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Standards for Soil Erosion and Sediment Control in New Jersey



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S T A N D A R D S

for

SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY

Adopted

June 14, 1972

by the

NEW JERSEY STATE SOIL CONSERVATION COMMITTEE

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FOREWORD



As Secretary of the New Jersey Department of Agriculture and Chairman of the State Soil Conservation Committee, I am pleased to present these Standards for Soil Erosion and Sediment Control in New Jersey. When utilized in conjunction with construction and, in fact, with any major land disturbance activities, significant benefits will accrue to the citizens of this State.

Problems of soil erosion and sedimentation, sometimes thought of as related only to agriculture, are actually many times greater as a result of land disturbance activities associated with urbanization. Erosion at the site of such activities generates sediment which finds its way to our streams and rivers to become, by sheer volume, the greatest pollutant of these waterways.

The control and prevention of soil erosion and sedimentation are major objectives of the State Soil Conservation Committee and our 15 soil conservation districts. The development of these Standards has provided an important tool to help implement such controls at all levels of government and by all persons who use the land.

I wish to express sincere thanks to the U.S. Department of Agriculture Soil Conservation Service for providing much of the basic technical information and to the members of the Development Committee listed on page ii who have contributed their time and expertise in the preparation of this outstanding document for use in New Jersey.

Phillip Alampi, Chairman
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PREFACE

The last several decades of rapid suburban development in the State of New Jersey has resulted in a number of undesirable effects. One of the most evident and harmful effects having very serious consequences is the erosion of soil by both wind and water. When soil is displaced unintentionally in this manner, problems are usually created in several areas: the area where the soil comes from; and the area (s) where it is deposited. If a waterway or drainage facility is involved, silting of the stream or drainage facility occurs. The cost of correcting the damage, pollution, and inconvenience this causes is much greater than the cost of preventing soil erosion in the beginning. Fortunately, the technology for preventing soil erosion is well established. Planners, engineers, developers and contractors must begin to utilize these tried and proven methods.

The New Jersey State Soil Conservation Committee under the chairmanship of Secretary of Agriculture Phillip Alampi, recognized a need for developing a comprehensive State wide plan to control these problems of erosion and sedimentation. A Sediment Control Committee was appointed and a copy of their report and recommendations has been published.

Among the recommendations of this group were the development of model ordinances for use by municipalities to regulate land disturbance activities to control erosion and sedimentation. Such model ordinances have been prepared by a committee of representatives from industry, government and concerned groups. Local governmental units should and will be encouraged to use them to establish the proper and necessary controls to reduce soil erosion.

Also recommended was the development of a single source of standards and recommendations to guide local governments, developers and technical personnel with erosion control techniques. Secretary of Agriculture Alampi responded to this recommendation and appointed the committee of knowledgeable persons listed on page ii of this report to develop these standards.

The committee has worked diligently to produce these Standards which are a model of professional excellence. It is their earnest hope that concerned citizens, local governments and their technical advisors will act expeditiously to adopt the needed ordinances and stop the poor practices which have been laying our precious land to waste and ravaging the most valuable and beautiful features of the Garden State.

Thomas Birdsall, Chairman
Committee for Review and
Development of Standards

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INTRODUCTION

Construction projects that involve major land disturbance such as housing and industrial developments, highways and pipelines should be planned and designed with soil erosion and sediment control in mind. The subsequent reduction of soil losses on construction sites and the reduction of associated damages from sedimentation will result in substantial savings to the community, the contractor, the developer and to the landowner as well as providing for enhancement of the environment. The contractor who controls soil erosion during construction will also promote good will in the community.

While erosion and sedimentation controls are important on all sites, particular attention should be given to areas of steep topography and highly erodible soils. The larger the disturbed area and the longer it is left unstabilized, the more serious the problem becomes.

Natural vegetation covers and protects most of our lands from erosion. Its removal necessitates application of alternative protective measures. Establishment of mechanical structures engineered to control water runoff, the application of artifical protective cover or the rapid re-establishment of vegetation are among the methods which are suitable to control erosion and sedimentation.

The purpose of these Standards is to help those responsible for construction to control soil movement through use of these methods. The comprehensive erosion control methods which follow have been developed to provide this help. Interpretive assistance in their application and use is available through the soil conservation district where the land disturbance will take place. A district directory is included in the appendix.

GUIDE LINES

FOR SOIL EROSION AND SEDIMENT CONTROL

Planning

Effective erosion control begins in the project planning stage. Proper planning requires consideration of water control and soils to be encountered in order to reduce erosion problems during and after construction. Steep slopes, potential landslide areas, stream crossings, stream encroachments, and cut and fill sections should be evaluated for construction problems involved in reducing erosion and the resulting sediment damage to streams and water supplies. The evaluation of soils, existing vegetation, geologic and hydrologic data is necessary to define problem areas. Every consideration should be given to assure the successful establishment of vegetation on disturbed areas as quickly as possible in order to minimize erosion and sediment damage.

Design

Proper design includes measures for erosion control and provides for the early establishment of vegetation that will help to avoid erosion problems during and after construction. Alignment, grades, area of disturbed soil and bank slopes should be based on soil erodibility, climatic exposure, geology, proposed vegetative restoration and expected maintenance. The erosion potential from wind or rain, concentrated runoff or snow melt should be evaluated and measures to prevent erosion selected on the basis of both effectiveness of the measure and consequence. Some features involved in earth construction are more vulnerable to erosion than others and require special design considerations.

Guidelines for design of measures and treatment to prevent erosion are as follows:

a. Earth Slopes: Erosion of cut or fill slopes is usually caused by water concentrations at the top of the slope flowing down an unprotected bank. Runoff should be diverted to safe outlets by diversions or other means. Slopes should be protected from erosion by quick establishment of vegetative cover, benches or terraces, slope protection structures, mulches, or a combination of these practices as required.

b. Waterways or Channels: Waterways should be designed to avoid serious erosion problems. Wide channels with flat side slopes lined with grass or other vegetation will usually be free from erosion. Where channel gradients are steep, concrete linings or grade control structures may be required. Space limitations may make it necessary to use concrete or stone linings. Every effort should be made to preserve natural channels.

c. Structures for Erosion Control: Erosion may be controlled by the use of grade control structures, energy dissipators, special culverts, and various types of pipe structures. Structures are expensive and should be used only after it has been determined that recommended vegetation, rock or other measures will not provide adequate erosion control.

d. Detention and Sediment Basins: Small ponds can be constructed to trap sediment. Dams for this purpose are inexpensive and may be permanent or temporary. Detention reservoirs can be designed to reduce peak flows increased by upstream paving to an amount near the original flow. This helps reduce erosion in downstream channels. Dams must be properly designed to avoid failure .

e. Existing Vegetation: Good stands of existing vegetation adequate to control erosion should be preserved wherever possible. Regeneration of wood plants should be encouraged where acceptable.

f. Soil Treatment: The ability of the soil to sustain vegetation intended for erosion control must be ascertained. The admixture of a fine textured topsoil to a coarse textured soil may be warranted to assure success of more attractive, lower maintenance vegetation. Liming and fertilization should b done according to recommendations resulting from soil test information.

g. Seed Bed Preparation: Lime and fertilizer should be incorporated into the soil, where practical, to depth of 4 inches. Soil shall not be too fluffy nor too compacted, but friable to permit proper coverage of seed.

h. Seeding: Seed mixtures, certified as to composition, should be chosen in accordance with standards considering soil drainage, and area usage. Follow recommended rates, dates, and seeding procedures.

i. Mulching: The more adverse the environment, the greater the advantage of mulching according to standards contained herein.

j. Practice Standards: Plans, designs and construction specifications should be in accordance with the standards covering design and installation of erosion control measures as contained herein.

Construction

The plans, specifications, and special provisions of a construction contract should show the location, scope, and manner of performing erosion control measures. Measures left to the discretion of the engineer should be few as practicable and the method of payment for such work should be stated in the contract.

Scheduling of construction operations is an important factor. A construction schedule that meets the requirements for erosion control should be made a part of the construction project proposal or should be submitted by the contractor for approval by the engineer.

Sub-division ordinances and building codes should also provide for adequate erosion control and scheduling of construction as indicated above for contracts.

Permanent soil protection, streets and drainage facilities should be completed as early as practicable, particularly intercepting channels and similar controls that will divert runoff from unprotected soil. The area of exposed soil and the length of exposure should be minimized by proper scheduling. Temporary protection such as fiber mats, plastic, straw, and fast-growing grasses may be required. Partially completed drainage structures should be inspected carefully during construction to prevent erosion.

Fording of streams with equipment should be kept to a minimum, and where frequent crossing are comtemplated, temporary bridges or culverts should be constructed.

Although disturbance of streams, lakes or reservoirs by construction should be avoided, drainage structures, channel changes, and embankment encroachments are sometimes necessary. Specifications and special provisions should include controls of the contractor's operation in performing work in these areas.

Diversions or other protective measures may be needed to avoid sediment problems. Embankment slopes that encroach on stream channels should be adequately protected. Where practicable, a protective area of vegetative cover should be left or established between embankments and adjacent stream channels.

Areas for borrow pits and waste disposal should be selected with full consideration of erosion control and the final treatment or restoration of the area.

en it becomes necessary to locate such areas near or in stream channels, ecial precautions should be taken to minimize erosion and accompanying sedi- nt problems.

efore borrow or disposal operations are begun, plans for the control of drain- e water must include measures to keep sediment from entering streams. Di- ersion channels, dikes, and sediment traps may be used for this purpose. Top- oil should be saved for use in restoring excavated areas. Final restoration of rrow or waste disposal areas should include grading and establishment of getative cover. The restored area should be well drained unless approval is iven to convert the pit area into lakes for fish and wildlife, recreation, stock ter or irrigation.

pecifications should include adequate control for the prevention of grass and rush fires since burned-over areas are usually highly vulnerable to erosion. areas where a severe fire hazard exists, fire equipment should be available r ready use. The contract should provide for suspending fire-hazardous erations at the direction of the engineer.

STANDARDS
FOR
TEMPORARY VEGETATIVE COVER

Definition

Establishment of temporary vegetative cover on soils exposed for periods of one to 12 months.

Purpose

To temporarily stabilize the soil and reduce damage from wind and water erosion until permanent stabilization is accomplished.

Where Applicable

On exposed soils that have the potential for causing off-site environmental damage.

Methods and Materials

Site Preparation

A. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and mulch anchoring. All grading should be done in accordance with Standards for Land Grading, page 4.11.

B. Install needed erosion control practices or facilities such as diversions, grade stabilization structures, berms, channel stabilization measures, desilting basins and waterways. See Standards 4.2 through 4.7.

Seedbed Preparation

A. Apply limestone and fertilizer according to soil test recommendations such as those offered by Rutgers University Soil Testing Laboratory. Contact your County Agricultural Agent at your county office. If soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 600 pounds per acre or 14 pounds per 1,000 square feet of 10-20-10 or equivalent. If seed is drilled over banded fertilizer, the rate of fertilizer is reduced 50 percent. Apply limestone (equivalent to 50 percent calcium plus magnesium oxides) as follows:

Soil Textures	Tons/Ac.	Lbs/1000 sq. ft.
Clay, clay loams and high organic soils	3	135
Sandy loams, loams, silt loams	2	90
Loamy sands, sands	1	45

Pulverized dolomitic limestone is preferred for most soils south of the New Brunswick-Trenton line.

B. Work lime and fertilizer into the soil as nearly as practical to a depth of 4 inches with a disc, springtooth harrow or other suitable equipment. The final harrowing or discing operation should be on the general contour. Continue tillage until a reasonably uniform seedbed is prepared.

C. Inspect seedbed just before seeding. If traffic has left the soil compacted, the area must be retilled as above.

III. Seeding

A. Select seed recommended in table below:

TABLE 3.1-1

TEMPORARY SEEDINGS AND SEEDING DATES

Crop	SEEDING RATE		SEEDING DATES 1/	
	Per acre	Per 1000 sq. ft.	North Jersey	South Jersey
Oats (spring)	2 1/2 bu.	2 lbs.	Before Apr. 25	Before Apr. 1
Rye	2 bu.	2.4 lbs.	Sept. 1-Oct. 15	Sept. 1-Nov. 1
Barley (winter)	2 bu.	2.2 lbs.	Sept. 20-30	Sept. 20-Oct. 15
Ryegrass (annual)	40 lbs.	0.9 lb.	Before May 20 Aug. 15-Oct. 15	Before May 15 Aug. 25-Nov. 1
Korean lespedeza*	25 lbs.	0.6 lb.	---	Feb. 1-July 5
Millet (foxtail*)	30 lbs.	0.7 lb.	May 10-June 20	May 1-July 1
Sudangrass*	60 lbs.	1.4 lb.	May 20-June 20	May 1-July 5
Weeping lovegrass	3 lbs.	0.1 lb.	June 1-Aug. 1	May 1-Aug. 15

*May be planted throughout summer if soil moisture is adequate or can be irrigated.

1/ North Jersey - Counties north of Mercer and Middlesex counties
South Jersey - Mercer, Middlesex and counties south of these

B. Apply seed uniformly by hand, cyclone seeder, drill, cultipacker seeder or hydro-seeder (slurry including seed and fertilizer). Optimum seeding depth for specified annuals is one inch (except sandy soils, 2 inches). Hydroseedings which are mulched may be left on soil surface.

C. Where feasible, except when a cultipacker type seeder or hydroseeded is used, the seedbed should be firmed following seeding operations with a roller, or light drag. Seeding operations should be on the contour.

IV. Mulching: Required on sites difficult to vegetate (sands, slopes or hydroseedings and off season operations).

A. Mulch materials should be unrotted salt hay or small grain straw at the rate of 1 1/2 to 2 tons per acre, or 70 to 90 pounds per 1000 square feet. Mulch should not be ground or chopped into short pieces.

B. Spread uniformly by hand or mechanically so that approximately 75 percent to 95 percent of the soil surface will be covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000 square feet sections and distribute 70 to 90 pounds within each section.

C. Mulch anchoring should be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area, steepness of slopes and costs.

1. Peg and Twine - Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a

square pattern. Secure twine around each peg with two or more round turns.

Mulch Nettings - Staple paper, jute, cotton or plastic nettings to the soil surface. Use a degradable netting in areas to be mowed.

Mulch Anchoring Tool - A tractor-drawn implement especially designed to punch and anchor salt hay or straw mulches into the surface soil may be used. This practice affords maximum erosion control, but its use is limited to those slopes upon which the tractor can operate safely. Tool penetration should be about 3 to 4 inches. The operation should be done on the contour.

Liquid Mulch-Binders - May be used to anchor salt hay or straw mulches.

a. Applications should be heavier at edges where wind catches mulch, in valleys and at crests of banks. Remainder of area should be uniform in appearance.

b. Use one of the following:

(1) Emulsified asphalt - (SS-1, SS-K, MS-2, RS-1, RS-2, RS-2K, or RS-3K)
Apply .04 gal./sq. yd. or 194 gal./acre on flat slopes and on slopes less than 8 feet high. On slopes 8 feet or more high use .075 gal./sq. yd. or 363 gal./acre.

(2) Cutback asphalt - rapid curing (RC-70, RC-250, or 7C-800) or medium curing (MC-250 or MC-800).
Apply .04 gal./sq. yd. or 194 gal./acre on flat areas and on slopes less than 8 feet high. On slopes 8 feet or more high use .075 gal./sq. yd. or 363 gal./acre.

STANDARDS
FOR
PERMANENT VEGETATIVE COVER

Definition

Establishment of permanent vegetative cover on exposed soils where perennial vegetation is needed for long term protection.

Purpose

To permanently stabilize the soil, assuring conservation of soil and water and to enhance the environment.

Where Applicable

On exposed soils that have a potential for causing off-site environmental damage.

Methods and Materials

I. Site Preparation

A. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application and anchoring, and maintenance. All grading should be done in accordance with Standard 4.1.

B. Install needed erosion control practices and facilities such as diversions, grade stabilization structures, berms, channel stabilization measures, desilting basins and waterways. See Standards 4.2 through 4.7.

II. Seedbed Preparation

A. Apply limestone and fertilizer according to soil tests such as those offered by Rutgers University Soil Testing Laboratory. Contact your county agricultural agent at your county office. If soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 600 pounds per acre or 14 pounds per 1,000 square feet using 10-20-10 or equivalent. Apply limestone (equivalent to 50 percent calcium plus magnesium oxides) as follows: 1/

Soil Textures	T/Ac.	Lbs./1,000 Sq. Ft.
Clay, clay loams and high organic soil	4	180
Sandy loams, loams, silt loams	3	135
Loamy sand, sands	2	90

Pulverized dolomitic limestone is preferred for most soils south of the New Brunswick-Trenton line.

B. Work lime and fertilizer into the soil as nearly as practical to a depth of 4 inches with a disc, springtooth harrow or other suitable equipment. The final harrowing or discing operation should be on the general contour. Continue tillage until a reasonably uniform, fine seedbed is prepared. All but clay or silty soils and coarse sands should be rolled to firm the seedbed wherever feasible.

1/ Acid soil conditions:

Soils having a pH of 4 or less shall be covered with a minimum of 12 inches of soil having a pH of 5 or more before seedbed preparation.

C. Remove from the surface all stones two inches or larger in any dimension remove all other debris, such as wire, cable, tree roots, pieces of concrete, clods, lumps or other unsuitable material.

D. Inspect seedbed just before seeding. If traffic has left the soil compacted, the area must be retilled and firmed as above.

III. Seeding

A. Select a mixture from Table 3.2-1.

B. Apply seed uniformly by hand, cyclone seeder, drill, cultipacker seeder or hydro-seeder (slurry including seed and fertilizer). Normal seeding depth is from 1/4 to 1/2 inch. Hydroseedings which are mulched may be left on soil surface.

C. Where feasible, except when a cultipacker type seeder is used, the seedbed should be firmed following seeding operations with a roller, or light drag. Seeding operations should be on the contour.

IV. Mulching - Required on sites difficult to vegetate (sands, slopes or hydroseedings and off-season operations).

A. Mulch materials should be unrotted salt hay or small grain straw at the rate of 1 1/2 to 2 tons per acre, or 70 to 90 pounds per 1000 square foot. Mulch should not be ground or chopped into short pieces.

B. Spread uniformly by hand or mechanically so that approximately 75 percent to 95 percent of the soil surface will be covered. For uniform distribution of hand spread mulch, divide area into approximately 1,000 square feet sections and distribute 70 to 90 pounds within each section.

C. Mulch anchoring should be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area, steepness of slopes and costs.

1. Peg and Twine - Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a square pattern. Secure twine around each peg with two or more round turns.

2. Mulch Nettings - Staple paper, jute, cotton or plastic nettings to the soil surface. Use a degradable netting in areas to be mowed.

3. Mulch Anchoring Tool - A tractor-drawn implement especially designed to punch and anchor mulch into the surface soil. This practice affords maximum erosion control, but its use is limited to those slopes upon which the tractor can operate safely. Tool penetration should be about 3 to 4 inches. On sloping land, the operation should be done on the contour.

4. Liquid Mulch-binders - May be used to anchor salt hay or straw mulches.

a. Applications should be heavier at edges where wind catches mulch, in valleys and at crests of banks. Remainder of area should be uniform in appearance.

b. Use one of the following.

(1) Emulsified asphalt - (SS-1, SS-K, SM-K, MS-2, RS-1, RS-2,

SOILS, SEED MIXTURES AND DATES FOR PERMANENT SEEDINGS

SOILS [1]	MIXTURES	RATE Lbs./Ac.	Lbs./1000 Sq. Ft.	OPTIMUM SEEDING DATES [2] North Jersey	OPTIMUM SEEDING DATES [2] South Jersey
A. Droughty (sands, shallow, steep, shaly, gravelly)	A-1 Perennial ryegrass	15	3/8	Before 5/1 8/1-9/1	Before 4/15 8/10-9/10
	Crownvetch	10	1/4		
	Creeping red fescue	10	1/4		
	Chewings red fescue	10	1/4		
	A-2 Weeping lovegrass	2	1/16	3/1-7/1	3/1-7/1
	Sericea lespedeza	20	1/2		
	Chewings red fescue	10	1/4		
	Creeping red fescue	10	1/4		
	A-3 Midland bermudagrass	8 bu. 2-3' centers		--	4/15-7/15
	A-4 Other hybrid bermudagrass	20 bu. 12" centers		--	4/15-7/15
	A-5 Perennial ryegrass	20	1/2	Before 5/1 8/1-10/15	Before 4/15 8/15-11/1
	Chewings red fescue	15	3/8		
	Creeping red fescue	15	3/8		
B. Well drained; moderately well drained	Mixtures A-1 thru A-5 are applicable				
	B-1 Ky-31 tall fescue	30	3/4	Before 6/1 8/1-10/15	Before 5/1 8/15-11/1
	Chewings red fescue	15	3/8		
	Creeping red fescue	15	3/8		
	B-2 Ky-31 tall fescue or	15	3/8	Before 6/1 8/1-9/1	-- --
	Creeping red fescue	15	3/8		
	Chewings red fescue	15	3/8		
	Birdsfoot trefoil	10	1/4		
	B-3 Perennial ryegrass	20	1/2	Before 6/1 8/1-10/15	Before 5/1 8/15-11/1
	Chewings red fescue	15	3/8		
	Creeping red fescue	15	3/8		
	Kentucky bluegrass	15	3/8		

1/ See Page 3.26 - Classification of New Jersey Soil Series into Site Conditions Important to Seeding.
2/ Same as Page 3.24.

TABLE 3.2-1 (cont'd)
SOILS, SEED MIXTURES AND DATES
FOR PERMANENT SEEDINGS

SOILS	MIXTURES	RATE Lbs./Ac.	Lbs./1000 Sq. Ft.	OPTIMUM SEEDING DATES 2/ North Jersey	South Jersey
C. Somewhat poorly drained	C B-2 and B-3 are applicable				
D. Poorly drained	D Reed canarygrass with Redtop or Perennial ryegrass	20 4 20	1/2 1/8 1/2	Before 6/1 8/1-10/15	Before 5/1 8/15-11/1
E. Channel stabilization	E Combine B-3 with D at half rates of each				
F. Shady, poor sites	F B-3 is applicable				

All of the above seed mixtures except A-1 through A-4 and B-2 above can be seeded at any time providing the sites are mulched. The possibility of failing to get a stand established is greater, however, when the optimum seeding dates are ignored. This is especially true during June and July unless the site is irrigated.

The following varieties are suggested and, where available, certified seed should be used.

Perennial Ryegrass	Red Fescue	Kentucky Bluegrass
Manhattan	Creeping	Kenblue
Norlea	Pennlawn	Delta
Pennfine	Ruby	So. Dakota Certified
	Chewings	
	Highlight	
	Jamestown	

NOTE:
Grass seed mixtures checked by the Chief of the Bureau of Seed Certification, New Jersey Department of Agriculture, Trenton, New Jersey, will assure the purchaser that the mixture obtained is the mixture ordered.

1/ Same as Page 3.23
2/ North Jersey - Counties north of Mercer and Middlesex counties.
South Jersey - Mercer and Middlesex counties and counties south of these.

RS-2K, or RS-3K)

Apply .04 gal./sq. yd. or 194 gal./acre on flat slopes and on slopes less than 8 feet high. On slopes 8 feet or more high use .075 gal./sq. yd. or 363 gal./acre.

(2) Cutback asphalt - rapid curing (RC-70, RC-250, or 7C-800) or medium curing (MC-250 or MC-800)

Apply .04 gal./sq. yd. or 194 gal./acre on flat areas and on slopes less than 8 feet high. On slopes 8 feet or more high use .075 gal./sq. yd. or 363 gal./acre.

V. Irrigation - (where feasible) - If soil moisture is deficient, supply new seedings with adequate water (a minimum of 3 to 4 inches penetration) for plant growth until they are well established. This is especially true when seedings are made in abnormally dry or hot weather or on droughty sites.

VI. Topdressing

A. Spring seedings will require an application of fertilizer such as 10-10-10 or equivalent at 400 pounds per acre or 10 pounds per 1,000 square feet between September 1 and October 15.

B. Fall seedings will require the above between March 15 and May 1.

C. Mixtures dominated by weeping lovegrass may not need topdressing.

D. Bermudagrass should be topdressed before August 15.

CLASSIFICATION OF NEW JERSEY SOIL SERIES INTO SITE CONDITIONS IMPORTANT TO SEEDING

A. Droughty
B. Well and moderately well drained
C. Somewhat poorly drained
D. Poorly and very poorly drained

Series	Cls.	Series	Cls.	Series	Cls.	Series	Cls
Abbottstown	C	Coplay	D	Lamington	C	Pope	B
Adelphia	B	Cossayuna	B	Lansdale	B	Portsmouth	D
Adrian	D	Crestmore	B	Lansdowne	C	Preakness	D
Albia	C	Croton	D	Lawrenceville	B	Quakertown	B
Amwell	C	Culvers	C	Legore	B	Raritan	C
Annandale	B[1/]	Donlonton	C	Lehigh	C	Raynham	C
Asbury	B	Downer	B	Lenoir	C	Readington	B
Atherton	D	Doylestown	D	Leon	D	Reaville	C
Athol	B	Dragston	C	Lincroft	A	Rhinebeck	C
Atsion	D	Duffield	B	Livingston	D	Ridgebury	D
Aura	B	Dunellen	B	Lyons	D	Riverhead	B
Barclay	C	Dutchess	B	Marksboro	C	Rockaway	B
Bartley	B	Edneyville	B	Marlton	B	Rockport	B
Bath	B[1/]	Elkton	D	Matapeake	B	Roe	C
Bayboro	D	Ellington	B	Matawan	B	Rowland	B
Beatty	B	Evesboro	A	Matlock	D	Royce	B
Bedington	B	Fallsington	D	Mattapex	B	Rutlege	D
Berks	B	Fort Mott	A	Meckesville	B	St. Johns	D
Berryland	D	Fredon	D	Middlebury	B	Sassafras	B
Bertie	C	Freehold	B	Minoa	C	Scio	C
Bibb	D	Freneau	D	Monmouth	B	Shrewsbury	D
Biddeford	D	Galestown	A	Mount Lucas	B	Sloan	D
Birdsboro	B	Hackettstown	B	Nassau	A	Stephensburg	B
Boonton	B	Haledon	C	Navesink	B	Swartswood	B
Bowmansville	C	Halsey	D	Neshaminy	B[1/]	Tinton	A
Boynton	D	Hammonton	B	Netcong	B	Tioga	B
Braceville	B	Hazen	B	Nixon	B	Townsbury	B
Bridgeville	C	Hazleton[1/]	B	Nixonton	B	Tunkhannock	B
Bucks	B	Hero	B	Norton	B	Turbotville	C
Burnham	D	Hibernia	C	Norwich	D	Unadilla	B
Califon	B	Holmdel	B	Oquaga	B	Valois	B
Carlisle	D	Holyoke	A	Osier	D	Wallkill	D
Cattaraugus	B	Hoosic	A	Othello	D	Washington	B
Chalfont	C	Howell	B	Otisville	A	Wassaic	B
Chatfield	B	Keansburg	D	Palmyra	B	Watchung	D
Chenango	B	Kendaia	D	Parker	A	Wayland	D
Chillum	B	Keyport	B	Parsippany	D	Weeksville	D
Chippewa	C	Kistler	B	Pasquotank	D	Wellsboro	C
Cokesbury	D	Klej	A	Pattenburg	B	Westphalia	B
Colden	D	Klinesville	A	Pemberton	A	Whippany	C
Colemanstown	D	Kresson	C	Penn	B	Whitman	D
Collington	B	Lackawanna	B	Phelps	C	Woodglen	D
Colonie	A	Lakehurst	A	Plummer	D	Woodmansie	B
Colts Neck	B	Lakeland	A	Pocomoke	D	Woodstown	B
Comly	C	Lakewood	A	Pompton	C	Wooster	B
						Wurtsboro	B

1/ Slopes more than 25 percent as 1.

STANDARDS
FOR
STABILIZATION WITH MULCH ONLY

Definition

abilizing exposed soils with non-vegetative materials.

Purpose

temporarily protect exposed soil surfaces from erosion damage and to reduce off-te environmental damage.

Where Applicable

is practice is applicable to areas subject to erosion, where the season and other ditions may not be suitable for growing an erosion-resistant cover or where abilization is needed for a short period until more suitable protection can be plied.

Methods and Materials

I. Site Preparation

A. Grade, as needed and feasible, to permit the use of conventional equipment for applying and anchoring mulch. All grading should be done in accordance with Standard 4.1.

B. Employ needed erosion control practices such as diversions, grade stabilization structures, berms, channel stabilization measures, desilting basins and waterways. See Standards 4.2 through 4.7.

II. Protective Materials

A. Unrotted small-grain straw or salt hay at 1.5 to 2 tons per acre is spread uniformly at 70 to 90 pounds per/1000 square feet anchored with a mulch anchoring tool, liquid mulch binders or netting tiedown.

B. Asphalt emulsion or cutback asphalt at 600 to 1,200 gallons per acre. This is suitable for a limited period of time where travel by people, animals or machines is not a problem.

