United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-99-014 September 1999

Storm Water Technology Fact Sheet
Flow Diversion

DESCRIPTION

Flow diversion structures (such as gutters, drains, sewers, dikes, berms, swales, and graded pavement) are used to collect and divert runoff to prevent the contamination of storm water and receiving water. Flow diversion structures can be used in two ways. First, flow diversion structures may be used to channel storm water away from industrial areas so that it does not mix with on-site pollutants. Second, flow diversion may be used to carry contaminated runoff to a treatment facility.

One of the most common methods for diverting flow is through storm water conveyance systems. These systems can be constructed from many different materials, depending on the design criteria and specifications for the site. Common materials used for these systems include concrete, clay tiles, asphalt, plastics, metals, riprap, compacted soils, and vegetation. These conveyances can be temporary or permanent.

Flow diversion structures are often modified by incorporating them into other pollution control BMPs. For example, diverted flow can be fed into an infiltration drainfield system, an infiltration basin, a constructed wetland treatment facility, or an onsite treatment facility for discharge under the NPDES program.

Another common modification is to construct a temporary flow diversion to determine its effectiveness. If the diversion structure is proven effective, it may then be made permanent.

APPLICABILITY

Storm water flow diversion systems work well at most industrial sites. The systems can be used to direct storm water downslope, away from industrial areas, and into channels or drain systems. This has two advantages. First, if storm water is potentially contaminated, it can be directed to a treatment facility. Second, if the runoff has not been contaminated, it can be kept separate from runoff that has been in contact with contaminated areas.

A good example of the utilization of a diversion structure is the Isle La Plume Wastewater Treatment Plant in La Crosse, WI. The area immediately surrounding the facility has been regraded in order for the storm water runoff to be directed into the process tanks. Here, the runoff is treated along with other wastewater.

ADVANTAGES AND DISADVANTAGES

Some advantages of using storm water conveyance systems to divert flow include:

- Storm water flow is directed around industrial sites, preventing contamination of the storm water, and also preventing flooding of the site.
- System maintenance requirements are low.
- Such conveyances are erosion-resistant.
- System installation may not require extensive construction.

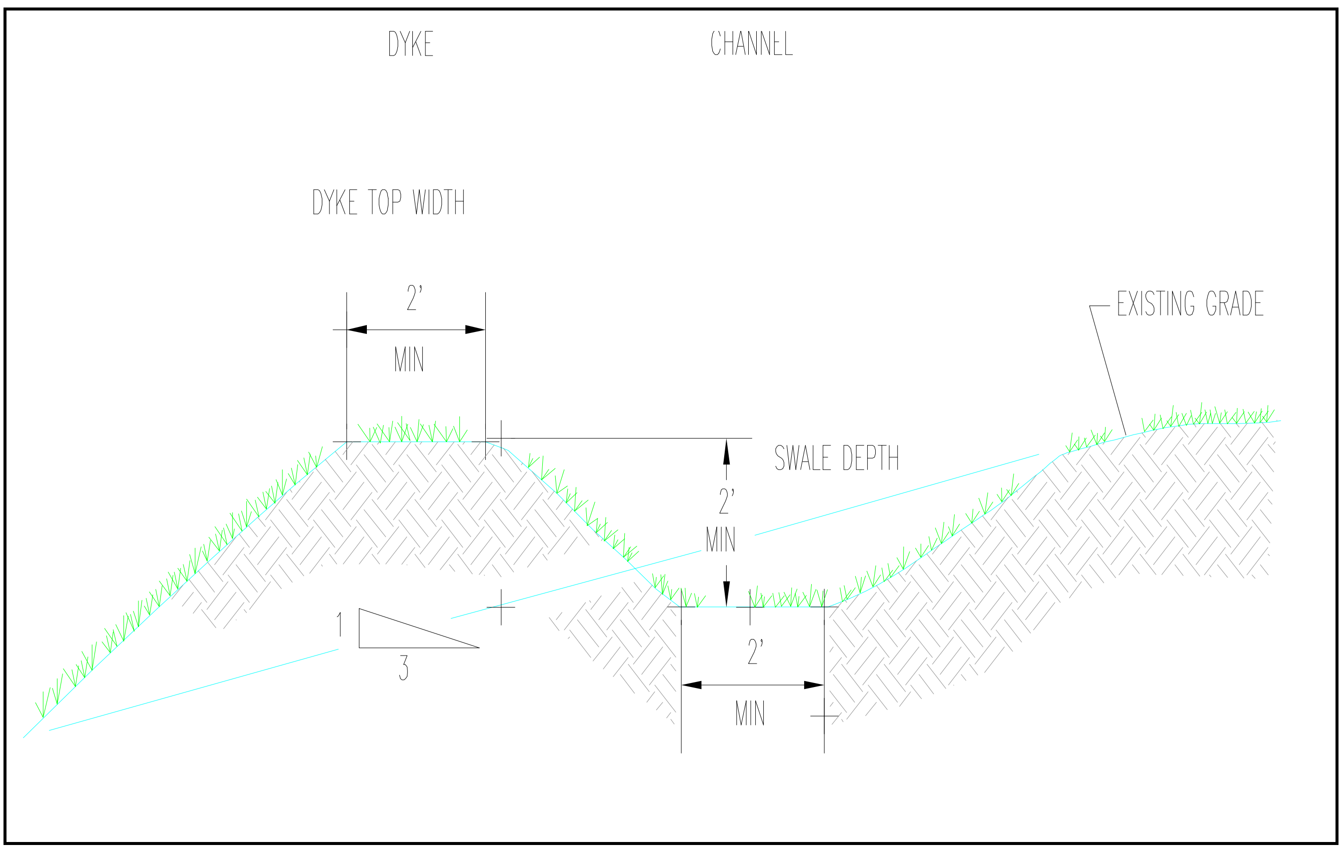
Potential disadvantages of flow diversion may include:

