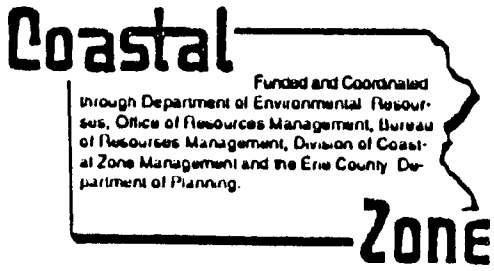
PHASE II STORM WATER MANAGEMENT PLAN
FOR THE
LAKE ERIE WATERSHED
INTERIM REPORT
FOR THE PERIOD FEBRUARY 2, 1993 THROUGH SEPTEMBER 30, 1994

DER GRANT/CONTRACT NO. - CZ1:93.01PE
GRANT TASK NO. - CZ1:93PE.06
ME NO. - 93229



A report of the Pennsylvania Department of Environmental Resources to the National Oceanic and Atmospheric Administration Pursuant to NOAA Award No. - NA37OZ0351

TABLE OF CONTENTS

Part 1: Project Status Report

Part 2: Newsletters

Part 3: Draft copies of Sections 1 and 2 of the Final Report

- Section 1: Introduction
- Section 2: Legal Framework for Storm Water Management

TD224 .P42 E93 1995 c.2

PART 1: PROJECT STATUS REPORT

CHESTER
ENVIRONMENTAL

OCT 0 6 1994

Ref. No. 4026-02

October 5, 1994

Mr. John Mong
Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

Dear Mr. Mong:

Re: Lake Erie Area Watershed Stormwater Management Plan
18-Month Project Status Report

In accordance with your request, I am pleased to provide the following report on the status of the Lake Erie Area Watershed Stormwater Management Plan.

GENERAL

On March 1, 1993, Erie County authorized Chester Environmental to complete a Phase II Pennsylvania Act 167 Watershed Stormwater Management Plan for the Lake Erie Watershed. According to the requirements of the Commonwealth of Pennsylvania's agreement with Erie County and the County's agreement with Chester Environmental, the plan is to be completed by June 30, 1996. The total budget for the project is $323,818 (Chester Environmental, $230,082; Erie County, $93,736). Pennsylvania will reimburse the County 75 percent of the total project cost.

The County's agreement with the Commonwealth specifies the following payment schedule:

Period	Payment for Period	Cumulative Payment	Cumulative Payment (Percent of Total)
1/2/93 - 6/30/93	$ 8,550.00	$ 8,550.00	3.5
7/1/93 - 6/30/94	80,000.00	88,550.00	36.5
7/1/94 - 6/30/95	80,000.00	168,550.00	69.4
7/1/95 - 6/30/96	74,313.50	242,863.50	100.0

WORK PROGRESS AS OF SEPTEMBER 1, 1994

The following paragraphs describe our work progress and status of our charges to the project as of September 1, 1994. The charges presented in this report include billed charges through July 31, 1994, and unbilled charges through September 1, 1994.

Task 1--Project Initiation

This task covers the administrative work required to initiate the agreements between the Pennsylvania Department of Environment (DER), the County, and Chester Environmental.

600 Clubhouse Drive
Moon Township, Pennsylvania 15108
412-269-5700; Fax 412-269-5749

Task 1 was completed at the inception of the project. This included meetings and negotiations with DER, preparation of the documents required to proceed to Phase II, and execution of our contract with Erie County.

No work remains to be completed under this task.

Billings under this task total $3,536.00 or 99.75 percent of the budgeted total ($3,548).

Task 2--Project Coordination/Public Participation

This task consists of project coordination and reporting requirements as well as implementing a public participation program consisting of a project newsletter, meetings with the Watershed Plan Advisory Committee, a training session, and public hearing.

Task 2 will be ongoing throughout the project. Elements of this task completed to date include conducting two Phase II Watershed Plan Advisory Committee (WPAC) meetings and issuing ten newsletters to the WPAC members and other interested parties.

Work remaining to be completed under this task consists of the continued publication of the newsletter and conducting the three remaining WPAC meetings, training session, and public hearing.

Charges under this task total $18,481.50 or 63.2 percent of the budgeted total ($29,264).

Task 3--Data Collection Review and Analysis

Task 3 involves the efforts required to gather, review, and analyze the basic information required to complete the technical and institutional planning steps.

The following work has been completed under this task:

- Collection, review, and compilation of flood problem information from Flood Information Studies completed throughout the watershed.
- Analysis of Flood Information Studies and the extraction of data describing streamflow and velocity relationships at various locations throughout the watershed.
- Collection of rainfall data from the region and the analysis of this information to produce the determination of storm volume/duration/frequency relationships for the region.
- Compilation, review, and analysis of stream obstruction data contained in the prior plan.
- Identification, inspection, and measurement of additional obstructions as required to supplement the available information.
- Development of initial estimates of obstruction capacities.

- Collection of topographic mapping covering the area and the compilation of the hard copy topographic maps into a base map.
- Purchase of digital elevation models spanning the area.
- Preparation and distribution of municipal questionnaires.
- Compilation of the stormwater problem information contained in the municipal questionnaire responses.
- Compilation of the existing and proposed flood protection facilities information contained in the returned questionnaires.
- Contacting DER to obtain information relative to existing and proposed flood protection facilities in the watershed.
- Compilation of the existing and proposed stormwater control facility information contained in the returned municipal questionnaires.
- Obtaining and incorporating TIGER file data into the project GIS database.
- Obtaining and incorporating the County street centerline data into the project GIS database.
- Obtaining and incorporating the Landsat Thematic Mapper Imagery into the project GIS database.
- Discussing municipal questionnaire responses at the WPAC meeting.
- Requesting streamflow monitoring records from the City of Erie.
- Collecting streamflow data from U.S.G.S records.

Work under this task is essentially complete. We are awaiting only the of receipt of additional available streamflow records.

Charges under this task total $30,632.50 or 100 percent of the budgeted total ($30,636).

Task 4--Institutional Data Preparation

This task involves the evaluation of the municipal ordinances in order to prepare a municipal ordinance matrix. This matrix is intended to display the current stormwater management provisions contained in the various municipal ordinances. Work completed to date includes:

- Receipt of stormwater management ordinances currently in effect in the watershed.
- Preliminary review of the content of the ordinance.
- Providing the County with a sample municipal ordinance matrix to be used in compiling the matrix for the Lake Erie Area Watershed.

Work remaining under this task consist of working with the County to guide the assembly of the ordinance matrix.

No charges have been made to this task. Budgeted total, $2,832.

Task 5--Data Preparation for Technical Analysis

This task involves the engineering work necessary to transform the raw information collected in Task 3 into a form that can be directly used for the later technical tasks in the overall planning program.

Work completed under this task includes the following:

- Initial classification of the satellite imagery to produce a preliminary land use classification.
- Delineation of subwatersheds and subbasins. A total of 1,603 individual subareas have been delineated.
- Digitization of the delineated subareas and incorporation of the subarea boundaries into the project GIS.
- Digital elevation models have been incorporated into the project GIS for the purpose of calculating subarea slope area characteristics.
- Digitization of the hydrologic soil group boundaries is ongoing.
- Stream segment length information has been measured and assembled for each of the 1,600 delineated subareas.
- Locations of reported stormwater problem areas have been transferred to the base maps for subsequent digitization.
- Locations of existing and proposed flood control and stormwater management facilities have been transferred to the base maps for subsequent digitization.
- The existing land cover database and GIS coverage for use in the hydrologic model have been completed.
- Locations of reported stormwater problem areas have been digitized and included in the GIS.
- Locations of existing and proposed flood control and stormwater management facilities have been digitized and included in the GIS.
- Locations of significant obstructions have been digitized into the GIS.

- Streamflow velocity information for various streams and locations throughout the watershed have been extracted from published flood information studies for use in developing travel time estimates for modeling purposes.

- Dimensional statistics have been developed for each of the 1,600 subareas.

- Digitization of the hydrologic soil group boundaries is nearing completion.

Work remaining under this task includes incorporation of the County's land use projections, completion of digitizing hydrologic soil group boundaries, and completion of the GIS analysis to produce estimates of runoff curve numbers, impervious percentages, and ground slopes.

Charges under this task total $44,857.50 or 83.4 percent of the budgeted total ($53,748).

Task 6--Model Selection and Setup

Model selection and setup involve the selection and preparation of a hydrologic model appropriate for the analysis of the existing and projected land characteristics of the watershed.

Work completed to date under this task includes the following:

- The Penn State Runoff Model has been selected for use on this project.

- Input data files containing the required topology and layout information have been prepared for all of the watersheds.

- The dimensions of the runoff model have been expanded to accommodate the size of the Elk Creek Watershed.

- Data describing the physical dimensions of the subareas have been incorporated into the model files.

- Testing of the model input files has begun.

- Work regarding the determination of stream segment information and characteristics of small lakes in the watershed is underway.

Work remaining under this task consists of the incorporation of the remaining hydrologic data describing the subareas and information describing the hydraulic characteristics of stream segments and minor lakes.

Charges to date under this task total $21,160.00 or 94.6 percent of the budgeted total ($22,368).

Tasks 7 - 9

The following tasks consist of activities that will be completed in the later stages of the project. No charges have yet been made to them.

Task 7--Completion of Model Runs
Task 8--Technical Standards and Criteria
Task 9--Institutional Analysis

The total budget for these tasks is $44,356.00.

Task 10--Plan Report Preparation

This task consists of the preparation of a report documenting the investigations, findings, and recommendations of the planning process. To date, the following work has been completed under this task:

- Completion of draft Section 1--Introduction.
- Completion of draft Section 2--Legal Framework for Stormwater Management
- Completion of draft Section 3--Watershed Characteristics

Work remaining under this task consists of the preparation of the report as work progresses.

Charges to date under this task total $3,600.00 or 16.6 percent of the total ($21,620.00).

Task 11--Plan Adoption

Work under this task involves work to be performed in conjunction with securing plan adoption. This work will be completed at the close of the project.

No charges have been made to this task which has a total budget of $2,210.00.

Direct Costs

Represent cost items for the purchase of data and materials, travel, mail, telephone, printing costs, and miscellaneous expenses.

Charges to date total $5,102.34 or 26.2 percent of the budgeted amount ($19,500).

STATUS OF BUDGET AND SCHEDULE

The status of our budget and progress relative to the schedule contained in our contract with the County is summarized in Figure 1. This graph compares our progress and total charges by work task to the schedule. As is indicated in Figure 1, we are essentially on schedule for Tasks 1, 2, 3, 7, 8, 9, and 11. We are slightly behind schedule on Task 5, but anticipate that Task 5 will be completed within the next two months and will not affect our overall schedule. Task 4 is behind schedule. However, it is not on the critical path and can be comfortably completed anytime during the next six months. This is a task for which the County has the primary responsibility for completion. We are ahead of schedule for Tasks 6 and 10.

We estimate that our work is approximately 60 percent complete versus a scheduled completion rate of 57 percent as of September 1, 1994. Charges to date total $128,035.10. This represents 56 percent of the total budget. The project continues to be on budget relative to progress and cost.

In terms of DER's minimum progress and payment schedule, we are approximately 5 months ahead of schedule.

Please contact me at 269-5828 if you have any questions.

Very truly yours,

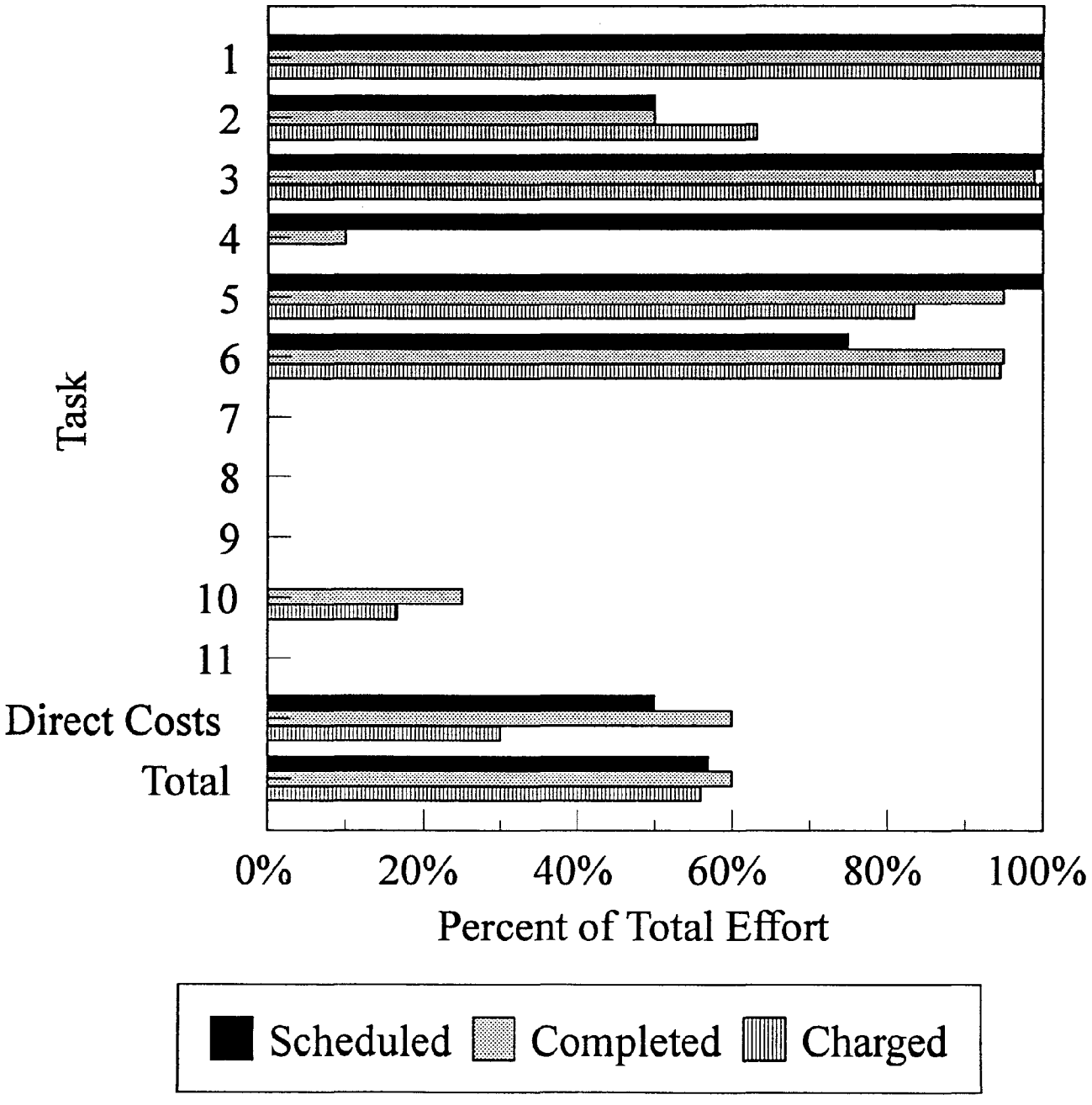
John M. Maslanik, P.E.
Technical Manager

JMM/dje/1

Enclosures

cc: Sharon Knoll

Figure 1
Status of Schedule and Budget



PART 2: NEWSLETTERS

❖Lake Erie Stormwater Management Update❖

Volume 1 Issue 1 March 1993

Lake Erie Area Watershed Plan Set To Proceed

On February 9, 1993, the Pennsylvania Department of Environmental Resources and Erie County signed a watershed stormwater management planning grant agreement for the preparation of an Act 167 Phase II Stormwater Management Plan. The plan, referred to as the Lake Erie Area Stormwater Management Plan, will address stormwater management issues throughout 330 square miles of Erie County which are drained by streams which discharge into Lake Erie.