C. Synthetic soil stabilizers may be used--under suitable conditions and in sufficient quantities.

D. Wood-fiber or paper-fiber mulch at the rate of 1,500 pounds per acre may be applied by hydroseeding.

E. Mulch netting, such as paper, jute, excelsior, cotton or plastic, may be used.

F. Mulch anchoring should be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area, steepness of slopes and costs.

1. Peg and Twine - Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a square pattern. Secure twine around each peg with two or more round turns.

2. Mulch Nettings - Staple paper, jute, cotton, excelsior, or plastic nettings to the soil surface. Do not use non-degradable netting in areas to be mowed. Netting is usually available in rolls 4 feet wide and up to 300 feet long.

3. Mulch Anchoring Tool - A tractor-drawn implement especially designed to punch and anchor mulch into the surface soil. This practice affords maximum erosion control, but its use is limited to those slopes upon which the tractor can operate safely. Tool penetration should be about 3 to 4 inches. On sloping land, the operation should be done on the contour.

4. Liquid Mulch-binders

   a. Applications should be heavier at edges where wind catches mulch, in valleys, and at crests of banks. Remainder of area should be uniform in appearance.

   b. Use one of the following:

      (1) Emulsified asphalt - (SS-1, SS-K, SM-K, MS-2, RS-1, RS-2 RS-2K or RS-3K)

      Apply .04 gal./sq. yd. or 194 gal./acre on flat slopes and slopes less than 8 feet high. On slopes 8 feet or more high use .075 gal./sq. yd. or 363 gal./acre.

      (2) Cutback asphalt - rapid curing (RC-70, RC-250, or 7C-800) or medium curing (MC-250 or MC-800)

      Apply .04 gal./sq. yd. or 194 gal./acre on flat areas and on slopes less than 8 feet high. On slopes 8 feet or more high use .075 gal./sq.yd. or 363 gal./acre.

STANDARDS
FOR
PERMANENT STABILIZATION WITH SOD

Definition

Establishing permanent vegetation using sod.

Purpose

To permanently stabilize the soil, assuring conservation of soil and water and to enhance the environment.

Where Applicable

On exposed soils that have a potential for causing off-site environmental damage where a quick vegetative cover is desired.

Methods and Materials

1. Cultivated sod is preferred over native or pasture sod. Specify "Certified Sod," or other high quality cultivated sod.

2. Sod should be free of weeds and undesirable coarse weedy grasses.

3. Sod should be of uniform thickness, approximately 3/4 inch, plus or minus 1/4 inch, at time of cutting. (Excludes top growth).

4. Sod should have a compact root mat to assure mechanical strength and to assure early and firm anchoring to soil surface. Broken pads and torn or uneven ends will not be acceptable.

5. For slopes that are droughty or shady a sod of Kentucky 31 tall fescue and bluegrass is preferred over a straight bluegrass sod.

6. Only moist, fresh sod should be used. Sod should be harvested, delivered and installed within a period of 36 hours.

I. Site Preparation

   A. Grade as needed and feasible to permit the use of conventional equipment for liming, fertilizing and soil preparation. All grading should be done in accordance with Standard 4.1.

   B. Install needed erosion control practices and facilities, such as interceptor ditches, dikes and terraces, erosion stops and desilting basins. See Standards 4.2 through 4.7.

II. Seedbed Preparation

   A. Apply limestone and fertilizer according to soil tests such as those offered by Rutgers University Soil Testing Laboratory. Contact your county agricultural agent at your county office. If soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 600 pounds per acre or 14 pounds per 1,000 square feet using 10-20-10 or equivalent. Apply limestone (equivalent to 50 percent calcium plus magnesium oxides) as follows:

Soil Textures	T./Ac.	Lbs./1000 Sq. Ft.
Clay, and clay loams and high organic soil	4	180
Sandy loams, loams, silt loams	3	135
Loamy sands, sands	2	90

Pulverized dolomitic limestone is preferred for most soils south of the New Brunswick-Trenton line.

B. Work lime and fertilizer into the soil as nearly as practical to a depth of 4 inches with a disc, springtooth harrow or other suitable equipment. The final harrowing or discing operation should be on the general contour. Continue tillage until a reasonably uniform, fine seedbed is prepared.

C. Remove from the surface all objects that would prevent good sod to soil contact and remove all other debris, such as wire, cable, tree roots, pieces of concrete, clods, lumps or other unsuitable material.

D. Inspect site just before sodding. If traffic has left the soil compacted, the area must be retilled and firmed as above.

III. Sod Placement

A. Sod strips should be laid on the contour, never up and down the slope, starting at the bottom of the slope and working up. On steep slopes, the use of ladders will facilitate the work and prevent damage to the sod. During periods of high temperature, lightly irrigate the soil immediately prior to laying the sod.

B. Place sod strips with snug even joints. Open spaces invite erosion. Stagger joints.

C. Roll or tamp sod immediately following placement to insure solid contact of root mat and soil surface. Do not overlap sod. All joints should be butted tightly in order to prevent voids which would cause drying of the roots.

D. On sloping sites, secure sod to surface soil with wood pegs, wire staples, or split shingles (8 to 10 inches long by 3/4 inch wide).

E. Surface water cannot always be diverted from flowing over the face of the slope, but a capping strip of heavy jute or plastic netting, properly secured, along the crown of the slope will provide extra protection against lifting and undercutting of sod. This same technique can be used to anchor sod in water-carrying channels and other critical areas. Wire staples must be used to anchor netting in channel work.

F. Immediately following installation, sod should be watered until moisture penetrates the soil layer beneath sod to a depth of 4 inches. Maintain optimum moisture for at least two weeks.

STANDARDS FOR TOPSOILING

Definition

Topsoiling entails the distribution of suitable quality soil on areas to be vegetated.

Purpose

To improve the soil medium for plant establishment and maintenance.

Where Applicable

Topsoil should be used where soils are: sands, gravelly soils, loamy sands, clays, silty clays, very shallow or where they are extremely acid (less than pH 4.0) or salty (content greater than 1,000 ppm); or where topsoil is available on site and assurance of improved vegetative growth is desired.

Methods and Materials

I. Materials

Topsoil should be friable and loamy, free of debris, objectionable weeds and stones and contain no toxic substance that may be harmful to plant growth. A pH range of 5.0-7.5 is acceptable. Soluble salts should not exceed 500 ppm.

II. Stripping and stockpiling

A. Field exploration should be made to determine whether quantity and or quality of surface soil justifies stripping.

B. Stripping should be confined to the immediate construction area.

C. Where feasible, lime may be applied before stripping at a rate determined by soil tests to bring the soil pH to 6.5. In lieu of soil tests, see lime rate guide in seedbed preparation for permanent vegetative cover, 3.21.

D. A 4 to 6 inch stripping depth is common, but may vary depending on the particular soil.

E. Stockpiles of topsoil should be situated so as not to obstruct natural drainage or cause off-site environmental damage.

F. Stockpiles should be vegetated in accordance with standards previously described herein, see 3.1 or 3.2.

III. Site Preparation

A. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation. Seeding, mulch application and anchoring, and maintenance. See Standard 4.1.

B. Subsoil should be tested for lime requirement and limestone, if needed, should be applied to bring soil pH to 6.5 and incorporated into the soil as nearly as practical to a depth of 4 inches.

C. Immediately prior to topsoil distribution, the surface should be scarified to provide a good bond with the topsoil.

D. Employ needed erosion control practices such as diversions, grade stabilization structures, berms, channel stabilization measures, desilting basins and waterways. See Standards 4.2 through 4.7.

IV. Applying Topsoil

A. Topsoil should be handled only when it is dry enough to work without damaging soil structure.

B. A uniform application to a depth of 5 inches (unsettled) is recommended, but may be adjusted by direction of engineer or landscape architect.

CUBIC YARDS OF TOPSOIL REQUIRED
FOR APPLICATION TO VARIOUS DEPTHS

Depth (Inches)	Per 1,000 Square Feet	Per Acre
1	3.1	134
2	6.2	268
3	9.3	403
4	12.4	537
5	15.5	672
6	18.6	806

STANDARDS
FOR
MAINTAINING VEGETATION

Definition

The perpetuation of vegetative cover.

Purpose

To assure the continuing function of the vegetative cover in the conservation of soil and water and the enhancement of the environment. It is usually less costly to carry on a maintenance program than it is to make repairs after an extended period of neglect.

Where Applicable

On areas where existing vegetation protects or enhances the environment.

Methods and Materials

A preventive maintenance program anticipates requirements and accomplishes work when it can be done with least effort and expense to insure adequate vegetative cover.

Maintenance should occur on a regular basis, consistent with favorable plant growth, soil and climatic conditions. This involves regular seasonal work for mowing, fertilizing, liming, watering, pruning, fire control, weed and pest control, reseeding and timely repairs.

The degree of preventive maintenance depends upon the category of the vegetation and land; i.e., improved, semi-improved and unimproved grounds.

A. Mowing is a recurring practice and its intensity depends upon the function of the ground cover. On improved areas, such as lawns, certain recreation fields and picnic areas, mowing will be frequent. On semi-improved areas, mowing will be infrequent. Unimproved areas may be left unmowed to permit natural succession.

B. Fertilizer should be applied as needed to maintain a dense stand of desirable species. Frequently mowed areas and those on sandy soils will require more fertilization.

C. Lime requirement should be determined by soil testing every 2 or 3 years. Fertilization increases the need for liming.

D. Weed invasion may result from abusive mowing and inadequate fertilization and liming. Brush invasion is a common consequence of lack of mowing. The amount of weeds or brush that can be tolerated in any protective planting depends upon the land category and its intended use. Drainageways are subject to rapid infestation by weeds and woody plants. These should be controlled since they often reduce drainageway efficiency. Control of weeds or brush is accomplished by using herbicides or mechanical methods.

E. Pest and disease controls are more necessary on improved areas than on unimproved areas.

F. Fire hazard is greater where dry vegetation has accumulated. The taller the vegetation, the greater the hazard.

STANDARDS
FOR
DUNE STABILIZATION

Definition

Controlling surface movement of sand dunes or shifting sand by vegetative or mechanical means.

Purpose

To reduce soil blowing and the encroachment of shifting sands on valuable property; provide a barrier against tide water; and to make the areas useful for other purposes.

Where Applicable

On seashore areas where blowing sands, tide and storm waters may cause damage.

Methods and Materials

A. Vegetative

1. American beachgrass (Ammophila breviligulata) is best planted between October 1 and April 30 when sand is not frozen.

2. Three to five stems with roots, which may be joined, are placed in a hole approximately 8 to 9 inches deep.

3. It is recommended that planting stock be cut back to approximately 15 inches high. Roots should be dipped in a mud slurry.

4. Plants are spaced 18 x 18 inches; where erosion is servere, 12 x 12 inches. Plants should be staggered in alternate rows.

5. A common grade of mineral or a slow-release fertilizer equivalent to a minimum of 400 pounds of 10-10-10 is applied per acre. Mineral fertilizer, when used, is applied as a top dressing. When a slow-release fertilizer is used, it is placed in the holes with plants being planted.

6. The sand is packed firmly around the transplant to eliminate air pockets.

7. To build dunes, plantings are made to form a continuous bank and should consist of at least 10 rows paralleling the shoreline. Rows should be closer together at the center of the dune and wider apart at the edges.

8. Site - Planting is delayed on hydraulic fill until salt has been leached to a low level. Sand placed by earth moving equipment is allowed to be compacted by rains prior to dune planting. Dunes built with aid of snow fence are planted when dune is near top of fence.

9. Plantings are maintained with applications of fertilizer applied as needed to keep desired density. A minimum annual application of 30 pounds N, and 10 pounds P_2O_5 should be applied per acre.

B. Mechanical

1. In frontal areas, dunes may be created by erection of snow fences, brush fences, or Christmas trees set in parallel rows 20 to 30 feet apart, parallel to the beach, and well back from the mean high water line. Barriers are added until the desired height and width of the dune is obtained. The frontal dune should be about 120 feet wide at the base and 12 feet high.

a. If brush is used, it is lashed to horizontal rails nailed to the line of posts.

b. If Christmas trees are used, they are anchored well in the sand and spaced to touch each other in the row.

2. Dunes are stabilized as in A, above (with vegetation).

3. Where foot or vehicular traffic is appreciable over frontal dunes, it is advisable to direct such traffic over paths of gravel or boards to prevent dune blowout.

STANDARDS
FOR
LAND GRADING

Definition

Reshaping the ground surface by grading to planned grades which are determined by topographic survey and layout.

Purpose

The practice is for one or more of the following: Provide more suitable sites for land development; improve surface drainage; and control erosion.

Conditions Where Practice Applies

This practice is applicable where grading to planned elevations is practical and it is determined that grading is needed. Grading that involves the disturbance of vegetation over large areas should be avoided.

Planning Criteria

The grading plan and installation shall be based upon adequate topographic surveys and investigations. The plan is to show the location, slope, cut, fill and finish elevation of the surfaces to be graded. The plan should also include auxiliary practices for safe disposal of runoff water, slope stabilization, erosion control and drainage. Facilities such as waterways, ditches, diversions, grade stabilization structures, retaining walls and subsurface drains should be included where necessary.

Erosion control measures should be designed and installed in accordance with the applicable standard contained herein.

The development and establishment of the plan shall include the following:

1. The cut face of earth excavations and fills shall be no steeper than the safe angle of repose for the materials encountered and flat enough for proper maintenance.

2. The permanently exposed faces of earth cuts and fills shall be vegetated or otherwise protected from erosion.

3. Provisions shall be made to safely conduct surface water to storm drains or suitable water courses and to prevent surface runoff from damaging cut faces and full slopes.

4. Subsurface drainage is to be provided in areas having a high water table, to intercept seepage that would adversely affect slope stability, building foundations or create undesirable wetness.

5. Adjoining property shall be protected from excavation and filling operations.

6. Fill shall not be placed adjacent to the bank of a stream or channel, unless provisions are made to protect the hydraulic, biological, asthetic and other environmental functions of the stream.

Installation Requirements

Timber, logs, brush, rubbish, rocks, stumps and vegetable matter which will interfere with the grading operation or affect the planned stability or fill areas shall be removed and disposed of according to the plan.

Topsoil is to be stripped and stockpiled in amounts necessary to complete finish grading of all exposed areas requiring topsoil. See Standard for topsoiling (P. 3.51).

Fill material is to be free of brush, rubbish, timber, logs, vegetable matter and stumps in amounts that will be detrimental to constructing stable fills.

Cut slopes which are to be topsoiled will be scarified to a minimum depth of 3 inches prior to placement of topsoil.

All fills shall be compacted sufficiently for their intended purpose and as required to reduce slipping, erosion or excess saturation.

All disturbed areas shall be left with a neat and finished appearance and shall be protected from erosion. See vegetative Standards.

STANDARDS FOR DIVERSIONS

Definition

A channel with a supporting ridge on the lower side constructed across the slope.

Purpose

To divert water from areas where it is in excess to sites where it can be used or disposed of safely. It includes reducing slope lengths and diverting runoff.

Conditions Where Practice Applies

This standard covers the installation of diversions with drainage areas up to 100 acres on construction sites and urban developments.

It includes temporary diversions, channels, interceptors and diversion dikes as well as permanent diversions and level spreaders. Temporary diversions usually have a life expectancy of one year or less and the failure hazard is low.

This practice applies to sites where runoff is damaging: (1) low lying areas, (2) cut or fill slopes or steeply sloping land, (3) critical sediment source areas in construction sites, (4) buildings, residences and streets and (5) active gullies or other erodible areas.

Diversions must have stable outlets. The site, slopes and soils must be such that the diversion can be maintained throughout its planned life.

Permanent diversions are not applicable below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversions.

Design Criteria

Capacity

Peak runoff values shall be determined by the method contained in Chapter 2, Ref. (1), The Rational Method (Q = CIA), or by other accepted methods.

Design frequencies and freeboard requirements shall comply with the information in Table 4.2-1. Channel dimensions may be determined by using the appropriate retardance factor such as contained in Chapter 7 and 9, Ref. (1), or by Manning's formula using a suitable "n" value.

TABLE 4.2-1 DESIGN FREQUENCIES AND FREEBOARD

Diversion Type	Typical Area of Protection	Design Frequency	Freeboard Required
Temporary	Construction Areas (roads, pipelines, etc.)	2 years	0.0
	Building Sites	5 years	0.0
Permanent	Land Areas, Play Fields, Recreation Areas, etc.	25 years	0.3 ft.
	Homes, Schools, Industrial Buildings etc.	50 years	0.5 ft.
	Agricultural Land	10 years	0.3 ft.

Permissible Velocities

Permissible velocities should be as shown in Tables 4.2-2 and 4.2-3.

Cross Section

The shape of the channel cross section shall be such that the diversion can be properly maintained with modern equipment.

The channel may be parabolic, vee-shaped, or trapezoidal and shall have stable side slopes. The side slopes for permanent diversions should not be steeper than 3:1 for maintenance purposes, and preferably 4:1. Where frequent crossings are expected, slopes should be flatter. The back slope of the ridge is not to be steeper than 2:1 and preferably 4:1. The ridge should include a settlement factor equal to 5 percent of the height. The minimum top width of the diversion ridge after settlement is to be 4.0 feet at the design water elevation. In determing the cross section for temporary diversions, consideration should be given to soil type, frequency of operation, and type of equipment that is anticipated to be crossing the diversion. In no case should slopes be steeper than 1:1.

Grade

Channel grade may be uniform or variable. The permissible velocity for soil type and vegetative cover will determine maximum grade. Level diversions with blocked ends may be used provided adequate pipe outlets are provided through the embankment.

TABLE 4.2-2 GUIDE TO SELECTION OF VEGETAL RETARDANCE

Stand	Average Length of Vegetation	Degree of Retardance	Stand	Average Length of Vegetation	Degree of Retardance
Good	Longer than 30"	A	Fair	Longer than 30"	B
	11 to 24"	B		11 to 24"	C
	6 to 10"	C		6 to 10"	D
	2 to 6"	D		2 to 6"	D
	Less than 2"	E		Less than 2"	E

Ref: Soil Conservation Service Engineering Field Manual, Chapter 9 (1969).

TABLE 4.2-3 PERMISSIBLE VELOCITIES

Soil Texture	Bare Channel	Permissible Velocity - Ft./Sec. Channel Vegetation			
		Retardance	Poor	Fair	Good
Sand, silt, sandy loam & silty loam	1.5	B C D	1.5	3.0 2.5 2.0	4.0 3.5 3.0
Silty clay loam	2.0	B C D	2.5	4.0 3.5 3.0	5.0 4.5 4.0
Clay	2.5	B C D	3.0	5.0 4.5 4.0	6.0 5.5 5.0

Ref: Soil Conservation Service Engineering Field Manual, Chapter 9 (1969).

Outlets

Diversions are to have adequate outlets which will convey runoff without damaging erosion. The following types of outlets are acceptable.

1. Natural or constructed vegetated outlets capable of safely carrying the design discharge. The outlet should be established and well vegetated prior to construction of the diversion.

2. Constructed outlet channels lined with rock, concrete, asphalt, metal or other suitable protective materials.

3. Properly designed and constructed grade stabilization structures or storm sewers.

Level Spreader

A level lip spreader shall be used at diversion outlets discharging onto area already stabilized by vegetation. Spreaders shall be excavated at least 6 inches deep into undisturbed soil. The bottom of the excavation and the downstream lip of edge shall be level. Minimum spreader lengths shall be based on the peak rate of flow from a 10-year frequency storm as indicated in Figure 4.2-I.

Diversion Dikes and Interceptors

Diversion dikes for the temporary and permanent protection of cut or fill slopes as shown in Figure 4.2-II or graded rights-of-way as shown in Figure 4.2-III shall be installed to divert runoff. Diverted runoff must be discharged onto a stabilized area or through a slope protection structure. (See figure 4.2 II and 4.2-III)

Protection Against Sediment

1. Temporary diversions - none required.

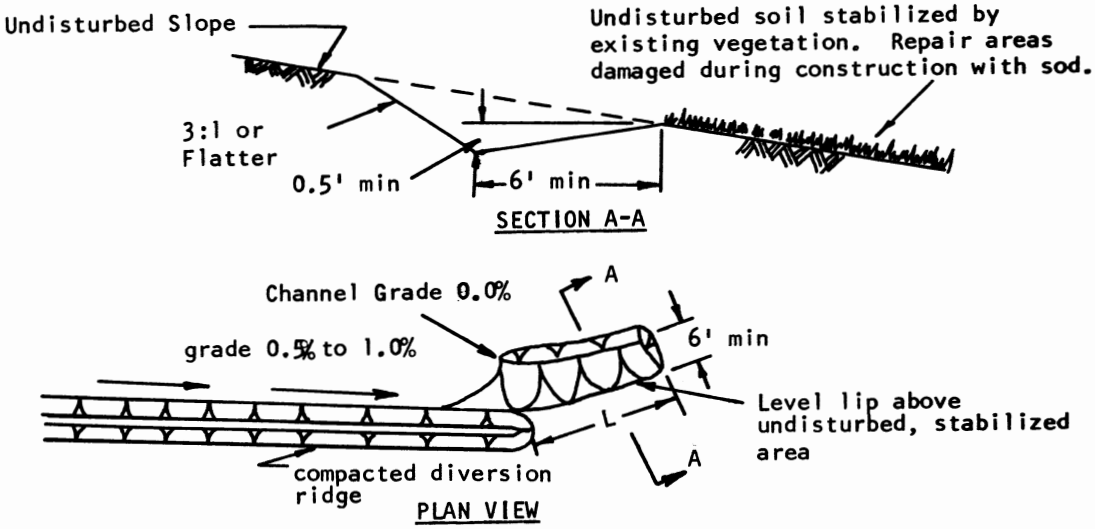
2. Permanent diversions - as a minimum, a filter strip of sod-forming grass shall be maintained above the channel. The width of the filter, measured from the center of the channel, shall be one-half the channel width plus 15 feet.

The diversion ridge and channel are to be seeded to grass to prevent erosion. See standard for permanent vegetative cover.

Eroded areas and sediment producing channels draining into the diversion are to be shaped and seeded prior to or at the time the diversion is constructed.

FIGURE 4.2-I

LEVEL SPREADER



DESIGN CRITERIA

Spreader length will be determined by estimating Q_{10} (10 year storm frequency) flow and selecting the appropriate length from Table.

Designed Q_{10} (cfs)	Minimum Length ("L" in Feet)
Up to 10	15
11 to 20	20
21 to 30	26
31 to 40	34
41 to 50	44
51 to 60	56
61 to 70	70
71 to 80	86
81 to 90	100

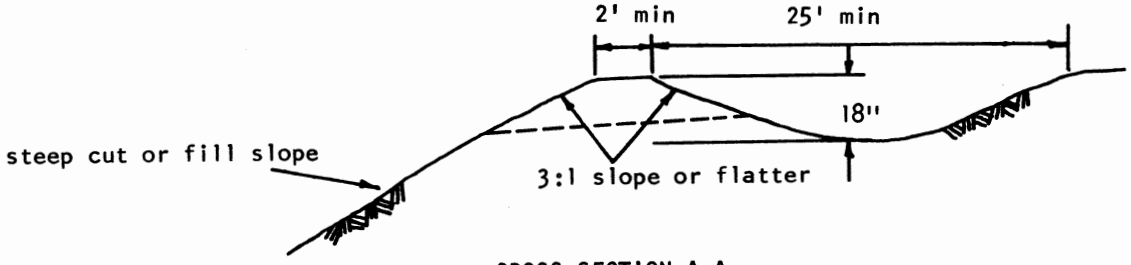
GENERAL NOTES:

1. Construct level lip on zero percent grade to insure uniform spreading of storm runoff (converting channel flow to sheet flow).
2. Level spreaders must be constructed on undisturbed soil (not on fill).
3. Entrance to spreader must be graded in a manner to insure that runoff enters directly onto the zero percent graded channel.
4. Storm runoff converted to sheet flow must outlet onto areas already stabilized by existing vegetation.
5. Periodic inspection and maintenance must be provided to insure intended purpose is accomplished.

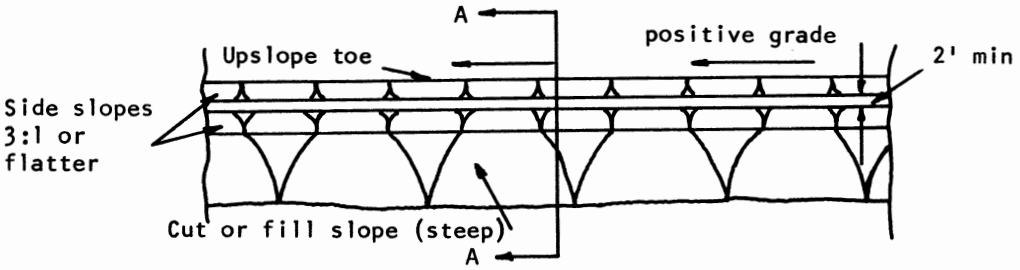
FIGURE 4.2-II

DIVERSION DIKE ABOVE STEEP SLOPES

FOR USE ON DRAINAGE AREAS OF 5 ACRES OR LESS. LARGER AREAS REQUIRE A DIVERSION DESIGN.



CROSS SECTION A-A



PLAN VIEW

DESIGN CRITERIA

Top width - 2 ft. min.
Height (compacted fill) - 18 in. unless otherwise noted on the plans.
(height measured from the upslope toe to top of the dike)
Side slopes - 3:1 or flatter.
Grade - dependent upon topography, but must have positive drainage of 0.25% to the outlet; may require vegetative or mechanical stabilization where grades are excessive.

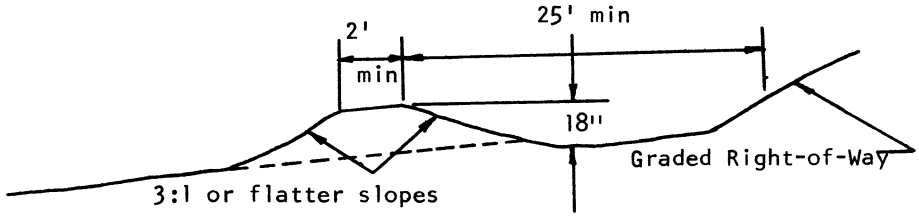
GENERAL NOTES:

1. All diversions must have positive grade draining to a stabilized outlet.
2. Diverted runoff must outlet onto a stabilized undisturbed area, a prepared level spreader, or into a slope protection structure.
3. Periodic inspection and required maintenance must be provided.

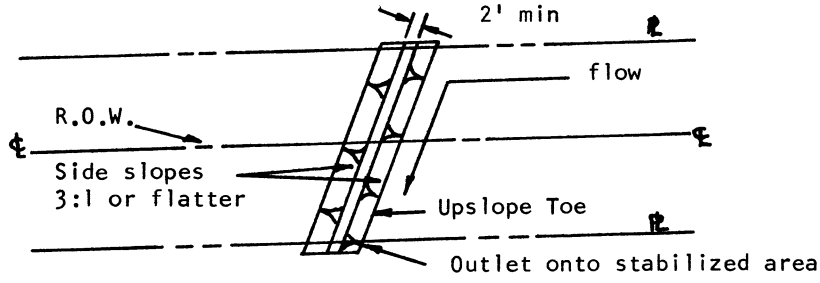
FIGURE 4.2-III

INTERCEPTOR DIVERSION FOR GRADED RIGHT-OF-WAY

FOR USE ON DRAINAGE AREAS OF 5 ACRES OR LESS. LARGER AREAS REQUIRE A DIVERSION DESIGN.



CROSS SECTION



PLAN VIEW

DESIGN CRITERIA

Top width - 2 ft. min.
Height - 18 in. unless otherwise noted on the plans (height measured from the upslope toe to top of the dike).
Side slopes - 3:1 or flatter (flat enough to allow construction traffic to cross if desired).
Grade - 0.5% to 1.0%
Spacing - 100 to 300 feet between diversions. (The steeper the slope the closer the spacing should be. Spacing may be checked by the Universal Soil Loss Equation, Appendix A1.)

GENERAL NOTES:

1. Top width may be wider and side slopes may be flatter, if desired.
2. Field location should be adjusted as needed to provide a stabilized safe outlet.
3. Diverted runoff shall outlet onto an undisturbed stabilized area, a prepared level spreader, or into a slope protection structure.
4. Periodic inspection and required maintenance must be provided.

Installation Requirements

All trees, brush, stumps and other objectionable material shall be removed so they will not interfere with construction or proper functioning of the diversion. All ditches or gullies which must be crossed will be filled and compacted prior to or as part of the construction. Fence rows and other obstructions that will interfere with construction or the successful operation of the diversion are to be removed.

Vegetation is to be removed and the base for the ridge thoroughly disked before placement of fill.

The minimum constructed cross-section is to meet the design requirements.

The top of the constructed ridge is not to be lower than the design elevation plus the specified amount for settlement.

Fertilizing, seeding and mulching shall conform to the recommendations in the standard for permanent vegetative cover. (Pg. 3.21)

If there is no sediment protection provided on temporary diversions, it should be anticipated that periodic cleanout may be required.

Construction operations shall be carried out in such a manner that erosion and air and water pollution will be minimized. State and local laws shall be complied with.

