

**DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Bureau of Watershed Management**

**COMMENT AND RESPONSE DOCUMENT**

**Technical Guidance #363-0300-002: Pennsylvania Stormwater Best Management Practices Manual**

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### COMMENTS AND RESPONSES:

**Comment:** Support: This Manual presents a catalyst towards bringing stormwater management in Pennsylvania inline with the current state of the science. The guidelines are clear, yet sufficient flexibility in choosing BMPs and developing plans which incorporate nonstructural and structural BMPs is built into the process to account for variability in site conditions. To this end, the Manual represents a significant step forward in providing a blueprint for achieving watershed protection in a more cost-effective manner. The manual is an improved and detailed document, presenting a thorough range of structural and nonstructural best management practices (BMPs) for reducing the environmental impacts associated with stormwater management, minimize stormwater runoff therefore reducing damage to our roads and bridges, recharge the natural groundwater regime, and to reduce pollution impacts on streams. (1) (3) (5) (7) (14) (17) (19) (20) (21) (25) (35) (36) (38) (39) (40) (41) (44) (45) (47) (51) (53)

**Response:** DEP acknowledges the comment and support for the manual.

**Comment:** Non-support: The manual is not applicable in all areas of the Commonwealth or to existing small lots (1/4 to 1/2 acre parcels). I would strongly suggest that the manual not be implemented until such time as viable solutions are found for the existing properties in the Northeast portion of the State. (2) (16)

**Response:** The goal of the BMP Manual is to provide guidance on meeting the regulatory standard to protect ground and surface water resources when performing land development activities by replicating, to the maximum extent practicable, the infiltration and runoff characteristics of the site prior to the development activity. To achieve this goal, the BMP Manual establishes an approach to stormwater management that emphasizes procedures that avoid, minimize, and then mitigate effects through BMPs that focus on infiltration, water quality treatment, and volume and rate discharge controls.

DEP recognizes the commentator's concerns related to the use of infiltration in some areas. Where on-site assessments indicate infiltration is not practical because of potential harm to the environment or public safety, infiltration is not appropriate. In these circumstances, the project designer still must ensure the post-construction stormwater management plan is designed to protect existing stream uses in all streams and to maintain water quality in High Quality and Exceptional Value streams. Project plans and narrative will be required to support the alternative methods of post-construction stormwater controls. An assortment of BMPs described in the Stormwater BMP Manual can be used to achieve this goal. Prior to proposing a land development activity, land developers, consultants, contractors, etc. will need to make careful choices regarding the type of stormwater BMPs to be implemented in order to compensate for the hydrologic changes caused by the development activity. The BMPs will need to reduce nuisance flooding, reduce stormwater pollutant loads, maintain ground water recharge, and protect stream channels and streambanks from scour and erosion. Selecting either non-structural or structural BMPs for a specific site

will require consideration of soil type, topography, geologic features, landscape position, hydrology, climatic conditions, and other pertinent information. The BMP Manual provides BMP efficiencies, specifications, standard drawings, and other essential information to guide the user in the selection and development of stormwater BMPs for these types of activities.

**Comment:** General - Training: We urge the Department to launch a comprehensive program to educate developers and municipal officials, engineers and solicitors about the new Manual. Because the Manual represents a significant paradigm shift and because so much of the Manual will be actually implemented at the municipal level, it is critical that municipal officials and staff understand its concepts and operation. A series of workshops, new informational materials including booklets and a possible DVD, and seminars at meetings of groups like the Pennsylvania State Association of Township Supervisors will be critical to ensure that the Manual is uniformly and successfully implemented across the state. (7) (18) (36)

**Response:** DEP agrees. An aggressive training and education program is essential for the successful implementation of the BMP Manual. DEP, with assistance from public and private partners, will ensure that a series of comprehensive training opportunities is provided to all potential users.

**Comment:** General - Model Ordinance/Manual: The Department must directly incorporate the Manual into the new Model Ordinance that it recommends for municipalities in the state. The new Model Ordinance must be completely consistent with the Manual and incorporate it by reference. Differences between the Manual and Model Ordinance will be confusing for developers and municipalities. Because developers will follow the legally binding ordinances instead of the Manual, failure to incorporate the Manual into the new Model Ordinance will ensure that the Manual will have a limited impact, wasting the thousands of dollars and hours that went into its development. (7)

**Response:** DEP has revised the Model Ordinance to specifically reference the design considerations identified in the BMP Manual.

**Comment:** The Department should require all municipalities that have already adopted stormwater management ordinances to ensure that their ordinances are at least as strong and protective as the new Manual and Model Ordinance. Many municipalities have already adopted stormwater management ordinances, some of which are not consistent with the new approaches in the Manual. Allowing municipalities to retain these weaker ordinances in the long-term will weaken the effectiveness of the Manual, and allow flooding, groundwater and baseflow depletion and stream impacts to continue.

We urge the Department to require all municipalities to review their ordinances within six months from the final adoption of the Manual and to revise their ordinances as soon as possible thereafter to ensure that they are at least as protective as the new Manual and Model Ordinance. This will ensure that all communities across the commonwealth will benefit from the new approaches and strategies in the Manual. (7) (14) (22) (28) (36) (40)

**Response:** Municipal involvement is an essential factor in successfully addressing stormwater runoff problems around the Commonwealth. The Model Ordinance has uniform requirements that have statewide applicability to address such impacts. The Model Ordinance establishes the minimum baseline requirements for counties and municipalities involved with Act 167 planning and implementation, and MS4 municipalities. All other municipalities will be encouraged to update their existing stormwater ordinances to be consistent with the model ordinance. Within resource constraints, DEP will assist municipal officials in this effort when requested.

**Comment:** Stormwater BMP retrofitting is not adequately addressed. Many of Pennsylvania's older developments have little or no stormwater management practices. And, unfortunately, many of today's developments employ outdated and ineffective methodologies. The result has had a significant, and growing, impact on our water resources. As such, a significant effort to retrofit existing developments with today's state-of-the-art stormwater BMPs is needed. To facilitate such, the Manual should include a chapter on such opportunities, including those in ultra-urban settings where no stormwater BMPs may exist.