The signing of this agreement followed the completion of the Phase I Scope of Study for the watershed in June 1992 and the subsequent negotiation of final scope and level of effort with DER.

Under the terms of the agreement, DER will reimburse the County 75% of the estimated $323,800 cost of preparing the plan. In order to accommodate DER funding requirements, the plan will be completed by June 30, 1996.

On March 1, 1993, Erie County retained Chester Environmental as the County's consultant for the preparation of the plan. Chester Environmental, which is headquartered in Pittsburgh, will work with Erie County Planning Department staff to provide the specialized engineering, hydrologic modeling and planning services necessary to complete the plan.

Having executed the agreement with DER and retained a consultant, Erie County is prepared to proceed with the development of the plan. This newsletter is the first step in initiating the project.

◆◆◆

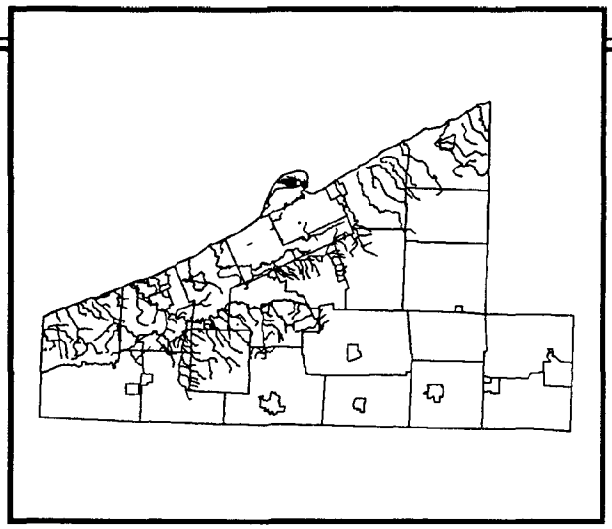


Illustration of streams comprising the Lake Erie Area Watershed. (stream locations and municipal boundaries extracted from U.S. Census Bureau TIGER files)

Basic Goal of the Plan Is To Prevent Future Flooding Problems

The preparation of the Lake Erie Area Watershed Stormwater Management Plan is mandated by the Pennsylvania Storm Water Act (Act 167 of 1978). Act 167 was passed in recognition that land development activities can significantly increase stormwater runoff and thereby create flooding, erosion and sedimentation problems which can damage downstream property and threaten public safety.

The water that runs off of the land into surface waters during and immediately after a rainfall event is referred to as stormwater. The amount of water which runs off of a particular area and the rate at which the water leaves the area are largely dependent upon the characteristics of the ground surface. Wooded or grassed areas exhibit much less stormwater runoff than what occurs from paved surfaces such as roads, buildings and parking areas.

Since land development activities frequently involve the conversion of land from a natural, low runoff potential state (i.e. wooded, grassed, etc.) to a high runoff potential state (i.e. paved or compacted surfaces), land development activities can result in substantial increases in the volume and velocity of stormwater runoff.

The general goal of the Stormwater Management Act is to require that stormwater runoff from land development activities be controlled as necessary to reduce the potential for the creation of flooding, sedimentation or erosion problems downstream of the development sites. This goal is to be achieved by instituting and enforcing municipal ordinance provisions which require the proper management and control of stormwater runoff from land development sites.

The purpose of the stormwater management plan is to develop the specific stormwater control standards and criteria which will be appropriate and effective in the watershed and to develop model stormwater management ordinance provisions which can be used as a guide by municipalities as they adopt ordinance provisions which they will subsequently enforce.

◆◆◆

Lake Erie Stormwater Mgmt. Newsletter Instituted

The Erie County Department of Planning considers the ongoing, informed involvement of local municipal officials, affected state and county agency personnel and interested citizens to be an important aspect of the plan development process. To that end the County intends to publish this "Lake Erie Stormwater Management Plan Update" newsletter.

This newsletter will be published semi-monthly and distributed to identified interested parties. The purpose of this newsletter will be to sustain interest in the project for the purpose of encouraging ongoing involvement in the preparation of the plan. This will be accomplished by providing brief reports of the status of the project, outlines of pending activities and general discussions of interim findings, conclusions and issues of concern.

Readers of this newsletter are encouraged to offer their comments relative to the content of the Update and other related issues. It is anticipated that if specific local issues and concerns are expressed as the plan is being prepared, they can be effectively addressed in the final plan document.

Erie County Department of Planning:

Sharon L. Knoll
Erie County Court House
Erie, PA 16501
(814) 451-6336

Chester Environmental

John M. Maslanik
Chester Environmental
P.O. Box 15851
Pittsburgh, PA 15244
(412) 269-5828

Watershed Plan Advisory Committee to be Reactivated

During the development of the Scope of Study for the Lake Erie and Elk Creek watersheds, the Erie County Department of Planning assembled a Watershed Plan Advisory Committee (WPAC). The committee was comprised of representatives of the municipalities which lie in the watersheds, staff of affected federal, state and county agencies and interested citizens.

This committee met twice during the preparation of the Scope of Study for the purpose of offering comment relative to the recommended approach to the development of the full stormwater management plan. The municipality representatives of the WPAC also provided the consultant with specific information regarding stormwater issues existing in their municipalities.

As we proceed with the development of the Lake Erie Area Stormwater Management Plan, the WPAC will be reactivated. To that end, within the next several weeks, the Erie County Planning Department will be contacting the municipalities, agencies and interested parties for the purpose of reconvening the WPAC. Each party will be asked to identify the individual designated as the WPAC representative. The municipalities involved in the Lake Erie Area Watershed Stormwater Management Plan are listed in Table 1.

In addition to these municipalities, various federal, state and county agencies will be asked to appoint or reappoint representatives. Private individuals and interest groups which have expressed an interest in this process will also be invited to participate via membership on the committee.

As was the case during the preparation of the Scope of Study, the WPAC members will be asked to provide specific information concerning stormwater management issues affecting their municipalities, agencies or interests and to comment upon the Plan as it is produced.

Table 1
Watershed Municipalities

Conneaut Township
Elk Creek Township
Erie City
Fairview Borough
Fairview Township
Franklin Township
Girard Borough
Girard Township
Greene Township
Greenfield Township
Harborcreek Twp.
Lake City Borough
Lawrence Park Twp.
McKean Borough
McKean Township
Millcreek Township
North East Borough
North East Township
Platea Borough
Springfield Township
Summit Township
Venango Township
Washington Twp.
Waterford Township
Wesleyville Borough

Five (5) WPAC meetings are planned to be held as the plan is being prepared. It is anticipated that the meetings will be held at six to nine month intervals during the course of the study. A "training session" will be held at the close of the planning process to provide an overview of implementation issues. Meetings will be held at the Erie County Court House.

In addition to these scheduled meetings, WPAC members will be kept informed of progress through this "Update" newsletter and other correspondence.

In the early months of the project, the WPAC members will be asked to assist in securing completed questionnaire forms from their municipalities. The questionnaires will request information concerning stormwater problems, existing and planned stormwater and flood control facilities and the approximate locations of stormwater drainage facilities. The forms will be distributed prior to the first WPAC meeting.

◆◆◆

Table 2
Named Streams

Bear Run
Brandy Run
Cascade Creek
Crooked Creek
Dewey Run
Eightmile Creek
Elk Creek
Falk Run
Fivemile Creek
Fourmile Creek
Goodban Run
Halls Run
Lawson Run
Little Elk Creek
Marshall Run
McDonnel Run
Middle Run
Mill Creek
Orchard Beach Run
Raccoon Creek
Sevenmile Run
Sixmile Creek
Sixteenmile Creek
Trout Run
Turkey Creek
Twentymile Creek
Walnut Creek
Wilkins Run

Lake Erie and Elk Creek Designated Watersheds Are Combined

What is now termed the Lake Erie Area watershed was originally designated by DER under Act 167 as two separate watersheds: 1) the Elk Creek watershed and 2) the Lake Erie watershed which was comprised of the other areas of Erie County which drain into Lake Erie within the County. A listing of named streams in the two watersheds is provided in Table 2.

In order to reduce planning costs and avoid duplication of efforts, Erie County petitioned DER to combine the two watersheds into a single designated watershed under Act 167. A public meeting was held on February 9, 1993 to open this proposal for public comment. There were no adverse comments received and receipt of formal notification of the redesignation of the watersheds is expected shortly.

◆◆◆

First WPAC Meeting in April

Pending the reactivation of the WPAC, the first meeting of the committee will be held in April. The purposes of the meeting will be to kick-off the planning effort, reintroduce the Act 167 planning process and discuss early data collection activities, including completion of the municipal questionnaires. WPAC members will be notified by mail of the date, time and location of the meeting.

◆◆◆

PENNVEST for Stormwater Projects

The PENNVEST Act of 1988 has been amended to make program monies available to municipalities and counties which are in compliance with Act 167. This added impetus to the completion and implementation of our stormwater management plan will be discussed in upcoming WPAC meetings and issues of this Update.

◆◆◆

❖Lake Erie Stormwater Management Update❖

Volume 1 Issue 2 May 1993

First WPAC Meeting Held

The first meeting of the Lake Erie Area Watershed Stormwater Management Plan Watershed Plan Advisory Committee (WPAC) was held on April 21, 1993. The meeting was held at 7:00 pm in Room 117 of the Erie County Court House.

The meeting was conducted as a "kick-off " to begin the process of developing the Lake Erie Area Watershed Stormwater Management Plan. All watershed plan advisory committee members and identified interested parties were invited to attend. Representatives of the Pennsylvania Department of Environmental Resources, the Erie County Planning Department and Chester Environmental were on hand to discuss Act 167 stormwater management issues and recent developments which open Pennsylvania Infrastructure Investment Authority (PENNVEST) funds to stormwater related projects.

Durla Lathia, of the PA Department of Environmental Resources, provided an overview of the requirements of Act 167 (the Pennsylvania Stormwater Management Act) and outlined the general procedures for complying with the Act. Mr. Lathia also reviewed the recent changes to the PENNVEST program. These changes make PENNVEST funds available to municipalities which are in compliance with the requirements of Act 167 for the purpose of constructing stormwater management facilities. Examples of the types of stormwater projects which may be eligible include the construction of detention basins to control runoff, upgrades of existing storm sewer systems or installation of new systems to address point or nonpoint source pollution associated with stormwater runoff. Additional information can be obtained by calling PA DER at (717)-540-5080.

John Maslanik, of Chester Environmental, presented an overview of the approach to be followed during the preparation of the Lake Erie Area Plan. He outlined the schedule for the completion of the plan and introduced the municipal questionnaire.

Municipal Questionnaires Distributed

The Erie County Planning Department has mailed municipal questionnaires to each of the municipalities in the Lake Erie Area Watershed. These questionnaires are designed to provide Erie County and its consultant with information critical to the development of the Lake Erie Area Watershed Stormwater Management Plan. The general types of information requested in the questionnaire include:

1. storm drainage / flooding problems;
2. existing and proposed flood control projects;
3. existing and proposed stormwater control facilities;
4. existing and proposed stormwater collection systems; and
5. additional information that the municipality believes should be considered during the preparation of the plan.

(continued on next page)

List of Attendees
April 21, 1993 WPAC Meeting

Mark Corey, Harborcreek Twp.
William Dunagan, Millcreek Twp.
LeRoy Gross, Erie County Conservation District
Leon Johnson, Millcreek Twp.
Sharon Knoll, Erie County Planning Department
Durla N. Lathia, PA DER
Lynn E. Manahan, PA DER
John Maslanik, Chester Environmental
Chuck Maynard, Fairview Borough
Mike McKee, Chester Environmental
Richard Morris, City of Erie
Carl D. Rupp, Greenfield Twp.
Ray Sanders, Washington Twp.
David Skellie, Erie County Planning Department
Lew Steckler, U.S. S.C.S.
Joseph Skrzypczak, Millcreek Twp.
Robert Smith, Greene Twp.
Robert Snow Sr., Springfield Twp.
Robert Weir, McKean Twp.
Bill Westerberg, Girard Twp.

Municipal Questionnaire *(Continued)*

Each municipality has been requested to complete the questionnaire to the best of their knowledge and ability. WPAC members have been asked to encourage their municipalities to complete the questionnaire and assist in the completion of the forms, if appropriate.

Several municipalities have already responded and have submitted questionnaires.