- Erosion problems due to concentrated flows.
- Potential groundwater contamination if conveyance channels have high infiltration capacities.
- Inadequately treated discharges to undersized water treatment facilities.
- Space limitations can make diversion structures impractical.
- Diversion structures my be too expensive for small facilities or for a site that has already been constructed.
- Maintenance is required after heavy rains.

DESIGN CRITERIA

Planning for flow diversion structures should incorporate data from the typical storm water flow. Also, the patterns of storm water drainage should be considered so that the channels may be located to divert and collect the flow efficiently. When deciding the type of material for the conveyance structure, planners should consider the material's resistance to erosion, its durability, and its compatibility with any pollutants it may carry.

Diversion systems are most easily installed during facility construction. The diversion system should be designed to incorporate the site's existing grades. This will reduce the BMP's design and construction costs. The site should be graded to allow for continued movement of runoff through the conveyance system. (Note: care must be exercised to limit flow velocities through the diversion system to reduce the possibility of erosion.) A typical diversion swale is shown in Figure 1.



Source: SEWPRC, 1991.

FIGURE 1 TYPICAL DIVERSION SWALE DETAILS

PERFORMANCE

Properly designed storm water diversion systems are very effective for preventing storm water from being contaminated and for routing contaminated flows to a proper treatment facility. For example, at Denver International Airport (DIA), flow diversion techniques intercepts 80 percent of the glycol used in airplane deicing and prevents it from entering Barr Lake, the local receiving waterbody. At the La Crosse, WI, Wastewater Treatment Plant, approximately one-third of the facility's storm water runoff is diverted into the plant's treatment process.

OPERATION AND MAINTENANCE

A maintenance program should be established to ensure that the system functions properly. Storm water diversion systems should be inspected to remove debris within 24 hours after a significant rainfall event since heavy storms may clog or damage the system. Flow diversion structures should also be inspected annually to ensure that they meet their hydraulic design requirements. This will ensure peak performance.

DIA has been in operation since 1995 and a continuous maintenance program is being implemented. Some techniques include conveying deicer-contaminated runoff from passenger aircraft deicing pads to a Pond or the Spent Glycol Storage Tanks for subsequent recycling and offsite reuse, if the runoff is in sufficient concentration. The deicer-contaminated storm runoff from other areas is diverted to storage ponds for pumping to Metro Wastewater Reclamation District (Metro).

COSTS

Costs vary depending on the type of flow diversion structure used. For example, the Southeastern Wisconsin Regional Planning Commission reports that vegetated swale costs vary between $41.83 and $246.06 per linear meter ($12.75 and $75 per linear foot), depending upon swale depth and bottom width (SEWRPC, costs adjusted from original 1991 document based on 1998 personal communication). Costs for the Denver International Airport flow diversion system are in the low millions of dollars range, however exact capital cost information has not yet been released.

REFERENCES

1. Denver International Airport, 1999. *Aircraft Deicing Fluid Collection and Treatment*.

2. James M. Montgomery, Consulting Engineers, Inc., 1992. Site Visit Data.

3. Minnesota Pollution Control Agency, 1989. *Protecting Water Quality in Urban Areas*.

4. Southeastern Wisconsin Regional Planning Commission, 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*, Technical Report No. 31.

5. U.S. EPA, 1981. *NPDES BMP Guidance Document*.

6. U.S. EPA, Pre-print, 1992. *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices*. EPA 832-R-92-006.

7. Washington State Department of Ecology, 1992. *Storm Water Management Manual for Puget Sound*.

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