Focus on Prevention: Throughout the Manual, it is important that DEP make the point that use of best management practices will reduce the pollution, flooding, erosion, habitat loss, drought and community harm created by inappropriate development and peak rate focused stormwater management strategies. Discussion about the benefits of a best management practices approach (as opposed to a peak rate focused approach) is limited in the current draft.

The proposed manual is inadequate because it fails to focus on best management practices such as design that would actually prevent stormwater runoff. Instead the manual presupposes that stormwater runoff is inevitable and focuses upon a peak rate approach. Such an approach will not solve or assist with stormwater runoff because it will create the same cycle of sediment and erosion problems and inadequate measures that we presently see, thereby harming water quality.

The manual discusses many scientific data and approaches that I do not believe are scientifically accurate or valuable. For example, to discuss base pollutant loading with a chart derived from the NJ coastal plain is irrelevant. I am utterly confused by Chapter 8 and hope that we will be able to comment again, once this chapter has been simplified and revised.

As a more editorial comment, the Council recommends that the Department review many of the images that were copied from other documents and placed into the Manual and make sure that the resolution is high and the images are sharp and clear. While the Council is aware that this is a "living document", the Manual will also be used as an everyday guide; therefore, to the extent the images are highly legible and readable it will facilitate better understanding and comprehension by users, particularly those individuals less familiar with these practices.

There is a lot of good information in this manual. However, chapters 2, 3, and 8 need significant additional attention. The manual presents far too many general "rules of thumb" without stating they are just "rules of thumb". This will result in reviewers potentially making designers modify good designs into poor designs.

We are very concerned that the above important elements are not sufficiently emphasized and supported in the present draft. The Manual, for example, should emphasize, throughout, the use of strategies to prevent the generation of stormwater runoff. And it should discourage both unnecessary destruction of natural resources that provide natural capture of precipitation and also the use of outmoded and harmful peak rate focused stormwater management strategies.

Large runoff events will always occur, continue to get worse, and become more frequent despite this manual. Therefore, the State should include outright restrictions against any development within floodplains or drainageways, or other critical stormwater areas, some of which are addressed in Chapter 5.

Some commentators had detailed comments directly related to a specific BMP. These comments have not been added to this summary, however are generally represented in the comments above. (1) (5) (8) (29) (30) (33) (34) (36) (37) (45) (46) (49) (47) (50) (52)

**Response:** DEP recognizes the problems associated with the lack of, or inadequate past stormwater management practices. The BMP Manual primarily focuses on new land development rather than restoration and remediation, retrofitting stormwater management BMPs for past practices. Remedial actions could be a component of a local Act 167 Stormwater Plan, MS4 municipality, or other locally approved ordinance. Depending on site conditions, most of the BMPs highlighted in the manual can be used to manage stormwater from redevelopment.

DEP agrees that problem prevention should be the primary means of addressing stormwater and it is emphasized throughout the Manual. Prevention is the first and most effective means of controlling stormwater runoff. The manual identifies prevention, minimization and mitigation as the hierarchy of stormwater management strategies. The manual addresses all aspects of stormwater management including peak rate, volume and water quality.

Chapters 2, 3, and 8 have been substantially edited to improve readability and enhance understanding of the document. The manual will be published with the clearest and highest quality pictures and graphics feasible.

While DEP generally agrees that floodplain development should be restricted, the Manual is not a regulation and is not the proper vehicle to address the issue. Avoiding sensitive areas and preserving “green infrastructure”, is a major theme of Chapter 5 and it is highlighted throughout the document.

**Comment:** General - Application of standards, consistency: A clear methodology and process for reconciling the differences of stormwater management approaches needs to be established. It is unclear how differences between requirements, standards, criteria and approvals at the local, county, and the state or DEP regional level will be reconciled in advance of projects being run through the process. Current approaches at various levels of government are not consistent and sometimes are directly contradictory in their requirements. (For example, where the Manual calls for BMPs that foster infiltration of stormwater, some communities with karst conditions or other concerns have ordinances that preclude such infiltration designs.)

While recognizing that Pennsylvania is a state of many socio-economic and physiographic regions, and that solutions from one region may not be desirable for another region, DEP must, as part of its implementation of the Manual, ensure that inconsistencies in interpretation and application between regions and programs are reduced. In that regard, one of our more serious concerns is that some regional DEP staff will treat this Manual as if it were a “regulation,” providing a cookbook recipe for what BMPs can or should be undertaken at each development. Our experience has been that such an approach is impractical and unworkable. Department staff, as well as county and municipal officials, needs clear direction that this Manual is a reference point and resource for BMP ideas, not a prescription for every case. Site-by-site considerations and a balancing of factors is required to select the right BMPs for any property or development, and creativity, common sense and good engineer practices must be applied in the BMP selection and implementation process.

A good BMP manual contains specific guidance on how to select, size, design, construct, and maintain practices at each development site. Both the construction and long-term operation and maintenance of stormwater management practices need to be consistently evaluated.

Who will review these new design guidelines/criteria? Neither the State, Counties, nor municipalities have adequately educated staff to review these new criteria. The State must consider the consequences of providing unlicensed regulatory officials with methods to evaluate designs or computations performed by a licensed professional (engineer, land surveyor, landscape architect). (30) (35) (42) (47) (48)

**Response:** DEP, in conjunction with the Stormwater Manual Oversight Committee, has endeavored to identify the best and most innovative BMPs in the Pennsylvania Stormwater BMP Manual.

This Manual will promote and improve consistency among all levels of government by providing rational, scientifically supportable strategies and methods of properly controlling stormwater. The model ordinance is designed to support this objective. Education will be key to maximizing consistency among potential user groups.

The Manual has been revised to further emphasize that it is a guidance document and not a regulation. This key point will be clearly conveyed at all training and outreach sessions, and at all other presentations and meetings. The Manual has also been revised to more clearly state that its intent is that of a technical reference of planning concepts and design standards that must be tailored to local site conditions. It is not a “cookbook” and not a substitute for good judgment or good engineering practice.