STANDARDS
FOR
GRASSED WATERWAY OR OUTLET

Definition

A natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as needed for safe disposal of runoff water.

Purpose

To provide for the disposal of excess surface water from construction sites and urban areas without damage from erosion.

Conditions Where Practice Applies

This standard applies to the installation of grass-lined waterways with drainage areas up to approximately 200 acres.

The practice also applies to sites where added capacity or vegetative protection or both are required to control erosion resulting from concentrated runoff.

Supplemental measures may be required with this practice. These may include such things as (1) grade control structures, (2) subsurface drainage to permit the growth of suitable vegetation and to eliminate wet spots, (3) a section stabalized with stone or other material within the waterway or (4) buried storm drain to handle frequently occurring storm runoff, base flow or snowmelt.

Design Criteria

Capacity

Peak runoff values shall be determined by the method contained in Chapter 2, Ref. (1), The Rational Method (Q = CIA), or by other accepted methods.

The minimum capacity shall be that required to convey the peak runoff expected from a 10-year frequency storm. Channel dimensions may be determined by using the appropriate retardance factor as shown in Table 4.3-1 or by Manning's formula using a suitable "n" value. Channel dimensions can be selected from charts contained in Chapter 7, Ref. (1), or from other accepted references.

Table 4.3-1 RETARDANCE FACTORS

Retardance	Cover	Stand	Condition and Height
A	Reed Canarygrass	Excellent	Tall (Average 36")
	Tall fescue	Excellent	Tall (Average 36")
	Smooth bromegrass	Excellent	Tall (Average 36")
	Weeping lovegrass	Excellent	Tall (Average 30")
	Switchgrass	Excellent	Tall (Average 36")
B	Bermudagrass	Good	Average (12"tall)
	Alfalfa	Good	Uncut (Average 11" tall)
	Lespedeza sericeas	Good	Not Woody (Average 19" tall)
	Weeping lovegrass	Good	Average (24" tall)
	Tall fescue	Good	Average (20" tall)
	Smooth bromegrass	Good	Average (20" tall)
	Switchgrass	Good	Average (20" tall)
	Red fescue	Good	Uncut (Average 16" tall)
	Kentucky bluegrass	Good	Uncut (Average 16" tall)
	Redtop	Good	Average (22" tall)
C	Bermudagrass	Good	Mowed (Average 6")
	Kentucky bluegrass	Good	Headed (6 to 12")
	Grass-legume mixture (orchardgrass, ryegrass and common lespedeza)	Good	Uncut (6 to 8")
	Red fescue	Good	Headed (6 to 12")
D	Bermudagrass	Good	Cut to 2.5"
	Kentucky bluegrass	Good	Cut to 2.5"
	Grass-legume mixture	Good	Uncut, 4"
	Red fescue	Good	Cut to 2.5"
	Lespedeza sericea	Good	Cut to 2"

Classification of vegetal cover in waterways and channels as to degree of retardance. Reference Soil Conservation Service, Engineering Field Manual, Chapter 7 (1969).

TABLE 4.3-2 PERMISSIBLE VELOCITIES

Cover	Slope 2/ Range (percent)	Permissible Velocity 1/	
		Erosion Resistant Soils (ft. per sec.) K=0.10 - 0.35	Easily Eroded Soils (ft. per sec.) K=0.36 - 0.80
Bermudagrass	0-5 5-10 over 10	8 7 6	6 5 4
Kentucky bluegrass Tall fescue	0-5 5-10 over 10	7 6 5	5 4 3
Grass mixtures Reed canarygrass	2/ 0-5 5-10	5 4	4 3
Lespedeza Sericea Weeping lovegrass Redtop Red fescue	3/ 0-5	3.5	2.5

1/ Use velocities exceeding 5 feet per second only where good cover and proper maintenance can be obtained.

2/ Do not use on slopes steeper than 10 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

3/ Do not use on slopes steeper than 5 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

4/ K is the soil erodibility factor used in the Universal Soil Loss Equation. (See Appendix A1)

Reference Soil Conservation Service Engineering Field Manual Chapter 7, (1969)

Velocity

The design velocity is to be based upon soil, duration of flow and type and quantity of vegetation. Table 4.3-2 indicated permissible velocities to be used for grassed waterway design.

Values contained in Table 4.3-2 are for established vegetation. Caution should be used during the establishment of the grass lining. Protective measures such as jute matting may be required during this critical period.

Cross Section

The cross section may be parabolic, vee-shaped, or trapezoidal.

Depth

The minimum depth of waterway receiving water from diversions or tributary channels is to be that required to keep the design water surface in the waterway or outlet at or below the design water surface elevation in the diversion or other tributary channel at their junction. To provide for loss in channel capacity due to vegetal matter accumulation, sedimentation and normal seedbed preparation, the channel depth and width should be increased proportionally to maintain the hydraulic properties of the waterway. In parabolic channels this may be accomplished by adding 0.3 foot to the depth and 2 feet to the top width of the channel. This is not required on waterways located in natural watercourses.

Where a paved or rock lined bottom section is used in combination with vegetative linings, the paved section is to be designed to handle the base flow, snowmelt or runoff from a one-year frequency storm, whichever is greater. This section shall be below the bottom of the grass lining and have a minimum depth of 0.5 feet.

Drainage

In areas with high water table or seepage problems, underdrains, stone centers, or other subsurface drainage methods are to be provided. A minimum drainage coefficient of 3/8 inch in 24 hours is to be used for underdrain design. An open joint storm drain may be used to serve the same purpose and also handle frequently occurring storm runoff, base flow or snowmelt. The storm drain should be designed to handle base flow, snowmelt or the runoff from at least a one-year frequency storm, whichever is greater.

Installation Requirements

Construction

Trees, brush, stumps and other material in objectional amounts are to be cleared and disposed of so as not to interfere with construction or proper functioning of the waterway.

Fills are to be compacted as needed to prevent unequal settlement that will cause damage in the completed waterway.

Vegetative Lining

Waterways or outlets shall be protected against erosion by vegetative means as soon after construction as practical and before diversions or other channels are outletted into them. Consideration should be given to the use of jute matting, excelsior matting (see Appendix A-5), or sodding channels to provide erosion protection as soon after construction as possible.

Seeding, fertilizing, mulching and sodding shall be in accordance with the applicable standards.

STANDARDS FOR SEDIMENT BASINS

Definition

A basin formed by a barrier or dam constructed across a waterway or at other suitable locations to intercept and retain sediment and debris.

Purpose

To provide a permanent or temporary means of preserving the capacity of reservoirs, ditches, canals, diversions, waterways and streams and to prevent undesirable deposition on bottomlands, and other developed areas, by providing basins for the deposition and storage of silt, sand, gravel, stone and other detritus.

Conditions Where Practice Applies

This practice applies where physical conditions preclude the treatment of the sediment source by the installation of erosion control measures to keep soil in place.

It may also be used as a permanent or temporary measure during construction operations that expose areas to erosion. If the basin is temporary, it may be removed once the construction is completed and the area is permanently protected against erosion.

This standard covers the installation of sediment basins on sites where:

(1) Failure of the structure would not result in loss of life or interruption of use or service of public utilities;

(2) The drainage area does not exceed 320 acres; and

(3) The water surface area at the crest of emergency spillway does not exceed 5 acres. For the purpose of this standard, basins are classified according to the following table:

TABLE 4.4-1 SEDIMENT BASIN CLASSIFICATION

Type	Max. Drainage Area (Acres)	Max. Height 1/ of Dam (Feet)	Emergency Spillway Required	Design Storm Frequency
1 2/	20	5	No	15 yr.
2	20	10	Yes	15 yr.
3	300	20	Yes	50 yr.

1/ Height is measured from the low point of original ground along the centerline of dam to the top of dam for Type 1 and to crest of emergency spillway for Types 2 and 3.

2/ Type 1 basins are to be used only where site conditions are such that it is impractical to construct an emergency spillway in undistrubed ground.

Design Criteria

The capacity of a basin shall equal the volume of sediment and debris expected to be trapped at the site during the planned useful life of the structures or improvements it is designed to protect. Where it is determined that removal of sediment and debris on a predetermined schedule is practicable, the capacity may be proportionately reduced.

Storage Capacity - When periodic cleanout is anticipated, the minimum basin capacity shall be equal to 0.6 inches of runoff or 0.05 acre-feet per acre of drainage area cottributing runoff water and sediment. This volume shall be contained in the basin below the emergency spillway crest or principal spillway crest if there is no emergency spillway. Basin cleanout shall be required when the storage capacity is reduced by sediment accumulation to 0.02 acre-feet per acre of drainage area. Therefore, the cleanout volume is 0.03 acre-feet per acre of drainage area or approximately 48 cubic yards per acre of drainage area. A stage storage curve showing the basin storage volume vs. elevation and the cleanout elevation corresponding to the cleanout volume should be attached to the drawings.

When periodic cleanout is not anticipated, the minimum basin capacity shall be 0.07 acre-feet per acre of drainage area contributing runoff.

Surface Area and Depth - The average basin length should be at least twice the average width. The minimum width in feet for average conditions should be 10 times the square root of the peak discharge of the 5-year storm in cubic feet per second. When downstream sediment damage may be severe, the minimum width should be increased to 10 times the square root of the peak discharge of the 25-year storm. The average design depth shall be at least 4 feet.

Spillway Design - Peak runoff values shall be determined by the method contained in Chapter 2, Ref. (1), The Rational Method (Q = CIA), or by other accepted methods.

The runoff computations should be based on soil cover conditions expected during the life of the structure, including the construction period.

For Type 2 basins the combined capacities of the principal and emergency spillways shall be sufficient to pass the peak discharge from a 15-year frequency storm after adjusting for flood routing.

For Type 3 basins the combined capacities of the principal and emergency spillways shall be sufficient to pass the peak discharge from a 50-year frequency storm after adjusting for flood routing.

Principal Spillways

Drop Inlet Spillway - Will consist of a vertical pipe or box type riser joined to a conduit which will extend through the embankment and outlet beyond the downstream toe of the fill as illustrated in Figure 4.4-I. Sizes may be determined from charts contained in Chapter 6, Ref. (1), or from other accepted references.

The minimum capacity of drop inlet spillways shall be based on a percentage of the peak flow expected from a 25-year frequency storm and shall be determined by multiplying the 25-year peak by the appropriate factor.

Factors for different drainage areas are shown in the following table.

TABLE 4.4-2 MINIMUM DROP INLET SPILLWAY CAPACITY

Drainage Area (Acres)	Factor
0 - 75	0.05
75 - 200	0.10
200 - 300	0.15

The crest elevation of the riser shall be at least 1 foot below the crest elevation of the emergency spillway.

The riser shall be half round pipe, full round pipe or a concrete box. Risers may be closed, perforated or fitted with flashboards. Perforations in round metal risers shall be approximately 1 inch in diameter, spaced 8 - 10 inches vertically, and 10 - 12 inches horizontally around the pipe. Closed box type risers should be ported or have some means for complete drainage of the sediment pool within a 5-day period following storm inflow.

Risers shall have a cross sectional area at least 1.5 times that of the barrel or conduit under the fill.

All conduit joints under the embankment shall be watertight.

Pipes such as asbestos cement, concrete and vitrified clay shall be laid in concrete bedding.

The structure shall be capable of withstanding both internal and external loads.

An approved trash rack and an anti-vortex device shall be firmly attached to the top of the riser if the conduit spillway conveys 25 percent or more of the peak rate of runoff from the design storm.

Anti-seep collars shall be installed around the pipe conduit within the normal saturation zone when any of the following conditions exist:

1. The settle height of dam exceeds 15 feet.
2. The conduit is of smooth pipe.
3. The conduit is of corrugated metal pipe larger than 12 inches in diameter.

The anti-seep collars and their connection to the pipe shall be watertight. The maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. In no case shall spacing exceed 25 feet. At least one anti-seep collar shall be used in each installation.

Protection against scour at the discharge end of the spillway shall be provided. Measures may include an impact basin, rock riprap, revetment, excavated plunge pools or use of other approved methods.

Other Spillway Structures - Include straight drop spillways, box inlet drop spillways and chute spillways illustrated in Figure 4.4-II, 4.4-III and 4.4-IV. Emergency spillways are not normally necessary when these spillways are used.

Drop structures may be of reinforced concrete, prefabricated metal, concrete block, timber sheeting or steel sheeting.

All drop structures with headwalls up to 5 feet high should be designed to pass 15-year design storm and all drop structures with headwalls greater than 5 feet high should be designed to pass a 50-year design storm. Chutes should be designed to pass a 50-year design storm.

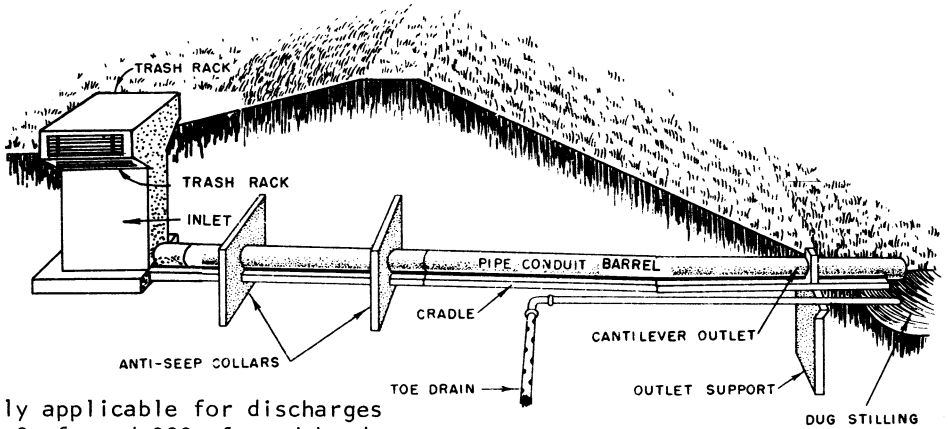
Weir flow capacities can be determined from Chapter 6, Ref. (1), or other acceptable references.

Structural design shall be based on sound engineering data with acceptable soil and hydrostatic loadings as determined on an individual site basis.

Earth Emergency Spillways

Type 2 and 3 basins shall have emergency spillways excavated in undisturbed or compacted fill wherever site conditions permit. The emergency spillway cross section shall be trapezoidal with a minimum bottom width of 8 feet.

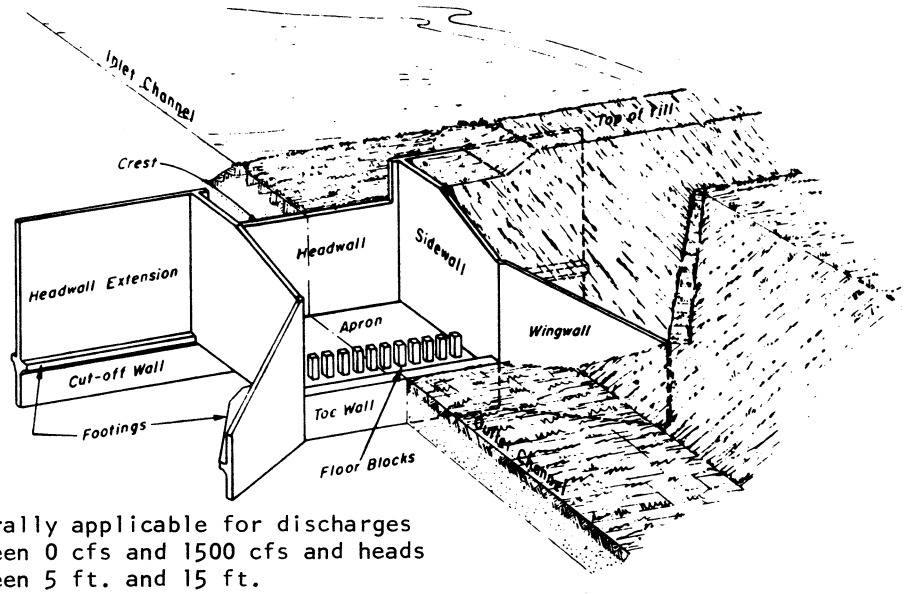
Figure 4.4-I



Generally applicable for discharges between 0 cfs and 200 cfs and heads between 5 ft. and 80 ft.

DROP INLET SPILLWAY

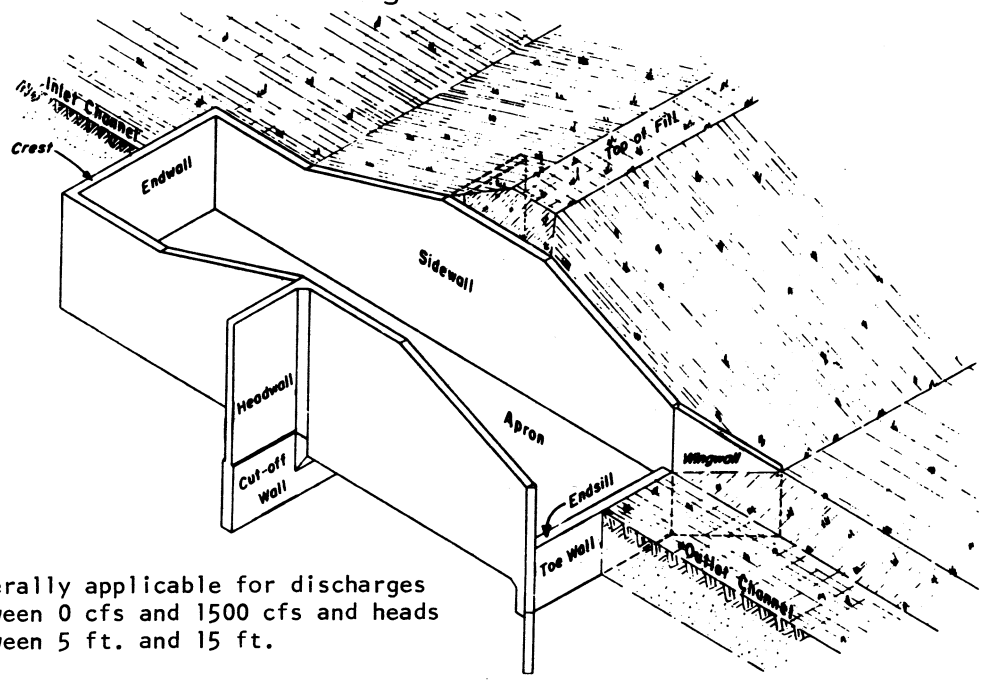
Figure 4.4-II



Generally applicable for discharges between 0 cfs and 1500 cfs and heads between 5 ft. and 15 ft.

STRAIGHT DROP SPILLWAY

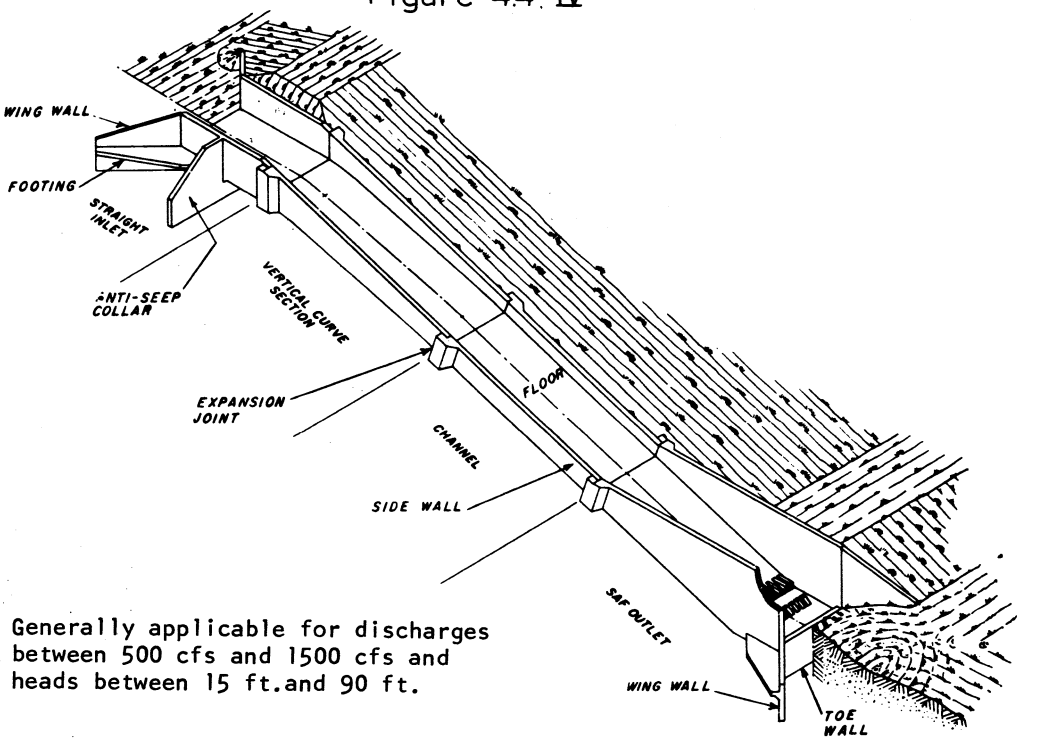
Figure 4.4-III



Generally applicable for discharges between 0 cfs and 1500 cfs and heads between 5 ft. and 15 ft.

BOX INLET DROP SPILLWAY

Figure 4.4-IV



Generally applicable for discharges between 500 cfs and 1500 cfs and heads between 15 ft.and 90 ft.

CHUTE SPILLWAY

Type 1 basins may utilize the embankment as an emergency spillway. The downstream slope of the embankments used as emergency spillways shall be 5:1 or flatter and must be immediately protected from erosion. Erosion protection shall be by sodding, rock riprap, asphalt or portland cement concrete paving or other approved methods.

The minimum capacity of the emergency spillway shall be that required to pass the peak rate of runoff from the design storm, less any reduction due to the flow in the drop inlet spillway. Emergency spillway dimensions can be determined by using the method outlines in Chapter 11, Ref. (1), or from other accepted references.

The maximum allowable velocity of flow in the exit channel shall be 6 feet per second for vegetated channels. For channels with erosion protection other than vegetation, velocities shall be in the safe range for the type of protection used.

Freeboard is the difference between the design flow elevation in the emergency spillway and the top of the settled embankment. The minimum freeboard for Type 2 and 3 basins shall be 1 foot.

Embankment (Earthfill)

Type 1 Basins - The minimum top width shall be 10 feet. The upstream slope shall be no steeper than 3:1. The downstream slope shall not be steeper than 5:1.

Type 2 and Type 3 Basins - The minimum top width shall be 10 feet. Side slopes shall not be steeper than 2 1/2:1.

The embankment shall be designed to an elevation 10 percent higher than the design height to allow for settlement if compaction is obtained with hauling equipment. If compactors are used for compaction, the overbuild may be reduced to 5 percent.

Embankment (Other than Earthfill) - Type 1 Basins Only

The embankment may be constructed of materials such as:

1. Pressure creosoted timber crib - rock filled
2. Precast reinforced concrete crib - rock filled
3. Gabions (Design in accordance with Ref. (5))

When the above material is used for the embankment, a principal spillway is not required; however, the dam shall be pervious to allow for drainage during times of low inflow. Basins constructed of the above materials should be used only when the sediment to be trapped is coarse grained material such as GW or GP material (Unified Soil Classification System) as outlined in Chapter 4, Ref. (1), or other accepted references.

Installation Requirements

Site Preparation

Timber, logs, brush, rubbish, rocks, stumps and vegetable matter under the embankment and any structural works shall be cleared, grubbed and disposed of. In order to facilitate cleanout and restoration, the pool area shall be cleared of all brush and excess trees.

Cutoff Trench

A cutoff trench shall be excavated along the centerline of earthfill embankments more than 10 feet high to a minimum depth of 2 feet. The cutoff trench shall extend up both abutments to the riser crest elevation. The minimum bottom width shall be 4 feet but wide enough to permit operation of compaction equipment. The side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for embankment. The trench shall be kept free from standing water during the backfilling operations.

Embankment

The fill material shall be taken from approved designated borrow areas. It shall be free of roots, woody vegetation, stones over 6 inches, or other objectionable material. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material should contain sufficient moisture for proper compaction.

All fills shall be compacted sufficient for their intended purpose.

Drop Inlet Spillways

The riser shall be solidly attached to the barrel and all connections shall be watertight. The barrel and riser shall be placed on a firm foundation. The fill material around the drop inlet spillway shall be compacted to at least the same density as the adjacent embankment. A minimum of 2 feet of hand compacted backfill shall be placed over the barrel before crossing it with construction equipment.

Emergency Spillway (Type 2 and 3 Basins)

The emergency spillway shall be installed in undisturbed earth unless specified otherwise in the plan. The lines and grades must conform to those shown on the plans as nearly as skillful operation of the excavating equipment will permit.

Safety

Signs shall be installed warning the public of hazards of soft sediment and floodwater. Consideration should be given to fencing.

Seeding

All disturbed areas except within the reservoir below the crest of the principal spillway shall be seeded or sodded. Seeding, fertilizing and mulching shall conform to the standard for permanent vegetative cover, (P. 3.21.)

Final Disposal

In the case of temporary structures when the intended purpose has been accomplished and the drainage area property stabilized, the embankment and resulting silt deposits are to be graded or otherwise disposed of.

The area shall be seeded or sodded in accordance with the standards for permanent vegetative cover, (P. 3.21.)

STANDARDS
FOR
SLOPE PROTECTION STRUCTURES

Definition

A structure to safely conduct surface runoff from the top of a slope to the bottom of the slope.

Purpose

The purpose of this practice is to convey storm runoff safely down cut and fill slopes to minimize erosion.

Conditions Where Practice Applies

Slope protection structures are to be used where concentrated water will cause excessive erosion on cut and fill slopes. Temporary structures should be left in place until adequate vegetation and the permanent drainage system have been installed. Permanent structures are part of the drainage system.

Design Criteria

Open Flumes

Flumes shall be adequately designed to convey runoff water concentrations safely down steep slopes based on a 10-year frequency storm, or sized in accordance with the requirements of Tables 4-5.1 and 4-5.2.

Recommended dimensions for flumes are defined as follows:

1. b - Is the bottom width of the paved down slope section of a trapezoidal or rectangular flume. The minimum bottom widths and associated maximum drainage areas shall conform to Table 4.5-1.

2. T - Is the top width of parabolic flumes. The minimum top widths and maximum drainage areas shall conform to Table 4.5-2.

3. H - Is the height of the dike at the entrance to the structure and shall be a minimum of 2.5 feet.

4. d - Is the depth of the paved down slope section and shall be a minimum of 10 inches for trapezoidal or rectangular flumes. The depths of parabolic flumes shall be as shown in Table 4.5-2.

TABLE 4.5-1 FLUMES WITH TRAPEZOIDAL AND RECTANGULAR SECTIONS

Bottom Widths and Drainage Area for Trapezoidal Flumes with Flow Depths Equal 10 Inches		Bottom Widths and Drainage Area for Rectangular Flumes with Flow Depths Equal 10 Inches	
Bottom Width ft.	Drainage Area Acs.	Bottom Width ft.	Drainage Area Acs.
2	7	2	3
4	10	4	5
6	13	6	10
8	16	8	13
10	19	10	16
12	24	12	20

Dikes to be 2.5 ft. in height above flume entrance

TABLE 4.5-2 FLUMES WITH PARABOLIC SECTIONS

Depth Equal 1 Foot			Depth Equal 1.5 Feet	
Top Width Ft.	Drainage Area Acs.		Top Width Ft.	Drainage Area Acs.
4	3		4	4
6	4		6	5
8	5		8	5
10	6		10	7
12	7		12	8
14	8		14	10
			16	11

Dikes to be 2.5 ft. in height above flume entrance

5. L - Is the length of the inlet and outlet paved sections and each shall be an minimum of 6 feet.

The above dimensions are illustrated in Figure 4.5-1.

If a minimum of 75 per cent of the drainage area will have a good grass or woodland cover throuhgout the life of the structure, the drainage areas listed in Tables 4.5-1 and 4.5-2 may be increased by 50 per cent. If a minimum of 75 per cent of the drainage area will have a good mulch cover throughout the life of the structure, the drainage area listed in Tables 4.5-1 and 4.5-2 may be increased by 25 per cent.

Flumes with dimensions and associated drainage areas other than those shown in this standard shall be designed on an individual job basis. Capacities shall be determined by acceptable hydrologic and hydraulic computations.

Pipe Drops

The design capacity shall be as required to pass peak runoff from a 10-year frequency storm. Runoff values shall be determined by the method contained in Chapter 2, Ref. (1), The Rational Method (Q = CIA), or by other accepted methods. Pipe capacities may be determined from charts in Chapter 6, Ref. (1), or other accepted sources.

A hood inlet type entrance should be used as shown in Figure 4.5-2. The pipe drop inlet shall be protectd by riprap or concrete.

Outlet protection shall be provided by riprap or other means.

Diversion dikes - shall be used in conjunction with pipe drops. The dike height above the pipe inlet invert shall be adequate to contain a water elevation sufficient to cause full pipe flow plus an allowance of at least 0.5 feet for freeboard. A minimum water depth of 1.8 times the pipe diameter above pipe inlet invert is required to assure full pipe flow.

Installation Requirements

1. The structure shall be placed on undisturbed soil or well compacted fill.

2. The cut or fill slope shall not be steeper than 1 vertical to 1.5 horizontal (1.5:1) and should not be flatter than 20:1.