We recognize that the completion of the questionnaires represents an expenditure of time and effort on the part of the municipalities. However, the information which can be provided in this manner will be extremely important in the preparation of the Watershed Stormwater Management Plan. Consequently, we encourage each municipality to complete and return the questionnaires to the Erie County Department of Planning by July 1, 1993. Questions regarding the questionnaire should be addressed to Sharon Knoll at County Planning.

Assembly of Hydrologic Database Proceeding

A key element of the preparation of the Watershed Stormwater Management Plan is the assembly of a comprehensive database describing factors which affect stormwater runoff volumes and rates of flow. These factors, which are referred to collectively as a hydrologic database, include information about the following:

1. the sizes, location and orientation of drainage areas;
2. ground slopes and direction of slope;
3. soil characteristics related to runoff potential;
4. type of land cover and amount of impervious surfaces;
5. stream channel configurations;
6. locations and characteristics of major storm drainage facilities;
7. historical rainfall storm information, including the frequency at which storms of various sizes occur;
8. available information describing measured rainfall amounts and resultant stream flows.

Chester Environmental is currently proceeding with the compilation of the hydrologic database. To date, the 330 square mile Lake Erie Area Watershed has been divided into over 500 sub-drainage basins. These subbasins have been delineated on a United States Geological Survey (USGS) topographic map base. The boundaries of each subbasin will be digitized into a computerized geographic information system. Specific physical descriptions of land cover, soil classifications, slope and drainage area will be assembled for each of these areas and coded into the hydrologic model.

Work has also proceeded with acquiring data from various sources, including the U.S. Soil Conservation Service (soils data); USGS (digital elevation models); National Climatic and Atmospheric Administration (rainfall records); Earth Observation Satellite Corporation (LandSat imagery); Federal Emergency Management Agency (flood information studies). This information is being assembled as it is obtained.

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 1 Issue 3 July 1993

Federal Flood Insurance Studies Reviewed to Identify Flood Problem Areas

An important aspect of the Watershed Stormwater Management Plan for the Lake Erie Area Watershed consists of the identification of existing flooding problems within the watershed. This information is used for several purposes. Most importantly, the location of existing flooding problems is considered during the development of recommended stormwater management standards. This information is also included in the stormwater plan document as a compendium of areas which should be considered for remedial activities.

Information identifying flooding problems will be obtained from several sources, including past studies, responses to the municipal questionnaires and input provided by the members of the Watershed Plan Advisory Committee. An important source of information concerning flooding problems are Flood Insurance Studies (FIS) published by the U.S. Federal Emergency Management Agency Federal Insurance Administration. These studies typically contain brief descriptions of reported flooding problems within the municipality for which the study has been prepared.

Available Flood Insurance Studies for the municipalities in the Lake Erie Area Watershed have been obtained. These studies have been reviewed to extract information which describes reported flooding problems. This information is summarized in this newsletter. We encourage you to review this information. We ask that you use the municipal questionnaire or drop the County Planning Department a note to bring to our attention any additional problem areas with which you may be familiar.

Conneaut Township

The FIS does not identify any flooding problems in the Township.

City of Erie

The worst flood in the City's history occurred on Mill Creek in August 1915 during which time 5.8 inches of rain fell in 13-1/2 hours. On July 22, 1947, significant flooding occurred when a total of 10.4 inches fell on the City during a 24 hour period. Since these floods, a large storm drainage system has been installed to carry all or parts of Mill Creek, Cascade Creek, McDaniel Run and several smaller streams. The FIS reports that, since the construction of these facilities, the City has experienced few flooding problems.

Fairview Borough

Most flooding in the Borough is caused by intense localized thunderstorms in the summer and by heavy rains combined with snow melt in the winter and early spring. The Borough has experienced few serious flooding problems in the past, probably due to a lack of development in the flood plains. The drainage structures along Trout Run are generally adequate to pass flood flows without severe backwater effects if they are kept clear of debris.

Fairview Township

The Township has experienced few serious flooding problems, probably due to a lack of development in the flood plains. The drainage structures on the streams studied in detail in the FIS are generally adequate to pass flood flows without severe backwater effects if they are kept clear. Occasionally, a culvert or bridge will clog with ice or debris and create a local flooding hazard.

Greenfield Township

No specific flooding problems are listed for Greenfield Township, although the FIS indicates flooding due to heavy rains combined with snow melt in the winter and spring, ice jams in the spring and heavy local thunderstorms in the summer.

Harborcreek Township

No major floods of record are reported within the Township. Minor flooding of low lying areas occurs usually as a result of spring rains and snow melt. Flash floods also occur sometimes as a result of severe thunderstorms. At times, ice jams have caused minor backwater flooding at the State Route 5 bridge.

Lawrence Park Township

The major flood of record on McDaniel Run and Fourmile Creek occurred as a result of the intense storm described previously under the City of Erie discussion. Flooding has also occurred along the small unnamed tributary between Smithson Avenue and Tydall

FIS Reported Problems *(Continued)*

Street.

McKean Borough

No flooding problems are reported.

McKean Township

The FIS indicates that unspecified areas in the Township are subject to flash flooding from high intensity thunderstorms.

Millcreek Township

Only minor flooding is reported to occur along streams due to limited development in the flood plain. However, more serious flooding can occur when bridge and culvert openings are blocked by ice and debris. Other problems occur in the flat, highly developed northwest portion of the Township where there is insufficient natural slope to permit storm water to flow to the streams, thus creating surface ponding. The areas along West Branch Cascade Creek, especially from the 15th Street Bridge to the corporate limits, are specifically identified as being affected by flooding due to clogging of several small culverts.

North East Borough

During a local storm on March 16, 1942, streams throughout the Borough flooded causing thousands of dollars of damage and the death of one resident. On June 23, 1972, rains from Hurricane Agnes caused flooding but not as serious as in 1942. A flooding problem is reported to exist at the grade crossing of South Washington Street and the railroad. This problem is attributed to an undersized culvert.

North East Township

No specific problems are presented, although the FIS points to the possibility of minor flooding along streams as a result of spring rains and snow melt and flash flooding due to thunderstorms.

Summit Township

Some localized flooding is reported to occur along Walnut Creek.

Venango Township

No flooding problems are reported.

Washington Township

No flooding problems are reported.

Waterford Township

No flooding problems are reported.

Wesleyville Borough

Flooding and subsequent damage in the Borough occurred during a storm of July 22-23, 1947. This flooding and damage are reported to have been caused by backups in the storm sewer system rather that as a direct result of high water in Fourmile Creek. Reportedly, flooding in the Borough continues to be caused by problems in the storm sewer system.

Additions/Corrections?

We do not believe this information to be comprehensive and look to you to supplement this information with local knowledge you possess. Please use the Municipal Questionnaire to supplement this information or do so by dropping a note to Ms. Sharon Knoll at the Erie County Planning Department. Your assistance will be appreciated.

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 1 Issue 4 September 1993

Municipal Questionnaires Still Outstanding

In support of the preparation of the Lake Erie Area Watershed Stormwater Management Plan, the Erie County Planning Department has requested that each of the municipalities in the watershed complete and return a municipal questionnaire. The purpose of this questionnaire is to collect information critical to the development of the watershed stormwater management plan. The questionnaire also provides the representatives of the municipality with an opportunity to voice their ideas and concerns related to stormwater management planning.

It was requested that the questionnaires be returned by July 1, 1993. To date, we have received completed questionnaires from 16 out of the 25 municipalities involved in the plan. Completed questionnaires remain outstanding from the following municipalities:

Conneaut Township
Fairview Township
Girard Borough
Millcreek Township
North East Township
Platea Borough
Springfield Township
Waterford Township
Wesleyville Borough

We encourage the representatives of the municipalities listed above to attempt to complete and return their questionnaires as soon as possible. Questions concerning the questionnaire should be addressed to Sharon Knoll at County Planning.

Analysis of Satellite Imagery is Underway

Existing land cover use is an important factor affecting stormwater runoff. Land cover relates to the type of features present on the surface of the earth. Urban buildings, roads, grassed lands, forested lands, water and farm fields are all examples of land cover. The amount of rain water which runs off of the land is directly affected by the nature of the land cover. For example, much more water runs off a paved area than from the same sized area which is grassed. Similarly, more rain water tends to run off from agricultural fields than from forested areas. Consequently, the estimation of existing land cover types throughout the watershed is an important element of the Lake Erie Watershed Stormwater Management Plan.

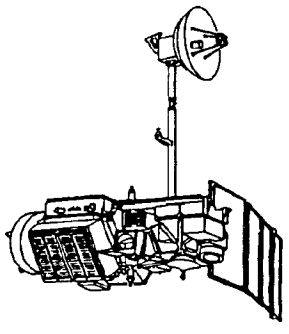
The estimation of land cover types throughout the watershed is being based primarily upon information obtained from LANDSAT. LANDSAT is an earth observation satellite that contains two different sensor systems: the multispectral scanner and the thematic mapper. Since the resolution and usefulness of the multispectral scanner is not as good as for the thematic mapper, our work will employ data collected by the thematic mapper. The thematic mapper is sensitive to seven different and carefully selected wavelengths or bands of electromagnetic energy.

Since various types of land cover reflect light differently, different types of land cover can be distinguished in the satellite image by analyzing the amounts of light reflected in each of the seven spectral bands. The process of analyzing the satellite image to produce estimates of land cover types is referred to as classification. Chester Environmental has purchased a LANDSAT satellite image spanning the watershed and has begun the process of classifying the image to extract information concerning land cover conditions.

Using the satellite image and supplemental information obtained from existing maps and aerial photographs, the distribution of the following categories of land cover will be described:

1. residential
2. commercial
3. industrial
4. transportation
5. other/mixed urban
6. cropland and pasture
7. orchards, vineyards, etc.
8. other agriculture
9. forests
10. barren land
11. water

The locations of these land cover classes will be mapped digitally in a geographic information system. This information will be combined with soil property information being assembled to produce estimates of the runoff potential of specific areas throughout the watershed.



LANDSAT Satellite.

Digitization of Watershed Drainage Areas Proceeding

The Lake Erie Watershed has been divided into over 500 individual drainage areas. These drainage areas were defined based upon an analysis of topography, stream drainage patterns and the locations of possibly significant stream obstructions. These individual drainage areas will be used to model hydrologic conditions throughout the Lake Erie Area Watershed. This model will be used to develop standards for the control of stormwater from new land development activities.

The information describing conditions in this large number of areas spanning the over 300 square mile watershed is being developed and managed using a computerized geographic information system (GIS). In order to enter the drainage area boundaries into the computer, it is necessary to translate the information shown on maps into a machine readable format. This is currently being accomplished through a process known as digitization. Once completed, the outlines of the boundaries of each of the drainage areas will be described in the computer database. These drainage areas will be registered to the State Plane Coordinate System so that this information can readily be combined with data and information from other sources to describe hydrologic conditions existing within each drainage area. This additional information includes land cover, soil characteristics and ground slope.

Initial Field Survey of Obstructions Completed

The 1981 stormwater management plan contains information describing the dimensions of 345 stream obstructions in the watershed. This information has been reviewed and an additional 77 obstructions for which no information is contained in the existing database were identified. In August 1993, Chester Environmental personnel visited the sites of each of these additional obstructions to field measure their dimensions. The dimensional information will be used to produce evaluations of the ability of significant stream obstructions to pass the stream flows generated by storms of various magnitudes. As we proceed with the review of information provided in the municipal questionnaires, we will conduct additional field investigations as necessary to gather information about specific identified problem areas.

This newsletter is published semi-monthly as a means of informing interested parties of the progress of the planning process and encouraging their input into the planning process. We encourage you to direct any questions or comments to:

Erie County Department of Planning:

Sharon L. Knoll
Erie County Court House
Erie, PA 16501
(814) 451-6336

or

Chester Environmental

John M. Maslanik
Chester Environmental
P.O. Box 15851
Pittsburgh, PA 15244
(412) 269-5828

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 1 Issue 5 December 1993

Development of Watershed Technical Standards and Criteria

Introduction

The basic standard for stormwater management as established by the Pennsylvania Stormwater Management Act (Act 167) is that those involved in activities which can generate additional stormwater runoff, increase its velocity, or change the direction of its flow must be responsible for controlling and managing the runoff so that those changes will not cause harm to other persons or property throughout the watershed. In order for land developers to control and manage their stormwater runoff discharges as required by Act 167, it is necessary that they be informed of the runoff control standards which they must meet. They also must be informed of the characteristics of the rainfall events for which they must provide adequate controls.

The primary purpose for the completion of the watershed stormwater management plans required by Act 167 is the development of appropriate runoff control standards and control storm criteria for each watershed studied. This issue of the newsletter provides an introduction to the development of appropriate stormwater management design storm criteria. A subsequent issue will address control standards. Specific criteria for the Lake Erie Area watersheds will be developed through the investigation of conditions in the watershed and the application of the hydrologic model being assembled during the planning process.

Control Storm Characteristics Criteria

Clearly, since the objective of stormwater management is to control stormwater runoff and runoff is directly related to the characteristics of the rainfall event which produces the runoff, it is important that the characteristics of the rainstorms which must be adequately controlled be defined.

The critical rainfall event characteristics are as follows:

1. An identified duration of the particular rainfall event.
2. An identified frequency of occurrence of the storm event.
3. An identified volume or total amount of rainfall that can be expected from a particular storm.
4. An identified distribution or pattern of precipitation falling during the storm.

Storm Duration

Storm duration refers to the length of time over which the specified amount of precipitation falls. This factor is of concern because rainfall duration has a direct effect upon the resulting runoff volume and peak rate of discharge. The length of the rainfall period contributing to the peak runoff rate is related to the time it takes for runoff to travel from the most distant point of the watershed to the point of interest. This is referred to as the time of concentration. In very small watersheds, the critical storm duration may be measured in minutes. However, in watersheds the size of those in the Lake Erie area, the critical storm duration will be measured in hours.

The hydrologic model will be used to identify the appropriate design storm duration for use in the Lake Erie area watersheds. The model will be used to simulate the effects that storms with 3, 6, 12 and 24 hour durations will have on peak stream discharges. The storm durations producing the largest peak stream discharges will be identified and specified for use in the design of stormwater controls.