It is anticipated that individual BMP operation and maintenance will be performed and evaluated by the BMP owners, as well as local and state government. The model ordinance highlights the need for effective operation and maintenance and identification of responsible parties. New BMPs will undoubtedly continue to emerge through research, innovative designs and business ventures. BMPs not currently listed in the manual may be used if their efficiency can be documented and verified.

**Comment:** General - Regulatory status of Manual: In summary, we request that Pennsylvania retain and perhaps embellish on language in the Manual that makes it clear that the manual is guidance, not regulation, and should be used in the field in a flexible manner.

When the process began to develop the Stormwater BMP Manual, it was emphasized that this was a Best Management Practices Manual only and there would be no regulation. However, now there is the accompanying Model Ordinance that local municipalities can adopt. This is a major concern to our industry here in Pennsylvania. (17) (24)

**Response:** This guidance has been developed in accordance with longstanding DEP practice and with public participation. It is not a regulation or statute. It describes the framework for stormwater management in Pennsylvania, utilizing existing statutory and regulatory authority. These statutes and regulations were duly promulgated in accordance with law. Solutions other than those presented in the Manual of protecting water quality will be evaluated on a site-by-site basis.

**Comment:** General - Liability for problems from failed BMPs especially infiltration. Can this policy be implemented statewide and across all soils types and topography? Karst areas, in particular, are difficult to infiltrate into and the recharge may result in unforeseen problems and potential liability. If a designer states that mandated “volume control” is not physically possible or recommended, but DEP staff insists it upon, will DEP staff be considered culpable to future litigation that results? Additionally, if DEP requires a professional to seal “engineered infiltration” designs, then the DEP reviewer should likewise be required to professionally seal their review. How else will reviewers be held accountable? (26) (34) (40) (47) (48)

**Response:** The BMP Manual outlines an approach that identifies avoidance, minimization, and mitigation of stormwater to recharge groundwater, provide base flows to watercourses over the year, reduce pollutant loadings to streams, and reduce the threat of flash flooding and stream bank erosion during storm events. Groundwater recharge through infiltration BMPs, where appropriate, can be a key objective of an effective stormwater management plan to support and sustain groundwater resources, and to maintain baseflow of streams. The goal is to minimize potential problems resulting from land development activities to ground and surface water resources by replicating to the maximum extent practicable, the infiltration and runoff characteristics of the site prior to the development activity. To achieve this goal an approach to stormwater management that emphasizes infiltration, water quality treatment, and volume and rate discharge controls is recommended. Selecting infiltration and other BMPs for a specific site will require consideration of soil type, topography, geologic features, landscape position, hydrology, climatic conditions, and other pertinent information.

DEP recognizes the commentator's concerns related to the use of infiltration in some areas. Where on-site assessments, field measurements, and the collection of other data conducted by professional hydrogeologists indicate infiltration is not practical because of potential harm to the environment or public safety, infiltration may not be appropriate. In these circumstances, the project designer must utilize other BMPs that address volume to ensure that the post-construction stormwater management plan is designed to protect existing stream uses in all streams and to maintain water quality in High Quality and Exceptional Value streams. Project plans and narrative will be required to support the demonstration of non-discharge alternatives and Antidegradation Best Available Combination Of Technologies (ABACT) methods for post-construction stormwater controls. An assortment of BMPs can be utilized to achieve these water quality protection goals. The BMPs contained within the stormwater BMP manual are considered environmentally sound and cost effective when used according to the standards, specifications, and other information provided within the Manual.

Prior to proposing a land development activity, land developers, consultants, contractors, etc. will need to make careful choices regarding the type of stormwater BMPs to be implemented in order to compensate for the hydrologic changes caused by the development activity. The BMPs will need to prevent flooding, reduce stormwater pollutant loads, maintain ground water recharge, and protect stream channels and streambanks from scour and erosion.

This Manual will provide BMP standards, specifications, standard drawings, and other essential information to guide the user in the selection and development of stormwater BMPs, however it is not intended to replace the decision making of professionals in private practice. DEP is aware and concerned of potential environmental and safety issues. Project developers and planners will be responsible for site assessment to determine the site limitations.

**Comment:** General – Variability of socio-economic conditions: The Manual as written does not evaluate or address the economic costs associated with implementation of the recommended BMPs. Early in the Commonwealth's development of this proposal, it was determined that DEP did not need any further laws or regulations to meet the EPA requirements for stormwater management. Given the breadth of the program and its increased scope to address water quality and quantity issues, this decision needs to be reopened. The Manual creates an iterative process for managing stormwater. This approach provides little regard for the costs involved in this process. Those costs will be passed on to homebuyers and consumers, and/or can have significant impacts on the economic competitiveness of the Commonwealth in attracting new plants and investments. The full range of costs associated with how these BMP's will be implemented (including costs on governmental agencies at all levels, and capital and O&M costs imposed on property owners) need to be clearly articulated and understood. In order to understand the true impact

of the regulatory program being promoted, this Manual should go through the same type of socio-economic impact evaluation as would be applied to a regulation. (35)

**Response:** The Stormwater BMP Manual is a DEP guidance document and not a regulation. Stormwater management is already being incorporated into most land development plans to meet existing local ordinances, and state and federal regulatory requirements. This guidance document refocuses those plans to more effectively manage and protect our ground and surface water resources. Costs associated with these BMPs should not significantly affect the overall project costs, and in many cases could prove to be less costly. From a cost effective perspective, improved stormwater management will translate to less frequent downstream flooding, reducing property damage and associated costs.

**Comment:** PENNDOT, The Turnpike, and DEP develop a Stormwater manual (this would be a chapter in the DEP Manual) as a guideline for future highway reconstruction and development. (11)

**Response:** Chapter 7 specifically references roads and highways. The purpose of this chapter is to consider the most suitable BMPs for managing runoff from roadways. It is imperative that careful consideration of roadway design, construction, and maintenance should be included in the selection of BMPs that minimize the rate and volume, and enhance the quality of road and highway runoff.

Mitigating the impacts of runoff from highways and roads is a concern not only for state highway managers (such as PennDOT and the PA Turnpike Commission) but also for municipalities, particularly those with and NPDES stormwater management responsibilities.

