

CITY OF MIDLAND

TEXAS

STORM DRAINAGE DESIGN MANUAL



CITY OF MIDLAND, TEXAS

STORM DRAINAGE DESIGN MANUAL

MAYOR

CARROLL THOMAS

CITY COUNCIL

J. D. FAIRCLOTH

TOM JOHNSTON

JAMES DEVENPORT

L. D. "BUDDY" SIPES, JR.

REV. MICHAEL R. DEVAUGHN

WM. C. MORROW

CITY MANAGER

FRED W. POE

DIRECTOR OF ENGINEERING

HARVEY HANSEN, P.E.

ENGINEERING STAFF

JAMES ROBERTSON, P.E. BILL GREATHOUSE, P.E. RENE FRANKS, P.E.

WITH ASSISTANCE FROM:



Parkhill, Smith & Cooper, Inc.
Engineers • Architects • Planners

CITY OF MIDLAND, TEXAS

STORM DRAINAGE DESIGN MANUAL

ERRATA SHEET

[illegible]

CITY OF MIDLAND, TEXAS
STORM DRAINAGE DESIGN MANUAL

TABLE OF CONTENTS

Section 1:	Storm Water Drainage Policy
Section 2:	Submittal Requirements
Section 3:	Hydrology and Hydraulic Software
Section 4:	Determination of Storm Runoff
Section 5:	Street and Alley Drainage
Section 6:	Storm Drains
Section 7:	Inlets
Section 8:	Open Channels
Section 9:	Culverts
Section 10:	Storm Water Detention
Section 11:	Storm Water Pump Stations
Section 12:	Storm Water Quality
Appendix A:	Federal Emergency Management Agency Guidelines and Criteria
Appendix B:	Corps of Engineers 404 Permits

SECTION 1

STORM WATER DRAINAGE POLICY

- 1.1 General
- 1.2 Policy
- 1.3 Community Rating System
 - 1.3.1 Public Information Activities
 - 1.3.2 Mapping and Regulatory Activities
 - 1.3.3 Flood Damage Reduction Activities
 - 1.3.4 Flood Preparedness Activities

SECTION 1

STORM WATER DRAINAGE POLICY

1.1 GENERAL

The continued growth of the City of Midland has created the need for a uniform policy for the planning, design and installation of storm water conveyance, detention and storage facilities. Proper planning is necessary to ensure that adequate storm water storage or detention areas are properly located, and that adequate storm water outlets and conveyance systems are provided to properly serve new areas of development.

The major goals of the City of Midland's storm water drainage policy are as follows:

- A. Minimize storm water impacts on existing drainage systems.
- B. Promote orderly community growth.
- C. Minimize the storm water drainage impacts on downstream areas of the City.
- D. Mitigate street flooding.
- E. Reduce the costs for street maintenance attributed to storm water runoff.
- F. Improve traffic flow during storm events.
- G. Improve the City of Midland's community rating in the National Flood Insurance Program in order to minimize flood insurance premiums.

1.2 POLICY

The City of Midland's goals listed above can be realized only through the orderly growth of the community where storm runoff is given due consideration. Community growth encompasses new developments and these new developments contribute to larger runoff volumes and reduced times of concentration. This, in turn, contributes to higher peak discharges than would otherwise occur. In order to minimize the effects of storm water runoff, the City's policy is that post-development peak discharge from proposed new development areas cannot exceed the peak discharge of existing land use, or predevelopment, conditions. Attenuation of peak discharge values may be accomplished through the use of total retention ponds, detention ponds or other methods approved by the City Engineer and that conform to the City's Master Drainage Plan.

A companion policy to the limitation of peak discharges to predeveloped conditions is that of providing suitable outlets or storage in areas subject to new development, and which do not have sufficient runoff storage nor suitable topography for surface conveyance. In order to provide for areas such as these, the City has a Master Drainage Plan to which future development must conform. The Master Drainage Plan depicts those areas in which requirements may include

regional detention storage, on-site detention storage, storm drains and inlets, open channels, culverts and total retention storage. This Drainage Design Manual has been developed as an aid to the implementation of the City's policy and provide for the uniform design of storm drainage improvements. The storm frequencies to use for various storm water facility designs are specified in the following chapters of this design manual.

The City of Midland Drainage Design Manual offers design charts, tables and graphs as well as examples for their use. The examples given are illustrative in nature and can not cover every conceivable situation likely to be encountered. The designer of storm drainage facilities is expected to use competent judgement as well as sound hydrologic and hydraulic principles. Revisions and updates will be made to this manual as experience is gained in its use and constructive comments are received for its improvement.

No attempt has been made to provide complete construction details as a part of this manual. Some construction details and requirements are available from the City through the Engineering Department and the City of Midland Subdivision Ordinances. The designer, however, remains ultimately responsible for the adequacy and completeness of any construction drawings.

1.3 COMMUNITY RATING SYSTEM

As stated earlier, one of the goals of the City of Midland's drainage policy is to enhance the community's rating in the National Flood Insurance Program (NFIP). The NFIP established three goals for the Community Rating System (CRS) after consultation with the Federal Insurance Administration, insurance companies, and state and local floodplain managers. Those three goals are:

"To encourage, by the use of flood insurance premium adjustments, community and state activities beyond those required by the National Flood Insurance Program to 1) reduce flood losses, 2) facilitate accurate insurance rating, and 3) promote the awareness of flood insurance."

The NFIP grants premium credits when a community implements one or more of 18 activities in four categories. The 18 activities listed below within the four categories are evaluated by the Regional Office of the Federal Emergency Management Agency (FEMA), the NFIP State Coordinator and the Flood Insurance Administration to determine an individual community's rating. The community rating can range from Class 1 to Class 10, with Class 1 having the greatest premium credit.

1.3.1 Public Information Activities

- A. Elevation Certificate: Maintain FEMA's Elevation Certificate and make copies available to inquirers.
- B. Map Determinations: Respond to inquiries for Flood Insurance Rate Map zone and flood data.
- C. Outreach Projects: Advise residents about the flood hazard, flood insurance, and flood protection measures.

- D. Hazard Disclosure: Advise potential purchasers of flood-prone property about the hazard.
- E. Flood Protection Library: Maintain and publicize a library of references on flood insurance and flood protection.
- F. Flood Protection Assistance: Provide direct advice to property owners desiring to protect themselves from flooding.

1.3.2 Mapping and Regulatory Activities

- A. Additional Flood Data: Develop new flood elevations, floodway delineations, wave heights, or other regulatory flood hazard data.
- B. Open Space Preservation: Credit is provided according to the amount of vacant floodplain that is kept free from buildings and filling.
- C. Higher Regulatory Standards: Regulations that require new development to be protected to a level greater than the NFIP rules.
- D. Flood Data Maintenance: Make the community's floodplain maps more current, useful, or accurate.
- E. Storm Water Management: Regulate new developments throughout the watershed to minimize their impact on surface drainage and runoff.

1.3.3 Flood Damage Reduction Activities

- A. Repetitive Loss Projects: Develop and implement a plan to mitigate losses in repeatedly flooded areas.
- B. Acquisition and Relocation: Purchase or relocate buildings and convert flood-prone properties to open space.
- C. Retrofitting: Credit is provided according to how buildings have been retrofitted to protect them from flood damages.
- D. Drainage System Maintenance: Conduct periodic inspections and maintain the capacities of the channels and retention basins.

1.3.4 Flood Preparedness Activities

- A. Flood Warning Program: Provide early flood warnings to the general public and special facilities.
- B. Levee Safety: Maintain levees that are not credited with providing base flood protection and emergency response plans for them.

- C. Dam Safety: All communities in a state with an approved dam safety program receive credit.

As can be seen by a review of the activities listed above, Levee Safety and Dam Safety are not applicable to the City of Midland simply because there are not levees or dams existing in the watershed draining into the City, nor existing within the City itself. However, the City of Midland intends to pursue the remaining activities to improve the community's rating consistent with the directives of the City Council, available manpower and available financial resources.

END

SECTION 2
SUBMITTAL REQUIREMENTS

2.1 General

2.2 Preliminary Plans and Plats

2.2.1 General

2.2.2 Check List for Preliminary Plans and Plats

- A. Drainage Area Map
- B. Drainage Analysis

2.3 Final Plans and Plats

2.3.1 General

2.3.2 Check List for Final Plans and Plats

- A. Drainage Area Map
- B. Drainage Analysis
- C. Construction Drawings

SECTION 2

SUBMITTAL REQUIREMENTS

2.1 GENERAL

The purpose of this section is to assist the designer with the development of the submittal data required for review of the drainage plan. Enough information should be submitted to allow the City of Midland Engineering Department to verify that the drainage plan meets with the drainage criteria established in this manual. The data submitted will depend upon the methods and procedures used. Justification for methods and procedures which vary from those recommended in this manual also needs to be submitted. If a method is utilized which is not recommended or approved in this manual, detailed documentation of the method will be submitted with the drainage plan.

It is strongly recommended that an initial contact with the City of Midland Engineering Department be made to discuss the proposed development and drainage plan. This initial contact allows discussion of the drainage plan and the data required for submission of both the preliminary plan and final plan. A check list has been developed for both the preliminary and final approval stages indicating the data submission requirements. Since it is difficult to establish a list which will cover all drainage situations, it may be necessary to submit more or less data than that specified depending upon the drainage area involved. This is why it is strongly recommended that an initial contact with the City of Midland Engineering Department be made to review the data necessary for submission.

If an official map change from the Federal Emergency Management Agency (FEMA) is requested, the data required for submission will include most of the data required for final plans and plats as well as the data specified in Appendix A of this manual. For assistance in this process, contact the City of Midland Engineering Department.

Before a drainage plan will be reviewed by the City of Midland Engineering Department, any 404 permits as described in Appendix B of this manual must be obtained. The City anticipates that the review time of the drainage plan for each of the submittal stages will be approximately 3 weeks. However, this review time will vary depending on the methods utilized in the analysis and the extent of the drainage area involved.

2.2 PRELIMINARY PLANS AND PLATS

2.2.1 General

The drainage data required for review during the preliminary plans and plats stage should only include general drainage concepts. However, sufficient data must be submitted to determine compliance with the storm drainage design manual. The drainage plan must take into account storm runoff from areas

outside of the study area, as applicable, as well as the storm runoff from the study area itself.

A drainage area map must be submitted for preliminary review. This map should show the drainage area boundaries, drainage areas, off-site drainage into the study area and design flows at key points in the analysis. The drainage map should include contours at intervals sufficient to identify the drainage areas. The drainage map should include contours for off-site drainage areas. Bench marks used to establish elevations of drainage structures or to compare to Flood Insurance Rate Map (FIRM) base flood elevations must be shown on the drainage area map. The direction of flow within streets, alleys, drainage ways and all intersections should be shown on the drainage area map. The extent of the 100-year floodplain as shown on the FIRM as well as any changes anticipated due to the development must be shown on the drainage map.

A drainage analysis report must be included along with the drainage map and should describe the methods and techniques utilized for the drainage calculations. This report should also contain the design criteria used and any assumptions made in the preliminary analysis. All calculations should be submitted in the report.

2.2.2 Check List for Preliminary Plans and Plats

A. Drainage Area Map

1. Use 1"=200' scale for the study area. Other scales may be used provided that the scale is adequate for review.
2. Identify bench marks used in the calculations.
3. Identify the 100-year floodplain as shown on the FIRM.
4. Show existing and proposed storm sewers and inlets.
5. Identify drainage areas.
6. Show contours at intervals which will allow delineation of drainage areas.
7. Show points of flow concentration.
8. Identify runoff rates and direction of flow at all street/alley intersections and drainage ways.
9. Identify flow paths for existing and proposed times of concentration.
10. Identify proposed locations of drainage features such as detention basins, ditches, storm sewers and inlets.

B. Drainage Analysis

1. Provide supporting calculations for all preliminary analysis.
2. Calculate 100-year peak discharge for each drainage area.
3. Calculate maximum street section capacity from 5' back-of-curb to 5' back-of-curb. Maximum street section

- capacity shall meet or exceed the 100-year peak discharge.
4. Calculate maximum alley section capacity from edge of pavement to edge of pavement. Maximum alley section capacity shall meet or exceed the 100-year peak discharge.
 5. Calculate the 100-year flow and flow depth in drainage channels.
 6. Provide calculations of culvert size selection and design flow.
 7. Include preliminary detention basin requirements for storage and discharge.

2.3 FINAL PLANS AND PLATS

2.3.1 General

The data necessary to be submitted for final review will include the data submitted for preliminary review as well as additional detailed data including construction drawings. The construction drawings should show plan and profile of streets, alleys, storm drains, culverts and drainage ways. Detail drawings for drainage structures such as inlets, culverts, manholes and drop structures should be included in the construction drawings.

The drainage analysis report should include tables or printouts, if from approved software programs, showing the information used in the computation of runoff. The method of calculating runoff shall meet the criteria established in this manual. The table or printout should include as a minimum the drainage area and its 5-year and 100-year peak discharge. If the Rational Method is used, the time of concentration, intensity, runoff coefficient and area should also be included in the table. For the SCS method, the table should include the curve numbers, time of concentration and area for each drainage area in the computation. For HEC-1 or TR-20 methods, tables showing how the rainfall loss and unit hydrograph parameters were developed must be included in the report. Complete time of concentration calculations shall be included for any method utilized.

The drainage report should include tables which show street/alley section, drainage area contributing to flow, street/alley width, 5-year peak discharge, 100-year peak discharge and maximum street/alley capacity at 6" above top of curb or at edge of pavement.

Data on storm drain inlets, if used, should be included in the drainage report. The hydraulic grade line for the storm sewer and inlets must meet the requirements as established in this manual and must be shown on the profile sheets of the construction drawings. The calculations for the hydraulic grade line must be included in either computer generated print-out if from a program or tabular if computations are by hand. The data on inlets must include inlet size, capacity and slope.

The drainage report must include data on open channels and culverts. For minor ditches, a step backwater analysis is not required. The analysis of minor ditches may be based on normal depth and uniform flow. For large ditches or channels, a step backwater analysis is required and must be submitted with the drainage report. The same method used to compute the step backwater analysis of the ditch or open channel should be used to analyze any culverts in the same ditch or open channel.

If detention basin(s) are utilized, the drainage report must include the calculations for the minimum storage. Calculations for the design of the outlet structure shall be included which shows that the outlet structure can discharge the design outflow without pond overtopping. The discharge of the outlet structure shall not be more than the design outflow. Provisions and designs for emergency spillways to release flow rates from storms greater than the design storm must be included in the plans and analyses.

2.3.2 Check List for Final Plans and Plats

A. Drainage Area Map

1. Use 1"=200' scale for the study area. Other scales may be used provided that the scale is adequate for review.
- ✓ 2. Identify bench marks used in the calculations.
- ✓ 3. Identify the 100-year floodplain as shown on the FIRM.
- ✓ 4. Show existing and proposed storm drains and inlets.
5. Identify drainage areas.
- ✓ 6. Show contours at intervals which will allow delineation of drainage areas.
- ✓ 7. Show points of flow concentration.
8. Identify runoff rates and direction of flow at all inlets, street intersections and drainage ways.
9. Identify flow paths for existing and proposed times of concentration.
10. Identify proposed locations of drainage features such as detention basins, ditches, storm sewers and inlets.

B. Drainage Analysis

- ✓ 1. Provide supporting calculations for all analyses.
- ✓ 2. Provide supporting information on any drainage plan changes made from the drainage plan given preliminary approval.
- ✓ 3. Calculate 5-year and 100-year peak discharge for each drainage area.
- ✓ 4. Calculate maximum street section capacity from 5' back-of-curb to 5' back-of-curb. Maximum street section capacity shall meet or exceed the 100-year peak discharge.

5. Calculate maximum alley section capacity from edge of pavement. Maximum alley section capacity shall meet or exceed the 100-year peak discharge.
6. Calculate the 100-year flow and flow depth in drainage channels.
7. Calculate street/alley section 5-year and 100-year flow depth.
8. Calculate and show hydraulic grade line for all storm sewers and inlets.
9. Calculate flow rates for each inlet.
10. Calculate the 100-year flow and flow depth in drainage channels.
11. Provide step backwater analysis for large ditches or open channels.
12. Provide calculations of culvert size selection and design flow.
13. Provide calculations of detention basin(s), including outlet structures, normal outlet discharge flow rates and emergency spillway flow rates.

C. Construction Drawings

1. Provide construction drawings on 24"x36" sheets.
2. Show plan and profile of all streets, alleys, storm drains, open channels, culverts and major ditches.
3. Show hydraulic grade line on storm drain, culvert and open channel profiles.
4. Show detail drawings of drainage structures such as inlets, culverts, manholes and drop structures.

END

SECTION 3

HYDROLOGY AND HYDRAULIC SOFTWARE

3.1 Hydrograph Methods

- 3.1.1 General
- 3.1.2 HEC-1 Hydrology
- 3.1.3 TR-20 Hydrology
- 3.1.4 Recommended Method

3.2 Hydraulic Methods

- 3.2.1 General
- 3.2.2 HEC-2 Hydraulics
- 3.2.3 WSP-2 Hydraulics
- 3.2.4 Recommended Method
- 3.2.5 THYSYS Hydraulics

3.3 Software Guidelines

3.4 Summary

Bibliography

SECTION 3

HYDROLOGY AND HYDRAULIC SOFTWARE

3.1 HYDROGRAPH METHODS

3.1.1 General

The original flood insurance study for the City of Midland was performed by the Fort Worth District of the U.S. Army Corps of Engineers. In that flood insurance study, the Corps used a variation of HEC-1 named SWFHYD. SWFHYD is a hydrology program used internally by the Corps of Engineers and is not supplied for public use due to the manpower and expense necessary for software support and up-to-date documentation, and problems inherent with public use of non-standard methods.

In an effort to model the hydrology and hydraulics of Midland on a more localized experience basis, the following hydrology and hydraulics software were considered for suitability. The software was evaluated for flexibility, capacity and effectiveness in modeling the results of the master drainage plan's proposed runoff mitigation measures. Some of the software was also evaluated from a purely design engineering viewpoint for future works of improvement.

3.1.2 HEC-1 Hydrology

HEC-1 is a very flexible program for modeling the rainfall-runoff response of a watershed. This program was developed by the Hydrologic Engineering Center of the Corps of Engineers at Davis, California. A single computer run of HEC-1 can accommodate a multi-flood analysis which includes the simulation of up to nine ratios of a design flood for up to three different plans of a stream network. HEC-1 is also the closest in program format to the SWFHYD program used for the City's flood insurance study.

The user has a wide selection of options in HEC-1. Rainfall and runoff can be input from actual gage measurements and the program calibrated, or a synthetic storm can be produced through input of National Weather Service point rainfall data. The rainfall loss rates due to interception and infiltration can be modeled through four methods: 1) Initial and uniform loss rate; 2) Exponential loss rate; 3) SCS curve number; and 4) Holtan loss rate. In addition to these options, there are three options for defining the discharge hydrograph from any area: 1) Clark Unit Hydrograph; 2) Snyder Unit Hydrograph; and 3) SCS Dimensionless Unit Hydrograph.

Flood routing within HEC-1 also gives the user several options for routing hydrographs through floodways, channels, overbank areas and reservoirs. The user can select the Muskingum, Modified Puls, Working R and D, Average-Lag or Kinematic Wave methods for routing through floodways and other channel segments. Routing through reservoirs is usually done by balancing mass inflow, mass outflow and storage over incremental time periods.

Although the HEC-1 flood hydrograph program gives the user considerable flexibility in modeling watersheds and storm events, the program does have its disadvantages. There is often difficulty in selecting certain required input parameters, particularly where there is insufficient watershed

gage data to calibrate the model. Another disadvantage is the fact that the order of computation, and a possible lack of program input labels, can be difficult to decipher for those not involved in originally setting up the watershed simulation.

3.1.3 TR-20 Hydrology

The TR-20 hydrological modeling program was developed by the Soil Conservation Service (SCS), an agency of the U.S. Department of Agriculture. It is a single event model which will compute direct runoff for a synthetic storm event, or it can be calibrated when rainfall records and hydrograph records are available. Up to nine storm events can be modeled with routings through a maximum of 200 stream reaches and 99 structures in a single run. The procedures used are described in the Soil Conservation Service National Engineering Handbook, Section 4, Hydrology and the TR-20 user's manual.

The program can distribute single-event synthetic rainfall through the use of six preprogrammed rainfall distribution tables, or the user may input a customized rainfall distribution table. Hydrographs are developed from the SCS dimensionless unit hydrograph based on time of concentration and runoff depth. The unit hydrograph can also be replaced with a user input unit hydrograph. Runoff depth is determined using SCS curve number theory, which also defines rainfall reductions due to infiltration and interception.

Stream reach routing is accomplished through the use of a Modified Attenuation-Kinematic (ATT-KIN) method. THE ATT-KIN method develops a routing coefficient from a valley storage-discharge curve that represents the reach. The user must either input a cross section flow rate-elevation-cross sectional area rating table for the reach, or input the "x" and "m" variables which the program uses to calculate the routing coefficient ($Q = xA^m$).

Routing through structures involves the balancing of mass inflow, mass outflow and changes in storage over incremental time intervals. A rating table for the structure, which includes elevation, storage and discharge, must be input by the user for structural routing. The definition of structure for the purpose of TR-20 is a detention basin, floodwater retarding dam with spillways, or other hydrograph attenuating facility.

The advantages of TR-20 are its simplicity of operation, its applicability to ungaged watersheds where gage data are lacking, and its input parameters are user-oriented. Two disadvantages of this particular program are that it is sometimes difficult to calibrate and match data where rainfall and hydrograph records are available; and some professionals contend that the SCS dimensionless hydrograph yields peak flow rates that are too high when compared to other methods.

3.1.4 Recommended Method

The City of Midland recommends that computer modeling of watershed hydrology studies and hydrological designs conform to the HEC-1 program. The flood insurance study performed by the Corps of Engineers using the SWFHYD software is being converted to HEC-1 and will be available for use as a base model.

3.2 HYDRAULIC METHODS

3.2.1 General

Although the city of Midland's Flood Insurance Study hydraulics were modeled using HEC-2, various other computer models and hand-calculated methods exist for the determination of channel and closed conduit hydraulic grade lines. In open channels and gravity flow closed conduits the hydraulic grade line coincides with the free water surface, however in surcharged conduits the hydraulic grade line occurs at a point above the top of the conduit. This narrative briefly evaluates the computer software available for determining open channel water surface profiles and closed conduit hydraulic grade lines.

3.2.2 HEC-2 Hydraulics

HEC-2 is a U.S. Army Corps of Engineers computer program for determination of open channel water surface profiles. The program was developed for the calculation of water surface profiles for steady, gradually varied flow (one-dimensional flow) in natural or man-made channels. Friction losses can be calculated by one of five alternative approaches, and one alternative is internally set as the default approach. The friction loss is calculated with Manning's equation and the trial energy gradient elevations are iteratively balanced to within ± 0.01 -foot between iterations at the reach endpoints. The program is limited to fourteen profiles in a single run. The September 1990 version of the user's manual specifies a maximum number of 800 cross sections or reaches.

Input to HEC-2 is rather straightforward in regard to cross section ground elevations and distances. Distances can be entered as negative or positive numbers to indicate distances left or right of a channel survey base line. A word of caution, though. Negative cross-section distances can result in erroneous output where the program's encroachment subroutine is engaged. In such instances the cross-section distances should be entered in increasing positive numbers from left to right across the section. Manning's "n" values for flow resistance can be varied across a cross section through a combination of input horizontal distances and elevations. Flow through bridges and culverts can be accommodated by HEC-2 through the appropriate normal bridge, special bridge or special culvert input card images.

HEC-2 has the advantages of being able to calculate either subcritical or supercritical water surface profiles, can be used for split flow routines and a variety of user-defined output tables can be specified in addition to the standard output tables. One disadvantage of HEC-2 is that defining bridges can be quite involved and confusing to infrequent users.

3.2.3 WSP-2 Hydraulics

WSP-2 is the SCS counterpart to the Corps of Engineers' HEC-2. The procedures used in the program for calculating water surface profiles are described in the user's manual and in associated SCS engineering handbooks. As with HEC-2, WSP-2 utilizes the standard step method for determination of subcritical flow water surface profiles.

The core program limits for a single run are fifteen water surface profiles for up to fifty reach and road sections, and each cross section is limited to 48 horizontal and vertical points. The limit on cross sections and profiles can be expanded through user call-up of certain subroutines. Manning's "n" value can be varied within a cross section by user specified values of

elevation or hydraulic radius, but not by input horizontal distance. The program will iteratively balance the energy gradient of a reach until differences between iterations at the reach endpoints are 0.1-foot or less. Culvert input is sometimes easier than that for HEC-2 since WSP-2 contains preprogrammed codes for culvert shapes and materials. Bridges are defined by input cross sections and pier shapes.

WSP-2 has the advantage being user-oriented in its input requirements; however it is limited to subcritical flow analysis and has somewhat low limits on the maximum basic number of cross sections.

3.2.4 Recommended Method

After careful evaluation of the advantages and disadvantages of both HEC-2 and WSP-2, the City of Midland recommends that computer-modeled channel analyses be done in the HEC-2 format.

3.2.5 THYSYS Hydraulics

The Texas Hydraulic System (THYSYS) was developed for the Texas State Department of Highways and Public Transportation (SDHPT) as an aid for the design and analysis of highway storm water conveyance structures. It is composed of five major subroutines:

HYDRO	Hydrology, computes peak flow for surface runoff.
HYDRA	Hydraulics, computes channel flow characteristics, but is limited in scope.
CULBRG	Culvert/Bridge, designs or analyzes the hydraulic characteristics of culverts or bridges.
SEWER	Storm Sewer, designs or analyzes the hydraulics of storm sewer networks.
PUMP	Pump Stations, designs or analyzes the hydraulics of pump stations.

THYSYS is designed so that computed data output may be automatically passed as input data from one subroutine to another subroutine. Also, any one of the subroutines may be used independently of the others if the appropriate data is input. The exception is the SEWER subroutine, which is independent of the others, however this subroutine also has its own capability for calculating peak discharges by the Rational Method.

The HYDRO subroutine can be used to calculate peak discharge by one of three methods: 1) Rational Method, 2) the Gage Analysis Method which employs major runoff history on a stream to determine peak flow, and 3) the USGS Method which employs equations derived by regional analysis of the hydrology of the State of Texas.

The HYDRA subroutine is used to compute water surface elevations and conveyance at stream cross sections. The user can specify one of three methods for computing the water surface elevations: 1) One-Section Method, 2) Two-Section Method, and 3) Many-Section Method. HYDRA is primarily used for the

determination of tailwater elevation on proposed culverts. For complex analysis or long stream segments, HEC-2 is the preferred analytical tool.

The CULBRG subroutine performs a complete design or analysis of hydraulic structures under highways. The system can be used to analyze proposed or existing structures. Three types of barrel sections may be defined for culverts, and those are circular, arch or box sections. Straight and broken-back profiles may be defined for circular and box sections. For bridges, the user must supply bridge header slopes and flow divide information.

The SEWER subroutine, which is independent of the other THYSYS subroutines, can be used for the design or analysis of proposed or existing storm sewer systems. It computes the peak discharge to inlets, designs inlets and computes the hydraulic grade lines for a storm sewer network. The maximum size network that can be designed or analyzed in a single run can include 100 junctions, 99 runs and 26 lines. A junction is defined as an inlet, manhole or other juncture with one pipe leaving and as many as three pipes entering the juncture. A run is a pipe length which begins and ends at a junction. A line is an alpha-numeric labeling scheme which defines the storm sewer network.

The PUMP subroutine can be used for design and analysis of storm water pumping stations. The approach is rather simplistic, but this subroutine provides useful data and cross-checking with hand calculations. Complex pump stations should be designed or analyzed through other methods.

THYSYS has the advantages of well-defined input and output labels, a minimum of required input and it is relatively easy to use. Output from the program is easy to follow and is also well labeled. The underlying analytical methods can also be hand-calculated through procedures found in the SDHPT Hydraulics Manual. One disadvantage of the program is that the user's manual often leaves much to be desired in the way of input and program logic documentation. In any case, the City will accept design submittals in the THYSYS format as long as the program is used within its capabilities, and the design is not complex enough to warrant other methods.

3.3 SOFTWARE GUIDELINES

Suggestions and guidelines for the use of software have been included in the various other sections of this manual. Users should consult the specific sections of this drainage design manual for these guidelines. Two examples would be "Section 6: Storm Drains" for THYSYS storm sewer guidelines and "Section 8: Open Channels" for helpful information on using HEC-2. Other sections of this manual which discuss storm runoff, culverts, detention and other design features also include helpful information on the use of the preferred software.

3.4 SUMMARY

There are many hydraulic software packages available from various suppliers which will calculate hydrographs, open channel water surface profiles and storm drain hydraulics. Any of these hydraulic software programs may be used, however the results will be judged by the City based on analyses formulated through HEC-1, HEC-2 or THYSYS as applicable for a particular design.

END

SECTION 3
BIBLIOGRAPHY

1. Corps of Engineers, HEC-1 Flood Hydrograph Package User's Manual, Revised 1985.
2. Corps of Engineers, HEC-2 Water Surface Profiles User's Manual, September 1982.
3. Bedient and Huber, Hydrology and Floodplain Analysis, Addison-Wesley 1988.
4. Hoggan, Computer Assisted Floodplain Hydrology and Hydraulics, McGraw-Hill 1989.
5. Soil Conservation Service, TR-20 Project Formulation, Hydrology, Draft of Second Edition, May 1983.
6. Soil Conservation Service, Technical Release 61, WSP-2 Computer Program, May 1976.
7. Texas State Department of Highways and Public Transportation, User Manual for Texas Hydraulic System (THYSYS), 1977.
8. Texas State Department of Highways and Public Transportation, Hydraulic Manual, December 1985.

SECTION 4

DETERMINATION OF STORM RUNOFF

- 4.1 General
- 4.2 Effects of Urbanization
- 4.3 Method of Analysis
- 4.4 Rational Method
 - 4.4.1 Runoff Coefficient (C)
 - 4.4.2 Time of Concentration
 - A. Upland Flow
 - B. Storm Drain Flow
 - C. Open Channel Flow
 - 4.4.3 Rainfall Intensity (i)
 - 4.4.4 Drainage Area (A)
 - 4.4.5 Rational Method Example
- 4.5 Soil Conservation Service (SCS) Method
 - 4.5.1 General
 - 4.5.2 Soil Classification
 - 4.5.3 Curve Number
 - 4.5.4 Curve Number Adjustment in Flood Insurance Study
 - 4.5.5 Rainfall-Runoff Relationship
 - 4.5.6 SCS Type II Rainfall Distribution
 - 4.5.7 Time of Concentration
 - 4.5.8 Peak Discharge by Graphical Method (SCS TR-55)
 - 4.5.9 SCS Tabular Method (TR-55)
- 4.6 Unit Hydrograph Theory
- 4.7 Dimensionless Unit Hydrograph (SCS)
- 4.8 HEC-1 Hydrograph Package
- 4.9 TR-20 Hydrograph Package (SCS)

Bibliography

SECTION 4

DETERMINATION OF STORM RUNOFF

4.1 GENERAL

If historical records of runoff volumes and peak discharges were as available as records of precipitation, then such records would provide the best source of information on which to base the design of storm drainage, flood prevention and flood mitigation systems. Unfortunately, such records are available in very few areas in sufficient quantity to permit an accurate prediction of stormwater runoff and are not available in the Midland area. Such runoff measurements are usually only available on major river tributaries at U.S. Geological Survey gaging stations. The accepted practice, therefore, is to relate runoff to rainfall. This practice provides a means for prediction of the amount of runoff to be expected from urban watersheds at given recurrence intervals.

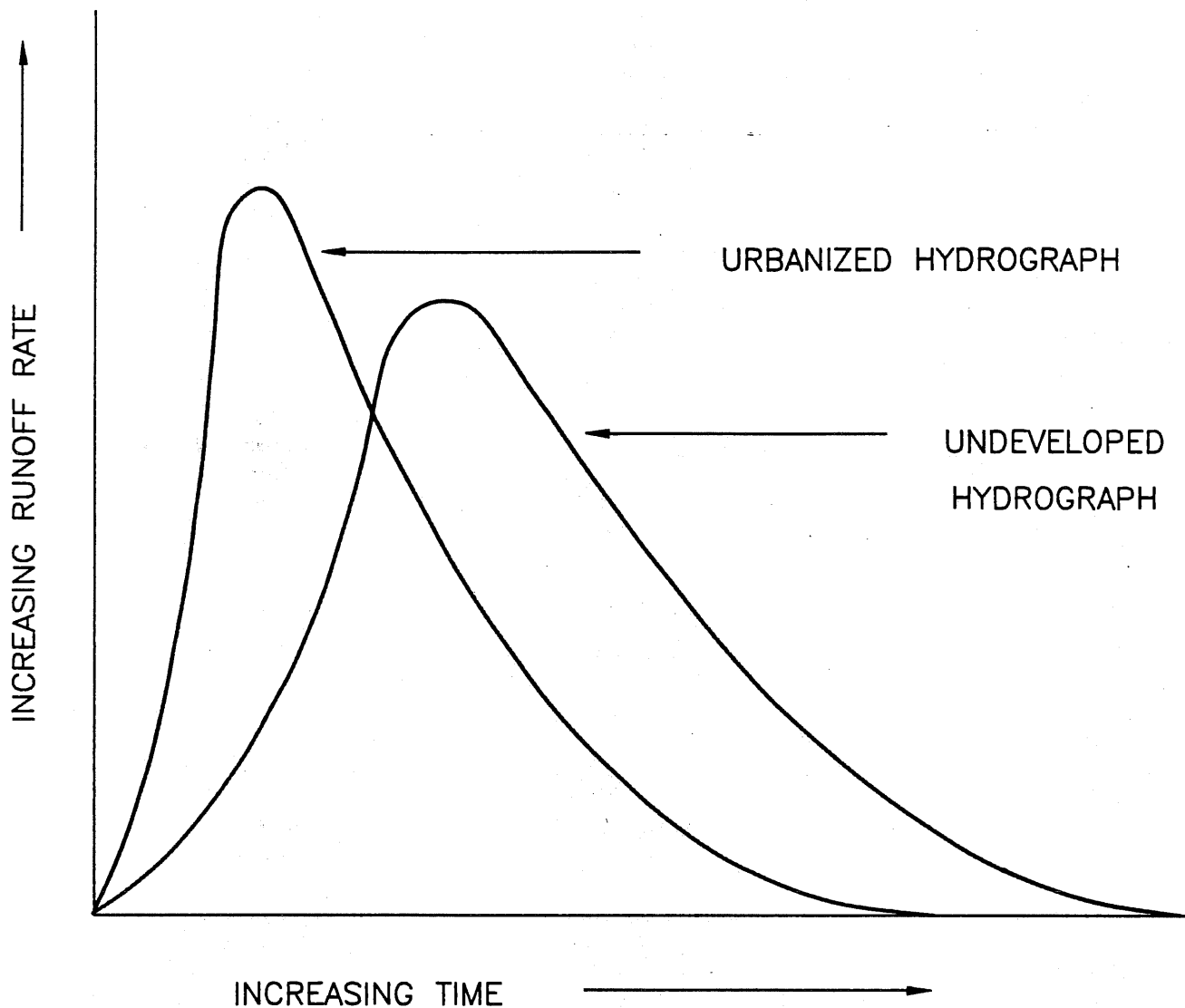
There are a number of methods available for storm runoff computations on which the design of storm drainage systems may be based. The method chosen is dependent on the designer's familiarity with that method and the size of the area to be analyzed. Within the method chosen, the designer will be responsible for estimating the development characteristics of the study area. The study area, depending on the watershed's total area and characteristics, may require the designer to accommodate runoff from offsite areas under both existing undeveloped conditions and future developed conditions. Such offsite stormwater runoff may require an increase in the capacity of the drainage facility under consideration.

4.2 EFFECTS OF URBANIZATION

For a given rainfall, increased volume of runoff and increased peak discharge are two effects attributable to urban development. The hydraulic efficiency of a watershed, or a drainage area, is generally improved by urbanization which not only reduces the storage capacity of the watershed, but also usually provides more efficient flow paths for the runoff. This reduction of the watershed's storage capacity, and the increased efficiency of the runoff flow paths, is a direct consequence of the elimination of porous soil surfaces, small ponds, holding areas and providing paved channels for runoff flow. This is due to the grading and paving of building sites, streets, drives, parking lots, and sidewalks, and the construction of buildings and other facilities characteristic of urban development. The result of improved hydraulic efficiency is illustrated graphically in Figure 4-1. Figure 4-1 is a generalized plot of the peak discharge versus time for a single storm event with two different stages of urbanization.

4.3 METHOD OF ANALYSIS

There are numerous methods available for rainfall-runoff computation on which the design of storm drainage and flood control systems may be based. For the City of Midland, there are three methods which will be considered acceptable for design and analysis within certain, specified limits:



COMPARISON OF URBANIZED AND UNDEVELOPED WATERSHED HYDROGRAPHS

FIGURE 4-1

- A. Rational Method.
- B. Graphical/Tabular Method (TR-55).
- C. Unit Hydrograph Method (TR-20, HEC-1).

The Rational Method is acceptable for drainage areas of 100 acres or less. For larger drainage systems, the hydrograph methods (TR-55, TR-20 or HEC-1) should be used. There are two exceptions to the 100-acre limit for the Rational Method. One is where the Rational Method is used for the hydraulic modeling and design of storm drain networks. The second exception is for the calculation of the hydraulic capacity of streets. The designer is encouraged to consult with the City of Midland Engineering Department with any questions on the area limitations for certain runoff computation methods.

The method of hydrologic analysis selected must be consistent when drainage areas are combined. The method which applies to the largest drainage area should be used. For example, say 60 acres are under consideration for development. An existing detention basin downstream of the proposed 60-acre development will be impacted and the basin is hydrologically modeled in the HEC-1 hydrology program. This particular detention basin collects runoff from a three square-mile total drainage area. The Rational Method in this case is perfectly acceptable for calculating storm drain capacities and street capacities within the 60-acre development. But, when the development's effects on the existing downstream detention basin are analyzed, then the developed area will have to be modeled into the HEC-1 program. Table 4-1 is to be used as a guide in determining some of the applicable methods for calculating storm runoff.

TABLE 4-1
STORM RUNOFF CALCULATION METHODS

<u>Drainage Area</u>	<u>Runoff Methods</u>
100 Acres or Less (See Paragraph 4.3 of narrative for exception to 100-acre limit)	Rational Graphical (TR-55) Tabular Hydrograph (TR-55)
101 Acres - 640 Acres (1 sq. mi.)	Graphical (TR-55) Tabular Hydrograph ¹ (TR-55) Unit Hydrograph (TR-20, HEC-1)
Over 640 Acres (1 sq. mi.)	Unit Hydrograph (TR-20, HEC-1)

¹ The SCS Tabular Method by hand calculation is not recommended for areas greater than one square mile due to the rigorous nature of the calculations and likelihood for error. If a computer version of TR-55 is used, then the limit is 3 square miles. A Unit Hydrograph model may still be required for analysis of downstream effects.

Table 4-1 is also presented in a logic diagram in Figure 4-2. The designer can use other methods if approved by the City of Midland Engineering Department. It should be noted that the City's reference standard for hydrograph evaluation is the Corps of Engineers HEC-1 hydrology program. If a designer wants to change the floodplain limits within a watershed, then the HEC-1 standard will be required. Designers are required to include in their analysis the City's Flood Insurance Study hydrographs when floodplain changes are requested.

4.4 RATIONAL METHOD

The Rational Method is based on the following assumptions for the determination of peak discharge:

- A. The storm duration is equal to the time of concentration.
- B. The return period, or frequency, of the calculated peak discharge is the same as the return period for the design storm.
- C. The runoff coefficient does not vary during a storm and the necessary basin characteristics can be identified.
- D. The rainfall intensity is constant during the storm duration, and is uniform over the entire drainage area under consideration.
- E. The calculated peak discharge at the design point is a function of the average rainfall rate during the time of concentration to that point.

With these underlying assumptions the peak discharge can be calculated as:

$$Q = CiA \quad (\text{Eq. 4-1})$$

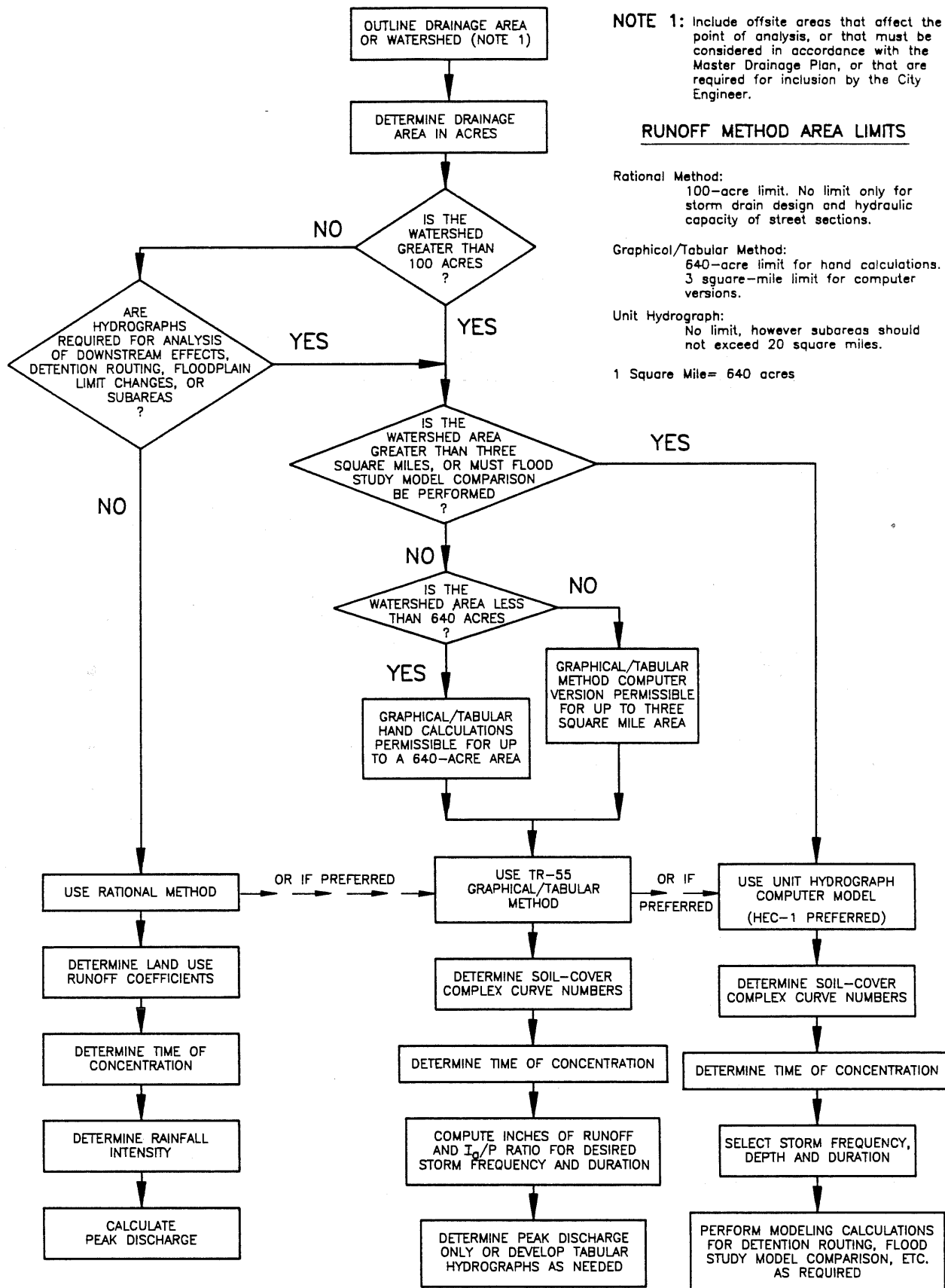
with the terms defined as:

- Q - Peak discharge in cubic feet per second.
- C - Runoff coefficient which represents the ratio of runoff to rainfall for the drainage area considered.
- i - The average rainfall intensity in inches per hour for a period of time equal to the time of concentration (T_c) for the drainage area under consideration.
- A - The drainage area, in acres, contributing runoff to the point of consideration.

A dimensional analysis of the Rational Method equation above would quickly reveal that the units for Q are actually acre-inches per hour. However, since one cubic-foot per second is equal to 1.008 acre-inches per hour, the nearly equivalent unit of cubic feet per second is usually used. This one-to-one ratio varies from the true 1:1.008 ratio by less than one percent, and is sufficiently accurate for practical design.

4.4.1 Runoff Coefficient (C)

The proportion of the total rainfall that will reach the design point depends on the imperviousness of the surface, the slope and the ponding characteristics of the area. Impervious surfaces, such as asphalt pavements and roofs of buildings, will be subject to approximately 100 percent runoff (regardless of the slope). On-site inspections and aerial photographs may prove valuable in estimating the nature of the surfaces within the drainage area.