Storm Distribution

The rate at which rain falls during the storm is seldom constant. The variation of rainfall intensities during the rainfall event is referred to as the storm rainfall distribution. This distribution of rainfall is relevant because it has a direct bearing upon the peak rate of runoff produced by the storm. The U.S. Soil Conservation Service (SCS) has developed synthetic rainfall distribution patterns based upon National Weather Service data for various parts of the country. These distribution patterns were developed to produce design storm distributions which tend to produce conservative peak discharge runoff estimates. The Type II SCS pattern will be used in the Lake Erie area.

Storm Return Frequencies and Rainfall Volumes

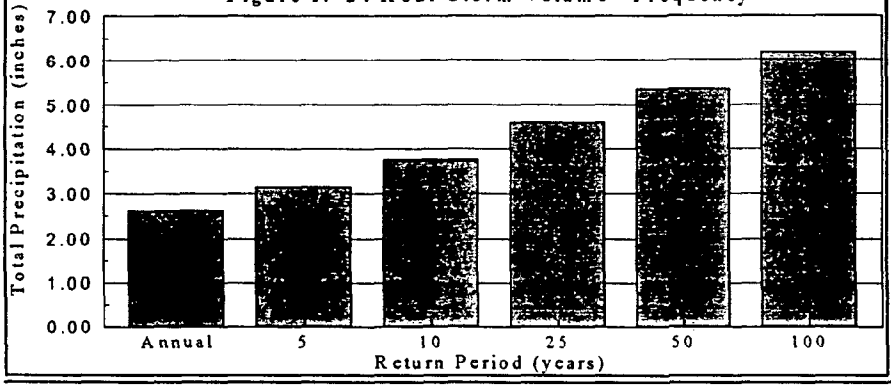
Storm return frequency refers to the average interval in years over which a storm event of a given precipitation volume can be expected to recur. For example, reference to a "10-year" storm with an associated 3.7 inch 24 hour duration storm volume indicates that a storm producing 3.7 inches of rainfall over a 24 hour period on average can be expected to occur approximately once every ten years. Another way to consider this storm is that a storm producing 3.6 inches of rain over a 24 hour period has approximately a 10% chance of occurring in any given year.

Information describing the return frequency of storms of various durations and volumes throughout Pennsylvania has been developed for the Pennsylvania Department of Transportation. This information is summarized for a 24 hour duration storm in Figure 1. As is indicated in Figure 1, the total 24 hour rainfall volume ranges from 2.6 inches for a storm which can be expected to be experienced at least once per year to 6.2 inches for a storm which will occur roughly once every 100 years.

Since larger rainfall volumes produce larger amounts of stormwater runoff, the selection of the return period of the storms to be managed will directly effect the sizing of stormwater control facilities and the degree of stormwater runoff protection afforded to downstream persons and property.

The selection of the appropriate design storm return frequencies and associated volumes will be made based upon a review of current conditions in the watershed, design currently in place, standard practice and local preferences as revealed through consultation with the County Planning Department and the Watershed Plan Advisory Committee.

Figure 1: 24 Hour Storm Volume - Frequency



This newsletter is published semi-monthly as a means of informing interested parties of the progress of the planning process and encouraging their input into the planning process. We encourage you to direct any questions or comments to:

Erie County Department of Planning:

Sharon L. Knoll
Erie County Court House
Erie, PA 16501
(814) 451-6336

or

Chester Environmental

John M. Maslanik
Chester Environmental
P.O. Box 15851
Pittsburgh, PA 15244
(412) 269-5828

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 2 Issue 1 February 1994

Development of Watershed Stormwater Control Standards

Introduction

The basic standard for stormwater management as established by the Pennsylvania Stormwater Management Act (Act 167) is that those involved in activities which can generate additional stormwater runoff, increase its velocity, or change the direction of its flow must be responsible for controlling and managing the runoff so that those changes will not cause harm to other persons or property throughout the watershed. In order for land developers to control and manage their stormwater runoff discharges as required by Act 167, it is necessary that they be informed of the runoff control standards which they must meet. They also must be informed of the characteristics of the rainfall events for which they must provide adequate controls.

The primary purpose for the completion of the watershed stormwater management plans required by Act 167 is the development of appropriate runoff control standards and control storm criteria for each watershed studied. The December issue of the newsletter provided an introduction to the development of appropriate stormwater management design storm criteria. This issue introduces the basic concepts to be used in the development of stormwater runoff control standards. Specific stormwater control standards for specific locations throughout the Lake Erie Area watersheds will be developed through the application of the hydrologic model being assembled during the planning process.

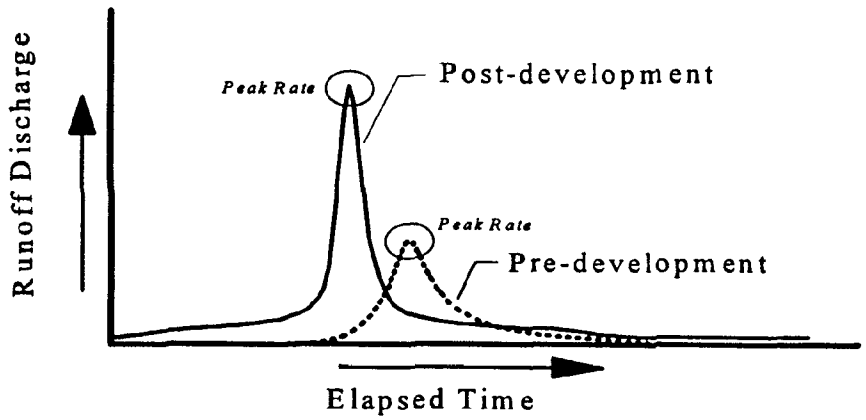
General Effects of Land Development on Runoff

Land development activities generally change the characteristics of the land surface in several ways that have a direct effect upon the amount of stormwater runoff that is generated from the development site. Land development normally includes paving and/or otherwise covering the ground with impervious surfaces. For example, a natural area generally contains no paved surfaces. If this area is developed into a single family residential land use, 10% to 20 % of the area will be covered by such impervious surfaces as roads, streets, walks and homes. If the area is developed to a commercial or industrial land use, the amount of impervious surface will increase to as much as 90% of the area. Such an increase in the amount of paved surfaces reduces the opportunity for rainfall to percolate into the ground and results in increased runoff volumes.

Land development also tends to reduce the amount of vegetation covering the site. This reduces the amount of precipitation which is captured in the vegetation and held until it evaporates. This further increases runoff volumes. Finally, land development frequently increases the speed at which runoff leaves the site. This is a result of replacing natural drainage channels with smooth lined channels and pipes.

The hydrographs presented below illustrate the overall effects of typical land development on stormwater runoff. The indicated increases in total runoff volume and peak rate of discharge are the results of decreased infiltration into the ground water and decreased rainfall interception by vegetation. The higher runoff velocities associated with land development contribute to the higher peak discharge rate and the more rapid rise and fall of the runoff hydrograph.

Comparison of Pre and Post Development Hydrographs



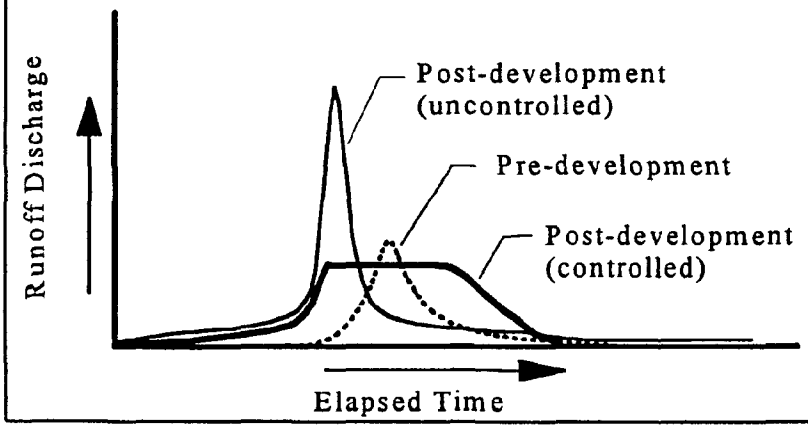
Runoff Control Standards

The most effective means of satisfying the basic requirements of Act 167 would be by controlling runoff from new land development such that both the total volume and peak rate of runoff from new development are identical to that which occurred from the site before that land was changed. In other words, the post-development runoff hydrograph would be identical to the pre-development hydrograph. If this could be accomplished, runoff from the new development would not produce any effect on downstream flows and any concern relative to the creation of downstream damage potentials would be eliminated. Unfortunately, in most cases, it is impossible to avoid increasing total runoff volumes. Therefore, the inevitability of some degree of runoff volume increases must be accepted and the primary emphasis of the runoff control standards is placed upon the control of the peak rate of discharge. The peak rate of discharge is defined as the maximum rate of flow from the development site. It is represented by the highest point of the discharge hydrograph. If the maximum rate of discharge from a developing site is limited so that it does not exceed the maximum rate that occurred prior to development, the potential for creating downstream flooding problems is minimized.

The basic runoff control standard to be enforced in the watershed will, therefore, be that the post-development peak runoff discharge rate shall not exceed the peak runoff discharge rate that occurred prior to development (pre-development).

Controlling the discharges of the larger post-development runoff volumes in order to limit the peak discharge rate to the pre-development level usually is accomplished by storing portions of the runoff and "bleeding" the runoff from the site at a controlled rate. This tends to extend the hydrograph and increases the period of time over which the elevated flow rates are discharged. Because the elevated flow rates occur for a longer period of time, the potential exists for the extended high flows to combine with peak discharges originating from other points in the watershed. This combination of flows can result in increases to downstream peak flows. Release rate percentages will be assigned to subareas throughout the watershed to avoid this from occurring. Release rate percentages are percentages of the pre-development discharge rate to which post-development discharges must be limited to avoid problems associated with attenuated peak discharges. **The release rate percentage represents the second level of runoff control standard.** The results of the application of the basic and release rate percentage standards are illustrated by the hydrographs shown to the left.

Illustration of Controlled Discharge Hydrograph



Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 2 Issue 2 April 1994

Stormwater Control Techniques
Runoff Volume Reduction Measures

Introduction

Previous issues of this newsletter described the basic runoff standards generally adopted under the Pennsylvania Stormwater Management Act. In general, the runoff control standards call for control the runoff from new land development sites such that the post-development peak rate of runoff does not exceed the pre-development peak or a percentage thereof as is necessary to prevent the occurrence of flooding problems.

This can be accomplished in two ways: 1) steps can be taken to avoid increases in total runoff volume and 2) facilities can be constructed to limit peak discharge rates through the use of stormwater detention facilities. This issue of the newsletter contains a general overview of measures which can be taken to minimize increases in total runoff volume.

All things considered, the most advantageous means of meeting these requirements is by minimizing the amount of increased runoff volumes produced. If it were possible to complete the new development in a manner such that there would be no change to either the volume or peak rate of discharge after development, there would be essentially no stormwater related impacts resulting from the development. While it is recognized that, in most cases, it may not be possible to accomplish the goal of making both post-development runoff volumes and peak discharge rates match pre-development conditions, reasonable efforts should be made to minimize increases in total runoff volumes prior to the design of supplemental peak discharge control facilities.

The following are brief descriptions of measures which may be taken to limit increases in total runoff volumes resulting from new developments. The applicability of these measures is highly site specific and dependent upon the nature of the development. However, it is recommended that the potential for instituting one or more of these measures be seriously evaluated and considered early in the design of the land development.

Limit the Amount of Land Disturbed

The added volume of runoff produced as a result of the development of "virgin" land is directly related to the amount of land cover changed from its natural state to a more impervious condition (typically pavement). Consequently, increases in runoff volumes can be minimized to the extent that land cover disturbances can be minimized.

Individuals involved in land development activities should, therefore, be encouraged to optimize their development activities from the standpoint of accomplishing the objectives of the development while minimizing the amount of natural area disturbed and the amount of impervious surfaces created.

Utilize Grass and Rock Lined Waterways

Grassed and rock lined waterways serve to reduce runoff volumes and peak rates of discharge in two ways. First, they convey the runoff over a pervious surface, thereby providing an increased opportunity for infiltration to the ground water. Second, they reduce flow velocities, thereby increasing the time of concentration and reducing peak discharge rates.

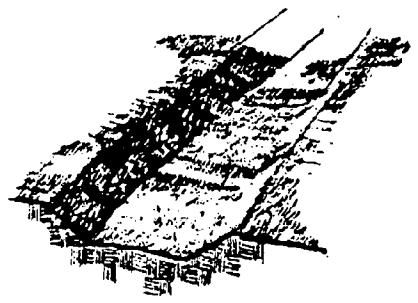


Illustration of a grass lined waterway

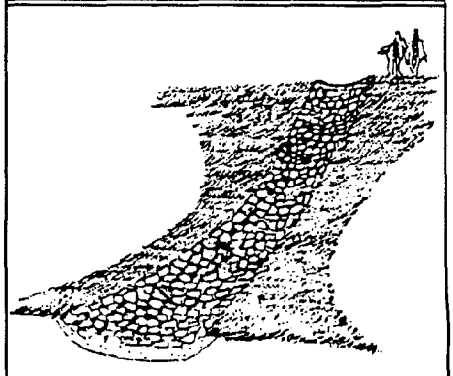
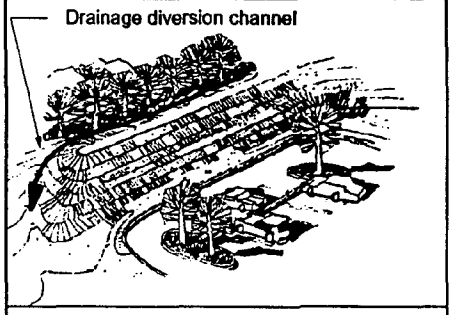


Illustration of a rock lined waterway

Maintain Moderate Slopes

Maintaining moderate slopes will increase the time of concentration of the runoff by reducing overland flow velocities and often increasing the overland flow length. This will also produce the additional benefit of reducing total runoff volumes through infiltration if the site has well drained soils. Where steep slopes cannot be avoided, drainage should be diverted around the steep slopes.



