



Maryland's Stormwater Management Program

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ABSTRACT

The adverse impacts of urbanization have contributed to a decline in the water quality of some of Maryland's streams and rivers, and the Chesapeake Bay. One of the state of Maryland's initiatives in response to this was the creation of a statewide stormwater management (SWM) program in 1982. This multipurpose program addresses a full range of hydrologic consequences and not just traditional runoff peak control. The Maryland Department of the Environment administers the program and is responsible for program implementation, plan review and approval, grants administration, education and training, and inspection and enforcement. Local jurisdictions administer their own programs that must meet minimum State standards. Water quality measures to enhance pollutant removal are emphasized. Practices used for the treatment of stormwater include infiltration structures, shallow marsh creation, extended detention basins, and water quality inlets. Retrofitting of existing SWM structures is done to enhance pollutant removal. Maryland's erosion and sediment control program is a key part of management efforts. Research and monitoring are conducted, and the use of innovative practices is encouraged.

INTRODUCTION

Urbanization generates detrimental changes to the hydrologic equilibrium of the land surface and the receiving fluvial estuarine environments. These changes include: increases in peak flow and total volume of stormwater runoff; accelerated stream channel erosion; decreases in low flow volumes in receiving streams; and decreases in water quality and the stream environment.

Efforts to control these conditions in the state of Maryland have resulted in statewide programs for erosion and sediment control, stormwater management (SWM), and flood plain management. Impetus for the control of runoff from new developments came from pressure by environmental groups because of the declining water quality of some of the state's streams and rivers, and the Chesapeake Bay; and the U.S. Environmental Protection Agency report on the Bay. The report documented the declining water quality of the Bay and identified urban stormwater as one of the causes. Nutrients, sediments, toxics, and other pollutants from surface runoff entering the Bay are not readily flushed out into the ocean but accumulate within the Bay.

Prior to a statewide program, stormwater management efforts in Maryland had focused on the control of increased peak flows and were not universally implemented. Water quality as well as quantity control implemented on a statewide basis had to be addressed if the program was to protect and improve the quality of surface waters in Maryland. The State's multipurpose program was designed to address the full range of hydrologic consequences resulting from urban development, and reduce the adverse effects of stormwater runoff. Erosion and sediment control is a key part of management efforts - runoff during construction is often greater than after site stabilization.

LAWS AND REGULATIONS

Legislation creating a statewide stormwater management (SWM) program in Maryland was enacted in 1982. It required each county and municipality to adopt a stormwater management program by July, 1984 subject to minimum criteria established in Regulations promulgated in July, 1983. For the first time in Maryland, water quality protection became a major component of all stormwater programs. Highlights of the act include:

1. Providing for an approved SWM plan for residential, commercial, industrial, or institutional land development. Agricultural land is exempt from these requirements;

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2. Permitting each county and municipality to adopt a fee system to cover the cost of SWM plan review and program implementation;
3. Requiring the State to review the local SWM programs at least once every 3 years;
4. Providing for civil and criminal penalties for violations of the SWM Law;
5. Requiring the State to provide technical assistance, training, research, and coordination in SWM technology to the local governments;
6. Requiring that Rules and Regulations be adopted, and outlining the items to be addressed by these;

Rules and Regulations established criteria and procedures for SWM in Maryland to ensure effective implementation of the local programs as well as the State program. The Regulations contained:

1. Responsibilities of the State for implementation and supervision of the SWM program.
2. The minimum content of the local county and municipal SWM ordinances;
3. Exemptions from the provisions of the regulations;
4. Allowance for waiver provisions in local ordinances for individual developments;
5. Minimum control requirements based on the hydrologic characteristics and SWM needs of different parts of the state;
6. A preferential list of SWM measures plus design criteria that must be used in developing a SWM plan;
7. Requirements for proper construction inspection of SWM facilities;
8. Provisions for periodic inspection and maintenance of stormwater facilities.

The Regulations were not universally accepted throughout Maryland, especially in the nine counties with existing programs (Maryland has 23 counties) and some municipalities for which SWM programs also existed. There was some resentment by local governments to the State redirecting the local programs. Change was not always easily accepted. One newspaper article from a county with no SWM program told how "the County Commissioner's room shook under the specter of a monster... Armageddon? No. Stormwater Management Regulations." It then related how the requirements "...could put an end to life as we know it." Nine public hearings were held throughout the state and there was considerable consultation with the local jurisdictions.