LOGIC DIAGRAM FOR RUNOFF DETERMINATION

FIGURE 4-2

The runoff coefficient "C" in the Rational Formula is also dependent on the character of the soil. The type and condition of the soil determines its ability to absorb precipitation. The rate at which a soil absorbs precipitation generally decreases as the rainfall continues for an extended period of time. The soil infiltration rate is influenced by the presence of soil moisture (antecedent precipitation), the rainfall intensity, the proximity of the ground water table, the degree of soil compaction, the porosity of the subsoil, and ground slopes.

It should be noted that the runoff coefficient "C" is the variable of the Rational Method which is least susceptible to precise determination. A reasonable coefficient must be chosen to represent the integrated effects of infiltration, detention storage, evaporation, retention, flow routing and interception, all of which affect the time distribution and peak rate of runoff.

Table 4-2 presents recommended ranges for "C" values based on specific land use types.

It is often desirable to develop a composite runoff coefficient based upon the percentages of different types of surfaces in the drainage area. This procedure is often applied to typical "sample blocks" as a guide to selection of reasonable values of the coefficient for an entire area. Suggested coefficients with respect to specific surface types are given in Table 4-3. The designer also has the option of providing detailed development information which might result in different "C" values than those shown in Table 4-3.

4.4.2 Time of Concentration

The time of concentration is the time associated with the travel of runoff from an outer point which best represents the shape of the contributing areas. Runoff from a drainage area usually reaches a peak at the time when the entire area is contributing, in which case the time of concentration is the time for a drop of water to flow from the most remote point in the watershed to the point of interest. Runoff may reach a peak prior to the time the entire drainage area is contributing. Sound judgment should be used to determine the time of concentration. The time of concentration to any design point is a combination of the sheet flow (overland), the shallow concentrated flow and the channel flow, which includes storm sewers. The minimum time of concentration for any area shall be 10 minutes.

A. Upland Flow

The velocity to be used in calculating the travel time for agricultural areas, landscaped areas and gutter flow should be determined from Figure 4-3. Reading from left to right, the first four curves (range with heavy ground litter, fallow or minimum tillage cultivation, short grass pasture and lawns, nearly bare ground) should only be used for a maximum of 500 feet. After 500 feet, the runoff concentrates to a certain extent and flows more in accordance with the characteristics of a grassed waterway, a small upland gully or is concentrated in streets. A field reconnaissance of actual conditions, or an estimation of future conditions, will usually dictate which remaining curves to use.

The following limitations exist for the use of the curves on Figure 4-3. The crowned curb and gutter street flow gives excellent results for all street

TABLE 4-2

RATIONAL METHOD RUNOFF COEFFICIENTS BY LAND USE
Runoff Coefficient (C)

Character of Surface	Return Period					
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
DEVELOPED						
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95
Concrete/Roof	0.75	0.80	0.83	0.88	0.92	0.97
Grass Areas (Lawns, Parks, etc.)						
<u>Poor Condition</u> (grass cover less than 50 percent of the area)						
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53
<u>Fair Condition</u> (grass cover on 50 to 75 percent of the area)						
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49
<u>Good Condition</u> (grass cover larger than 75 percent of the area)						
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46
UNDEVELOPED						
Cultivated Land						
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51
Pasture/Range						
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41
Average, 2-7%	0.34	0.36	0.38	0.42	0.45	0.49

Note: Where the topsoil over caliche and rock layers is less than or equal to a two-foot thickness, the runoff coefficients for grass areas and undeveloped land shall be increased by adding 0.10 to the above tabulated coefficient.

Example: Poor condition grass, 5-year, Flat, $C = 0.34$
Shallow soil $C = 0.34 + 0.10 = 0.44$

TABLE 4-3

RATIONAL METHOD RUNOFF COEFFICIENTS
FOR COMPOSITE ANALYSIS
FOR USE IN $Q = CiA$
Runoff Coefficient (C)

Zoned Land Use	Percent Impervious	5-Year Runoff Coefficients (C) for Watershed Slopes		100-Year Runoff Coefficients (C) for Watershed Slopes	
		Slope 0-2%	Slope 2-7%	Slope 0-2%	Slope 2-7%
Single Family, Zone 1F	60%	0.57	0.61	0.73	0.77
Multifamily:					
Zones 2F, MF-1	60%	0.57	0.61	0.73	0.77
Zone MF-2	70%	0.62	0.65	0.78	0.81
Mobile Home, Zone MH	55%	0.57	0.60	0.72	0.75
Commercial, General Office: Zones O-1, O-2	80%	0.69	0.70	0.85	0.87
Commercial Service: Zones C-1, C-2, C-3	85%	0.73	0.74	0.90	0.92
Industrial Park, Zone IP-1	50%	0.54	0.58	0.69	0.73
Light Industrial, Zone LI					
Heavy Industrial, Zone HI	65%	0.64	0.66	0.80	0.82
Townhomes, Zone TH	70%	0.62	0.65	0.78	0.81
Agricultural Estate Zone AE	15%	0.36	0.43	0.49	0.56
Parking, Local Retail and Neighborhood Service	98%	0.79	0.79	0.96	0.96

Composite "C" value for developed conditions (C_{DEV}) is:

$$C_{DEV} = IC_1 + (1-I)C_2$$

where,

I = Impervious cover, percent

C_1 = "C" value for impervious cover, Table 4-2

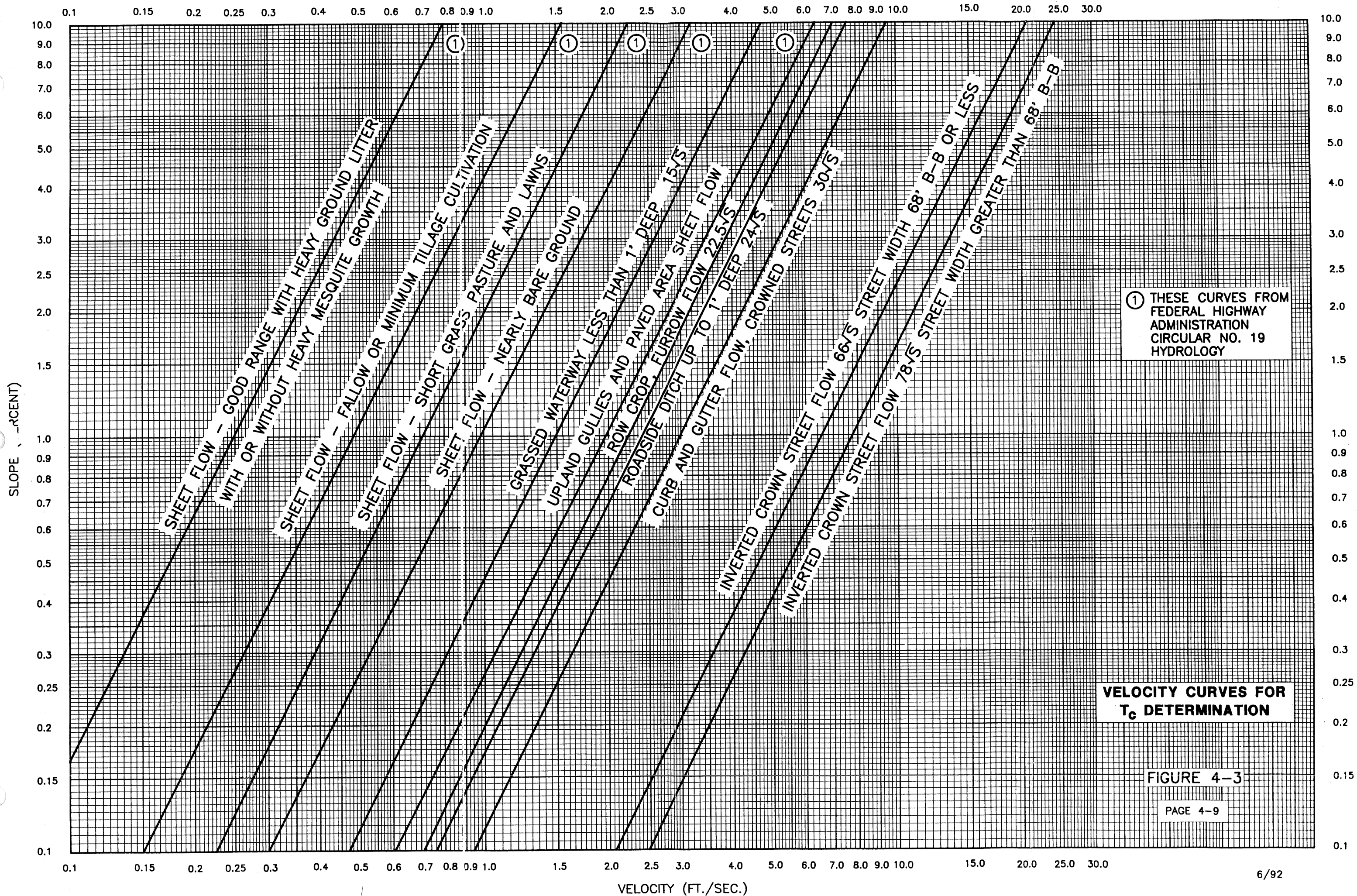
C_2 = "C" value for pervious area (Grass, lawns, parks, etc.), Table 4-2

Listed values of "C" are for soil thickness greater than two feet over caliche and rock layers.

The designer shall determine "C" values for zones not listed.

Where lower runoff coefficient values are to be used for design, the designer shall submit a detailed analysis justifying the lower values.

The City Engineer may require the use of greater runoff coefficient values if the percent impervious exceeds that listed for the specified land use.



This page intentionally blank.

widths and even various depths from 0.25 feet deep to top of curb. Velocities in inverted streets are more variable. The curves give velocity at top of curb only, but should be adequate for travel-time purposes. The grassed waterway curve is based on wide, flat flow areas less than eight inches deep and very small ditches less than six inches deep. The roadside ditch curve is limited to a one-foot depth of flow in ditches varying from zero to six feet in bottom width with side slopes which range from two horizontal to one vertical (2:1) up to six horizontal to one vertical (6:1).

If open channel estimated flow rates result in a depth of flow greater than the depth limits for the curves in Figure 4-3, then velocities to use in travel time calculations should be determined by the open channel method discussed below.

Where the flow is intercepted and concentrated by storm drains or open channels, the velocity of flow will be much higher and should be determined by methods described in the following paragraphs.

B. Storm Drain Flow

For the purpose of calculating travel time velocities in a storm drain, the pipe or box may be considered as flowing full. The slope of the hydraulic grade line may also be taken as equal to the flow line slope of the storm drain. The velocity can then be determined using Manning's equation: $V = (1.486/n)(R^{0.67})(S^{0.5})$. The details of using Manning's equation and selecting Manning's "n" values for storm drains can be obtained from "Section 6: Storm Drains."

C. Open Channel Flow

An open channel can be considered as flowing bank-full for the purpose of calculating the velocity to use in the time of concentration or a reasonable flow estimate may be used. The slope of the hydraulic grade line may be taken as equal to the channel bed slope for the purposes of this section. Manning's equation can then be used to calculate the velocity. The details of using Manning's equation and selecting Manning's "n" values for open channels can be obtained from "Section 8: Open Channels." In some instances, it may be helpful to run several HEC-2 water surface profiles for the channel in question in order to gain a more accurate velocity estimate. HEC-2 output can be defined by the user. Travel times can be requested by user input and read directly from the output tables.

4.4.3 Rainfall Intensity (i)

Rainfall intensity (i) is the average rainfall rate in inches per hour, and is selected on the basis of design rainfall duration and design frequency of occurrence. The design duration is equal to the time of concentration for the drainage area under consideration. The design frequency of occurrence is a statistical variable which is established by design standards or chosen by the designer as a design parameter.

The selection of the frequency criteria is necessary before applying any hydrologic method. The various sections of this manual contain the frequency criteria for street drainage, inlets, storm drains, open channels, culverts and pump stations. The user should consult the appropriate section of the manual to

obtain the minimum storm frequency to be used for design and analysis of drainage facilities.

The rainfall intensity used in the Rational Method is read from the intensity-duration-frequency curves based on the selected design frequency and design duration. The Midland intensity-duration-frequency curves are based on data from the U.S. Department of Commerce Technical Paper 40, with constants and exponents contained in the Texas State Department of Highways and Public Transportation's (SDHPT) December 1985 Hydraulic Manual. Rainfall intensity-duration-frequency curves are shown in Figure 4-4 with selected calculated values shown in Table 4-4.

The following equation represents mathematically the Midland intensity-duration-frequency curves:

$$i = b/(t+d)^e \quad (\text{Eq. 4-2})$$

where:

i = Average rainfall intensity, inches per hour

t = Storm duration, minutes (equal to time of concentration)

b, d, e = Coefficients for different storm frequencies, listed in Table 4-4

The intensity-duration-frequency curves and the intensity-duration-frequency equations are applicable for the design frequencies shown and for storm durations from 10 minutes to three hours. For durations greater than three hours, it is recommended that hydrograph methods be employed for analysis.

4.4.4 Drainage Area

The size (acres) of the watershed needs to be determined for application of the Rational Method. The area may be determined through the use of maps, supplemented by field surveys where topographic data has changed or where the contour interval is too great to distinguish the direction of flow. The drainage divide lines are determined by street layout, lot grading, structure configuration and orientation, and many other features that are created by the urbanization process.

4.4.5 Rational Method Example

In this example which shows the use of the Rational Method, a hypothetical situation is purposely shown so that the various travel times already discussed can be illustrated, as well as the computation of the runoff coefficient and the rainfall intensity.

Example: An existing culvert at the downstream end of a watershed must be analyzed to see if its capacity is adequate to carry stormwater runoff from future development. The hypothetical watershed is illustrated in Figure 4-5. Shown on the illustration are the predicted future land use areas and the controlling runoff route for determining the time of concentration. Find the peak discharge to the culvert for the future conditions shown for the 100-year frequency storm.

RATIONAL FORMULA RAINFALL INTENSITIES FOR MIDLAND, TEXAS

INTENSITY (IN/HR) VS TIME (MIN)

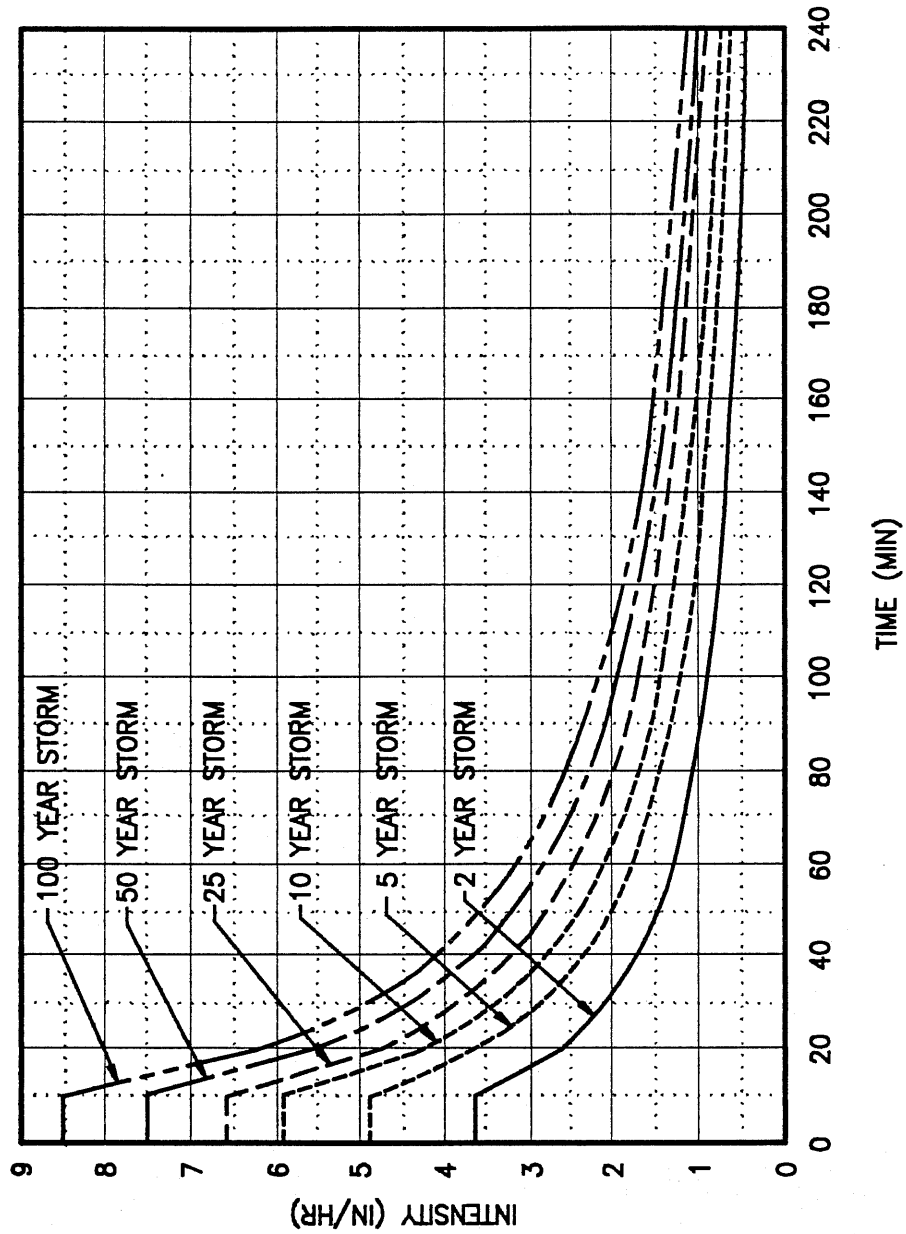


FIGURE 4-4

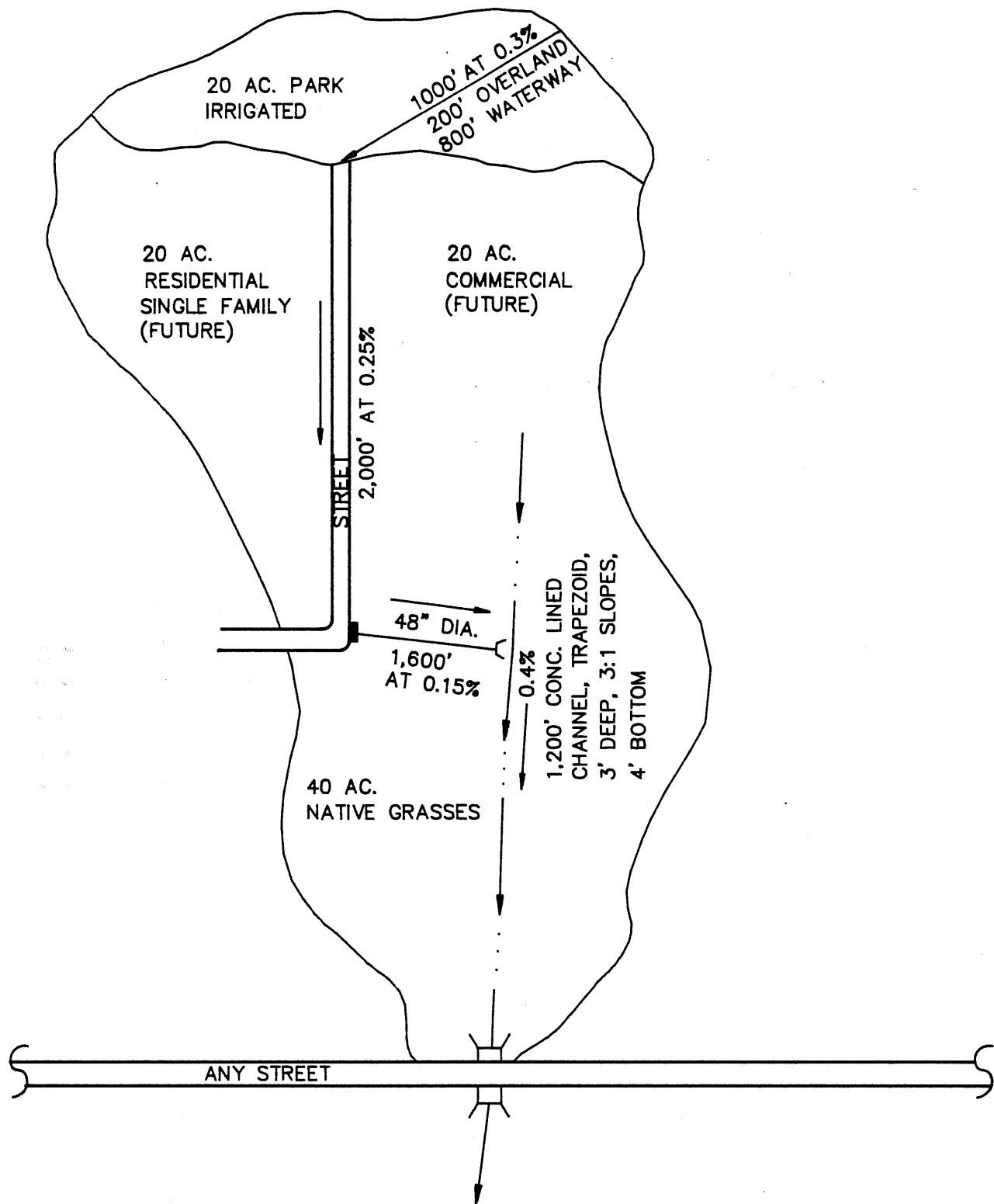
TABLE 4-4
INTENSITY (I) CURVE DATA FOR MIDLAND COUNTY
Intensity Equation from the Texas Highway Department
Hydraulic Manual, Third Edition, December 1985

$I = b / (T_c + d)^e$ T_c = Time of Concentration (min)
--

Midland County Intensity Constants

Storm Year	2	5	10	25	50	100
Constants						
e =	0.817	0.812	0.823	0.788	0.795	0.789
b =	42	57	71	71	83	90
d =	9.8	10.5	10.5	10.5	10.5	9.8

Time of Concentration (min)	Storm Intensities					
	2 Year Storm (in/hr)	5 Year Storm (in/hr)	10 Year Storm (in/hr)	25 Year Storm (in/hr)	50 Year Storm (in/hr)	100 Year Storm (in/hr)
10	3.66	4.91	5.91	6.57	7.52	8.53
20	2.62	3.55	4.26	4.80	5.48	6.18
30	2.07	2.82	3.38	3.84	4.38	4.92
40	1.72	2.36	2.81	3.23	3.67	4.12
50	1.48	2.04	2.43	2.80	3.18	3.57
60	1.31	1.80	2.14	2.48	2.82	3.16
70	1.17	1.62	1.92	2.24	2.53	2.84
80	1.07	1.47	1.74	2.04	2.31	2.59
90	0.98	1.35	1.60	1.88	2.12	2.38
100	0.90	1.25	1.48	1.74	1.97	2.21
110	0.84	1.16	1.38	1.63	1.84	2.06
120	0.79	1.09	1.29	1.53	1.73	1.94
130	0.74	1.03	1.21	1.44	1.63	1.83
140	0.70	0.97	1.15	1.37	1.54	1.73
150	0.67	0.92	1.09	1.30	1.46	1.64
160	0.63	0.88	1.03	1.24	1.40	1.57
170	0.60	0.84	0.99	1.18	1.33	1.50
180	0.58	0.80	0.94	1.13	1.28	1.43
190	0.55	0.77	0.90	1.09	1.23	1.38
200	0.53	0.74	0.87	1.05	1.18	1.33
210	0.51	0.71	0.84	1.01	1.14	1.28
220	0.49	0.69	0.81	0.98	1.10	1.23
230	0.48	0.66	0.78	0.94	1.06	1.19
240	0.46	0.64	0.75	0.91	1.03	1.15



WATERSHED FOR RATIONAL METHOD EXAMPLE

FIGURE 4-5

Step 1: Determine a composite runoff coefficient.

Total Area = 20 + 20 + 20 + 40 = 100 acres.

All soils in the area greater than two feet deep.

Residential C = 0.6 (Table 4-3)

Commercial C = 0.94 (Table 4-3)

Irrigated Park C = 0.36 (Table 4-2)

Native Grasses C = 0.41 (Table 4-2)

Composite C =

$$\frac{(0.6 \times 20 \text{ ac}) + (0.94 \times 20 \text{ ac}) + (0.36 \times 20 \text{ ac}) + (0.41 \times 40 \text{ ac})}{100 \text{ ac}}$$

Composite C = 0.54

Step 2: Determine controlling travel times.

200 feet overland flow, short grass and lawn, at 0.3% slope in irrigated park.

From Figure 4-3, V = 0.39 fps

Travel time, Park_o T_t = (200'/0.39 fps)/60 sec per min

Park_o T_t = 9 minutes

800 feet waterway flow @ 0.3% slope in irrigated park.

From Figure 4-3, V = 0.82 fps

Travel time, Park_w T_t = (800'/0.82 fps)/60 sec per min

Park_w T_t = 16 minutes

2000 feet gutter flow @ 0.25% slope.

From Figure 4-3, V = 1.48 fps

Street T_t = (2,000'/1.48 fps)/60 sec per min

Street T_t = 23 minutes

1,600 feet of 48-inch diameter storm drain flow @ 0.15% slope.

$$V = \frac{1.486}{n} R^{0.67} S^{0.5}$$

$$S = 0.15\%/100 = 0.0015 \text{ ft/ft}$$

$$\text{PIPE } R = d/48 = 48"/48 = 1.0$$

$$n = 0.015 \text{ (Concrete pipe, Storm Drains, Section 6)}$$

$$V = \frac{1.486}{0.015} (1.0^{0.67})(0.0015^{0.5})$$

$$V = 3.8 \text{ fps}$$

$$\text{PIPE } T_t = (1,600'/3.8 \text{ fps})/60 \text{ sec per min}$$

$$\text{PIPE } T_t = 7 \text{ minutes}$$

1,200' Concrete-lined trapezoidal channel @ 0.4%.

$$V = \frac{1.486}{n} R^{0.67} S^{0.5}$$

$$S = 0.4\%/100 = 0.004 \text{ ft/ft}$$

$$R = \frac{\text{Wetted end area}}{\text{Wetted perimeter}}$$

$$\begin{aligned} \text{Wetted end area} &= [4' \text{ width} + (3 \text{ sideslope})(3' \text{ depth})]3' \\ &\quad \text{depth} \\ &= 39 \text{ sq. ft. (See Section 8, Open Channels} \\ &\quad \text{for geometry of open channels)} \end{aligned}$$

Wetted Perimeter, P.

$$P = \text{Bottom width} + 2 (\text{depth})(1 + \text{sideslope}^2)^{0.5}$$
$$= 4 + (2)(3)(1 + 3^2)^{0.5} = 23 \text{ feet}$$

$$R = A/P = 39/23 = 1.7$$

$$n = 0.015 \text{ (Open Channels, Section 8)}$$

$$V = (1.486/0.015)(1.7^{0.67})(0.004^{0.5})$$

$$V = 8.9 \text{ fps}$$

$$\text{Channel } T_t = (1,200'/8.9 \text{ fps})/60 \text{ sec per min}$$

$$\text{Channel } T_t = 2 \text{ minutes}$$

Step 3: Determine Time of Concentration, T_c , from travel times, T_t .

$$T_c = \text{Sum of Travel Times}$$

$$T_c = 9 + 16 + 23 + 7 + 2 = 57 \text{ minutes}$$

Step 4: Determine rainfall intensity.

Entering Figure 4-4 with 57 minutes and the 100-year curve, read approximately 3.3 iph.

Alternatively, using the intensity equation and constants from Table 4-4.

$$i = \frac{90}{(57 + 9.8)^{0.789}} = 3.27 \text{ iph, use 3.3 iph}$$

Step 5: Calculate peak discharge, round to nearest whole number.

$$Q = CiA$$

$$Q = (0.54)(3.3 \text{ iph})(100 \text{ acres}) = \underline{178 \text{ cfs}} \quad \text{ans.}$$

4.5 SOIL CONSERVATION SERVICE (SCS) METHOD

4.5.1 General

The Soil Conservation Service (SCS) Method is originally based on the observed runoff from agricultural watersheds. As this method was applied on a more frequent basis to urban areas, the SCS developed additional guidance for using the method on urban areas which have impervious surfaces.

The SCS Method uses a curve number to define some of the characteristics of the watershed. This curve number reflects a combination of the soil hydrologic group, the land use and the treatment class. This combination of items used in determination of the curve number is referred to as the hydrologic soil-cover complex. The curve number then selected, based on the hydrologic soil-cover complex, is used to determine runoff volume. One item which most affects the soil-cover complex is the hydrologic characteristic of the soil itself.

4.5.2 Soil Classification

Over 4,000 soils have been classified by the SCS into four distinct hydrological groups: A, B, C or D. National Engineering Handbook Section 4 listed in the bibliography contains a complete listing of the soil names and each soil's hydrologic group. These hydrologic groups are based on the infiltration capacity of each soil and are defined as follows:

- Group A: (Low Runoff Potential). Soils having a high infiltration rate even when thoroughly wetted and consisting chiefly of deep, well-drained to excessively drained sands or gravels. These can be deep sand, deep loess and aggregated silts. Tivoli soil in Midland County is an example of an "A" Group soil.
- Group B: Soils having a moderate infiltration rate when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well-drained soils with moderately fine to moderately coarse texture. These can be shallow loess and sandy loam. Two examples for a "B" Group in Midland County are Amarillo and Miles soils.
- Group C: Soils having a slow infiltration rate when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soil with moderately fine to fine texture. Common examples are clay loams, shallow sandy loam, soils low in organic content and soils usually high in clay. Abilene and Potter are two of the "C" Group soils in Midland County.
- Group D: (High Runoff Potential). Soils having a very slow infiltration rate when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material. Examples are soils that swell significantly when wet, heavy plastic clays and certain saline soils. There are no "D" Group soils listed for Midland County.

The soil classifications and hydrologic groups to be used with the SCS Method will be those contained in the Soil Conservation Service Soil Survey of Midland County, Texas.

4.5.3 Curve Number

As briefly mentioned earlier, the SCS Method uses a curve number for numerical definition of the soil-cover complex for a defined drainage area. The selection of a curve number defines the soil hydrologic group, the percentage of impervious cover, the condition of vegetative cover and the antecedent moisture condition. The soil hydrologic group descriptions have been covered in previous paragraphs.

The impervious cover in the watershed includes roofs, sidewalks, paved driveways, paved streets, and paved parking areas. Impervious surfaces in a large watershed are usually included in a composite curve number which defines the entire watershed or subarea. However, a small drainage area such as a mall shopping area may have such an insignificant area of unpaved surfaces and landscaping that it may be more practical to consider it as 100% impervious.

The condition of the vegetative cover in unpaved areas has an effect on the volume and rate of runoff from a watershed. The SCS has qualitatively defined vegetative cover as poor, fair or good condition relative to the percentage of ground cover. These qualitative terms are defined below.

- Poor: Less than 50 percent ground cover; heavily grazed with no plant litter.
- Fair: 50 to 75 percent ground cover; not heavily grazed, some plant litter.
- Good: Greater than 75 percent ground cover; only lightly or occasionally grazed.

Existing open areas in an urban setting and post-development open areas will usually be classified as having fair or good cover. Range land that is proposed for development may be sufficiently infested with mesquite growth such that bare areas exist beneath the tree canopy. Although such areas of pre-development heavy mesquite cover are not expected to be extensive, curve number selection for these areas may have to be selected on a woodland basis. The designer should consult with the City Engineer on the selection of a pre-development curve number when heavy mesquite infestations are involved.

Finally, the Antecedent Moisture Condition (AMC) affects the curve number value, which in turn affects the volume and rate of runoff from a watershed. The AMC is descriptive of the precipitation received on the design watershed prior to the design storm event. As most designers know, the more saturated a soil is prior to a storm event, then the greater the runoff volume and peak discharge that can be expected. The SCS has defined three AMC's according to season and the precipitation which occurs in the five-day period immediately preceding a design storm event. AMC I has the lowest runoff potential. The soils in the design watershed are dry enough for satisfactory plowing or cultivation to take place. AMC II is defined as the average condition. AMC III has the highest runoff potential since the watershed is considered practically saturated from antecedent rains. The following table from the SCS National Engineering Handbook Section 4 summarizes the Antecedent Moisture Condition parameters.

AMC Group	<u>Total 5-day Antecedent Rainfall</u>	
	<u>Dormant Season</u> (Inches)	<u>Growing Season</u> (Inches)
I	<0.5	<1.4
II	0.5 to 1.1	1.4 to 2.1
III	>1.1	>2.1

These AMC's for the dormant season are valid when the soils are not frozen and there is no snow on the ground. For designs in Midland County, soil freezing and snow may be ignored for practical design purposes. The Flood Insurance Study for Midland County made use of AMC I.4, which was determined to be the actual average antecedent moisture condition for this region.

Table 4-5 lists the soil-cover complex curve numbers for various land uses for an AMC II condition. Table 4-6 lists curve numbers by land use that specifically apply to Midland for AMC II conditions. Table 4-7 lists the AMC I, AMC I.4 and AMC III curve numbers which correspond to an AMC II condition. The AMC I.4 curve numbers in Table 4-7 are interpolations between the AMC I and AMC II curve numbers and represent the drier than average antecedent moisture condition for areas surrounding Midland. It is determined by

$$CN \text{ AMC I.4} = CN \text{ AMC I} + 0.4(CN \text{ AMC II} - CN \text{ AMC I}) \quad (\text{Eq. 4-3})$$

TABLE 4-5
SOIL-COVER COMPLEX CURVE
NUMBERS FOR AMC II CONDITIONS

COVER DESCRIPTION, TYPE AND HYDROLOGIC CONDITION		CURVE NUMBER FOR HYDROLOGIC SOIL GROUP			
		A	B	C	D
Developed Urban Areas					
Open Space, lawns, parks, golf courses, cemeteries, etc.	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Impervious Areas (roofs, paved parking lots, sidewalks, paved streets, etc.)		98	98	98	98
Gravel streets and alleys		76	85	89	91
Dirt streets and alleys		72	82	87	89
Commercial and business areas (85% impervious)		89	92	94	95
Industrial area (72% impervious)		81	88	91	93
Residential, by lot size					
1/8 acre or less	(65% impervious)	77	85	90	92
1/4 acre	(38% impervious)	61	75	83	87
1/3 acre	(30% impervious)	57	72	81	86
1/2 acre	(25% impervious)	54	70	80	85
1 acre	(20% impervious)	51	68	79	84
2 acres	(12% impervious)	46	65	77	82
Bare Ground		77	86	91	94
Pasture, grassland or range - continuous forage for grazing	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Brush-weed-grass mixture with brush the major element	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Farmsteads-buildings, lanes, driveways, and surrounding lots		59	74	82	86

Source: SCS TR-55, June 1986.

TABLE 4-6
SCS METHOD COMPOSITE
CURVE NUMBERS FOR AMC II

Zoned Land Use	Percent Impervious	AMC II Composite Curve Number for Hydrologic Soil Group			
		A	B	C	D
Single Family, Zone 1F	60%	74	83	88	91
Multifamily:					
Zones 2F, MF-1	60%	74	83	88	91
Zone MF-2	70%	80	87	91	93
Mobile Home, Zone MH	55%	76	85	89	92
Commercial					
General Office:					
Zones 0-1, 0-2	80%	86	91	93	94
Commercial Service:					
Zones C-1, C-2, C-3	85%	89	92	94	95
Industrial Park, Zone IP-1	50%	74	84	89	91
Light Industrial, Zone LI					
Heavy Industrial, Zone HI	65%	88	91	94	95
Townhomes, Zone TH	70%	80	87	91	93
Agricultural Estate	15%	56	73	82	86
Zone AE					
Parking, Local Retail and Neighborhood Service	98%	97	97	98	98

The designer shall determine runoff curve numbers for zones not listed.

Detailed analysis must be submitted to justify the use of lower curve number values.

The City Engineer may require the use of higher curve number values if the percent impervious exceeds that listed above.

TABLE 4-7
CURVE NUMBER CONVERSION
FOR AMC-I, AMC I.4 AND AMC-III

AMC II CURVE NO.	CORRESPONDING CURVE NO.'S		
	AMC I CURVE NO.	AMC I.4 CURVE NO.	AMC III CURVE NO.
35	18	25	55
36	19	26	56
37	20	27	57
38	21	28	58
39	21	28	59
40	22	29	60
41	23	30	61
42	24	31	62
43	25	32	63
44	25	33	64
45	26	34	65
46	27	35	66
47	28	36	67
48	29	37	68
49	30	38	69
50	31	39	70
51	31	39	70
52	32	40	71
53	33	41	72
54	34	42	73
55	35	43	74
56	36	44	75
57	37	45	75
58	38	46	76
59	39	47	77
60	40	48	78
61	41	49	78
62	42	50	79
63	43	51	80
64	44	52	81
65	45	53	82
66	46	54	82
67	47	55	83
68	48	56	84
69	50	58	84

TABLE 4-7
CURVE NUMBER CONVERSION
FOR AMC-I, AMC I.4 AND AMC-III

AMC II CURVE NO.	CORRESPONDING CURVE NO.'S		
	AMC I CURVE NO.	AMC I.4 CURVE NO.	AMC III CURVE NO.
70	51	59	85
71	52	60	86
72	53	61	86
73	54	62	87
74	55	63	88
75	57	64	88
76	58	65	89
77	59	66	89
78	60	67	90
79	62	69	91
80	63	70	91
81	64	71	92
82	66	72	92
83	67	73	93
84	68	74	93
85	70	76	94
86	72	78	94
87	73	79	95
88	75	80	95
89	76	81	96
90	78	83	96
91	80	84	97
92	81	85	97
93	83	87	98
94	85	89	98
95	87	90	98
96	89	92	99
97	91	93	99
98	94	96	99
99	97	98	100
100	100	100	100

Source: SCS National Engineering Handbook, Section 4.

where CN AMC I.4 = Curve number after interpolation which corresponds to the average rural moisture condition.

condition. CN AMC I = Curve number corresponding to the normal AMC I

CN AMC II = Curve number corresponding to the normal AMC II condition.

For existing conditions where the land use is primarily range, the AMC II curve number should be converted to an AMC I.4 curve number. The AMC II curve number should be used for proposed development areas located within the City of Midland and its extra-territorial jurisdiction, as well as the existing urban areas. This will account for the potential runoff effects due to the antecedent moisture condition from lawn and landscape irrigation.

4.5.4 Curve Number Adjustment in Flood Insurance Study

As described in Section 3.1.1, the original Midland County Flood Insurance Study was performed by the U.S. Army Corps of Engineers. Due to the huge size of the watersheds involved, it was not possible to route through every playa lake. The Corps developed a procedure to account for playa lake storage by curve number reductions.

This procedure is as follows:

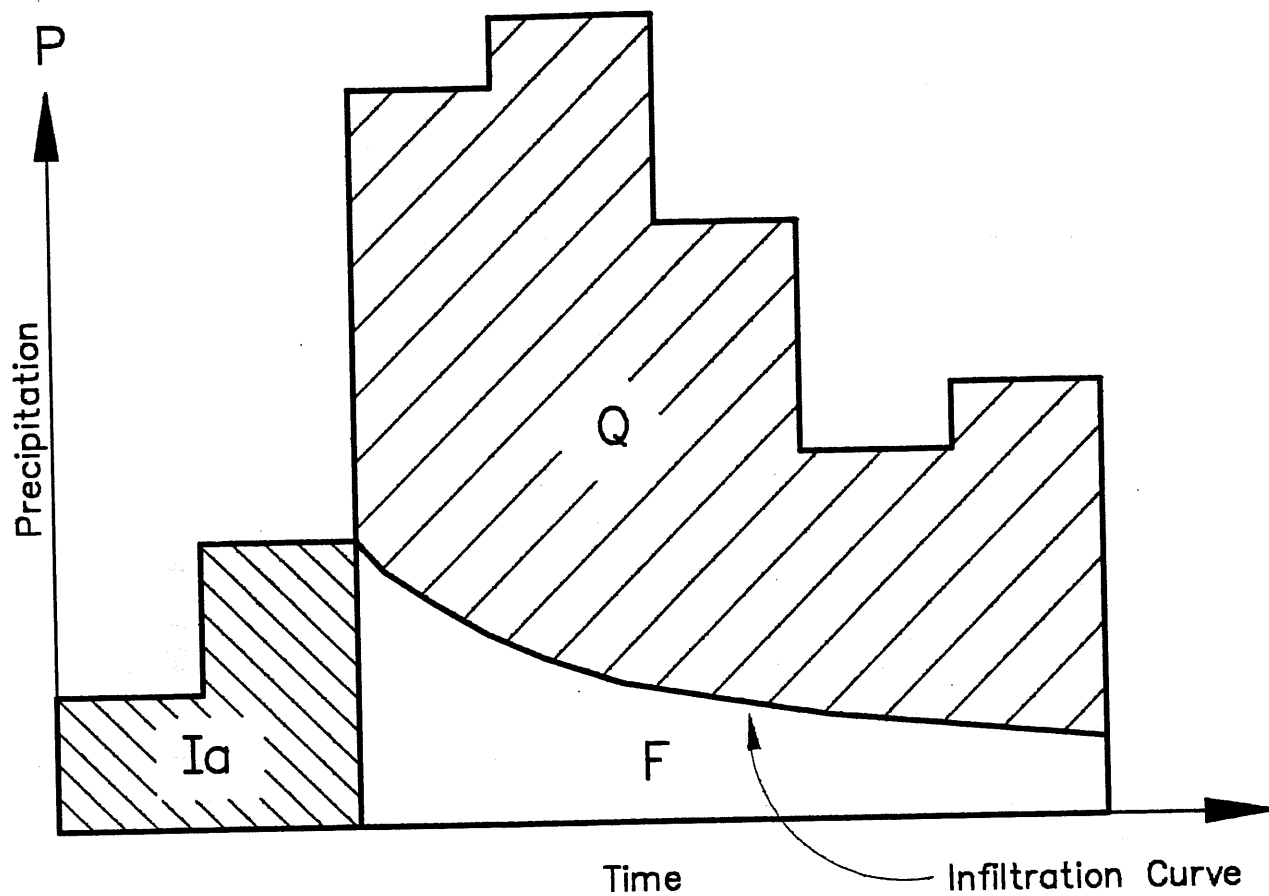
- Computer runoff in inches from each subarea using correct AMC I.4 curve number and equation 4-9.
- Multiply runoff by subarea acreage to obtain total runoff volume in acre-inches.
- Estimate playa lake storage volume in acre-inches.
- Subtract playa lake storage volume from total runoff volume to obtain effective runoff volume in acre-inches.
- Divide effective runoff volume by subarea acreage to compute an effective runoff in inches.
- Replace runoff Q in Equation 4-9 with the effective runoff and solve the equation for S, the potential maximum retention.
- Solve equation 4-10 for CN using the S developed in the last step.

This method used for the Jal and Midland Draw watersheds resulted in curve numbers as low as 25. While this method produces the correct runoff volume in large watersheds, it is not adequate for design. In instances where the Flood Insurance Study is to be updated and a playa lake is in the affected portion, a storage routing through the playa must be used.

All playa lakes within new developments must not have their volume reduced through fill or lowering of the overflow elevation. "Section 10: Storm Water Detention", Subsection 10.7, contains a more complete discussion of playa lakes.