3. Adequate vegetative protection and drainage works shall be installed.

4. Open Flume

   a. The top of the earth dikes shall not be lower at any point than the top of the lining at the entrance of the structure.

   b. The lining should be placed beginning at the lower end and proceding up the slope to the upper end. The lining shall be well compacted and free of voids.

   c. The entrance floor at the upper end of the structure shall have a slope toward the outlet of 1/4 to 1/2 inch per foot.

5. Hood Inlet Pipe Drops

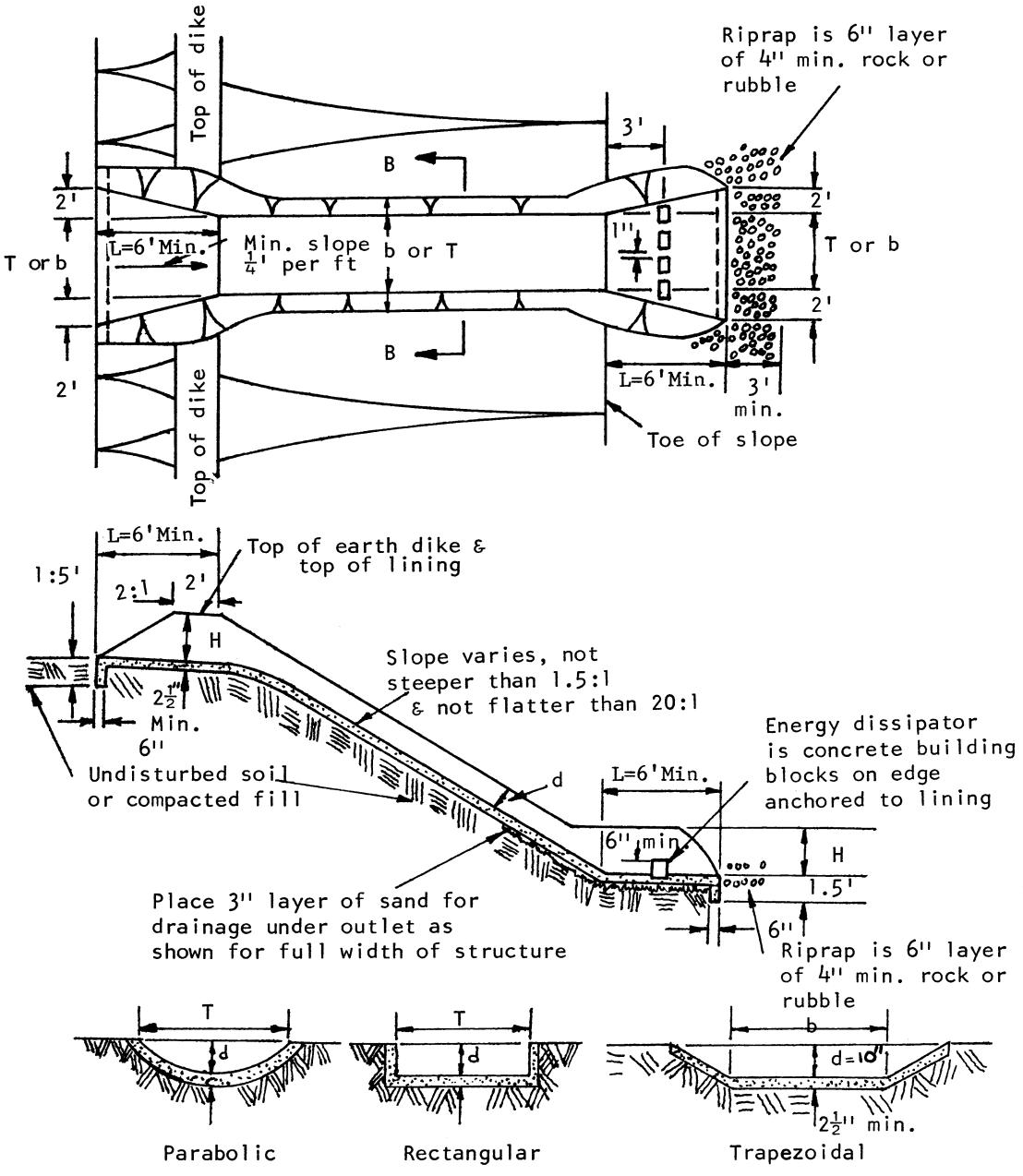
   a. The pipe shall be imbedded in the embankment to a depth that will insure stability.

   b. Protection measures of concrete or riprap shall be installed at the inlet and outlet as needed to protect against erosion.

   c. The pipe shall be smooth or corrugated and of the required strength and durability.

   d. Backfill shall be carefully placed in layers and tamped to insure adequate compaction.

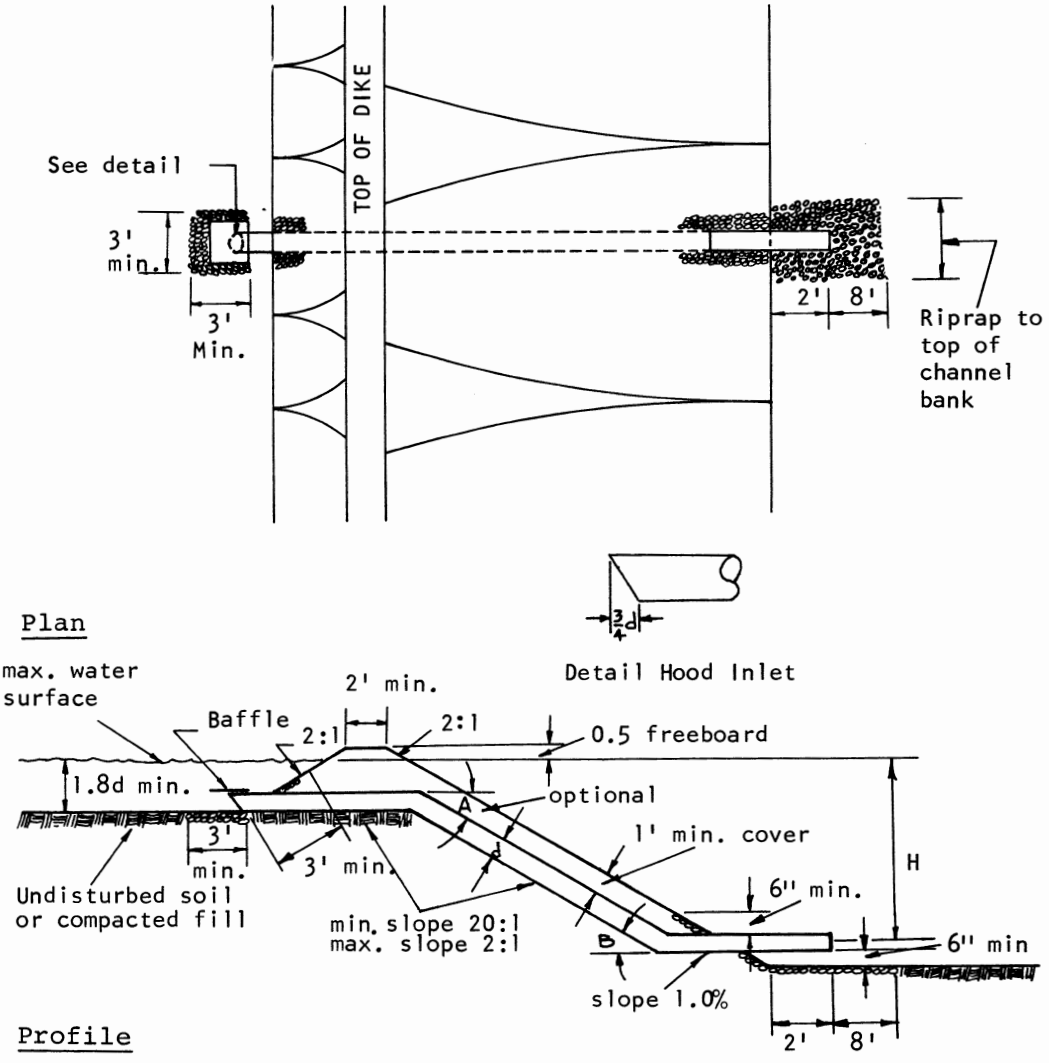
FIGURE 4.5-I
TYPICAL OPEN FLUME



Alternate Sections B-B

Notes:
1. Lining shall be Portland Cement concrete, bituminous concrete or comparable material.
2. Some type of energy dissipator, such as the one shown above, must be used to prevent erosion at the outlet.
3. The paved down slope section should have side slopes as required by construction methods.

FIGURE 4.5-II
BANK PROTECTION STRUCTURE
Hood Inlet Pipe



No scale

STANDARDS
FOR
CHANNEL STABILIZATION

Definition

Stabilizing a channel, either natural or artifical, in which water flows with a free surface.

Purpose

Open channels are constructed or stabilized to be nonerosive and provide adequate capacity for the conveyance of flood waters, drainage, other water management purposes, or any combination thereof.

Conditions Where Practice Applies

This standard applies to the construction and stabilization of open channels, and existing streams or ditches regardless of drainage area. It does not apply to diversions or grassed waterways.

An adequate outlet for the modified channel reach must be available for discharge by gravity flow. Construction or other improvements of the channel should not adversely affect the environmental integrity of the area and must not cause significant erosion upstream or flooding and/or sediment deposition downstream.

Design Criteria

Planning

The alignment and design of channels shall give careful consideration to the preservation of valuable fish and wildlife habitat and trees of significant value for wildlife flood or shelter or for aesthetic purposes.

Where channel construction will adversely affect a significant fish or wildlife habitat, mitigation measures should be included in the plan. Mitigation measures may include pools, riffles, flats, cascades or other similar provisions.

As many trees are to be left inside channel rights-to-way as possible, considering the requirements for construction, operation, and maintenance.

Unusually large or beautiful trees shall be saved.

Realignment

The realignment of channels shall be kept to an absolute minimum and will be permitted only to correct an adverse environmental condition.

Channel Capacity

The capacity for open channels shall be determined by procedures applicable to the purposes to be served.

Hydraulic Requirements

Manning's formula shall be used to determine the velocities in the channels.

The "n" values for use in this formula shall be estimated using currently accepted guides along with knowledge and experience regarding the conditions.

Acceptable guides can be found in Ref. (6) and (7).

Channel Cross Section

The required channel cross section and grade are determined by the design capacity, the materials in which the channel is to be constructed, and the requirements for maintenance. A minimum depth may be required to provide adequate outlets for subsurface drains, tributary ditches or streams.

Channel Stability (General)

All channel construction, improvement and modification shall be in accord with a design which can be expected to result in a stable channel which can be maintained.

Characteristics of a stable channel are:

1. It neither aggrades or degrades beyond tolerable limits.
2. The channel banks do not erode to the extent that the channel cross section is changed appreciably.
3. Excessive sediment bars do not develop.
4. Excessive erosion does not occur around culverts and bridges or elsewhere.
5. Gullies do not form or enlarge due to the entry of uncontrolled surface flow to the channel.

The determiniation of channel stability considers bankfull flow. Bankfull flow is defined as the flow in the channel which creates a water surface that is at or near normal ground elevation for a significant length of a channel reach. Excessive channel depth created by cut through high ground, such as might result from realigment of the channel, should not be considered in determinations of bankfull flow.

Channel Stability (Drainage area of one square mile or less)

Channels in this category shall be considered stable if the check velocity is less than the allowable velocities shown in Table 4.6-1. The check velocity is defined as the lesser of the:

a. Bankfull velocity
b. 10-year frequency peak discharge velocity

TABLE 4.6-1 ALLOWABLE VELOCITIES FOR VARIOUS SOIL TEXTURES

Soil Texture	Allowable Velocity ft./sec.
Sand and sandy loam (noncolloidal)	2.5
Silt loam (also high lime clay)	3.0
Sandy clay loam	3.5
Clay loam	4.0
Stiff clay, fine gravel, graded loam to gravel	5.0
Graded silt to cobbles (collodial)	5.5
Shale, hardpan and coarse gravel	6.0

Channel Stability (Drainage area greater than one square mile)

Channel stability shall be determined for an aged condition and the velocity shall be based on the design flow or the bankfull flow, whichever is greater, using an "n" value based on the expected kind and density of vegetation and assuming good maintenance. In no case is it necessary to check channel stability for discharges greater than that from the 25-year frequency storm. The discharge used in stability analyses of channels having a controlled inflow shall be the design flow.

Channels also must be stable under conditions existing immediately after construction. For this stability analysis the velocity shall be calculated for the expected flow from a 10-year frequency storm on the watershed, or the bankfull flow, whichever is smaller, and the "n" value for the newly constructed channel shall be used. The "n" values of newly constructed channels in fine-grained soils and sands shall not exceed 0.025. The "n" value for channels to be improved by clearing and snagging only shall be determined by reaches according to the expected channel condition upon completion of the work.

The allowable velocity in the newly constructed channel may be increased by a maximum of 20 percent to reflect the effects of vegetation to be immediately established under the following conditions:

1. The soil and site in which the channel is to be constructed are suitable for rapid establishment and support of erosion-controlling vegetation.

2. Species of erosion-controlling vegetation adapted to the area and proven methods of establishment are known.

The above stability checks may be made using either the tractive force or allowable velocity procedures. The choice of method will depend upon the grain size and cohesiveness of the soil being checked. The following may be used as a guide in choosing the method:

A. Tractive Force - See Reference (8)
   1. Coarse grained soils
   2. Fine grained noncohesive soils (PI $\leq$ 10)

B. Allowable Velocity - To be determined using figure 4.6-I
   1. Course grained soils (tractive force procedure recommended)
   2. Fine grained cohesive soils (PI $>$ 10)
   3. Fine grained noncohesive soils (PI $<$ 10) (tractive force procedure recommended)

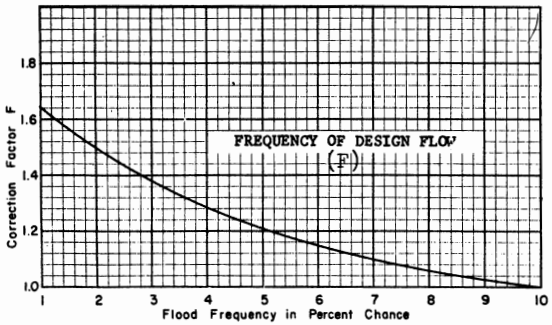
Stability checks should be made for each significant soil horizon present. Soil sampling and testing is required to determine the grain size distribution and plasticity index of each material to be checked.

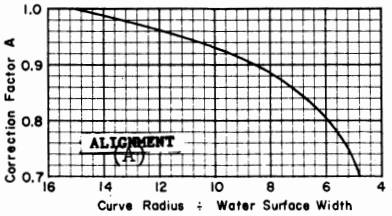
Channel Linings and Structural Measures

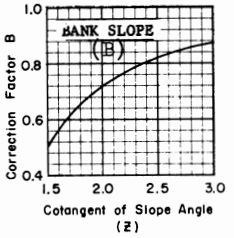
Channel shall be protected by linings.

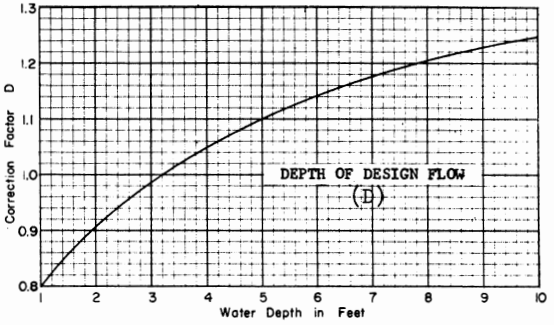
Where channel velocities exceed safe velocities for vegetated lining due to increased grade or a change in channel cross section or where durability of vegetative lining is adversely affected by seasonal changes, channel linings of rock concrete or other durable material may be needed. Grade stabilization structures may also be needed.

Channels may be stabilized by using one or more of the following methods:







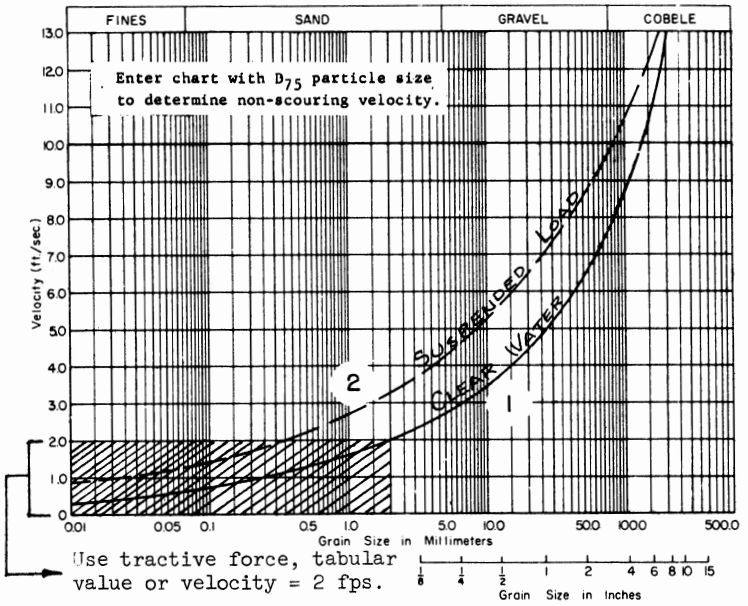


(Tabular Values)

NON-SCOURING VELOCITIES FOR VARIOUS EARTH MATERIALS

SOIL DESCRIPTIONS	SOIL CLASSIFICATION		VELOCITY (FT./SEC.)		
	GROUP	PI	CLEAR WATER	SUSPENDED LOAD	BEDLOAD
Stiff clay, high cohesion	CH	Above 20	4.5	6.0	3.5
Lean to moderately cohesive clays; silty or sandy clays.	CL	7-10	Curve 1	Curve 2	*
	CL	10-20	2.5	4.0	2.5
	CL	Above 20	4.0	5.5	3.5
Colloidal alluvial silts; micaceous or diatomaceous silts; organic silts and clays with high LL.	MH,OH	Below 10	Curve 1	Curve 2	*
	MH,OH	10-20	2.5	4.0	2.5
	MH,OH	Above 20	3.5	5.0	3.0
Non-colloidal alluvial silts; sandy or clayey silts; organic silts with low LL.	ML,OL	Below 10	Curve 1	Curve 2	*
	ML,OL	10-20	2.5	4.0	2.5
Silty sands or gravelly silty sands containing more than 5% fines.	SM	Below 10	Curve 1	Curve 2	*
	SM	10-20	2.5	4.0	2.5
Clayey sand or gravelly clayey sands containing more than 5% fines.	SC	7-10	Curve 1	Curve 2	*
	SC	10-20	2.5	4.0	2.5
	SC	Above 20	4.0	6.0	3.5
Clayey gravels or clayey sandy gravels containing more than 5% fines.	GC	7-10	Curve 1	Curve 2	*
	GC	10-20	Curve 1 or 4.0	Curve 2 or 5.5	* or 5.0
	GC	Above 20	Curve 1 or 5.0	Curve 2 or 6.5	* or 6.0
Silty gravels or silty sandy gravels containing more than 5% fines.	GM	Below 10	Curve 1	Curve 2	*
	GM	10-20	Curve 1 or 4.0	Curve 2 or 5.5	* or 5.5
Clean sands and gravels or sand-gravel mixtures containing less than 5% fines.	GW	-	Curve 1	Curve 2	*
	GP	-	Curve 1	Curve 2	
	SW	-	Curve 1	Curve 2	
	SP	-	Curve 1	Curve 2	

(Chart Values)



*Use curve number 1 if the bed load concentration is less than the capacity of the stream or if the size of the bed load material is larger than the D_{75} size of the channel materials. Use curve number 2 if the bed load concentration is equal to the capacity of the stream or if the size of the bed load material is smaller than the D_{75} size of the channel materials.

Note:
In no case should the allowable velocity be exceeded by the 10% chance discharge regardless of the frequency of occurrence of the design flow.

DESIGN VELOCITIES FOR UNLINED EARTH CHANNELS

TYPE OF FLOW	SOIL GROUP	ALLOWABLE DESIGN VELOCITY
Sustained Flow	Non-Cohesive PI<10	Chart value x D x A x B
	Cohesive PI>10	Tabular value x D x A
Intermittent Flood Flow	Non-Cohesive PI<10	Chart value x D x A x B
	Cohesive PI>10	Tabular value x D x A x F

FIGURE 4.6-I

ALLOWABLE VELOCITIES FOR UNPROTECTED EARTH CHANNELS

Reference, Soil Conservation Service, Technical Release No. 25

Rock Riprap Lining

Rock riprap shall be deisgned to resist displacement when the channel is flowing at the bankfull discharge or 25-year frequency discharge whichever is the lesser.

Procedures for determing riprap gradation may be found in Ref. (2).

Dumped and machine placed riprap should not be installed on slopes steeper than 1-1/2 horizontal to 1 vertical. Where riprap is placed by hand the slopes may be steeper.

A filter blanket of sand and/or gravel shall be placed between the riprap and base material. The filter blanket material shall be at lesst 6 inches thick with a gradation that is consistant with the base material and the riprap.

Rock shall be dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended.

Concrete Lining

Concrete linings shall be designed according to currently accepted guides for structural and hydraulic adequacy. They must be designed to carry the required discharge and to withstand the loading imposed by site conditions.

Grade Stabilization Structures

Grade stabilization structures are used to reduce or prevent excessive erosion by reduction of velocities in the watercourse or by providing structures that can withstand and reduce the higher velocities.

They may be constructed of concrete, rock, masonry, steel, aluminim or treated wood.

These structures are constructed where the capability of earth and vegetative measures is exceeded in the safe handling of water at permissible velocities, where execssive grades or overall conditions are encountered or where water is to be lowered structurally from one elevation to another. These structures should generally be planned and installed along with or as a part of other erosion control practices.

The structures must be designed hydraulically to adequately carry the channel discharge and structurally to withstand loadings imposed by the site conditions.

Chapter 6, Ref. (1), provides procedures for use in the design of these structures.

Installation Requirements

1. Where needed, all trees, brush, stumps and other objectionable materials shall be removed so they will not interfere with the construction or proper functioning of the channel.

2. Where possible, trees will be left standing, rush and stumps will not be removed and channels will be excavated from one side leaving vegetation on the opposite side.

3. Excavation shall be at the locations and grades shown on the drawings.

4. Construction plans will specifically detail the location and handling of spoils. Spoil material resulting from clearing, grubbing and channel excavation shall be disposed of in a manner which will:

   a. Not cause an increase in flood stage.
   b. Minimize overbank wash.
   c. Not cause an adverse effect on the environemntal integrity of the area.

d. Provide for the free flow of water between the channel and flood plain unless the valley routing and water surface profile are based on continuous dikes being installed.
e. Leave the right-of-way in the best condition feasible.
f. Improve the aesthetic appearance of the site to the extent feasible.

5. Channel linings shall be established or installed immediately after construction or as soon as weather conditions permit.

6. Structures shall be installed according to lines and grades shown on the plan. The foundation for structures shall be cleared of all undesirable materials prior to the installation of the structures.

7. Materials used in construction shall be of a permanency commensurate with the design frequency and life expectancy of the facility.

8. Earthfill, when used as a part of the structures, shall be placed according to the installation requirements for sediment basin embankments, P.4.49.

9. Seeding, fertilizing and mulching shall conform to the standard for permanent vegetative cover, (P. 3.21).

10. Construction operations shall be carried out in such a manner that erosion, air and water pollution will be minimized. State and local laws; concerning pollution abatement shall be complied with.

11. Vegetation shall be established on all disturbed areas immediately after construction, weather permitting. If weather conditions are such as to cause a delay in the establishment of vegetation, the area shall be mulched in accordance with the standard for mulching. (P. 3.31)

12. All temporary access roads or travelways shall be appropriately closed to exclude traffic.

13. Trees and other fallen natural vegetation that is not causing a deterent to stream flow should be left for the purposes of fish habitat.

14. Construction work in the stream shall be done only after consultation with the State Division of Fish and Game for timing purposes.

STANDARDS
FOR
FLOODWATER RETARDING STRUCTURES

Definition

A structure providing for temporary storage of floodwater and for its controlled release.

Purpose

Floodwater retarding structures are installed to reduce erosion and other flood damages downstream by controlling the release rate from flood flows of predetermined frequencies. They may also permit the use of more economical channel improvements or stabilizing structures in the channel downstream and reduce environment hazards and pollution.

Conditions Where Practice Applies

This standard applies to structures where the product of the storage and the height of the dam is less than 3,000, the contributing drainage area is no more than 320 acres, and the height of the dam is less than 20 feet. The storage is measured in acre-feet at the elevation of the crest of the emergency spillway and the height of the dam is measured in feet from the lowest point in the original cross section on centerline to the crest of the emergency spillway.

This practice also applies only to sites meeting all of the following conditions:

1. The construction of the structure is permitted by applicable State statutes and regulations.

2. Topographic, geologic and soils conditions at the proposed site are satisfactory for the development of a feasible dam and reservoir.

3. The sediment yield at the site is not excessive unless adequate provisions are made to remove sediment periodically from the reservoir.

Special attention will be given to maintaining habitat for fish and wildlife and to preserve the environmental integrity.

Design Criteria

Cutoff Trench

A cutoff of relatively impervious material shall be provided under the dam, except in those cases where a layer of such material exists at the surface of the foundation. The layer of impervious material shall be thick enough to provide stability. The cutoff shall extend along the centerline of the dam and its abutments are as required and be deep enough tc extend into a relatively impervious layer.

The cutoff trench shall have a bottom width and side slopes adequate to accommodate the equipment used for excavation, backfill and compaction operations.

Earth Embankment

Top Width - The minimum top width of the dam shall be:

Height of Dam	Top Width
0 - 15 feet	10 feet
15 - 20 feet	12 feet
20 - 25 feet	14 feet

Side Slopes - The side slopes of the settled embankment shall not be less than 2-1/2 horizontal to 1 vertical.

Freeboard - The minimum elevation of the top of the settled embankment shall be 1 foot above the water surface in the reservoir with the emergency spillway flowing at design or a minimum of 2 feet above the crest of the emergency spillway.

Allowance for Settlement - The design height of the dam shall be increased by the amount needed to insure that the design top elevation will be maintained after all settlement has taken place. This increase shall not be less than 5 per cent of the design height of the dam.

Design Discharge - Peak discharge values shall be determined by the method contained in Chapter 2, Ref. (1), The Rational Method (Q = CIA), or by other accepted methods.

Design Hydrographs - May be compiled by the method contained in Chapter 21, Ref. (2).

Drop Inlet Spillway - The drop inlet spillway will consist of a vertical pipe or box. The riser joined to a conduit which will extend through the embankment and outlet beyond the downstream toe of the fill as illustrated in Figure 4.4-1 contained in standards for sediment basins.

The crest of elevation of the riser shall be at least 1.0 foot below the crest elevation of the earth spillway. The size of the pipe and crest elevation of the riser should be such that full flow will be generated in the barrel before there is discharge through the earth spillway. The capacity of the drop inlet spillway should be adequate to discharge, in 10 days or less, the floodwater storage needed to provide the desired level of protection to the downstream benefited area. The determination of capacity must be based on consideration of the benefits that accrue to the reduction in the discharge rate, damages that may result from prolonged outflow, and limitations in water rights or other legal requirements. The discharge through gated outlets shall not be considered in determining the emptying time of the retarding pool.

All component parts of the spillway except attached gates and trash racks shall have an expected service life equal to or greater than the design life of the structure.

The diameter of the conduit used as a drop inlet spillway may be determined from charts contained in Chapter 6, Ref. (1), or from other accepted references. All pipe joints shall be made watertight. Pipes such as asbestos cement, concrete and virtrified clay shall be laid in concrete bedding. The structure shall be capable of withstanding both internal and external loads. Anti-seep collars shall be provided in all cases. Collars and their connection to the pipe shall be watertight. The maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. In no case shall the spacing exceed 25 feet.

An adequate drain pipe with a suitable valve or gate shall be provided.

Sediment Storage Requirements - The storage volume to be provided shall not be less than the expected sediment accumulation during a period equal to the design life, unless adequate provisions are made to remove sediment periodically from the reservoir.

Floodwater Storage Requirements - The retarding storage requirements shall be such as to contain the runoff expected to occur at a frequency consistent with the level of protection to be provided to the downstream benefited area, with proper allowance made for discharge through the drop inlet spillway. The minimum reservoir storage volume and associated spillway design discharge shall be adequate to prevent an unstable downstream channel condition.

Channel stability can be checked by the methods contained in standard for channel stabilization, p. 4.61. The retarding storage capacity shall be sufficient to limit the use of the emergency spillway to a permissible frequency and duration, based upon a consideration of the erosion resistance of the spillway material and the vegetative protection to be provided.

Earth Emergency Spillways - An emergency spillway must be provided for each installation, unless the drop inlet spillway is large enough and of a design which will pass the routed design runoff and the anticipated trash. Earth spillways shall have a minimum bottom width of 8 feet. The crest of the emergency spillway shall be at least 2 feet below the top of the settled embankment. The minimum design capacity of an emergency spillway should be that required to convey the routed runoff from a 100-year frequency storm, or a storm with a frequency equal to the design life of the structure, whichever is greater.