**Comment:** Please extend the comment period for an additional 30 days for the PA Stormwater Manual. The draft ordinance was released half way through the comment period for the manual and it is appropriate that both be considered together as they should complement each other. (5) (6) (7) (31)

**Response:** The comment period was extended until July 14, 2006.

**Comment:** Chapter 2 - More soils information: *Section 2.2 – General:* This chapter needs to be a well organized and technically correct discussion of hydrologic and hydrogeologic processes in Pennsylvania as they relate to stormwater management. A good chapter 2 is critical as a foundation for the rest of the manual. This document promotes engineered infiltration into and through soils, but nowhere does it provide a discussion of soils and the importance of water movement through soils as it relates to the design of engineered infiltration facilities. You have some “process” information mixed in the chapter, but it is not complete or well organized. And there is still misleading information included (see comments above).

Critical missing information includes:

- a general discussion of soil characteristics and their relationship to the movement of water in soils;
- a discussion of soil and geologic structure in PA and how that might impact water movement; (37)

**Response:** Chapter 2 provides more on the natural structure (not texture) of undisturbed soils (or amended soils) and the enhanced infiltration that this provides especially in the surface horizons. Structure can sometimes play a larger role in infiltration than the soil texture. The surface horizons are important because they provide a convenient opportunity to address wide array of water quality treatment needs, especially if rain gardens and organically amended soils are considered here. The purpose of this chapter is to provide a concise background about the important role soil plays in managing and renovating stormwater, and to underscore that it is critical to understand soil characteristics of a given

site when selecting and designing stormwater BMPs. The BMP Manual includes a general discussion of soil characteristics, water movement and Pennsylvania soil conditions.

**Comment:** Chapter 2 - Need to refine/set the stage for SWM: Section 2.2.1 neglects the temporal seasonal effect of rainfall. Additionally, in most of Pennsylvania the distribution of precipitation event magnitudes is only approximately uniform over the year for minor or negligible precipitation events. For example, Figure 1 shows the average monthly rainfall for the State College area by event magnitude for a 100-year period. From the graph it can be observed that rainfall events less than or equal to 0.25" account for approximately 20% of the average annual rainfall and are uniformly distributed throughout the year. However, these events often never generate surface runoff or "recharge". The most important trend to notice in Figure 1 is that the majority of the rainfall events (especially high intensity events) greater than 1" occur when Evapotranspiration (ET) is greatest, or when soil moisture is the most depleted, which provides a buffering effect against flooding. Make it clear that flooding increases with rain events of all sizes including the smaller storms, whereas the current version of the manual suggests that flooding increases only with the smaller storms. (14) (47)

**Response:** There is no "Figure 1" in Chapter 2, however the concerns expressed in the comment have been addressed. The discussion of annual precipitation distribution is based on records that have been kept for decades or, in some cases, over a century. Section 2.2.2 clearly discusses seasonal variations in evapotranspiration, and its affect on infiltration and groundwater recharge. The Chapter has been revised to place added emphasis on the importance of controlling all sizes of storm events.

**Comment:** Chapter 2- Better organization on the "process": You have some "process" information mixed in the chapter, but it is not complete or well organized. And there is still misleading information included. Failures are due more to a misunderstanding of hydrologic processes. Unfortunately, the entire document then uses these same weak standard hydrologic modeling tools to make all of the new arguments of what should be done. This indicates the authors do not understand the difference between simplified hydrologic tools used for engineering and actual hydrologic processes. This is the main reason this manual will result in new types of problems the authors do not yet understand. (47) (37)

**Response:** The intent of Chapter 2 is to generally describe the hydrologic process, how it is altered by activity on the land, and how stormwater can best be managed to compensate for the resultant hydrologic imbalance. The chapter also acknowledges that the presentation of the hydrologic process is an oversimplification of complex interactions that define surface and subsurface flow processes in Pennsylvania. DEP disagrees that that the information in Chapter 2 is misleading, or that it affects the validity of the entire document.

**Comment:** Chapter 3 - Concern of CG-1 vs. CG-2 being equivalent standards: Control Guideline 1 (CG-1) and 2 inappropriately apply static statewide design criteria to sites across the entire state and should be eliminated in favor of statewide design criteria algorithms.

By relying on CG-1 and CG-2 to be applied across-the-board statewide, the Manual ignores site-specific conditions that may limit the ability of the site to achieve the prescribed level of control. To remedy this condition, CG-1 and 2 should be eliminated in favor of design criteria algorithms, which dictate site-specific design specifications.

Numerous other state manuals, including Maryland, New York, Vermont, Iowa, Georgia, and other states and counties employ a site-specific approach for sizing stormwater best management practices (BMPs) to meet pollutant removal goals, maintenance and enhancement of groundwater resources, reduction in

channel erosion, prevention of overbank flooding and extreme floods. The algorithms employed in these manuals require site-specific inputs to determine how pre-development site conditions, particularly hydrology, can be maintained post-development.

Such an approach provides a set of discrete and scientifically justifiable algorithms in which existing site conditions (e.g., soil type) and other parameters dictate the appropriate level of stormwater management so as to maintain hydrological balance, including infiltration. It is CBFs position that this methodology is vastly superior to the CG-1 and 2 concept presented in the Manual. (5)

**Response:** DEP chose to use a series of site control guidelines as a basis for managing the rate, volume and quality of stormwater that are comprehensive and consistent with Pennsylvania’s Comprehensive Stormwater Management Policy. It is recognized that other options are available, but the guidelines were selected as the most effective and equitable means managing stormwater runoff in Pennsylvania. DEP made its decision after considerable discussion with the members of the Stormwater Management Oversight Committee. While the volume control guidelines in particular may be specific concerning the volume of runoff to be controlled from a development site, it does not limit or prescribe the methods to be used to accomplish the goal. The selection of BMPs is left to the design professionals based on site conditions.