4.5.5 Rainfall-Runoff Relationship

The Soil Conservation Service (SCS) has developed a rainfall-runoff relationship to calculate the total runoff volume for a single storm. The volume of runoff depends on the volume of precipitation and the volume of storage that is available for retention. The actual retention is the difference between the volumes of precipitation and runoff. Furthermore, a certain volume of the precipitation at the beginning of the storm will not appear as runoff and this volume is called the initial abstraction. The SCS developed the following rainfall-runoff relation which is also shown schematically in Figure 4-6:



RELATIONSHIP BETWEEN PRECIPITATION, RUNOFF, AND RETENTION

Source: Richard McCuen, A Guide to Hydrologic Analysis
Using SCS Methods

FIGURE 4-6

$$\frac{F}{S} = \frac{Q}{P-I_a} \quad (\text{Eq 4-4})$$

where F = Actual retention

S = Potential maximum retention (S is equal to or greater than F)

Q = Actual runoff volume

P = Precipitation as rainfall (P is equal or greater than Q)

I_a = Initial abstraction

The actual retention (F), when the initial abstraction (I_a) is considered is:

$$F = (P-I_a) - Q \quad (\text{Eq 4-5})$$

Substituting Equation 4-5 into Equation 4-4 yields the following:

$$\frac{(P-I_a) - Q}{S} = \frac{Q}{P-I_a} \quad (\text{Eq 4-6})$$

Rearranging Equation 4-6 to solve for Q results in:

$$Q = \frac{(P-I_a)^2}{(P-I_a)+S} \quad (\text{Eq 4-7})$$

The initial abstraction (I_a) is a function of land use, treatment and condition; interception; infiltration; depression storage; and antecedent soil moisture. An empirical analysis was performed by the SCS for the development of the rainfall-runoff relation, and the following formula was found to be best for estimating I_a:

$$I_a = 0.2S \quad (\text{Eq 4-8})$$

Research performed by the Soil Conservation Service since the development of Equation 4-8 has suggested that Equation 4-8 may not be correct under all circumstances. However, it remains in use until the SCS performs and accepts a more comprehensive study. It is important to note that Equation 4-8 implies that the factors affecting I_a would also affect S. Substituting Equation 4-8 into Equation 4-7 yields:

$$Q = \frac{(P-0.2S)^2}{P + 0.8S} \quad (\text{Eq 4-9})$$

While Equation 4-7 has two unknowns, I_a and S, Equation 4-9 has been reduced to an equation with one unknown, S. Empirical studies indicate that S can be estimated by:

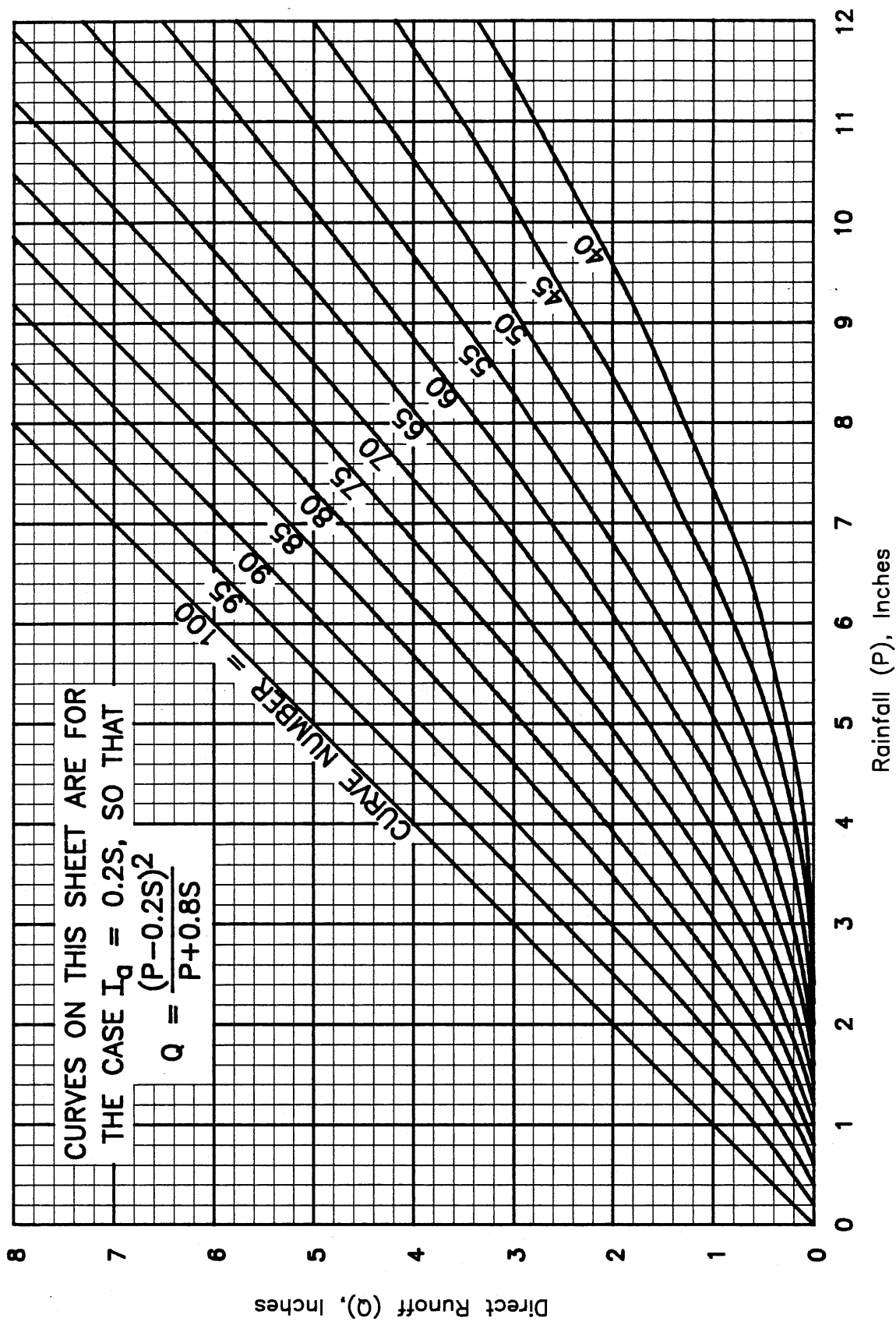
$$S = \frac{1000}{CN} - 10 \quad (\text{Eq 4-10})$$

where:

CN = Soil-cover complex curve number

S = Potential maximum retention.

Thus, the rainfall relationship of Equation 4-9, which has one unknown, has been replaced with another relationship with one unknown, CN. The runoff volume can be determined as a function of precipitation volume and curve number. The SCS has prepared rainfall versus runoff curves which are shown in Figure 4-7. With a known curve number and the design rainfall then the direct runoff can be read from Figure 4-7.



SOLUTION OF SCS RUNOFF EQUATION

FIGURE 4-7

SOURCE: SCS TR-55, JUNE 1986

4.5.6 SCS Type II Rainfall Distribution

The SCS has developed a dimensionless rainfall distribution using the U.S. Weather Bureau's Rainfall Frequency Atlases. The rainfall frequency data for areas less than 400 square miles, for durations to 24 hours and for major regions, and the resulting rainfall distributions were labeled Type I and Type II. The Type I distribution is intended for Hawaii, Alaska and the coastal side of the Sierra Nevada and Cascade Mountains in California, Oregon and Washington. Since the Type I distribution is not applicable to the Midland, Texas area, it is dropped from further discussion and consideration. The Type II distribution will define the rainfall distribution to be used in designs within, and around, the City of Midland.

The Type II distribution is based on the generalized rainfall depth-duration-frequency relationships shown in technical publications of the Weather Bureau (now known as the National Weather Service of the National Oceanic and Atmospheric Administration), and rainfall depths for durations from 30 minutes to 24 hours were obtained from these publications and used to derive the storm distribution shown in Figure 4-8.

A tabular summary of the 24-hour Type II distribution is shown in Table 4-8. Both Figure 4-8 and Table 4-8 are for 24-hour rainfall durations only. A dimensionless Type II rainfall distribution table has been included in Table 4-9 which can be used for all rainfall durations.

Table 4-10 contains the rainfall depths to be used with hydrologic computer models for designs in the City of Midland. Rainfall durations of other than 24 hours are included in Table 4-10. Some aspects of design, such as the design of detention basin outlet works, require evaluation with different rainfall frequencies, depths and durations so that downstream hydrographs can be analyzed for detrimental peak discharges and peak times. Note that the 2-year, 5-year and 10-year storm rainfall values are partial-duration series. The rainfall depths for these frequencies must be multiplied by the factors at the bottom of Table 4-10 for conversion to annual series. This must be done manually except for HEC-1 hydrologic models. HEC-1 will automatically apply the conversion factor to the input rainfall depth.

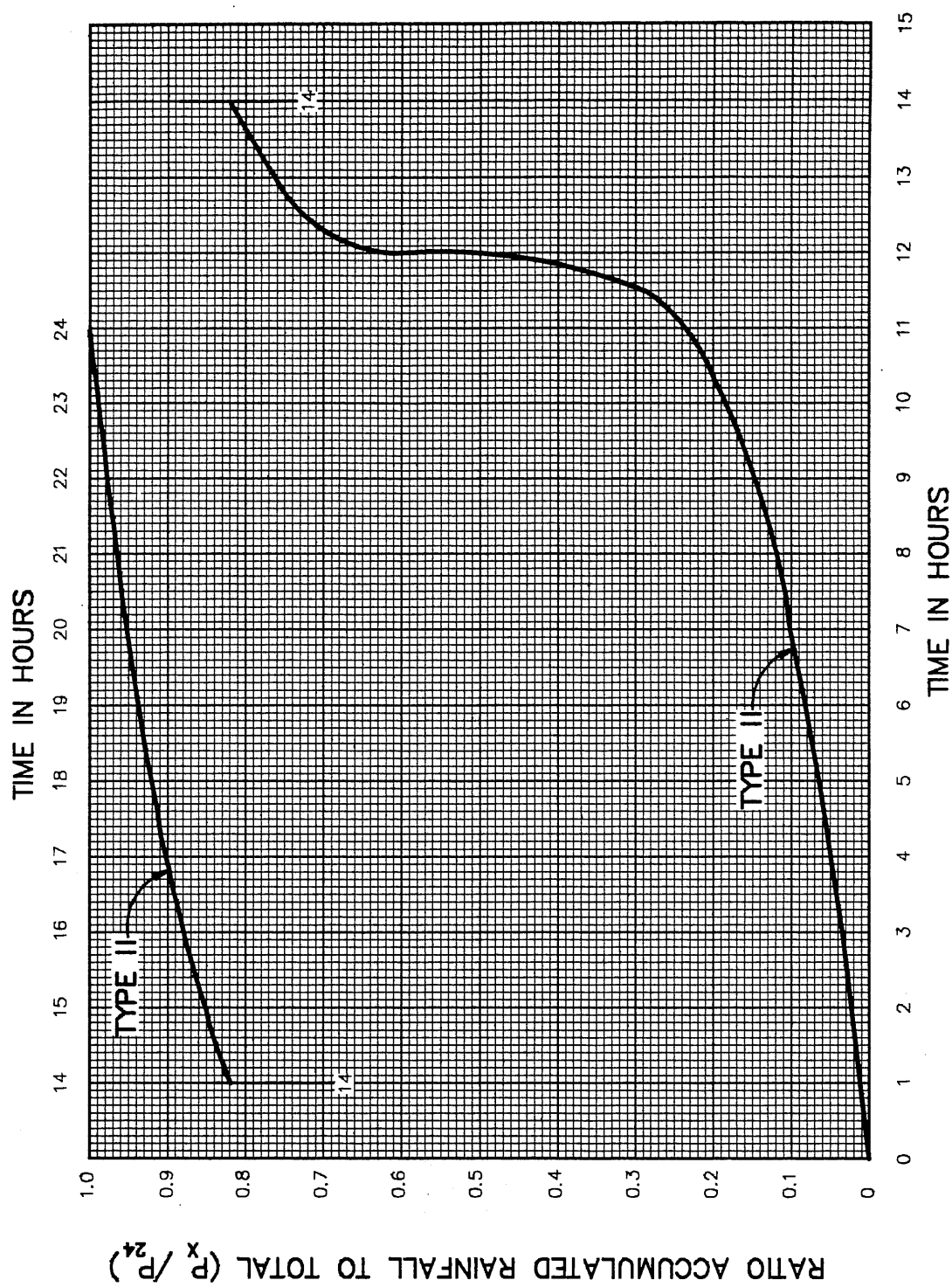
4.5.7 Time of Concentration

The time of concentration will be calculated as discussed in the previous paragraphs of this manual section. The time of concentration will be the sum of the various travel times for the watershed subarea under consideration. On large watersheds or subareas of over three square miles area, the initial 500 feet of overland flow time is very small relative to total travel time and may be ignored for practical purposes.

4.5.8 Peak Discharge by Graphical Method (SCS TR-55)

The Graphical Method of peak discharge determination derives its name from a graph that relates the time of concentration (T_c) in hours, and the unit peak discharge in cubic feet per second per square mile of drainage area per inch of runoff (csm/in). This graph is reproduced in Figure 4-9. Note that the initial abstraction to precipitation ratio (I_a/P) must be determined to use Figure 4-9.

The Graphical Method is subject to certain limitations which are stated in "SCS Technical Release 55, Urban Hydrology for Small Watersheds" (TR-55), June 1986, and Richard McCuen's "Hydrologic Analysis and Design" (Reference 11).



TYPE II TWENTY-FOUR HOUR RAINFALL DISTRIBUTION (SCS)

Source: Richard McCuen, A Guide to Hydrologic Analysis
Using SCS Methods

FIGURE 4-8

TABLE 4-8
SCS 24-HOUR TYPE II
RAINFALL DISTRIBUTION

STORM TIME (HOURS)	CUMULATIVE PRECIPITATION RATIO (P_x/P_{24})	STORM TIME (HOURS)	CUMULATIVE PRECIPITATION RATIO (P_x/P_{24})
0.0	0.0		
0.5	0.0053	12.5	0.7351
1.0	0.0108	13.0	0.7724
1.5	0.0164	13.5	0.7989
2.0	0.0223	14.0	0.8197
2.5	0.0284	14.5	0.8380
3.0	0.0347	15.0	0.8538
3.5	0.0414	15.5	0.8676
4.0	0.0483	16.0	0.8801
4.5	0.0555	16.5	0.8914
5.0	0.0632	17.0	0.9019
5.5	0.0712	17.5	0.9115
6.0	0.0797	18.0	0.9206
6.5	0.0887	18.5	0.9291
7.0	0.0984	19.0	0.9371
7.5	0.1089	19.5	0.9446
8.0	0.1203	20.0	0.9519
8.5	0.1328	20.5	0.9588
9.0	0.1467	21.0	0.9653
9.5	0.1625	21.5	0.9717
10.0	0.1808	22.0	0.9777
10.5	0.2042	22.5	0.9836
11.0	0.2351	23.0	0.9892
11.5	0.2833	23.5	0.9947
12.0	0.6632	24.0	1.0000

Source: Richard McCuen, A Guide to Hydrologic Analysis Using SCS Methods

TABLE 4-9
SCS TYPE II DIMENSIONLESS
RAINFALL TABLE

CUMULATIVE TIME RATIO ($T_X/T_{DURATION}$)	CUMULATIVE PRECIPITATION RATIO ($P_X/P_{DURATION}$)	CUMULATIVE TIME RATIO ($T_X/T_{DURATION}$)	CUMULATIVE PRECIPITATION RATIO ($P_X/P_{DURATION}$)
0.0	0.0		
0.02	0.0080	0.52	0.724
0.04	0.0162	0.54	0.742
0.06	0.0246	0.56	0.759
0.08	0.0333	0.58	0.775
0.10	0.0425	0.60	0.790
0.12	0.0524	0.62	0.8043
0.14	0.0630	0.64	0.8180
0.16	0.0743	0.66	0.8312
0.18	0.0863	0.68	0.8439
0.20	0.0990	0.70	0.8561
0.22	0.1124	0.72	0.8678
0.24	0.1265	0.74	0.8790
0.26	0.142	0.76	0.8898
0.28	0.160	0.78	0.9002
0.30	0.180	0.80	0.9103
0.32	0.205	0.82	0.9201
0.34	0.255	0.84	0.9297
0.36	0.345	0.86	0.9391
0.38	0.437	0.88	0.9483
0.40	0.530	0.90	0.9573
0.42	0.603	0.92	0.9661
0.44	0.633	0.94	0.9747
0.46	0.660	0.96	0.9832
0.48	0.684	0.98	0.9916
0.50	0.705	1.00	1.000

Source: Soil Conservation Service, TR-20 Project Formulation (User's Manual), Hydrology, 1965.

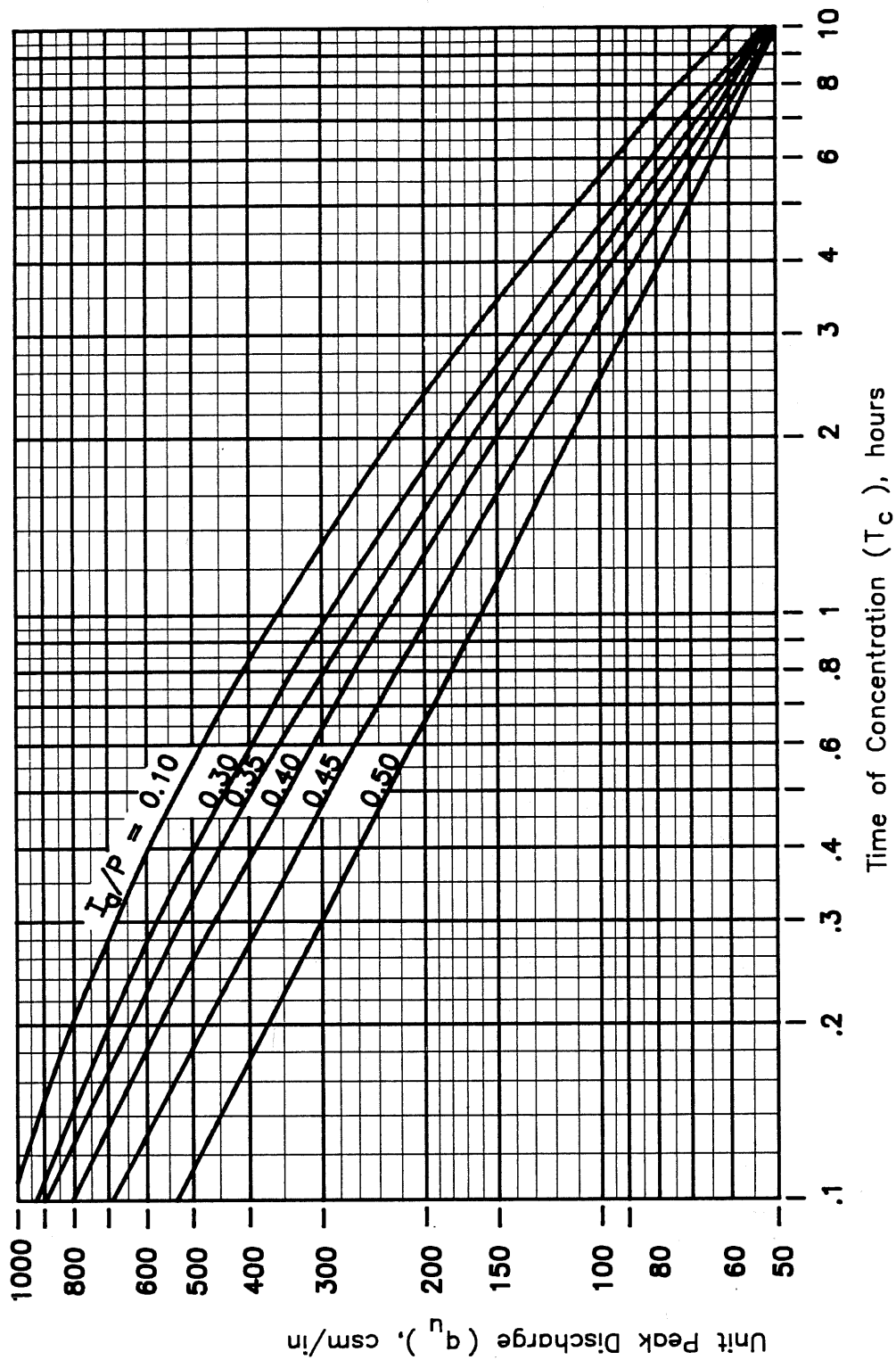
TABLE 4-10
CITY OF MIDLAND, TEXAS
RAINFALL DEPTH-DURATION

SOURCES: TECHNICAL PAPER 40, U.S. DEPT. OF COMMERCE
USDA SOIL CONSERVATION SERVICE FORMS 4-R-15480
NOAA TECHNICAL MEMORANDUM NWS HYDRO-35

RETURN PERIOD	5-MIN DURATION	15-MIN DURATION	1-HOUR DURATION (INCHES)	2-HOUR DURATION (INCHES)	3-HOUR DURATION (INCHES)	6-HOUR DURATION (INCHES)	12-HOUR DURATION (INCHES)	24-HOUR DURATION (INCHES)
2-YEAR	0.42	0.79	1.41	1.57	1.72	2.10	2.35	2.74
5-YEAR	0.51	0.82	1.82	2.19	2.30	2.79	3.26	3.79
10-YEAR	0.58	1.16	2.15	2.62	2.78	3.34	3.91	4.58
25-YEAR	0.67	1.37	2.50	3.05	3.27	3.86	4.66	5.31
50-YEAR	0.75	1.53	2.80	3.41	3.73	4.49	5.28	6.08
100-YEAR	0.82	1.70	3.32	3.85	4.19	5.05	5.94	6.83
500-YEAR*	0.98	2.26	4.20	5.17	5.63	6.80	8.10	9.10

(2-Year Depth) X 0.88 = Annual Series
(5-Year Depth) X 0.96 = Annual Series
(10-Year Depth) X 0.99 = Annual Series

*500-Year frequency rainfall depths extrapolated from log depth vs. probability plots of 2-year through 100-year rainfall depths.



UNIT PEAK DISCHARGE (q_u) FOR SCS TYPE II RAINFALL DISTRIBUTION

FIGURE 4-9

SOURCE: SCS TR-55, JUNE 1986

The limitations to using the Graphical method of TR-55 are:

A. The watershed should have a homogeneous weighted curve number. Where parts of the watershed have curve numbers that differ by 5 or more, then the watershed should be subdivided and either the Tabular Method (Section 4.5.9) or the Hydrograph Method (Section 4.6) used for peak discharge determination.

B. The curve number which defines the drainage area must be greater than 40.

C. The time of concentration must be between 0.1 hours and 10.0 hours.

D. The initial abstraction to precipitation ratio (I_a/P) must range from 0.1 to 0.5. If the calculated I_a/P ratio is outside of the 0.1 to 0.5 limits, then use 0.1 or 0.5 as the limiting ratio as applicable.

E. The watershed has no more than one main channel, or when there are two main channels the times of concentration for each channel are nearly equal.

F. Detention and channel routing cannot be performed with this method.

G. If watershed storage is greater than 5% of the runoff volume, or is located on the flow path used to determine the time of concentration, then another method must be used.

H. When the Graphical Method is used to develop estimates of peak discharge for both present and developed conditions of a watershed, then use the same method for the calculation of the time of concentration.

Example: A small watershed of 100 acres is under consideration for development into single-family housing units. The undeveloped hydrologic group B site is poor condition range with a curve number of 79 (Table 4-5). The finished site is expected to have a curve number of 75 for 1/4-acre lots (Table 4-5). The time of concentration for predeveloped and post-developed conditions are 0.8 hours and 0.5 hours respectively. Find the predeveloped and post-developed peak discharges for the 100-year, 24-hour rainfall event of 6.83 inches (Table 4-10). Use AMC I.4 for predeveloped conditions and AMC II for developed conditions. The predevelopment T_c is 0.8 hours and the post-development T_c is 0.5 hours.

Step 1: Adjust the predeveloped condition runoff curve number.

Convert Range AMC II CN to AMC I.4 CN.

Table 4-7, AMC II CN 79 = AMC I.4 CN 69.

Step 2: Compare site conditions with Graphical Method limitations. For this example, the conditions are within Graphical Method limits.

Determine Initial Abstraction (I_a)

$I_a = 0.2S$

$$S = (1000/CN) - 10$$

$$\text{Predeveloped } S = (1000/69) - 10 = 4.49$$

$$I_a = 0.2 \times 4.49 = 0.90 \text{ inches}$$

$$\text{Post-developed } S = (1000/75) - 10 = 3.33$$

$$I_a = (0.2)(3.33) = 0.67 \text{ inches}$$

Step 3: Determine I_a/P ratios.

100-year 24-hour rainfall depth = 6.83 inches.

$$\text{Predeveloped } I_a/P = 0.90/6.83 = 0.13$$

$$\text{Post-developed } I_a/P = 0.67/6.83 = 0.098 \text{ use } 0.10$$

Step 4: Determine runoff volume

$$Q = \frac{(P-0.2S)^2}{P+0.8S} = \frac{((6.83 - (0.2 \times 4.49))^2}{6.83 + (0.8 \times 4.49)}$$

$Q = 3.38$ inches, use 3.4 inches predeveloped

$$Q = \frac{((6.83 - (0.2 \times 3.33))^2}{6.83 + (0.8 \times 3.33)}$$

$Q = 4.0$ inches post-developed.

Figure 4-7 can also be used to determine the runoff volume.

Step 5 Determine unit peak discharge.

Enter Figure 4-9 with the predeveloped T_c of 0.8 hours, predeveloped runoff Q of 3.4 inches, and I_a/P from Step 3 of 0.13, then read the unit peak discharge $q_u = 400$ csm/in.

Convert the drainage area to square miles.

$$100 \text{ ac.}/640 \text{ ac. per sq. mi.} = 0.156 \text{ sq. mi.}$$

Find the predeveloped condition peak discharge.

$$\text{Predeveloped } Q_p = (400 \text{ csm/in})(0.156 \text{ sq. mi.})(3.4 \text{ inches})$$

$$\text{Predeveloped } Q_p = \underline{212 \text{ cfs}} \quad \text{ans.}$$

Find the post-developed peak discharge.

Enter Figure 4-9 with the post-developed T_c of 0.5 hours, post-developed runoff Q of 4.0 inches, and I_a/P from Step 3 of 0.10, read the unit peak discharge $q_u = 530$ csm/in.

Calculate Q_p with post-developed values.

$$\text{Post-developed } Q_p = (530 \text{ csm/in})(0.156 \text{ sq. mi.})(4.0 \text{ inches})$$

$$\text{Post-developed } Q_p = \underline{331 \text{ cfs}} \quad \text{ans.}$$

4.5.9 SCS Tabular Method (TR-55)

The Tabular Method presented in TR-55, based on the 1986 revision of the manual, was designed for use in the following circumstances:

A. For developing composite flood hydrographs at any point within a watershed;

B. For measuring the effects of changes in land use of one or more subwatersheds;

C. For assessing the effects of stormwater detention structures or combinations of structures.

In general, the procedure was intended for measuring the effect on the composite flood hydrograph of changes within subwatersheds of a larger drainage area.

The input requirements for the Tabular Method are minimal. The 24-hour rainfall depth for a selected return period is required. For each subwatershed, the drainage area, the runoff curve number, and the time-of-concentration must be determined. Additionally, the travel time for each channel reach is necessary.

Before the method is used, a user should be familiar with several constraints. First, the constraints that were used in developing the method are important when applying the method. The tabular method was developed by making numerous computer runs with the TR-20 program. In each case, a runoff CN of 75 was used with a drainage area of one square mile, a T_c ranging from 0.1 hour to 2 hours, and T_t ranging from zero hours to 3 hours. The Modified Att-Kin Method was used for reach routing. Rainfall volumes were sufficient to yield three inches of runoff. When the tabular method is applied to cases having characteristics that are significantly different from the conditions used in developing the method, then the resulting hydrograph may not provide close agreement with the hydrograph that would result from a TR-20 analysis. These assumptions are not considered to be critical when the sole purpose in using the method is to assess the effect of changes in a watershed, such as land use or structure changes. The difference in the before/after hydrographs is relatively insensitive to the assumption of a CN of 75.

In order to make accurate assessments of watershed changes, there are certain limitations that should be adhered to in applying the method. First, within any subwatershed there should be little variation in curve number (CN). This does not mean that subwatersheds should have similar CN's but that each separate subwatershed should have little internal variation in soil and land use characteristics. Second, the area of each subwatershed should be less than 20 square miles. This criteria manual has limited TR-55 usage to drainage areas of one square mile for hand calculations and three square miles for computer versions of the method. Third, if the I_a/P ratio for the rainfall being analyzed falls outside of the range shown in the TR-55 hydrograph tables, then use the limiting table value. Again, if the weighted curve number is less than 40 as with the Graphical Method, then another method must be used to determine runoff.

For each rainfall type, there are 30 tables of tabular discharges in cfs per square mile per inch of runoff (csm/in) for hydrograph times (ie, the time from the beginning of runoff) ranging from 11.0 hours to 26.0 hours in various time increments. There are ten possible times of concentration to use ranging from 0.1 to 2.0 hours. For the selected time of concentration, there are three possible tables representing three I_a/P ratios: 0.1, 0.3 and 0.5. The I_a/P ratio is computed using equations 4-8 and 4-10, with P equal to the total precipitation. Once the correct table is located, the line of that table corresponding to the travel time for the subarea is used to obtain a hydrograph for the subarea at the computation point. The designer will only use those tables applicable to the Type II rainfall distribution for Midland analysis.

It will be noted that only even values of T_c , T_t , and I_a/P are used in the tables. Interpolation of T_c and T_t values is not permitted because the peaks of the hydrograph do not line up for different times. T_c and T_t should be rounded up or down to the table values in such a way that this rounded sum is as close as possible to their actual sum. For a given T_c and T_t , however, the I_a/P value may be linearly interpolated since the peak times tend to be constant.

The procedure used in developing a tabular discharge hydrograph is to segment the watershed into appropriate subareas and identify the necessary input for each subarea and channel reach. The hydrograph at the design point due to runoff from any subarea is determined by entering the appropriate table in TR-55 for the subarea T_c , the correct I_a/P ratio and the total travel time from the outlet of the subarea to the design point. Each tabular value is multiplied by the subarea's runoff amount and contributing watershed area. The total hydrograph is determined by summing the subarea hydrographs. The solution procedure is best illustrated with an example.

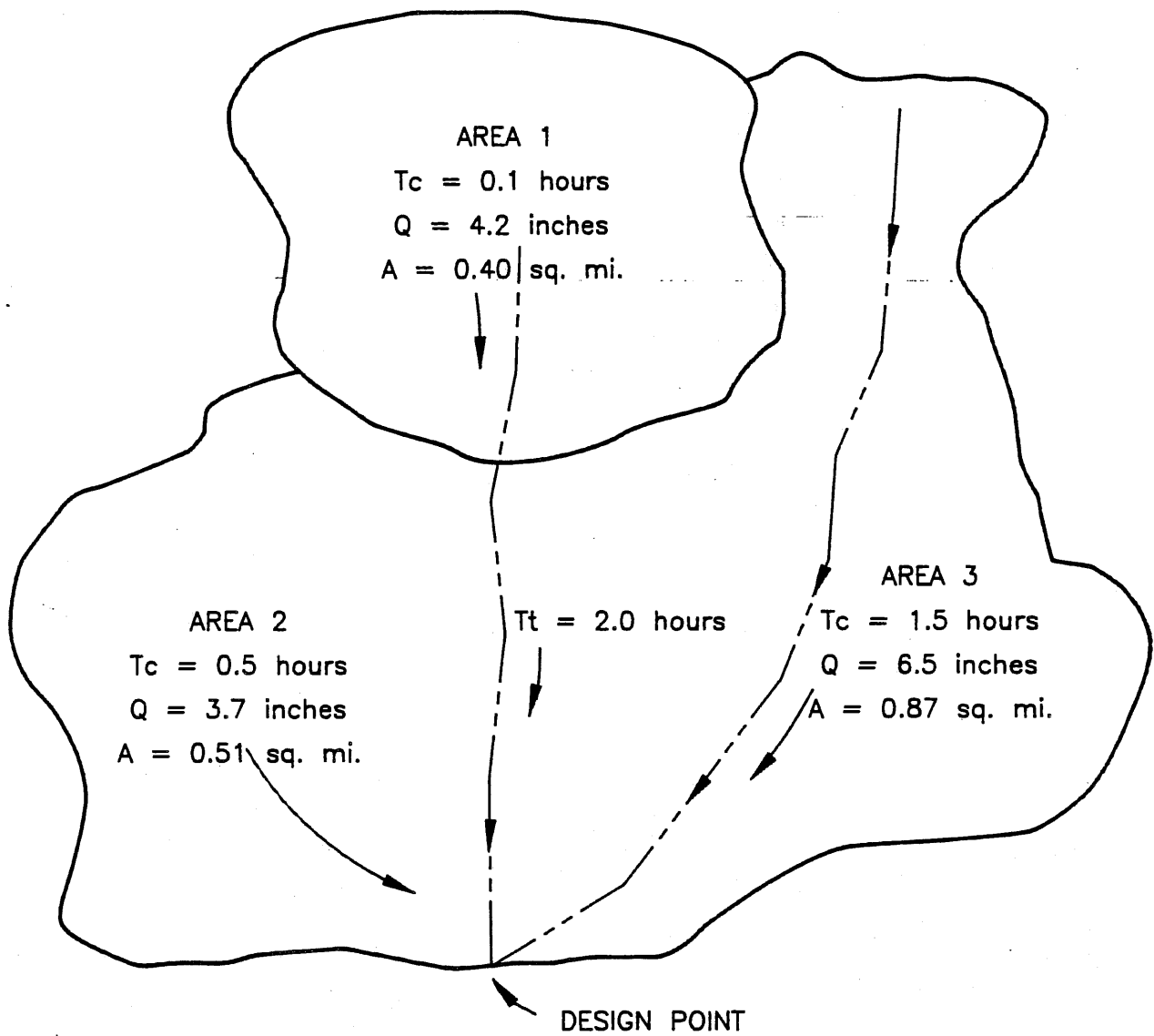
Example: A watershed consisting of three subareas is shown in Figure 4-10. Rainfall depth is 6.83 inches. The times of concentration (sum of travel times), runoff depths (from curve numbers and rainfall depths) and I_a/P ratios are as follows:

Area No.	Area (sq. mi)	T_c (hr)	T_t (hr)	CN	S	I_a (in.)	Q (in.)	I_a/P
1	0.40	0.1	2.0	77	3.0	0.6	4.2	0.1
2	0.51	0.5	0	72	3.9	0.8	3.7	0.1
3	0.87	1.5	0	59	6.9	1.4	2.4	0.2

Table 4-11 contains the unit peak discharges from TR-55 for T_c 's of 0.1 hours, 0.5 hours and 1.5 hours. Table 4-11 also has the unit peak discharges for the two-hour travel time of Area 1 to the design point. Since I_a/P interpolation is needed for Area 3, values for both I_a/P ratios of 0.1 and 0.3 are also included in Table 4-11. Calculate the peak discharge at the outlet of Area 1 and the hydrograph at the design point.

Step 1: The peak discharge at the outlet to Area 1 is rather simple to calculate. The greatest peak unit discharge from Table 4-11 for $T_c = 0.1$ hours, $I_a/P = 0.10$ and $T_t = 0$ hours is 1010 csm/in at a hydrograph time of 12.1 hours. Since peak discharge is the only value of interest for this subarea at this point, then the 1010 csm/in needs only to be multiplied by the drainage area and inches of runoff.
 Area 1 $Q_p = 1010 \text{ cfs/in/sq.mi.} \times 0.40 \text{ sq.mi.} \times 4.2 \text{ in.}$
 Area 1 $Q_p = \underline{1,697 \text{ cfs}}$ ans.

Step 2: To determine the tabular hydrograph at the design point, a hydrograph for Area 1, Area 2 and Area 3 must be separately determined and then added together as explained below.



WATERSHED AND SUBAREAS FOR TABULAR METHOD EXAMPLE

FIGURE 4-10

TABLE 4-11
TR-55 TABULAR DISCHARGES (CSM/IN)
(Note: $I_a/P = I_a/P$)

TIME OF CONCENTRATION = 0.1 HOURS, $I_a/P = 0.1$

	Hydrograph Time in Hours																			
	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
I_t	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
0	24	34	53	334	647	1010	623	217	147	123	104	86	76	66	57	51	46	42	38	34
2.00	4	6	7	9	9	10	11	12	13	15	16	18	20	25	37	72	150	252	336	312
I_t	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0										
0	26	23	21	20	19	18	15	13	12	0										
2.00	58	42	34	30	27	24	20	18	13	8										

TIME OF CONCENTRATION = 0.5 HOURS, $I_a/P = 0.1$

	Hydrograph Time in Hours																			
	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
I_t	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
0	17	23	32	57	94	170	308	467	529	507	402	297	226	140	96	74	61	53	47	41
I_t	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0										
0	29	26	23	21	20	19	16	14	12	0										

TIME OF CONCENTRATION = 1.5 HOURS, $I_a/P = 0.1$

	Hydrograph Time in Hours																			
	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
I_t	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
0	9	11	15	21	25	31	41	58	82	112	147	184	216	255	275	236	198	159	129	98
I_t	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0										
0	43	35	30	25	23	21	18	16	12	1										

Source: Soil Conservation Service, TR-55, June 1986

TABLE 4-11 CONTINUED
 TR-55 TABULAR DISCHARGES (GSM/IN)
 (Note: $I_a/P = I_a/P$)

TIME OF CONCENTRATION = 1.5 HOURS, INTERPOLATED $I_a/P = 0.2$

I_t	Hydrograph Time in Hours																			
	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
0	5	6	8	11	13	16	24	37	57	83	114	148	180	224	250	222	192	158	132	103
																			83	64
I_t	Hydrograph Time in Hours																			
	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0										
0	50	42	36	31	29	26	23	21	16	2										

TIME OF CONCENTRATION = 1.5 HOURS, $I_a/P = 0.3$

I_t	Hydrograph Time in Hours																			
	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3
0	0	0	0	0	0	1	6	15	31	53	80	112	144	193	225	208	186	157	134	108
																			89	70
I_t	Hydrograph Time in Hours																			
	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0										
0	56	48	42	37	34	31	28	25	20	2										

Source: Soil Conservation Service TR-55, June 1986

Step 3: For Area 1, the unit peak discharges from Table 4-11 for $T_c = 0.1$ hours, $I_a/P = 0.1$ and $T_t = 2.0$ hours are multiplied by 0.40 square miles and 4.2 inches of runoff. The result of the multiplication is shown on line one in Table 4-12.

Step 4: For Area 2, the unit peak discharges from Table 4-11 for $T_c = 0.5$ hours, $I_a/P = 0.1$ and $T_t = 0$ hours are multiplied by 0.51 square miles and 3.7 inches of runoff. The result of this multiplication is shown on line two of Table 4-12.

Step 5: For Area 3, the unit peak discharges from Table 4-11 for $T_c = 1.5$ hours, interpolated $I_a/P = 0.2$ and $T_t = 0$ hours are multiplied by 0.87 square miles and 2.4 inches of runoff. The multiplication products are shown in line three of Table 4-12.

Step 6: Add the three hydrographs together to determine the inflow hydrograph at the design point. The resultant inflow hydrograph shown in Table 4-12 has its peak at 12.5 hours with a flow rate of 1,155 cfs.

The calculation effort can significantly increase for watersheds with many subareas, which in turn increases the likelihood for computational errors. The City of Midland's major watersheds are composed of many subareas. An attempt to perform hydrologic analysis with the TR-55 Tabular Method then becomes a large hand-computational exercise with many opportunities for error. This is the reason why the TR-55 Tabular Method is limited by the City to drainage areas of less than one square mile as previously shown in Table 4-1 and Figure 4-2 unless a computer version is used. For computer versions of TR-55 the drainage area limit for its use then becomes three square miles.

4.6 UNIT HYDROGRAPH THEORY

The unit hydrograph of a drainage basin or watershed is defined as a graph of direct runoff resulting from one inch of effective rainfall generated uniformly over a basin area at a uniform rate during a specified time or duration. A unit hydrograph can be used to derive the hydrograph of runoff or peak discharge due to any amount of rainfall. Unit hydrograph theory is composed of the definition above and the following assumptions:

A. The effective rainfall is uniformly distributed within its duration or specified period of time.

B. The effective rainfall is uniformly distributed throughout the whole area of the drainage basin.

C. The base or time duration of the hydrograph of direct runoff, due to an effective rainfall of unit duration, is constant. The time distribution of direct runoff is assumed to be independent of antecedent precipitation.

D. Direct runoff ordinates for a storm of given duration are assumed directly proportional to rainfall excess volumes. Thus, twice the rainfall excess produces a doubling of hydrograph ordinates.

TABLE 4-12
SCS TABULAR METHOD EXAMPLE

Hydrograph Time (hours)																							
Area	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	
1	7	10	12	15	15	17	19	20	22	25	27	30	34	42	62	121	252	423	564	524	363	183	
2	32	43	60	108	177	321	581	881	998	957	759	560	426	264	181	140	115	100	89	77	68	60	
3	10	13	17	23	27	33	50	77	119	173	238	309	376	468	522	464	401	330	276	215	173	134	
Total	49	66	89	146	219	371	650	978	1139	1155	1024	899	836	774	765	725	768	853	929	816	604	377	

Area	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
1	97	71	57	51	45	40	34	30	22	13
2	54	49	43	39	37	36	30	26	22	0
3	104	88	75	65	61	54	48	44	33	4
Total	255	208	175	155	143	130	112	100	77	17

Line 1 Continued
Line 2 Continued
Line 3 Continued

At Design Point
Peak Time 12.5 hours
 Q_p 1,155 cfs

E. For a given drainage basin, the hydrograph of runoff due to a given period of rainfall reflects all the combined physical characteristics of the basin.

The assumptions above can be condensed into a single-sentence summary: The hydrologic system is linear and time invariant. While the assumptions of linearity and time invariance are not strictly correct for a watershed, the results obtained from linear methods are acceptable for most engineering purposes.

Hydrographs give the designer an accurate tool to use for analysis since actual rainfall-runoff events can be simulated. Where gage data are available, model simulation parameters can be calibrated to match actual historical events for a watershed. With calibration to actual historical events, then a calibrated model can be used to simulate other events of different magnitudes for that same watershed.

Where gage data are not available for calibration, synthetic unit hydrographs can be developed from remote drainage basins that have similar characteristics. This approach was taken by the Soil Conservation Service in developing its synthetic triangular unit hydrograph. Synthetic hydrographs for ungaged drainage basins, or watersheds, still provide the designer a more accurate tool for simulation and analysis than non-hydrograph methods. A simple visual observation of a stream segment or a curb and gutter during a storm event shows that runoff and discharge will build to a peak over time and then gradually recede. While a synthetic unit hydrograph may not exactly simulate the occurrence, the variation of runoff with time in the synthetic unit hydrograph more closely portrays the actual occurrence than a non-hydrograph method. Such variation with time provides a more realistic analysis of detention pond routing simulations and peak discharges.

4.7 DIMENSIONLESS UNIT HYDROGRAPH (SCS)

To estimate the peak discharge and establish a runoff hydrograph in the Soil Conservation Service Methods, the concept of a dimensionless unit hydrograph is applied. Designers submitting drainage plans for review will use the SCS unit hydrograph where hydrograph design analysis is required. The Soil Conservation Service dimensionless unit hydrograph was derived from analysis of a large number of unit hydrographs developed using gage data from watersheds of a wide range in size and geographical location. The dimensionless unit hydrograph has ordinate values expressed in a dimensionless ratio q/q_p and abscissa values of t/T_p , where q_p is the peak discharge at T_p and q is the discharge at time t . Figure 4-11 shows the shape of the dimensionless unit hydrograph. At the same time, the mass curve is also illustrated in Figure 4-11 with ordinates of Q_a/Q versus t/t_p , in which Q_a is the accumulated volume at time t , and Q is the total volume. Table 4-13 lists dimensionless discharge ratios and mass curve ratios for the dimensionless time ratios shown for use in calculating unit hydrographs and mass curves.

The curvilinear unit hydrograph can be approximated by an equivalent triangular unit hydrograph, as shown by the dashed lines in Figure 4-11. The area under the rising limb (before time T_p) of the two unit hydrographs are the same.

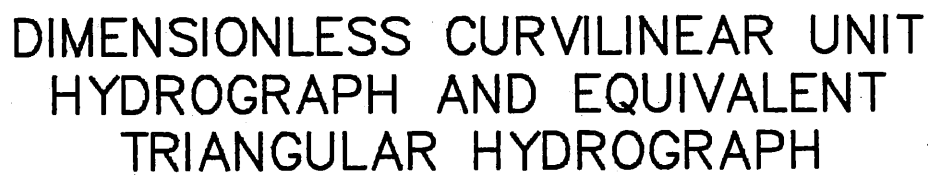


FIGURE 4-11

TABLE 4-13
RATIOS FOR SOIL CONSERVATION SERVICE DIMENSIONLESS UNIT
HYDROGRAPH AND MASS CURVE

TIME RATIOS (τ/T_p)	DISCHARGE RATIOS (q/q_p)	MASS CURVE RATIOS (Q_a/Q)
0.0	.000	.001
0.1	.030	.001
0.2	.100	.006
0.3	.190	.012
0.4	.310	.035
0.5	.470	.065
0.6	.660	.107
0.7	.820	.163
0.8	.930	.228
0.9	.990	.300
1.0	1.000	.375
1.1	.990	.450
1.2	.930	.522
1.3	.860	.589
1.4	.780	.650
1.5	.680	.700
1.6	.560	.751
1.7	.460	.790
1.8	.390	.822
1.9	.330	.849
2.0	.280	.871
2.2	.207	.908
2.4	.147	.934
2.6	.107	.953
2.8	.077	.967
3.0	.055	.977
3.2	.040	.984
3.4	.029	.989
3.6	.021	.993
3.8	.015	.995
4.0	.011	.997
4.5	.005	.999
5.0	.000	1.000

Source: Soil Conservation Service, National Engineering Handbook Section 4.

The time base of the dimensionless unit hydrograph is five times the time-to-peak (T_p), while the time base of the triangular unit hydrograph is only 2.67 times the time-to-peak (T_p). The transformation of curvilinear unit hydrograph to triangular unit hydrograph provides a solution for the peak flow.

The area under the triangular unit hydrograph on Figure 4-11 equals the volume of direct runoff Q , which can be calculated by:

$$Q = q_p(T_p + T_r)/2 \quad (\text{Eq. 4-11})$$

where,

$$\begin{aligned} Q &= \text{Direct runoff, inches} \\ T_p &= \text{Time to peak, hours} \\ T_r &= \text{Recession time, hours} \\ q_p &= \text{Peak discharge, inches per hour} \end{aligned}$$

The runoff Q derived from this equation is the same as estimated by Equation 4-9.