Earth spillway dimensions can be determined by using the method outlined in Chapter 11, Ref. (1), or from other accepted references.

The storm runoff shall be routed through the reservoir starting with the water surface at the elevation of the crest of the drop inlet spillway.

Installation Requirements

Site Preparation

Timber, logs, brush, rubbish, rocks, stumps and vegetable matter under the embankment and any structural works shall be cleared, grubbed and disposed of. In order to facilitate cleanout and restoration, the pool area will be cleared of all brush and excess trees.

Cutoff Trench

A cutoff trench shall be excavated along the centerline of earth fill embankments more than 10 feet high to a minimum depth of 2 feet. The cutoff trench shall extend up both abutments to the riser crest elevation. The minimum bottom width shall be 4 feet but wide enough to permit operation of compaction equipment. The side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for embankment. The trench shall be kept free from standing water during the backfilling operations.

Embankment

The fill material shall be taken from approved designated borrow areas. It shall be free of roots, woody vegetation, stones over 6 inches, or other objectionable material. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material should contain sufficient moisture for proper compaction.

All fills shall be compacted sufficiently for their intended purpose.

Pipe Inlet Spillways

The riser shall be solidly attached to the barrel and all connections shall be water tight. The barrel and riser shall be placed on a firm foundation. The fill material around the drop inlet spillway shall be compacted to at least the same density as the adjacent embankment. A minimum of 2 feet of hand compacted backfill shall be placed over the barrel before crossing it with construction equipment.

Emergency Spillway

The emergency spillway shall be installed in undisturbed earth unless specified otherwise in the plan. The lines and grades must conform to those shown on the plans as nearly as skillful operations of the excavation equipment will permit.

Safety

Signs shall be installed warning the public of harzards of soft sediment and floodwater. Consideration should be given to fencing.

Seeding

All disturbed areas above the crest of the principal spillway shall be seeded or sodded. Seeding, fertilizing and mulching shall conform to the appropriate standard.

APPENDIX A1

THE UNIVERSAL SOIL LOSS EQUATION

The Universal Soil Loss Equation may be used to predict soil loss from sheet erosion.

The rate of sheet erosion depends on several factors as follows: (1) rainfall energy and intensity, (2) soil erodibility, (3) land slope and length of slope or topography, (4) condition of the soil surface and land management practices in use and (5) surfact cover involved such as grass, woodland, crops, pavement or no cover at all. These factors may be assigned quantitative values to be used for computing soil loss by the Universal Soil Loss Equation, E = RK (LS) CP, where E is the estimated average soil loss from sheet erosion in tons per acre per year. See Ref. (3).

R, the rainfall factor, is the number of erosion index units in a normal year's rain. The erosion index is a measure of the erosive force of specific rainfall. See figure A1-I for values of R.

K, the soil-erodibility factor, is the erosion rate per unit of erosion index for a specific soil in cultivated continuous fallow on a 9 percent slope 72.6 feet long. See Table A1-2a, A1-2b or A1-2c for values of K and (KR), the product of K and R, for New Jersey soils.

L, the slope length factor, is the ratio of soil loss from the field slope length to that from a 72.6-foot length on the same soil type and gradient.

S, the slope gradient factor is the ratio of soil loss from the field gradient to that from a 9 percent slope. See Table A1-3 for values of (LS) for various slope gradient and length combinations.

C, the cropping management factor, is the ratio of soil loss from a field with specified cropping management to that from the fallow condition on which the factor K is evaluated. This factor is also called the cover index and can be used to represent the effect of land cover or treatment that may be used to protect construction sites. See Table A1-4 for values of the soil cover index Cc for treatment that may be used to protect construction sites.

P, the erosion control practice factor, is the ratio of soil loss with contour stripcropping or terracing to that with straight row farming up and down the slopes. The condition of the soil surface, particularly at construction sites, can also be reflected in the practice factor. See Table A1-5 for soil surface condition factors Pc for construction sites.

The value of E may also be modified by a factor M shown in Table A1-6. M may be used to estimate the soil loss for a portion of a year or for a year and a portion of another year or more. The use of this factor provides a means of estimating the average soil loss on a critical sediment source area that will remain as such for a portion of a year or during the performance time of a construction contract.

The factor R is equal to the average annual value of the erosion index EI when the equation is being used to estimate average annual soil loss. This value or the equation may be modified to reflect soil loss probability and individual-storm losses. Estimates of average soil loss, based on probability and single storm losses, can be made by multiplying the equation by the factors shown in Table A1-8. These factors reflect an alteration in the value of R and, therefore, the erosive effect of rainfall. They do not account for such things as snow melt, freezing, thawing and snow cover.

Detailed definitions and explanations for each of these factors are contained in Reference (3).

The soil information contained in Tables A1-2a, A1-2b and A1-2c are of a general nature, useful for planning purposes. It should not be used, without verification, for evaluation of construction sites for erosion control. Where erosion may be

expected during construction involving earth moving, on site investigations should include information on soils to be exposed as follows: (1) field identification and classification for both agricultural textures and the unified system, (2) sampling for grain size distribution, Atterburg limits and laboratory classification, and (3) in-place density as determined by a volumeter and the speedy moisture tester or other means.

The soil grain size is useful in determining the value of practices for the control of erosion and particularly sediment. For example, sediment basins will not be very effective for trapping very fine sediment. Soils made up of a high percentage of material with a grain size of 0.05 mm or less have a slow settling velocity in water. Material with a 0.05 mm grain size has a settling velocity close to 0.006 feet per second. This means that, theoretically a detention time of about 15 minut is required to settle out 0.05 mm material in 5 feet of still water.

Soil loss computed by the universal soil loss equation represents gross sheet erosi This value plus erosion from rilling, gullies and other sources is the gross erosio To obtain sediment yield at a point downstream, the gross erosion must be adjusted downward by a delivery rate factor in percent equal to the ratio of sediment yield the damage area to gross erosion. Delivery rates vary somewhere between 10 percent and 90 percent depending on conditions that end to trap sediment between the sourc and the damage area.

Water pollution in the form of turbidity or discoloration may be as damaging to water supplies or swimming areas as the accumulation of sediment. Turbid water may be the result of algae or other organisms but generally it is caused by fine silt or clay particles held in suspension. The very fine, divided clay particles found in some soils are difficult to control and may take months to settle out in still water.

Downstream damage from sediment depends on the following conditions:

1. Distance from the construction site to the nearest stream, pond or reservoir along with the condition of the vegetation and the slope of the area between the site and the stream of the reservoir. Areas with flat slopes and dense vegetation will tend to filter out sediment.

2. Once the sediment gets into a stream, the distance downstream to the damage point, such as a pond or water supply intake, is important. Also to be considered is the stream channel gradient and the flood plain width. Wide flat flood plains with dense vegetation will trap more sediment than steep narrow valleys.

3. The use of the stream or reservoir must be considered. It is very important to keep sediment out of streams used for fishing, recreation or water supply.

4. Another factor that should be considered is the size of the construction area and the length of time it will be bare of vegetative cover and subject to erosion. The total sediment expected should be compared with the capacity of the damage area to sustain sediment. If the total sediment to be expected from the site during the entire construction period is greater than can be tolerated in the damage area, considerable effort should be made to reduce it. If this cannot be done, arrangements to alleviate the damage should be made. These arrangements may include cleanout of ponds and reservoirs or restoration of stream channels.

A look at the Soil Loss Equation will show the factors over which man can exercise some control. These are lengths of slope, exposure time, and the total area exposed. Slope length is contained in the equation as part of the (LS) factor and its effect on soil loss can be evaluated. The length of time and time of year of exposure can also be evaluated on a monthly basis using factors in Table A1-6. Total soil loss from different size areas can also be estimated.

The following example illustrates the use of the soil loss equation.

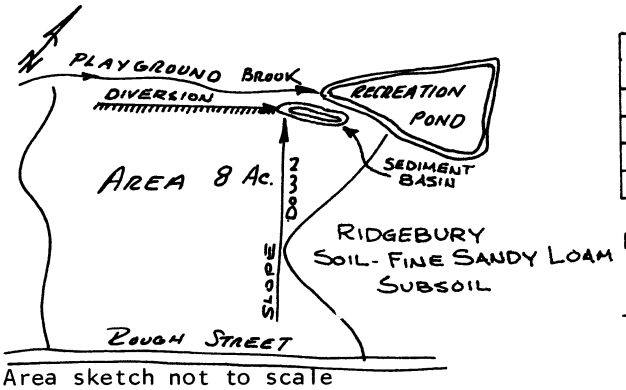
The township engineer has requested an erosion and sediment evaluation of a small construction site just above a recreation pond. The district conservationist made a visit to the site to evaluate the potential damage, verify the information on the soils map, and check topographic data. The construction plans show that 8 acres are to be regraded for the construction of a factory and parking area. The drawings and construction performance time estimates indicate that the B soil horizon is to be exposed on most of the area for about 18 months. The ground surface slope will be about 4 percent. Soil loss computations, findings and recommendations are as shown in the example on page A1.4

EXAMPLE OF SOIL LOSS EVALUATION

Owner GREENBELT TOWNSHIP Work Unit GARDENTOWN Sh 1 of 1
Location GREENBELT TOWNSHIP Compiled by E.Z. SILTY Date 0/0/72

SOIL LOSS AND SEDIMENT SOURCE EVALUATION

Dowstream Condition DAMAGE AREA IS VERY CLOSE TO THE CONSTRUCTION SITE, DELIVERY RATE = 0.9 R= 175 LRA= 144



Area sketch not to scale

KR AND LS

S. Area No.	Wt'd KR	L (Ft.)	S (%)
-	53	600	4

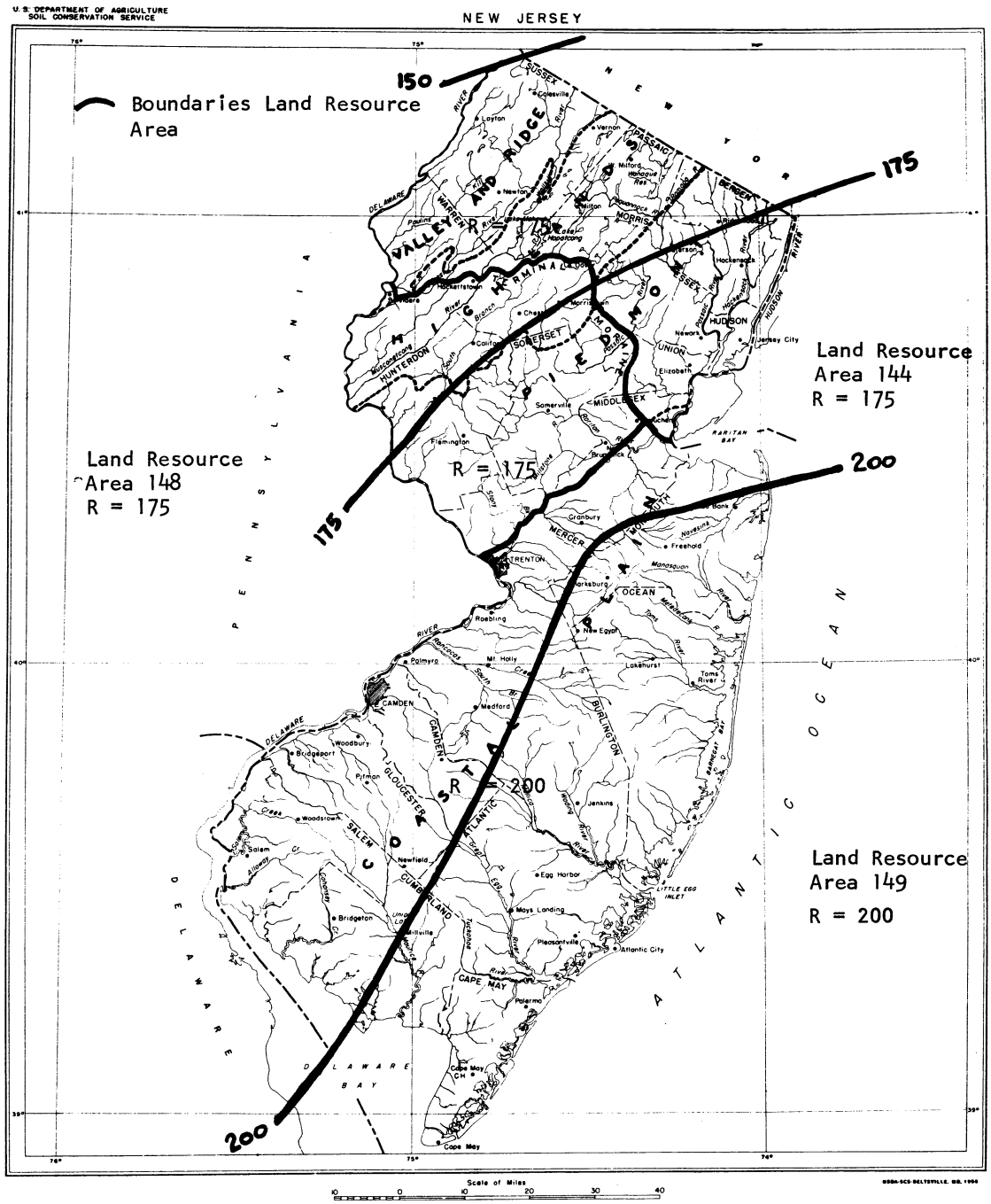
Expected Surface Conditions:
ROUGH GRADING

Time of Exposure: 18 MONTHS START APRIL, END SEPT. OF NEXT YEAR M = 1.80

1 Sub-Area	2 Condition Or Treatment	3 KR	4 LS	5 C_c	6 P_c	7 M	8 E_t* Tons/Ac.	9 Area (acs.)	10 E_T (tons)	11** Yd(lbs/cu.ft)	12 Vol. (Ac. FT.)
	NO COVER, ROUGH GRADING	53	1	—	—	1	53	8	424	100	0.2
	LOSS FOR 18 MONTHS	53	1	—	—	1.80	95	8	760	100	0.35
	SATURATED SED. VOL.	—						→	760	60	0.59
	REDUCE L TO 100'	53	0.41	—	—	1	21.7				
	18 MONTHS	53	0.41	—	—	1.80	39	8	312	100	0.14
	SATURATED SED. VOL.	—						→	312	60	0.24
								Totals			

*E_t = KR (LS) C P M = Average soil loss for construction time M in tons/ac.
** From Table A1-7
REMARKS: THE AREA IS A CRITICAL SEDIMENT SOURCE AREA.
TOTAL VOLUME OF SOIL LOSS (18 MOS.) IN CU. YDS. = (0.35)(1600) = 560 CU. YDS.
ESTIMATED SEDIMENT VOLUME REACHING THE POND = (0.59)(0.9) = 0.53 AC. FT. OR (0.51)(1600) = 816 CU. YDS.
TO CONTROL SOIL LOSS TO WITHIN REASONABLE LIMITS, SLOPE LENGTHS ON UNPROTECTED AREAS SHOULD BE REDUCED TO 100 FT. OR EXTENSIVE SEEDING, MULCHING OR SODDING SHOULD BE USED TO REDUCE THE TIME OF EXPOSURE. MULCHING AT A RATE OF 2 TONS PER ACRE CAN REDUCE THE SOIL LOSS TO ABOUT 1 TON PER ACRE PER YEAR. A SEDIMENT BASIN SHOULD BE CONSTRUCTED AS SHOWN. CONSTRUCT ACCORDING TO STANDARD FOR SEDIMENT BASIN.

FIGURE A1-1



Rainfall Erosion Factor "R" by Land Resource Areas

TABLE A1-1

USDA TEXTURE ABBREVIATIONS USED IN TABLEA1-2a, A1-2b, A1-2c

c	-	clay, clayey
ch	-	channery
co	-	coarse
e	-	extremely
f	-	fine
g	-	gravelly
k	-	cobbly
l	-	loam, loamy
m	-	muck
r	-	rocky
s	-	sand, sandy
sh	-	shaly
si	-	silt, silty
st	-	stony
v	-	very

SOIL-ERODIBILITY CLASSES

K	-	class
0.17 - 0.24	-	low
0.28 - 0.37	-	medium
0.43 - 0.49	-	high

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (inches)	USDA Texture Range	Unified System	K	KR
Adrian		0-42	m	Pt	-	-
		42-60	ls	SP-SM,SM	0.2	35
Albia		0-16	gl,estl	GM,GC,SC	0.24	42
		16-40	gl (pan)	GM,GC,SC	0.4	70
		40-60	gl	GM,GC,SC	0.3	53
Asbury		0-30	sil	GL,ML	2/	-
		30-60	ls,gls,vgls	SM,GM	-	-
Atherton		0-30	l	SM,SC,ML,CL	0.24	42
		30-60	scl	SM,SC	0.2	35
Bartley		0-11	l,g	ML,CL	0.32	56
		11-32	cl,l,scl	ML,CL	0.3	53
		32-42	sl,l	SM,SC	0.2	35
		42-60	sl,l,gsl,gl	SM,SC	0.2	35
Bath		0-28	l,sil	SM,SC	0.24	42
			gl,vstl	GM,GC	0.17	30
		28-48	l,sil	SM,SC	0.2	35
			gl,gsil	GM,GC	0.2	35
		48-60	gsl	SM,SC,GM,GC	0.2	35
Beatty		0-25	l	CL,ML	2/	-
		25-60	ls,gls	SM,GM	-	-
Biddeford		0-8	ml	Pt	-	-
		8-18	sil	ML,CL	-	-
		18-44	sicl,c,cl	CL,CH	-	-
		44-60	sil,cl,sicl	ML,CL	-	-
Boonton		0-6	gl,estl	ML	0.20	35
		6-30	fsl,l,sil, gfsl,gl,gsil	ML,CL	0.2	35
		30-45	fsl,sil,gfsl, gsil	ML,CL,SM,SC	0.2	35
		45-60	gsl	SM	0.2	35
Braceville		0-24	gsl	SM,GM	0.24	42
		24-36	g or vg, l,sl	SM,SC,GM	0.3	53
		36-60	stratified scg	SM,SP,SP-SM,GP	0.2	35
Bridgeville		0-30	sl,gl	SM	0.24	42
		30-60	gl,g,s	SM	0.2	35
Burnham		0-12	l,sil	ML,CL	0.32	26
		12-48	gl	ML,CL	0.3	53
		48-60	stone,g	SM,SC,GM,GC	0.2	35

1/ Mapping units may be inserted on the basis of the local county soil survey.
2/ Alluvial soil, unassigned.

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local 1/ Mapping No.	Typical Profile (inches)	USDA Texture Range	Unified System	K	KR
Carlisle		0-60	m	Pt	-	-
Cattaraugus		0-20	fsl	SM,ML,CL	0.24	42
			gl	SM,ML,CL	0.17	30
		20-60	fsl(pan)	SM,ML,CL	0.3	53
Chatfield		0-28	l	ML,CL	0.17	30
		28+	gneiss bedrock			
Chenango		0-20	sl	SM	0.24	42
			gfsl,ksl	GM	0.17	30
		20-30	vgsl,gsl	SM,GM	0.2	35
		30-60	g,s,gls	GP-GM,GM	0.2	35
Chippewa		0-13	sil	ML,CL	0.32	56
			chsil,estl	ML,CL	0.24	42
		13-50	l,chsil(pan)	ML,CL,GM	0.4	70
Colden		0-8	sil	ML,CL	0.43	75
		8-45	sicl	ML	0.4	70
Colonie		0-16	lfs,ls	SM,SP-SM	0.24	42
		16-60	fs,ls,lfs	SM,SP-SM	0.2	35
Comly		0-11	sil	ML,CL	0.37	65
		11-20	sicl,l,sil	ML,CL,CH	0.4	70
		20-27	sicl (pan)	ML,CL,CH	0.5	88
		27-40	sil,l,sicl	ML,CL,CH	0.3	53
Coplay		0-10	sil	ML,CL	0.32	56
		10-60	sicl,cl	ML,CL	0.3	53
Cossayuna		0-24	l,vfsl	SM,ML,CL	0.24	42
			gl	SC,GM,GC	0.17	30
		24-48	g,gl (pan)	SC,GM,GC,SM,ML	0.3	53
		48-60	gsl	SM,GM	0.2	35
Crestmore		0-30	l,sil	ML,CL	0.32	56
		30+	bedrock			
Culvers		0-16	fsl	SM,ML,CL	0.28	49
			chsil	SM,ML,CL	0.20	35
		16-45	l	ML	0.3	53
			chsil	ML,CL,GM	0.3	53
Dutchess		0-60	sil,l,shl, shsil	GM,SM	0.20	35
Ellington		0-15	l,fsl	ML,SM	0.24	42
			gl,gsl	ML,SM	0.24	42
		15-38	l,sl	ML,SM	0.3	53
			gl,gsl	ML,SM	0.2	35
		38-60	s,gs	SM,SP-SM,GM	0.2	35

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local 1/ Mapping No.	Typical Profile (inches)	USDA Texture Range	Unified System	K	KR
Fredon		0-7	l	ML,CL,SM	0.24	42
		7-30	sl,fsl	SM,ML,CL	0.3	53
			gsl,gfsl	SM,ML,CL	0.2	35
		30-60	s,g	GP-GM,SP-SM	0.2	35
Hackettstown		0-30	sl	SM	0.24	42
			gsl	SM,GM	0.17	30
		30-60	gls,gsl	SM,GM	0.2	35
Haledon		0-10	sil,gsil	ML,CL	0.32	56
		10-46	sil,l,fsl, gsil,gl,gfsl	ML,CL	0.3	53
		46-60	vfsl,sl,gvfsl gsl	SM,SC	0.2	35
Halsey		0-24	l	ML,SM	0.24	42
		24-30	fsl,l,sl	SM	0.3	53
		30-60	g,gs,s & g	GP,GM,SM,SP	0.2	35
Hazen		0-12	gsl,gl	ML,CL	0.17	30
		12-32	gl	ML,CL	0.2	35
		32-60	g & S	SM	0.2	35
Hero		0-10	l	SM,ML,CL	0.24	42
		10-24	fsl,gsl	SM	0.2	35
		24-60	s,gs	SM,GM	0.2	35
Hibernia		0-25	l	ML,CL,SM,SC	0.37	65
			gl,stl,vstl	ML,CL,SM,SC	0.32	56
		25-36	l,scl,sl,	ML,CL,SM,SC	0.3	53
			gl,gscl,gsl	SM,SC,GM,GC	0.3	53
		36-72	gls,gsl,kls	SM,GM	0.2	35
Holyoke		0-17	rsil	ML,CL	0.24	42
		17+	Bedrock			
Hoosic		0-15	gl,gsl	SM,GM,ML,CL	0.17	30
		15-26	gsl,vgsl	GM,SM,ML,CL	0.2	35
		26-60	s & g	SW,GW,SM,GM, SP,GP	0.2	35
Kendaia		0-8	sil,l,fsl	ML	0.28	49
		8-20	sil,l	ML,ML-CL	0.4	70
		20-40	sil,l	ML-CL,ML,SM	0.4	70
				ML-CL,ML,SM GM-GC	0.3	53
Kistler		0-14	shsil	ML,CL	0.24	42
		14-24	vshsil	ML,CL,GM	0.2	35
		24+	slate bedrock			
Lackawana		0-26	l	ML,CL	0.24	42
			chsil	ML,CL	0.17	30
		26-52	chl(pan)	ML,CL	0.3	53

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local 1/ Mapping No.	Typical Profile (inches)	USDA Texture Range	Unified System	K	KR
Livingston		0-10	si,sicl	ML,CL	0.49	86
		10-50	sic	ML,CL MH,CH	0.5	88
Lyons		0-9	vstsil	CL,ML,SM,SC	0.28	49
		9-18	sil,fsl,sicl	SM,SC,GM,GC, ML,CL	0.4	70
		18-40	fsl,cl	SM,SC,ML,CL	0.4	70
		40-60	gl	ML,CL,GM,GC	0.3	53
Marksboro		0-10	l	ML,CL	0.24	42
			gl	ML,CL,SM,SC	0.24	42
		10-40	l,gsl	SM,SC	0.4	70
Menlo		0-22	l	ML,CL	0.24	42
			gl	ML,CL	0.24	42
		22-40	gl(pan)	SM,SC	0.5	88
Middlebury		0-10	fsl	SM,SC,ML	0.24	42
		10-50	fsl,sil	SM,SC,ML	0.4	70
Minoa		0-30	sil,fsl	ML,CL,SC	0.28	49
		30-60	lfs,sil,lvfs	SM	0.2	35
Nassau		0-7	shsil, chsil, vsil	SM,GM	0.20	35
		7-16	chsil,vchsil shsil,vshsil	SM,SC,GM,GC	0.2	35
		16+	shale bedrock			
Netcong		0-60	gsl,sl	SM,SC	0.24	42
Norwich		0-6	sil	ML,CL	0.32	56
			vstsil	ML,CL	0.28	49
		6-30	chsicl	ML,CL	0.3	53
		30-60	vchsil	ML,CL	0.3	53
Oquaga		0-16	vstsl,estl	SM	0.20	35
		16-26	stsl	SM	0.3	53
		26+	Bedrock			
Otisville		0-10	sl,gsl,gls	SM,SP-SM,GP-GM	0.17	30
		10-60	gls,gs GP-GM	SM,SP-SM,GM,	0.2	35
Palmyra		0-18	sil,gfsl	ML,CL	0.24	42
		18-24	sil	ML,CL	0.2	35
		24-40	g & s	SM	0.2	35

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local 1/ Mapping No.	Typical Profile (inches)	USDA Texture Range	Unified System	K	KR
Parsippany		0-7	sil	ML,CL	0.43	75
		7-34	cl,sicl,sic	ML,CL,CH	0.4	70
		34-60	sicl,cl,l	ML,CL,CH	0.4	70
Paulina		0-21	l,shl	ML,CL	0.28	49
		21-38	shl	ML,CL	0.2	35
Phelps		0-21	fsl	SM	0.24	42
		21-45	sl	SM	0.3	53
		45-50	g & s	SM	0.2	35
Pompton		0-28	sl,fsl	SM	0.24	42
		28-60	s & g	SM,GM	0.2	35
Preakness		0-12	sl,l	SM	0.28	49
		12-30	sl	SM	0.2	35
		30-60	ls,sl	SM,SP-SM	0.2	35
			gls	GM,SP-SM	0.2	35
Raynham		0-28	sil	ML,CL	0.49	86
		28-60	sil,vfsl	ML,CL	0.4	70
Red Hook		0-10	fsl	SM,SC	0.24	42
		10-35	sil	ML,CL	0.4	70
		35-60	ls	SM	0.4	70
Rhinebeck		0-12	sil,sicl	ML,CL,0L	0.49	86
		12-30	sicl,sic	CL,ML	0.4	70
		30-40	sicl,sil,vfsl	CL,ML	0.5	88
Ridgebury		0-16	sl,fsl,l	SM,ML,SC	0.24	42
			vstl,estl	SM,ML,SC	0.24	42
		16-40	gl,gsl	SM,SC	0.3	53
		40-60	gs,s	SM,GM	0.2	35
Riverhead		0-9	sl	SM,SC	0.28	49
			gsl	SM,SC	0.20	35
		9-34	fsl,slgsl, gfsl	SM,SC	0.3	53
		34-60	ls,s,gls,gs	SP-SM,SM,GP-GM GM	0.2	35
Rockaway		0-30	l	ML,SM,SC	0.24	42
			gsl,gl,vstl, vstsl,estsl	ML,SM,SC	0.17	30
		30-60	gsl	SM,SC	0.2	35
Rockport		0-10	shsil	ML,CL	0.20	35
		10-36 Rock	sicl,sic	ML,CL,MH CH	0.4	70
Roe		0-10	l	ML,CL	0.24	42
		10-36	l,sil	ML,CL	0.3	53
		36-60	fs	SM	0.2	35

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Scio		0-40	sil	ML,CL	0.49	86
		40-60	sl	SM	0.3	53
Sloan		0-45	sil,sicl	ML,CL	-	-
		45-60	gsl	SM		
Stephensburg		0-19	shl	ML	0.28	49
		19-26	vshl	GM,SM	0.2	35
		26+	shale bedrock		-	-
Swartswood		0-30	gfsl,gls,vstsl	SM,SC	0.17	30
		30-60	gfsl(pan)	SM,SC	0.3	53
Townsbury		0-13	l	SM,ML	0.24	42
			vstl	SM,ML	0.17	30
		13-36	l	SM,ML,SC	0.4	70
			gl	SM,Ml,SC	0.2	53
		30-60	gsl	SM	0.2	35
Tunkhannock		0-18	gl,vgl	SM,GM,ML	0.17	30
		18-32	vgsl	GM,SM	0.2	35
		32-60	s,gs	SM,GMSP,GP	0.2	35
Unadilla		0-10	vfsl	ML,CL	0.49	86
		10-60	sil,vfsl	ML,CL	0.4	70
		60-70	g & s	SP-SM,GP-GM, GW-GM	0.3	53
Valois		0-60	shl	ML,CL	0.17	30
Wallkill		0-8	sil	OL,CL,ML,SM,SC	0.32	56
		8023	sil	CL,ML,SM,SC	0.4	70
		23-60	muck & peak	OL,Pt	0.4	70
Washington		0-9	l,sil	ML,CL	0.32	56
			vstl	ML,CL	0.28	49
		9-60	l,sicl,cl	ML,CL	0.3	53
Wassaic		0-14	sil,l	ML,CL	0.32	56
			gl,gsl	SM,SC,GM,GC	0.24	42
		14-23	l,sl	SM,SC,ML,CL	0.3	53
			gsil	GM,GC	0.2	35
		23+	Bedrock			
Wayland		0-7	sil	OL-ML,CL	0.32	56
		7-38	sil	ML,CL	0.5	88
		38-50	stratified sil & fsl	ML,CL,SC,SM,GM, GC	0.4	70
Wellsboro		0-11	sil,fsl,l	SM,ML,CL	0.28	49
			chsil	SM,ML,CL	0.20	35
		11-22	l,sil	ML,CL	0.3	53
		22-60	fsl,sil,gl (pan)	SM,SC,ML,CL	0.3	53