**Comment:** Chapter 3 - Establish a hierarchy of situations or identify limited application(s) for CG-2: The Manual should either eliminate Control Guidance 2 (CG-2) or at the very least set CG-1 as the preferred control guidance. Using two guidance strategies is both confusing and also will not guarantee that the most effective measures are being used when dealing with stormwater management in the Commonwealth. Since the Manual identifies the CG-1 as the most effective strategy for addressing stormwater management, this should be put front and center for use in Pennsylvania. Proposing a second, weaker standard only hinders the state from using the strongest possible stormwater management practices and will confuse officials who must implement these practices. (1) (5) (7) (12) (14) (27) (28) (29) (30) (33) (38) (43) (44) (45) (47)

**Response:** The Manual will continue to present two volume control guidelines. However, because of concerns raised about the effectiveness of CG-2 on larger projects, this control guidance is limited to projects that disturb 1 acre or less. DEP has outlined circumstances in which either CG-1 or CG-2 can be utilized. CG-1 is recommended to be used for the design of stormwater management strategies and controls for most land development projects. CG-2 will be more useful for small projects such as building expansions or additions on single lots or some redevelopment projects. Chapter 3 has been expanded to highlight the most likely and preferred application of the two guidelines and the application or limitation on CG-2.

**Comment:** There is a consistent lack of objective criteria that can be used for design and evaluation of BMPs. Review and enforcement of the principles in this manual will be uneven and arbitrary depending on the emphasis of individual reviewers. (23)

**Response:** Chapter 6 presents twenty-one structural BMPs for consideration. The presentations list “Key Design Elements”, make reference to Protocol 1 (Site Evaluation and Soil Infiltration Testing) and Protocol 2 (Infiltration Systems Guidelines) where relevant and Chapter 8 (Stormwater Calculations and Methodology) where appropriate; provides design considerations, discusses construction sequence, describes maintenance and cost issues, lists specifications, and shows typical drawings. In addition, Appendix D presents a Case Study that includes stormwater calculations and methodologies. This level of guidance should be sufficient for professionals to design BMPs customized to the project site, and be a

sound technical reference for plan reviewers. The Manual will ensure consistency in project design and review.

**Comment:** Chapter 3 - Evaluate use of BMP efficiencies as a water quality indicator or pollutant loading criteria: The recommended Water Quality Control Guidelines of striving to achieve specific reductions in pollutant loads, i.e. 85% reduction in TSS, by assuming a percent removal efficiency of stormwater BMPs from Table 8.4, I feel will lead to many cases of litigation throughout the State. As we all know, and as was discussed in the SMOC meetings, there are two many variables to assign a pollutant removal efficiency to BMPs including design configuration, percent imperviousness and size of drainage area, etc. This concept promotes concentrating “dirty” runoff to the BMP, since a BMP will more easily achieve a percent reduction in pollutants from “dirty” runoff, than from “clean” runoff. This defeats the whole impetus of promoting nonstructural BMPs and promoting clean runoff on-site before it reaches the BMP. DEP may also want to consider the legal justification to assuming BMP treatment efficiency (Table 8.4) with no reference and no quantitative backing of the numbers. This was discussed in the SMOC and I though it was decided that legally, scientifically and engineering wise, these numbers could not be generalized. (3)

**Response:** The overarching strategy of avoiding, minimizing and mitigating stormwater problems should first be applied. Managing stormwater to minimize pollutant loading includes reducing the sources of these pollutants as well as restoring and protecting the natural systems that are able to remove pollutants. To reduce the impact from land development, the recommended approach is to avoid any increase in rate and volume of surface runoff, including the pollutants transported with this runoff that comprises an equally significant impact. Management strategies that address quantity will in most cases address quality.

The intent of the Water Quality Control Guideline is to assist the designer in the selection of both non-structural and structural BMPs that will achieve water quality protection goals. The numerical reduction goals in Chapter 3 are not effluent limitations or performance standards, but are composite efficiency goals that can be used to select appropriate BMPs for a specific site. When the volume and peak rate control guidelines are followed, the identified pollution reduction efficiencies for typical stormwater pollutants at typical concentrations should be met.

**Comment:** Chapter 3 - Consider individual BMP efficiencies and the contribution to the plans effectiveness in meeting WQS: The water quality control guidelines, which require removal of 85% of sediment loads, 85% of phosphorus loads and 50% of solute loads (as represented by NO<sub>3</sub>-N) are important standards, and CBF commends the Department for establishing them in this Manual. However, unlike other states such as New Jersey, the Department has chosen to consider the WQCs as guidelines and not requirements. Simply stated, the WQC guidelines should be incorporated into the Department’s Comprehensive Stormwater Policy, Technical Guidance Document No. 392-0300-002 (September 28, 2002) as requirements and municipalities should be required to adopt the WQC guidelines as standards in local stormwater management ordinances in order to minimize pollutant loads to the maximum extent practicable. (5) (23) (35)

**Response:** The commentator has correctly stated that the Water Quality Control Guideline is not a requirement, nor does the guideline establish a set of numerical effluent limitations. The intent of the Water Quality Control Guideline is to assist the designer in the selection of both non-structural and structural BMPs that will achieve water quality protection goals. The numerical reduction goals in Chapter 3 are composite efficiency goals that can be used to select appropriate BMPs for a specific site. Because stormwater BMPs are subject to highly variable field conditions, precise numerical efficiencies

or limitations will not be required. DEP will continue to use a performance-based, presumptive approach to water quality protection. When the guidelines are not followed or BMPs other than those identified in the manual are used, the burden of proof is on the applicant to demonstrate required levels of water resource protection.

**Comment:** Chapter 3 - Regulatory/scientific justification for the 2-year/24 hour standard: The 2-year rainfall event is selected as the basis for Control Guidance 1. The justification is that 95% of the total rainfall volume falling during an average year occurs in events less than or equal to the 2 year rainfall event. What is the justification for using the 95% value? Why not 90%, or 85%, or 99%? The 2-year rainfall event is still an extreme event. What scientific basis is there for selection of the 2-year or 95% event? Provide scientific justification for using this value....or simply state that it was an arbitrarily selected value. (34) (37)

**Response:** As stated in Chapter 3, the basis for Volume Control Guideline 1 is as follows:

- The 2-year event represents over 95% of the annual runoff volume across the state. Most stream channel erosion results from storms under a 2-year storm event (95-98% of rainfall events).
- Volume reduction BMPs based on this standard will provide a storage capacity to help reduce to help reduce the increase in peak flow rates for larger runoff events.
- In a natural stream system in Mid-Atlantic States, the bank full stream flow occurs with a period of approximately 1.5 years. If the runoff volume from storms less than the 2-year event is not increased, the fluvial impacts on the stream will be reduced.
- The 2-year storm is well defined and data is readily accessible for use in the stormwater management calculations.