By Equation 4-11, the peak discharge q_p can be solved as:

$$\begin{aligned} q_p &= 2Q/(T_p + T_r) & (\text{Eq. 4-12}) \\ \text{Let } K &= 2/(1 + (T_r/T_p)) & (\text{Eq. 4-13}) \\ \text{therefore, } q_p &= KQ/T_p & (\text{Eq. 4-14}) \end{aligned}$$

where,

$$\begin{aligned} Q &= \text{Direct runoff, inches} \\ T_p &= \text{Time to peak, hours} \\ T_r &= \text{Recession time, hours} \\ q_p &= \text{Peak discharge, inches per hour.} \end{aligned}$$

In making the conversion from inches per hour to cubic feet per second and putting the equation in terms ordinarily used, including drainage area (A) in square miles and time (T) in hours, Equation 4-14 becomes the general equation:

$$q_p = (645.33 KAQ)/T_p \quad (\text{Eq. 4-15})$$

Where q_p is peak discharge in cubic feet per second and the conversion factor 645.33 is the rate required to discharge one (1) inch of excess rainfall from one (1) square mile in one (1) hour.

The relationship of the triangular unit hydrograph shows that $T_r = 1.67 T_p$ and gives $K = 0.75$ by Equation 4-13. Then substituting into equation 4-15 gives:

$$q_p = 484 A Q/T_p \quad (\text{Eq. 4-16})$$

Since the volume under the rising side of the triangular unit hydrograph is equal to the volume under the rising side of the curvilinear dimensionless unit hydrograph in Figure 4-11, the constant 484, or peak rate factor, is valid for calculation of the peak discharge for the dimensionless unit hydrograph. The constant 484 reflects a unit hydrograph that has 3/8 of its area under the rising limb. For mountainous watersheds, the fraction under the rising limb could be expected to be greater and the constant in Equation 4-16 may be nearer 600. For flat, swampy areas the constant may be on the order of 300. For Midland designs the constant will remain at 484.

4.8 HEC-1 HYDROGRAPH PACKAGE

The HEC-1 hydrograph package was developed by the Corps of Engineers for hydrologic modeling of watersheds for water resource projects. This computer model is the selected model for City of Midland designs and floodplain management, and all other design models will be evaluated against HEC-1 results. The City of Midland is developing an existing condition HEC-1 hydrologic model and this model will be available to users for analysis and update.

HEC-1 offers several options for the development of stormwater runoff hydrographs, however the SCS curve number method and the SCS unit hydrograph method will be the preferred methods for determination of rainfall losses and runoff hydrograph development. The preferred methods for routing of runoff will be the storage-indication method for detention facilities and the Modified Puls Storage Versus Outflow Relationship for channel routing. These specified methods are believed to more accurately simulate Midland conditions, especially in view of the limitations of the other alternatives offered in HEC-1.

Some helpful hints in using HEC-1, especially for those designers experienced in using TR-20, are:

A. For synthetic storms, HEC-1 requires user input of rainfall depths beginning with the 5-minute duration through the design duration desired. Use the values from Table 4-9.

B. HEC-1 will automatically make the conversion from partial-duration to annual series for the 2-year, 5-year and 10-year storm frequencies. Manual conversion prior to input using the factors on Table 4-9 is not necessary.

C. HEC-1 will automatically make the rainfall areal adjustment for subareas greater than 10 square miles in accordance with TP-40. Manual adjustment prior to input is not necessary, however a JD card image must be supplied in the input.

D. An AMC I.4 or AMC II curve number as appropriate will be the input curve number value. HEC-1 does not require definition of an AMC.

E. The time of concentration (T_c) for the watershed is not input into HEC-1. The watershed lag (T_{LAG}) is input instead according to the relationship $T_{LAG} = 0.6 \times T_c$.

F. For Modified Puls routing, make a HEC-2 multiple profile run with flows ranging from 0.2 to 1.2 times the expected peak flow in each routing reach. Flow should not change within the reach. Modern versions of HEC-2 have an option to create a file containing the storage-outflow tables for each routing reach which can be input directly to HEC-1.

There are various publications oriented toward the HEC-1 hydrograph package and which contain additional helpful hints and user instructions.

4.9 TR-20 HYDROGRAPH PACKAGE (SCS)

Technical Release 20, Project Formulation Hydrology (TR-20) is a computer program developed by the Soil Conservation Service (SCS) and is based on

procedures contained in the SCS National Engineering Handbook, Section 4 except for the reach routing procedures. The modified Attenuation - Kinematic (ATT-KIN) routing method is used for reach routing in the most recent versions of TR-20. Uniform rainfall depth and distribution over time are assumed for a synthetic storm over a subarea, groups of subareas or a whole watershed. The program also allows a user to input actual rainfall from an observed storm event. The runoff hydrograph is developed from the curve number, antecedent moisture condition, rainfall distribution and time of concentration.

TR-20 was developed to assist the SCS in the hydrologic evaluation of flood events for use in analysis of water resource projects. Besides development of the runoff hydrograph from any synthetic or natural storm rainfall, the program provides the capability to route, add, store, divert or divide hydrographs to convey stormwater runoff from the headwaters to the watershed outlet.

For Midland designs, TR-20 is an acceptable design tool for closed basins (such as playas or detention basins) and to evaluate pre-development and post-development hydrologic characteristics. TR-20 can also be used for channel reach routing, however the ATT-KIN routing method may result in values somewhat higher or lower than those resulting from the HEC-1 program described earlier.

Some helpful hints when using TR-20 are:

A. When rainfall depths from Table 4-9 for the 2-year, 5-year and 10-year frequencies are used for synthetic storm development, the table values must be converted to annual series using the factors shown on Table 4-9 prior to input to TR-20.

B. If the subarea under consideration exceeds 10 square miles, the rainfall areal adjustment must be done manually prior to input to TR-20.

C. When using AMC I.4 curve numbers, the AMC condition on the TR-20 input cards should be defined as condition II, but the AMC I.4 curve number value will still be the input curve number.

D. The time increment specified on the executive control input should not exceed one-fourth of the time-to-peak (T_p) of the hydrograph. Some versions of TR-20 will print a warning message if the time increment is too large.

As with HEC-1, there are other helpful hints in the TR-20 User's Manual as well as other publications.

END

SECTION 4

BIBLIOGRAPHY

1. City of Austin, Texas, Drainage Criteria Manual, February 1991 Edition.
2. Ven Te Chow, Handbook of Applied Hydrology, McGraw-Hill, New York 1964.
3. William DeGroot, Editor, Proceedings of the Conference on Stormwater Detention Facilities: Planning, Design, Operation and Maintenance, American Society of Civil Engineers, New York 1982.
4. Frederick Merritt, Editor, Standard Handbook for Civil Engineers, Second Edition, McGraw-Hill, 1976.
5. Texas State Department of Highways and Public Transportation, Bridge Division, Hydraulic Manual, Austin, December 1985.
6. U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, Washington, D.C., May 1961.
7. U.S. Department of Transportation, Federal Highway Administration, Hydraulic Engineering Circular No. 19: Hydrology, October 1984.
8. U.S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook Section 4: Hydrology, Washington, D.C., August 1972.
9. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55: Urban Hydrology for Small Watersheds, Washington, D.C., June 1986.
10. Richard H. McCuen, A Guide to Hydrologic Analysis Using SCS Methods, Prentice-Hall, Englewood Cliffs, N.J., 1982.
11. Richard H. McCuen, Hydrologic Analysis and Design, Prentice-Hall, Englewood Cliffs, N.J., 1989.
12. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Midland County, Texas, Washington, D.C., April 1973.
13. U.S. Department of Agriculture, Soil Conservation Service, NOAA Technical Memorandum NWS HYDRO-35, Five- to 60-Minute Precipitation Frequency For the Eastern and Central United States, Washington, D.C., 1977.
14. Philip B. Bedient and Wayne C. Huber, Hydrology and Floodplain Analysis, Addison-Wesley Publishing Company, New York, NY, 1988.
15. U.S. Department of Agriculture, Soil Conservation Service, User's Manual, Draft TR-20 Project Formulation Hydrology, Washington, D.C., May 1983.
16. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package User's Manual, Davis, CA 1990.

SECTION 5

STREET AND ALLEY DRAINAGE

- 5.1 General
- 5.2 Storm Water Peak Discharge
- 5.3 Hydraulics of Street Flow
 - 5.3.1 Gutter Capacity Using Straight Crown
 - 5.3.2 Alley Capacity
 - 5.3.3 Gutter Capacity Using Parabolic Crown
 - 5.3.4 Inverted Crown Streets
 - 5.3.5 Interference to Flow Due to Ponding
 - 5.3.6 Interference to Flow at Intersections
- 5.4 Design Considerations
 - 5.4.1 Maximum Allowable Flow Depth
 - 5.4.2 Maximum and Minimum Street Grades
- 5.5 Surface Outfalls to Channels
 - 5.5.1 Sawtooth Curb and Gutter
 - 5.5.2 Capture of Flow in Gutter
 - 5.5.3 Drainage Flumes

Bibliography

SECTION 5

STREET AND ALLEY DRAINAGE

5.1 GENERAL

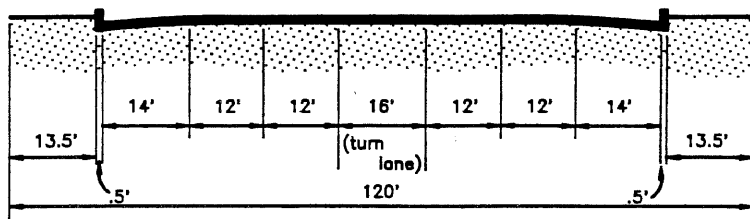
This section contains minimum storm drainage design criteria and demonstrates the design procedures to be employed on projects utilizing street drainage in the City of Midland.

The arrangement, character, extent, and location of streets shall be considered in relation to existing and planned streets, to topographical conditions, to drainage in and through the proposed and adjacent subdivisions, to public convenience and safety, and in appropriate relation to the proposed uses of land to be served by such streets. Due consideration will be given to the effect of street drainage on traffic.

Table 5-1 below defines the various classifications of streets based on function. The street sections for the various street classifications are shown in Figures 5-1 and 5-2.

Table 5-1
Street Classification Definitions

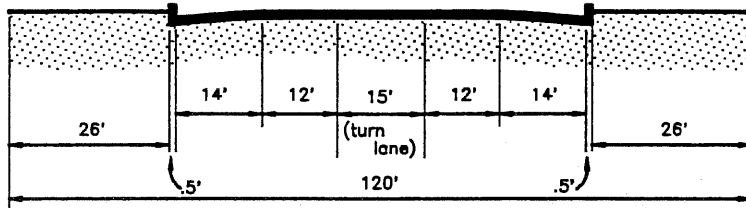
<u>Classification</u>	<u>Function-Uses</u>
Primary Arterial or Expressway, Type A	This is the highest classification for an urban street, except for a freeway. Included in this classification would be highways, loop streets, inter-city routes and other more important arterial streets which provide the basic framework of major streets for carrying traffic over long distances through and within the community. Midkiff Road and Big Spring Street are examples of functional primary arterials responsible for handling heavier concentrations of commercial and retail activity.
Major, Type B	A secondary arterial is a basic arterial (major) thoroughfare having continuity for at least several miles and designed to connect neighborhoods with places of employment and business services. Wadley Avenue and Illinois Avenue are examples of secondary arterial streets.
Major, Type C	The Type C design as shown in Figure 5-1 may be used in lieu of the Type B standard where lesser traffic volumes are anticipated and where right-of-way is restricted. This thoroughfare standard normally accommodates four lanes of traffic. Scharbauer Drive and Illinois Avenue are examples of the Type C standard.



93' B-B

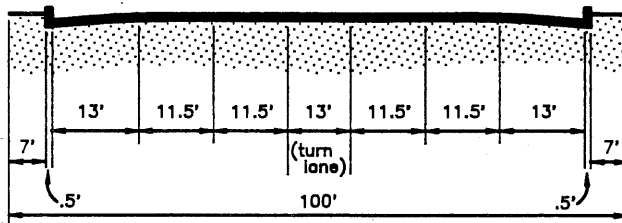
6 LANES
(with turn lane)

TYPE A
PRIMARY ARTERIAL
OR EXPRESSWAY



68' B-B

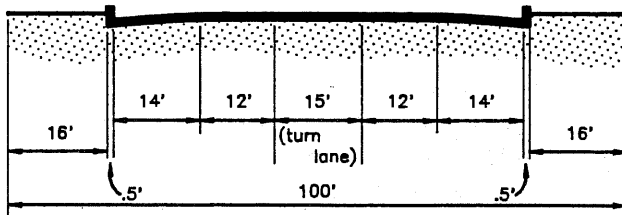
4 LANES
(with turn lane)



86' B-B

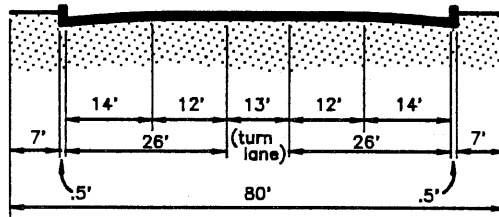
6 LANES
(with turn lane)

TYPE B
MAJOR



68' B-B

4 LANES
(with turn lane)

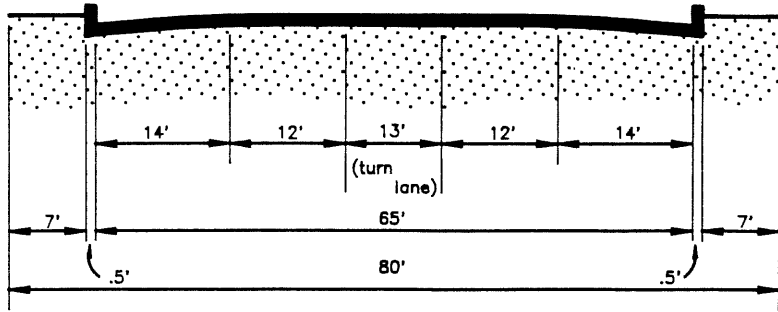


66' B-B

TYPE C
MAJOR

STREET CLASSIFICATION

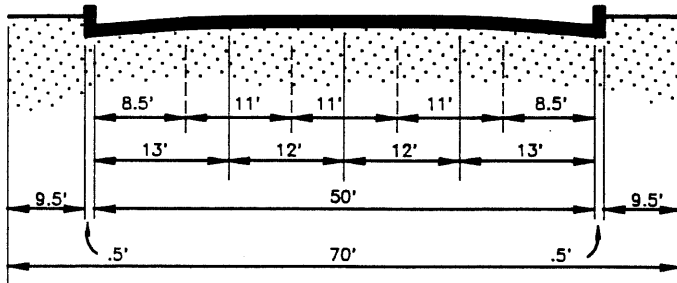
FIGURE 5-1



COLLECTOR

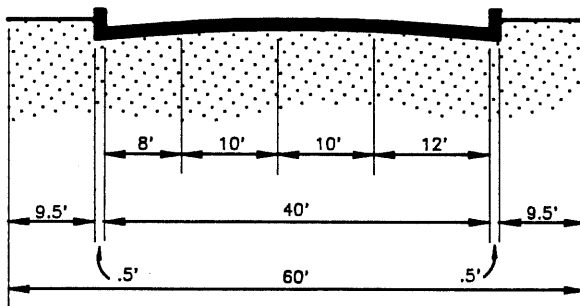
66' B - B

TYPE D



ONE WAY PAIRS OR
TWO WAY - NO PARKING

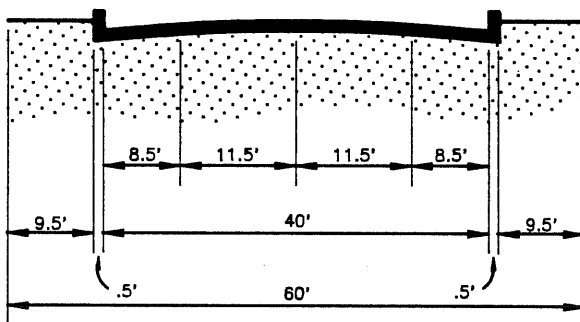
51' B - B



ONE WAY PAIRS

41' B - B

TYPE E



COLLECTOR

41' B - B

STREET CLASSIFICATION

FIGURE 5-2

Collector Streets
Type D and Type E

This type of street may be imposed between major thoroughfares where needed to supplement traffic carrying capacity. Primary collector streets (Type D) are normally wider than secondary collector streets (Type E). Collector streets are designed to distribute traffic from the interior areas of a neighborhood to major thoroughfares. Type D and E streets can also function as one-way pairs. In retail, commercial and industrial areas, the local access streets should be of collector (Type D) standard to accommodate higher traffic volumes including truck turning movements. Likewise, in dense housing areas such as apartments it will be appropriate to use this street type for local access streets.

At the time this manual was written, there were continuing discussions for the inclusion of 30-foot and 37-foot wide streets for residential areas. Upon completion of the discussions and the street standards, then the additional street widths will be included or deleted from this manual as necessary.

5.2 STORM WATER PEAK DISCHARGE

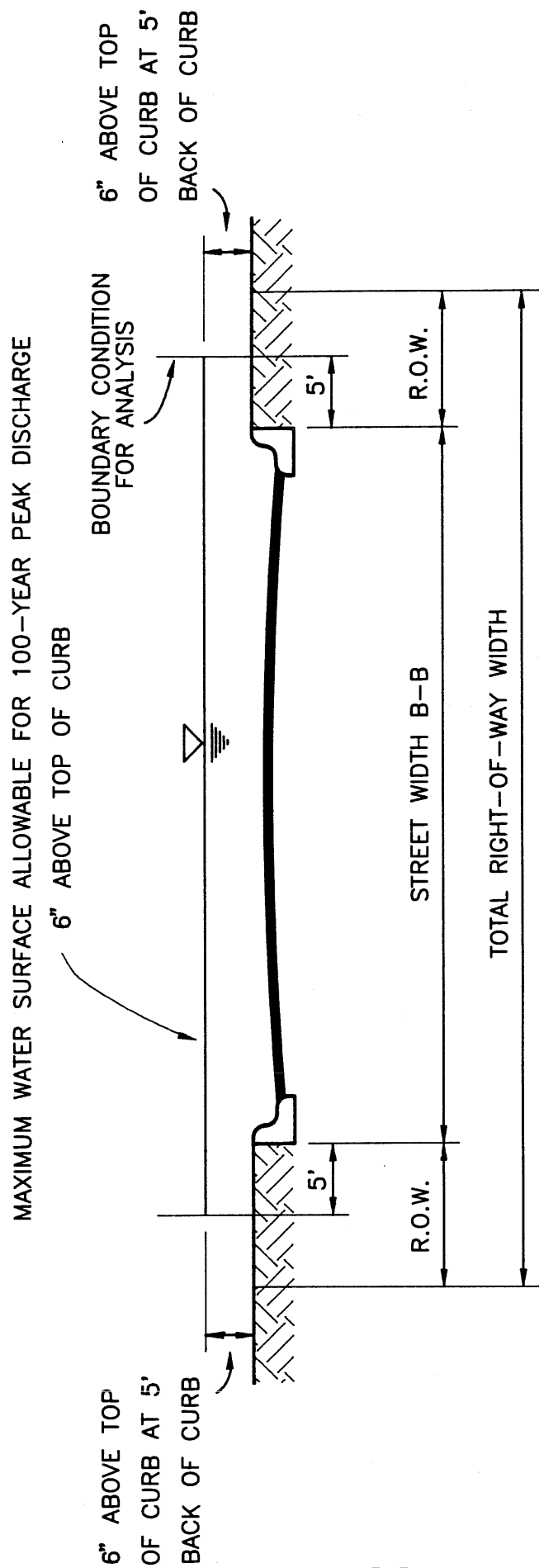
When calculating the peak discharge of storm water runoff to determine street flow depths, the peak discharge shall be determined by the Rational Method or TR-55 as presented in "Section 4: Determination of Storm Runoff" of this manual. The storm frequency used for this determination will be according to the facility to be designed. For inlets on grade, the minimum design frequency is the 5-year storm event. For inlets at sags, the minimum design frequency is the 25-year storm event. The street under consideration must also be capable of conveying the 100-year peak discharge using the boundary conditions shown in Figure 5-3. Figure 5-4 shows the relationship of the maximum allowable street and alley water surface elevation with a building first-floor elevation.

Emergency overflows, where required by the City of Midland Engineering Department, are to be located at sags and T-intersections of streets to prevent surface water damage. Such an overflow area could consist of additional space between building structures and channelization of runoff. One situation is shown in Figure 5-5. Any emergency overflow area should be designed for adequate hydraulic capacity for the 100-year storm runoff without exceeding an elevation six inches below the floor elevations of adjacent buildings.

5.3 HYDRAULICS OF STREET FLOW

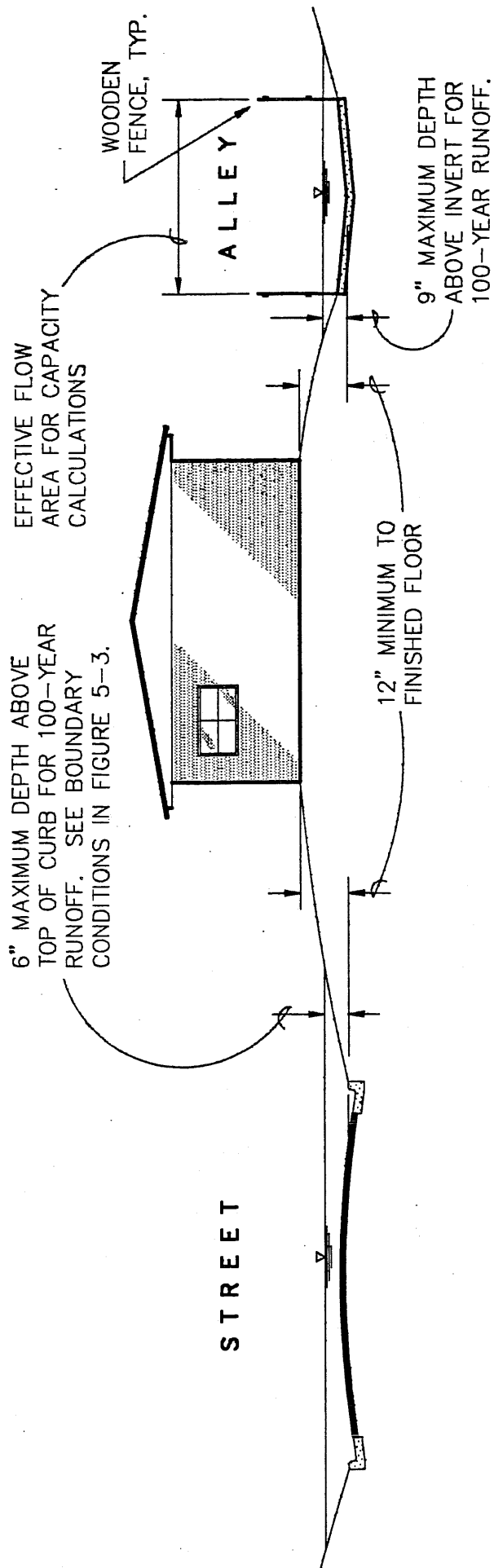
5.3.1 Gutter Capacity Using Straight Crown

Flow in gutters on straight crown pavements is normally assumed to be uniform, with Manning's Equation being used to determine the flow. However, because the hydraulic radius assumption in the Manning's Equation is not able to adequately describe the hydraulic characteristics of the gutter cross section, modification of the equation is necessary to accurately compute the flow. The modified Manning's Equation is:



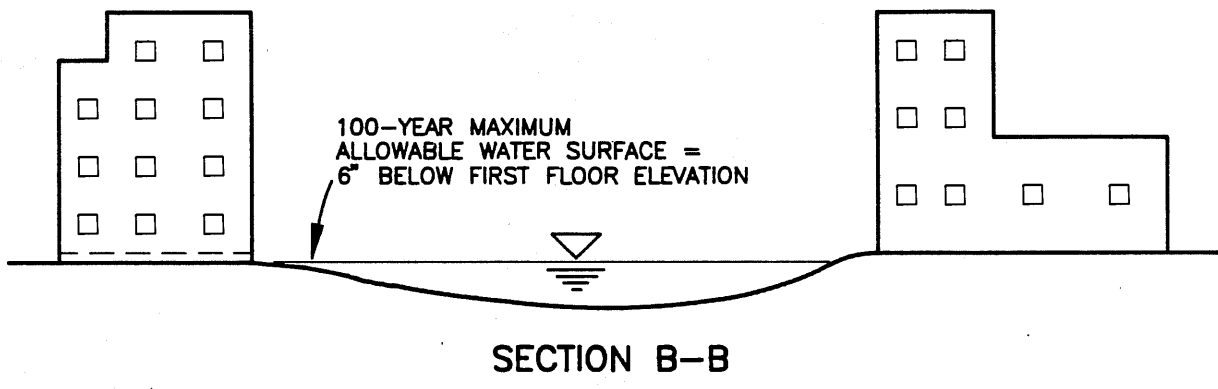
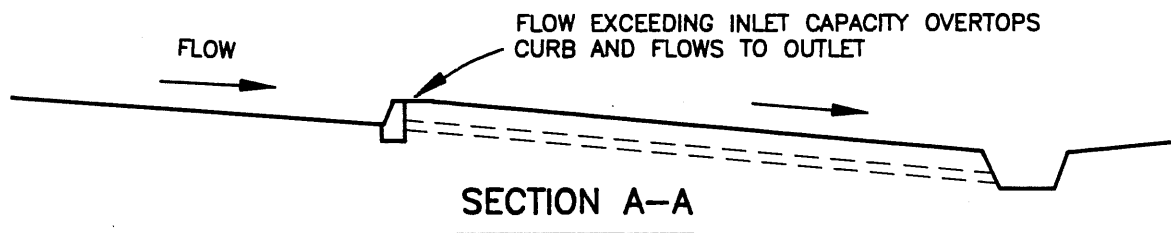
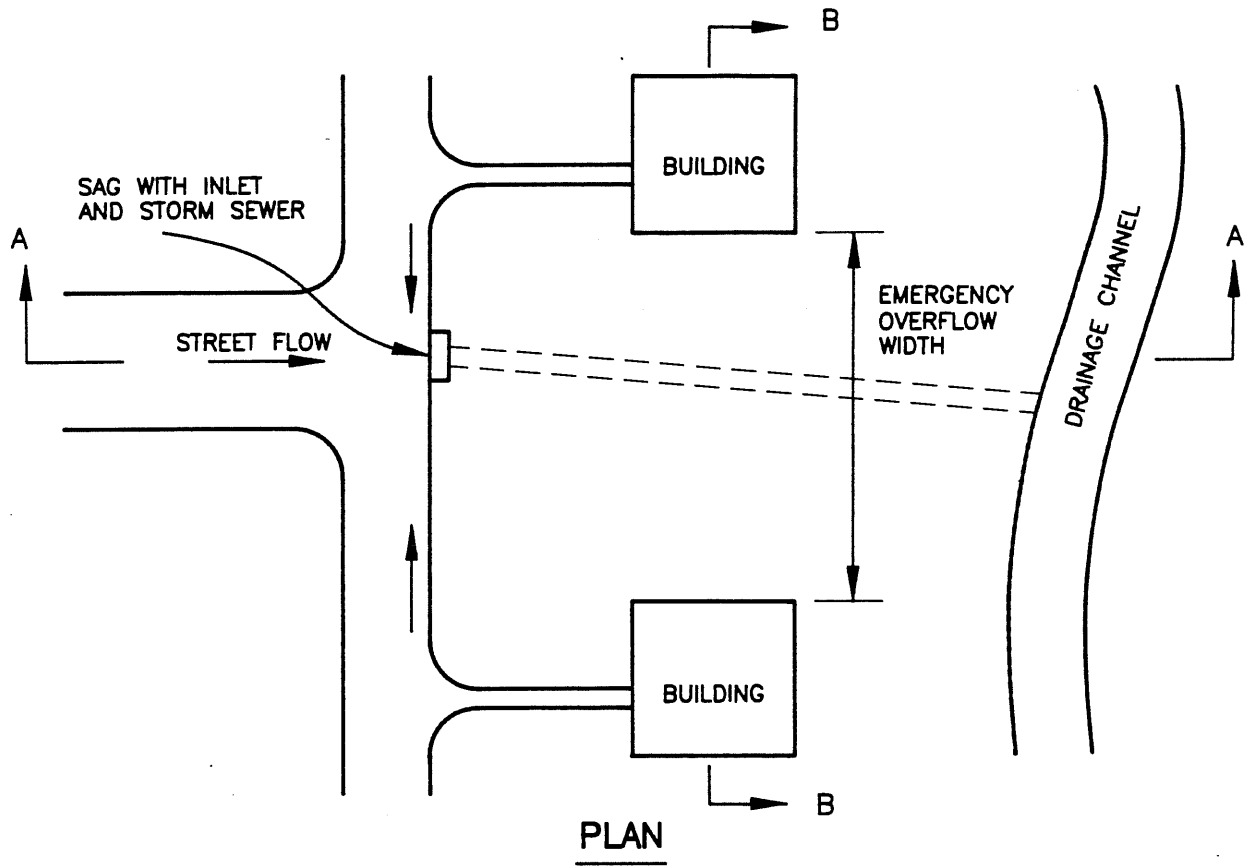
TYPICAL CROWNED STREET SECTION FOR 100 YEAR STORM WATER CAPACITY ANALYSIS

FIGURE 5-3



MAXIMUM ALLOWABLE STREET AND ALLEY WATER SURFACE

FIGURE 5-4



TYPICAL EMERGENCY OVERFLOW AT SAG

FIGURE 5-5

$$Q_o = 0.56 (z/n) S_o^{1/2} Y_o^{8/3} \quad (\text{Eq. 5-1})$$

where,

Q_o = Gutter discharge, cfs
 z = Reciprocal of the crown slope, ft/ft
 S_o = Street or gutter slope, ft/ft
 n = Roughness coefficient
 Y_o = Depth of flow in gutter, feet

For the City of Midland, with its flat grades and windblown material that collects in the gutters, a value of 0.02 for Manning's "n" will be used. Figure 5-6 may be used in lieu of Equation 5-1 for straight crown gutter capacity calculations. Instructions for using the nomograph are given in Figure 5-5.

5.3.2 Alley Capacity

The configuration of Midland alley pavements result in a shallow "V" section as shown in Figure 5-7. The capacity of the alley section from the invert to the top of pavement can be determined from Figure 5-6. The five-year frequency storm water runoff should be contained within the alley "V" shape limits shown in Figure 5-7.

When checking the total capacity of the alley for the 100-year storm event, the maximum allowable depth is six inches above the edge of pavement. This translates into nine inches above the alley invert. Open channel methods of determining capacity are used since the boundary conditions exceed the applicability of the triangular channel nomograph in Figure 5-6. The equation shown in Figure 5-8, $Q = 656S^{0.5}$, where S is the alley slope in feet per foot, can be used to determine the alley capacity where there is no anticipated backwater to affect the flow. Where backwater conditions are anticipated to affect the alley flow characteristics, then a step-backwater analysis of the alley should be performed.

5.3.3 Gutter Capacity Using Parabolic Crown

The street sections for the City of Midland normally follow a parabolic curve as shown in Figure 5-9. Also shown are the mathematical relationships for finding the height of the street crown as well as the height of any point on the street cross section.

In order to determine the flow area for a parabolic-crowned street, the cross sectional area available for flow is divided into small incremental flow depths. For each depth, the wetted perimeter is essentially the width of that segment plus the depth at the curb face. The total area for that flow depth is divided by the entire wetted perimeter to get the hydraulic radius. Then Manning's equation is solved to get the total flow rate for the selected depth at the curb face. In this manner the capacity of the parabolic-crowned street at various flow depths can be determined. The calculation process described in this paragraph is shown in Figure 5-10.

As an aid to reduce design time and promote the consistency of design analyses, nomographs have been prepared for the determination of parabolic street flow capacity. These nomographs are contained in Figures 5-11 through 5-18 and correspond to the widths for 30-foot and 37-foot streets as well as for Type A, B, C, D and E streets. Figures 5-11 through 5-18 give the flow capacity

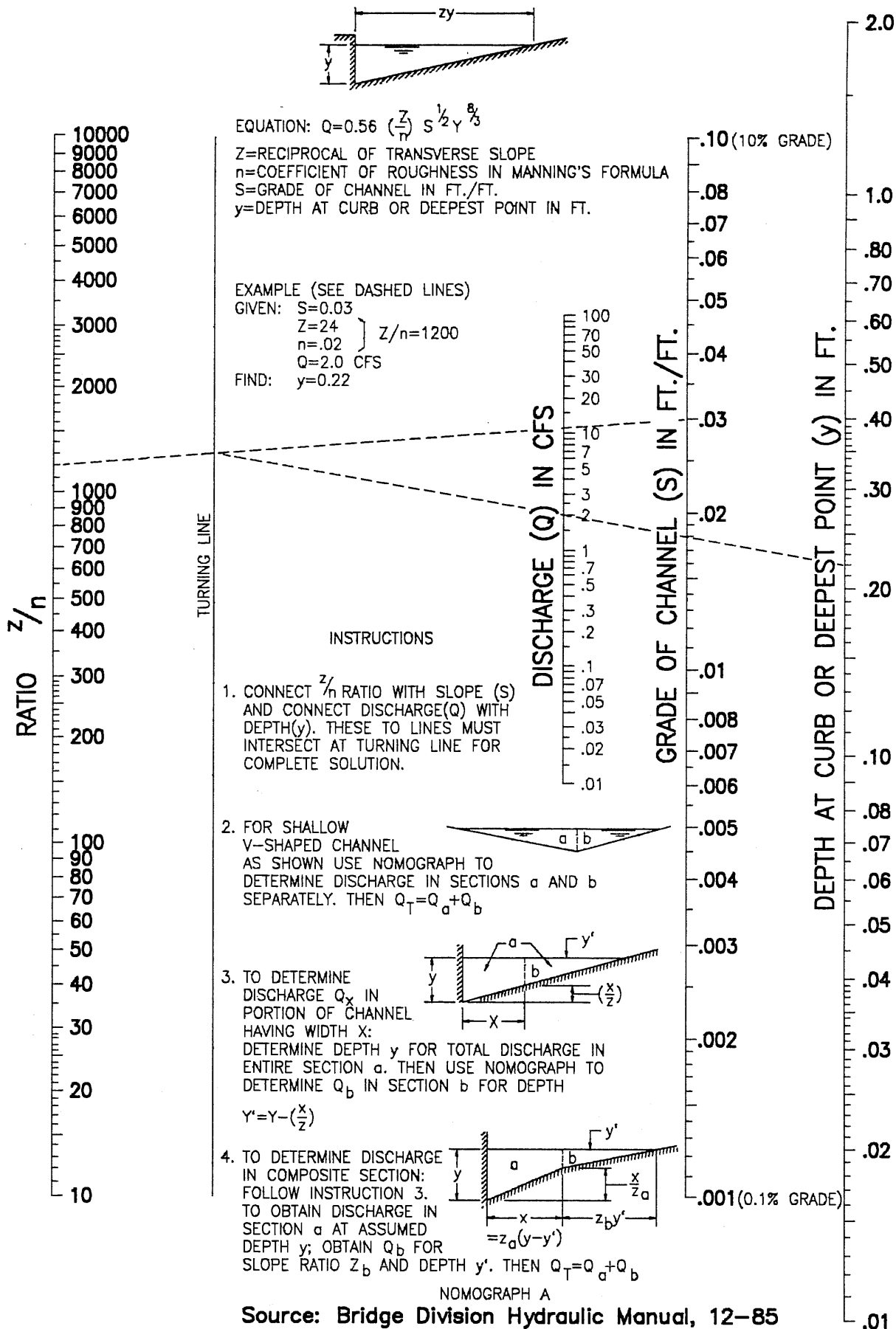
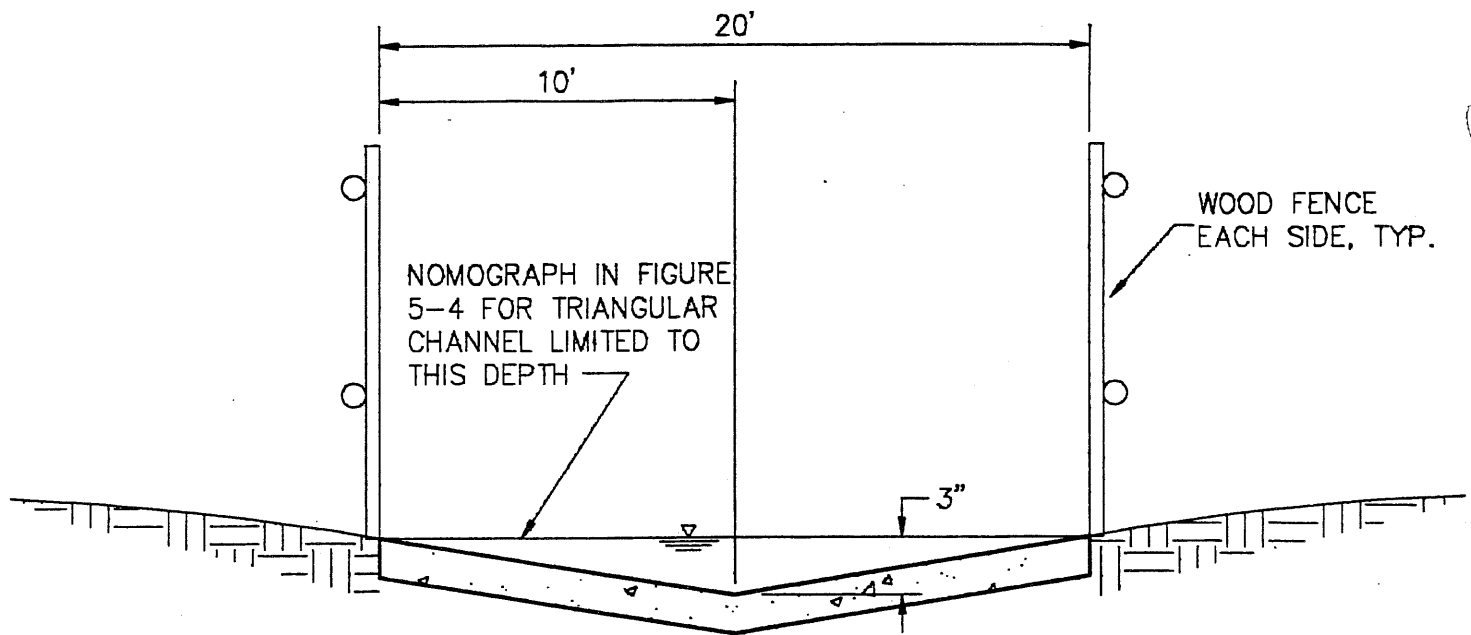


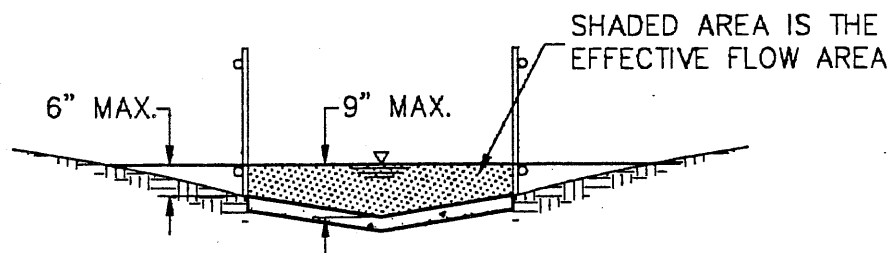
FIGURE 5-6

NOMOGRAPH FOR FLOW
IN TRIANGULAR CHANNELS



TYPICAL ALLEY SECTION

FIGURE 5-7



MAXIMUM ALLOWABLE DEPTH = 6 INCHES ABOVE EDGE OF ALLEY PAVEMENT

EFFECTIVE FLOW AREA AT MAXIMUM DEPTH = 12.5 SQUARE FEET

WETTED PERIMETER AT MAXIMUM DEPTH = 21.0 FEET

HYDRAULIC RADIUS AT MAXIMUM DEPTH = 0.595 FEET

MANNING'S "n" = 0.020

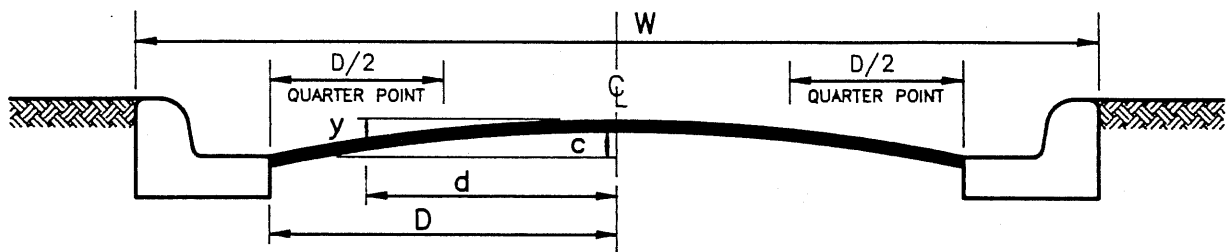
$$Q = \frac{1.486 AR^{0.67} S^{0.5}}{n}$$

$$Q = \frac{1.486 (12.5 \text{ SQ. FT.}) (0.595 \text{ FT.})^{0.67} S^{0.5}}{0.020}$$

$Q = 656 S^{0.5}$ WHERE S IS THE GROUND SLOPE IN FEET PER FOOT. THIS EQUATION IS NOT APPLICABLE WHERE BACKWATER FROM DOWNSTREAM AREA AFFECTS THE ALLEY FLOW CHARACTERISTICS.

TYPICAL ALLEY CAPACITY FOR 100-YEAR STORM EVENT

FIGURE 5-8



$c = \frac{W}{100} =$ HEIGHT OF CROWN ABOVE LIP OF GUTTER AT C_L
 (Usually rounded to nearest half-inch in construction drawings)

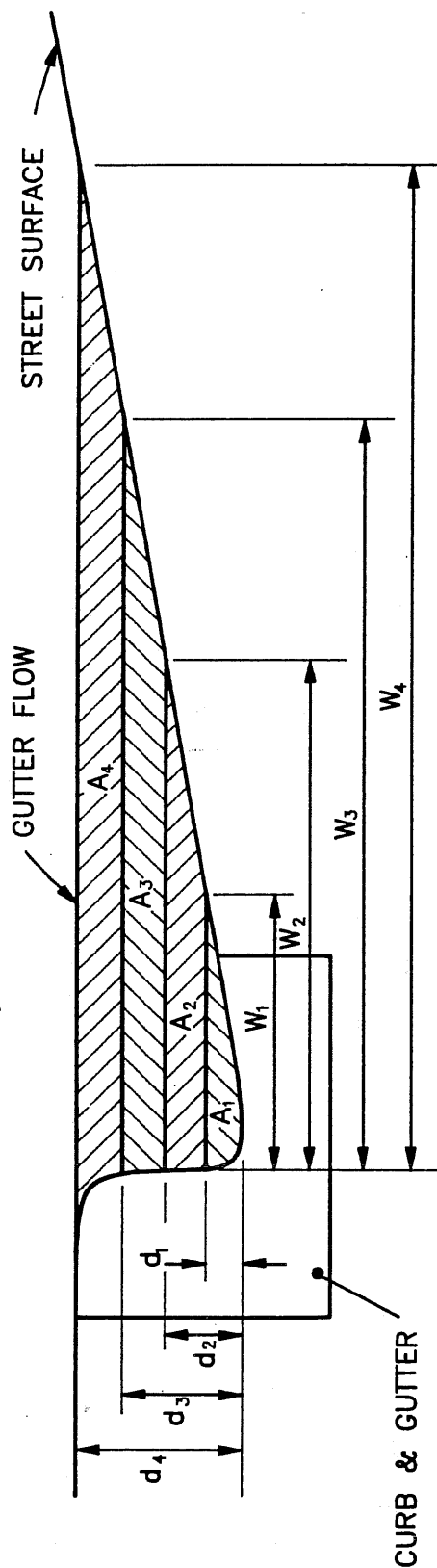
$y = c(d/D)^{1.5} =$ DISTANCE BELOW C_L CROWN AT ANY POINT ON STREET SECTION

$\frac{2C}{3} =$ QUARTER POINT HEIGHT ABOVE LIP OF GUTTER

$\frac{D}{2} =$ QUARTER POINT DISTANCE

CROWNED STREET GEOMETRY

FIGURE 5-9



DETERMINE AREA, A , FOR SELECTED DEPTH

WETTED PERIMETER AT SELECTED DEPTH $= W + d$ ($P_1 = W_1 + d_1$, $P_2 = W_2 + d_2$, $P_3 = W_3 + d_3$, etc.)

HYDRAULIC RADIUS AT SELECTED DEPTH $= \frac{A}{P}$ ($R_1 = \frac{A_1}{P_1}$, $R_2 = \frac{A_1 + A_2}{P_2}$, $R_3 = \frac{A_1 + A_2 + A_3}{P_3}$, etc.)