An amendment to the SWM law was enacted in the spring of 1988 that provides for the use of stormwater management practices to enhance water quality when land is redeveloped, even when the amount of impervious area does not increase. The SWM Rules and Regulations will be updated to reflect this change.

IMPLEMENTATION

The Sediment and Stormwater Administration of the Maryland Department of the Environment is responsible for administering the state's stormwater management and sediment control programs. The Administration is currently composed of three Programs: the Policy and Evaluation Program, the Construction Management Program, and the Compliance Program.

The Policy and Evaluation Program is responsible for promulgation of Rules and Regulations which establish criteria and procedures for State, county, and municipal programs. Publications are produced to provide technical guidance for local jurisdictions in the implementation of their programs. Research is conducted to refine current practices and evaluate innovative approaches initiated by the Program.

This Program administers the State's nonpoint source management program. The primary goal of the program is to implement Maryland's Chesapeake Bay Nutrient Reduction plan which calls for a 40% reduction in nutrient loadings to the Bay.

The Program oversees local stormwater management programs which are reviewed and evaluated every three years. The county or municipal stormwater management ordinance, the administrative procedures that guide implementation of the program, the plan review and approval process, the use of State funding for program implementation, and the effectiveness of inspection and enforcement procedures to correct violations are considered during the review.

Education and training opportunities are available for government agencies, consultants, developers and home builders, and environmental groups. Events include: a sediment and stormwater conference, inspectors workshops, technical assistance, presentations to groups upon request, and displays at various events.

The Construction Management Program reviews and approves sediment control and SWM plans for State and Federal construction projects to ensure compliance with SWM Regulations. Coordination occurs with inspectors from the Enforcement Division to evaluate field implementation and approve field modifications as required. In FY89 there were 400 new State and Federal projects for which over 1000 submittals were received and reviewed.

Funding is provided by the State for stormwater management retrofit projects and local SWM programs. Retrofit funds are used for the implementation of state-of-the-art best management practices and the modification of existing SWM structures in urban areas to enhance water quality benefits. Since 1984 five million dollars has been awarded under this program. Funds come from the sale of State bonds. The grant program funds plan review, inspection, and other personnel to implement the local programs. Grant funds of approximately \$1.6 million per year have been authorized for the 23 counties and 9 municipalities with approved SWM programs. Funding is from the financial commitment included in Maryland's "Chesapeake Bay Initiatives" and comes from state general funds.

The Compliance Program is responsible for inspection and enforcement of sediment control and SWM for all State and Federal construction projects. It is also responsible for sediment control inspection and enforcement for some of Maryland's counties and municipalities. The Program is organized into four field regions. Periodic and unscheduled inspections of approved projects are made to ensure compliance with approved plans.

A majority of the inspector's time is spent on erosion and sediment control as opposed to SWM. Good erosion and sediment control is crucial for innovative SWM practices such as infiltration and shallow marshes - sediment can clog infiltration structures or smother young marsh plants. Stormwater responsibilities include inspection of structures during construction, coordinating field modifications to the approved plans, and responding to citizen's complaints about drainage problems due to a particular project. Twelve to fourteen thousand site inspections of approved projects are made annually.

Enforcement actions, either administrative or legal, are based on the nature, extent, and impact of the violations. Primary emphasis is given to "in the field" corrective action and follow-up. Administrative civil penalties of \$1,000 per day for sediment control violations are possible. Fifteen to twenty criminal or judicial civil actions are initiated yearly. The Program is responsible for emergency response and immediate enforcement actions for violations of the Laws and Regulations.

PRACTICES

The primary goal of the Maryland SWM Program is to maintain after development, as nearly as possible, the predevelopment runoff characteristics. Achieving this goal requires that the full range of hydrologic consequences resulting from urban development be addressed. In addition to the traditional control of peak flow, consideration of flow volume reduction, stream low flow augmentation, water quality control, and ecological protection is necessary.

A preferential list of SWM Practices to be considered on each proposed development is used. Justification needs to be provided by the person developing land for rejecting each practice based on site conditions. Ranking is determined by the water quality benefits associated with each practice. A combination of successive practices may be used to achieve the applicable water quantity control requirements. Minimum control requirements are established based on the hydrologic characteristics and SWM needs of different parts of the state. Most of the state has a 2 and 10-year control requirement because stream channel erosion and flood increases are of equal concern. Only 2-year control is required for the extremely flat terrain of Maryland's Eastern Shore.

