Article 57

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The Limits of Settling

Sediment basins and traps face an imposing performance challenge in removing sediment from construction site runoff: massive incoming suspended sediment concentrations (Table 1). Field and modeling research indicate that average total suspended solid (TSS) concentrations from construction sites are about 4,500 mg/l (with some storms as high 17,500 mg/l). If a basin is capable of achieving an impressive removal rate of 90%, the basin would still discharge sediment at a concentration of 450 mg/l. This is noticeably muddy to any downstream observer. If a basin's removal rate is increased to 95%, the discharged TSS concentration is still 225 mg/l—again a highly turbid discharge by most standards. It takes a herculean removal effort—99% or more—to produce a TSS level (45 mg/l) that in any way resembles a clear water discharge. Is it realistic, then, to expect sediment basins to meet such an imposing performance challenge? This article reviews some recent field and modeling studies to examine how much removal can practically be expected from sediment basins.

Field Monitoring

Surprisingly few sediment basins and traps have been tested in the field. Of the limited number of performance monitoring studies that have been conducted, three of the most informative are Horner's (1990) study of three highway sediment basins in Washington state, Jarrett's (1996) Pennsylvania test basin study, and Schueler and Lugbill's (1990) study of five basins and traps in the suburban Maryland piedmont. These studies (entries 1 - 9 in Table 1) clearly suggest that basin removal rates are highly variable. A quick glance shows that three of the nine basins or traps were found to remove sediment at a rate above 94%, five basins were in the 55 to 85% range, and one trap removed less than 20% of incoming sediments (due to internal erosion at inlets).

Table 1: The Performance of Sediment Basins and Traps
A Summary of Field, Laboratory and Modeling Results

Research study or site	TSS (mg/l) Mean inflow	TSS (mg/l) Mean outflow	Mean % Reduction*
1. SR-204 [1]	3,502	154	98.6%
2. Seattle [1]	17,500	626	86.7%
3. Mercer Island [1]	1,087	63	75.1%
4. RT1 [2]	359	224	18.0%
5. RT2 [2]	4,623	127	99.8%
6. SB1 [2]	625	322	54.7%
7. SB2 [2]	415	91	80.3%
8. SB4 [2]	2,670	876	66.8%
9. Pennsylvania Test Basin [3]	9,700	800	94.2%
10. Georgia Model [4]	1,500 - 4,500	200 - 1,000	42 - 87%
11. Maryland Model [5]	1,000 - 5,000	200 - 1,200	68 - 99.5%
12. Uncontrolled construction site runoff (MD) [6]	4,200	—-	—
Means	4,498	365	75%

Sources:
[1] *Horner, Guerdy, and Kortenhof, 1990*
[2] *Schueler and Lugbill, 1990*
[3] *Jarrett, 1996*
[4] *Sturm and Kirby, 1991*
[5] *Barfield and Clar, 1985*
[6] *York and Herb, 1978*
* Note: Based on mean of individual storm removals.