MANNING'S $n = 0.020$

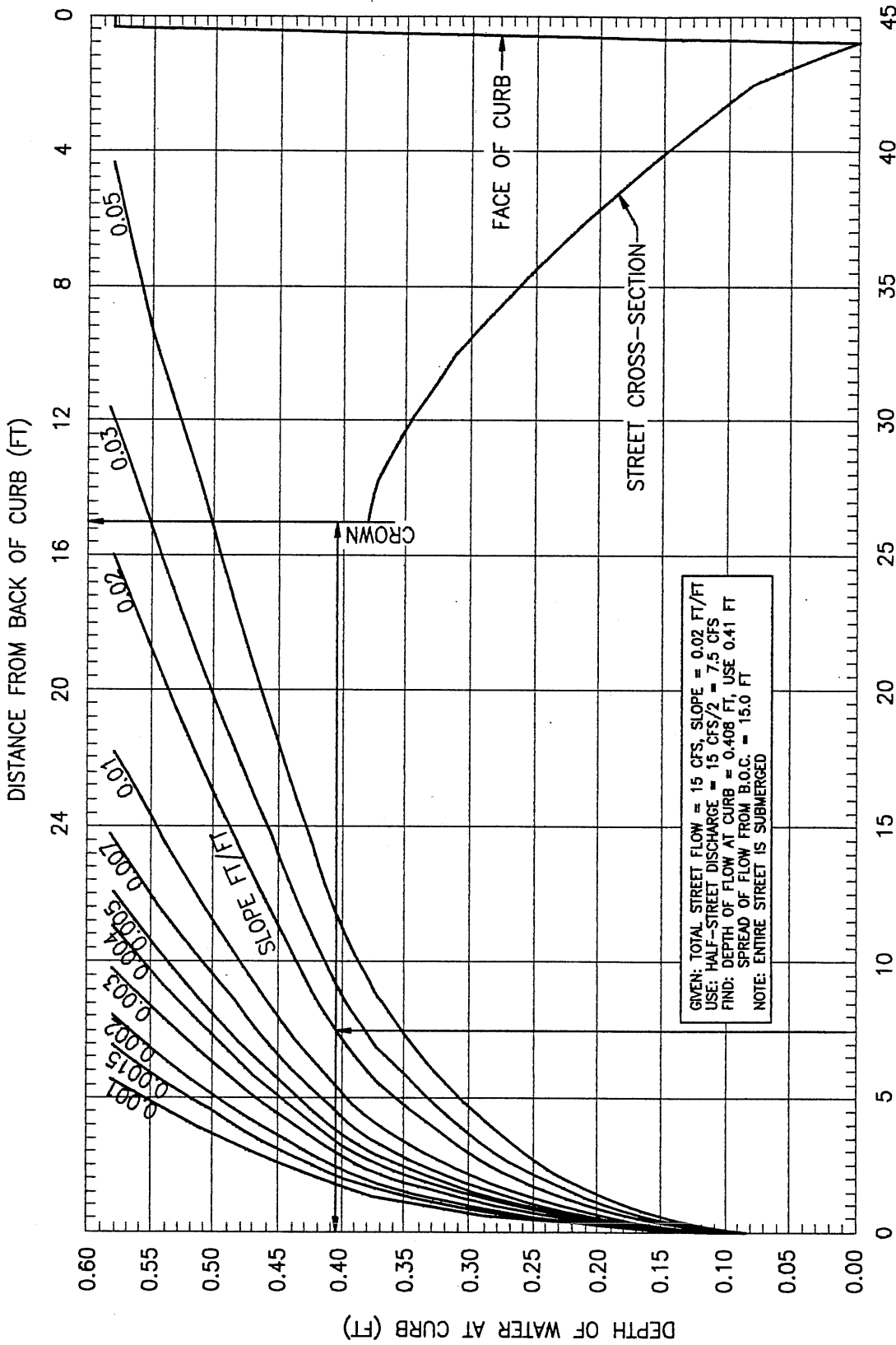
$$\text{FLOW AT DEPTH} = Q_1 = \frac{1.486 A_1 R_1^{0.67} S^{0.5}}{n}$$

$$= 74.3 A_1 R_1^{0.67} S^{0.5}$$

DETERMINATION OF PARABOLIC STREET SECTION FLOW CAPACITY

FIGURE 5-10

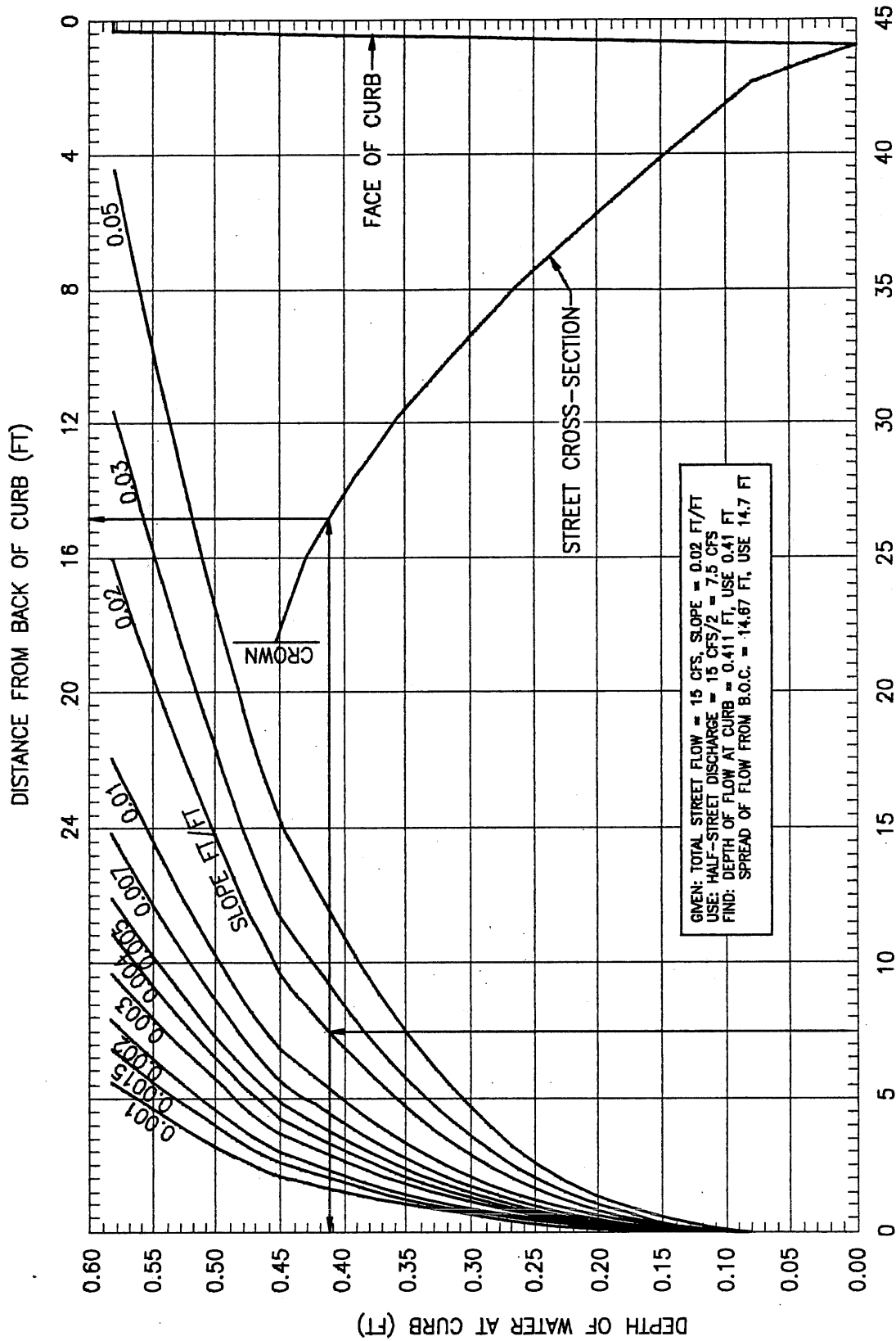
GUTTER DISCHARGE-DEPTH CURVES FOR 30' B-B STREET WIDTH



DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-11

GUTTER DISCHARGE-DEPTH CURVES FOR 37' B-B STREET WIDTH



DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-12

GUTTER DISCHARGE-DEPTH CURVES FOR 41' B-B STREET WIDTH

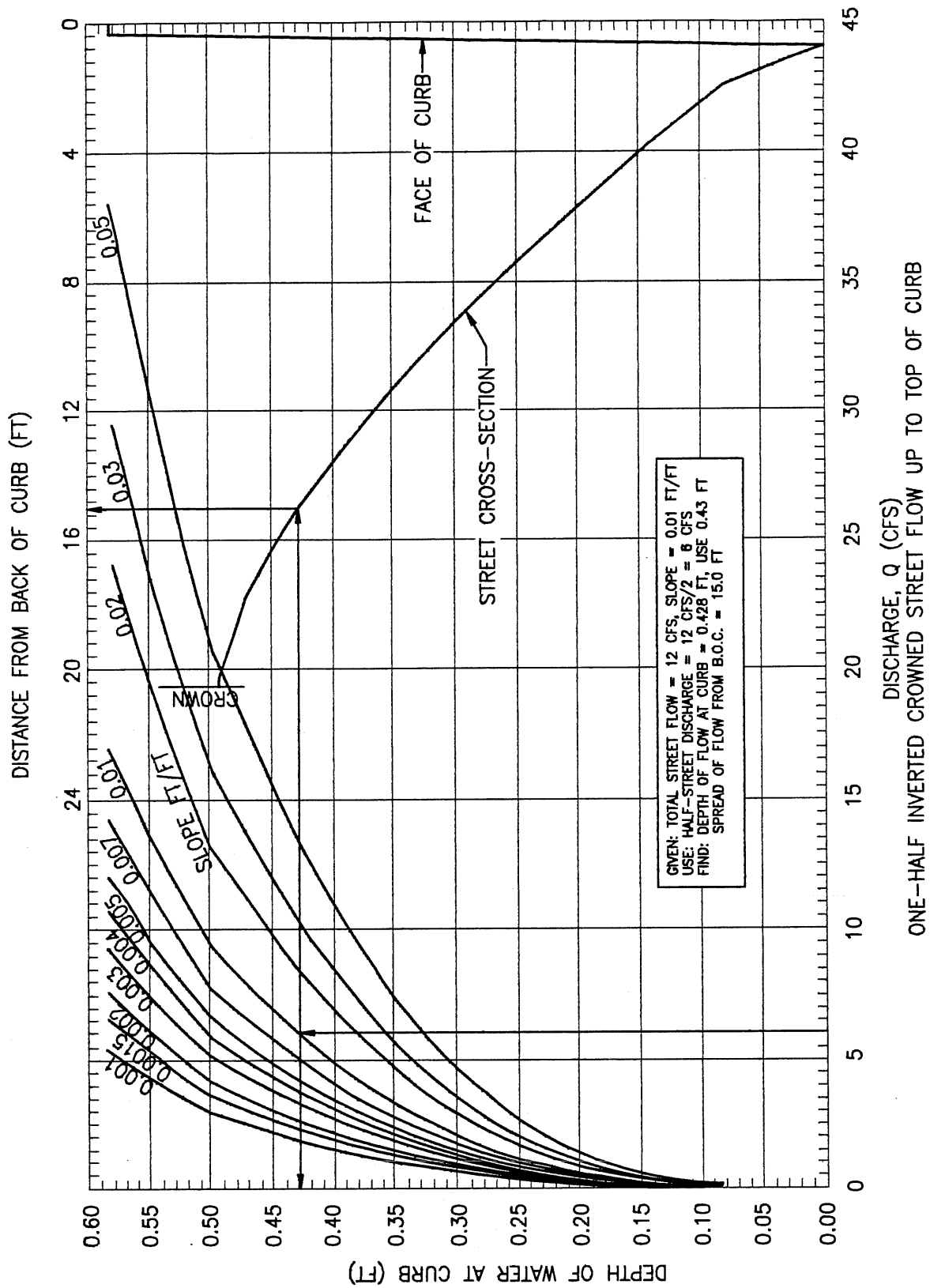
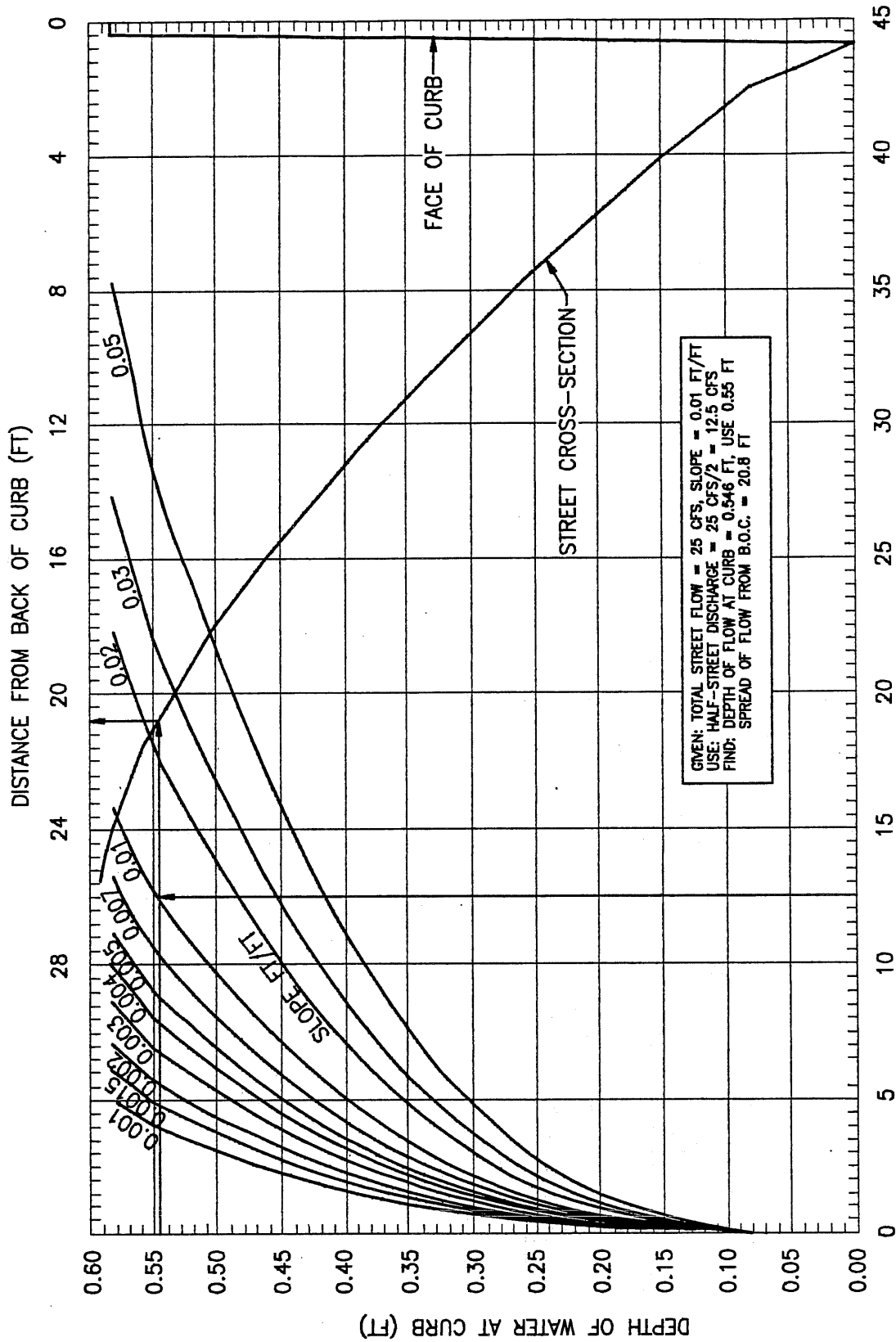


FIGURE 5-13

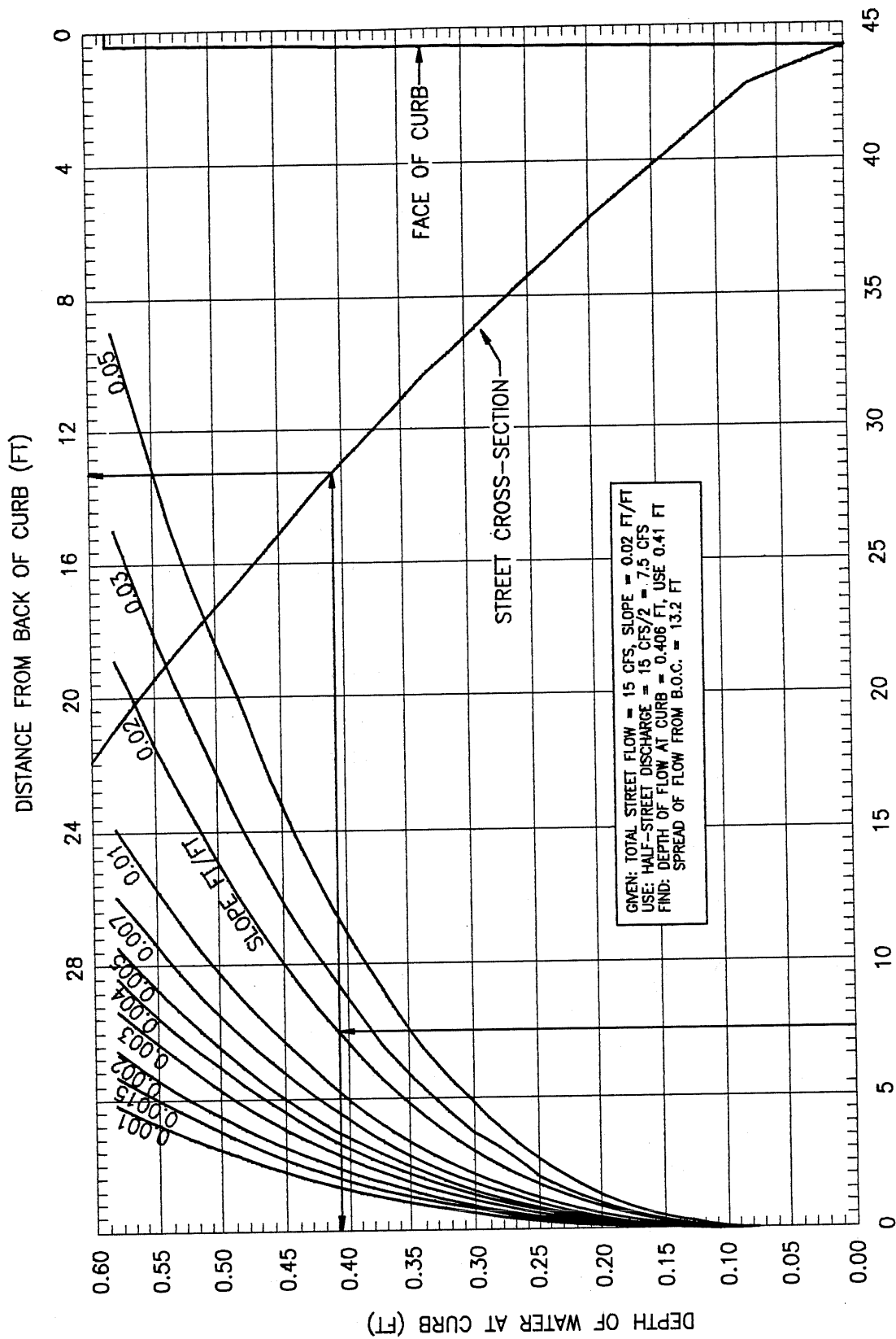
GUTTER DISCHARGE-DEPTH CURVES FOR 51' B-B STREET WIDTH



DISCHARGE, Q (CFS)
ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-14

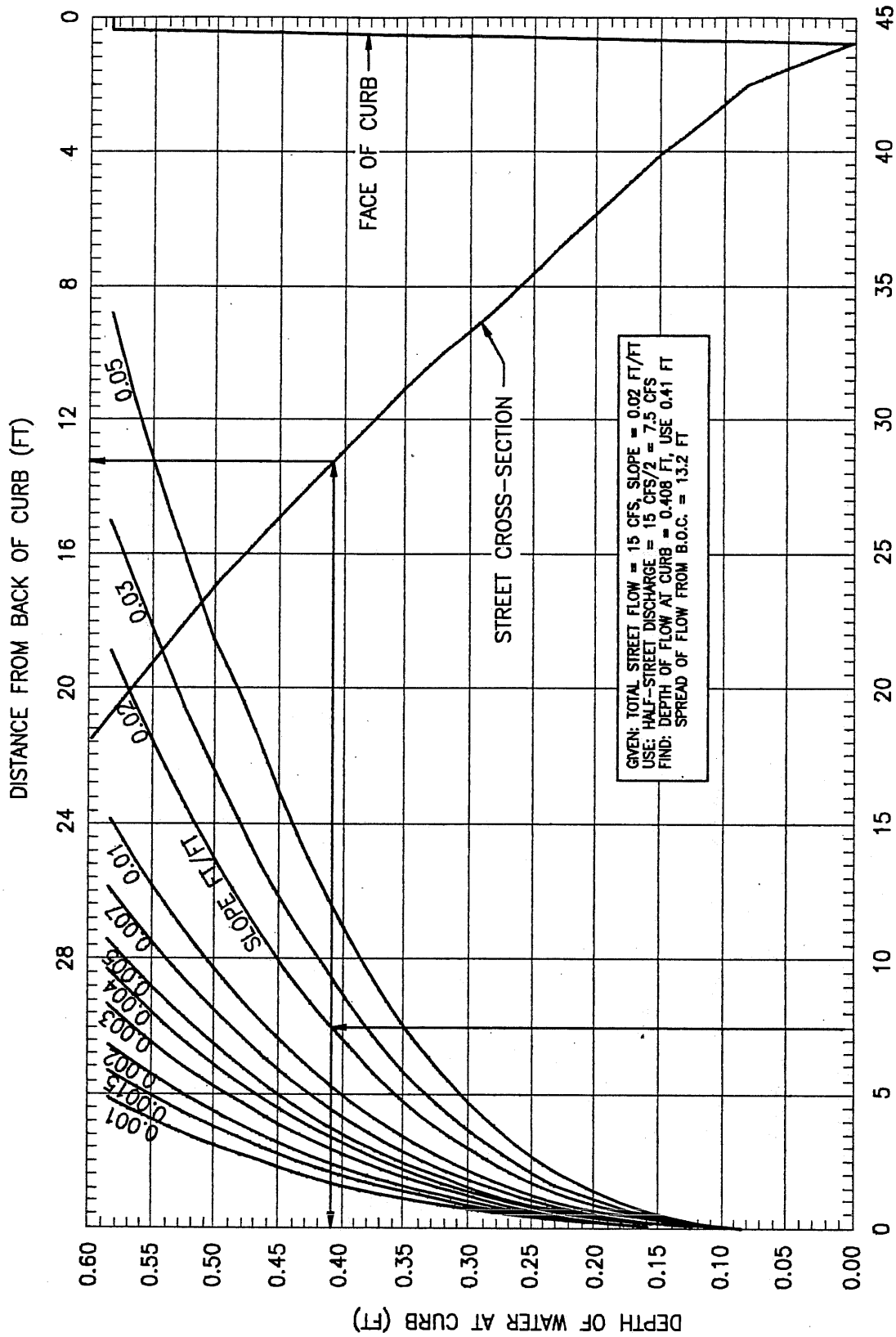
GUTTER DISCHARGE-DEPTH CURVES FOR 66' B-B STREET WIDTH



DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-15

GUTTER DISCHARGE-DEPTH CURVES FOR 68' B-B STREET WIDTH

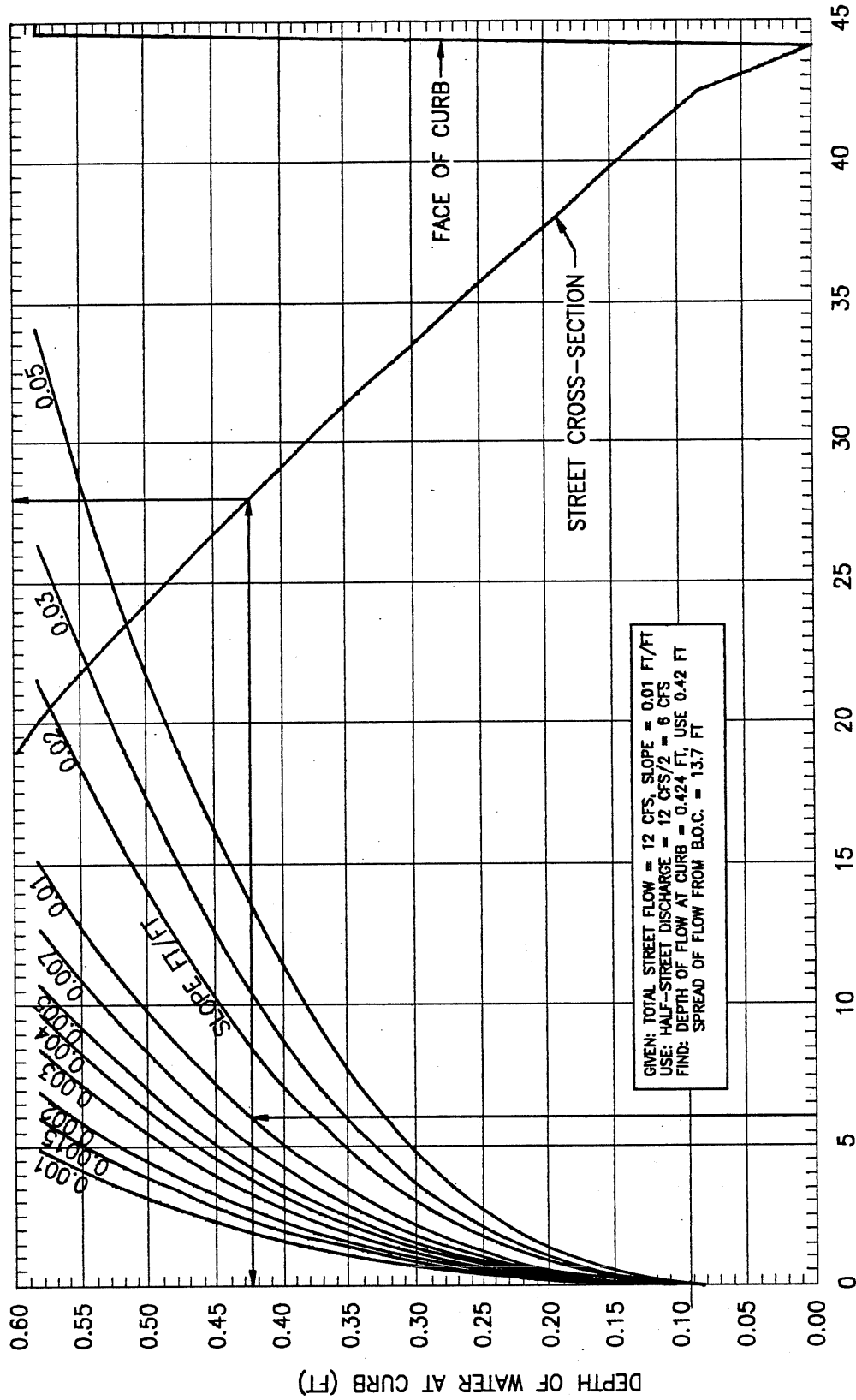


DISCHARGE, Q (CFS)
ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-16

GUTTER DISCHARGE-DEPTH CURVES FOR 86" B-B STREET WIDTH

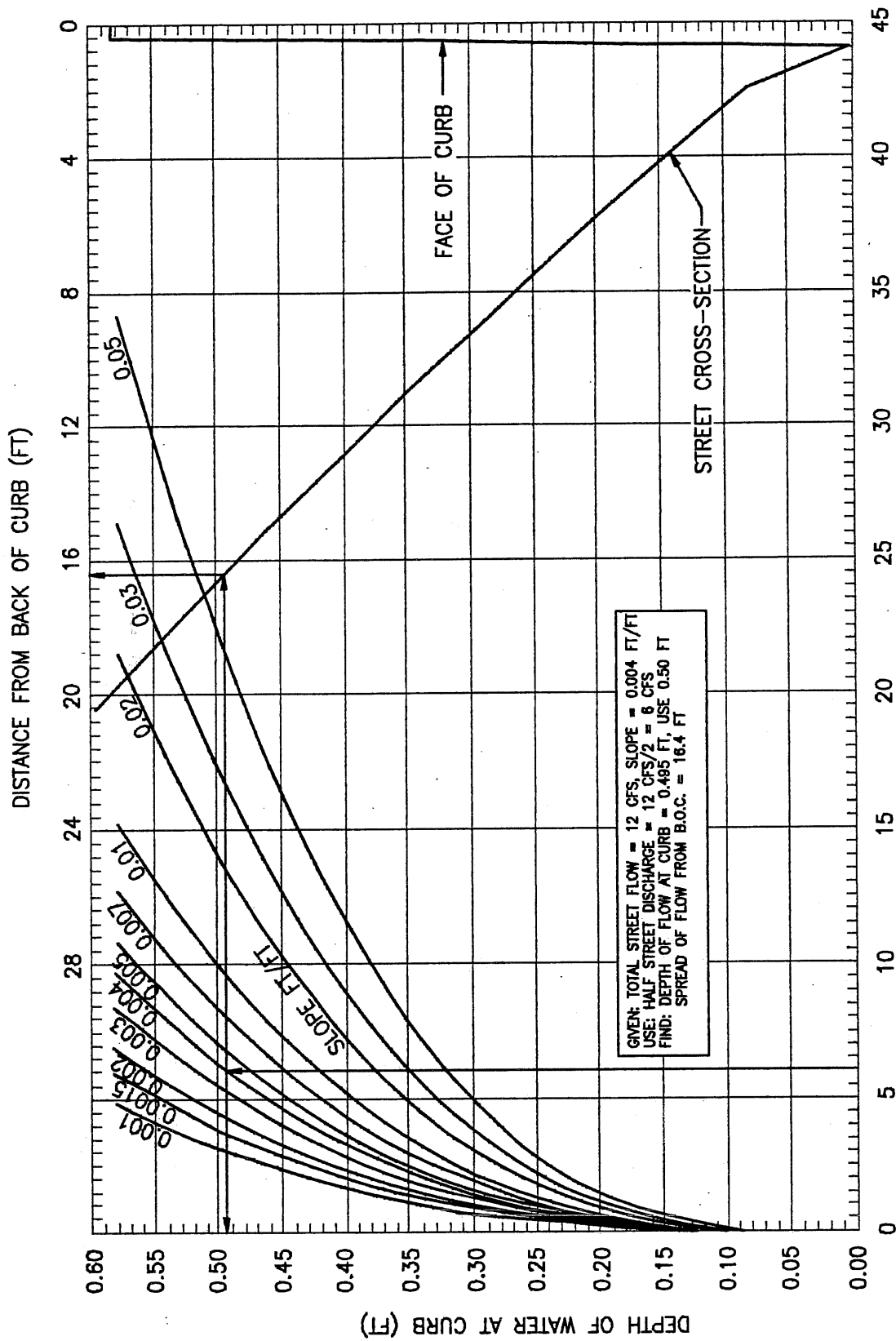
DISTANCE FROM BACK OF CURB (FT)



DISCHARGE, Q (CFS)
ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-17

GUTTER DISCHARGE-DEPTH CURVES FOR 93' B-B STREET WIDTH



DISCHARGE, Q (CFS)
ONE-HALF CROWNED STREET FLOW UP TO TOP OF CURB

FIGURE 5-18

curves for one gutter up to the top of curb. The top width to which the design flow spreads can also be determined from each nomograph. Note that some streets are fully submerged when the flow depth reaches the top of curb. Figures 5-19 through 5-26 provide the flow capacity of the street when the depth of flow exceeds the top of curb. Figures 5-19 through 5-26 can be used to find the flow capacity of a street up to six inches above the top of curb with the horizontal boundary set at five feet back-of-curb as illustrated in Figure 5-3. Examples are shown on these street flow curves to show how the curves are used.

5.3.4 Inverted Crown Streets

Inverted crowns in streets shall be permitted only as a last resort. An inverted crown may be considered when there is a lack of headroom for storm drains or there is a lack of a defined channel for a storm drain outlet.

To insure that perpendicularly crossing traffic shall not be excessively impeded, the maximum depth of water in the inverted crown shall not exceed twelve (12) inches using a storm of 100-year frequency.

The width of an inverted crown street should correspond to the widths for Type A, B, C, D or E streets, or the 30-foot and 37-foot wide streets as applicable. The center of an inverted crown street shall also be of concrete to enhance drainage of the street and reduce the City's maintenance costs normally found with asphalt pavement. The City Engineer may also require nuisance drains for the removal of small flows, such as runoff from landscape irrigation systems.

A typical section for an inverted crown street is shown in Figure 5-27 along with the geometric relationships for that type of section. Determination of the flow capacity for an inverted parabolic street section follows the same procedure as that for parabolic-crowned streets discussed earlier. The street section is divided into selected incremental depths and then the flow rate is determined for total depth.

Figures 5-28 through 5-35 have been developed to reduce design time and provide for consistent analysis. These figures can be used to determine flow capacity, depth of flow and the top width of the water surface. An example is also given on these figures which illustrates how to use the nomographs. Note that the inverted crown street capacity curves only extend to the top of curb at maximum depth. However, the maximum flow depth of 12 inches, discussed earlier for inverted crown streets, is still applicable.

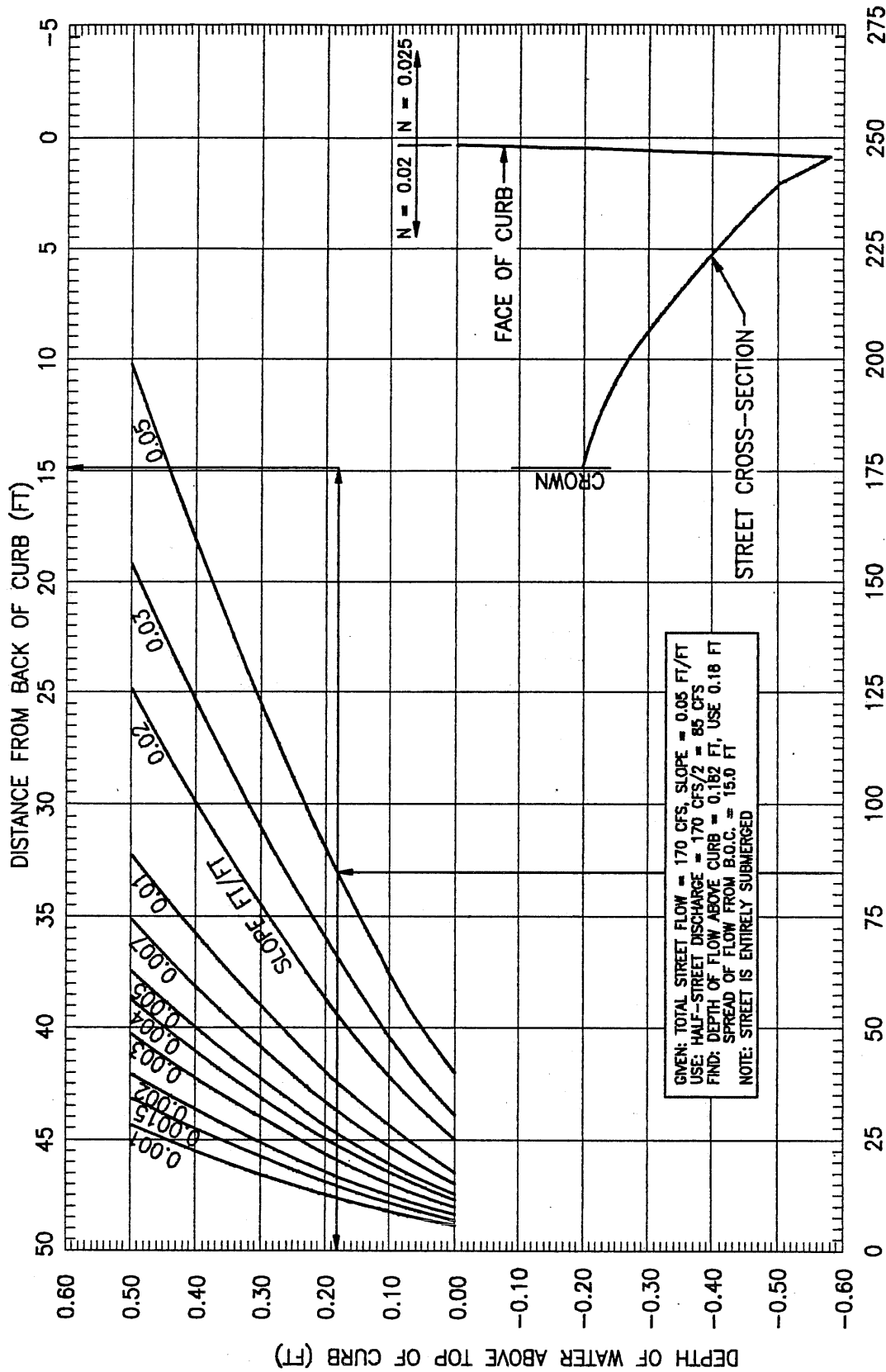
5.3.5 Interference to Flow Due to Ponding

Where possible, ponding is to be avoided.

5.3.6 Interference to Flow at Intersections

Where possible, and storm drains are in use, inlets should be placed upstream from an intersection to prevent large amounts of water running through the intersection. The inlets should be located on the approach street to an intersection and in alleys where necessary to prevent water from entering these intersections in amounts which would cause the allowed street capacity to be exceeded.

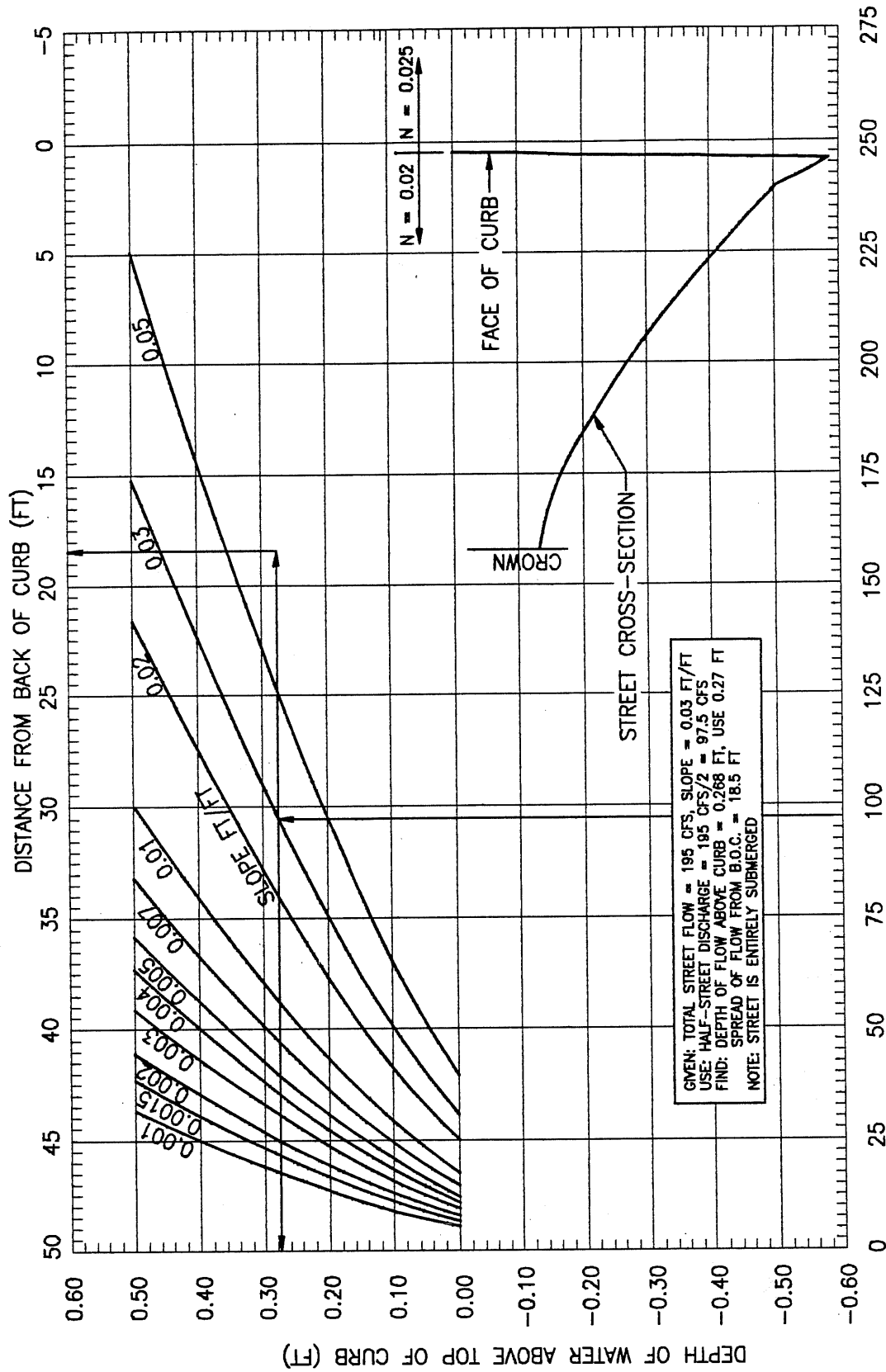
STREET CAPACITY DISCHARGE-DEPTH CURVES, 30' B-B STREET WIDTH, 40' FLOW WIDTH LIMIT



DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
 CURVES INCLUDE FLOW BELOW TOP OF CURB