Example of landscaping around steep slopes.

Use Infiltration Devices

Infiltration devices are used to reduce runoff volumes and flood peaks by releasing all or part of the stored runoff into the ground water. Infiltration devices include basins, pits and trenches, all of which serve to induce the infiltration of surface water runoff into the ground water. When properly and carefully designed, infiltration devices can be effective. However, caution should be exercised in their use. Large scale infiltration techniques should only be used in areas underlain by soils with high infiltration capacities. In addition, the use of large scale infiltration devices should not be used in landslide prone areas and in proximity to water supply wells. In general, infiltration systems should not be used where there is a significant potential for the runoff to be contaminated (i.e. industrial sites, commercial parking areas, etc.).

Install Porous Pavements

The use of porous paving materials is an option that can be employed in selected applications. Porous paving materials include gravels, open paving stones or blocks, and special asphalt mixtures designed to pass water at a high rate to a specially prepared subbase. Regardless of the type of material, the goal is to provide a suitably solid and stable surface to satisfy the needs of the development while maintaining a degree of perviousness through which runoff can infiltrate to ground water. As is the case with all of the methods presented in this newsletter, it is unlikely that porous pavements alone can adequately control runoff from significant developments. However, each technique can be an important component of an effective overall stormwater management system consisting of combinations of volume reduction measures and stormwater detention peak flow control techniques.

This newsletter is published semi-monthly as a means of informing interested parties of the progress of the planning process and encouraging their input into the planning process. We encourage you to direct any questions or comments to:

Erie County Department of Planning:

Sharon L. Knoll
Erie County Court House
Erie, PA 16501
(814) 451-6336

or

Chester Environmental

John M. Maslanik
Chester Environmental
P.O. Box 15851
Pittsburgh, PA 15244
(412) 269-5828

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 2 Issue 3 June 1994

Watershed Plan Advisory Committee Meeting Held

A meeting of the Lake Erie Area Stormwater Management Watershed Plan Advisory Committee (WPAC) was held at 7:30 pm on May 17 in the Erie County Court House. The meeting was conducted by the Erie County Department of Planning and included presentations by Durla Lathia and Pat Pingel of the Pennsylvania Department of Environmental Resources and John Maslanik of Chester Environmental.

Mr. Lathia presented a brief introduction of several of his staff members attending the meeting and invited the WPAC members' participation in the planning process.

John Maslanik provided an overview of the status of the project and reported on information collected through the municipal questionnaire forms and other sources.

Ms. Pingel presented a brief introducion to the Coastal Nonpoint Pollution Program and gave an overview of Pennsylvania's activities under the program.

An open discussion and question and answer session was conducted during the meeting. During this session, members of the WPAC discussed the possibility of forming a stormwater management district that would be involved in the financial and administration aspects of stormwater management in the future. WPAC members also expressed a desire that long term stream gauging stations be installed in the watershed to monitor changes in stream flows which may occur as development progresses and the recommendations of the watershed stormwater management plan are implemented. These issues will be pursued in the coming months and as the preparation of the plan progresses.

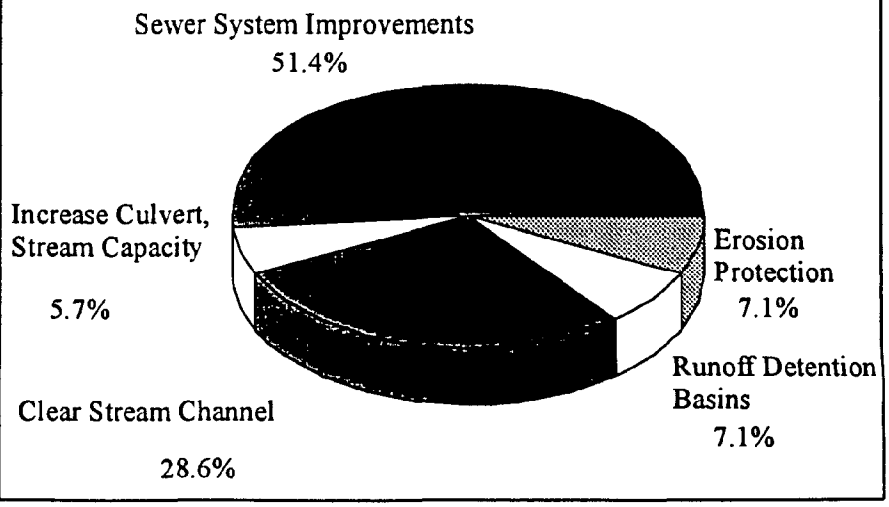
Stormwater Problem Areas Reported and Described

At the start of the process for developing the Watershed Stormwater Mangement Plan for the Lake Erie Area Watershed, a municipal questionnaire was distributed to each of the municipalities that lie entirely or partially within the watershed. The purposes of this questionnaire were to obtain information describing current conditions in the watershed and afford an opportunity for input into the planning process. Twenty-one of the twenty-five municipalities in the watershed provided responses to the questionnaire

The municipal questionnaires requested information describing known problems related to stormwater runoff. Fifteen municipalities in the watershed reported a total of 109 specific problems. Over 70% of the problems reported are described as flooding problems. Roughly 10% of the problems are associated with sedimentation and erosion, while the remaining 20% of the problems consist of flooding accompanied by erosion and sedimentation problems.

The distribution of the suggested solutions to the problems identified by the municipalities is illustrated in Figure 1. As is indicated in Figure 1, over half of the reported problems are associated with deficiencies in the local storm sewer systems. These deficiencies range from undersized storm sewers to a general lack of

Figure 1
Suggested Solutions to Stormwater Problems



storm sewer facilities. Solutiions to nearly 35% of the problems involve clearing debris and obstructions from the stream channel or otherwise increasing the capacity of streams.

The remaining categories of solutions consist of providing protection from erosion and the construction and the operation of runoff detention basins.

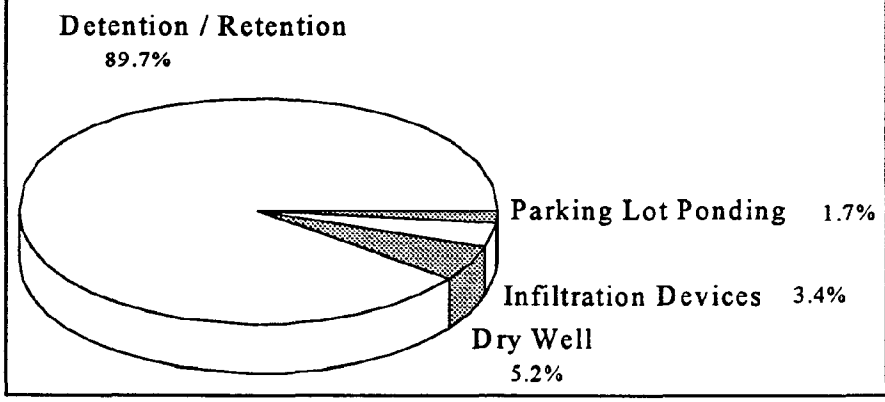
Stormwater Control Facilities Reported

The municipal questionnaires also requested information relative to existing and proposed stormwater control facilities. Stormwater control facilities are facilities that are constructed in order to control the rates of discharge of stormwater to storm sewer systems and/or natural stream channels. Thirty-nine existing stormwater control facilities were reported by the following nine municipalities:

- Erie City
- Fairview Township
- Girard Township
- Harborcreek Township
- Lake City Borough
- Millcreek Township
- North East Township
- Summit Township
- Venango Township

In addition, these same nine municipalities reported that 21 more stormwater control facilities are presently proposed. The as is indicated in Figure 2, the vast majority of the exisiting and proposed facilities are stormwater detention facilities. The major significance of this information is that stormwater control facilities are currently rather widely used. This local familiarity and acceptance of such controls will assist in the overall implementation of the plan.

Figure 2
Stormwater Control Facilities



This newsletter is published semi-monthly as a means of informing interested parties of the progress of the planning process and encouraging their input into the planning process. We encourage you to direct any questions or comments to:

Erie County Department of Planning:

Sharon L. Knoll
Erie County Court House
Erie, PA 16501
(814) 451-6336

or

Chester Environmental

John M. Maslanik
Chester Environmental
P.O. Box 15851
Pittsburgh, PA 15244
(412) 269-5828

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

❖Lake Erie Stormwater Management Update❖

Volume 2 Issue 4 August 1994

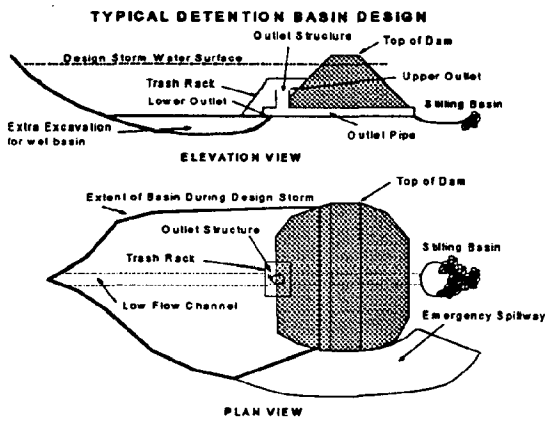
Stormwater Control Techniques
Peak Discharge Control Measures

Introduction to Peak Discharge Control Measures

The February 1994 issue of this newsletter described the basic runoff standards generally adopted under the Pennsylvania Stormwater Management Act. In general, the runoff control standards call for controlling runoff from new land development sites so that the post-development peak rate of runoff does not exceed the pre-development peak or a percentage thereof as is necessary to prevent the occurrence of flooding problems.

This can be accomplished in two ways: 1) steps can be taken to avoid increases in total runoff volume and 2) stormwater detention facilities can be constructed to limit peak discharge rates. The April 1994 issue of this newsletter contained a general overview of measures which can be taken to minimize increases in total runoff volume. This issue presents a general overview of methods than can be used to control peak discharge rates.

As was discussed in the April newsletter, the ideal means of managing runoff would be to avoid any increase in the amount of runoff produced and the rate at which it occurs. However, in most cases, it is not feasible to develop a site for the intended uses without creating changes to the land surface which increase the amount of stormwater runoff produced. Therefore, in most cases, it is necessary to combine volume reduction features with some form of facilities designed to control peak discharges. The following paragraphs contain brief descriptions of available methods used to control peak discharge rates from newly developed sites despite the unavoidable increases in the total amount of runoff produced.



Peak Discharge Control Facilities

Peak discharge control facilities are those which control peak discharge rates by capturing and storing stormwater runoff and subsequently releasing the runoff at a controlled rate. The stored water is released at a flow rate that is designed not to cause flooding or other types of harm downstream.

The following are the most widely used general forms of peak discharge control facilities:

1. Detention ponds or basins
2. Underground detention tanks
3. Parking lot storage
4. Roof-top storage
5. Multiple use impoundment areas

The selection of the types of facilities to employ for a specific development application should be made based upon an evaluation of site specific conditions such as space availability, type of development and volume requirements.

Detention Basins

Detention basin are the most widely used form of stormwater storage facilities. They are surface ponding areas specifically designed to provide the necessary volume to properly control the release of stormwater runoff. A design of a typical detention basin is illustrated above. As is indicated in the illustration, the facilities consist of a dam or embankment, water ponding area, outlet control structure with trash rack, and emergency / high flow spillway. The basins may be designed to normally be dry and to fill only during rainfall events. Alternatively, they can be designed

as wet ponds that contain water at all times, with the water level fluctuating during rainfall conditions. In any event, the basins are designed to accept peak flows and volumes runoff from the design storms specified in the stormwater management ordinances.

Underground Detention Tanks

This type of peak discharge control facility consists of underground holding tanks or large diameter pipes that temporarily store excess runoff volumes. The cost of constructing underground facilities is generally higher than for typical detention basins. However, in areas where land is expensive, insufficient surface area is available to permit the use of surface storage alternatives, or surface topography is unsuitable for surface storage, underground tanks can be an appropriate solution. The basic mode of operation is similar to that of standard detention basins employing outlet control devices and high flow bypass or overflow features.

Rooftop Storage

Rooftop detention utilizes the built-in structural capabilities of rooftops to store a certain amount of rainfall that falls upon them. The control of the rate of discharge from the rooftop is accomplished using specially designed roof drains with the proper outlet capacities to limit release rates to the design level. Overflow mechanisms are provided to preclude danger from overloading. Building codes in many locations specify that roofs be designed to support snow loads. Although the structural capacity of roofs must be carefully considered when designing a roof for the temporary storage of rainwater, a roof designed for snow loads can usually accommodate an equivalent water load without the need for major structural modifications.

Parking Lot Storage

Stormwater runoff can be detained on parking lot sites using shallow basins or swales. With this type of control, excess runoff from a relatively small site can be detained on the site at low cost and with minor inconvenience to traffic. Storage in parking lots can also be accomplished by constructing catchbasins with inlet grates that cause the water to pond. The only negative feature of this system is the temporary inconvenience that the ponding water may cause to the users of the parking facility, even though it is for only a short time.

Multiple Use Facilities

Multiple use areas utilize sites having primary functions other than runoff control. Examples include open space and grassed areas provided in the development to enhance aesthetic appeal that can also be used as stormwater detention facilities and hard court basketball or tennis courts can be designed to drain adjacent areas and retain water on the court surfaces during rain conditions. Positive drainage and outlet control devices must be provided in the design.

