



Reviewing Site Plans For Stormwater Management

SC NEMO Fact Sheet #7

CONSIDERING STORMWATER MANAGEMENT IN SITE PLAN REVIEW

Volunteers serving on planning and zoning commissions routinely review site plans to determine compliance of proposed development with land use regulations. A major consideration of this site plan review should be the proposed development's impact on water resources, particularly from polluted stormwater runoff, or nonpoint source pollution.

Traditionally, stormwater management has emphasized water quantity, with little concern for water quality. To address both of these factors in a comprehensive manner, each site plan should contain a stormwater management plan that details the impact of proposed land use on water quantity and quality, both on-site and within the watershed. While the detailed engineering is best left to trained professionals, land use commissioners can review plans for compliance with general planning guidelines.

THE NEED FOR STORMWATER MANAGEMENT IN A WATERSHED FRAMEWORK

When water falls to earth as rain or snow, most of it seeps into the ground. However, if the ground is saturated, frozen or covered with impervious surfaces, excess precipitation flows over the land. Stormwater management is the process of controlling and cleansing excess runoff so it does not harm natural resources or human health. A major focus of stormwater management should be prevention of nonpoint source water pollution (see SC NEMO Fact

Sheet #2). It is more cost effective to prevent flooding and water pollution than to correct problems after damage has occurred.

POTENTIAL IMPACTS OF DEVELOPMENT ON WATER RESOURCES

Development may disturb land and create impervious surfaces such as roads, rooftops and compacted soil that in turn drastically change natural drainage patterns. During construction, existing grades and vegetation can be damaged, resulting in soil erosion. Runoff from these areas can pollute creeks and rivers.

Development, through increases in impervious surfaces and installation of storm sewers, speeds movement of concentrated pollutants off-site and interferes with water infiltration to the ground (see SC NEMO Fact Sheet #3).

TRADITIONAL APPROACHES TO STORMWATER MANAGEMENT

Most communities attempt to manage stormwater by emphasizing water quantity rather than water quality. The goal has been to drain water from developed sites as rapidly as possible through the use of gutters, downspouts, pipes, curbs, catch basins and culverts. Some communities require developers to install detention ponds to temporarily store a portion of the excess runoff, then gradually release it after the peak natural runoff has occurred. Many hydrologists are concerned that mandating detention ponds on each site, while controlling runoff in the immediate vicinity, may work to collectively increase peak flows in the

watershed, resulting in downstream flooding. Experts caution about the reliance on one management practice to solve all drainage issues.

THE IMPORTANCE OF STORMWATER MANAGEMENT PLANS

Stormwater management begins with an understanding that every piece of land is part of a watershed. A watershed is defined as an area in which all drainage flows to a common outlet. Comprehensive land use planning and sound site design are necessary for effective stormwater management. Water resource experts strongly recommend that local governments develop watershed management plans, so that management practices on individual sites can be coordinated as to location, size and function. Comprehensive watershed management plans include data from field inspections and inventories of existing drainage structures, mapping of waterways, analysis of runoff rates and allowable capacities, and identification of existing and potential problem areas.

In addition to hydraulic and quantity impact analysis, watershed management plans should also address water quality issues. Things to be identified in the plan should include: priority water resources to be protected; known sources of contamination and existing pollutant levels; particular contaminants of concern; water quality goals; and overall watershed-level protection measures (such as use of buffer zones along waterways).

Within the context of a watershed plan, stormwater management should combine efforts to minimize impervious surfaces with efforts to maximize infiltration of clean runoff into the ground. Untreated stormwater should not be allowed to discharge directly into surface or subsurface waters. Site-specific runoff control measures should be based on their location within the watershed. Effective stormwater management will maintain the natural patterns of runoff within the watershed. For instance, clean runoff from the lower portions of the watershed should be allowed to pass downstream without delay (as long as the downstream floodway is

capable of handling these flows), while runoff from the central and upper sections of the watershed should be slowed or held back to prevent increasing peak flow rates.

THE CONTENTS OF A STORMWATER MANAGEMENT PLAN

Developers are generally required to submit site plans to help local officials determine whether proposed development complies with municipal land use regulations. Each site plan should contain a stormwater management plan addressing the impact the proposed land use will have on water quantity and quality.

