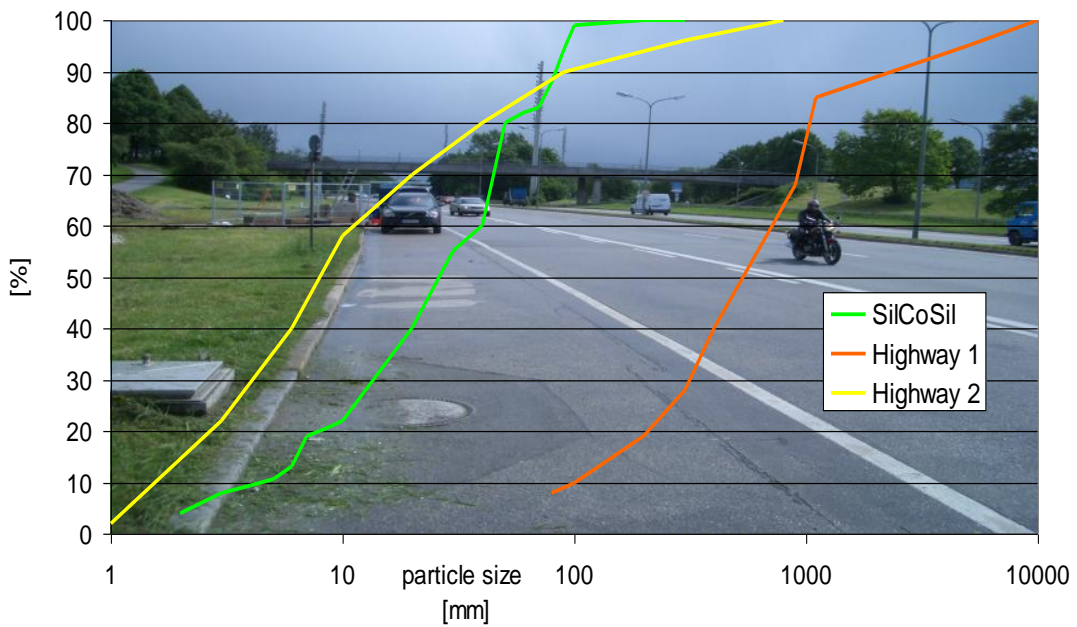
The key to successful stormwater treatment is the removal of sediments from stormwater-run-off contaminated by heavy metals, hydrocarbons and their floating residuals from paved, impervious sites. Chemical pollutants and heavy metals tend to be associated with the finer particles in stormwater sediments, therefore it is essential to contain these polluted sediments within any removal device.

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STORMWATER POLLUTANTS: TSS



TSS (Total Suspended Solids)
First step to effectively clean stormwater is to remove sediments.



STORMWATER POLLUTANTS: FLOATABLES



FLOATABLES

Floatables are water-borne litter and debris. They come mainly from street litter that ends up in the City's storm drains (catch basins) and sewers. Floatables can be discharged into the surrounding waters during certain rain events when water flow into treatment plants exceeds treatment capacity.

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STORMWATER POLLUTANTS: HEAVY METALS



Heavy Metals:

Copper

Zinc

Lead

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STORMWATER POLLUTANTS: NUTRIENTS



NUTRIENTS:

A nutrient is a chemical that an organism needs to live and grow or a substance used in an organism's metabolism which must be taken in from its environment.

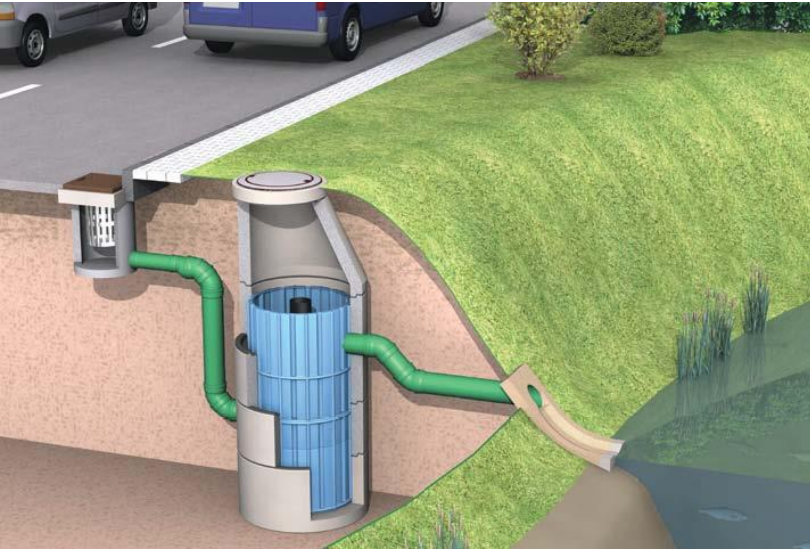
High concentrations of nutrients lead to excessive algae growth.

