Article 68

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The Economics of Stormwater Treatment: An Update

Stormwater management can be the single greatest "out-of-pocket" cost that developers have to pay to meet local watershed protection requirements. Yet, surprisingly, very little is known about the actual cost of constructing stormwater practices. The last major study on the cost of urban stormwater management occurred over a decade ago when Wiegand and his colleagues (1986) investigated the construction cost of 65 stormwater management ponds in the Washington metropolitan area.

Since then, developers and watershed managers alike continue to be keenly interested in questions about the economics of stormwater practices. For example, has the cost of constructing stormwater management facilities increased over the last decade? If so, by how much? To what extent have new design and permitting requirements pushed up these costs? How much does it cost to build sand filters, bioretention areas or stormwater wetlands and other practices that were unheard of a dozen years ago? Are they cheaper to construct than ponds? What share of total stormwater management costs are due to water quality requirements as opposed to stormwater detention for peak discharge control? Do stormwater practices still exhibit economies of scale, i.e., is it still cheaper to construct a single large stormwater practice than a series of smaller ones to serve the same drainage area?

To address these questions, the Center undertook a second study in 1996 to update design and construction cost data for urban stormwater practices. The cost survey included 73 stormwater practices in the Mid-Atlantic area for which bond estimates, engineering estimates and actual construction contracts were available. The major stormwater practices that were analyzed included 41 pond systems (18 dry extended detention ponds and 20 wet extended detention and wet ponds and three wetlands); 11 bioretention areas, 11 sand filters and five infiltration trenches. Cost estimates for the practices were obtained from 14 private engineering firms and public agencies operating in Maryland and Virginia. Consequently, the population of stormwater practices that were sampled spanned a wide range of local design criteria and stormwater permitting requirements. In addition, the Center reviewed each stormwater practice design to determine watershed area, impervious cover, water quality storage volume and stormwater detention storage. Not all cost estimates were complete. In particular, specific cost information for control structures, landscaping, and erosion and sediment control (ESC) were frequently missing. These gaps were filled by using "unit rates" for each construction component developed from a survey of typical design and construction costs in the region. Unit rates for the basic component costs involved in stormwater practice construction are compared in Table 1.

The adjusted stormwater practice cost database was then statistically analyzed to examine the relationship between storage volumes (stormwater quality and quantity) and base construction cost (i.e., excavation and grading, ESC, and control structure costs) first established in the earlier Wiegand study. In general, the new study confirmed that stormwater storage volume was a reasonably strong indicator of construction cost for urban stormwater practices.

The new cost study found a strong relationship between pond storage volume and total construction cost of 41 stormwater ponds (see Figure 1). The equation describing the relationship had about the same slope and correlation coefficient as the 1986 pond cost equation (Table 2). The two cost equations are graphically compared in Figure 2. From this analysis, it is evident that the cost of providing a cubic foot of pond storage has climbed by 75% over the last decade. When inflation is factored out, the real cost increase is much smaller—about 30%. The higher cost is attributed to the adoption of enhanced pond design criteria, particularly those that have specified longer-lived but more costly construction materials (e.g., concrete vs. corrugated metal pipes).

In general, about a third of every dollar spent on stormwater pond construction was devoted to water quality control, with the remainder spent on flood control

Table 1: Comparison of Basic Component Cost of Stormwater Practice Construction

Basic Components of Construction Costs	Ponds	Sand Filters	Bioretention
Excavation/Grading	48 %	21 %	25 %
Control Structure	36	68	50
Appurtenances	16	11	25[a]

[a] includes landscaping costs