**Comment:** Chapter 4 - Need to include more narrative on cost benefits/cost effectiveness of LID: Integral to initiating the necessary paradigm shift to comprehensive stormwater management that integrates site design techniques that minimize the generation of stormwater and treat it in decentralized micro-scale techniques is addressing the concerns of developers on the issue of cost.

Construction costs can be either higher or lower for a LID project than they would be for a conventional development, depending on the site. However, overall research continues to indicate that LID is more cost-effective than conventional development in the medium and long-term.

In fact, recent research in Maryland and Illinois show that new residential developments using LID saved \$3,500 to \$4,500 per lot (quarter-to-half-acre lots) when compared to new developments with conventional stormwater controls.

Because of its emphasis on preserving natural processes and micro-scale management practices, LID is often less costly than conventional stormwater controls. LID practices have a longer life cycle cost than centralized stormwater strategies and developers benefit by spending less on pavement, curbs, gutters, piping, and inlet structures. And LID creates a desirable product that often sells faster and at a higher price than equivalent conventional developments.

Given the importance of economic considerations by those in the development community, CBF contends that it is imperative that information detailing the cost-effectiveness of such techniques be clearly presented in detail in the Manual. (5)

**Response:** DEP agrees with the comment. Although Chapters 5 and 6 (Non-Structural BMPs, and Structural BMPs) both have sections of each BMP description devoted to cost, DEP agrees that a discussion of economic considerations and cost-effectiveness would enhance Chapter 4 (Integrating Site Design and Stormwater Management).

**Comment:** Chapter 4 - Need to recognize the cost of BMP implementation and maintenance: Although the procedure contained in this chapter is the ideal method to look at land development, the state needs to consider the cost to implement these regulations, both to the municipalities required to enforce it, the developers who will need to construct to the required standards, and the consultants who will be designing using it. Developers especially will not appreciate the cost for the multiple cycles of testing and fitting preventative Non-structural BMPs to the site. The increases in cost will have to be passed on to the purchasers of the lots, including future maintenance and replacement costs for the BMPs. Even Non-Structural BMPs have a cost related to them and require management that is not understood by the general public or municipalities who become responsible for them. Dollars are also a resource that needs to be considered. When the cost of construction, operation and maintenance become unreasonable, they may be constructed but it is unlikely they will receive proper operation and maintenance unless the owners are threatened with litigation and/or fines. (27)

**Response:** Some form of stormwater management is already being incorporated into most land development plans to meet existing local ordinances, and state and federal regulatory requirements. This policy refocuses those plans to more effectively manage and protect our ground and surface water resources. Costs associated with these BMPs should not significantly affect the overall project costs, and in many cases could prove to be less costly than the previous methods of stormwater management. From a cost effective perspective, improved stormwater management will translate to less frequent downstream flooding and a possible reduction in property damage.

**Comment:** Chapter 4 - Provide more emphasis on the hierarchy of preferred BMPs, especially Structural BMPs: The only addition we highly recommend is to separate out the volume and quality focused BMPs from the peak rate focused BMPs and to make clear that structures focused on infiltration, volume reduction and that provide water quality benefits are encouraged third, with structures focused on peak rate (e.g. detention basins) being the least desirable, and therefore the fourth place, strategy that is recommended. (14)

**Response:** Comprehensive stormwater management must address the peak rate and quantity of the discharge, and protect water quality. DEP has proposed a BMP approach that recommends technical methods, structural or non-structural, that will meet these objectives.

Prior to proposing a land development activity, careful choices regarding the type of stormwater BMPs to be implemented in order to compensate for the hydrologic changes caused by the development activity will need to be made. The BMPs will need to prevent flooding, reduce stormwater pollutant loads, maintain ground water recharge, and protect stream channels and streambanks from scour and erosion. In selecting BMPs, the responsible party should first evaluate specific site considerations such as soil type, topography, geologic features, landscape position, hydrology, climatic conditions, natural drainage features, riparian buffers, and other pertinent information. These natural features need to be incorporated into the design to avoid and minimize the generation of increased volume and rate of stormwater. The BMP Manual presents structural stormwater management BMPs that can be utilized to address infiltration, water quality treatment, and volume and rate discharge.

**Comment:** Chapter 4 - Need to clarify (flow chart) the relationship of BMP manual to Act 167: The recommended site design procedure is certainly interesting, but if Figure 4-1 is supposed to be a flow chart, it is extremely difficult to follow. At the same time, the chart and the text fail to mention the requirements of Act 167 stormwater management plans, and just how they fit in this process. Indeed, the Manual seems to dismiss the Stormwater Management Act entirely, and assumes that stormwater management is simply a matter of municipal input coupled with the suggested guidance and design recommendations in this Manual. (This is again mirrored in the draft Model Stormwater Ordinance, which as we read it attempts to establish municipal stormwater control measures that exceed the requirements of the Stormwater Management Act as well as the PaDEP Comprehensive Stormwater Management Policy.) (35)

**Response:** DEP has made the revision to the final policy as recommended by the commentator.

**Comment:** Chapter 5 - Too much emphasis on creation and preservation of open space: There is too much text devoted within Chapter 5 to the creation and preservation of open space. While this is a key element in promoting healthy, livable communities and reducing the volume of runoff created, it is not necessarily the topic of this manual. The manual overall may be better suited, and much less bulky, by eliminating some of this superfluous text. There are many good open space documents already written. We are fearful that by emphasizing this approach and by putting it first in the manual, DEP expects that it will happen and that it will help solve stormwater problems. We have outlined some of the specific problems in our comments below. (4)

**Response:** Chapter 5 (Non-Structural BMPs) presents a number of BMPs that encourage the protection of sensitive areas, clustering and concentrating building, minimizing disturbance and required maintenance, reducing impervious cover, and disconnecting and decentralizing stormwater sources of runoff. These practices are very important considerations that must be employed where feasible to avoid and minimize stormwater runoff problems. When placed in the proper context, the presentation of these BMPs does not infer that the creation and preservation of open space is the topic of the Manual. By their nature, these practices in many cases result in the creation and preservation of open space as a side benefit to comprehensive stormwater management. In recognition of the commentators concern related to the size of Chapter 5, it has been reviewed and edited to condense or remove unnecessary text where possible.