This newsletter is published semi-monthly as a means of informing interested parties of the progress of the planning process and encouraging their input into the planning process. We encourage you to direct any questions or comments to:

Erie County Department of Planning:

Sharon L. Knoll
Erie County Court House
Erie, PA 16501
(814) 451-6336

or

Chester Environmental

John M. Maslanik
Chester Environmental
P.O. Box 15851
Pittsburgh, PA 15244

Erie County Department of Planning
Erie County Court House
Erie, Pennsylvania 16501

PART 3: DRAFT COPIES OF SECTIONS 1 AND 2 OF THE FINAL REPORT

SECTION 1: INTRODUCTION
SECTION 2: LEGAL FRAMEWORK FOR STORM WATER MANAGEMENT

LAKE ERIE AREA WATERSHED STORMWATER MANAGEMENT PLAN

SECTION I INTRODUCTION

BACKGROUND

GENERAL

Curbs, gutters, storm sewers, and other drainage systems have traditionally been designed to remove stormwater from developed properties as quickly as possible to minimize the possibility of flooding the properties served by the drainage systems. Little or no efforts were made to minimize increases in volumes and rates of runoff which resulted as land was converted from a permeable, vegetated state to an impervious, paved condition. Similarly, little consideration was given to the potential effects of accelerated runoff on downstream properties. Under this approach, progressive development in a watershed resulted in ever increasing stormwater runoff until damaging downstream problems developed. Problems attributable to inadequate control of stormwater runoff include flooding and accelerated erosion.

A significant change in the approach to stormwater management in Pennsylvania occurred with the passage of the Storm Water Management Act (Act 167) and its companion bill, the Flood Plain Management Act (Act 166). This legislation was passed by the Pennsylvania General Assembly on October 4, 1978 and requires a comprehensive approach to planning and managing excess stormwater runoff. Acts 166 and 167 were enacted in response to increasing problems caused by inadequately controlled stormwater runoff and the associated threats to public health and safety. The Storm Water Management Act established a program for managing accelerated runoff so that it does not lead to increased flooding, while the Flood Plain Act provides for the preservation and restoration of flood plains which function as natural stormwater storage areas.

PENNSYLVANIA STORM WATER MANAGEMENT ACT

The statement of legislative findings at the beginning of the Storm Water Management Act sums up the critical interrelationship between development, accelerated runoff, and floodplain management:

> Inadequate management of accelerated runoff of storm water resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control storm water, undermines flood plain management and flood control efforts in downstream communities, reduces groundwater recharge, and threatens public health and safety.
>
> A comprehensive program of storm water management, including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety and welfare and the environment.

The stated policy and purpose of the Storm Water Management Act is to:

1. Encourage planning and management of stormwater runoff in each watershed which is consistent with sound water and land use practices.

2. Authorize a comprehensive program of stormwater management designated to preserve and restore the flood-carrying capacity of Commonwealth streams; to preserve, to the maximum extent practicable, natural stormwater runoff regimes and natural course, current and cross section of water of the Commonwealth; to protect and conserve ground waters and ground water recharge areas.

3. Encourage local administration and management of stormwater consistent with the Commonwealth's duty as trustee of natural resources and the people's constitutional right to the preservation of natural, economic, scenic, aesthetic, recreational and historical values of the environment.

The general procedure established by the Act for achieving these goals includes

1. Development of guidelines and regulations to be applied state wide.

2. Preparation of stormwater management plans for designated watersheds throughout the Commonwealth.

3. Implementation of the stormwater management plans.

4. Adherence to the plan requirements by individuals involved in land development activities.

Act 167 establishes the following duties and responsibilities for individuals and various governmental agencies:

PERSONS ENGAGED IN LAND DEVELOPMENT: Act 167 states that any landowner and any person engaged in the alteration or development of land which may affect stormwater runoff characteristics must implement such measures consistent with the provisions of the applicable stormwater management plan as are reasonably necessary to prevent injury of health, safety or other property. Such measures must include such actions as are required:

1. to assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities; or

2. to manage the quantity, velocity and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.

DEPARTMENT OF ENVIRONMENTAL RESOURCES (DER): Act 167 assigns the Department of Environmental Resources the primary responsibility to carry out the policies and purposes of the Act. These responsibilities include providing guidelines for county stormwater management plans; designating watersheds for which stormwater management should be prepared; review and

approval of the plans; providing technical assistance and model local ordinances; developing grants and reimbursement regulations governing the disbursement of grant monies; and generally coordinating stormwater management activities state wide.

COUNTIES: Counties are required to prepare and adopt a watershed stormwater management plan for each designated watershed in their jurisdiction.

MUNICIPALITIES: Municipalities are required to adopt new or to amend existing regulations as necessary to comply with and implement the stormwater management plans.

In 1980, the Department of Environmental Resources (DER) designated 353 watersheds for which plans are to be prepared. The number of designated watersheds now totals 356. Model ordinances were made available in September 1981, followed by detailed stormwater management guidelines in June 1983. These guidelines and model ordinances were approved by the Pennsylvania General Assembly in June 1985 and now have the force of law. In May 1984, Act 167 was amended to authorize DER to administer grants to municipalities and counties to pay 75% of the costs of preparing and administering stormwater management plans and regulations.

LAKE ERIE AREA WATERSHED PLAN DEVELOPMENT APPROACH

GENERAL PLANNING REQUIREMENTS AND APPROACH

The overall scope of work and general planning approach employed in the preparation of the Lake Erie Area Stormwater Management Plan were defined to a large extent by specific planning requirements contained in Act 167 and Storm Water Management Guidelines and Model Ordinances developed by the Pennsylvania Department of Environmental Resources. The basic requirements of the plan as outlined in these documents are that the plan shall:

1. contain such provisions as are reasonably necessary to manage storm water such that development or activities in each municipality within the watershed do not adversely affect health, safety and property in other municipalities within the watershed and in basins to which the watershed is tributary; and

2. consider and be consistent with other existing municipal, county, regional and state environmental and land use plans.

Specific and more detailed plan requirements were also defined in the Act. Beyond the general and specific plan requirements established by law and regulations, several additional considerations served as a guide to the development of the planning approach and scope employed during the preparation of this Lake Erie Area Stormwater Management Plan. These additional planning considerations are as follows:

1. The development of the technical standards contained in the plan should accurately reflect local conditions.

2. The development of the technical standards should employ accepted computational techniques familiar to the local planning agencies.

3. The computational procedures employed should be reproducible and amenable to direct application when the plan is updated.

4. The recommended stormwater management control standards and criteria should be attainable, clear, concise, broadly applicable and enforceable. The standards should clearly define performance requirements but allow sufficient latitude to permit creative stormwater control approaches.

5. The recommended stormwater management controls and associated institutional framework should represent a reasonable and measured approach to effectively managing stormwater runoff. The plan should not produce unnecessary impediments to development nor excessive local government responsibilities.

6. The recommended stormwater legal/institutional framework should be compatible with existing municipal and county financial, legal, technical and administrative capabilities.

TECHNICAL APPROACH

The technical approach was designed to satisfy the above listed considerations by employing accepted hydrologic modeling techniques to define existing conditions and quantify stormwater control criteria necessary to comply with the intent of Act 167. The technical analysis utilized the Penn State Runoff Model (PSRM) to estimate existing and future runoff characteristics. The model was also employed to define hydrologic interactions throughout the study area to provide a basis for establishing stormwater runoff control criteria on a watershed wide basis. The PSRM was selected for use because it is recognized by DER as an appropriate tool for watershed stormwater planning and it possesses several attributes of particular value in the development of specific stormwater control performance criteria.

The data collection effort was designed to take fullest advantage of available data sources and current data analysis and management techniques to maximize the accuracy of the physical features data base necessary to model the watershed. Land cover information was obtained from a number of sources, principally digital SPOT and Landsat Thematic Mapper images and National High Altitude Program (NHAP) color infrared photographs of the watershed. Land cover was classified to a 30 meter resolution. Terrain characteristics, expressed in terms of slope and the direction of slope, were derived from the United States Geological Service's (USGS) Digital Elevation Model (DEM) digital terrain models and information extracted from USGS 7.5 minute quadrangle maps.

Soil characteristics as reflected by hydrologic soil group classes were obtained through digitization of United States Soil Conservation Service (SCS) soils maps. These data were digitally overlaid and processed using geographic information system software to define the hydrologic characteristics of the watershed to a resolution approximating 30 meters. This data, in turn, was aggregated into the individual subbasins comprising the Lake Erie Area watershed.

Additional information, including obstruction sizes and capacities, stream characteristics, stormwater collection system locations, and descriptions of stormwater and flood control and flood protection facilities were obtained by conducting field and mail surveys and reviewing available data sources.

LEGAL/INSTITUTIONAL APPROACH

This portion of the study deals with four interrelated issues:

1. The primary laws governing stormwater management in Pennsylvania.

2. The institutional options for organizing an effective stormwater management effort in the watershed.

3. Institutional system initiatives and precedents established by previous watershed stormwater management planning efforts completed in the region.

4. Guidelines for incorporating stormwater provisions into stormwater management ordinances to implement the plan's technical recommendations.

5. Methods of fine-tuning stormwater control provisions to address issues encountered during the implementation of pilot stormwater management plans completed in the region.

As part of the analysis, various laws were reviewed to determine specific areas of concern, requirements, duties, penalties and remedies, along with interrelationships with the other statutes. In addition to the laws related directly to stormwater management, common law relative to private and public nuisances and state and local municipal immunity statutes were reviewed, with attention to the remedies that provided for solutions to stormwater problems and issues.

This plan document includes proposals for ordinance provisions designed to implement the recommended technical measures. These ordinance standards are intended to provide a guide to the municipalities in enacting or amending their existing ordinances. These standards may not be appropriate for direct incorporation into an existing municipal ordinance. They do, however, indicate the types of provisions that are required and in which ordinances they properly belong. The municipalities should consult with their solicitors and the County Planning Office as they proceed amending with existing or enacting new ordinances for specific guidance as to how the key model ordinance provisions can be incorporated into their existing ordinance structure.

Finally, the institutional section outlines alternative organizational arrangements for developing and managing stormwater control facilities and for administering local ordinances. Since the stormwater management plans cannot be implemented effectively on a piecemeal basis, a watershed-wide management approach and intergovernmental cooperation are required. Therefore, this study identifies several approaches that the municipalities, county, and state can take to implement a workable stormwater management system.

The nature of the optimal institutional system will be determined to a large extent by the roles and duties the system will be expected to fulfill. The system may be expected to perform a variety of duties, ranging from planning and regulation to construction, operation and maintenance, and financing. Consequently, this plan outlines the range of responsibilities associated with stormwater management, describes the capabilities, resources and legal authorities necessary to discharge those responsibilities, and discusses alternative institutional arrangements.

The selection of the recommended institutional framework will also depend upon the nature of the existing institutional system and the anticipated future roles and capabilities of each level of government. This plan, therefore, presents an overview of the existing system and a discussion of expectations relative to the future role of each level of government in stormwater management issues.

CONTENTS OF THE PLAN

The Lake Erie Area Watershed Stormwater Management Plan report is presented in two volumes. Volume 1, the Plan Study Report, contains the plan text and describes the background and general characteristics of the study area, the method used for data collection, the analytical tools used, results of the analyses, and stormwater runoff control alternatives. Specific control requirements and management and regulatory responsibilities are identified as they relate to developers and local, county, and state agencies. Volume 2, the Executive Summary, contains a condensed overview of the plan development process and summarizes the findings and recommendations of the plan.

Copies of the materials and data developed during plan preparation and a working version of the Lake Erie Area PSRM hydrologic model are on file at the Erie County Department of Planning.

LAKE ERIE AREA WATERSHED
STORMWATER MANAGEMENT PLAN

SECTION II
LEGAL FRAMEWORK FOR STORMWATER MANAGEMENT

GENERAL

An analysis of stormwater management would not be complete without a discussion of the law that created the stormwater management program, along with the other laws that relate to its implementation. This is particularly true in the case of the Storm Water Management Act (Act 167), where there are relatively few administrative regulations and little case law with which to interpret the Act's meaning and provisions.

The law as it relates to stormwater management is not widely understood by local officials, developers, and property owners. Pennsylvania's common law relating to drainage rights has developed over decades into a very complex system. As a result, it is not always easy to determine who has what rights and when. Many persons are still not aware of the extent to which Act 167 redefines prior common law. Further, many municipal officials, engineers, and developers are not well informed on other laws which relate to stormwater, development regulation, and governmental liabilities.

Besides the Storm Water Management Act, other laws that collectively provide the legal framework within which to implement a comprehensive stormwater management plan include the following:

- Dams Safety and Encroachments Act (Act 325-1978).
- Clean Streams Law (specifically, the erosion and sedimentation regulations adopted pursuant to the Law).
- Flood Plain Management Act (Act 166--1978).
- Municipalities Planning Code (Act 247, as amended).

As part of this stormwater management plan, each of these laws was reviewed to determine its scope, standards, duties, penalties and remedies, and enforcement responsibilities. The interrelationships between the five statutes and regulations were also examined. Additionally, common law relative to private and public nuisances, municipal codes, and state and municipal immunity statutes was researched relative to the powers, duties, and remedies that are provided for stormwater related issues.

A general overview of these items is offered as a background to the discussion of the five statutes specifically impacting stormwater management. Key provisions of each of the five primary statutes are presented and the elements that are most pertinent to the watershed stormwater plan and management program are highlighted. A brief discussion of governmental immunities is included because it is helpful for the municipalities to understand their potential liabilities. The comments on these acts do not represent official legal opinions or constitute advice on any specific issue or case. This is especially true for Act 167 where there are presently no administrative regulations or case law to interpret the Act. This section is provided solely to assist in a general understanding of the legal framework for stormwater management.

COMMON LAW BACKGROUND

Stormwater law developed in the courts of the Commonwealth of Pennsylvania and across the United States in cases between private landowners. Common law rights, duties and responsibilities relative to drainage and flooding evolved from the resultant court decisions. In the common law, a basic distinction is drawn between waters in a watercourse and surface waters. A watercourse was defined as a channel with defined bed and banks. Watercourse law also included lakes, ponds, marshes and swamps. Surface water, on the other hand, was defined as diffused water running overland, to a defined channel or watercourse. Flood water which overflowed the banks of a watercourse and followed the course of the stream, was also held to be governed by the laws of watercourses. However, flood waters which entirely lost their connection with a watercourse, spreading out over the adjoining countryside and settling in low places, were governed by the law of surface waters.