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2a EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 144, R=175

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Whippany		0-9	sil	ML,CL	0.43	75
		9-60	sil,sicl,sic,c	ML,CL,CH	0.4	70
Whitman		0-10	fsl,sl,lvfsl, vstl,estsl	OL,SM,ML	0.24 0.24	42 42
		10-40	fsl,sl,l	SM,ML-CL	0.2	35
		40-60	gsl	SM	0.2	35
Woodglen		0-10	l	ML,CL	0.49	86
		10-36	sicl,c	ML,CL,MH,CH	0.4	70
		36-60	l,cl	ML,CL	0.4	70
Wooster		0-32	l,sil,cl	ML,CL	0.32	56
			gl,chl,gsil, chsil,gcl,chcl	ML,CL	0.3	53
		32-60	l,sil,chl, chsil gl,gsil	ML,CL,SM,SC	0.3	53
Wurtsboro		0-18	fsl	SM,SC	0.24	42
			gfsl	SM,SC	0.17	30
		18-60	fsl(pan)	SM,SC	0.3	53
			gfsl	SM,SC	0.2	35

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2b EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 148, R=175

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Abbottstown		0-20	sil	ML,CL	0.43	75
		20-38	sil(pan)	ML,CL	0.4	70
		38-48	shsil	ML,CL	0.4	70
			shl	SM,GM	0.3	53
Amwell		0-10	sil	ML,CL,SC	0.32	56
			gsil	ML,CL,SC	0.28	49
		10-23	sil,sicl,gsil	ML,CL	0.3	53
		23-41	gsicl,ksicl	ML,CL	0.3	53
			vgsil	GM,GC	-	-
		41-53	kfsl,gsil, vgsl	ML,CL,GC	0.3	53
Annandale		0-10	l	ML,SM	0.28	49
			gl	SM	0.24	42
		10-32	l,cl,scl	ML,CL	0.4	70
			gl,gcl,gscl	ML,CL	0.3	53
		32-44	same as 7-32 inches with pan		0.5	88
		44-60	sl	SM,ML	0.3	53
			gsl	SM,GM	0.2	35
Athol		0-10	gl	SM	0.32	56
		10-38	sicl,cl	ML,CL	0.3	53
			gcl	SM,SC	0.3	53
		38-60	sicl,cl	ML,CL	0.3	53
			gsl,gl	SM,SC,GM,GC	0.3	53
Bartley		0-11	l,g	ML,CL	0.32	56
		11-32	cl,l,scl	ML,CL	0.3	53
		32-42	sl,l	SM,SC	0.2	35
		42-60	sl,l,gsl,gl	SM,SC	0.2	35
Bedington		0-9	shsil	ML,CL	0.32	56
		9-35	shsil,shl	ML,CL	0.2	35
			sil	ML,CL	0.3	53
		35-66	vshl,vshsil	ML	0.2	35
			shsil	CL	0.3	53
		66-72	wesh	GM	0.2	35
Berks		0-8	shsil,chsil	GM,GC,ML	0.24	42
		8-20	sh to vshsil	SM,GM,GC	0.2	35
		20-30	vshsil	GM,GC,SM	0.2	35
		30+	shattered shale		0.2	35
Birdsboro		0-16	sil,l	ML,CL,SM	0.28	49
		16-48	sicl,cl	CL,ML,SM	0.3	53
		48-60	sl,s,g	GM,GC,SM,GW	0.2	35
			sicl,l	CL,ML	0.3	53
Bowmansville		0-8	sil	ML,CL	0.43	75
		8-32	sil,l,scl	ML,CL	0.4	70
		32-60	sil,scl,sl	ML,CL	0.4	70
			s,g		0.3	53

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2b EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 148, R = 175

Soil Series (Alpha. Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Bucks		0-21	sil	ML,CL	0.32	56
		21-36	sicl,sil	ML,CL,MH	0.4	70
		36-52	shsil,vshsil	ML,CL,GM,GC	0.2	35
Califon		0-10	l	ML,SM	0.28	49
			gl,gsil,vstl	SM	0.24	42
		10-32	l,cl,scl	ML,CL	0.4	70
			gl,gcl,gscl	ML,CL	0.3	53
		32-44	same as 10-32 but with pan		0.5	88
		44-60	sl	SM,ML	0.3	53
			gsl	SM,GM	0.2	35
Chalfont		0-18	sil	ML,CL	0.43	75
			vstsil	ML,CL	0.37	65
		18-50	sil,sicl	ML,CL	0.6	105
		50-60	shsil,shl	ML,GM	0.6	105
Cokesbury		0-15	l	ML,CL,SM	0.32	56
			gl,vstl,estl	SM,SC	0.24	42
		15-25	cl,sicl	ML,CL	0.4	70
		25-48	l,sl	ML,SM	0.5	88
		48-60	gl	SM,SC	0.4	70
Croton		0-18	sil	ML,CL	0.43	75
			vstsil	ML,CL	0.37	65
		18-36	sil,sicl	ML,CL,CH	0.5	88
		36-48	shsil,shsicl	ML,CL,SMSC	0.4	70
		48+	Shale bedrock			
Doylestown		0-20	sil	ML,CL	0.43	75
		60-48	sil	ML,CL	0.6	105
			shl	GM,GC	0.4	70
Duffield		0-10	sil	ML,CL	0.32	56
			vsil,vrsil	ML,CL	0.28	49
		10-36	sicl	ML,CL,MH,CH	0.3	53
		36-60	sicl	ML,CL	0.4	70
			shsil	ML,CL	0.3	53
Dunellen		0-15	l,sl	ML,SM	0.24	42
			gl,gsl	ML,SM	0.24	42
		15-38	l,sl	ML,SM	0.3	53
			gl,gsl	ML,SM	0.2	35
		38-60	s,gs	SM,SP-SM,GM	0.2	35
Edneyville		0-11	estl,gl,stl, vstl	ML,SM	0.24	42
		11-39	sl,l,scl	ML,SM,SC	0.4	70
			gsl,gl,gscl	ML,SM,SC	0.3	53
		39-65	gsl	SM,GM	0.2	35
Hazleton		0-9	chl,vstl	SM,GM	0.24	42
		9-40	chl	SM,GM	0.20	35
		40-50	vchl	GM	0.20	35

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2b EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 148, R=175

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Klinesville		0-13	shsil,shl, shsil,vshsil	GM,SM,SC,ML	0.20	35
		13-18	vshsil,vshsl	GM,GP	0.2	35
		18+	Shale, Bedrock			
Lamington		0-10	sil	ML,CL	0.43	75
		10-23	sil,sicl	ML,CL	0.4	70
		23-45	cl,sil,l	ML,CL	0.4	70
		45-60	s,sl,sil	SM,SP-SM,ML	0.3	53
Lansdale		0-14	l,sl	SM,SC,ML,CL	0.28	49
			chl,vstl	SM,SC,ML,CL	0.24	42
		14-30	scl,sl	SM,SC	0.3	53
			l	ML,CL	0.4	70
		30-45	chsil,gsl	ML,CL	0.3	53
		45-60	chsl,gsl,fsl	SM,SC	0.2	35
Lansdowne		0-10	l,sil	ML,CL	0.43	75
		10-26	cl,sicl	CL,CH	0.4	70
		26-40	l,sicl	ML,CL	0.4	70
		40-60	shsicl	ML,CL	0.4	70
Lawrenceville		0-28	sil	ML,CL	0.49	86
		28-60	sil	ML,CL	0.6	105
			sl,vfsl	SM,SC	0.6	105
Legore		0-8	gl	SM,GM	0.20	35
		8-24	cl	ML,MH,CL	0.3	53
			gcl,gl,gsicl	SM,SC	0.2	35
		24-66	l,sil,sicl	ML,CL	0.3	53
			gl,vgl,gcl	SM-SC	0.2	35
Lehigh		0-14	sil	ML,CL	0.43	75
			chsil,vstsil	ML,CL	0.37	65
		14-30	chsicl	ML,CL	0.4	70
		30-41	chsicl,vchsil	ML,CL,GM	0.3	53
		41+	Shale Bedrock			
Meckesville		0-10	gl	ML,CL	0.28	49
		10-31	cl,l,scl, sicl(g)	ML,CL,SC	0.4	70
		31-38	l	ML,CL	0.4	70
		38-60	l,scl,(g,k)	ML,CL,SM,SC	0.3	53
Mount Lucas		0-9	sil	ML,CL	0.32	56
			vstsil	ML,CL	0.28	49
		9-32	l,cl,scl,sicl	ML,CL	0.3	53
		32-60	l	ML	0.4	70
			sl	SM-SC	0.3	53
Neshaminy		0-14	sil	ML,CL	0.32	56
			vstsil,gsil	ML,CL	0.28	49
		14-54	sicl,cl	ML,CL	0.3	53
			scl,sl	SM,SC	0.3	53
		54+	Diabase Bedrock			

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2b EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 148, R=175

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Nixon		0-12	sil,l,sl	ML,CL,SM	0.28	49
		12-45	sil,sicl,cl	ML,CL	0.4	70
		45-60	sl,sil,s	SM,ML	0.3	54
			gsil,gs	SM,ML	0.2	35
Norton		0-14	sil,l	ML	0.32	56
		14-63	sicl	ML,CL	0.4	70
		63-70	sil	ML	0.4	70
			vgl,shl	GM	0.3	53
Parker		0-40	vgl,vgsl,gsl, kl estsp	SM,GM,GP	0.17	30
		40-60	vstl,vstls, stsl,stls	GM	0.20	35
Parsippany		0-9	l,sicl,sil	ML	0.43	75
		9-50	sicl,cl	ML,CL	0.5	88
		50-60	sicl,cl	ML,CL,CH	0.4	70
Pattenburg		0-7	l,gl,vgl	ML,SM,GM	0.32	56
		7-30	vgl,l,cl,scl	ML,GM,SM,SC	0.3	53
		30-60	gl,vgl,gsl, vgsl	GM,SM	0.2	35
Penn		0-8	l	ML	0.32	56
			shsil	ML,CL	0.28	49
		8-30	sil	ML,CL	0.4	70
			shsil,sicl	SC-SM	0.3	53
		30+	Shale Bedrock			
Pope		0-12	fsl	SM	-	-
		12-46	fsl,l	SM,SC	-	-
		46-60	s,sl,gs,gsl, vgs,vgsl	SP-SM,SM,GP-GM, GM	-	
Quakertown		0-16	sil	ML	0.32	56
			chsil	ML	0.28	49
		16-32	sicl	ML,CL	0.3	53
		32-48	chsil,cl	ML,CL	0.3	53
		48+	Sandstone Bedrock			
Raritan		0-14	sil	ML,CL	0.43	75
		14-43	cl,sicl	ML,CL,CH	0.3	53
		43-60	stratified	SM,SC	0.2	35
			s,fsl	SP,SM	0.2	35
			c,sil,l	ML,CL,CH	0.3	53
			g	GM	0.3	53

1/ Mapping units may be inserted on the basis of the local county soil survey

TABLE A1-2b EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 148, R=175

Soil Series (Alpha Listing)	Local 1/ Mapping No.	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Readington		0-12	sil	ML,CL	0.43	75
		12-40	sil,sicl	SM,SC,ML,CL	0.4	70
		40-50	sil	ML,CL	0.4	70
			v,sh,sil	GM	0.3	53
		50+	Shale Bedrock			
Reaville		0-13	sil	ML,CL	0.43	75
			shsil	ML,CL	0.37	65
		13-23	shsil	ML,CL	0.3	53
				GM,GC	0.3	53
		23+	Shale and Silstone Bedrock			
Riverhead		0-9	sl	SM,SC	0.28	49
			gsl	SM,SC	0.20	35
		9-34	fsl,slgsl,gfsl	SM,SC	0.3	53
		34-60	ls,s,gls,gs	SP-SM,SM,GP-GM GM	0.2	35
Rowland		0-44	sil,l	ML,CL	0.43	75
			sicl	SM,SC	0.4	70
		44-60	stratified	SM,GM	0.3	53
			s & g	SP,GM	0.2	35
			sil	ML	0.4	70
Tioga		0-9	fsl	ML,CL,SM	0.49	86
		9-24	sil,l,fsl	ML,CL,SM	0.4	70
		24-60	vgls	SM,GM	0.2	35
Turbotville		0-50	l,sil	ML,CL	0.43	75
		50-60	l,sl	ML,SM	0.3	53
Washington		0-9	l,sil	ML,CL	0.32	56
			vstsl	ML,CL	0.28	49
		9-60	l,sicl,cl	ML,CL	0.3	53
Watchung		0-9	sil	ML,CL	0.43	75
		9-46	c,cl,sicl	ML,CL,CH	0.4	70
		46-60	sil,sicl,l	ML,CL	0.4	70
Whippany		0-10	sil	ML,CL	0.43	75
		10-60	sic,c,sicl	ML,CL,CH,MH	0.5	88

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2c EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 149, R =200

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Adelphia		0.14	sl,fsl,l	ML,CL,SM,SC	0.32	64
		14-37	l,scl,fsl	SM,SC,ML,CL	0.4	80
		37-60	sl,ls	SM	0.2	40
Atsion		0-16	s,fs	SP,SP-SM	0.17	34
		16-60	s,ls	SP,SP-SM	0.2	40
Aura		0-13	sl,l	SM,ML,CL	0.43	86
			gl,gsl	SM,SC	0.32	60
			ls	SP-SM,SM	0.28	40
		13-59	scl	SM,SC	0.4	80
			gscl,gsl	GM,GC	0.3	60
		59-72	scl,sl	SM,SC	0.4	80
			gsl,gcl	SM,SC,GM,GC	0.3	60
			ls	SP-SM	0.2	40
Barclay		0-14	fsl,lfs	SM	0.49	98
		14-40	vfsl,fsl	SM	0.4	80
		40-60	fs,lfs	SM,SP-SM	0.3	60
Bayboro		0-14	sl,l,sil	ML	0.37	74
		14-64	c,cl,sic	CH,CL,MH	0.2	40
Berryland		0-12	s,fs	SP,SP-SM	0.17	34
		12-72	s,ls,sl	SP,SP-SM	0.2	40
Bertie		0-14	sil,l	ML,CL	0.37	74
		14-40	sil,sicl,l	ML,CL	0.4	80
		40-60	stratified sl,l,ls	SM,SC,ML	0.3	60
			gsl	SM	0.2	40
Bibb		0-28	sl to sicl	ML,CL,SM	0.32	64
		28-60	highly variable	SM,GM,CL	0.20	40
Chillum		0-28	sil	ML,CL	0.32	64
		28-60	gscl,gl	SM,SC	0.3	60
			gsl	GM	0.2	40
Colemantown		0-14	l	ML,CL,SM	0.43	86
		14-30	sc,scl	CL,CH,MH	0.4	80
		30-60	sl,cl,scl	SC,ML,CL	0.4	80
Collington		0-13	sl,fsl	SM,SC,ML	0.28	56
			ls	SM	0.20	40
		13-32	scl,cl,sl,l	SC,SM,ML,CL	0.4	80
		32-60	sl,ls	SM,SC	0.2	40
Colts Neck		0.14	sl	SM	0.28	56
			ls	SM	0.20	40
		14-34	scl,sl,l	SM,SC	0.4	80
		34-60	sl	SM	0.3	60

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2c EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 149, R=200

Soil Series (Alpha Listing)	Local Mapping No.	1/ Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Donlonton		0-12	fsl	ML,CL,SM,SC	0.43	86
		12-40	sc,cl,sic	CH,CL,ML	0.4	80
		40-60	sc,sicl,cl,ls	SM,SC,ML,CL	0.3	60
Downer		0-16	sl	SM,SP-SM	0.28	56
			ls	SM	0.20	40
		16-30	sl	SM	0.3	60
		30-60	s,ls	SP,SP-SM	0.2	40
Dragston		0-14	fsl,sl,lfs	SM,SC,ML	0.28	56
		14-30	sl,scl	SM,SC,CL	0.3	60
		30-60	ls,lfs	SM	0.2	40
Elkton		0-10	sil,sl,l	ML,CL,SM	0.43	86
		10-36	sic,c	CH,CL,MH	0.4	80
		36-60	sic,sicl,scl,c	SC,SM,CL,CH,MH	0.4	80
Evesboro		0-60	ls,s,fs	SM,SP	0.17	34
Fallsington		0-14	sl,fsl,l	SM,SC,ML	0.28	56
		14-35	scl,sl	SM,SC,ML	0.3	60
		35-50	s,ls,sl	SM,SP-SM	0.2	40
Fort Mott		0-24	s,ls	SP-SM,SM	0.20	40
		24-40	sl	SM	0.3	60
		40-60	s	SP-SM,SM	0.2	40
Freehold		0-14	fsl,sl,l	SM,ML	0.28	56
			ls,lfs	SM	0.20	40
		14-32	sl,scl	SM,SC	0.4	80
		32-60	stratified ls,fsl	SM	0.2	40
Freneau		0-60	sl,l	SM,ML	0.28	56
Galestown		0-60	ls,s	SM,SP	0.17	34
Hammonton		0-18	sl	SM	0.28	56
			ls	SP-SM,SM	0.20	40
		18-36	sl	SM	0.3	60
		36-60	s,ls,gs,gls	SP-SM,SM	0.2	40
Holmdel		0-14	fsl,sl,l,lfs	SM,ML	0.28	56
		14-36	sl,scl,l	SM,SC	0.4	80
		36-60	ls,sl	SM	0.2	40
Howell		0-14	fsl,l	SM,ML,CL	0.43	86
		14-35	cl,sicl	CL	0.4	80
		35-60	c,sic,sicl	MH,ML,CL	0.3	60
Keansburg		0-30	sl,fsl,l	SM,ML,SC	0.28	56
		30-60	sl,l	SM	0.3	60

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2c EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 149, R=200

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR	
Keyport		0-10	sil,l,fsl,sl	SM,ML	0.43	86	
		10-44	c,sic,cl	CL,CH,MH	0.4	80	
		44-72	sicl,sic	CL,ML,MH	0.4	80	
Sandy Substratum		44-72	scl,sl	SM,SC,ML,CL	0.3	60	2/
Klej		0-40	ls,fs	SM,SP-SM,SP	0.17	34	
		40-60	ls,fs,lfs,sl	SM,SP-SM,SP	0.2	40	
Kresson		0-10	l,sl,ls,fsl	ML,CL,SM,SP-SM	0.43	86	
		10-45	sc,scl	ML,MH,CL,CH	0.4	80	
		45-60	sl,l	SM,SC,ML,CL	0.3	60	
Lakehurst		0-60	s,fs	SP,SP-SM	0.17	34	
Lakeland		0-60	ls,lfs,s	SM,SP	0.17	34	
Lakewood		0-60	s,fs	SP,SP-SM	0.17	34	
Lenoir		0-10	sil,l,fsl	SM,ML	0.43	86	
		10-60	sicl,c,sic,cl	CL,CH,ML,MH	0.4	80	
Sandy Substratum		40-72	scl,sl	SM,SC,ML,CL	0.3	60	2/
Leon		0-16	s	SP,SP-SM	0.17	34	
		16-60	s,ls	SP,SP-SM	0.2	40	
Lenoir		0-10	l,sil	ML,CL	0.43	86	
		10-40	c,sic,cl	CL,CH,MH	0.4	80	
		40-60	cl,sicl	CL,MH,ML	0.4	80	
Lincroft		0-60	ls,s	SM,SP-SM	0.17	34	
Marlton		0-14	sl,fsl	SM,SC	0.43	86	
		14-45	sc,scl	ML,CL,MH,CH	0.4	80	
		45-60	sl,scl	SM,SC,CL,ML	0.4	80	
Matapeake		0-16	sil,fsl,l	ML-SM,CL	0.32	64	
		16-34	sil,sicl	ML,CL	0.4	80	
		34-60	s,ls,sl,l gs	SM,SC,CL,ML	0.3	60	
Matawan		0-20	sl,ls,fsl	SM,SC	0.32	64	
		20-60	cl,scl,sc,sl	CL,SC,SM	0.4	80	
Mattapex		0-14	sil,l	ML,CL	0.37	74	
		14-40	sicl,sil,cl	ML,CL	0.4	80	
		40-60	sl,ls,s,l gs	SM,SC,CL,ML	0.2	40	
Matlock		0-10	l	ML,CL	0.43	86	
		10-35	sc,scl	ML,CL,MH,CH	0.4	80	
		35-60	sl,l	SM,SC,ML	0.3	60	

1/ Mapping units may be inserted on the basis of the local county soil survey.
2/ Data for sandy substratum.

TABLE A1-2c EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 149, R=200

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Monmouth		0-11	fsl,l,lfs	SM,SC,ML,CL	0.43	86
		11-40	sc,scl	CL,SC	0.4	80
		40-60	sl,scl,sc	SM,SC	0.3	60
Nixonton		0-14	fsl,lfs	SM	0.49	98
		14-40	vfsl,fsl	SM	0.4	80
		40-60	lfs,ls	SM,SP-SM	0.2	40
Osier		0-60	s,fs,ls,lfs	SM,SP-SM	0.17	34
Othello		0-14	sil,l,fsl,sicl	ML,CL	0.37	74
		14-34	sicl,sil	ML,CL	0.4	80
		34-60	sl,ls,scl	SM,SC,CL	0.3	60
Pasquotank		0-30	vfsl,fsl	ML,SM	0.49	98
		30-60	vfsl,sl,ls	ML,SM	0.2	40
Pemberton		0-24	s,ls	SM,SP-SM	0.20	40
		24-34	sl	SM,SC	0.2	40
		34-60	s,ls	SM,SP-SM	0.2	40
Plummer		0-46	s,fs,ls,lfs	SM,SP-SM	0.17	34
		46-60	sl,scl	SM,SC	0.30	60
Pocomoke		0-28	sl,l,fsl,ls, lfs	SM,ML	0.28	56
		28-60	ls,s	SM,SP-SM	0.2	40
Portsmouth		0-26	sil	ML,CL	0.28	56
		26-60	fs,cos	SP,SP-SM	0.2	40
Rutlege		0-18	ls,lfs	SM,SP-SM	0.17	34
		18-60	s,fs,ls,lfs	SP-SM,SP,SM	0.2	40
St. Johns		0-12	s	SP,SP-SM	0.17	34
		12-72	s,ls,sl,gs	SP,SP-SM	0.2	40
Sassafras		0.14	fsl,l,sl	SM,ML	0.28	56
			ls,lfs	SM	0.20	40
			gsl	SM,SP	0.24	48
		14-36	scl,sl,l	SM,SC,CL,ML	0.3	60
		36-60	sl,ls,fsl	SM	0.2	40
			gsl,gls	SM,SP,SP-SM	-	-
Shrewsbury		0-14	sl,fsl,l	SM,ML	0.28	56
		14-30	scl,sl	SC,SM,CL	0.3	60
		30-60	s,ls,sl	SM,SP-SM	0.2	40
Tinton		0-24	s,ls	SM,SP-SM	0.20	40
		24-60	s,ls	SM,SC,SP-SM	0.20	40
Weeksville		0-14	fsl	ML,SM	0.49	98
		14-44	sil,fsl	ML,SM	0.4	80
		44-60	vfsl,fsl,scl	ML,CL,SM	0.4	80

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-2c EROSION PROPERTIES OF SOILS IN NEW JERSEY
LAND RESOURCE AREA 149, R=200

Soil Series (Alpha Listing)	Local Mapping No. 1/	Typical Profile (Inches)	USDA Texture Range	Unified System	K	KR
Westphalia		0-14	fsl,lfs	SM,ML	0.49	98
		14-28	fsl,lfs, vfsl	SC,SM,ML	0.4	80
		28-60	fs,lfs,fsl	SM,ML,SP-SM	0.3	60
Woodsmansie		0-17	s	SM,SP-SM	0.20	40
		17-30	sl	SM,SC	0.2	40
		30-60	s,ls,sl	SM,SP-SM	0.2	40
Woodstown		0-14	sl,fsl,l	SM,SC,ML	0.28	56
			ls	SM	0.20	40
		14-36	scl,l,sl	SM,CL,SC,ML	0.4	80
		36-60	s,ls,sl	SM,SP-SM	0.2	40
			gsl,gls	SM,SP-SM		

1/ Mapping units may be inserted on the basis of the local county soil survey.

TABLE A1-3

ADJUSTMENT FACTORS (LS) FOR SLOPE PERCENT AND SLOPE LENGTH

PERCENT SLOPE	SLOPE LENGTH (FEET)																														
	10	15	20	25	30	35	40	50	60	72.6	80	90	100	120	140	160	180	200	220	240	260	280	300	350	400	500	600	700	800	900	1000
0.5	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.12	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.18	0.20	0.21	0.24	0.26	0.28	0.30	0.32	0.33
1.0	0.04	0.05	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.12	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.21	0.21	0.22	0.23	0.24	0.26	0.28	0.31	0.34	0.36	0.39	0.41	0.44
2.0	0.07	0.08	0.10	0.11	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.24	0.25	0.27	0.29	0.30	0.32	0.33	0.35	0.36	0.37	0.40	0.43	0.48	0.53	0.57	0.61	0.64	0.68
3.0	0.10	0.12	0.14	0.15	0.17	0.18	0.19	0.22	0.24	0.26	0.27	0.21	0.31	0.34	0.36	0.39	0.41	0.43	0.45	0.48	0.49	0.51	0.53	0.57	0.61	0.69	0.75	0.81	0.87	0.92	0.97
4.0	0.13	0.16	0.19	0.21	0.23	0.25	0.26	0.29	0.32	0.35	0.37	0.39	0.41	0.45	0.49	0.52	0.56	0.59	0.61	0.64	0.67	0.69	0.72	0.77	0.83	0.93	1.01	1.09	1.17	1.24	1.31
5.0	0.17	0.21	0.24	0.27	0.29	0.37	0.34	0.39	0.42	0.46	0.48	0.51	0.54	0.59	0.63	0.68	0.72	0.76	0.80	0.83	0.86	0.90	0.93	1.00	1.07	1.20	1.31	1.42	1.52	1.61	1.71
6.0	0.21	0.26	0.30	0.34	0.37	0.40	0.43	0.48	0.52	0.57	0.60	0.64	0.67	0.74	0.80	0.85	0.90	0.95	1.00	1.04	1.09	1.13	1.17	1.26	1.35	1.51	1.65	1.78	1.91	2.02	2.13
7.0	0.26	0.32	0.37	0.41	0.45	0.49	0.52	0.58	0.64	0.70	0.74	0.79	0.83	0.91	0.98	1.05	1.11	1.17	1.23	1.28	1.33	1.38	1.43	1.55	1.65	1.85	2.02	2.19	2.34	2.48	2.61
8.0	0.31	0.39	0.44	0.50	0.55	0.59	0.63	0.70	0.77	0.85	0.89	0.95	0.99	1.09	1.18	1.26	1.33	1.41	1.48	1.54	1.60	1.66	1.72	1.86	1.99	2.22	2.44	2.63	2.81	2.98	3.14
9.0	0.37	0.46	0.53	0.59	0.65	0.70	0.74	0.83	0.91	1.00	1.05	1.12	1.18	1.29	1.39	1.49	1.58	1.67	1.75	1.82	1.90	1.97	2.04	2.20	2.36	2.63	2.84	3.12	3.33	3.53	3.72
10.0	0.44	0.53	0.62	0.69	0.75	0.82	0.87	0.97	1.07	1.17	1.23	1.31	1.38	1.51	1.63	1.74	1.85	1.95	2.04	2.13	2.22	2.30	2.38	2.57	2.75	3.08	3.37	3.64	3.89	4.13	4.35
11.0	0.50	0.62	0.71	0.80	0.87	0.94	1.00	1.12	1.23	1.35	1.42	1.51	1.59	1.74	1.88	2.01	2.13	2.25	2.36	2.46	2.56	2.66	2.75	2.97	3.18	3.55	3.89	4.21	4.50	4.77	5.03
12.0	0.58	0.70	0.81	0.91	1.00	1.08	1.15	1.29	1.41	1.55	1.63	1.73	1.82	1.99	2.15	2.30	2.44	2.57	2.70	2.82	2.93	3.04	3.15	3.40	3.64	4.07	4.45	4.81	5.14	5.45	5.75
13.0	0.65	0.80	0.92	1.03	1.13	1.22	1.30	1.46	1.60	1.76	1.84	1.96	2.06	2.26	2.44	2.61	2.77	2.92													
14.0	0.74	0.90	1.04	1.17	1.28	1.38	1.47	1.65	1.81	1.99	2.08	2.21	2.33	2.55	2.76	2.95	3.13	3.30													
15.0	0.82	1.01	1.16	1.30	1.42	1.54	1.64	1.84	2.01	2.21	2.32	2.46	2.60	2.84	3.07	3.28	3.48	3.67													
20.0	1.33	1.62	1.88	2.10	2.30	2.48	2.65	2.97	3.25	3.58	3.75	3.98																			
25.0	1.95	2.39	2.76	3.09	3.38	3.66	3.90	4.37	4.79	5.26	5.52	5.86																			
30.0	2.70	3.30	3.82	4.27	4.68	5.05	5.40	6.04	6.62	7.27	7.63	8.10																			
35.0	3.56	4.36	5.04	5.64	6.18	6.68	7.13	7.97	8.74	9.61	10.08	10.70																			
40.0	4.55	5.57	6.44	7.20	7.89	8.52	9.10	10.18	11.56	12.27	12.87	13.66																			
50.0	6.88	8.43	9.73	10.89	11.93	12.89	13.76	15.40	16.88	18.55	19.47	20.67																			

$$(LS) = \frac{\sqrt{L}}{100}\,(0.76 + 0.54S + 0.076S^2)$$

TABLE A1-4

COVER INDEX FACTOR C_c

CONSTRUCTION SITES

TYPE OF COVER		FACTOR C_c	%*
None (fallow ground)		1.0	0.0
Temporary Seedings (90% Stand):			
Ryegrass (perennial type)		0.05	95
Ryegrass (annuals)		0.1	90
Small grain		0.05	95
Millet or sudan grass		0.05	95
Field bromegrass		0.03	97
Permanent Seedings (90% stand)		0.01	99
Sod (laid immediately)		0.01	99
Mulch:			
Hay rate of application tons per acre:			
	1/2	0.25	75
	1	0.13	87
	$1\frac{1}{2}$	0.07	93
	2	0.02	98
Small grain straw	2	0.02	98
Wood chips	6	0.06	94
Wood cellulose	1 3/4	0.1	90
Fiberglass	1/2	0.05	95
Asphalt emulsion (1250 gals/acre)		0.02	98

Fiber matting, excelsior, gravel and stone may also be used as protective cover.