FIGURE 5-19

STREET CAPACITY DISCHARGE-DEPTH CURVES, 37' B-B STREET WIDTH, 47' FLOW WIDTH LIMIT

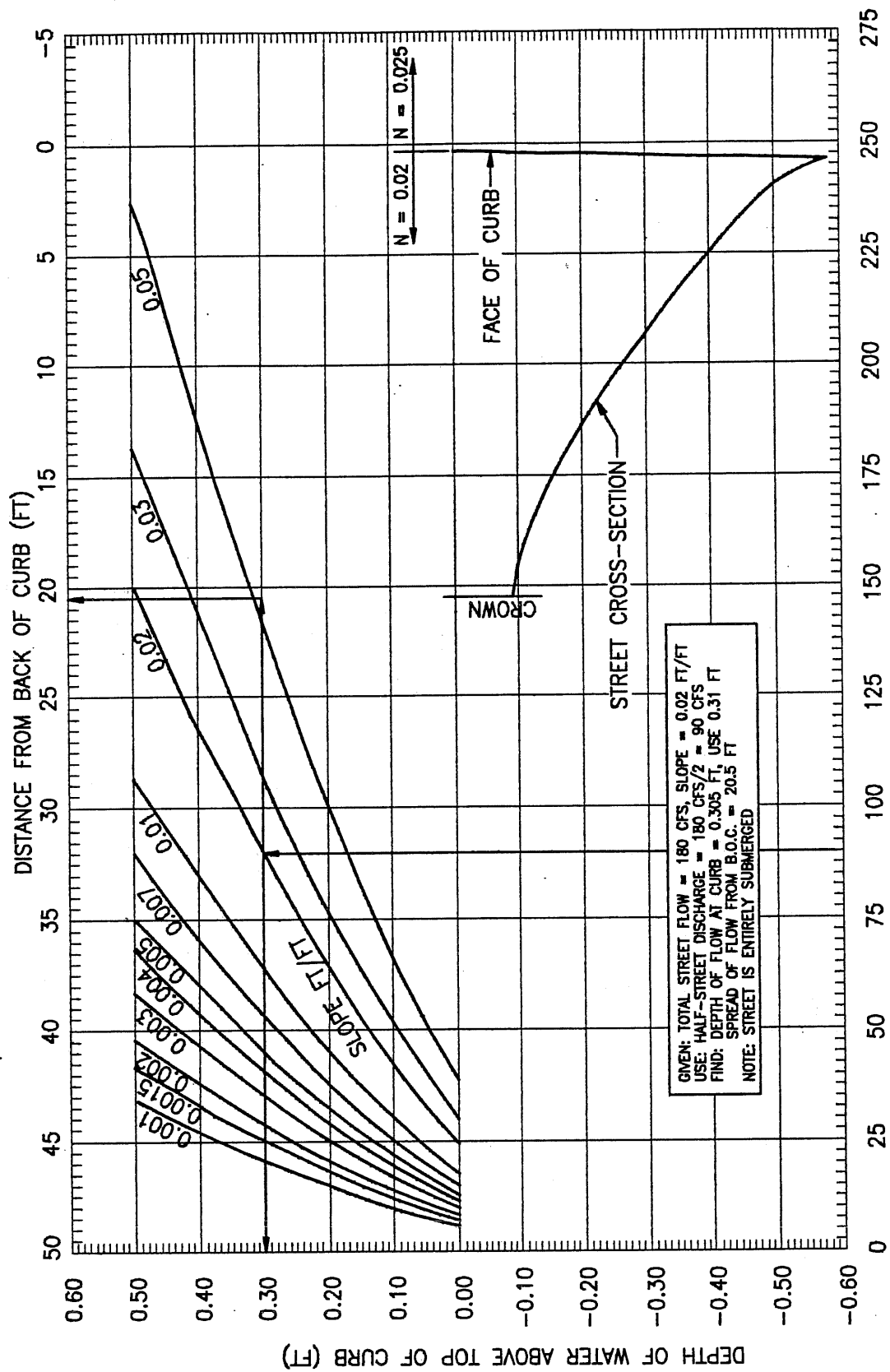


DISCHARGE, Q (CFS)
ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
CURVES INCLUDE FLOW BELOW TOP OF CURB

FIGURE 5-20

STREET CAPACITY DISCHARGE-DEPTH CURVES, 41' B-B STREET WIDTH, 51' FLOW WIDTH LIMIT

DRAINAGE



5-24

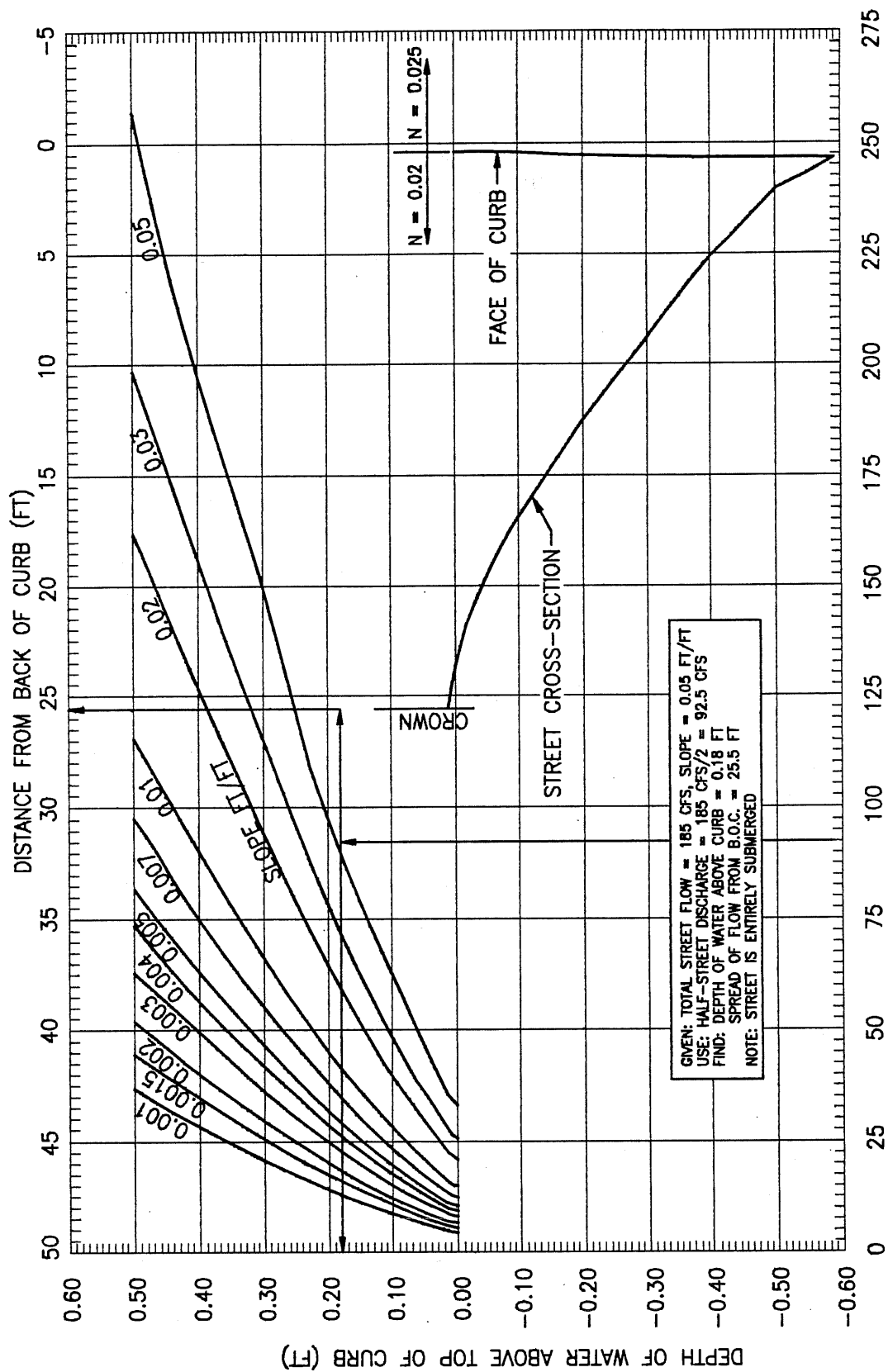
DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
 CURVES INCLUDE FLOW BELOW TOP OF CURB

FIGURE 5-21

6/92

STREET CAPACITY DISCHARGE-DEPTH CURVES, 51' B-B STREET WIDTH, 61' FLOW WIDTH LIMIT

DRAINAGE



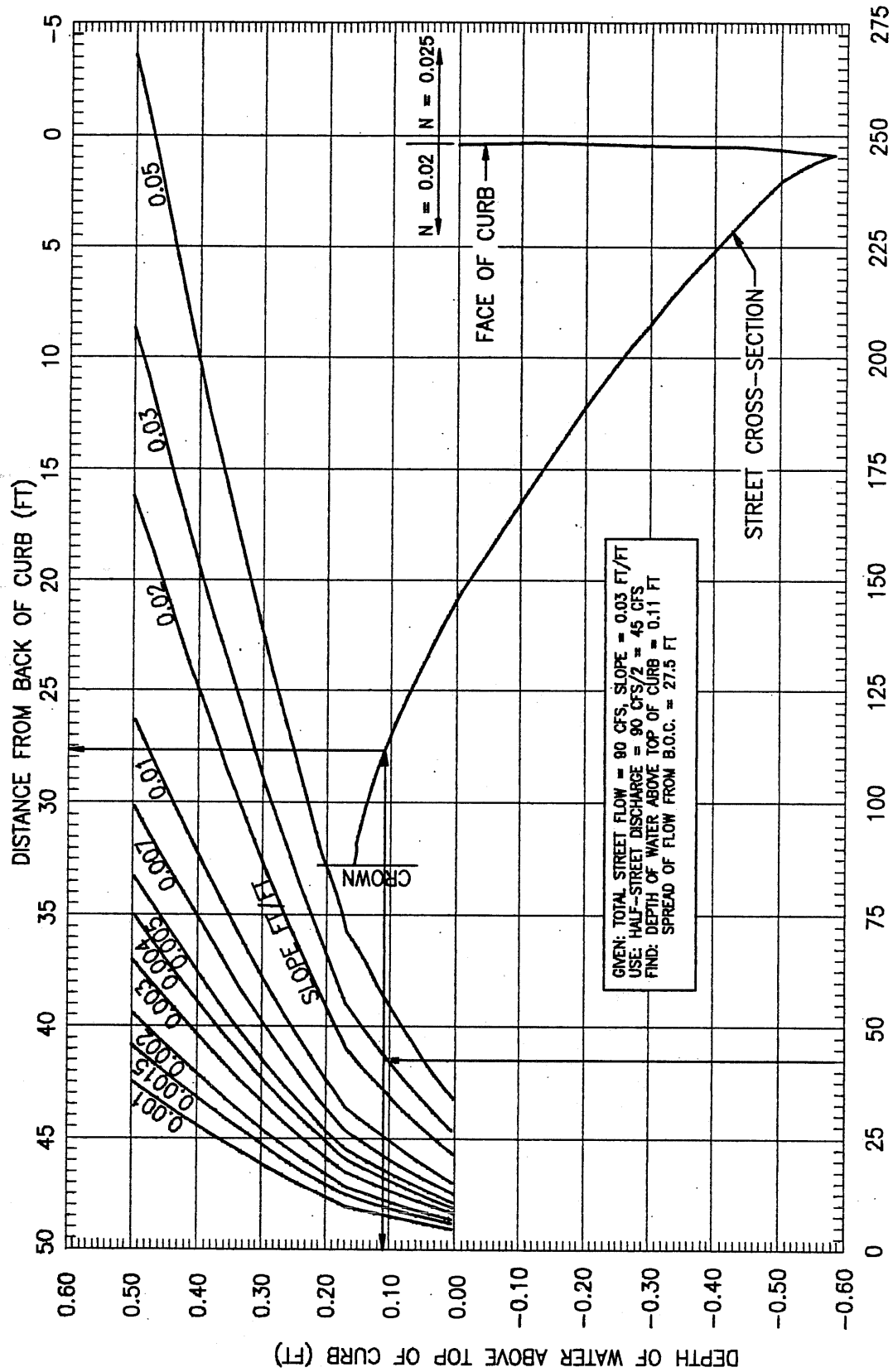
5-25

DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
 CURVES INCLUDE FLOW BELOW TOP OF CURB

FIGURE 5-22

6/92

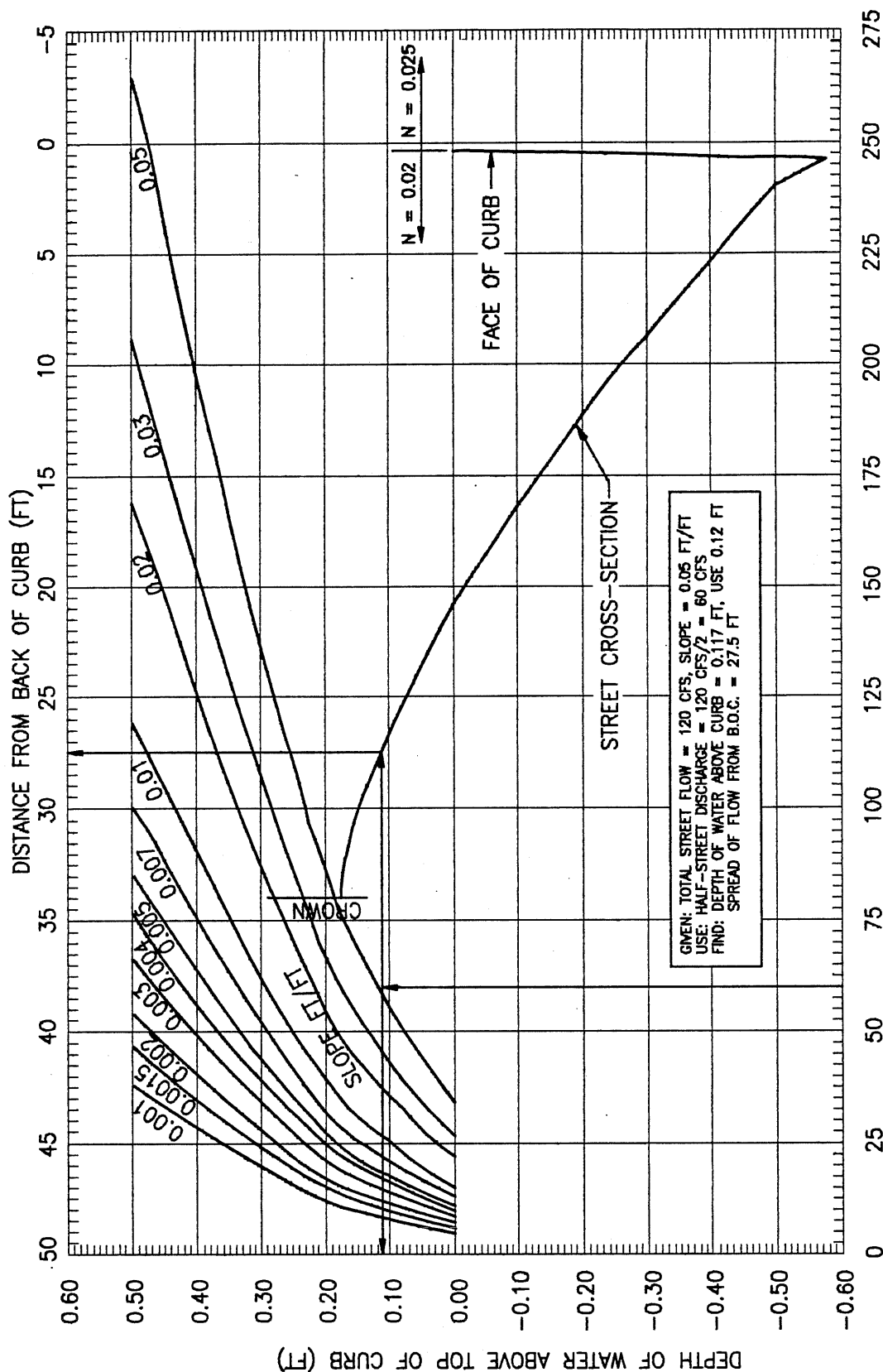
STREET CAPACITY DISCHARGE-DEPTH CURVES, 66' B-B STREET WIDTH, 76' FLOW WIDTH LIMIT



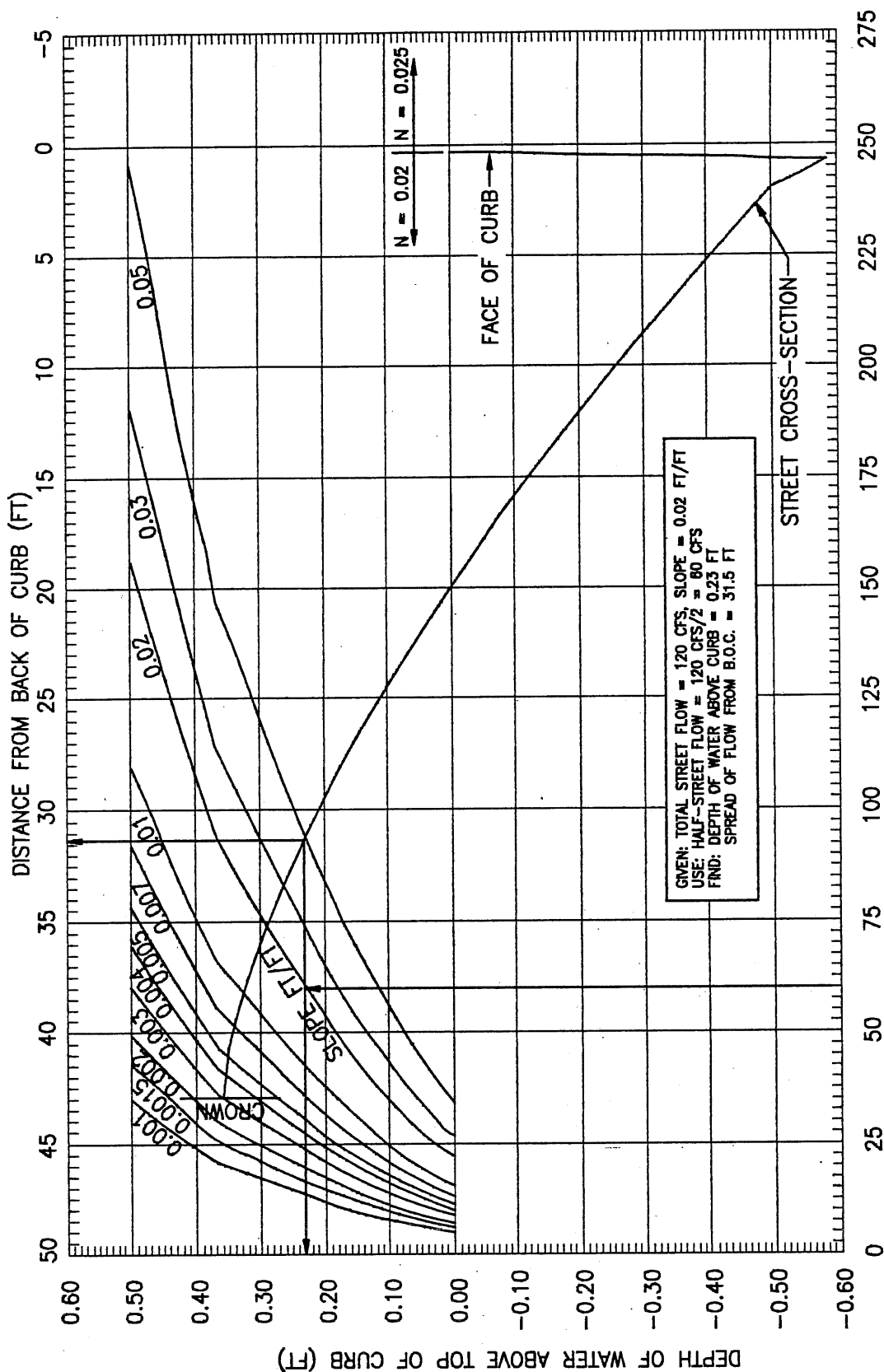
DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
 CURVES INCLUDE FLOW BELOW TOP OF CURB

FIGURE 5-23

STREET CAPACITY DISCHARGE-DEPTH CURVES, 68' B-B STREET WIDTH, 78' FLOW WIDTH LIMIT



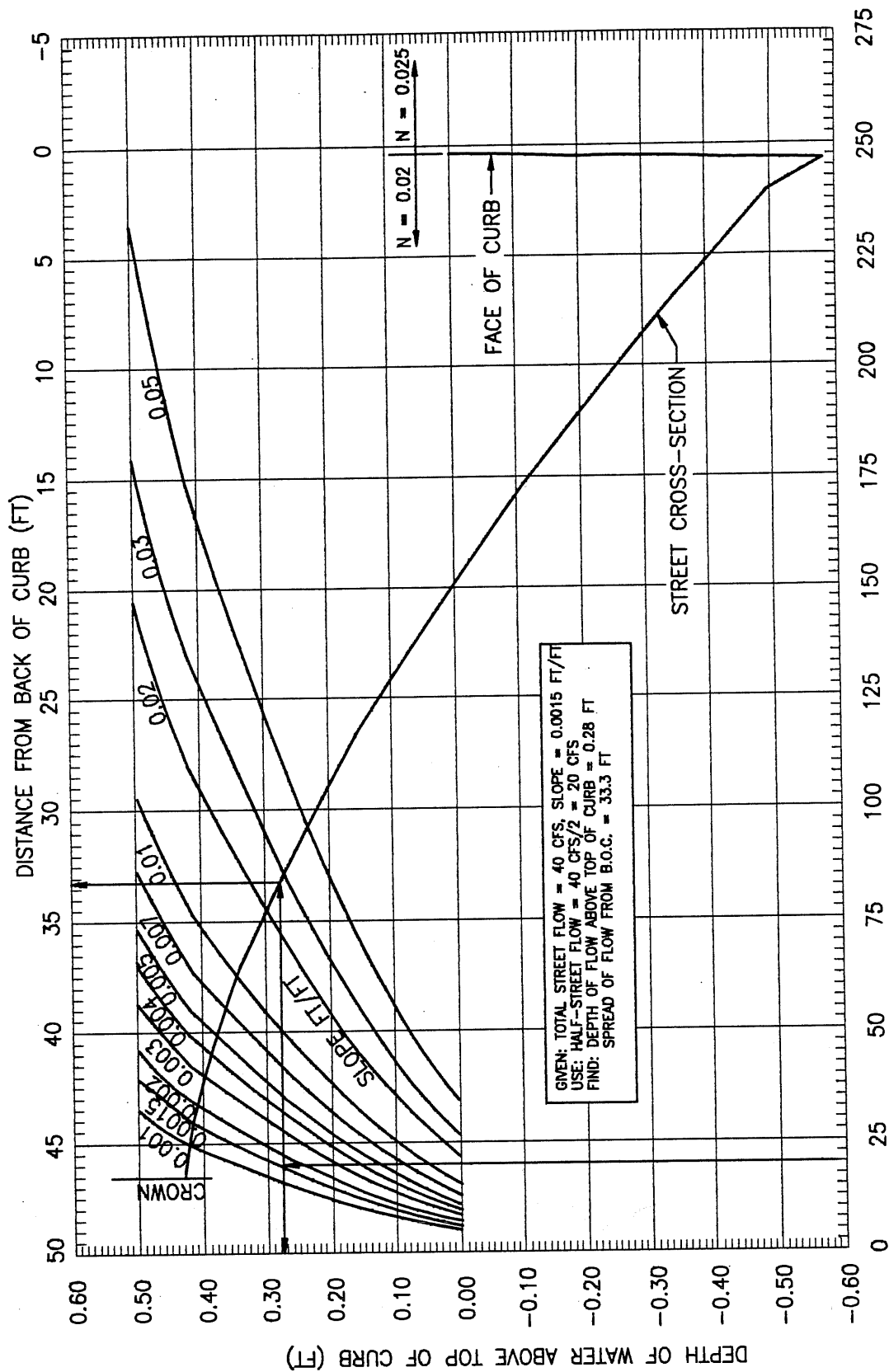
STREET CAPACITY DISCHARGE-DEPTH CURVES, 86' B-B STREET WIDTH, 96' FLOW WIDTH LIMIT



DISCHARGE, Q (CFS)
ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
CURVES INCLUDE FLOW BELOW TOP OF CURB

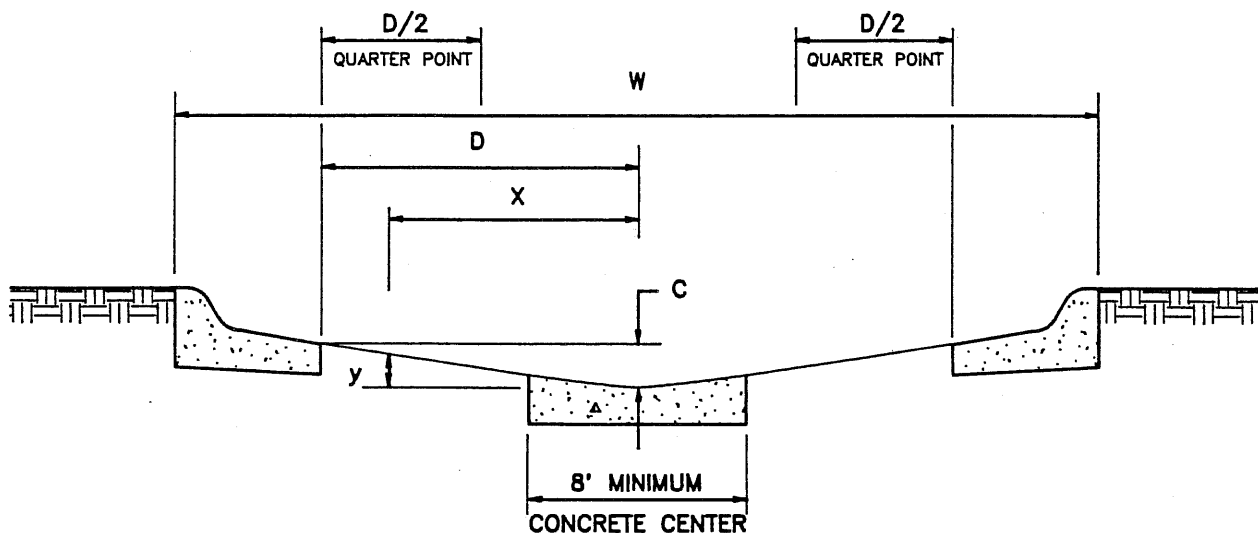
FIGURE 5-25

STREET CAPACITY DISCHARGE-DEPTH CURVES, 93' B-B STREET WIDTH, 103' FLOW WIDTH LIMIT



DISCHARGE, Q (CFS)
 ONE-HALF CROWNED STREET FLOW UP TO SIX INCHES ABOVE TOP OF CURB
 CURVES INCLUDE FLOW BELOW TOP OF CURB

FIGURE 5-26



$C = \frac{W}{100}$ = DEPTH OF STREET INVERT BELOW LIP OF CURB AND GUTTER
(USUALLY ROUNDED TO NEAREST HALF-INCH IN CONSTRUCTION DRAWINGS)

$$y = \left(\frac{x}{D}\right)^{1/2} C$$

C = DEPTH OF INVERT BELOW LIP OF GUTTER

y = RISE AT ANY POINT ABOVE CENTERLINE INVERT
AT DISTANCE X FROM STREET CENTERLINE

D = DISTANCE FROM LIP-OF-GUTTER TO STREET C

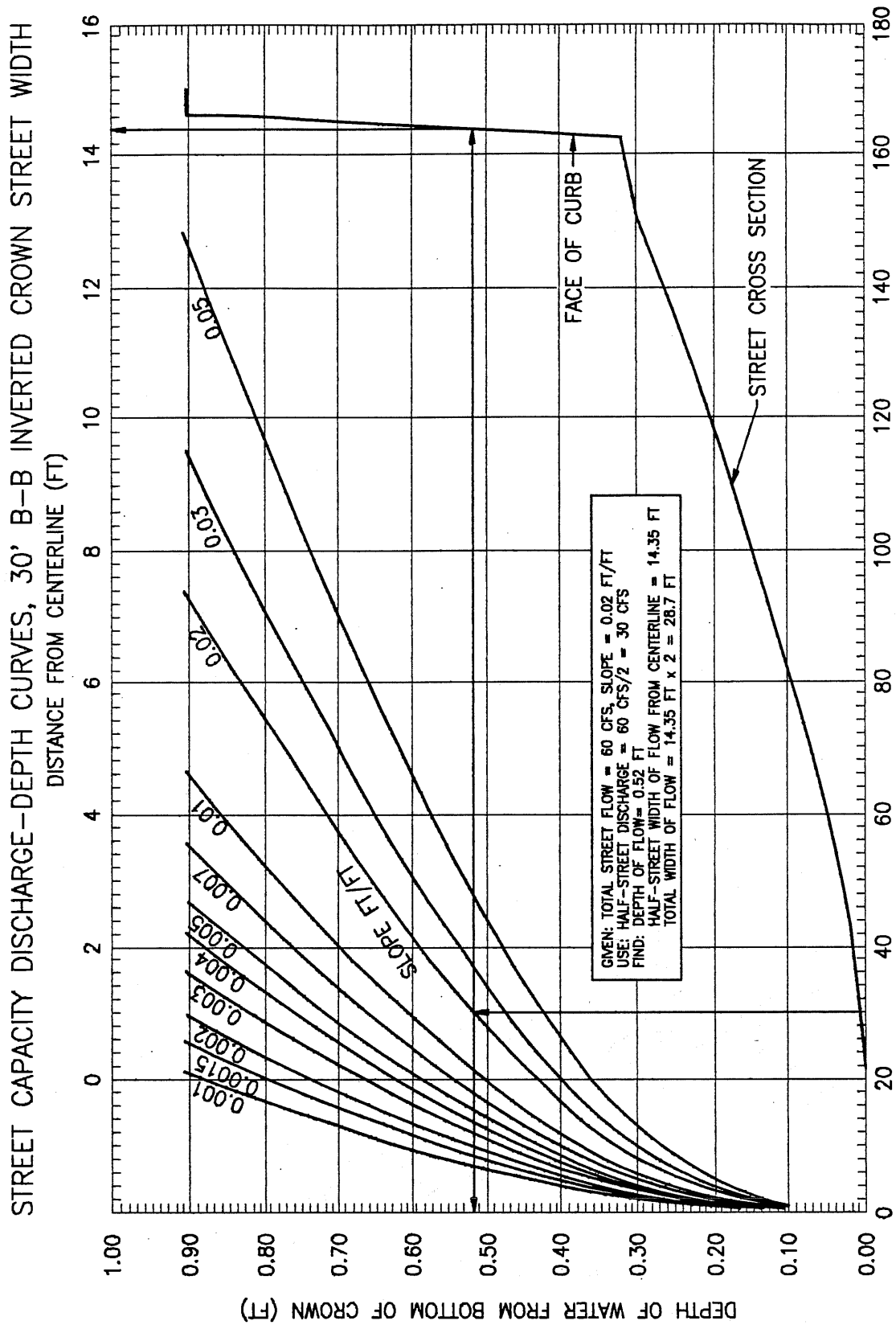
W = TOTAL BACK-TO-BACK STREET WIDTH

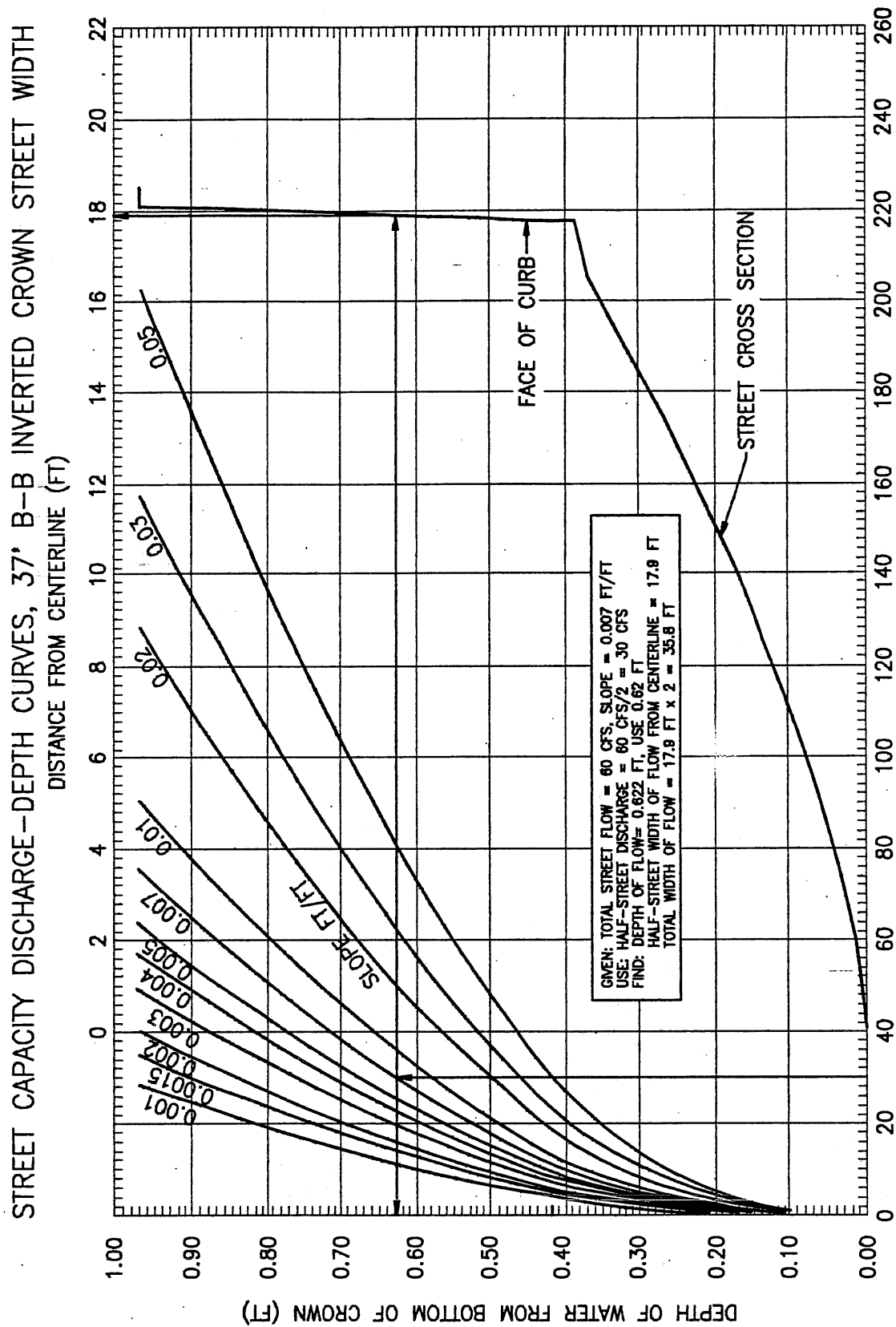
$\frac{D}{2}$ = QUARTER POINT DISTANCE

$\frac{2C}{3}$ = DEPTH OF QUARTER POINT BELOW LIP OF GUTTER

INVERTED CROWN STREET GEOMETRY

FIGURE 5-27





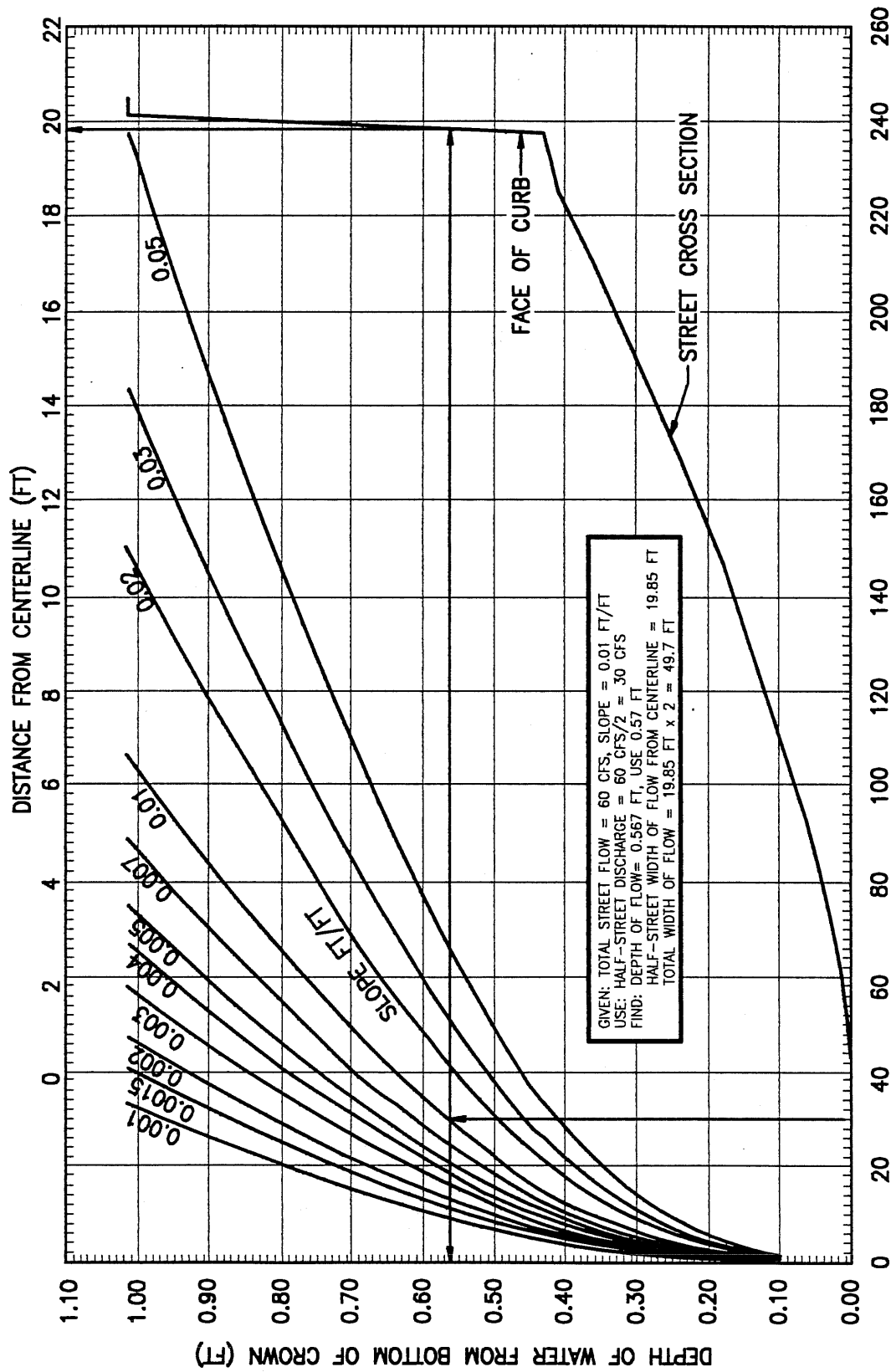
DISCHARGE, Q (CFS)

ONE-HALF INVERTED CROWN STREET FLOW UP TO TOP OF CURB

INVERTED CROWN STREET

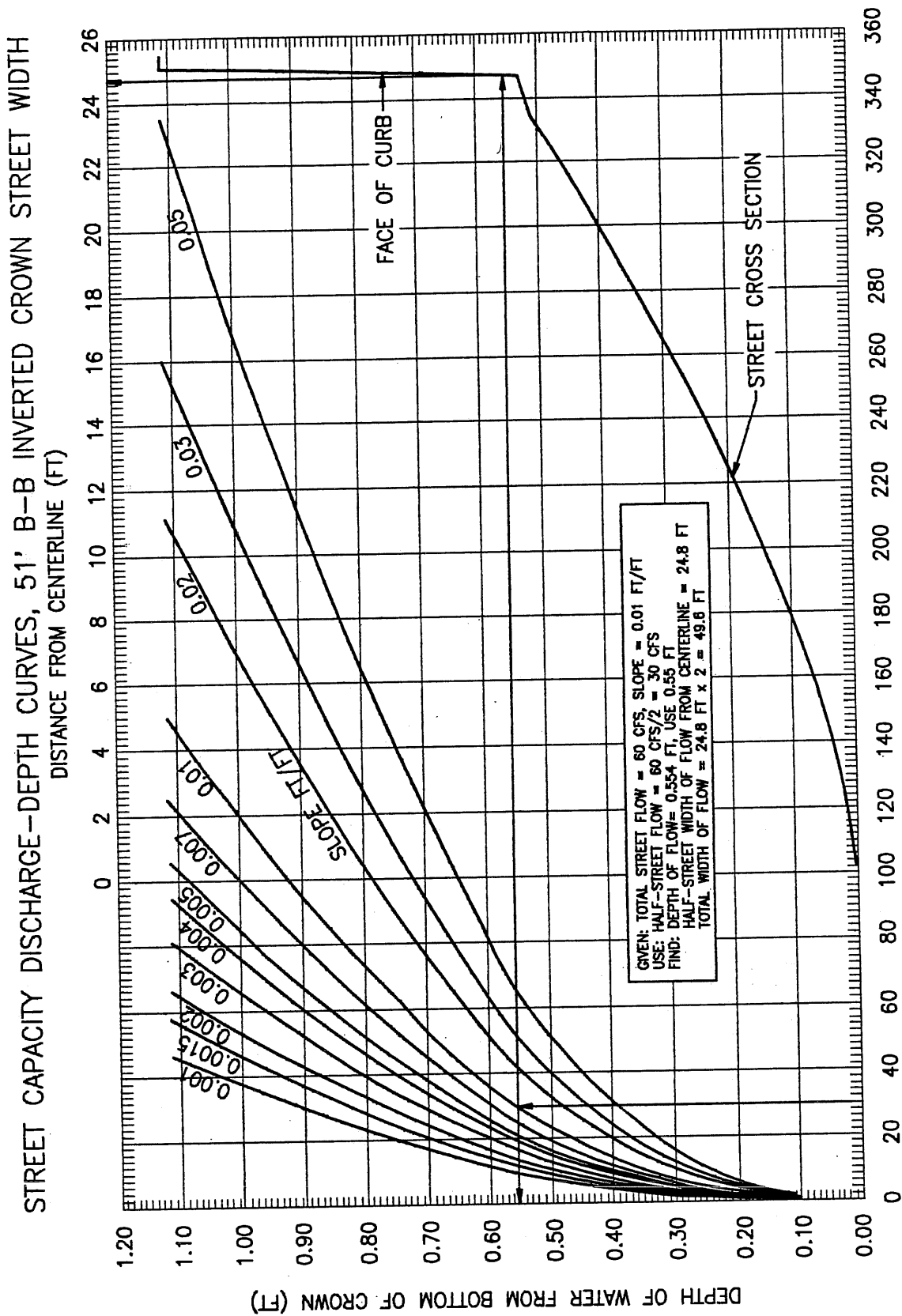
FIGURE 5-29

STREET CAPACITY DISCHARGE-DEPTH CURVES, 41' B-B INVERTED CROWN STREET WIDTH



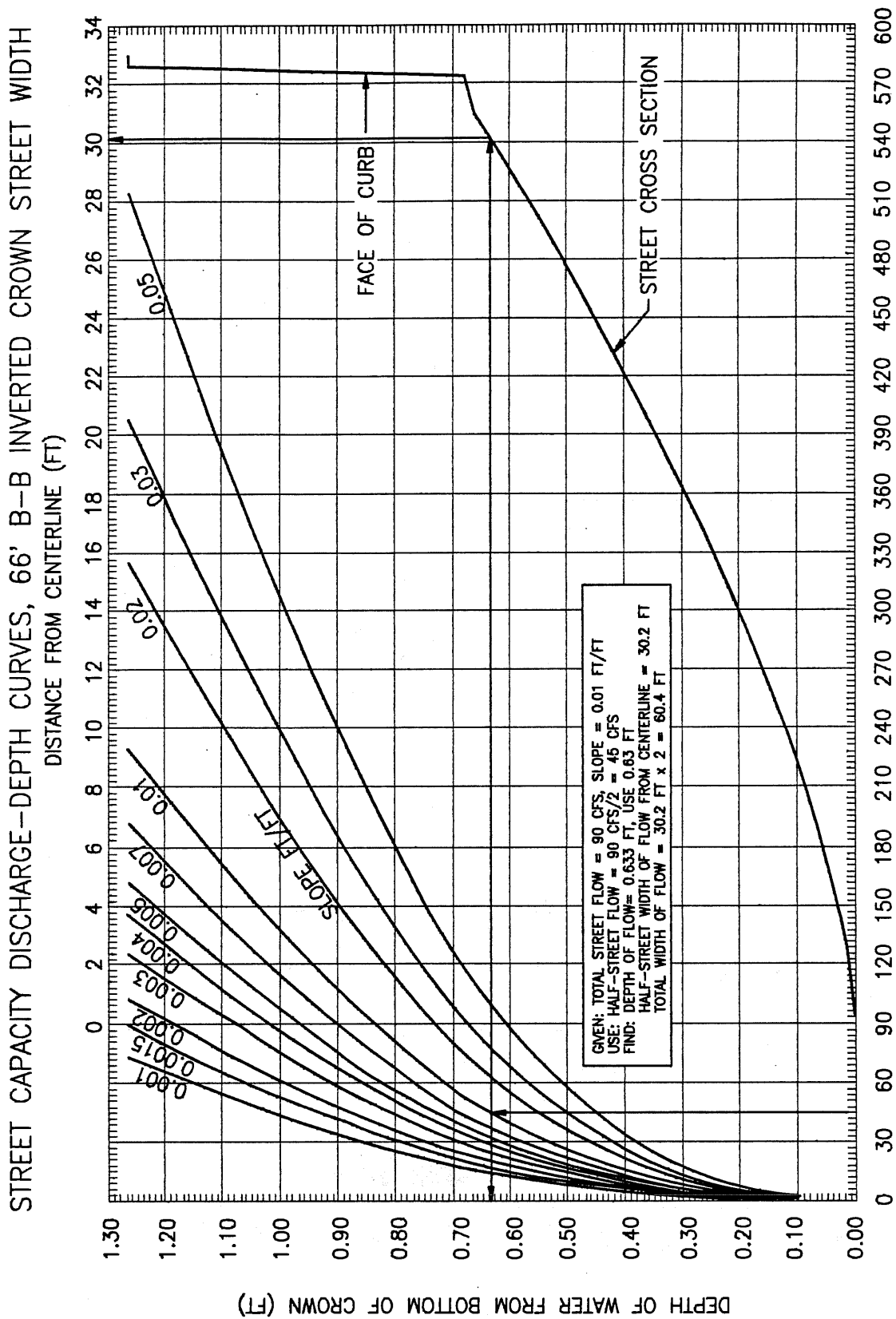
DISCHARGE, Q (CFS)
 ONE-HALF INVERTED CROWN STREET FLOW UP TO TOP OF CURB
 INVERTED CROWN STREET