Site-level stormwater management plans are generally composed of maps and a narrative. The maps and associated construction drawings show existing site features and proposed alterations highlighting the location and type of proposed stormwater management system. The narrative consists of a written statement explaining the natural and proposed drainage system, a detailed description of projected runoff quantity and quality and an explanation of why certain management practices were chosen for pollution control. Highlighted should be a detailed description of the relationship of the proposed development to drainage and runoff within the entire watershed (with reference to a watershed management plan should one exist). Provisions for site safety and maintenance of approved management measures should also be included.

PRINCIPLES TO STRIVE FOR IN STORMWATER MANAGEMENT

Stormwater management should include measures to control and convey runoff flow, and to collect and cleanse runoff on-site. These principles might be summarized as "The Four Cs" of stormwater management: ***control, conveyance, collection, and cleansing***. Measures do not fall neatly into one category in most cases; for instance, measures that control runoff, such as swales, may convey and clean runoff as well. These four principles, however, can provide a helpful framework for looking at stormwater plans.

- 1) **Control:** Control measures can be broken down into two categories: source control and runoff control. Source control measures focus on pollution prevention. Their objective is to avoid or limit the generation of pollutants. Typical source control measures include erosion control, street and parking lot sweeping, hazardous waste collection, and reduced usage of fertilizers and pesticides. Runoff control measures focus on slowing down runoff, in order to reduce the likelihood of erosion, downstream flooding, and pollutant transport. These measures include limiting impervious surfaces, directing flow over grass swales or other vegetated areas, storing runoff in ponds, and installing infiltration systems.
- 2) **Conveyance:** Conveyance systems are used to drain and direct the flow of runoff generated on a site. This is often done with tile pipes feeding into catch basins and storm sewers. More natural systems using vegetated depressions and swales, which look and function much like the natural drainage system, should be used whenever possible. Existing systems can be adapted to reduce runoff; for example, perforated pipes can be used to promote infiltration. Particular attention should be given to system outlets, which commonly become restricted or blocked if poorly designed.
- 3) **Collection:** Capture and storage of runoff for more timely release is a vital component of most stormwater management systems. When runoff is collected in a vegetated storage area like a retention or detention pond, the sites' adverse impacts on water resources can be greatly reduced. For sites where total capture is not feasible, studies suggest that collecting the "first flush" of one-half to one inch of rainfall can capture a high percentage of contaminants. All collection systems require regular monitoring and maintenance to insure their continued effectiveness.
- 4) **Cleansing:** Control, conveyance and collection of runoff mean little without provisions for cleansing. Cleansing is commonly accomplished through techniques that promote filtration and settling of pollutants, and their natural processing by vegetation and soil. Filtering devices include engineered structures like catch basins, sediment basins, and porous pavement, but also include more natural systems like buffers and vegetated filter strips. Depending on their design, many collection systems like ponds and wetlands also serve to cleanse water. Infiltration of stormwater into the ground, which allows pollutants to be cleansed by natural biological and chemical processes in the soil and helps to recharge groundwater, should be encouraged wherever soil type and groundwater systems can support it.

SUMMARY PLANNING GUIDELINES FOR STORMWATER MANAGEMENT

Site-by-site evaluation of stormwater plans can be greatly improved and facilitated by having a set of guidelines clearly stating the key management principles that the commission wants each applicant to address in a site plan. As part of site plan review, commissioners should require assurances that any stormwater management plan complies with these general guidelines. The detailed engineering formulas and designs used to attain compliance with the guidelines are best handled by referring engineers and developers to commonly accepted manuals. Review of engineering design should be left to trained staff or consultants experienced in the field of water resources.

Below is a suggested list of guidelines that applicants should address when designing a stormwater management plan. Commissions should consider using these when reviewing submitted plans. Towns and counties might also consider including these guidelines in their subdivision and zoning regulations, and referencing them in watershed management plans.

The Stormwater Management System Shall:

1. Consider the total environmental impact of the proposed system.
2. Consider water quality as well as water quantity.
3. Be consistent with the local Comprehensive Plan, and any existing watershed management plan.
4. Coordinate with erosion control measures and aquifer protection.
5. Minimize disturbance of natural grades and vegetation, and utilize existing topography for natural drainage systems.
6. Preserve natural vegetated buffers along water resources and wetlands.
7. Minimize impervious surfaces and maximize infiltration of cleansed runoff to appropriate soils.
8. Direct runoff to minimize off-site volume.
9. Reduce peak flow to minimize the likelihood of soil erosion, stream channel instability, flooding and habitat destruction.
10. Use wetlands and water bodies to receive or treat runoff only when it is assured that these natural systems will not be overlooked or degraded.
11. Provide a maintenance schedule for management practices, including designation of maintenance responsibilities.

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