*Per cent soil loss reduction as compared with fallow ground.

TABLE A1-5

PRACTICE FACTOR P_c OR SURFACE CONDITION FOR CONSTRUCTION SITES

SURFACE CONDITION WITH NO COVER	FACTOR P_c*
Compact and smooth, scraped with bulldozer or scraper up and down hill	1.3
Same condition, except raked with bulldozer root rake up and down hill	1.2
Compact and smooth, scraped with bulldozer or scraper across the slope	1.2
Same condition, except raked with bulldozer root rake across the slope	0.9
Loose as a disced plow layer	1.0
Rough irregular surface equipment, tracks in all directions	0.9
Loose with rough surface greater than 12" depth	0.8
Loose with smooth surface greater than 12" depth	0.9

*Values based on estimates

TABLE A1-6

ADJUSTMENT FACTOR M FOR ESTIMATING MONTHLY AND PORTIONS OF ANNUAL SOIL LOSS FOR NEW JERSEY

Starting Months	ENDING MONTHS											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Jan	0	0.02	0.04	0.06	0.10	0.20	0.35	0.55	0.76	0.86	0.93	0.97
Feb	0.98	0	0.02	0.04	0.08	0.18	0.33	0.53	0.74	0.84	0.91	0.95
Mar	0.96	0.98	0	0.02	0.06	0.16	0.31	0.51	0.72	0.82	0.89	0.93
Apr	0.94	0.96	0.98	0	0.04	0.14	0.29	0.49	0.70	0.80	0.87	0.91
May	0.90	0.92	0.94	0.96	0	0.10	0.25	0.45	0.66	0.76	0.83	0.87
June	0.80	0.82	0.84	0.86	0.90	0	0.15	0.35	0.56	0.66	0.73	0.77
July	0.65	0.67	0.69	0.71	0.75	0.85	0	0.20	0.41	0.51	0.58	0.62
Aug	0.45	0.47	0.49	0.51	0.55	0.65	0.80	0	0.21	0.31	0.38	0.42
Sept	0.24	0.26	0.28	0.30	0.34	0.44	0.59	0.79	0	0.10	0.17	0.21
Oct	0.14	0.16	0.18	0.20	0.24	0.34	0.49	0.69	0.90	0	0.07	0.11
Nov	0.07	0.09	0.11	0.13	0.17	0.27	0.42	0.62	0.83	0.93	0	0.04
Dec	0.03	0.05	0.07	0.09	0.13	0.23	0.38	0.58	0.79	0.89	0.96	0

All dates in the table are as of the 1st of each month, read from left to right.
M=1.0 for one full year.

Example: Given KR=70. (LS) = 1.2 What is soil loss for month of July?

E_t=70 x 1.2=84.0 tons per acre per year.

E_t for July=84x0.2=17 tons per acre for July on the average

What is the soil loss if construction begins on the first of May and sod is established on disturbed areas by September 1st?

E_t May to Septmeber=84 x 0.66=55 tons per acre.

TABLE A1-7

APPROXIMATE WEIGHTS OF SOILS IN LBS. PER CUBIC FT. AND CONVERSION FACTORS

Soils	Volume Wt. lb./cu. ft.	Conversion Factors Ac. Inches	Ac. Ft.	Tons to Cu. Yds.
Sands and loamy sands	110	0.005	0.00042	0.67
Sandy loam	105	0.0052	0.00044	0.71
Fine sandy loam	100	0.0055	0.00046	0.74
Loam	90	0.0061	0.00051	0.82
Silt loam	85	0.0065	0.00054	0.87
Silty clay loam	80	0.0069	0.00057	0.93
Clay loam	75	0.0073	0.00061	0.99
Silty, sandy clay and clay	70	0.0079	0.00066	1.06
Aerated Sediment	80*	0.0069	0.00057	0.93
Saturated Sediment	60*	0.0092	0.00077	1.24

*These are the approximate aerated and saturated weights to be used at damage sites. (Streams or reservoirs)

TABLE A1-8

FACTORS FOR MODIFYING THE SOIL LOSS EQUATION TO OBTAIN ESTIMATES BASED ON PROBABILITY AND SINGLE STORM SOIL LOSS

Probability		Single Storm	
One Year In	Factor	Exceeded Once In (Years)	Factor
2	0.9	1	0.2
5	1.25	2	0.3
20	1.70	5	0.4
		10	0.5
		20	0.7

Example: The average annual soil loss from a critical sediment source area was computed to be 100 tons per acre per year.

One year in 5 this loss could be: 100 x 1.25 = 125 tons per acre, or one year in 20 the loss could be: 100 x 1.7 = 170 tons per acre.

A single storm that may take place once in 10 years could cause a soil loss of 100 x 0.5 = 50 tons per acre. If the single storm is one that occurs once in 2 years, the loss might be: 100 x 0.3 = 30 tons per acre.

APPENDIX A2

SUGGESTED REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL PLANS

The following items should be included in or with a sediment and erosion control plan:

1. The preliminary subdivision plan.

2. The plan for storm drainage and culverts including:
   A. Location of drains and culverts.
   B. Discharge capacity and expected velocities at drain or culvert outlets.
   C. Condition below outlets and expected flow velocities.
   D. Supporting computation for the above.

3. The site grading plan showing existing topography and planned grades along with proposed street of highway profiles.

4. Proposed sediment control plan including:
   A. Sediment control structures such as diversions, waterways, slope stabilization structures, sediment basins, etc. In sufficient detail to implement their installation together with referenced standards for soil erosion and sediment control as appropriate. Design calculations as required for each structure.
   B. Seeding and/or sodding requirements for all exposed areas including seedbed preparation, seed mixtures, lime, fertilizer and mulching requirements with referenced standards.
   C. Schedule, or sequence, of operation with starting dates for clearing and/or grading, timing of storm drain and culvert installations, duration of exposure of soils, and critical area stabilization, both temporary and permanent. Indicate dates when critical area stabilization, paving, seeding and mulching or sodding is to be completed.
   D. General notes for sediment control that spell out the procedures for implementing the plan. The time schedules indicated in C should be included.
   E. Engineers seal and signature in an appropriate title block.

5. A request for approval should accompany all sediment control plans and may be in a form similar to Figure A2-I.

FIGURE A2-I

REQUEST FOR APPROVAL FORM

Gentlemen:

The enclosed Sediment Control Plan, supporting documents, drawings and computations are respectfully submitted for your approval.

Legal Title:_____

Type Zoning:_____

Size of Tract:_____

Preliminary Plan

_____

Owner (s):_____

Address:_____

_____

Phone:_____

Location of Tract:_____

_____

Document (s) submitted: _____

_____

_____

_____

Major Soils (Soil Survey Sheet(s) #)

_____

Utilities: (Public or on-site)

Sewer_____

Water_____

Storm Drainage System Includes:_____

_____

_____

Scheduled Start of Grading:_____

Grading Balance: Borrow needed____
Excess spoil_____

Scheduled Completion of Storm Drainage, Paving and/or Stabilization:_____

Sediment Control Practices Planned:

Grading options:

____Limited initial grading (designate areas)_____

_____

____Delayed site (or lot) grading
____Delayed finish grading
____Total site grading initially

Erosion Control Devices

____Diversions
____Slope stabilization structure(s) (specify flume, pipe drop, etc.)
____Level speaders
____Sodded waterways (or ditches)
____Sediment Basin

Critical Area Stabilization:

____Mechanical (crushed stone, paving, etc.)
____Vegetative (temporary, permanent or mulch only)

Plans Prepared By:

_____

APPENDIX A3

GUIDE FOR CONSTRUCTION SPECIFICATIONS

The contractor shall perform all work, furnish all materials and install all measures required to reasonably control soil erosion resulting from construction operations and prevent excessive flow of sediment from the construction site. Such work may include the installation of water diversion structures, diversion ditches, and sediment basin, and seeding, mulching or sodding critical areas to provide temporary protection. The contractor shall submit a plan showing the methods to be used for controlling erosion during construction along with the schedule of construction operations. When no work will be performed on critical areas for more than 30 days, they shall be protected by temporary seeding, mulching, or sodding, or the slope lengths shall be reduced by the installation of diversions or other means. When topography permits, debris basins shall be constructed at points of water concentration from critical area that will remain unprotected longer than 30 days. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by paving or other means acceptable to the engineer.

Critical areas shall be those areas subject to excessive erosion due to highly erodible soils, slope length and steepness or water concentrations. Concentrations of runoff water, or other reasons, may cause the area to be critical. All areas that may become critical when the vegetation or other soil surface protection is removed as shown or noted on the drawings or otherwise identified.

The permanent restoration of vegetative cover such as seeding or sodding on all areas shall be accomplished within 10 days after final grading operations have been completed. Time extensions beyond the 10 days requirement may be requested in writing and are subject to written approval by the engineer.

Structural measures for erosion shall be designed and constructed in accordance with the attached Engineering Practice Standards for diversions, waterways and debris basins.

Seeding, mulching and sodding of critical area shall be in accordance with the attached vegetative standards.

Exposed soil having a pH value of less than 4 shall be covered with a minimum of 12 inches of soil material no coarser than a sandy loam or SM and that can be corrected to a minimum pH of 6.5.

Unless otherwise approved in writing by the engineer, construction operations in rivers, streams, ponds and reserviors shall be restricted to those areas of work shown on the drawings and to those areas which must be entered for the construction of temporary or permanent structures. Rivers, streams, ponds or reservoirs shall be promptly cleared of all temporary false work, piling, debris or other obstructions placed therein or caused by the construction operations.

Excavated soil material shall not be placed adjacent to rivers, streams or bodies of water in a manner that will cause it to be washed away by high water or runoff.

Frequent fording of streams with construction equipment will not be permitted, therefore, temporary bridges, culverts or other structures shall be used wherever stream crossings are necessary. Unless otherwise approved in writing by the engineer, mechanized equipment shall not be operated in streams except as may be required to construct channel work and temporary or permanent structures.

Pollutants such as chemicals, fuels, lubricants, bituminous, raw sewage and other harmful waste shall not be discharged into or alongside of rivers, streams, impoundments or into natural or man-made channels leading thereto.

The contractor shall comply with applicable State and local regulations relating to the prevention and abatement of pollution.

APPENDIX A4

MAINTENANCE STRUCTURAL MEASURES

Maintenance is the work required to keep practices in, or restore them to, their original physical and functional condition.

Maintenance includes the performance of work and application of measures to prevent deterioration as well as restoring, rebuilding, replacing and putting together parts that have been torn, broken or deteriorated.

All structural measures for the control of erosion, sediment and water disposal must have timely maintenance if the measures are to endure and perform their function. All structures should be inspected at least semiannually and after each heavy rain. Particular attention should be given to temporary structures.

A comprehensive program should be outlined for use of those who have maintenance responsibility. Maintenance items should include but not be limited to those shown for each of the following measures.

Channel Linings (Including slope protection structures)

Check for: cracking; spalling; deterioration from freezing, salt or chemicals; plugging of weep holes; operation of automatic drainage gates; condition of safety fences; channel obstructions; scour at inlet and outlet.

Cracks should be sealed, protective coatings applied when needed, and modification or riprap repairs made where and when necessary.

Earth Channels (Including diversions and waterways)

Check for: points of scour or bank failure and deposition; rubbish or channel obstruction; rodent holes; excessive wear from play, traffic or settling.

Remove deposition and undesirable plant growth. Repair damages from scour, rodents and loss of freeboard.

Dams and Spillways

Check fill for cracks, damage from wave action, rodents, undesirable vegetation growth, and obstructions to principal and emergency spillways. Check gates, trash racks, metal work, anchors, conduits and appurtenances for damage from corrosion, ice and debris.

Filling of scour holes, modification, riprap, repair of damaged vegetative cover, obstruction removal should be on a timely basis.

Valves and gates should be cleaned, lubricated and operated through their full range.

Unauthorized modifications, tampering or vandalism must be controlled.

APPENDIX A5

GUIDE FOR INSTALLING SOIL STABILIZATION MATTING

Soil stabilization matting is used as a mechanical aid to protect the soil from erosion during the critical period of vegetative establishment. It is easier to lay and hold in place against wind. It has the tensile strength and weight to resist water flow and erosion.

Materials

Jute mat shall be cloth of a uniform plain weave of undyed and unbleached single jute yarn, 48 inches in width plus or minus 1 inch and weighing an average of 1.2 pounds per linear yard of cloth with a tolerance of plus or minus 5 percent, with approximately 78 warp ends per width of cloth and 41 weft ends per linear yard of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one half of its normal diameter.

Excelsior mat shall be wood excelsior, 48 inches in width plus or minus 1 inch and weighing 0.8 pounds per square yard plus or minus 10 percent. The excelsior material shall be covered with a netting to facilitate handling and to increase strength.

Staples - Staples for anchoring soil stabilization matting shall be made of 12 -to- 20 inch lengths of No. 8 plain iron wire.

Installation Requirements

Site Preparation: Shape and grade the waterway, channel or area to be protected as required by job plans and specifications.

Remove rocks, clods over 1½ inches in diameter, sticks and other material that will prevent contact of the matting with the soil surface.

Seeding: Lime, fertilizer and seed in accordance with the applicable seeding standard except that for jute matting one half of the seed may be applied prior to laying the matting and the remaining seed applied after laying the matting.

Do not cultipack.

Laying the Matting: (If instructions have been followed, the matting will be laid on loose soil. See Figure A5-1.)

Start laying the matting from the top of the channel or slope and unroll downgrade so that one edge of the strip coincides with the channel center. Lay a second strip parallel to the first on the other side of the channel and allow at least a 2-inch overlap for jute matting. Excelsior matting may be butted. If one roll of matting does not extend the length of the channel, continue downhill with additional rolls.

Securing the Matting: Bury the top end of jute strips in a trench 4 inches or more deep. Tamp the trench full of soil. Reinforce with a row of staples driven through the jute about 4 inches downhill from the trench. These staples should be about 10 inches apart. Then staple the overlap in the channel center. These staples should be 3 to 4 feet apart. The outside edges may be stapled similarily at any time after the center has been stapled. Closer stapling along the sides is required where concentrated water may flow into the channel. The edges of excelsior matting should be stapled on 12 to 24 inch centers.

Succeeding strips of matting, farther down the channel or slope, are secured in a similar manner.

Where one roll of jute matting ends and another roll begins, the end of the top strip overlaps the trench where the upper end of the lower strip is buried. Make the overlap at least 4 inches and staple securely. Rolls of excelsior matting may be butted at the ends and securely stapled.

Erosion Stops: At any point, jute matting may be folded for burying in slit trenches and secured as were the upper ends. This checks water flow and erosion that may begin under the matting. It also gives improved tie-down. The procedure is recommended on the steeper slopes of sandy soil and gentler slopes subject to seepage. Spacings vary from 25 to 100 feet.

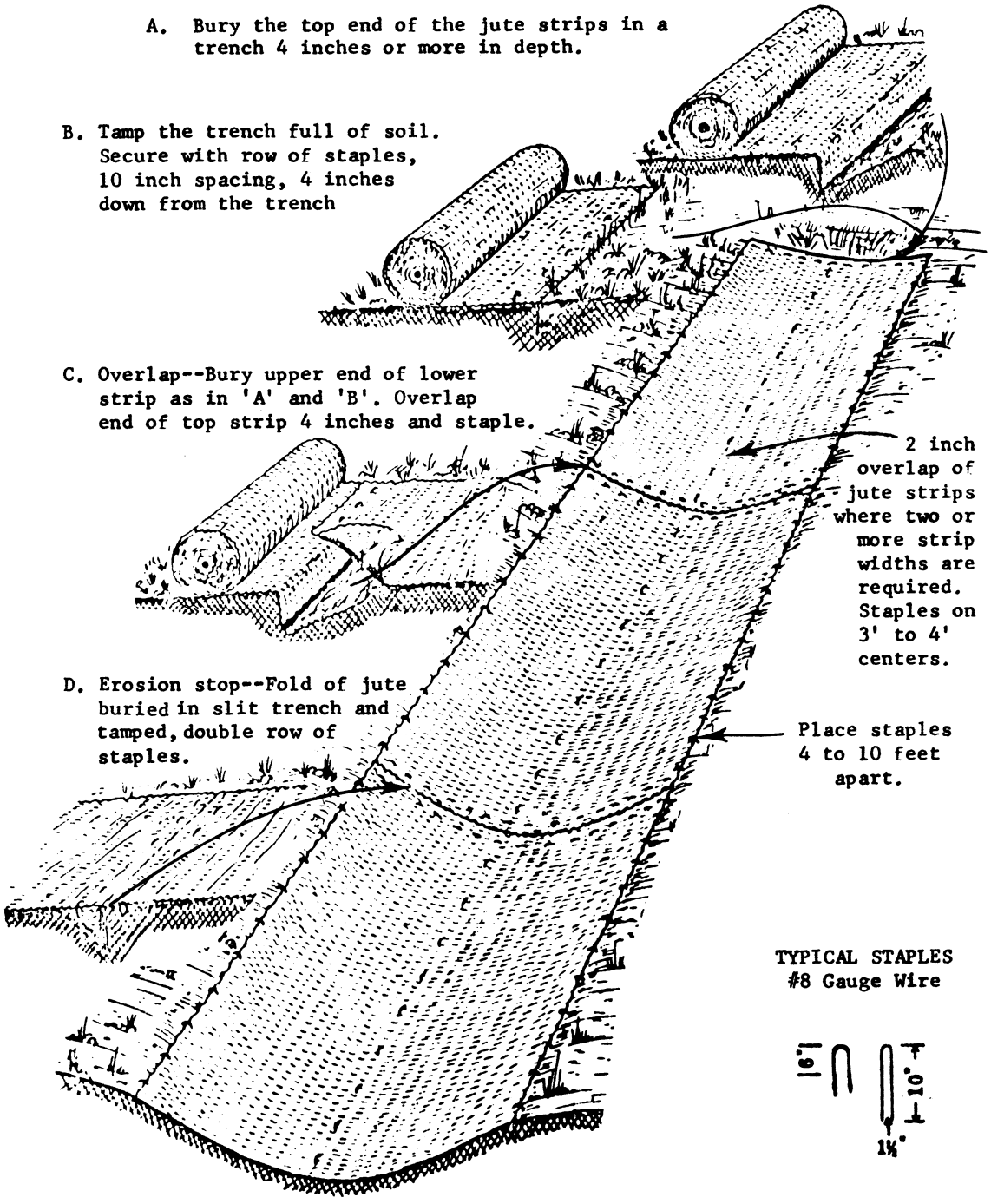
Diversions: Where diversions outlet into the waterway, the outlet should be protected with matting used in the same manner as in the main channel. The matting for the outlet is laid first so that matting in the main channel will overlap the outlet strip.

Matting Soil Contact: Get contact between matting and soil by rolling after laying, stapling and seeding are complete. Perfect contact is vital to keep water flow over - not under - the matting.

Inspection: After job completion, make sure the matting is in contact with the soil at all places and that critical areas are securely stapled down.

FIGURE A5-I

DETAIL FOR STABILIZING WATERWAYS WITH JUTE THATCHING



APPENDIX A6

REFERENCES

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8. Lane, E.W. Design of Stable Channels, Paper No. 2776, New York, N.Y., American Society of Civil Engineers, 1955. Transaction A.S.C.E. Vol. 120, Pg. 1234.

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Handbook of Concrete Culvert Pipe Hydraulics. Chicago, Ill., Portland Cement Association, 1964.

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* U.S. Government publications are available at the U.S. Government Printing Office, Washington, D.C.

** Available from Bulletin Clerk, the College of Agriculture and Environmental Science, Rutgers University, New Brunswick, New Jersey, 08903 or your County Agent.

APPENDIX B

EXAMPLE FOR SEED SPECIFICATIONS

A. The seed mixtures and specifications shall meet the minimum requirements as specified below.

1. Furnish the kinds and amounts of seed as indicated below to be seeded in all areas designated by the engineer, landscape architect, etc.

(List mixtures and amounts of each species here)

2. The minimum requirements for grass and legume seed used in the vegetative work are as follows:

a. All seed shall be labeled to show that it meets the requirements of the New Jersey State Seed Law.

b. Accumulated bag tags of seed used shall be submitted with the final pay estimate.

c. All seed shall have been tested within the 6 months immediately preceding the date of sowing such material on this job.

d. Inoculant - The inoculant for treating legume seed in the seed mixtures shall be a pure culture of nitrogen-fixing bacteria prepared for the species seeded. Inoculants shall not be used later than the date indicated on the container. Twice the supplier's recommended rate of inoculant will be used when seed is broadcasted; four times the recommended rate if hydroseeded.

e. The quality of the seed used shall conform to the guidelines shown on the following page.

B. Grass seed mixtures checked by the Chief of the Bureau of Seed Certification, New Jersey Department of Agriculture, Trenton, New Jersey, will assure the purchaser that the mixture obtained is the mixture ordered.

TABLE B1-1

QUALITY OF SEED*

LEGUMES	Minimum** Seed Purity (%)	Minimum*** Germination (%)
Crownvetch	95	68
Lespedeza, Korean	97	85
Lespedeza, sericea	98	85
GRASSES		
Bluegrass, Kentucky	80	85
Fescue, red (chewing and creeping)	97	80
Fescue, tall (KY-31)	97	85
Redtop	90	85
Reed canarygrass	96	80
Ryegrass, annual or common	98	85
Ryegrass, Perennial	98	85
Weeping lovegrass	95	87
ANNUALS		
Barley	98	90
Millet	99	80
Oats	98	80
Rye	98	85
Sudangrass	98	80

*Seed containing prohibited or restricted noxious weeds will not be accepted.
Prohibited noxious weeds - Bindweed, Canada thistle, quackgrass, hedge bindweed, and horse nettle.
Restricted noxious weeds - Wild garlic, bermudagrass, cheat, wild onion, corn cockle, dodder and wild onion, Johnsongrass, perennial sweet sudangrass, sorghum almum and other perennial sorghum hybrids.

**Seed should not contain in excess of 2.5 percent weed seed.

***Lower germination is allowed if seeding rates are raised to compensate.

TABLE B 2-1 GRASS AND LEGUME PLANTING GUIDE

Common Name	Botanical Name	1/ Germ. Time Days	Growth Habit 2/	Season		Drainage Class					Annual Cover		pH Range	Flooding Tolerance	Erodible Areas	Waterways & Channels	Shade Tolerance	Foot Traffic	Playgrounds, Lawns Athletic Fields	Beautification	Levels of 3/ Maintenance		
				Cool	Warm	Dry, (Not Drought)	Well Drained	Mod. Well Drained	Somewhat Poorly Drained	Poorly Drained	Winter	Summer									High	Medium	Low
Barley winter	Hordeum vulgare	7	A	X	-	-	X	X	-	-	X	-	5.5 -7.8	-	X	-	-	-	-	-	-	X	-
Bermudagrass	Cynodon dactylon	Plant Veg.	PL RS	-	X	X	X	X	X	-	-	-	4.5 -7.5	X	X	X	-	X	X	X	X	X	X
Bluegrass, Kentucky	Poa pratensis	21-28	PL R	X	-	-	X	X	X	-	-	-	5.5 -7.0	X	X	X	-	X	X	X	X	X	X
Canarygrass, Reed	Phalaria arundinacea	21	PL R	X	-	X	X	X	X	X	-	-	5.0 7.5	X	X	X	-	-	-	-	X	X	X
Fescue, creeping red	Festuca rubra	21-28	PL R	X	-	X	X	X	X	-	-	-	4.5 -7.5		X	X	X	X	X	X	X	X	X
Fescue, Chewings red	Festuca comutata	21-28	PL	X	-	X	X	X	X	-	-	-	4.5 -7.5	X	X	X	X	X	X	X	X	X	X
Fescue, tall (KY-31)	Festuca arundinacea	14	PL BR	X	-	-	X	X	X	-	-	-	5.0 -8.0	X	X	X	X	X	X	X	X	X	-
Lovegrass, weeping	Fragrostis curvula	5-14	Ps B	-	X	X	X	X	X	-	-	-	4.5 -8.0	-	X	-	-	-	-	-	X	X	X
Millet	Setaria & Pennise-tum spp.	7-14	A	-	X	X	X	X	X	-	-	X	4.5 -7.0	-	X	-	-	-	-	-	-	-	X
Oats	Avena sativa	10	A	X	-	-	X	X	-	-	X	-	5.5 -7	-	X	-	-	-	-	-	-	X	-

Notes: 1/ Germination time Days - No. of days required for majority of seeds to germinate and emerge under favorable conditions.

2/ Growth Habit: A - Annual; Bi - biennial; P - perennial; L - long-lived; s - short-lived; R - rhizomatous or spreads by rootstocks; S - stoloniferous; B - bunch

3/ Amount of fertilization and mowing tolerated.

TABLE B 2-1 GRASS AND LEGUME PLANTING GUIDE (cont'd)

Common Name	Botanical	1/ Germ. Time Days	Growth Habit 2/	Season		Drainage Class					Annual Cover		pH Range	Flooding Tolerance	Erodible Areas	Waterways & Channels	Shade Tolerance	Foot Traffic	Playgrounds, Lawns Athletic Fields	Beautification	Levels of 3/ Maintenance		
				Cool	Warm	Dry, (Not Drought)	Well Drained	Mod. Well Drained	Somewhat Poorly Drained	Poorly Drained	Winter	Summer									High	Medium	Low
Redtop	Agrostis alba	10	Ps B	X	-	X	X	X	X	X	-	-	4.0-7.5	X	X	X	-	X	X	-	-	X	X
Rye, winter	Secale cereale	7	A	X	-	X	X	X	-	-	X	-	5.5-7	-	X	-	-	-	-	-	-	X	X
Ryegrass, annual	Lolium multiflorum	14	A	X	-	-	X	X	X	-	X	-	5.5-7.5	X	X	-	X	-	-	-	-	X	X
Ryegrass, perennial	Lolium perenne	14	Ps B	X	-	-	X	X	X	-	-	-	5.5-7.5	X	X	-	X	X	X	X	X	X	-
Sudangrass	Sorghum sudanense	10	A	-	X	X	X	X	X	-	-	X	4.5-7.5	-	X	-	-	-	-	-	-	X	X
Clover, Alsike	Trifolium hybridum	7	Ps B	X	-	-	X	X	X	X	-	-	5.0-7.5	-	-	-	-	-	-	X	-	X	X
Crownvetch	Coronilla varia	14-21	PL R	X	X	X	X	X	-	-	-	-	5.5-7.5	-	X	-	X	-	-	X	-	X	X
Lespedeza, Korean	Lespedeza stipulacea	7-14	A	-	X	X	X	X	X	-	-	X	5.5-7.0	-	X	-	-	-	-	-	-	-	X
Lespedeza, sericea	Lespedeza cuneata	7-28	PL B	-	X	X	X	X	X	-	-	-	5.5-7.0	-	X	-	-	-	-	-	-	X	X
Trefoil, birdsfoot	Lotus corniculatus	10	PL	X	-	X	X	X	X	-	-	-	5.0-7.5	X	X	-	-	-	-	X	-	X	X
Vetch, hairy	Vicia villosa	10-14	A Bi	X	-	X	X	X	-	-	X	-	5.0-7.5	-	X	-	-	-	-	X	X	X	X

Notes: 1/ Germination time Days - No. of days required for majority of seeds to germinate and emerge under favorable conditions.