FIGURE 5-30



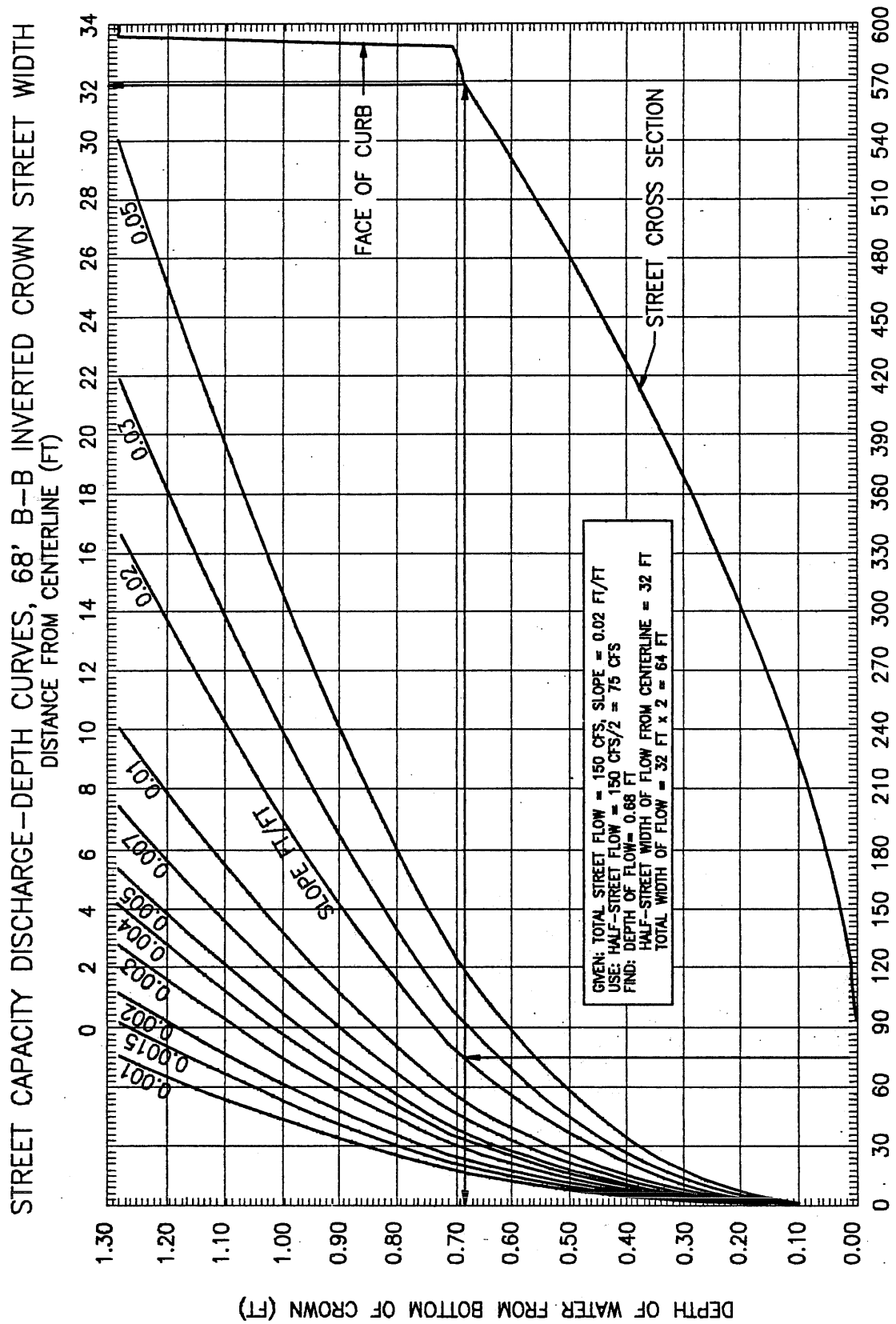
DISCHARGE, Q (CFS)
 ONE-HALF INVERTED CROWN STREET FLOW UP TO TOP OF CURB
 INVERTED CROWN STREET

FIGURE 5-31



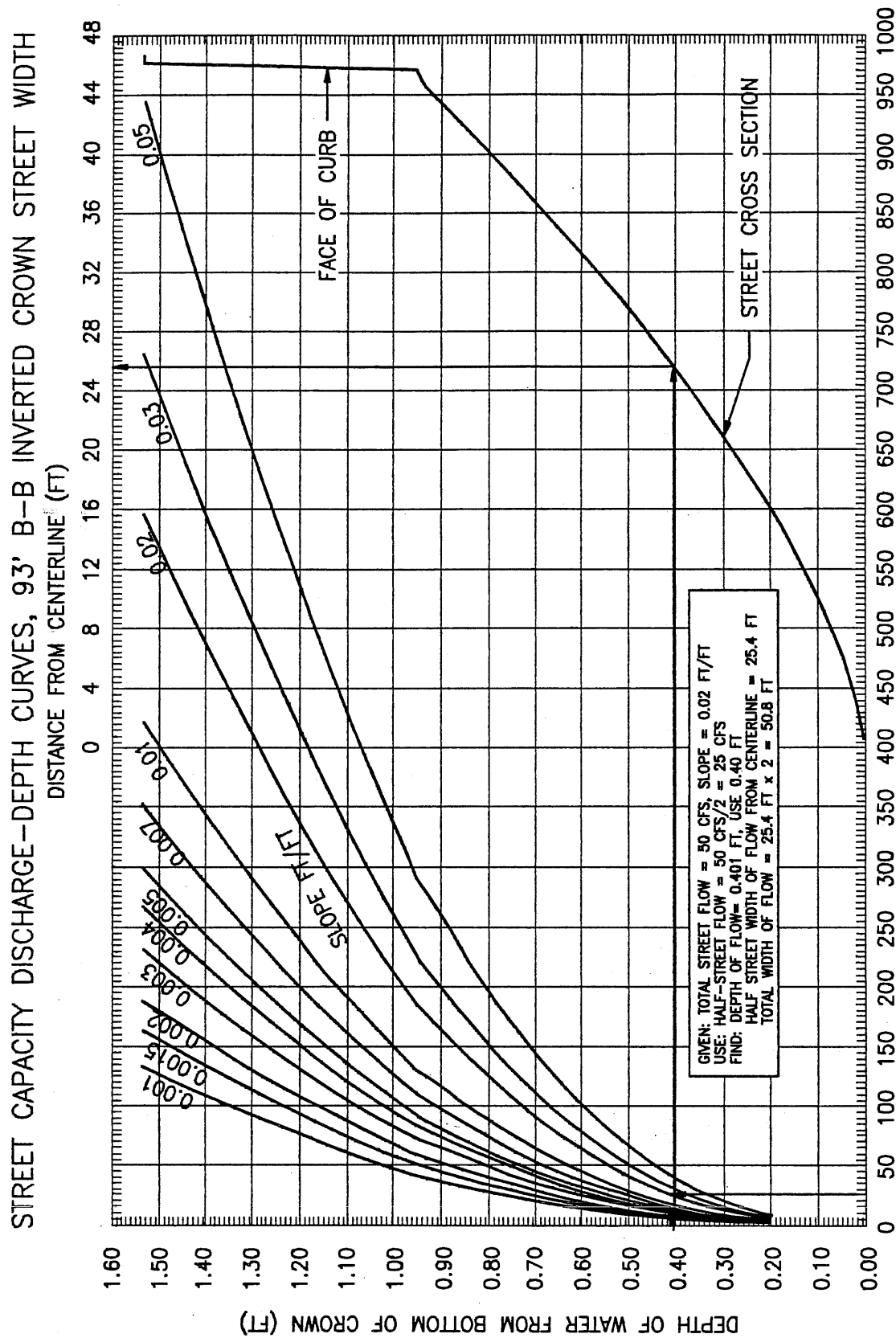
DISCHARGE, Q (CFS)
ONE-HALF INVERTED CROWN STREET FLOW UP TO TOP OF CURB
INVERTED CROWN STREET

FIGURE 5-32



DISCHARGE, Q (CFS)
 ONE-HALF INVERTED CROWN STREET FLOW UP TO TOP OF CURB
 INVERTED CROWN STREET

FIGURE 5-33



The use of valley gutters to convey storm water across an intersection is subject to the following criteria:

1. A major street should not be crossed with a valley gutter.
2. Wherever feasible, a secondary street should not be crossed with a valley gutter.
3. At any intersection, perpendicular valley gutters will not be permitted and parallel valley gutters should cross only the lower classified street.
4. Valley gutters of concrete construction will be required where the slope in the direction of flow is less than 0.004 feet per foot (0.4 percent).

5.4 DESIGN CONSIDERATIONS

5.4.1 Maximum Allowable Flow Depth

The City of Midland requires a storm drain conduit, where feasible, to begin at the point where the depth of flow based on the 5-year storm frequency reaches a depth which is above the top of curb, or the 100-year flow reaches a depth which is six inches above the top of curb. Inlets are then located as necessary to remove the flow based on a five year storm frequency. If, in the judgement of the City Engineer, the flow in the gutter would be excessive under either condition, then consideration should be given to extending the storm sewer to a point where the gutter flow can be intercepted by more reasonable inlet locations. Multiple inlets at a single location are permitted in extenuating circumstances.

Table 5-2 below shows the required traffic area free of storm water using a five-year frequency storm.

Table 5-2

<u>Street Classification</u>	<u>Area Free of Storm Water Using Five-Year Frequency Storm</u>
Type A, B or C	One lane in each direction
Type D	One lane (normally the center 12 feet)
Type E	N/A

5.4.2 Maximum and Minimum Street Grades

Maximum street grades should not exceed 0.10 feet per foot (10 percent). Minimum street grades should not be less than 0.002 feet per foot (0.2 percent). Grades less than 0.002 feet per foot usually result in inadequate drainage of the gutters and often have inadequate flow capacities. The street capacity nomographs discussed earlier cover street grades from 0.001 to 0.05 feet per foot (0.10 to 5.0 percent). These nomographs should cover the vast majority of applications in Midland.

5.5 SURFACE OUTFALLS TO CHANNELS

5.5.1 Sawtooth Curb and Gutter

A sawtooth curb and gutter may be used to route storm water from the gutter to an open channel or a drainage flume. This is a desirable feature where storm drains are not feasible and the storm water runoff must be routed away from the street by surface means. Figure 5-36 illustrates typical sawtooth curb and gutter construction. The openings in the curb permit the water to flow behind the curb. Figure 5-37 shows one possible use of sawtooth curb and gutter to convey runoff into a playa lake. Other applications include overflow sections of playa lakes and conveyance to open channels.

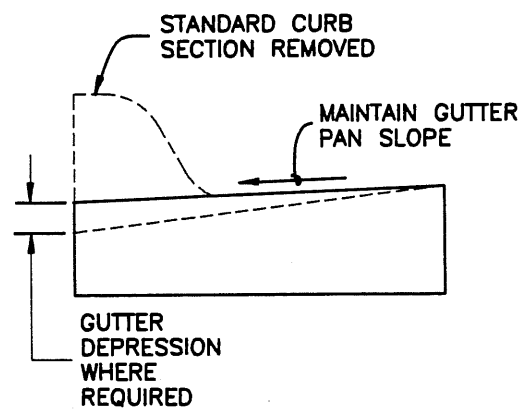
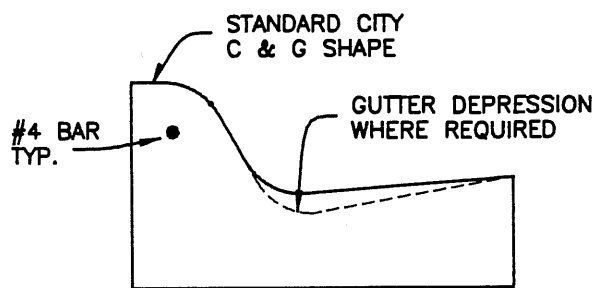
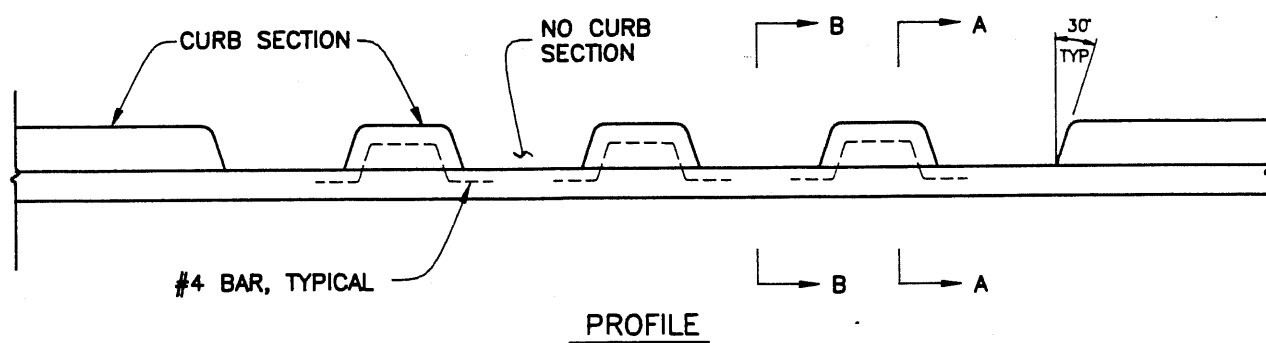
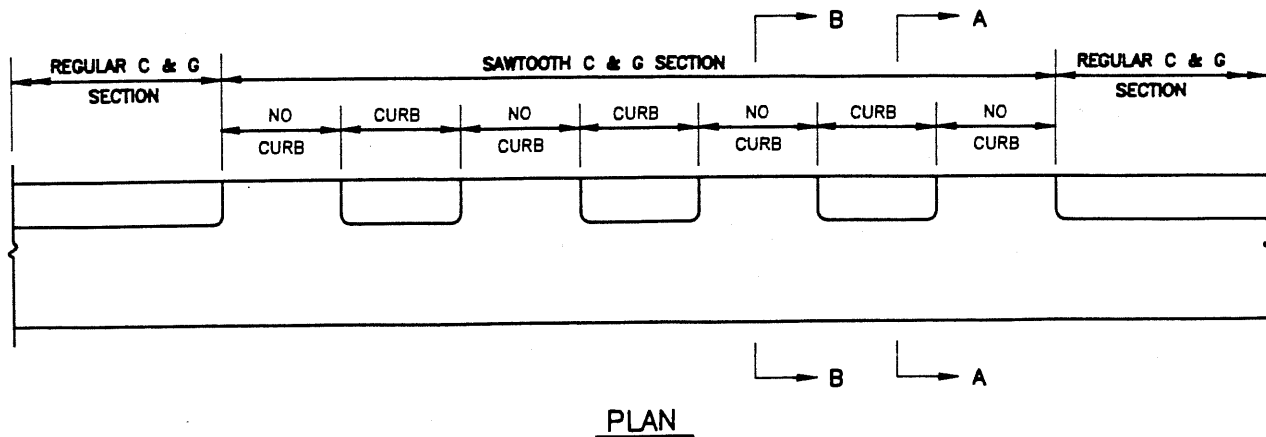
5.5.2 Capture of Flow in Gutter

All storm water shall be drained from the streets to the gutter. This shall be done through sheet flow perpendicular to the roadway. The gutter shall convey the storm water to a storm water reservoir or storm water inlet as required in section 5.2.

5.5.3 Drainage Flumes

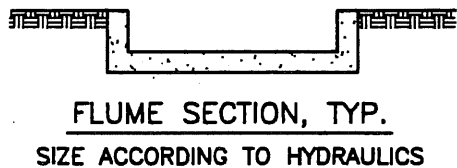
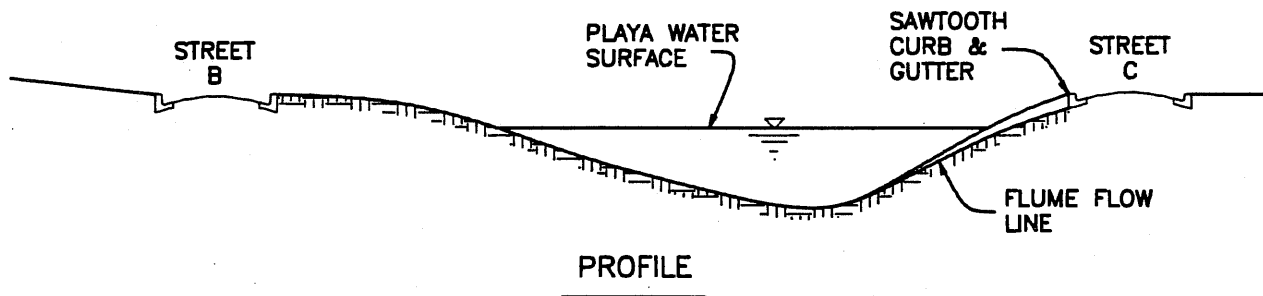
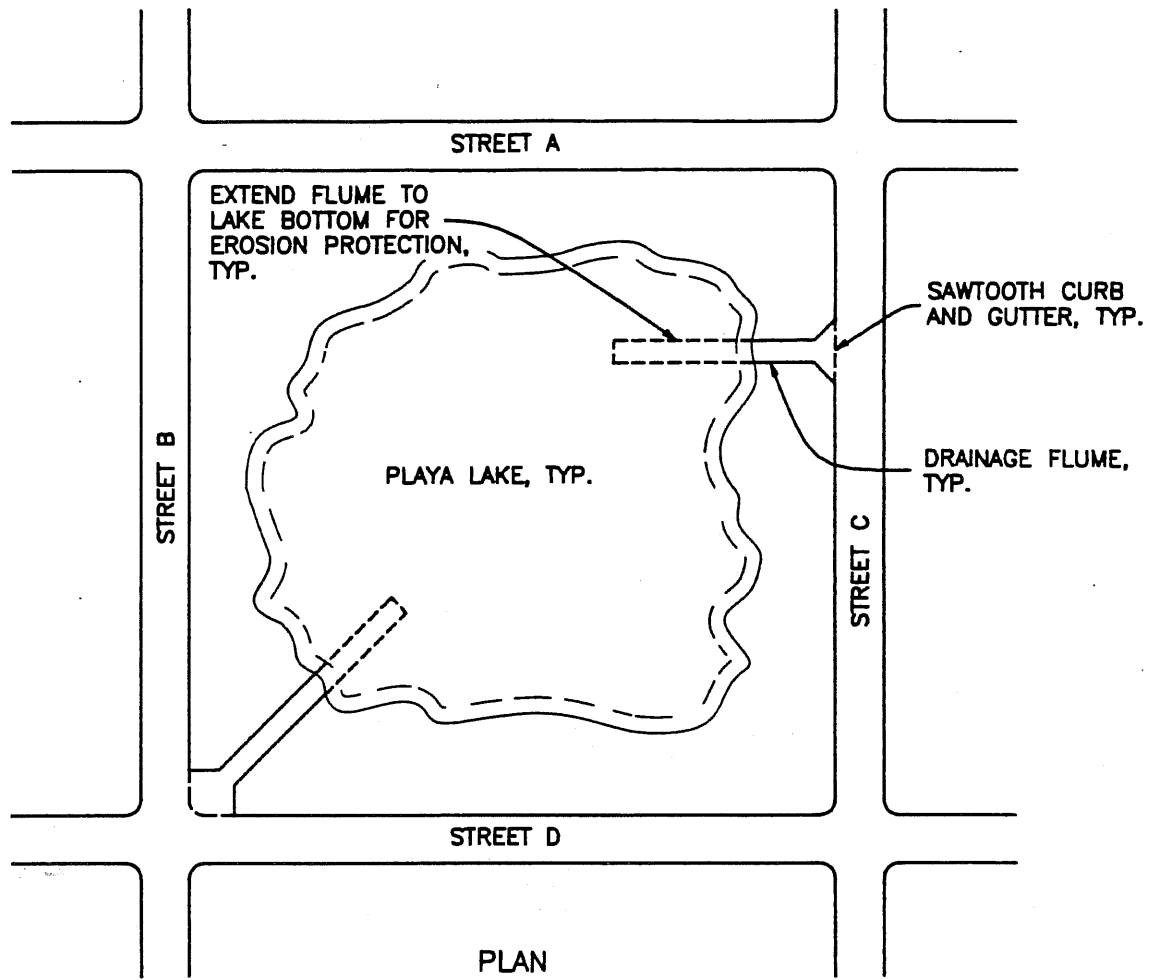
Drainage flumes may be used to convey storm water from a watershed if sheet flow is not desirable or easily obtainable. Figure 5-37 shows one typical application of a flume to convey storm water runoff from a street to a playa lake. Another application could be the conveyance of runoff from a street to a drop structure at an open channel as shown in Figure 5-38.

END



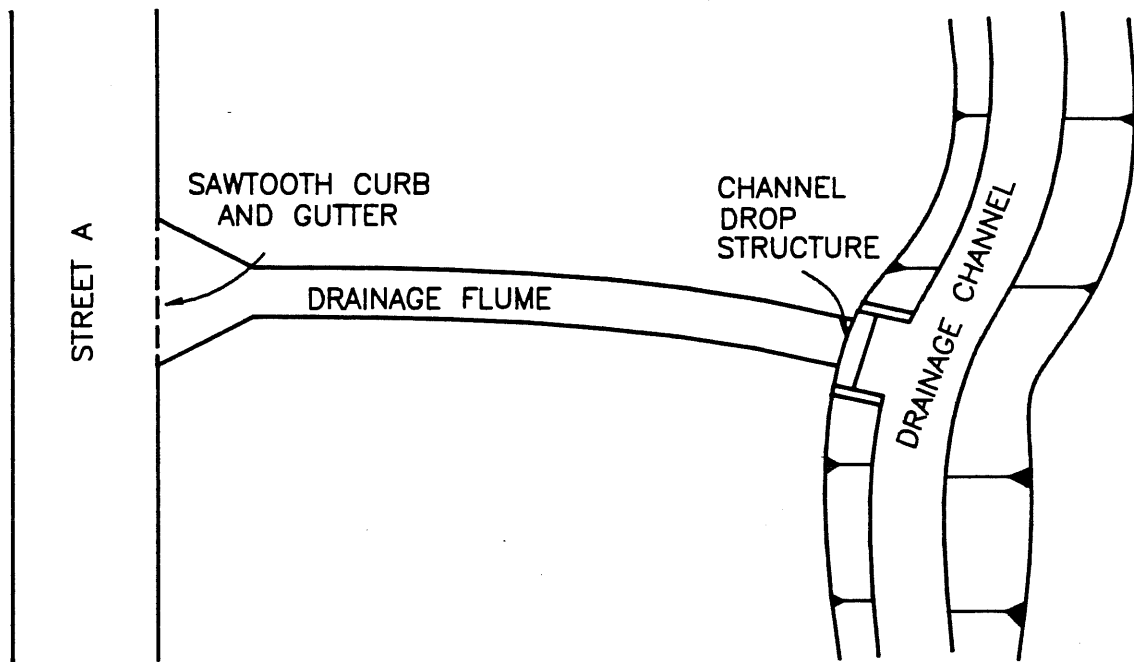
TYPICAL SAWTOOTH CURB AND GUTTER CONSTRUCTION

FIGURE 5-36

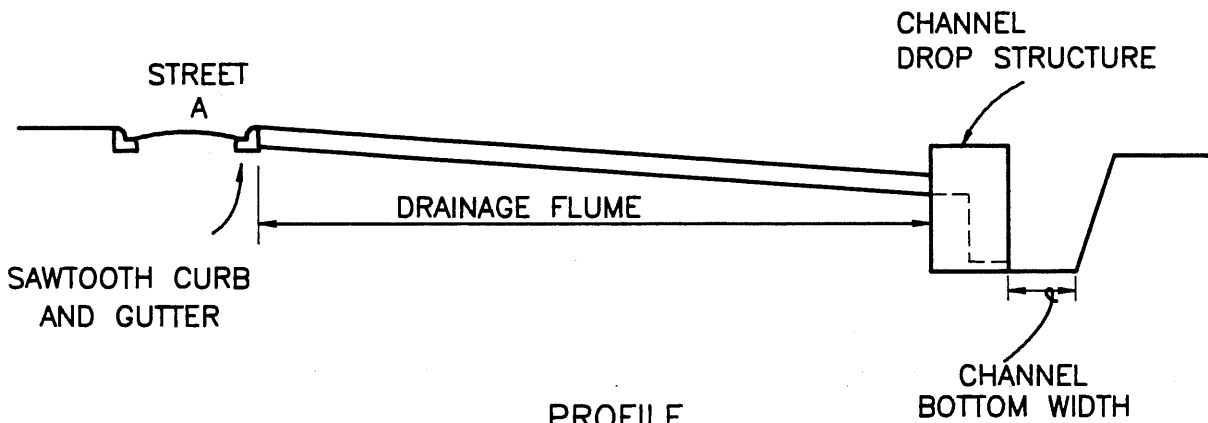


TYPICAL APPLICATION OF SAWTOOTH CURB AND GUTTER WITH DRAINAGE FLUMES

FIGURE 5-37



PLAN



PROFILE

TYPICAL DRAINAGE FLUME TO OPEN CHANNEL

FIGURE 5-38

SECTION 5

BIBLIOGRAPHY

1. City of Dallas, Texas, Department of Public Works, Design Manual for Storm Drainage Facilities, Undated.
2. City of Fort Worth, Texas, Department of Development, Development Procedures Manual, Adopted September 1975.
3. City of Austin, Texas, Drainage Criteria Manual, June 1988.
4. Texas State Department of Highways and Public Transportation, Bridge Division, Hydraulic Manual, Third Edition, December 1985.
5. American Association of State Highway and Transportation Officials, Highway Drainage Guidelines, 1982.
6. U.S. Department of Transportation, Federal Highway Administration, Hydraulic Engineering Circular No. 12: Drainage of Highway Pavements, March 1984.
7. U.S. Department of Transportation, Federal Highway Administration Offices of Research and Development Implementation Division, Design of Urban Highway Drainage: The State of the Art, August 1979, Reprinted September 1983.

SECTION 6
STORM DRAINS

- 6.1 General
- 6.2 Design Guidelines
- 6.3 Design Parameters
 - 6.3.1 Minimum Grades and Velocities
 - 6.3.2 Maximum Grades and Velocities
 - 6.3.3 Roughness Coefficients
 - 6.3.4 Manhole Spacing
 - 6.3.5 Location and Size of Easements
 - 6.3.6 Permissible Pipe Materials
- 6.4 Design Procedure
- 6.5 Design Example
- 6.6 THYSYS Helpful Hints
 - Design Nomographs
 - Blank Storm Drain Worksheet
 - Attachment 1: THYSYS Design Example Printout
 - Bibliography

SECTION 6

STORM DRAINS

6.1 GENERAL

The function of a storm drainage system, or storm sewer, is to convey storm runoff in a closed underground conduit to a suitable outlet. The outlet may be a body of water, such as a playa lake, or an open channel. Storm drainage systems are used to remove storm runoff in order to maintain trafficability of streets and highways, protect property from stormwater damage and provide drainage outlets for otherwise isolated areas which do not have natural surface drainage outlets.

The purpose of this section is to establish the hydraulic design of storm drains and their appurtenances in a storm drainage system. Usually, unsteady and non-uniform flow exists within a storm drain and the flow is either open channel gravity flow (conduit not flowing full) or surcharged flow (hydraulic grade line exceeds the top of pipe putting the storm drain in a pressure flow condition). Often, downstream runs of storm drains operate under surcharged conditions while upstream runs operate under gravity flow conditions. It is important that the hydraulic grade line for both conditions not interfere with the connecting inlets for the design storm.

The 5-year frequency storm event shall be the minimum design event for storm drains with inlets on grade. For storm drains draining sags or low points, the minimum design storm frequency shall be the 25-year event. In some cases, stormwater inlets on grade may be connected to the same storm drainage system that has inlets at low points. When a 5-year system is connected to a 25-year system the designer shall provide design documentation which shows that the storm drain has sufficient capacity so that neither the inlets on grade, nor the inlets at low points, are adversely affected with respect to the storm drainage system's hydraulics. A situation of this type may require that the storm drainage system design have additional hydraulic capacity.

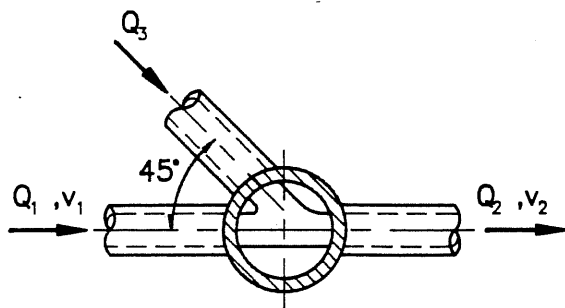
6.2 DESIGN GUIDELINES

There are several general rules to observe when designing storm sewers. When followed, these general rules will tend to alleviate or eliminate some common mistakes in storm drain design that result in operational problems. These general rules are as follows:

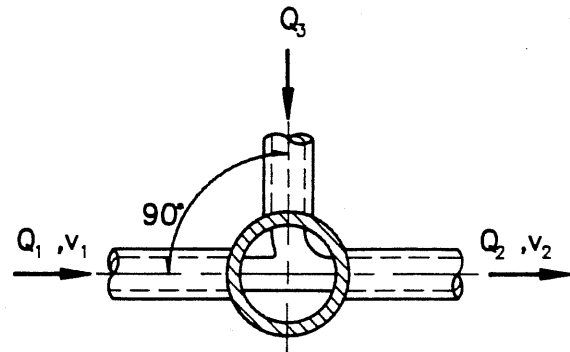
- A. Select pipe size and slope so that the velocity of flow will increase progressively or at least will not appreciably decrease at inlets, bends or other changes in geometry or configuration.
- B. Never discharge the stormwater of a larger conduit into a smaller conduit, even though the smaller conduit may have a higher capacity due to a steeper slope.
- C. Where connections are made of different pipe sizes, match the soffits of the pipes rather than the flow lines. The only exceptions shall be where wyes or tees are used. Where wyes or tees are used, they shall

be plant-manufactured to the manufacturer's standard details. Such standard manufacturing processes may preclude matching the soffits of different sizes of pipe.

- D. The minimum diameter for pipe storm drains in the City of Midland shall be 24 inches for trunk lines and 15 inches for lateral lines.
- E. The conduit of the storm drain system shall be placed at not less than the grade that maintains a minimum 2.5 feet per second velocity when the conduit is flowing one-half full.
- F. Non-standard sizes of pipes and box sections will not be permitted.
- G. For all pipe junctions other than a manhole, the angle of intersection should not be greater than 60 degrees. This includes discharges into channels and box sections. Recommended junction loss values are shown in Figure 6-1 and Figure 6-2 for various junction configurations.
- H. No pipe having an outside dimension greater than the inside dimension of a connected box section shall be allowed to discharge into that box section.
- I. Laterals under gravity flow conditions should be analyzed to compare critical depth with uniform depth. If the critical depth is greater than the uniform depth (indicative of a steep slope or supercritical flow regime), then the lateral may be operating under entrance control instead of the assumed uniform flow. If so, it may be found that the headwater caused at the upstream inlet for the lateral in question is unacceptable.
- J. The preferred storm drain configuration does not have the trunk storm drain pipe running through an inlet box. The inlet box should discharge into the trunk sewer through a wye connection or manhole. Where a storm drain does go through an inlet box, the inlet box shall be treated as a junction box and the hydraulic grade line, including losses, shall not interfere with the inlet box opening for the design storm event.
- K. The design hydraulic grade line of a storm drain system shall not be higher than two (2) feet below the adjacent street gutter elevation. Variation for hydraulic grade lines that are less than two feet below gutter elevation will be evaluated on a case-by-case basis by the City Engineer; however extenuating physical site conditions must be the cause for the variation.
- L. The tailwater elevation at the outlet of the storm drain system shall be placed at the top of the conduit, or actual outlet water surface elevation relative to the receiving channel's or playa lake's hydrograph time and flow rate, whichever selection results in the greatest tailwater elevation.



PLAN

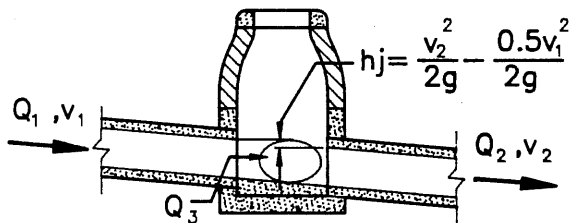


PLAN

NOTE:

$$60^\circ \text{ LATERAL } h_j = \frac{v_2^2}{2g} - \frac{0.35v_1^2}{2g}$$

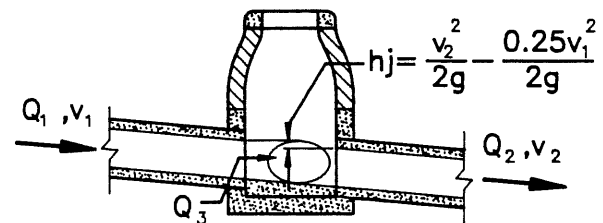
$$22\frac{1}{2}^\circ \text{ LATERAL } h_j = \frac{v_2^2}{2g} - \frac{0.75v_1^2}{2g}$$



SECTION

CASE A

MANHOLE ON MAIN LINE
WITH 45° BRANCH LATERAL



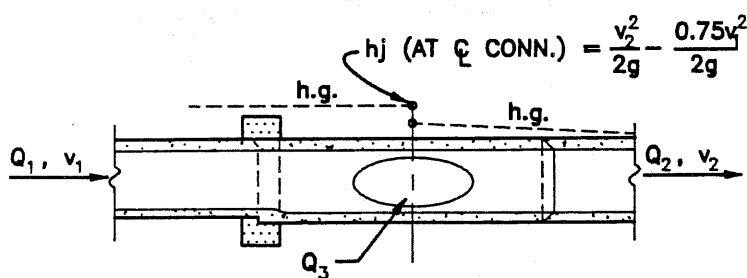
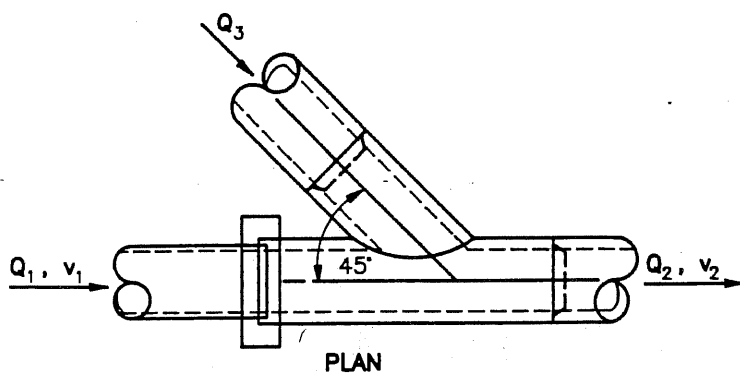
SECTION

CASE B

MANHOLE ON MAIN LINE
WITH 90° BRANCH LATERAL

MINOR HEAD LOSSES DUE TO TURBULENCE AT STRUCTURES

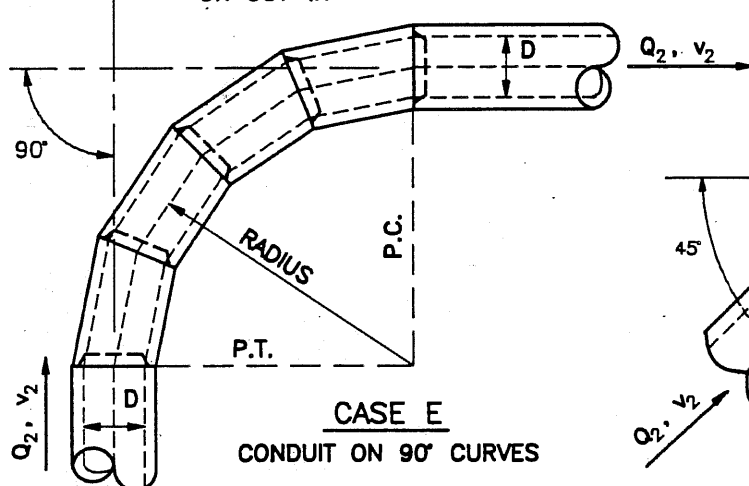
FIGURE 6-1



SECTION

CASE C

45° WYE CONNECTION
OR CUT-IN



CASE E
CONDUIT ON 90° CURVES

NOTE : HEAD LOSS APPLIED AT P.C. FOR
LENGTH OF CURVE.

$$\text{RADIUS} = \text{DIA. OF PIPE } h_j = 0.05 \frac{v_2^2}{2g}$$

$$\text{RADIUS} = (2-8) \text{ DIA. OF PIPE } h_j = 0.40 \frac{v_2^2}{2g}$$

$$\text{RADIUS} = (8-20) \text{ DIA. OF PIPE } h_j = 0.25 \frac{v_2^2}{2g}$$

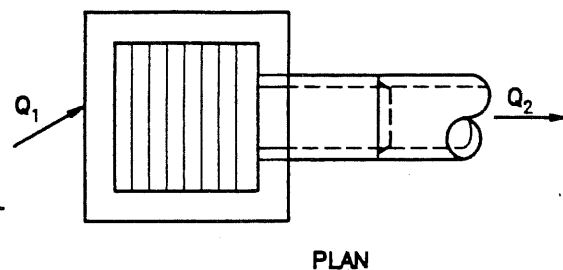
$$\text{RADIUS} = \text{GREATER THAN 20 DIA. OF PIPE } h_j = 0$$

WHEN CURVES OTHER THAN 90° ARE USED, APPLY
THE FOLLOWING FACTORS TO 90° CURVES.

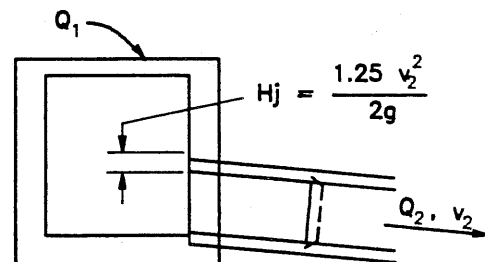
60° CURVES 85%

45° CURVES 70%

22 1/2° CURVES 40%



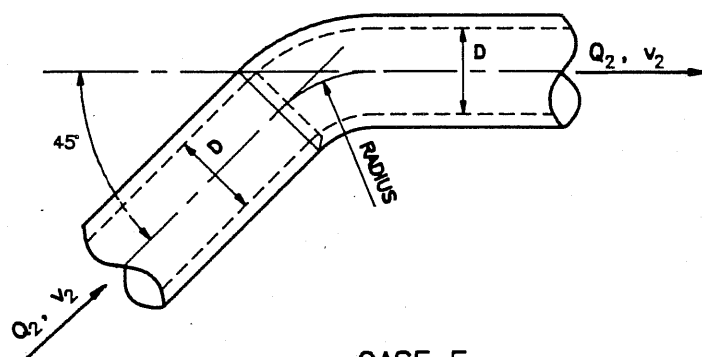
PLAN



SECTION

CASE D

INLET OR MANHOLE AT
BEGINNING OF LINE



CASE F

BENDS WHERE RADIUS IS
EQUAL TO DIAMETER OF PIPE

NOTE : HEAD LOSS APPLIED AT BEGINNING
OF BEND

$$90^\circ \text{ BEND } h_j = 0.50 \frac{v_2^2}{2g}$$

$$60^\circ \text{ BEND } h_j = 0.43 \frac{v_2^2}{2g}$$

$$45^\circ \text{ BEND } h_j = 0.35 \frac{v_2^2}{2g}$$

$$22 \frac{1}{2}^\circ \text{ BEND } h_j = 0.20 \frac{v_2^2}{2g}$$

MINOR HEAD LOSSES DUE TO TURBULENCE AT STRUCTURES

FIGURE 6-2

6.3 DESIGN PARAMETERS

6.3.1 Minimum Grades and Velocities

Storm drains shall be designed to maintain velocities which prevent the deposition of suspended solids in the storm drain conduit, regardless of whether the conduit is of pipe or box cross section. The controlling velocity for the prevention of solids deposition is near the flow line of the conduit and is less than the overall mean velocity. Storm drains shall be designed at a grade which results in a minimum velocity of 2.5 feet per second when the storm drain conduit is flowing half-full. The minimum practical grade for construction purposes shall not be less than 0.0010 feet per linear foot (0.10 percent), even if a flatter grade still results in a velocity of 2.5 feet per second or greater. Table 6-2 contains minimum design grades for circular pipes of various materials. The Manning's "n" values shown in Table 6-2 correspond to the Manning's "n" values in Table 6-3 for storm drain materials. The designer is responsible for submitting minimum grade analysis for arch pipe and elliptical pipe when those storm drain conduits are proposed. Table 6-1 below lists the minimum design grades for concrete box storm drains.

Where storm drains of box cross section are used, the designer shall carefully evaluate the effect of available box sections on the capacity of the storm drain. The box cross section normally has a larger dimension for the horizontal span than for the vertical rise. Precast boxes can be constructed to American Society of Testing and Materials (ASTM) standards, American Association of State Highway and Transportation Officials (AASHTO) standards and to standards of the Texas State Department of Highways and Public Transportation (SDHPT). The Texas SDHPT also has cast-in-place box section construction details available.

TABLE 6-1 MINIMUM DESIGN GRADES FOR CONCRETE BOX SECTION MANNING'S "n" = 0.015			
TYPE	SPAN (FT)	HEIGHT (FT)	MIN. GRADE (FT/FT)
Without Interior Haunches	3	2	0.0013
	3	3	0.0010
	4	2	0.0011
	4	3	0.0010
	4	4	0.0010
With Interior Haunches	3	2	0.0014
	3	3	0.0010
	4	2	0.0012
	4	3	0.0010
	4	4	0.0010
All Other Span and Height Combinations			0.0010

Minimum permissible design grade = 0.0010 ft/ft for construction purposes.

TABLE 6-2 MINIMUM DESIGN GRADES FOR CIRCULAR PIPE									
PIPE DIAMETER (INCHES)	MINIMUM DESIGN GRADE IN FT/FT FOR MANNING'S "n"								
	0.010	0.015	0.020	0.021	0.023	0.024	0.026	0.027	0.031
15	0.0034	0.0076	0.0135	0.0148	0.0178	0.0194	0.0227	0.0245	0.0323
18	0.0026	0.0059	0.0105	0.0116	0.0140	0.0152	0.0178	0.0192	0.0253
21	0.0021	0.0048	0.0086	0.0095	0.0114	0.0124	0.0145	0.0157	0.0206
24	0.0018	0.0040	0.0072	0.0079	0.0095	0.0104	0.0121	0.0131	0.0173
27	0.0015	0.0035	0.0061	0.0068	0.0081	0.0088	0.0104	0.0112	0.0148
30	0.0013	0.0030	0.0053	0.0059	0.0071	0.0077	0.0090	0.0097	0.0128
36	0.0010	0.0024	0.0042	0.0046	0.0055	0.0060	0.0071	0.0076	0.0101
42	0.0010	0.0019	0.0034	0.0038	0.0045	0.0049	0.0058	0.0062	0.0082
48	0.0010	0.0016	0.0029	0.0031	0.0038	0.0041	0.0048	0.0052	0.0069
54	0.0010	0.0014	0.0024	0.0027	0.0032	0.0035	0.0041	0.0044	0.0059
60	0.0010	0.0012	0.0021	0.0023	0.0028	0.0031	0.0036	0.0039	0.0051
66	0.0010	0.0011	0.0019	0.0021	0.0025	0.0027	0.0032	0.0034	0.0045
72	0.0010	0.0010	0.0017	0.0018	0.0022	0.0024	0.0028	0.0030	0.0040
78	0.0010	0.0010	0.0015	0.0016	0.0020	0.0022	0.0025	0.0027	0.0036
84	0.0010	0.0010	0.0014	0.0015	0.0018	0.0019	0.0023	0.0025	0.0033
90	0.0010	0.0010	0.0012	0.0014	0.0016	0.0018	0.0021	0.0022	0.0030
96	0.0010	0.0010	0.0011	0.0012	0.0015	0.0016	0.0019	0.0021	0.0027
108	0.0010	0.0010	0.0010	0.0011	0.0013	0.0014	0.0016	0.0018	0.0023
120	0.0010	0.0010	0.0010	0.0010	0.0011	0.0012	0.0014	0.0015	0.0020
132	0.0010	0.0010	0.0010	0.0010	0.0010	0.0011	0.0013	0.0013	0.0018
144	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0011	0.0012	0.0016

Minimum V = 2.5 fps. at d/D = 0.5 (d/D = 0.5 means conduit is one-half full)

See Table 6-3 for materials corresponding to "n" values.

Consult manufacturer for available circular pipe sizes.

Designer to provide minimum grade analysis for arch and elliptical pipe.

Minimum permissible design grade = 0.0010 ft/ft for construction purposes.

6.3.2 Maximum Grades and Velocities

Limiting the maximum velocity in a storm drain conduit is important since a high velocity can possibly erode the conduit's flow line at an excessive rate. The suspended solids which are carried with the stormwater runoff act as abrasives on the conduit's interior surfaces. The maximum permissible velocity for trunk storm drains is 20 feet per second. No maximum velocity has been established for laterals which serve only one inlet.

The maximum grade on which storm drains should be designed and constructed is that grade which corresponds to the 20 feet per second velocity limit.

6.3.3 Roughness Coefficients

The coefficients of roughness to be used for "n" in Manning's Equation are listed in Table 6-3.

6.3.4 Manhole Spacing

The maximum manhole spacing for straight, uniformly sloped storm drains should not exceed 300 feet. Where tees, wyes or bends are located, access to the storm sewer through either an inlet or a manhole shall be possible from both the upstream and downstream directions. Access to the storm drain shall be located not further than 150 feet in either the upstream or downstream direction from the tee, wye or bend.

A manhole shall be installed at all changes in pipe diameter, even if it is just a change in trunk line diameter without additional laterals.

6.3.5 Location and Size of Easements

The location of the storm drain pipe shall be within the City's street right-of-way whenever possible. For storm drain pipe not located within the street right-of-way, the owner, developer or other responsible party shall provide an offsite easement so that the City can have access for maintenance purposes. The minimum offsite easement width provided shall not be less than the following:

1. 20-foot easement width for circular pipe diameters or arch pipe spans less than 36 inches.
2. 30-foot easement width for circular pipe diameters or arch pipe spans greater than or equal to 36 inches.

Easements for storm sewers constructed of box cross-sectional shapes will be determined by the City Engineer on an individual, site-specific basis.