State Regulations require consideration of infiltration practices first because of the many benefits they provide to negate the adverse environmental impacts resulting from land development. Infiltration of stormwater

from a site can recharge groundwater, augment low stream flows, reduce the total runoff volume, and enhance water quality. If their use for peak discharge control is not feasible due to limiting constraints, the practice can be designed to capture the first flush of runoff. The first flush is recommended to be 0.5 inches of runoff per impervious area (MDE, 1986). Capturing this volume will result in the removal of many waterborne pollutants.

"Standards and Specifications for Infiltration Practices" (MDE, 1984) were developed to provide design guidance to consultants and regulatory agencies. The document establishes minimum criteria for the design, review, approval, construction, and maintenance of infiltration practices. Practices detailed include the infiltration basin, infiltration trench, dry well, porous asphalt pavement, and vegetated swales with check dams. Feasibility tests to determine if infiltration is suitable for a specific site, and the extent to which it may be applied are included.

The use of infiltration throughout the state has proceeded in a somewhat cautious manner due to concerns and unanswered questions. Research is currently in progress to investigate the potential for ground water pollution through the entry of runoff into the soil subgrade. Premature failure of infiltration practices due to a lack of adequate runoff filtering in the design, poor construction techniques, or a lack of proper sediment control during construction has been a problem. Maintenance of these structures may be difficult to accomplish or neglected. A utility approach that would include the financing of SWM maintenance is being pursued to address this. This involves the creation of a local government enterprise that provides services of stormwater management (quantity and quality control), drainage, and flood control. It is funded by user charges based on runoff volumes or impervious area, not property taxes.

The second item on the preferential list is open vegetated swales which have a high resistance to flow, and natural depressions. These practices retard the runoff and provide some water quality benefit. Vegetative methods, when kept within erosion control design limitations, are generally preferred over structural methods. The State's intention with this preference is to encourage local jurisdictions to be more flexible in the utilization of curb and gutter.

The third item on the preferential list is stormwater retention structures or wet ponds. The benefits of retention ponds regarding water quality enhancement are well documented in the U.S. EPA Nationwide Urban Runoff Program (NURP) studies (Wash. COG, 1983). In addition to water quality benefits, retention ponds provide aesthetic and possible wildlife benefits when properly designed. They provide an excellent opportunity for creation of shallow marsh habitat. Design criteria for the creation of artificial wetlands have been prepared (MDE, 1988). The guidelines contain physical and biological requirements for constructing wetlands. Research is currently proceeding at three artificial wetlands in Maryland to monitor water quantity and quality benefits.

The last item on the preferential list is detention structures (dry ponds) which generally only provide shaving of peak discharge rates to a specified level. Detention ponds have little or no water quality benefits, which accounts for their lowly position on the State preferential list. The use of extended detention is encouraged since it allows additional time for the settling of particulate pollutants and decreases downstream erosion of the receiving stream. The State has used a criteria that requires the runoff volume generated from the one year frequency storm be released over a minimum of 24 hours. Recent research has indicated that even slower runoff release rates than currently required are preferable to adequately protect stream channels (McCuen et al, 1988). Forthcoming changes to SWM Regulations will require the use of extended detention instead of detention.

CONCLUSION

Maryland's statewide SWM program is six years old. The decline of some of the state's streams and rivers, and the Chesapeake Bay was years in the making, and it will be years before SWM and other initiatives to restore surface water quality will fully achieve that goal. What has been learned in the short term can provide guidance for those considering the implementation of a SWM program:

1. The SWM program should have a clearly defined direction and the enabling legislation and regulations should reflect this;
2. Innovation, research, and monitoring are needed for successful evolution of a program;
3. A commitment to program implementation requires adequate monetary and manpower support;

4. Erosion and sediment control should be included as an integral part of the program;
5. Inspection of SWM practices is critical to avoid failure due to improper construction;
6. Maintenance of SWM structures is critical. A funding mechanism, such as a stormwater utility, is required;
7. An education and training program is essential. A lack of understanding SWM concepts can lead to poor design, plan review, and construction;
8. Enforcement penalties for non-compliance with stormwater requirements that are extreme enough to act as a deterrent are necessary;
9. Implementation of "natural engineering" techniques and practices which preserve and enhance existing features of a site should be addressed;

Stormwater management is not an exact science and will continue to evolve as our knowledge and experience increases. Implementation of Maryland's program has not been a simple process... the stormwater problem is multifaceted and has to be approached that way.

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