Nitrate

Phosphate

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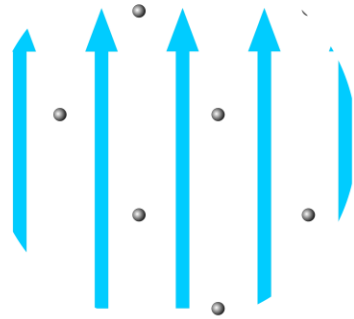
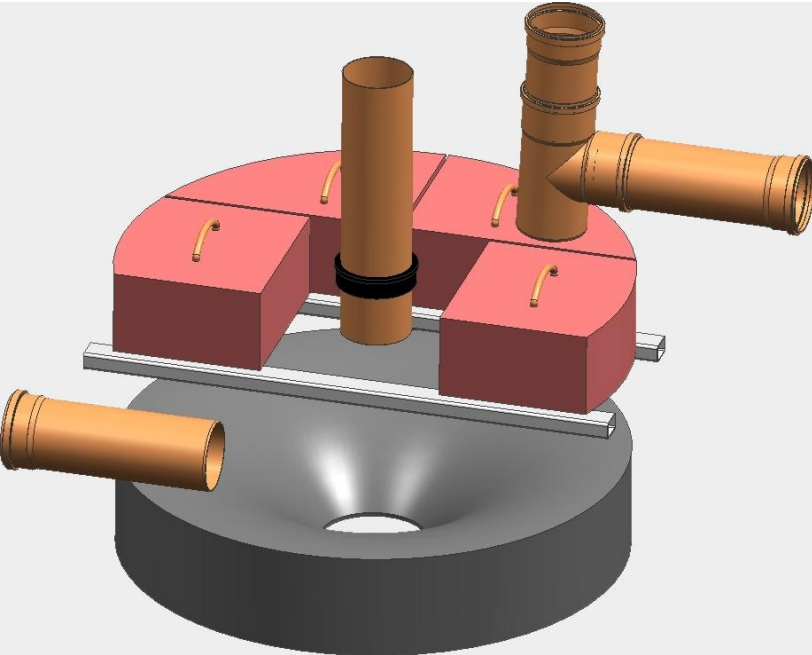
ECOSTORM PLUS: WORKING PRINCIPLE



The **ecoStorm plus** Stormwater Treatment System removes both solid particles and dissolved substances:

- Sediments
- Heavy metals (zinc, copper, lead, cadmium, chromium, nickel)
- Hydrocarbons (mineral oils, polycyclic aromatic hydrocarbons)
- Nutrients such as phosphates and nitrates.

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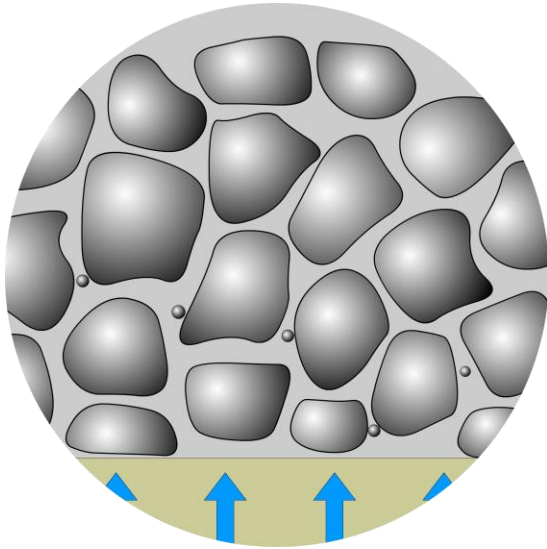


Step 1: Sedimentation Hydrocyclon separator:

Sediments are removed from stormwater by gravitation and trapped in the base section of the Pollution Control Pit.

A hydrocyclone baffle with sludge trap below it can be arranged in a sedimentation space. In order to activate the action of the hydrocyclone, the water feed is made to flow into the lower compartment in a tangential manner.