**Comment:** Chapter 5 - Subjective rather than objective criteria: Chapter 5 contains very few objective criteria. Most of the BMPs in the chapter are subjective. How will the regulators evaluate the use of the BMP when no objective standard is contained in the manual? What happens when local ordinances dictate design that is contrary to the BMP manual? (23)

**Response:** Chapter 5 (Non-Structural BMPs) includes key design elements, applications, and design considerations for each BMP in the chapter. Inherently, concise and objective design criteria for non-structural BMPs usually cannot be provided. The application of non-structural BMPs relies on a considerable amount of judgment and the will to carry them out. Evaluators will use the Manual as a starting point for reviewing proposals, and need to work closely with the owner/developer and engineer to resolve any concerns. Local ordinances will always prevail in the face of a conflict with the Manual. It is incumbent upon the municipality to amend ordinances, if necessary, to remove obstacles that may be preventing the application of effective stormwater management techniques.

**Comment:** Chapter 6 - Recommend establishment of a technical review team to evaluate/verify structural BMP performance: The disclaimer states that the DEP has not verified or confirmed accuracy of any product performance. If so, then why are any listed. Recommend that a Technical

Review Committee (TRC) or similar group be established to manage the Commonwealth's TARP membership. The TRC can consist of state and local regulators, consultants, academia, etc. Referring to other programs such as EvTEC, ETV, NJCAT, etc. without proper state oversight forces localities to evaluate the products, leading to inconsistency. (12)

**Response:** DEP will give consideration to establishing a Technical Review Committee.

**Comment:** Questions exist regarding the ability of the practices listed in Chapter 6 to be able to store the runoff required when using CG-1 or CG-2 criteria. The manual could be improved by showing some case studies that include acceptable hydrologic and hydraulic calculations related to stormwater management. (32)

**Response:** The case studies that have been included in Chapter 9 are designed to not only focus on successful BMP application, but also to identify the unique hydrology and hydraulic conditions that may be encountered. This case study discussion will be expanded to include lists of what to avoid and what does not work as well. DEP invites all interested stormwater stakeholders to submit case study information in the future for additional projects. Chapter 9, Section 9.2 is a list of information and data items that case study descriptions should address, although it is recognized that some data gaps may exist.

**Comment:** Chapter 7 - Consider off-site mitigation/compensation for special management areas, esp. highways. For road improvement and new road projects the applicant should be allowed to develop a trading system or otherwise get credit and bank credits for:

- a) Improvements to existing stormwater discharges that are more easily made in the same or adjacent watershed where site limitations exclude or make implementing BMPs difficult and costly or where there is an environmental advantage to going off site. For example a section of road maybe placed in a cut through a hillside where there is no room for a basin or other BMP. The applicant should be able to compensate for that section at another nearby section. A road section maybe being placed adjacent to a cold water stream where temperature impacts from discharges from equalization or infiltration (infiltration adjacent to a stream in most cases will go right into the stream) would be adverse to stream biology.
- b) Removal of stormwater contributions from combined sewer systems. PennDOT has many sections of road connected to municipal combined sewer systems. These contributions where they can be, should be required to be removed from the sewer system. Separate stormwater lines and outfalls should be provided without the requirement for equalization or infiltration. Road stormwater contributions to combined sewer systems consume conveyance and treatment capacity that would be better dedicated to assuring greater volumes of municipal sewage from homes, schools, hospitals... gets conveyed for treatment.
- c) Removal of streams from combined sewer systems. While the manual dismisses stream removal, there are several streams connected to the Pittsburgh area sewer system that pass under PennDOT roads that could be removed with PennDOT cooperation. The combined sewers in the Pittsburgh area bypass at minimal precipitation events. Rt 28 improvements reportedly include removal of two streams from the sewer system. Rt 28 overtly cuts-off these streams from the nearby Allegheny River and they now enter the combined sewer system. (Portions or all of the road drainage system are probably connected to the combined sewer system also.). Both the stream flows and road runoff could be easily conveyed to the Allegheny River as part of the proposed roadwork. The increased surface

area runoff quantity and quality for the new road should be more than offset by taking the stream section contributions (which end up being bypassed after mixing with sewage at the nearby Allegheny river diversion structures) out of the sewer system. Credit should be given for taking out the ongoing contribution of debris from steam transport, which consumes sewer capacity. This work would result in less sewage bypassing during dry and wet weather.

- d) In urban or otherwise built up areas give credit for participation in the removal and demolition of abandoned buildings with disconnects from combined sewer systems. Reducing the amount discharging from nearby combined sewer diversion structures could offset road stormwater (quantity and quality) discharges. The community would also benefit from the removal of problem structures that pose safety, crime, and blight problems.
- e) Construction or installation of riparian buffers in the same, adjacent, or nearby higher quality watershed. (10) (13) (21)

**Response:** Where on site BMPs cannot be effectively utilized to adequately address stormwater discharges, then DEP may consider offsite compensation projects in the same watershed and preferably upstream from the project site. These projects would be evaluated on their ability to protect and maintain water quality. If DEP would consider offsite compensation projects, these projects will be evaluated on a case-by-case, site-by-site basis.

**Comment:** Chapter 7 - Infiltration should be precluded, esp. brownfields, mined areas: Infiltration in brown field sites should be precluded unless there is an evaluation of the potential to contaminate or increase the contamination of ground or surface waters. Many of these sites are "cleaned up" to a very relaxed standard, which allows ground water pollution, surface water pollution, and contaminated soils to remain in place. Infiltration ponds in these areas will increase the spread of whatever contamination remains and pose a potential use limitation to surface and ground water and pose a threat to public health, safety, and property. (5) (21) (35)

**Response:** DEP agrees that infiltration in potentially contaminated areas should only be employed where it will not cause or contribute to the contamination of local surface or ground water resources.

