Article 70

Technical Note #1 from Watershed Protection Techniques. 1(1): 10-11

Pond/Wetland System Proves Effective in New Zealand

The performance of an innovative pond/wetland stormwater treatment system was evaluated in 1992 at a highly industrial site in the Auckland, New Zealand region. The newly retrofitted pond served a 24 acre, 66% impervious, Pacific Steel industrial site, which produces steel from automotive scrap recycled on-site.

As might be expected, the site had high loads of stormwater pollutants — concentrations were from five to ten times higher than residential areas in the Auckland region. This was particularly true for metals — median concentrations of copper, lead, and zinc were 0.14, 0.29, and 0.21 mg/l, respectively.

The pond/marsh system is shown in plan view in Figure 1. Innovative design features included an oil trap near the inlet to recover hydrocarbons, an extremely long flow path (2:1), a submerged berm that creates a quasi-forebay, a shallow marsh zone, and a micropool at the outlet. The total treatment volume averaged 1.92 watershed-inches (0.90 watershed inches when the full site is routed to the facility).

The 1.65 acre facility had 53% of surface area devoted to the pool, and 47% devoted to the marsh. However, 90% of the treatment volume was allocated to pool, and 10% to the marsh. The runoff frequency spectrum of the Auckland region was generally comparable to that of the American east coast and Midwest regions. In general, the particle-size distribution of the solids are considerably finer than those found in the United States due to the volcanic-derived soils.

Flow-composite monitoring of six storms during 1992 indicated that the pond/marsh system performed very effectively (Table 1). Removal of solids and various forms of phosphorus approached 75%. Removal of total copper, lead, and zinc exceeded 85%. Although nitrate removal was high (62%), a net export of ammonia was observed.

The pond/marsh system was relatively ineffective in removing COD (2%), however. Leersnyder attributes this to an initial deposition of oil-based forms of carbon followed by export of algal matter and plant detritus produced within the pond/wetland system.

Sampling of the bottom sediments of the pond revealed sharp gradients in metal, nutrient and hydrocarbon enrichment from the inlet to the outlet. Bottom sediments near the inlet structure were highly enriched with pollutants (23,956 mg/kg, 1,034 mg/kg, and 1,491 mg/kg of hydrocarbons, lead, and total phosphorus,

Figure 1: Plan View of Pacific Steel Pond (Leersnyder, 1993)

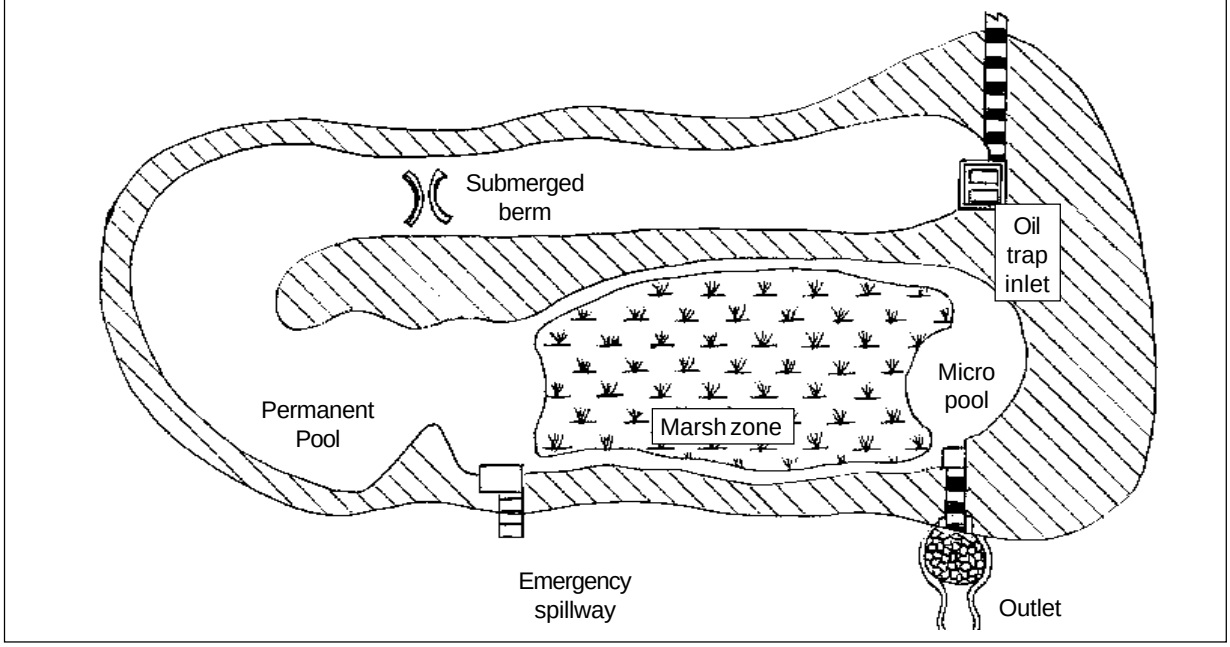

Table 1: Pollutant Removal Rates for Pond/Wetland System (Leersnyder, 1993)

Parameter	Removal Rate (%)
Suspended Solids	78
Total Phosphorus	79
Sol. Reactive Phosphorus	75
Nitrate	62
Ammonia	-43
COD	2
Total Copper	84
Total Lead	93
Total Zinc	88

Percent mass reduction in six monitored storms in 1992

respectively), but sediment concentrations declined by 80 to 97% at the outlet. The sharp gradient was consistent with Leersnyder's particle-size data, which indicated that most pollutants were attached to sediments deposited near the inlet.

Somewhat lower performance was reported for a second pond system located in a residential/commercial area of Auckland. While metal and sediment removal exceeded 60%, the removal of soluble reactive phosphorus (-42.7%), nitrate (28%) and ammonia (6%) was less than expected. The low nutrient removal was attributed to a high resident population of ducks, geese, and other waterfowl that lived on the pond.

The performance of the Pacific Steel pond/marsh system ranks among the highest yet reported for any pond system. This reflects not only the large treatment volume, but the system's excellent internal geometry, and the redundant treatment mechanisms of ponds and wetlands.

—TRS

Reference

Leersnyder, H. 1993. *Performance of Wet Detention for the Removal of Urban Stormwater Contaminants in the Auckland Region.* M.S. Thesis. Univ. of Auckland.