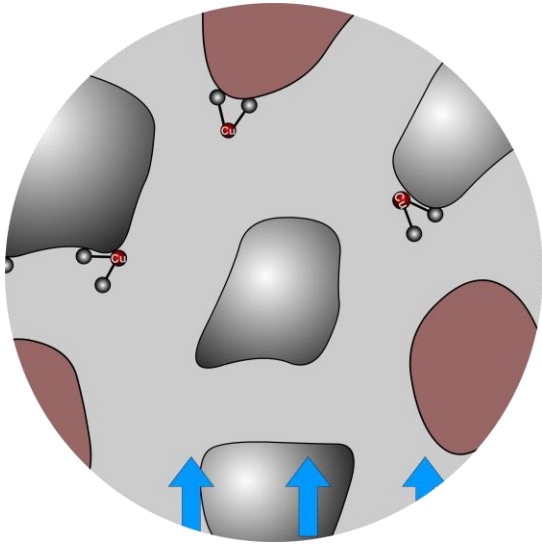
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Step 2: Filtration

The ecoStorm plus Filter:

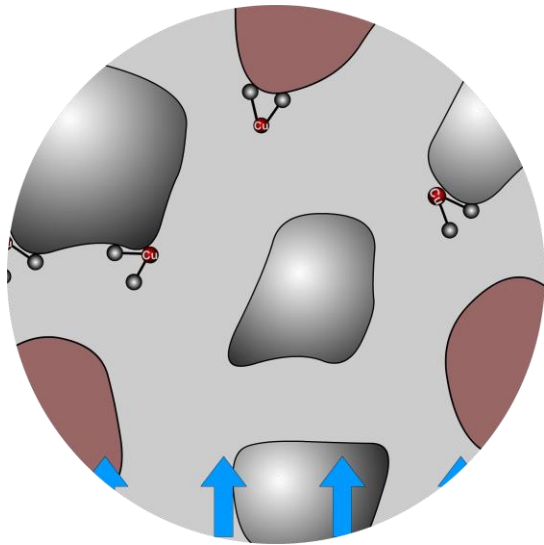
The filter disk consists of a or permeable filter material. Depending on the blend, the porous concrete filter media can pass 15-20gpm through its open cells for each square foot of surface area. Chemical additives are blended with the filter granulate to address selected target pollutants.



Step 3: Precipitation

Removal of soluble pollutants

The alkaline nature of the filter buffers the pH of the stormwater, which is typically acidic. Alkaline conditions promote precipitation and accumulation of dissolved substances. The fine pores of the filter allows water to seep slowly through the media providing greater opportunity for interaction between water and the alkaline composition of the filter.



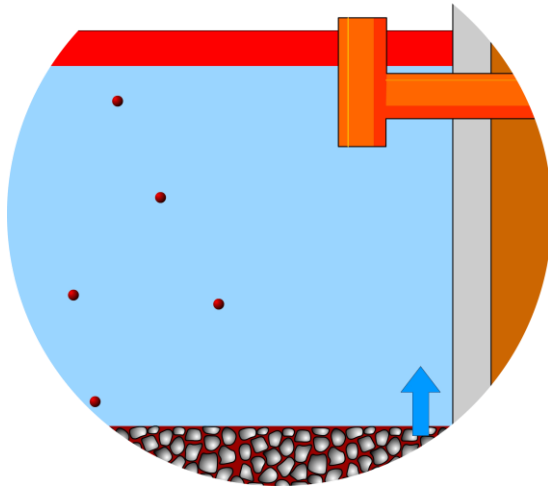
Step 4: Adsorption

Removal of soluble pollutants:

Soluble Pollutants like Phosphates and some dissolved heavy metals are absorbed by the filter media

Step 5: Oil retention Spill scenario

In the event of a spill, the T-outlet pipe retains oil in the ecoStorm plus chamber.



ECOSTORM PLUS: PERFORMANCE: OVERVIEW

TSS	>80%
Zinc	>80%
Lead	>90%
Copper	>90%
Hydrocarbons	>85%
Phosphorus	>70%

- ✓ Removes a variety of pollutants (heavy metals, hydrocarbons)
- ✓ Upstream sediment removal combined with low maintenance filters reduces maintenance intervals/costs
- ✓ Pre-assembled structure saves time and money
- ✓ Extensive laboratory and field-testing with proven results
- ✓ Modified to accommodate various applications and flow rates

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TSS (Total Suspended Solids)

- ✓ **Sil-co-Sil 106:**
82% Removal Efficiencies
- ✓ **Mechanical Sweeper**
96% Removal Efficiencies
- ✓ **Air Sweeper**
94% Removal Efficiencies

Copper

- ✓ Copper Influent:
32 to .044 mg/L
- ✓ Copper Effluent
0.27 to 0.002mg/L
- ✓ > 95% Removal Efficiencies