**Comment:** Chapter 7 - Karst - scientific basis for hydrostatic pressure (buoyancy): Hydrostatic pressure is known to support the weak geologic limestone structure in karst areas of Florida. However Pennsylvania limestone is much harder and can form vast cavern ceilings without collapsing. I've never heard of a fluctuating water surfaces causing structural instability of the subsurface in Pennsylvania. Provide an example to demonstrate that this actually happens in Pennsylvania. If it doesn't, then remove this from the text. (37)

**Response:** DEP has revised this Chapter to clarify the "buoyancy" factor as it relates to Pennsylvania's Karst geology.

**Comment:** Chapter 8 - Tree Credit-scientific basis: I know of no tree that can remove 1" of rainfall across the canopy area. Provide scientific data to support this amount or remove. (47)

**Response:** DEP acknowledges the comment. The purpose of establishing a credit system is to provide incentive to developers, consultants, and municipal officials to design and implement low impact or better site design developments in a manner that causes less impact to the Commonwealth's water resources. Scientific data has been established that documents that trees decrease stormwater

volume, peak rate, and pollutant concentrations. Further trees also provide an economic incentive for decreasing detention costs. The goal is to provide volume of runoff credits that can be estimated for certain site design practices and site conditions that can result in the reduction of runoff volume, rate, and pollutant concentration.

**Comment:** Chapter 8 - Additional information/guidance is needed on choosing appropriate stormwater methodologies: The spreadsheets presented for the computational methods appear to be made so anyone can do, or review, stormwater designs. This removes the use of engineering judgment, or skill, or any understanding of hydrologic processes from the design process. We do not need canned spreadsheets or tables, but rather simply define how something should be done. The manual fails at providing sound basic computational methods or guidance for designers to use. (47)

**Response:** Chapter 6 presents 21 structural BMPs for consideration. The presentations list “Key Design Elements”, make reference to Protocol 1 (Site Evaluation and Soil Infiltration Testing) and Protocol 2 (Infiltration Systems Guidelines) where relevant and Chapter 8 (Stormwater Calculations and Methodology) where appropriate; provides design considerations, discusses construction sequence, describes maintenance and cost issues, lists specifications, and shows typical drawings. In addition, Appendix D presents a Case Study that includes stormwater calculations and methodologies. This level of guidance should be sufficient for design professionals to design BMPs customized to the project site, and be a sound technical reference for plan reviewers. There is no expectation that this Manual be regarded as a “cookbook”, or substitute for professional judgment and good engineering practice.

**Comment:** Appendix B - Recommend adding salt tolerant, identifying salt sensitive native species: Plants sensitive to salt spray can be sued in highway landscaping but care must be exercised to locate the plants in areas that are not too close to the edge of the roadway. (8)

**Response:** The appendix will be revised as recommended.

**Comment:** Appendix C - Infiltration failures should include hillside hydrology: Certain topographic features need to be considered when locating BMPs (or infiltration test). We will elucidate the potential for infiltration failures, vulnerable and “special areas”. (9) (18) (47)

**Response:** DEP will consolidate and reiterate where necessary vulnerable or risk areas in the manual. A maximum % slope will be recommended for subsurface infiltration. DEP is aware of the prospect of side slope “bleeding”. Concave slopes and prominent swales should be avoided for subsurface infiltration BMPs. This will be included in the appendix C and again in the Design Considerations along with “special areas” treatment.

**Comment:** Appendix C - Infiltration testing protocol should separate testing approach from testing standards: Certain test (percolation) and test results are not appropriate to determine BMP efficiency.

Permeability Testing - Please note that the pictured Turf Tec Infiltrometer has double rings, which are too small, and do not meet testing requirements as put forth in the new procedures. Should it be indicated that the Turf Tec is to be used as possible support or for confirmatory testing?

The manual suggests a preferred calculation for percolation testing procedures, however, does not give a specific calculation for the double ring infiltration testing, is there a preferred calculation? (8) (15) (27) (37)

**Response:** DEP will attempt to simplify and clarify this area to some extent, including references to support any procedures or adjustment factors where necessary. Virtually all tests have limitations and therefore appropriate references will be provided to address these limitations and appropriate adjustments. The purpose of the testing procedure should be to provide an infiltration rate that most nearly reflects saturated hydraulic conductivity, since this is the rate measure that most reliably predicts the soils capacity to infiltrate external sources of water.

**Comment:** Appendix C - Emphasis should be placed on natural soil health and quality to maintain infiltration and water quality treatment. (41) (47)

**Response:** Reference is made to soils in Chapter 2.

**Comment:** Appendix C - Infiltration rate of 0.10 inches /hour is extremely low. Cost at many sites would be exorbitant because of the required size of the BMP treatment area. (27)

**Response:** A 0.10"/hour rate might corresponds to percolation rates of nearly 0.5"/hour or more in some cases. Recall that the design rate would be half this and therefore, the system design will be doubled to accommodate a 0.1'/hour rate.

**Comment:** Appendix C - Loading rate of 5:1 is not practical for small sites. (16)

**Response:** Because a 5:1 loading rate represents a higher proportion of runoff to treatment area, this rate actually favors smaller lots that have a high proportion of impervious area. A 5:1 loading may not be feasible if infiltration rates are low. A 2:1 loading could be problem for smaller lots because the proportion of BMP area is larger. DEP is considering using a maximum design safety factor of 2 rather than 4; meaning the designer would no more than double the BMP design based on a given infiltration rate. This would reduce cost. CG2 may be an option for some small lot development.

**Comment:** Appendix C - Assessment, planning and construction quality assurance is crucial to ensuring BMP performance, whether it be at the consultant level, contractor level, DEP regional level or conservation district level. Some level of consistency is required. (27) (48)

**Response:** DEP agrees and will work on programmatic processes and internal guidance to address this issue properly.