WATERCOURSE LAW

Watercourse law is based on the rights and duties established among riparian property owners (owners of land along the banks of a river or lake). The fundamental principle of the riparian system is that each riparian owner has an equal right to make a reasonable use of the water of a stream subject to the equal rights for the other riparians to do likewise. A riparian right is reciprocal in that a riparian owner must exercise his rights in a reasonable manner and extent so as not to interfere unnecessarily with the corresponding rights of others.

As a general rule in most jurisdictions, a riparian owner does not have the right to construct an embankment or dike to protect his land from ordinary floods, if in so doing he causes damage to the lands of others. Expressed in slightly different terms, a riparian owner has the right to protect his land but only if he causes no damage to other riparian owners in exercising this right.

SURFACE WATER LAW

There are three basic doctrines which the courts have adopted regarding surface waters. These are the "common enemy rule", the "civil law rule", and the "reasonable use rule".

As originally conceived under the civil law rule, a landowner may do anything he pleases with surface waters regardless of the harm it might do to others. The upper land owner can divert or drain surface waters onto the lower land, and the lower landowner may put up a barrier even if it floods the upper property. Since the water must go somewhere, this concept would appear to inevitably result in contests of engineering where "might makes right". Therefore, some courts have modified the strict rule, resulting in a "modern common enemy rule". This rule gives landowners the right to obstruct or divert surface waters, but only when such obstruction or diversion is incidental to the ordinary use, improvement or protection of their land, and when it is done without malice or negligence.

The civil law rule granted the owner of upland property the right to drain surface waters onto lower property; imposed a duty upon the lower property owner to receive surface water from upland property; granted the owner of upland property an easement

of natural flow over the lower property; and prohibited the owner of lower property from obstructing the natural flow of diffused surface water from upland properties. The key word is natural, meaning those waters which flowed from the land before alteration or development. A legal cause of action on the part of the lower property owner was deemed to have arisen when the upland property owner or another party interfered with natural conditions or caused water to be discharged in a greater quantity or in a different manner than would naturally occur.

The reasonable use rule is based on tort rather than on property law. In tort law, liability is based on negligence. A person can be held negligent if he has not acted like a "reasonably prudent man" in a given situation. The reasonable use rule recognizes common law in that use of one's property may occur in any reasonable manner which does not injure another person or their property. Common law considered the necessity to alter drainage to make use of one's property, the reasonable manner of accomplishing alterations so as to avoid injury, the utility of the conduct, and the gravity of the injury to the other.

Pennsylvania jurisprudence has, at one time or another, applied all three of the doctrines in various cases. The Pennsylvania Storm Water Management Act of 1978 more specifically and directly assigns responsibilities for stormwater control. The Act imposes a duty on any landowner and person (including municipalities) engaged in the alteration or development of land which may affect stormwater runoff to implement measures to prevent injury to health, safety or property.

STORM WATER MANAGEMENT ACT (ACT 167-1978)

The two key sections of the Storm Water Management Act are Section 5, which sets up watershed stormwater planning programs, and Section 13, which establishes the basic standard to manage stormwater runoff to prevent harm to persons and property. A primary goal of the Act is to prevent future problems resulting from uncontrolled runoff, including flooding, erosion, sedimentation, landslides, and the pollution and debris often carried by storm runoff. A secondary goal is the elimination or correction of existing stormwater and flooding problems.

WATERSHED STORMWATER PLANS

As discussed in the preceding chapter, one of the Act's innovative features is the creation of a public stormwater planning, management, and control system at the watershed level. Plans are to be prepared for each watershed delineated by the DER. Counties must organize watershed advisory committees for each watershed. Each committee must be composed of representatives from the municipalities in the watershed. The committee is to advise the county during the planning process, and the plans are to be adopted by the county commissioners and approved by DER, after public review and comment. The completed plans must be consistent with local land use plans and state plans, such as regional water quality management plans, the state water plan and floodplain programs.

After the adoption and approval of a watershed stormwater management plan, the location, design and construction of stormwater management systems, obstructions, flood control projects, subdivisions, major land developments, highways, transportation facilities, facilities for the provision of public utilities, and facilities owned and financed in whole or in part by the Commonwealth (including PennDOT) must be

conducted in a manner consistent with the plan (Section 11). This provision gives the stormwater plan a definite legal status. Unlike municipal comprehensive plans, which are only advisory documents, watershed stormwater plans are legally binding. In addition, each municipality in the watershed must adopt the land use and development ordinances within six months of the approval of the watershed stormwater management plan to implement the plan (Section 11). These regulations must be consistent with the plan, as well as standards of the Storm Water Management Act. Failure to adopt and implement the necessary ordinances may result in the state withholding money from its General Fund for which the municipality might be eligible.

BASIC STANDARD FOR STORMWATER MANAGEMENT

The basic premise of the Act is that persons whose activities generate additional runoff, increase its velocity, or change the direction of its flow should be responsible for controlling and managing the runoff so that their activities will not cause harm to other persons or property, either now or in the future. The policy is that Pennsylvania's legal system will no longer condone those who negligently disregard the impact of runoff from their activities or allow them to shift the burden of runoff management to the public and downstream property owners.

Section 13 of Act 167 defines the legal duties of developers and others engaged in the alteration of land by setting performance standards for runoff management. This section of the Act became effective immediately upon the signing of the Act (October 4, 1978). These new standards essentially replace prior common law rules. However, common law rules still apply to all development and land alteration that occurred prior to October 4, 1978. Section 13 states that:

> Any landowner and any person engaged in the alteration or development of land which may affect stormwater runoff characteristics shall implement such measures consistent with the provisions of the applicable watershed stormwater plan as are reasonably necessary to prevent injury to health, safety or other property. Such measures shall include such actions as are required:
>
> (1) to assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities; or
>
> (2) to manage the quantity, velocity and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.

Act 167 defines persons as individuals, private corporations, municipalities, counties, school districts, public utilities, sewer and water authorities, and state agencies. For example, when public agencies build storm sewers, roads, buildings, or utility lines, they must implement runoff control measures that comply with Section 13 standards. Section 13 is a comprehensive standard for stormwater control with the primary stormwater management measure of requiring reasonable actions to prevent harm or injury to health and property. This general duty is contained in the language which precedes Sections 13(1) and 13(2). Thus, the proverbial "bottom line" for stormwater management is to not cause harm. Section 13 then prescribes two alternatives [Section 13(1) and 13(2)] for meeting this basic objective.

When Section 13 is read in conjunction with other portions of Act 167, it becomes apparent that the intent of the Act is to protect all persons and property downstream of the site being altered, not only the persons or property immediately adjacent to the site. In other words, Section 13 is not spatially limited and applies not only as the runoff leaves the site, but as far as its impact can be reasonably determined.

Section 2 of the Act states that the Legislature found that inadequate management of runoff has adverse impacts on downstream communities and that reasonable regulation of activities causing runoff is fundamental to the public welfare. Section 3 indicates that the Act was intended to manage runoff at the watershed level. Further, Section 5(c)(1) requires that watershed plans contain provisions to manage stormwater so that an activity in one municipality does not have adverse effects on persons or property in another municipality in the watershed to which the activity is tributary. Therefore, it is clear that the stormwater plans and management activities must consider the watershed impact of land alteration activities and runoff controls must be designed to prevent reasonably foreseeable harm, from the boundary of the site and downstream to the base of the watershed.

The Section 13(1) standard does not contain any limiting language from which it could be implied that no increase in maximum rate means only at a development's property line. Likewise, Section 13(2) contains no language to suggest that its "do not cause harm" standard applies only to neighboring or nearby property. The term "runoff characteristics" is not spatially limited since Section 13(2) indicates that runoff characteristics include at least direction, volume, and velocity. Changes in any of these characteristics will affect a stream all the way to its mouth. Downstream from the generator, these runoff changes may result in an increase in peak rate, harm to persons or property, or both.

SECTION 13(1)

Section 13(1) requires that land alterations not cause an increase in the "maximum rate" of stormwater runoff. In other words, the maximum (peak) rate of runoff after development, for any level storm, may not be higher than the peak rate which would have been generated from the site before development. By referring to rate rather than volume, Section 13(1) implies that total volume of runoff generated may increase, but any increased volume must be retained and discharged over time so that the predevelopment maximum rate of flow will not be exceeded. This is an important point because a standard that did not permit any increase in volume could only be met at locations where additional runoff could be permanently stored or recharged on-site. Obviously, this would limit the use of many sites.

It is not clear whether no increase in the "maximum rate" of runoff applies to the site as a whole or to any point on the site from which runoff was discharged before development. Since the purpose of Section 13 is to prevent harm from changes in runoff characteristics and runoff characteristics include direction, it would seem that the no increase in peak rate standard should apply to each predevelopment discharge point. This interpretation seems necessary to control runoff from large developments in a manner which can achieve the purpose of the Act. Peak rate of discharge from the site as a whole could be used where runoff is discharged to a storm sewer or public retention system.

Section 13(1) basically states that development cannot increase the maximum rate of runoff at any point, from the boundary of the site to the bottom of the watershed. Also, development may not cause an increase in maximum rate of flow in any other watershed to which its location is tributary. The cutoff point for purposes of Section 13(1) seems to turn on the foreseeability of harm. Where it is reasonably possible for the developer to foresee that a higher peak rate will result because of the activities, then the duty imposed by Section 13(1) applies.

SECTION 13(2)

One of the purposes of Section 13(2) is to make the statutory drainage standard more flexible. Section 13(2) permits changes in runoff characteristics provided they do not cause harm. For example, Section 13(2) permits increased rates of runoff to be discharged into storm sewer systems, when the storm sewers can handle increased volumes and velocities without, in turn, causing harm. However, the Act does not define harm, thresholds of acceptable levels of potential harm, or address issues relating to how the potential for harm is to be assessed. It appears that the burden of establishing no harm is assumed by the developer. Practical problems associated with proving such a negative hypothesis (i.e. establishing that an action will not produce harm or increase the potential for harm throughout a watershed) is a major concern in developing means of generally incorporating Section 13(2) into watershed plans.

VIOLATIONS, PENALTIES, REMEDIES

Section 15 of the Storm Water Management Act makes any violation of any provision of the Act or of the watershed stormwater plan a public nuisance. A public nuisance is defined as being a nuisance by its very existence. Therefore, it is not necessary to wait and see if damage results from the public nuisance. An aggrieved person, affected municipality, or the DER can institute suits at equity to restrain or abate a violation of a law and sue for damages caused by a violation of this Act.

The state is not subject to penalty provisions and municipalities, county and state agencies are protected to a large extent from private damage suits by governmental immunity statutes. The rights and remedies created by the Act are in addition to rights and remedies which existed prior to the Act's passage. For example, private persons can still sue for private nuisances.

DAMS SAFETY AND ENCROACHMENTS ACT (ACT 325-1978)

Act 325 replaces several older state statutes dealing with dams safety, water obstructions and encroachments. This Act is the primary source of regulation for dams, existing and new obstructions, encroachments, fill in floodplains, culverts, bridges, retaining walls, and storm sewer outfalls in a stream or a 100-year floodplain. In some cases, retention/detention facilities may qualify as dams under the definition of the Act, requiring a permit from the DER. The Act requires permits for the construction, or alteration or abandonment of dams, obstructions and encroachments. The owners of existing obstructions or encroachments are also required to obtain permits. Permits are issued by the DER pursuant to the Act and regulations (25 Pa. Code Chapter 105).

By addressing both new and existing structures, the Dams Safety and Encroachments Act is quite broad in its coverage. It also requires permittee's and owners of obstructions to inspect, maintain, and repair their structures. For example, owners of culverts must inspect them annually and remove silt and debris if the carrying capacity is reduced by 10 percent or more (Regulations, Section 105.171). If conditions change such that the design of an obstruction or encroachment no longer conforms to the performance standards in the Act or regulations, the permittee or owner has a duty to make such alterations as are necessary to achieve compliance.

DER is the prime agency responsible for administering the Act. It must adopt regulations to implement the Act and is the permit issuing agency. The regulation [Section 105.14(b)(9)] requires the DER to consider the project's consistency with state and local floodplain and stormwater management programs when reviewing permits. Thus, the standards and provisions of the Storm Water Management Act and stormwater plans appear to be applicable to obstructions and encroachments. It is important to note that once the watershed stormwater plan is approved, the DER should consider local comments relative to consistency with the applicable watershed stormwater management plan when reviewing permit applications. Also, municipalities should not issue local building permits until necessary obstruction permits are obtained.

Violations of the Act are treated as a public nuisance. Therefore, municipalities can sue to enjoin or abate the nuisance, or can make necessary repairs and assess costs against the property. A private person also can sue on a private nuisance. As the prime enforcement agent, the DER can issue orders to permittees and landowners to correct a violation of the Act or of an issued permit. Failure to comply can expose the violator to civil and criminal penalties. This provision includes municipalities and counties when they are the permittee for a structure.

If the DER does not sue to correct the violation of the Act, any "affected municipality" may sue in the name of the Commonwealth. An affected municipality includes one where the violation occurs or where damage or harm results. The only limitation on these suits is that the municipality must give the State Attorney General 30 days notice of the municipality's intention to act.

CLEAN STREAMS LAW (EROSION/SEDIMENTATION REGULATIONS)

Pennsylvania's Clean Streams Law was enacted in 1937 for the purpose of regulating discharges of sewage and industrial wastes. Since its original enactment, its scope and duties have expanded substantially. In 1972, DER determined that sediment constitutes a water pollutant under the provisions of the law and promulgated regulations for the control of erosion and sedimentation (E&S) caused by earth moving activities (25 Pa. Code, Chapter 102).

The general requirement of the E&S regulations is that earth-moving activities (including excavations, land development, mineral extraction or any other activity that disturbs the surface of the land) be conducted in a manner to prevent accelerated erosion and resulting sedimentation of streams and other watercourses, such as culverts. Persons engaged in earth moving activities must prepare E&S control plans for the site. These plans must be available on the site at all times, and sites 25 acres or larger must obtain an E&S permit prior to commencing any activity. As with obstructions and floodplain permits, local building permits should not be approved prior to issuance of an E&S permit.