2/ Growth Habit: A - annual; Bi- biennial; P - perennial; L - long-lived; s - short-lived

APPENDIX C 1

MODEL MUNICIPAL LAND DISTURBANCE ORDINANCE
TO CONTROL
SOIL EROSION AND SEDIMENTATION

An ordinance to establish regulations for controlling soil erosion and sedimentation within the municipality of _____.

ARTICLE I
TITLE AND PURPOSE

A. TITLE

This ordinance shall be known as the "_____ Municipal Soil Erosion and Sediment Control Ordinance."

B. PURPOSE

The purpose of this ordinance is to control soil erosion and sediment damages and related environmental damage by requiring adequate provisions for surface water retention and drainage and for the protection of exposed soil surfaces in order to promote the safety, public health, convenience and general welfare of the community.

ARTICLE II
DEFINITIONS

A. RULES APPLYING TO TEXT

For the purpose of this ordinance certain rules of word usage apply to the text as follows:

1. Words used in the present tense include the future tense: and the singular includes the plural, unless the context clearly indicates the contrary.

2. The term "shall" is always mandatory and not discretionary: the word "may" is permissive.

3. The word or term not interpreted or defined by this article shall be used with a meaning of common or standard utilization.

B. DEFINITIONS

The following definitions shall apply in the interpretation and enforcement of this ordinance, unless otherwise specificially stated:

1. Applicant- A person, partnership, corporation or public agency requesting permission to engage in land distrubance activity.

2. Critical Area- A sediment-producing highly erodible or severly eroded area.

3. Excavation or Cut - Any act by which soil or rock is cut into, dug, quarried, uncovered, removed, displaced or relocated.

4. Erosion - Detachment and movement of soil or rock fragments by water, wind, ice and gravity.

5. Erosion and Sediment Control Plan - A plan which fully indicates necessary land treatment measures, including a schedule of the timing for their installation, which will effectively minimize soil erosion and sedimentation. Such measures shall be in accordance with standards as adopted by the State Soil Conservation Committee.

6. Farm Conservation Plan - A plan which provides for use of land, within its capabilities and treatment, within practical limits, according to chosen use to prevent further deterioration of soil and water resources.

7. Land - Any ground, soil, or earth including marshes, swamps drainageways and areas not permanently covered by water within the municipality.

8. Land Disturbance - Any activity involving the clearing, grading, transporting, filling and any other activity which causes land to be exposed to the danger of erosion.

9. Permit - A certificate issued to perform work under this ordinance.

10. Mulching - The application of plant residue or other suitable materials to the land surface to conserve moisture, hold soil in place, and aid in establishing plant cover.

11. Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

12. Sediment Basin - A barrier or dam built at suitable locations to retain rock, sand, gravel, silt or other material.

13. Soil - All unconsolidated mineral and organic material of any origin.

14. Soil Conservation District - A governmental subdivision of this State, which encompasses this municipality, organized in accordance with the provisions of Chapter 24, Title 4, N.J.R.S.

15. Site - Any plot, parcel or parcels of land.

16. State Soil Conservation Committee - An agency of the State established in accordance with the provisions of Chapter 24, Title 4, N.J.R.S.

17. Stripping - Any activity which significantly disturbs vegetated or otherwise stabilized soil surface including clearing and grubbing operations.

ARTICLE III
PROCEDURE

A. REGULATION

1. No land area shall be disturbed by any person, partership, corporation, municipal corporation or other public agency within this municipality unless; the applicant has submitted to the building inspector a plan to provide for soil erosion and sediment control for such land area in accordance with the Standards for Erosion and Sediment Control adopted by the New Jersey State Soil Conservation Committee and administered by the _____ _____ Soil Conservation District and such plan has been approved; and a valid land disturbance permit has been issued by the building inspector except as exempted by ARTICLE V.

B. DATA REQUIRED

The applicant must submit a separate soil erosion and sediment control plan for each noncontiguous site. The applicant may consult with the _____ Soil Conservation District in the selection of appropriate erosion and sediment control measures and the development of the plan. Such plan shall contain:

1. Location and description of existing natural and man-made features on and surrounding the site including general topography and soil characteristics and a copy of the soil conservation district soil survey (where available).

2. Location and description of proposed changes to the site.

3. Measures for soil erosion and sediment control which must meet or exceed STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL adopted by the State Soil Conservation Committee. STANDARDS shall be on file at the offices of the local soil conservation district and the township clerk.

4. A schedule of the sequence of installation of planned erosion and sediment control measures as related to the progress of the project including anticipated starting and completion dates.

5. All proposed revisions of data required shall be submitted for approval.

C. REVIEW AND APPROVAL

Soil erosion and sediment control plans shall be reviewed by the municipal engineer (or other designated official) and approved when in conformance with the Standards for Erosion and Sediment Control.

The municipal engineer may seek the assistance of the _____ soil conservation district in the review of such plans and may deem as approved those plans which have been reviewed and determined adequate by the said district.

ARTICLE IV
PRINCIPLES AND REQUIREMENTS

A. GENERAL DESIGN PRINCIPLES

Control measures shall apply to all aspects of the proposed land disturbance and shall be in operation during all stages of the disturbance activity. The following principles shall apply to the soil erosion and sediment control plan.

1. Stripping of vegetation, grading or other soil disturbance shall be done in a manner which will minimize soil erosion.

2. Whenever feasible, natural vegetation shall be retained and protected.

3. The extent of the disturbed area and the duration of its exposure shall be kept within practical limits.

4. Either temporary seeding, mulching or other suitable stabilization measure shall be used to protect expose critical areas during construction or other land disturbance.

5. Drainage provisions shall accommodate increased runoff, resulting from modified soil and surface conditions, during and after development or disturbance. Such provisions shall be in addition to all existing requirements.

6. Water runoff shall be minimized and retained on site wherever possible to facilitate ground water recharge.

7. Sediment shall be retained on site.

8. Diversions, sediment basins, and similar required structures shall be installed prior to any on-site grading or disturbance.

B. MAINTENANCE

All necessary soil erosion and sediment control measures installed under this ordinance, shall be adequately maintained for one year after completion of the approved plan or until such measures are permanently stabilized as determined by the municipal engineer. The municipal engineer shall give the applicant upon request a certificate indicating the date on which the measures called for in the approved plans were completed.

C. MAINTENANCE BONDS (As required by local conditions)

D. FEES (As required by local conditions)

E. PENALTIES FOR VIOLATIONS (As required by local conditions)

1. Monetary
2. Stop orders
3. Injunctive relief

ARTICLE V
EXEMPTIONS

The following activities are specifically exempt from this ordinance:

1. Land disturbance associated with existing one and two family dwellings.
2. Use of land for gradening primarily for home consumption.
3. Agricultural use of lands when operated in accordance with a farm conservation plan approved by the local soil conservation district or when it is determined by the local soil conservation district that such use will not cause excessive erosion and sedimentation.

ARTICLE VI
INSPECTION AND ENFORCEMENT

The requirements of this ordinance shall be enforced by the municipal engineer who shall also inspect or require adequate inspection of the work. If the municipal engineer finds existing conditions not as stated in the applicant's erosion and sediment control plan he may refuse to approve further work and may require necessary erosion and sediment control measures to be promptly installed and may seek other penalties as provided in ARTICLE IV E.

ARTICLE VII
APPEALS

Appeals from decisions under this ordinance may be made to the municipal governing body in writing within ten days from the date of such decision. The appellant shall be entitled to a hearing before the municipal governing body within thirty days from date of appeal.

ARTICLE VIII
VALIDITY AND SEVERABILITY

If any part of this ordinance is found not valid, the remainder of this ordinance shall remain in effect.

APPENDIX C 2

MODEL SOIL EROSION AND SEDIMENT CONTROL ORDINANCE
TO AMEND MUNICIPAL SUBDIVISION AND ZONING ORDINANCES

An ordinance to amend municipal subdivision and land use ordinances and establish regulations for controlling soil erosion and sedimentation within the municipality of _____.

ARTICLE I
TITLE AND PURPOSE

A. TITLE

This ordinance shall be know as the "_____ Municipal Soil Erosion and Sediment Control Ordinance."

B. PURPOSE

The purpose of this ordinance is to control soil erosion and sediment damages and related environmental damage by requiring adequate provisions for surface water retention and drainage and for the protection of exposed soil surfaces in order to promote the safety, public health, convenience and general welfare of the community.

ARTICLE II
DEFINITIONS

A. RULES APPLYING TO TEXT

For the purpose of this ordinance certain rules of word usage apply to the text as follows:

1. Words used in the present tense include the future tense; and the singular includes the plural, unless the context clearly indicates the contrary.

2. The term "shall" is always mandatory and not discretionary; the word "may" is permissive.

3. The word or term not interpreted or defined by this article shall be used with a meaning of common or standard utilization.

B. DEFINITIONS

The following definitions shall apply in the interpretation and enforcement of this ordinance, unless otherwise specifically stated:

1. Applicant - A person, partnership, corporation or public agency requesting permission to engage in land disturbance activity.

2. Critical Area - A sediment-producing highly erodible or severly eroded area.

3. Excavation or Cut - Any act by which soil or rock is cut into, dug, quarried, uncovered, removed, displaced or relocated.

4. Erosion - Detachment and movement of soil or rock fragments by water, wind, ice and gravity.

5. Farm Conservation Plan - A plan which provides for use of land, within its capabilities and treatment, within practical limits, according to chosen use to prevent further deterioration of soil and water resources.

6. Land - Any ground, soil, or earth including marshes, swamps, drainageways and areas not permanently covered by water within the municipality.

7. Land Disturbance - Any activity involving the clearing, grading, transporting filling and any other activity which causes land to be exposed to the danger of erosion.

8. Permit - A certificate issued to perform work under this ordinance.

9. Mulching - The application of plant residue or other suitable materials to the land surface to conserve moisture, hold soil in place, and aid in establishing plant cover.

10. Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

11. Sediment Basin - A barrier or dam built at suitable locations to retain rock, sand, gravel, silt or other material.

12. Erosion and Sediment Control Plan - A plan which fully indicates necessary land treatment measures, including a schedule of the timing for their installation, which will effectively minimize soil erosion and sedimentation. Such measures shall be equivalent to or exceed standards adopted by the New Jersey State Soil Conservation Committee and administered by the _____ Soil Conservation District.

13. Soil - All unconsolidated mineral and organic material of any origin.

14. Soil Conservation District - A governmental subdivision of this State, which encompasses this municipality, organized in accordance with the provisions of Chapter 24, Title 4, N.J.R.S.

15. Site - Any plot, parcel or parcels of land.

16. Stripping - Any activity which significantly disturbs vegetated or otherwise stabilized soil surface including clearing and grubbing operations.

ARTICLE III
PROCEDURE

A. REGULATION

No site plan or preliminary plan submitted to the planning board pursuant to the subdivision or land use ordinance or _____ (municipality) shall be granted approval unless it includes a soil erosion and sediment control plan developed in accordance with the Standards for Soil Erosion and Sediment Control adopted by the New Jersey State Soil Conservation Committee and administered by the _____ Soil Conservation District. The applicant may consult with the _____ soil conservation district in the development of the plan and the selection of appropriate erosion and sediment control measures. The applicant shall bear the final responsibility for the installation and construction of all required soil erosion and sediment control measures according to the provisions of this ordinance except as exempted by ARTICLE V.

B. DATA REQUIRED

The applicant must submit to the planning board a separate soil erosion and sediment control plan for each subdivision, site plan review, special exception, zoning variance or planned unit development application. Such plan shall contain:

1. Location and description of existing natural and man-made features on and surrounding the site including general topography and soil characteristics and a copy of the soil conservation district soil survey where available.

2. Location and description of proposed changes to the site.

3. Measures for soil erosion and sediment control which shall be equivalent to or exceed STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL adopted by the New Jersey State Soil Conservation Committee and administered by the _____ Soil Conservation District. Such STANDARDS shall be on file at the offices of the soil conservation district and the municipal clerk.

4. A schedule of the sequence of installation of planned erosion and sediment control measures as related to the progress of the project including anticipated starting and completion dates.

5. All proposed revisions of data required shall be submitted for approval.

C. REVIEW AND APPROVAL

Erosion and sediment control plans shall be reviewed by the planning board and approved when in conformance with the Standards for Erosion and Sediment Control. The board may seek the assistance of the _____soil conservation district in the review of such plans and may deem as approved those plans which have been reviewed and determined adequate by the _____ _____ soil conservation district.

ARTICLE IV
PRINCIPLES AND REQUIREMENTS

A. GENERAL DESIGN PRINCIPLES

Control measures shall apply to all aspects of the proposed site development involving land disturbance and shall be in operation during all stages of the disturbance activity. The following principles shall apply to the soil erosion and sediment control plan.

1. Stripping of vegetation, grading or other soil disturbance shall be done in a manner which will minimize soil erosion.

2. Whenever feasible, natural vegetation shall be retained and protected.

3. The extent of the disturbed area and the duration of its exposure shall be kept within practical limits.

4. Either temporary seeding, mulching or other suitable stabilization measure shall be used to protect exposed critical areas during construction or other land disturbance.

5. Drainage provisions shall accommodate all increased runoff resulting from modifications of soil and surface conditions during and after development or disturbance. Such provisions shall be in addition to existing requirements.

6. Water runoff shall be minimized and retained on site wherever possible to facilitate ground water recharge.

7. Sediment shall be retained on site.

8. Diversions, sediment basins, and similar required structures shall be installed prior to any on-site grading or disturbance.

B. MAINTENANCE

All necessary soil erosion and sediment control measures installed under this ordinance, shall be adequately maintained for one year after completion of the approved plan or until such measures are permanently stabilized as determined by the building inspector. The building inspector shall give the applicant upon request a certificate indicating the date on which the measures called for in the approved plans were completed.

C. MAINTENANCE BONDS (As required by local conditions)

D. FEES (As required by local conditions)

E. PENALTIES FOR VIOLATIONS (As required by local conditions)

1. Monetary

2. Stop orders

3. Injunctive relief

ARTICLE V
EXEMPTIONS

The following activities are specifically exempt from this ordinance:

1. Minor subdivisions

2. Site plans for development where the land will not be disturbed.

3. Agricultural use of lands when operated in accordance with a farm conservation plan approved by the local soil conservation district or when it is determined by the local soil conservation district that such use will not cause excessive erosion and sedimentation.

ARTICLE VI
INSPECTION AND ENFORCEMENT

The requirements of this ordinance shall be enforced by the municipal engineer who shall also inspect or require adequate inspection of the work carried out pursuant to site plan approval. If the municipal engineer finds existing conditions not as stated in the applicant's erosion and sediment control plan he may refuse to approve further work and may require necessary erosion and sedimentation control measures to be promptly installed and may seek other penalties as provided in ARTICLE IV E.

APPEALS

Appeals from decisions under this ordinance shall be made in the manner prescribed by the ordinance which it amends.

ARTICLE VIII
VALIDITY AND SEVERABILITY

If any part of this ordinance is found not valid, the remainder of this ordinance shall remain in effect.

APPENDIX D1

G L O S S A R Y

Acre-feet - An engineering term used to denote a volume 1 acre in area and 1 foot in depth.

Aggrade - The alteration of a channel caused by the deposition of sediment.

Anti-seep Collar - A device constructed around a pipe or other conduit placed through a dam, dike, or levee for the purpose or reducing seepage losses and piping failures. (See Figure 4.4-I)

Anti-vortex Device - A facility placed at the entrance to a pipe conduit structure such as a drop inlet spillway or hood inlet spillway to prevent air from entering the structure when the pipe is flowing full. (See Figure 4.4-I)

Barrel - See conduit.

Borrow Area - A source of earth fill materials used in the construction of embankments or other earth fill structures.

Bottomlands - A term often used to define lowlands adjacent to streams (flood plains in rural areas).

Box Inlet Drop Spillway - A form of principal spillway. (See Figure 4.4-III)

Cantilever Outlet - A discharge pipe extending beyond its support.

Cascades or Bedrock - Section of stream without pools, consisting primarily of bedrock with little rubble, gravel, or other such material present. Current usually more swift than in riffles.

Channel - A natural stream that conveys water; a depth or channel excavated for the flow of water.

Chute Spillway - A form of principal spillway. (See Figure 4.4-IV)

Conduit - A closed facility used for the conveyance of water.

Cover Crop - A crop grown primarily for the purpose of protecting soil between periods of permanent vegetative cover.

Cradle - A device usually concrete, used to support a pipe conduit or barrel. (See Figure 4.4-I)

Cutoff Trench - A long, narrow excavation constructed along the center line of a dam, dike, levee or embankment and filled with relatively impervious material intended to reduce seepage of water through porous strata.

Degrade - The alteration of a channel caused by the erosion and scour of the channel bottom.

Design Highwater - The elevation of the water surface as determined by the flow conditions of the design floods.

Design Life - The period of time for which a facility is expected to perform its intended function.

Diversion - A channel with or without a supporting ridge on the lower side constructed across or at the bottom of a slope for the purpose of intercepting surface runoff.

Embankment - A man-made deposit of soil, rock or other materials used to form an impoundment.

Emergency Spillway - A vegetated earth channel used to safely convey flood discharges in excess of the capacity of the principal spillway.

Energy Dissipator - A device used to reduce the energy of flowing water.

Erosion - Detachment and movement of soil or rock fragments by water, wind, ice and gravity.

Filter Blanket - A layer of sand and/or gravel designed to prevent the movement of fine-grained soils.

Filter Strip - A long, narrow vegetative planting used to retard or collect sediment for the protection of diversions, drainage basins, or other structures.

Flat - Section of stream with current too slow to be classed as riffle and too shallow to be classed as a pool. Stream bottom usually composed of sand or finer materials, with coarse rubble, boulders or bedrock occasionally evident.

Flood Plain - The relatively flat area adjoining the channel of a natural stream which has been or may be hereafter covered by flood water.

Flood Routing - Determining the changes in the rise and fall of flood water as it proceeds downstream through a valley or through a reservoir.

Flume - A device constructed to convey water on steep grades lined with erosion-resistant materials.

Freeboard - The vertical distance between the elevation of the design highwater and the top of the dam, dike, levee or diversion ridge.

Grade Stabilization Structure - A structure for the purpose of stabilizing the grade of a watercourse, thereby preventing further headcutting or lowering of the channel grade.

Grading - Any stripping, cutting, filling, stockpiling, or any combination thereof and shall include the land in its cut or filled condition.

Grassed Waterway - A natural or constructed channel, usually broad and shallow, covered with erosion-resistant vegetation, used to conduct surface water.

Hood Inlet - A pipe entrance wherein the top edge of the pipe is extended 3/4 of the diameter beyond the bottom invert cut on an angle. (See Figure 4.5-II)

Hydrograph - A graph showing for a given point on a stream or for a given point in any drainage system, the discharge, stage, velocity, or other property of water with respect to time.

Inoculant - A peat carrier impregnated with bacteria which form a symbiotic relationship enabling legumes to utilize atmospheric nitrogen. Most of our legumes require specific bacteria.

Impact Basin - A device used to dissipate the energy of flowing water. Generally constructed of concrete in the form of a depressed and partially submerged vessel and may utilize baffles to dissipate velocities.

Land - Any ground, soil or earth including marshes, swamps, drainageways and areas not permanently covered by water.

Level Spreaders - A shallow channel excavation at the outlet end of a diversion with a level section for the purpose of diffusing the diversion outflow.

Liquid Limit - The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Mannings Formula - A formula used to predict the velocity of water flow in an open channel or pipeline:

$$V = \frac{1.486\ r^{2/3} S^{1/2}}{n}$$

wherein "V" is the mean velocity of flow in feet per second; "r" is the hydraulic radius; "s" is the slope of the energy gradient or for assumed uniform flow the slope of the channel in feet per foot; and "n" is the roughness coefficient or retardance factor of the channel lining.

Mulching - The application of plant residue or other suitable materials to the land surface to conserve moisture, hold soil in place, aid in establishing plant cover and minimize temperature fluctuation.

Outlet - Point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Peak Discharge - The maximum instantaneous flow from a given storm condition at a specific location.

pH - A measure of acidity or basicity with pH 7 being neutral and pH 6.5 being a desirable degree of soil acidity. Basicity above pH 7 is rare in eastern U. S. soils.

Pipe Drop - A circular conduit used to convey water down steep grades.

Plasticity Index - The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic Limit - The moisture content at which a soil changes from a semisolid to a plastic state.

Plunge Pool - A device used to dissipate the energy of flowing water that may be constructed or made by the action of flowing. These facilities may be protected by various lining materials.

Pool - Section of stream deeper and usually wider than normal with appreciably slower current than immediate upstream or downstream areas and possessing adequate cover (sheer depth or physical condition) for protection of fish. Stream bottom usually a mixture of silt and coarse sand.

Principal Spillway - Generally constructed of permanent material and designed to regulate the normal water level, provide flood protection and/or reduce the frequency of operation of the emergency spillway.

Rational Formula - $Q=CIA$. Where "Q" is the peak discharge measured in cubic feet per second, "C" is the runoff coefficient reflecting the ratio of runoff to rainfall, "I" is the rainfall intensity for the duration of the storm measured in inches per hour, and "A" is the area of the contributing drainage area measured in acres.

Ridge - The bank or dike constructed on the downslope side of a diversion.

Riffle - Section of stream containing gravel and/or rubble, in which surface water is at least slightly turbulent and current is swift enough that the surface of the gravel and rubble is kept fairly free from sand and silt.

Riprap - Broken rock, cobbles or boulders placed on earth surfaces, such as the face of a dam or the channel of a stream, for protection against the action of water.

Risers - The inlet portions of a drop inlet spillway that extend vertically from the pipe conduit barrel and control the water surface.

Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of orgin by air, water, gravity or ice.

Sediment Basin - A depression formed by the construction of a barrier or dam built at suitable locations to retain rock, sand, gravel, silt or other material.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil Horizon - A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Stabilized Center Section - An area in the bottom of a grassed waterway protected by stone, asphalt, concrete or other materials to prevent erosion.

Stone Center - A stabilized center section made of stone.

Storm Frequency - An expression or measure of how often a hydrologic event of given size or magnitude should on an average be equaled or exceeded. The average should be based on a reasonable sample.

Straight Drop Spillway - A form of principal spillway. (See Figure 4.4-II)

Temporary Protection - Stabilization of erosive or sediment-producing areas.

Toe Drain - A drainage system constructed in the downstream portion of an earth dam or levee to prevent excessive hydrostatic pressures. (See Figure 4.4-I)

Trash Rack - A structure device used to prevent debris from entering a spillway or other hydraulic structure. (See Figure 4.4-I)

Underdrains - Pipelines of tile with open joints or perforated pipe used for the collection of subsurface water.

Unified Soil Classification System - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Uplift Forces - Vertical pressures acting upward on a structure, usually caused by a buoyant condition.

Vegetative Protection - Stabilization of erosive or sediment producing areas by covering the soil with:

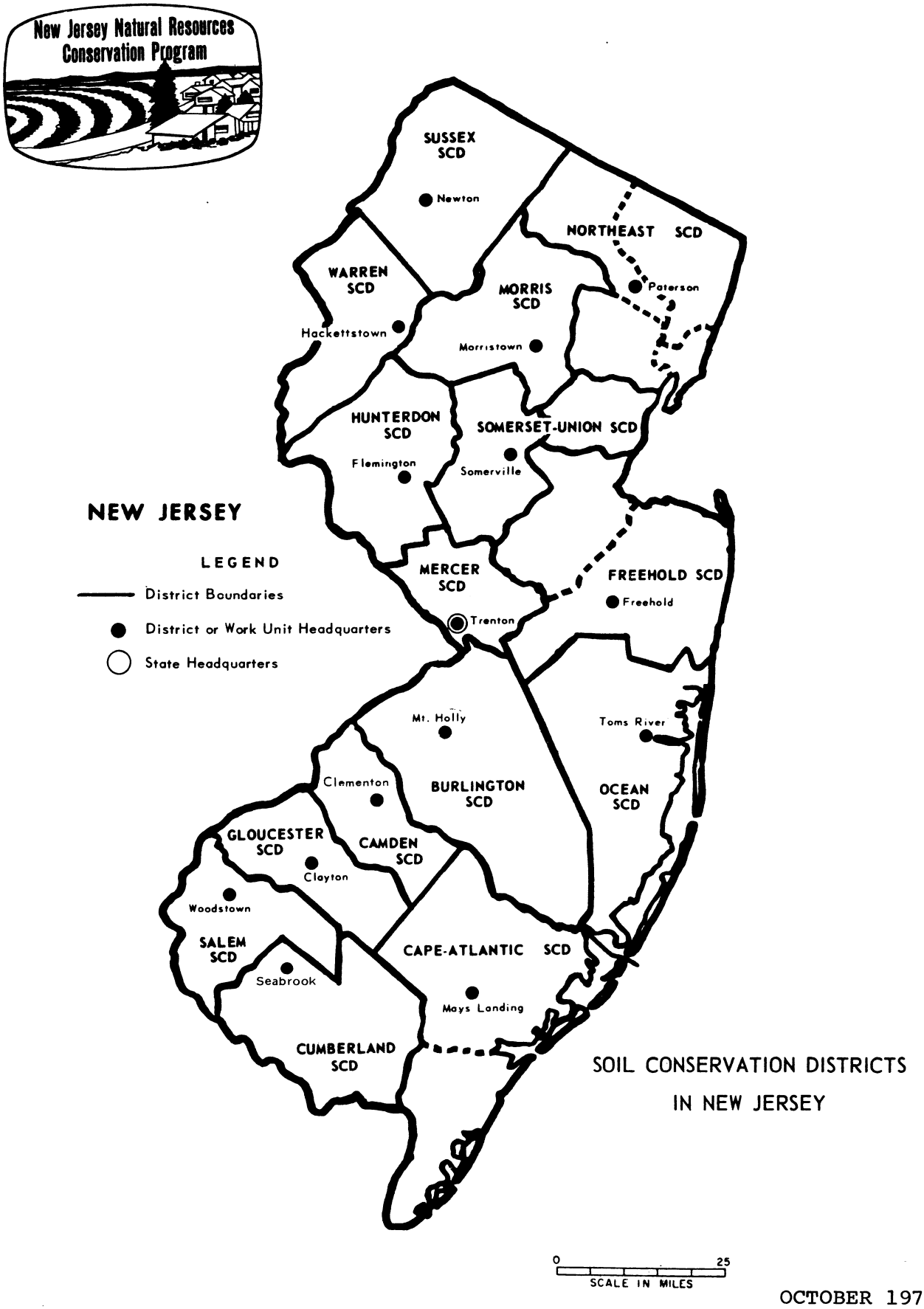
a. Permanent seeding, producing long-term vegetative cover,

b. Short-term seeding, producing temporary vegetative cover, or

c. Sodding, producing areas covered with a turf of perennial sod-forming grass.

Velocity - The rate of flow measured in feet per second.

Waterway - A natural course or constructed channel for the flow of water. See grassed waterway.


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SOIL CONSERVATION DISTRICTS
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OCTOBER 1972

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Name	Address	Telephone No.
Burlington SCD	Cramer Building Rt. 38, Mt. Holly 08060	609-267-0811
Camden SCD	152 Ohio Avenue Clementon 08021	609-767-3977 or 784-1001
Cape-Atlantic SCD	Atlantic Co. Office Bldg. 1200 W. Harding Highway Mays Landing 08330	609-625-2203 or 465-5115
Cumberland SCD	Seabrook 08302	609-451-2144
Freehold SCD (Mon. & Midsex. Co.)	20 Court St. Freehold 07728	201-462-1079
Gloucester SCD	Gloucester Co. Office Bldg. Clayton 08312	609-881-0240
Hunterdon SCD	Route 6, Box 49 Flemington 08822	201-782-3915
Mercer SCD	930 Spruce St. Trenton 08638	609-695-5415 or 609-396-4593
Morris SCD	Court House Morristown 07960	201-538-1552
Northeast SCD (Bergen, Essex, Hudson & Passaic Counties)	County Service Building 317 Pennsylvania Ave. Paterson 07503	201-525-5000 X 401 or 201-538-1552
Ocean SCD	Ocean County Agric. Center Whitesville Road Toms River 08753	201-349-1245
Salem SCD	43 S. Main St. Woodstown 08098	609-769-1125
Somerset-Union SCD	1151 U.S. Route 202 Somerville 08876	201-725-3848
Sussex SCD	R. D. 1, Box 13 Newton 07860	201-383-3800 or 852-5450
Warren SCD	Stiger St. Hackettstown 07840	201-852-5450

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