Zinc

- ✓ Zinc Influent
60 to 0.2 mg/L
- ✓ Zinc Effluent
3.0 to 0.0095mg/L
- ✓ > 95% Removal Efficiencies

Lead

- ✓ MCL Limit= 0.015mg/L
- ✓ Lead Influent
5.5 to 1.1 mg/L
- ✓ Lead Effluent
< 0.010mg/L
- ✓ > 95% Removal Efficiencies

Chemical Oxygen Demand (COD)

- ✓ COD Influent
15 to 32,000mg/L
- ✓ COD Effluent
< 10mg/L
- ✓ > 95% Removal Efficiencies

Total Oil and Grease

- ✓ Total Oil and Grease Influent
4.5 mg/L
- ✓ Total Oil and Grease Effluent
< 1.37mg/L
- ✓ > 60% Removal Efficiencies

Nitrates

- ✓ Nitrates Influent= 1.47mg/L
- ✓ Nitrates Effluent= 0.36mg/L
- ✓ >70% Removal Efficiencies

Total Phosphorous

- ✓ Total Phosphorous Influent= 5.0 to 0.81 mg/L
- ✓ Total Phosphorous Effluent= 1.0 to 0.15 mg/L
- ✓ >80% Removal Efficiencies

Dissolved Phosphorous

- ✓ Dissolved Phosphorous Influent= 0.25 to 0.1mg/L
- ✓ Dissolved Phosphorous Effluent= < 0.038mg/L
- ✓ > 62% Removal Efficiencies

ECOSTORM PLUS: PERFORMANCE

Parameter Unit	roof	Copper roof	Zinc roof	Parking lot Low traffic road	Highway main road	Waters LAWA	Drinking water	See- page	ecoStorm plus
	range	range	range	range	range	limit	limit	limit	
Conductivity (uS/cm)	25 270	25 270	25 270	50 2400	110 2400	-	2500	-	< 1500
pH (-)	4,7 6,8	4,7 6,8	4,7 6,8	6,4 7,9	6,4 7,9	-	6,5 - 9,5	-	7,0 - 9,5
Nutrients									
P ges (mg/l)	0,06 0,50	0,06 0,50	0,06 0,50	0,09 0,30	0,23 0,34	-	-	-	-
NH ₄ (mg/l)	0,1 6,2	0,1 6,2	0,1 6,2	0,0 0,9	0,5 2,3	-	0,5	-	-
NO ₃ (mg/l)	0,1 4,7	0,1 4,7	0,1 4,7	0,0 16,0	0,0 16,0	-	50,0	-	-
Heavy Metals									
Cd (mg/l)	0,2 2,5	0,2 1,0	0,5 2,0	0,2 1,7	0,3 13,0	1,0	5,0	5,0	< 1,0
Zn (mg/l)	24 4.880	24 877	1.731 43.674	15 1.420	120 2.000	500	-	500	< 500
Cu (mg/l)	6 3.416	2.200 8.500	11 950	21 140	97 104	20	2000	50	< 50
Pb (mg/l)	2 493	2 493	4 302	98 170	11 525	50	10	25	< 25
Ni (mg/l)	2 7	2 7	2 7	4 70	4 70	50	20	50	< 50
Cr (mg/l)	2 6	2 6	2 6	6 50	6 50	50	50	50	< 50
Organic Parameter									
PAH (ug/l)	0,4 0,6	0,4 0,6	0,4 0,6	0,2 17,1	0,2 17,1	-	0,1 (6 Verb.)	0,2	< 0,2
TOG (mg/l)	0,1 3,1	0,1 3,1	0,1 3,1	0,1 6,5	0,1 6,5	-	-	0,2	< 0,2

- critical parameter, purification absolutely necessary
- Important parameter, purification recommended
- Uncritical parameter
- No guidelines at this point of time



ECOSTORM PLUS: HIGHWAY IN HAMBURG, GERMANY

	TSS	Zn	Cu	Pb	Cd	PO₄-P	NH₄	TOG
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Average Inlet	848	0,39	0,239	0,043	< 0,0025	0,20	1,00	1,2
Average Outlet	43	0,11	0,049	0,015	< 0,0005	0,03	0,01	0,2
Target	150	0,50	0,050	0,025	0,0050	0,100	-	0,2
Removal Eff.(%)	95	73	80	65	-	74	98	82



ECOSTORM PLUS: ACADEMY OF ARTS, MUNICH, GERMANY: COPPER ROOF