The erosion plans must consider all factors which might contribute to increased erosion during and after land disturbance activities. Plans should include both temporary and permanent control measures, as well as a maintenance program for all control facilities. Since many of these temporary facilities can also serve as permanent stormwater runoff control structures, it is important that E&S and stormwater management controls be designed and reviewed as a package.

The adequate enforcement of erosion control plans is critical if stormwater management facilities are to function as designed. If culverts, storm sewers, detention ponds, or other facilities are filled with silt, they cannot function properly to control stormwater flows. As is discussed in subsequent sections of this Plan, problems of localized flooding often are caused by structures filled with sediment and debris. Implementing adequate erosion controls will reduce the amount and cost of maintaining structures.

Since the Clean Streams Law antedates the Storm Water Management Act, it does not specially mention the Storm Water Act. However, it can be assumed that E&S controls should be consistent with the Storm Water Act, and certainly an approved watershed stormwater plan. Since E&S controls could affect stormwater runoff management for the site, they would have to comply with Act 167 standards. Also, the Dams Safety and Encroachments Act requires that obstruction permits comply with the Clean Streams Law including the erosion regulations, which in turn must be consistent with stormwater management programs.

The DER has major administrative and regulatory responsibilities for implementing the Clean Streams Law, and may issue enforcement orders to establish compliance with the law. Failure to comply with an order is a nuisance and exposes the violator to abatement actions as well as civil and criminal penalties. The DER or an affected municipality may sue to abate or restrain anyone who is in violation of the law. A municipality can act in the name of the Commonwealth after due notice to the Attorney General. It is important to note that both private parties and municipalities may be subject to abatement actions. For example, the DER or a neighboring municipality may sue a municipal violator to compel action. When performing proprietary functions (e.g., constructing a road or sewer), a municipality or authority must comply with the same regulations as private individuals.

FLOOD PLAIN MANAGEMENT ACT (ACT 166 - 1978)

The Flood Plain Management Act requires municipalities with floodplain areas to participate in the National Flood Insurance Program, and to adopt floodplain management regulations that control new development in accordance with the minimum requirements established by the Federal Insurance Administration. Municipalities participating in the National Flood Insurance Program must require building permits for all construction and development occurring within identified floodplain areas. Such permits are not to be issued until all other required federal and state permits have been received by the applicant. Thus, municipalities should not issue building permits for development within floodplain areas unless the applicant has obtained all necessary obstruction and E&S permits. In addition, building permits should not be issued unless the proposed activity complies with the stormwater management regulations which have been adopted by the municipality.

Through this interrelated permitting process, the Flood Plain Management Act encompasses a comprehensive control of all activities in floodplains. It assures that there is compatibility among the actions governed by the different laws. As noted earlier, preservation of natural floodplains and comprehensive floodplain management are key parts of an effective overall stormwater management program. Natural flood areas should be maintained as part of the watershed's natural stormwater control system. Similarly, effective future stormwater management will preserve floodplains and assure that properties not now subject to flooding do not become so in the future.

MUNICIPALITIES PLANNING CODE (ACT 247, AS AMENDED)

The Municipalities Planning Code (MPC) is related to stormwater management because of the authority it grants to municipalities and counties. The MPC enables communities to prepare comprehensive land use plans and capital facilities programs. It also empowers them to prepare and adopt zoning, subdivision and land development, planned residential development, and official map ordinances. The various municipal codes (borough, township, etc.) authorize communities to adopt building/housing codes pursuant to their health, safety, and general welfare powers. These are the major planning and regulatory mechanisms that municipalities will use to implement the watershed plans. Section 11 of the Storm Water Management Act specifically requires municipalities to adopt "...such ordinances..., including zoning, subdivision and development, building code, and erosion and sedimentation ordinances..." to regulate development activity consistent with the watershed plan and Act 167. The reference to these ordinances in Section 11 implies that municipalities are supposed to utilize the land use and development authority granted by the MPC.

It is necessary to understand that various ordinances - zoning, subdivision and land development, and building - regulate different and distinct aspects or parts of the land use and development process. It is not possible to adopt one type of ordinance and simply include the items and controls covered by the other types of regulations. A community cannot regulate land usage in a subdivision and land development ordinance because the regulation of land use is a zoning power. Similarly, building code regulations such as structural standards for building construction cannot be contained in a subdivision and land development ordinance. Therefore, a comprehensive development regulation system requires, in most cases, the utilization of all three types of ordinances: zoning, subdivision/land development and a building code.

Applicable stormwater controls should be included in the proper ordinance whenever stormwater is being regulated for a land use or development activity that falls within the scope of one of the enabling authorities contained in the Planning Code (i.e., zoning, subdivision/land development, planned residential development) or under the building code's powers in the municipal codes. For example, if the activity being regulated is a subdivision, then the relative stormwater provisions belong in the subdivision ordinance. If a community utilizes a separate, single purpose stormwater ordinance, the ordinance should be clearly referenced into the appropriate sections of the municipality's zoning, subdivisions/land development and building codes. Also, the preamble of a separate stormwater ordinance should indicate that it is being adopted pursuant to the Municipalities Planning Code, Storm Water Management Act, and applicable sections of the municipal code. Under either approach, when a development activity is within the scope of the MPC, then the municipality should be sure to follow the various plan review processes and other administrative procedures in the MPC, including the procedures for enacting and amending zoning and subdivision regulations.

The inclusion of specific procedural requirements in the MPC clearly demonstrates the Legislature's concern that all development applications be given a fair and timely review. Since most stormwater management activities will relate to zoning, subdivision/land development or building code requirements, the stormwater reviews would adhere to the procedures required by the respective ordinances.

GOVERNMENTAL TORT IMMUNITY

Municipal immunity is becoming a concern to local communities and officials who have adopted and are implementing stormwater management regulations. Pennsylvania and municipal immunity statutes have also been the subject of recent changes and litigation. This section discusses governmental tort immunity and identifies the laws specifically dealing with federal, state, municipal, and public official immunity. The discussion summarizes the basic scope of the laws, with some analysis of the relationship of the new (1979) Subdivision Torts Claims Act to stormwater management issues in local municipalities. Municipal officials, of course, will have to be guided by the advice of their solicitors on potential liabilities as specific cases or situations arise.

FEDERAL AND STATE IMMUNITY

In common law there were three distinct levels of governmental tort immunity: sovereign immunity, political subdivision immunity, and public official immunity. Sovereign immunity was part of the common law from its very beginnings and became part of the law of this country and the Commonwealth of Pennsylvania when the common law of England was adopted after our county's independence was achieved. The concept behind the doctrine was that the king was sovereign and could be sued only if he consented. In fact, the rule of law came to be that "the king could do no wrong". After independence, the federal and state governments became sovereign and invested themselves with the king's immunity.

The U.S. Congress, by statute, has dramatically limited the doctrine of sovereign immunity as applied to the federal government. The Federal Tort claims Act (Title 28 U.S.C. 1346, 2671 et. seq.) provides, subject to certain enumerated exceptions, that the federal government can be held liable to the same extent as a private individual for the negligent acts or omissions of its employees.

With respect to the state sovereign immunity, the trend among states is to abolish or severely limit the doctrine by statute or case law. The belief is that the doctrine is unfair and not suited to the times. The Pennsylvania courts grudgingly applied the sovereign immunity doctrine, while pointing out its unjust results and strongly suggesting the need for legislation to reform the law. The Pennsylvania Supreme Court finally abolished the doctrine in Maybe vs. Pennsylvania Department of Highways, 479 Pa. 384 (1978). This case was decided in mid-July, 1978. Before the end of September of that year, the Legislature had recreated sovereign immunity by statute (42 Pa. C.S.A. 58521 et. seq). This new statute does provide for some very limited specifically enumerated exceptions to state sovereign immunity. Most of the exceptions go to negligent failure to adequately enforce state statutes and regulations. The statute also limits the amounts which can be recovered in suits brought under the exceptions. It is important to note that state immunity extends to state agencies, such as PennDOT and DER.

MUNICIPAL IMMUNITY

The second level of government tort immunity which developed as common law was applied to political subdivisions (i.e., municipalities, counties, municipal authorities, municipal agencies, commissions and departments, including planning commissions and zoning hearing boards). The historical basis of the doctrine was that local governments were the agents of the king. A substantial number of states have abolished municipal immunity by statute of judicial decision. The Pennsylvania Supreme Court first limited the doctrine by holding that it only applied to torts arising out of governmental function (i.e., those activities which are typically performed by government; e.g., police, fire, regulatory, etc.) and not to torts arising out of a municipality's proprietary activities (i.e., activities that could be done by private corporations, such as owning and operating utilities).

In 1973, the court abolished the municipal immunity doctrine in Ayala vs. Philadelphia of Public Education, 453 Pa. 584. The court's rationale was that compensating the victims of negligent public employees should be properly regarded as a cost of the administration of government and should be distributed by taxes to the public which benefits from that government. This decision exposed political subdivisions to unlimited liability, the same degree of liability to which private persons and corporations have always been exposed, for negligent acts or omissions and those of their employees and agents. This was the situation until 1978, when the Pennsylvania Legislature enacted the Political Subdivision Tort Claims Act. Since the effective date of this legislation (January 24, 1979), the doctrine of municipal immunity, with certain statutory exceptions, has been resurrected in Pennsylvania. The provisions of this Act have been amended and recodified as 42 Pa. C.S. 38501 et. seq..

The Tort Claims Act applies to municipalities, municipal authorities, and counties. The purpose of the statute is to limit the liability of political subdivisions for the torts of their agencies, appointed and elected officials, and their employees. Under the Act, a municipality is not liable for damages caused by the negligence of an officer, employee, or agent unless all three of the following preconditions are met:

- Damages would be recoverable under common law or a statute, if the defendant was not a municipality.
- The injury was caused by the negligence of the municipality or its officers, employees, or agents operating within the scope of his or her office or employments.
- The negligent acts or omissions by a local agency or its officer or employer fall within eight specified categories of activity. The specified categories are:
    - Operation of a motor vehicle.
    - Care, custody, and control of personal property of others.
    - Care, custody, and control of real property in the possession of the local agency.

- Dangerous condition of trees, traffic signs, lights, or other traffic controls under care, custody, or control of the local agency.
- Dangerous condition of stream, sewer, water, gas, or electric systems owned by the local agency.
- Dangerous condition of streets owned by the local agency.
- Dangerous condition of sidewalks within the right-of-way of streets owned by the local agency.
- Care, custody and control of animals within the possession of the local agency, [Note: The numbers used here correspond to the numbering of these categories under Section 8542(b)].

The final four categories above are further conditioned by the requirement that a plaintiff must prove that the local agency had actual notice or could reasonably be charged with notice of the dangerous condition at a sufficient time prior to the event to have taken measures to protect against the danger.

The Torts Claims Act limits municipal liability to eight specific areas of activity. If an activity does not fit into any of the eight categories, then it appears that the municipality is not subject to any liability. For example, a municipality does not seem to be liable for damage caused by stormwater runoff from a development constructed according to subdivision plans negligently approved by municipal officials or employees. Under the Torts Claims Act, failure to use reasonable care (i.e., negligence) in the plan review and ordinance enforcement process does not fit into any of the eight categories. Therefore, even though there was negligence on the part of the official in performing the duty prescribed in the subdivision regulations and harm may have resulted, the Act appears to prevent the injured party from recovering damages against the municipality. After the Ayala case and before the effective date of the Tort Claims Act, the case law in Pennsylvania would have imposed liability on the municipality in this situation.

The Political Subdivisions Tort Claims Act probably would be held to be controlling with respect to suits of injured parties (e.g., those injured by runoff that would not have occurred but for the negligent enforcement of a municipal ordinance), although the other acts (e.g., Storm Water Management) appear to create municipal liability. Both acts should be read together. Since the Tort Claims Act is directly applicable, unless the court finds a clear express Legislative intent to impose liability, the Tort Claims Act would control. An affected municipality or aggrieved person could take action under Section 15(c) of the Storm Water Management Act to enjoin a municipality from taking an action, such as a negligent plan approval, because such action was a violation of the Act. Similarly, an aggrieved party may be able to force the municipality or official to enforce liability. If "streets" includes culverts and bridges supporting them, as it would seem it should, any culvert or bridge which does not meet the requirements of the Obstructions Act (which incorporates the Storm Water Management Act standards) could expose the municipality to action for damages. For example, damages which result from backwater flooding due to failure to clean culverts or undersized culverts under a municipal street might be recoverable.

The Torts Claims Act only protects municipalities and their officials from private suits. It does not protect them from enforcement orders issued by a state agency or from any criminal penalties provided by a state statute. Both the Obstructions Act and Clean Streams Law provide for DER enforcement orders and criminal penalties for violations of the statutes.

OFFICIAL IMMUNITY

The final area of tort immunity is that immunity given to public officials, employees, and agents themselves. Sections 8545 and 8546 of Title 42 Pa. C.S. generally codify the common law rule with respect to official immunity. These sections provide that an elected and appointed officer, employee, or agent when carrying out official duties and acting within the scope of his or her employment, is liable for damages caused by his or her negligence only to the same extent as is the governmental unit (i.e., provisions of Paragraph 8542 of the Tort Claims Act are applied to public officials). This coverage does not extend to independent contractors under contract with the governmental unit, where the unit has no right of control. This could be the case for many consulting engineers.

In one respect, official immunity is broader than municipal immunity since the official may assert certain defenses. These include those available to employees at common law, good faith, and that the action was discretionary. There is no liability for discretionary as opposed to ministerial acts. Thus, most actions of members of the governing body of a municipality would be immune. In another respect, however, officials may be held totally liable. Title 42 Pa. C.S. Paragraph 8550 provides that when the conduct of the official constitutes a willful criminal act or involves actual malice or actual fraud, the immunity statute does not apply. Thus, if an official intentionally fails to enforce a regulation, he or she may be held personally liable to the extent of all of their private assets for any damage that their act causes. However, as noted above, the municipality is not liable.

NOAA COASTAL SERVICES CTR LIBRARY
3 6668 14111669 1