6.3.6 Permissible Pipe Materials

The pipe materials which the City of Midland considers acceptable for storm drain construction are the same as those shown in Table 6-3. Corrugated steel pipe shall be galvanized for all installations where it is used, and shall also be bituminous-coated when corrosive soils are suspected or known to be present. The City Engineer will determine the actual gauge and/or class of pipe to be used for a particular installation. The designer shall provide calculations supporting the pipe strength or gauge thickness proposed for each

run of storm drain. The City Engineer can require an increase in the class of pipe, or gauge thickness for metal pipe, upon review of the proposed bedding conditions, trench soil loads, traffic loads and soil corrosivity.

TABLE 6-3 MANNING'S "n" VALUES FOR STORM DRAINS			
MATERIAL	VARIATION		USE FOR DESIGN
	FROM	TO	
Concrete (Cast-in-place or Precast)	0.011	0.020	0.015
Galvanized Corrugated Steel Pipe 2-2/3" x 1/2" Annular Corrugations Unpaved 25% Paved	0.023	0.026	0.024 0.021
2-2/3" x 1/2" Helical Corrugations Unpaved 25% Paved	0.016 0.015	0.020 0.020	0.020 0.020
3" x 1" Annular Corrugations Unpaved 25% Paved			0.027 0.023
3" x 1" Helical Corrugations Unpaved 25% Paved	0.021 0.019	0.026 0.022	0.024 0.021
6" x 2" Structural Plate Pipe Unpaved 25% Paved	0.028 0.024	0.033 0.028	0.031 0.026
Galvanized Corrugated Steel Pipe, Full Concrete Lining	-	-	0.015
Galvanized Corrugated Steel Pipe, Smooth-Flo Lining	-	-	0.015
Smooth Interior HDPE Corrugated Pipe (limited to 24" diameter)	-	-	0.010
Centrifugally Cast Fiberglass Pipe	-	-	0.010

Consult manufacturer for available pipe, pipe arch, elliptical pipe and box sizes.

Sources: Handbook of Hydraulics, Brater and King
Open-Channel Hydraulics, Ven Te Chow
Handbook of Steel Drainage and Highway Construction Products,
American Iron and Steel Institute

6.4 DESIGN PROCEDURE

Either hand calculations or THYSYS computer models are acceptable for storm drain design. Other computer models may be used with prior approval by the city of Midland.

The design procedure will vary according to the expected operation of the storm drain. Under gravity flow conditions, or open channel operation, the design calculation will proceed from upstream to downstream in sequence. This is normally the calculation sequence where sufficient elevation difference is available to build storm drains at relatively steep grades, and pipe inverts at manholes can also be sufficiently staggered to offset junction losses. For surcharged storm drain conditions, or full conduit pressure flow, the design calculations proceed from the outlet in a step-backwater sequence to the most upstream inlet. The surcharged condition describes the flow regime most likely to be encountered in Midland.

In some instances, the flow regime for a storm drain may be surcharged flow conditions in the downstream reaches and gravity flow conditions in the upstream reaches. Such a flow transition occurs when the hydraulic grade line elevation decreases from a level above the top of the conduit to a level below the top of the conduit.

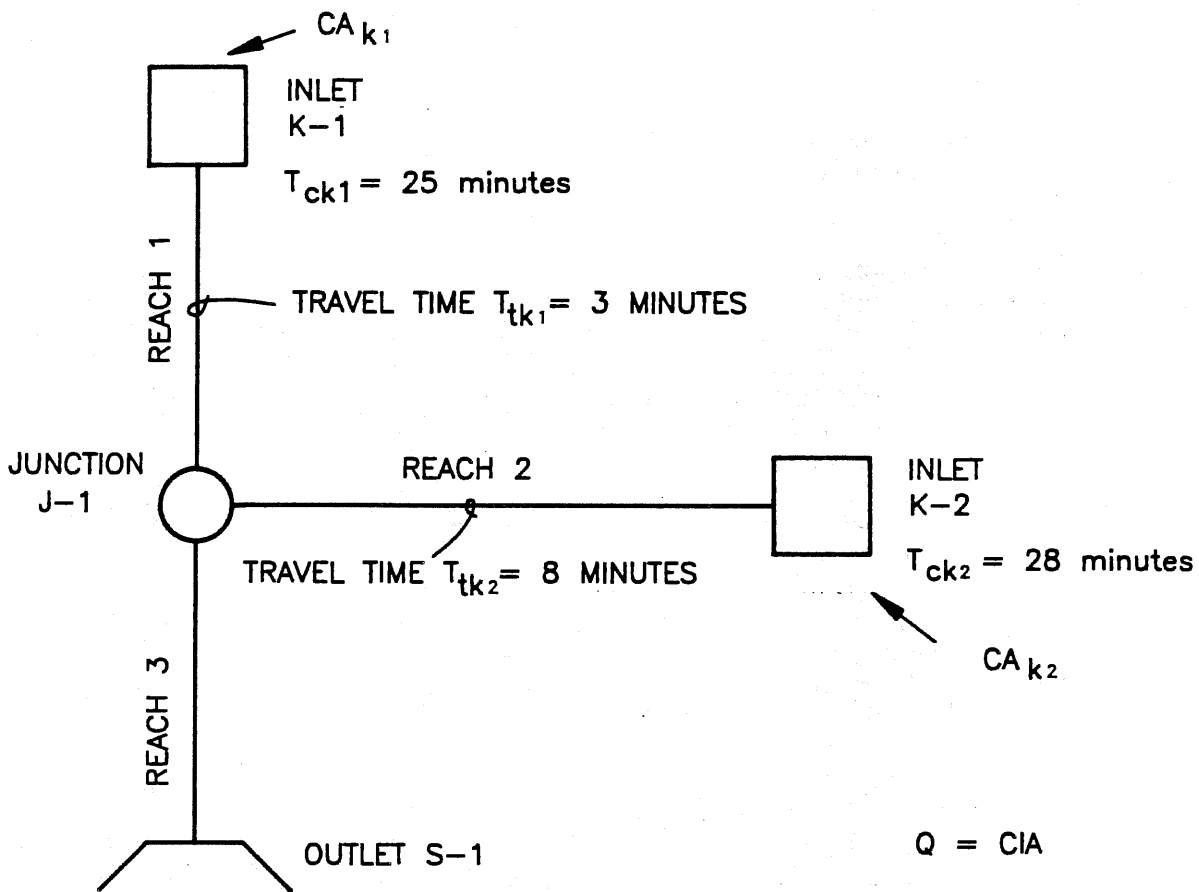
The peak discharge for design any point in the storm drain system is determined by the controlling time of concentration to that point. Shown on Figure 6-3 is a simple storm drain system illustrating the method by which the peak discharge (Q) is adjusted for design points downstream of inlets. Figure 6-3 is also arranged so that gravity flow conditions exist. Storm drain conduits can be sized for each reach and the velocity for each reach be determined for travel time purposes.

When the design is for a surcharged condition, then calculations begin at the outlet for the system and the upstream conduit reaches have not yet been sized and velocities not yet determined. For surcharged conditions, a velocity of 10 feet per second may be assumed in each reach for surcharged storm drain design purposes. The designer also has the option of performing iterations of the design in order to more accurately determine velocities for travel time calculations.

6.5 DESIGN EXAMPLE

An example storm drain design is shown below and has been analyzed through both a hand-computation method as well as a THYSYS computer model. The THYSYS computer model printout is shown in Attachment 1 of this chapter. Since the majority of storm drain designs in Midland are expected to operate under surcharged conditions because of available grades and tailwater conditions, the following example is for a surcharged storm drain with hand computations sequenced from downstream to upstream.

Example: A proposed subsurface storm drainage system to drain three separate sub-watersheds must be analyzed to determine capacity and conduit sizes, and for determination of the hydraulic grade line. The hypothetical subwatersheds are illustrated in Figure 6-4. Since all of the inlets are located at low points, or sags, the entire system must



1. REACH 1, Q IS DETERMINED FROM THE RAINFALL INTENSITY USING $T_{ck1} = 25$ MINUTES
2. REACH 2, Q IS DETERMINED FROM THE RAINFALL INTENSITY USING $T_{ck2} = 28$ MINUTES
3. FOR REACH 3, Q IS DETERMINED FROM THE RAINFALL INTENSITY USING THE CONTROLLING (LONGEST) TIME OF CONCENTRATION PLUS TRAVEL TIME.

$$T_{ck1} + T_{tk1} = 25 + 3 = 28 \text{ MINUTES}$$

$$T_{ck2} + T_{tk2} = 28 + 8 = 36 \text{ MINUTES}$$

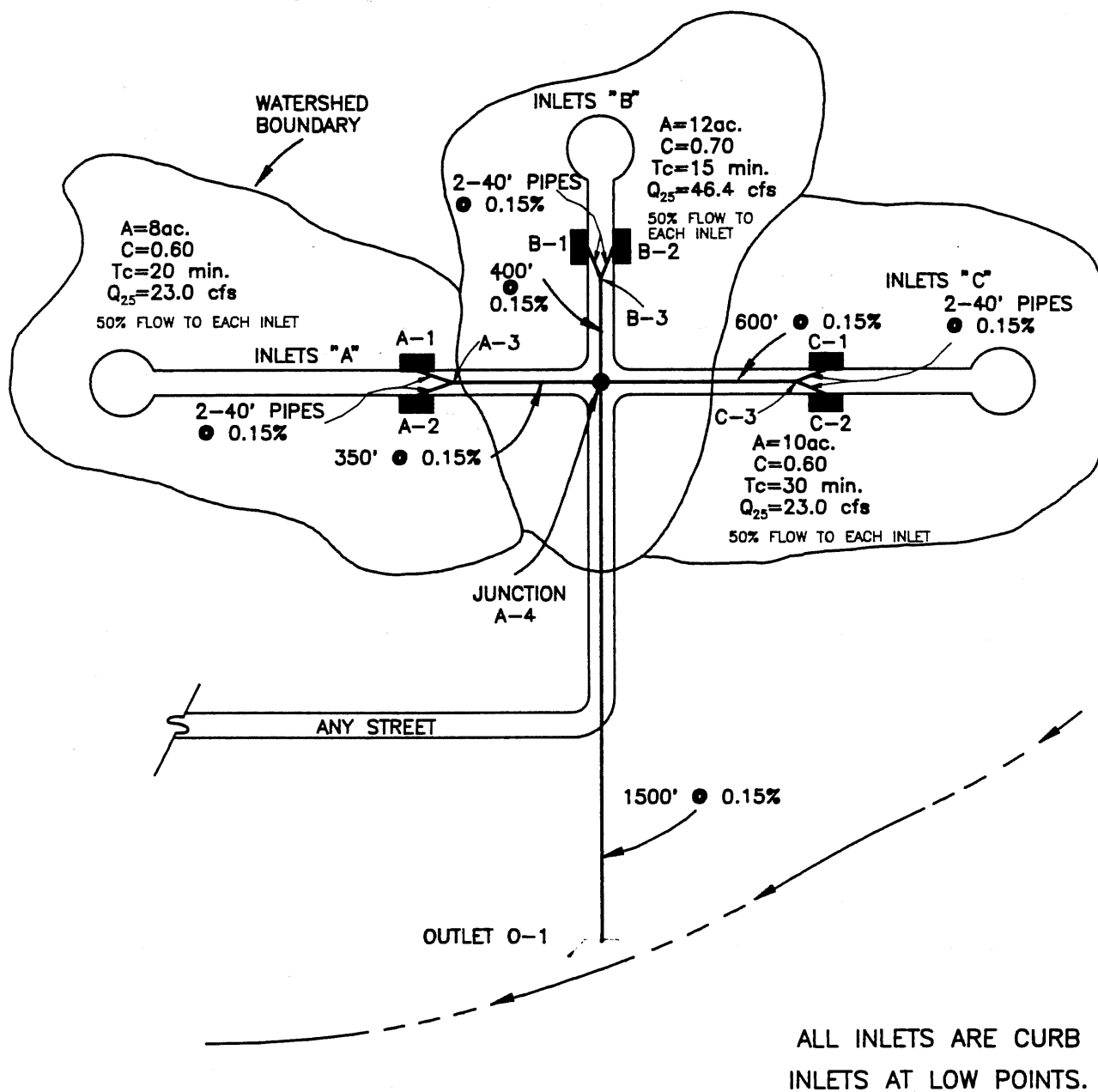
$$\text{CONTRIBUTING CA TO J-1} = CA_{k1} + CA_{k2}$$

USE 36 MINUTES TO DETERMINE THE RAINFALL INTENSITY AND Q FROM THE TOTAL CONTRIBUTING AREA AT J-1.

USE THIS REVISED Q FOR REACH 3 DESIGN.

STORM DRAIN DESIGN Q

FIGURE 6-3



STORM DRAIN DESIGN EXAMPLE

FIGURE 6-4

accommodate the 25-year frequency storm according to criteria. Shown on Figure 6-4 is each subwatershed's area, time of concentration, Rational Method runoff coefficient, 25-year frequency peak discharge from the Rational Method and the peak discharge to each inlet. Note that not all manholes required by criteria are shown in Figure 6-4, nor included in the following computations, in order to reduce the tediousness of computations for this example. Assume that the storm drain system outlets into a major channel which has HEC-1 hydrographs available for tailwater depth analysis. The channel flow line at the outlet, 0-1, is at elevation 2794.4 and preliminary calculations indicate that a 48-inch diameter pipe at the outlet is sufficient for the storm drainage system (See Figure 6-6).

The 25-year HEC-1 hydrograph for the outlet channel is analyzed for the time and elevation at which its peak occurs relative to the expected time-to-peak for the storm drainage system. For the Rational Method of peak discharge determination, the time-to-peak for the storm drain system equals the time of concentration at outlet 0-1. Assume for this example that the hydrograph's peak water surface elevation in the outlet channel occurs at approximately the same time as the expected time of concentration at outlet 0-1, and that it results in a tailwater depth that covers only three-fourths of the outlet pipe diameter. This would mean a channel hydrograph water surface elevation of 2797.4. The elevation of the top of the proposed 48-inch diameter outlet pipe is 2798.4. Criteria requires that the tailwater elevation be set at either the actual outlet water surface elevation or the top of conduit, whichever one results in the highest tailwater elevation. Since the top of pipe for this example results in the highest tailwater elevation, the design tailwater at 0-1 is set at elevation 2798.4 (Figure 6-6). Note that some preliminary calculation may be required to select the proper tailwater elevation.

Step 1: Determine the composite runoff coefficient, C.

$$\text{Total Area} = 12 + 8 + 10 = 30 \text{ acres}$$

$$\text{Composite C} = \frac{(8 \times 0.6) + (12 \times 0.7) + (10 \times 0.6)}{30} = 0.64$$

Step 2: Determine travel time (T_t) at the outlet 0-1. Assume a travel velocity of 10 fps.

$$T_t, \text{ Inlets "A" to A-4} = (350 \text{ ft} + 40 \text{ ft}) / 10 \text{ fps} / 60 \text{ sec per min.} \\ = 0.7 \text{ minutes}$$

$$T_t, \text{ Inlets "B" to A-4} = (400 \text{ ft} + 40 \text{ ft}) / 10 \text{ fps} / 60 \text{ sec per min.} \\ = 0.7 \text{ minutes}$$

$$T_t, \text{ Inlets "C" to A-4} = (600 \text{ ft} + 40 \text{ ft}) / 10 \text{ fps} / 60 \text{ sec per min.} \\ = 1.1 \text{ minutes}$$

Step 3: Determine the time of concentration (T_c) at A-4 from the largest combination of travel times plus times of concentration.

$$\text{Inlets "A" to A-4} = 20 \text{ min.} + 0.7 \text{ min.} = 20.7 \text{ min.}$$

$$\text{Inlets "B" to A-4} = 15 \text{ min.} + 0.7 \text{ min.} = 15.7 \text{ min.}$$

$$\text{Inlets "C" to A-4} = 30 \text{ min.} + 1.1 \text{ min.} = 31.1 \text{ min. (controlling } T_c)$$

Step 4: Determine the rainfall intensity for total contributing area.
From "Section 4: Determination of Storm Runoff," the intensity equation and 25-year frequency constants give:

$$I = \frac{71}{(31.1 + 10.5)^{0.788}} = 3.76 \text{ iph}$$

Step 5: Calculate peak discharge for the total contributing area.

$$Q = CIA$$

$$Q = 0.64(3.76 \text{ iph})(30 \text{ ac.}) = 72.19 \text{ cfs, use } 72.2 \text{ cfs}$$

Step 6: Determine hydraulic slope of outlet pipe, run A-4 to O-1.

$$48" \text{ diameter outlet pipe} \quad \text{Area} = 12.57 \text{ sq. ft.}$$

$$V = Q/A = \frac{72.2 \text{ cfs}}{12.57 \text{ sf}} = 5.74 \text{ fps}$$

$$\text{Hydraulic Radius} = R = d/4 = 4 \text{ ft.}/4 = 1.0 \text{ ft.}$$

$$\text{Hydraulic Slope} = S_f = (Vn/1.486 R^{0.67})^2$$

$$n = 0.15 \text{ for Concrete, Table 6-3}$$

$$S_f = ((5.74)(0.15)/(1.486)(1.0^{0.67}))^2 = 0.00336 \text{ ft/ft}$$

$$h_f = \text{Total HGL rise over distance due to conduit friction}$$

$$h_f = S_f \times \text{Length} = (0.00336 \text{ ft/ft})(1500 \text{ ft})$$

$$= 5.04 \text{ ft.}$$

Step 7: Determine the rainfall intensity for Areas A, B and C.
Using the Rational Method for runoff determination and the 25-year frequency constants given in "Section 4: Determination of Storm Runoff," the rainfall intensities are as follows.

$$\text{Area A} \quad I_A = 4.80 \text{ iph}$$

$$\text{Area B} \quad I_B = 5.53 \text{ iph}$$

$$\text{Area C} \quad I_C = 3.84 \text{ iph}$$

Step 8: The peak discharge to each inlet is 50 percent of its respective drainage area as shown on Figure 6-4.

Step 9: Determine the hydraulic slope of the main conduit from each of Areas A, B and C to the junction of A-4.

Area A (A-3 to A-4):

$$36" \text{ diameter concrete pipe, } n = 0.015, \text{ Area} = 7.07 \text{ sq. ft.}$$

$$V_A = Q/A = 23.0 \text{ cfs}/7.07 \text{ sq. ft.} = 3.25 \text{ fps}$$

$$\text{Hydraulic Radius, } R = d/4 = 3 \text{ ft.}/4 = 0.75 \text{ ft.}$$

$$S_{fA} = ((3.25)(0.015)/(1.486)(0.75^{0.67}))^2 = 0.00158 \text{ ft/ft}$$

$$h_{fA} = (0.00158 \text{ ft/ft})(350 \text{ ft}) = 0.55 \text{ ft.}$$

Area B (B-3 to A-4):

$$42" \text{ diameter concrete pipe, } n = 0.015, \text{ Area} = 9.62 \text{ sq. ft.}$$

$$V_B = Q/A = 46.4 \text{ cfs}/9.62 \text{ sq. ft.} = 4.82 \text{ fps}$$

$$\text{Hydraulic Radius, } R = d/4 = 3.5 \text{ ft.}/4 = 0.88 \text{ ft.}$$

$$S_{fB} = ((4.82)(0.015)/(1.486)(0.88^{0.67}))^2 = 0.0028 \text{ ft/ft}$$

$$h_{fB} = (0.0028 \text{ ft/ft})(400 \text{ ft}) = 1.12 \text{ ft.}$$

Area C (C-3 to A-4):

36" diameter concrete pipe, $n = 0.015$, Area = 7.07 sq. ft.

$$V_C = 23.0 \text{ cfs} / 7.07 \text{ sq. ft.} = 3.25 \text{ fps}$$

$$\text{Hydraulic Radius, } R = d/4 = 3 \text{ ft} / 4 = 0.75 \text{ ft.}$$

$$S_{fC} = ((3.25)(0.015) / (1.486)(0.75^{0.67}))^2 = 0.00158 \text{ ft/ft}$$

$$h_{fC} = (0.00158 \text{ ft/ft})(600 \text{ ft}) = 0.95 \text{ ft.}$$

Step 10: Determine the hydraulic slope of each lateral pipe from each curb inlet to the manhole where the two join in each drainage area. For Areas A, B and C flow is evenly split, therefore one lateral pipe in each area defines both lateral pipes for that area.

Area A Inlet:

Run from A-1 to A-3 also defines the run from A-2 to A-3.

24" diameter concrete lateral pipe, $n = 0.015$, Area = 3.14 sq. ft.

$$Q_{AL} = 23.0 \text{ cfs} / 2 = 11.5 \text{ cfs}$$

$$V_{AL} = Q_{AL} / A_{AL} = 11.5 \text{ cfs} / 3.14 \text{ sq. ft.} = 3.66 \text{ fps}$$

$$\text{Hydraulic Radius, } R = d/4 = 2 \text{ ft} / 4 = 0.50 \text{ ft.}$$

$$S_{fAL} = ((3.66)(0.015) / (1.486)(0.50^{0.67}))^2 = 0.0035 \text{ ft/ft}$$

$$h_{fAL} = (0.0035 \text{ ft/ft})(40 \text{ ft}) = 0.14 \text{ ft.}$$

Area B Inlet:

Run from B-1 to B-3 also defines the run from B-2 to B-3.

36" diameter concrete lateral pipe, $n = 0.015$, Area = 7.07 sq. ft.

$$Q_{BL} = 46.4 \text{ cfs} / 2 = 23.2 \text{ cfs}$$

$$V_{BL} = Q_{BL} / A_{BL} = 23.2 \text{ cfs} / 7.07 \text{ sq. ft.} = 3.28 \text{ fps}$$

$$\text{Hydraulic Radius, } R = d/4 = 3 \text{ ft} / 4 = 0.75 \text{ ft.}$$

$$S_{fBL} = ((3.28)(0.015) / (1.486)(0.75^{0.67}))^2 = 0.0016 \text{ ft/ft}$$

$$h_{fBL} = (0.0016 \text{ ft/ft})(40 \text{ ft}) = 0.06 \text{ ft.}$$

Area C Inlet:

Run from C-1 to C-3 also defines the run from C-2 to C-3.

24" diameter concrete lateral pipe, $n = 0.015$, Area = 3.14 sq. ft.

$$Q_{CL} = 23.0 \text{ cfs} / 2 = 11.5 \text{ cfs}$$

$$V_{CL} = Q_{CL} / A_{CL} = 11.5 \text{ cfs} / 3.14 \text{ sq. ft.} = 3.66 \text{ fps}$$

$$\text{Hydraulic Radius, } R = d/4 = 2 \text{ ft} / 4 = 0.50 \text{ ft.}$$

$$S_{fCL} = ((3.66)(0.015) / (1.486)(0.50^{0.67}))^2 = 0.0035 \text{ ft/ft}$$

$$h_{fCL} = (0.0035 \text{ ft/ft})(40 \text{ ft}) = 0.14 \text{ ft.}$$

Step 11: Determine minor losses for inlets.

$h_L = (1.25V^2) / 2g$ for inlets at upstream ends of laterals, where V is the lateral's velocity, Figure 6-2.

Area A Inlets:

$$V = 3.25 \text{ fps}$$

$$h_{LIA} = (1.25)(3.25^2) / (2)(32.2) = 0.26 \text{ ft.}$$

Area B Inlets:

$$V = 3.28 \text{ fps}$$

$$h_{LIB} = (1.25)(3.28^2) / (2)(32.2) = 0.21 \text{ ft.}$$

Area C Inlets:

$$V = 3.67 \text{ fps}$$

$$h_{LIC} = (1.25)(3.67^2) / (2)(32.2) = 0.26 \text{ ft.}$$

Step 12: Determine the junction losses for the manhole "Y" connections in each of Areas A, B and C.

Manhole A-3:

$$h_j = \frac{V_2^2 - 0.5 V_1^2}{2g} \quad \begin{array}{l} V_2 = \text{Outlet Pipe Velocity} \\ V_1 = \text{Inlet Pipe Velocity} \end{array}$$

$$h_{jA} = \frac{(3.66)^2 - 0.5 (3.25)^2}{2 (32.2)} = 0.13 \text{ ft} \quad \begin{array}{l} V_1 = 3.25 \text{ fps} \\ V_2 = 3.66 \text{ fps} \end{array}$$

Manhole B-3:

$$h_{jB} = \frac{(4.82)^2 - 0.5 (3.28)^2}{2 (32.2)} = 0.28 \text{ ft} \quad \begin{array}{l} V_1 = 3.28 \text{ fps} \\ V_2 = 4.82 \text{ fps} \end{array}$$

Manhole C-3:

$$h_{jC} = \frac{(3.66)^2 - 0.5 (3.25)^2}{2 (32.2)} = 0.13 \text{ ft} \quad \begin{array}{l} V_1 = 3.66 \text{ fps} \\ V_2 = 3.25 \text{ fps} \end{array}$$

Step 13: Determine the junction loss at manhole A-4. Trunk storm drains enter from Areas A, B and C as shown in Figure 6-4. The velocity differential that results in the greatest head loss controls the hydraulic grade line at A-4.

$$h_j = (V_2^2/2g) - (0.25V_1^2/2g) \text{ from Figure 6-1, Case B.}$$

V_2 = Outlet storm drain velocity, A-4 to O-1 for each trial.

Therefore, $V_2 = 5.74$ fps for each trial

Area A:

$$V_A = 3.25 \text{ fps}$$

$$h_j = ((5.74^2)/(2)(32.2)) - ((0.25)(3.25^2)/(2)(32.2)) = 0.47 \text{ ft.}$$

Area B:

$$V_B = 4.82 \text{ fps}$$

$$h_j = ((5.74^2)/(2)(32.2)) - ((0.25)(4.82^2)/(2)(32.2)) = 0.42 \text{ ft.}$$

Area C:

$$V_C = 3.25 \text{ fps}$$

$$h_j = ((5.74^2)/(2)(32.2)) - ((0.25)(3.25^2)/(2)(32.2)) = 0.47 \text{ ft.}$$

The greatest junction loss among the three trials is 0.47 feet, therefore this is the junction loss for A-4.

Step 14: Determine the hydraulic grade line elevation from A-4 to O-1. Tailwater elevation is at top of pipe at O-1 which is at an elevation of 2798.4.

$$2798.4 + h_f = 2798.4 + 5.04 = 2803.44$$

The hydraulic grade line elevation inside of A-4 also includes the junction loss.

$$2803.44 + h_j = 2803.44 + 0.47 = 2803.91$$

Step 15: Determine the hydraulic grade line elevation at A-3, A-2 and A-1. The hydraulic grade line at A-4 provides a beginning elevation of 2803.91

$$\text{HGL at A-3} = 2803.91 + h_{fA} = 2803.91 + 0.55 \text{ ft.} = 2804.46$$

$$\text{HGL inside A-3} = 2804.46 + h_{jA} = 2804.46 + 0.13 \text{ ft.} = 2804.59$$

$$\begin{aligned} \text{HGL at A-1 and A-2} &= 2804.59 + h_{fAL} = 2804.59 + 0.14 \text{ ft.} \\ &= 2804.73 \end{aligned}$$

$$\begin{aligned} \text{HGL inside A-1 and A-2} &= 2804.73 + h_{LIA} = 2804.73 + 0.26 \text{ ft.} \\ &= 2804.99 \end{aligned}$$

Step 16: Determine the hydraulic grade line elevation at B-1, B-2 and B-3. Again, the hydraulic grade line at A-4 provides a beginning elevation of 2803.91

$$\text{HGL at B-3} = 2803.91 + h_{fB} = 2803.91 + 1.12 \text{ ft.} = 2805.03$$

$$\text{HGL inside B-3} = 2805.03 + h_{jB} = 2805.03 + 0.28 \text{ ft.} = 2805.31$$

$$\begin{aligned} \text{HGL at B-1 and B-2} &= 2805.31 + h_{fBL} = 2805.31 + 0.06 \text{ ft.} \\ &= 2805.37 \end{aligned}$$

$$\begin{aligned} \text{HGL inside B-1 and B-2} &= 2805.37 + h_{LIB} = 2805.37 + 0.21 \text{ ft.} \\ &= 2805.58 \end{aligned}$$

Step 17: Determine the hydraulic grade line elevation at C-1, C-2 and C-3. As noted above, the hydraulic grade line at A-4 provides a beginning elevation of 2803.91

$$\text{HGL at C-3} = 2803.91 + h_{fC} = 2803.91 + 0.95 \text{ ft.} = 2804.86$$

$$\text{HGL inside C-3} = 2804.86 + h_{jC} = 2804.86 + 0.13 \text{ ft.} = 2804.99$$

$$\begin{aligned} \text{HGL at C-1 and C-2} &= 2804.99 + h_{fCL} = 2804.99 + 0.14 \text{ ft.} \\ &= 2805.13 \end{aligned}$$

$$\begin{aligned} \text{HGL inside C-1 and C-2} &= 2805.13 + h_{LIC} = 2805.13 + 0.26 \text{ ft.} \\ &= 2805.39 \end{aligned}$$

Step 18: Check hydraulic grade line elevations relative to ground surface elevations. If hydraulic grade line elevations are acceptable, the design is complete once the inlets are sized.

The hand calculations for a storm drainage system can be tedious, however a blank form for the designer's use has been included as Figure 6-20. The above example has been tabulated on one of these forms, Figure 6-5, to illustrate the form's use. Profiles of the storm drainage system are contained in Figures 6-6 through 6-8. Another iteration could be performed using the actual conduit travel times, which are other than 10 fps, however the iteration would only result in minor changes for this example. Nomographs for the designer's use have also been included in this chapter for circular, arch, elliptical and box shapes in Figures 6-9 through 6-19. These nomographs are based on a Manning's "n" of 0.012. For other Manning's "n" values the following conversion may be performed:

$$Q_o = 0.012 Q_n / n_o$$

where

Q_o = Flow based upon n_o

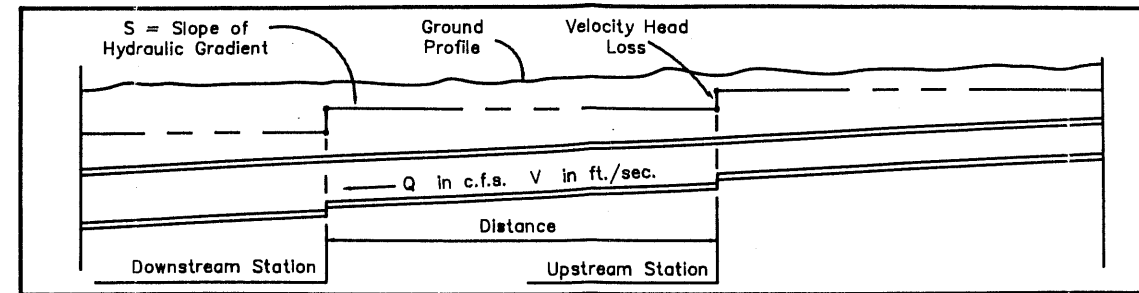
n_o = Value of Manning's "n" other than 0.012

Q_n = Flow from nomographs based on $n = 0.012$

FIGURE 6-5

STORM DRAIN LINE A, B, C NETWORK

INITIAL INLET TIME 30 MINUTES

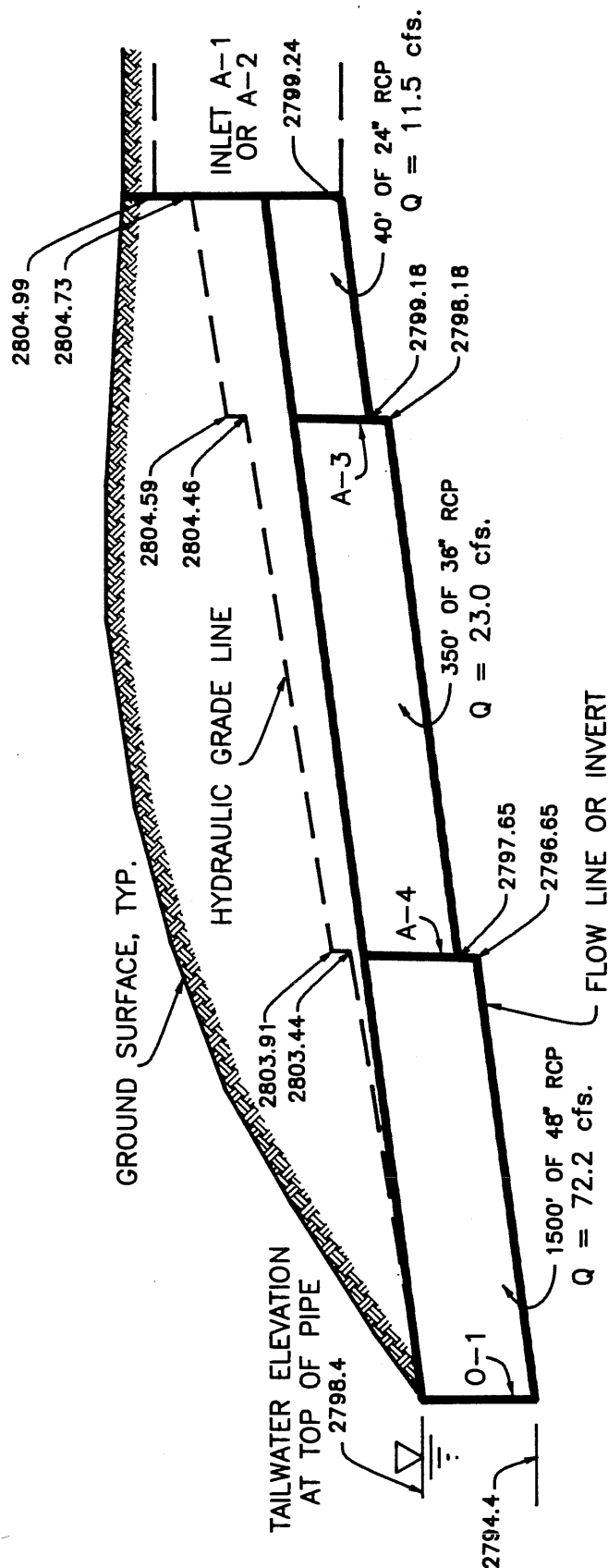


BY TSS

DATE 6/92

[illegible]

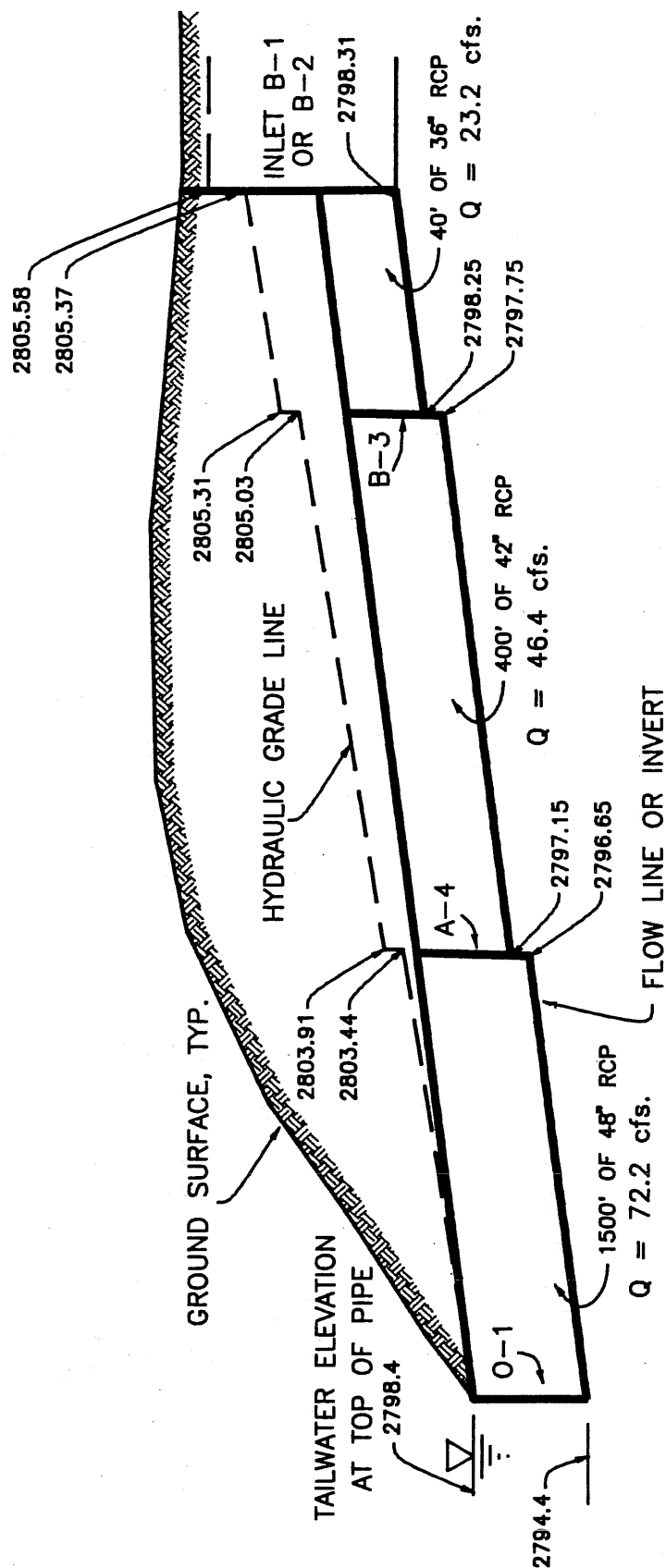
This page intentionally blank.



HYDRAULIC GRADE LINE FROM OUTLET TO INLETS "A"

FIGURE 6-6

STORM DRAIN DESIGN EXAMPLE

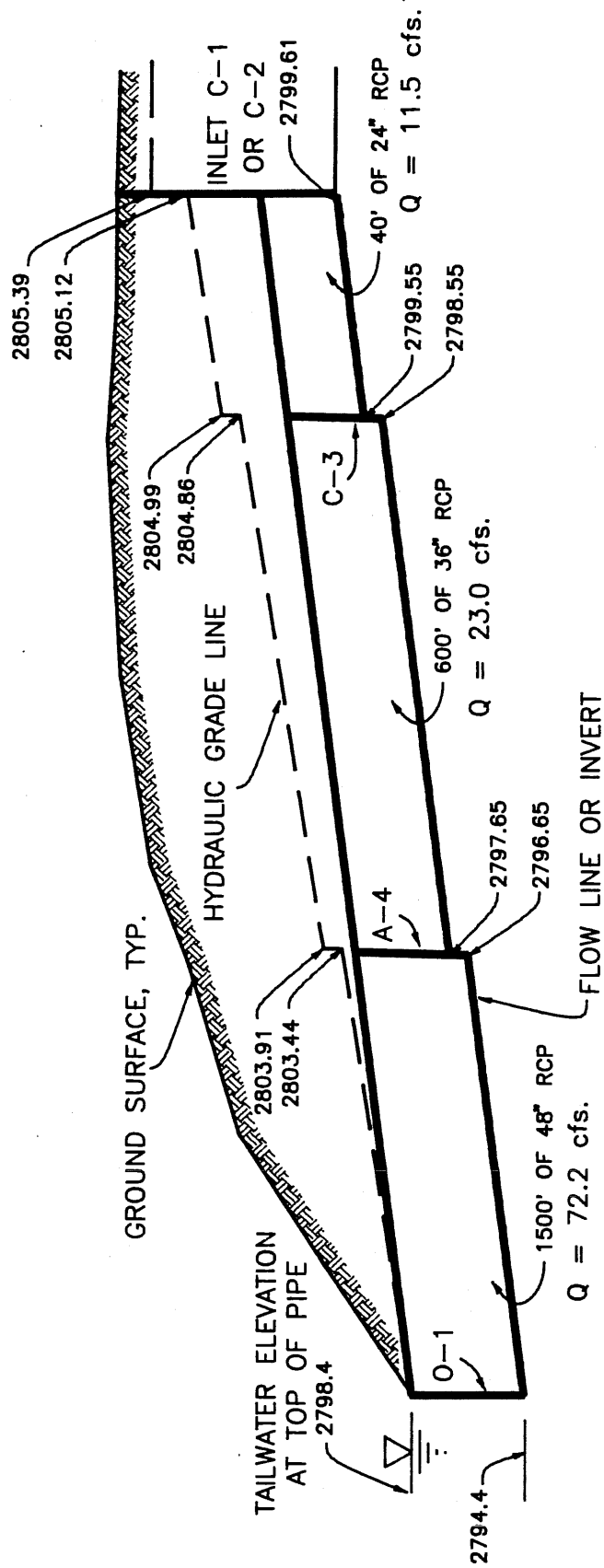


$S = 0.15\%$ FOR ALL PIPE

HYDRAULIC GRADE LINE FROM
OUTLET TO INLETS 'B'

FIGURE 6-7

STORM DRAIN DESIGN EXAMPLE



$S = 0.15\%$ FOR ALL PIPE

HYDRAULIC GRADE LINE FROM
OUTLET TO INLETS "C"

FIGURE 6-8

The above hand-calculated example has also been computer modeled on THYSYS with the printout results shown in Attachment 1 to this chapter. The hydraulic grade line elevations shown on the THYSYS printout are slightly different than those calculated by hand, however, the elevation differences are slight and usually can be ignored for practical purposes. Another iteration of the hand calculations, although tedious, would reduce even further the elevation differences between the two methods. The reasons for differences in the hydraulic grade line elevations between the two methods are:

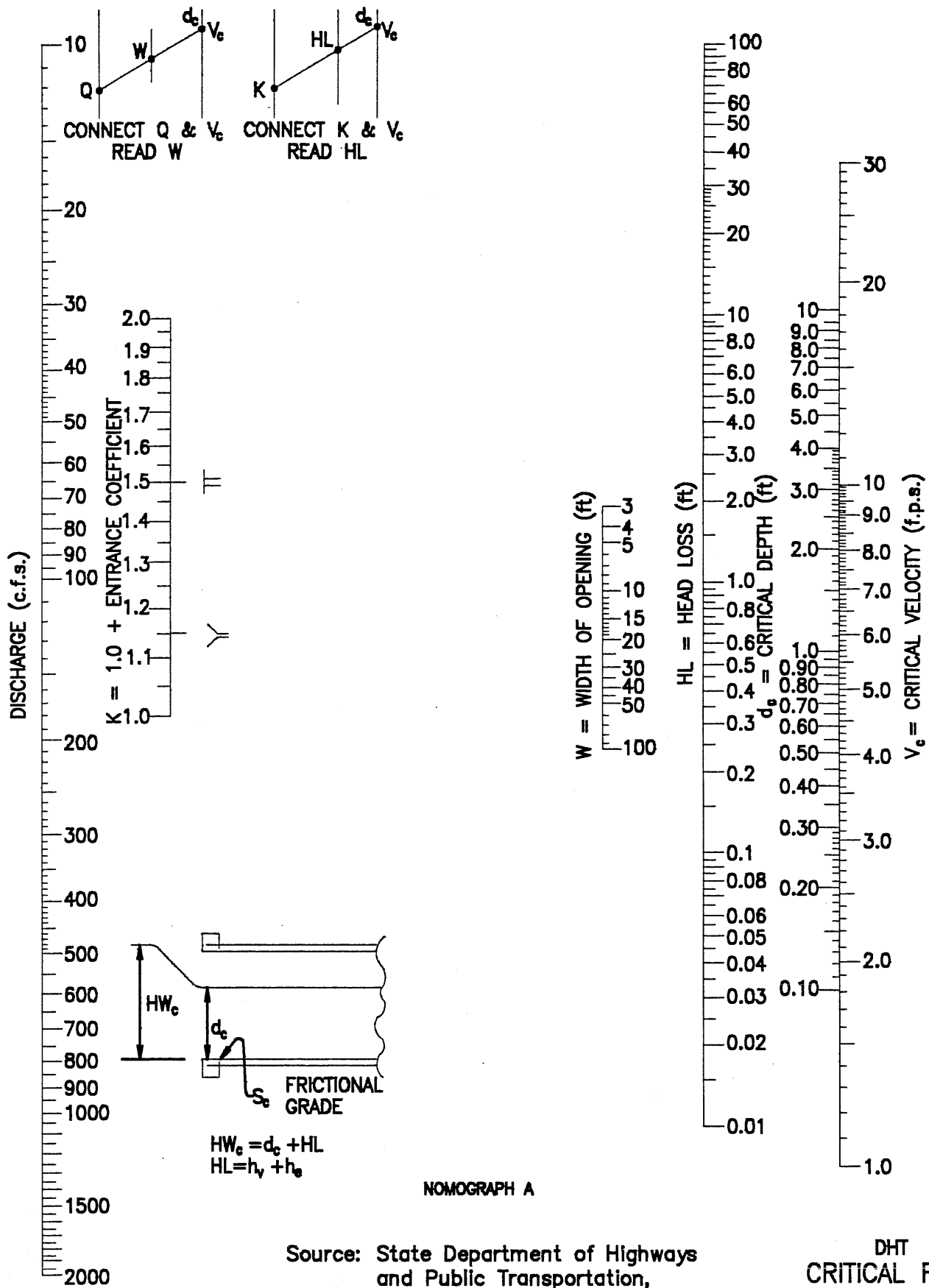
1. THYSYS uses the actual storm drain velocity to calculate travel time and peak discharges at downstream points. The hand calculations use an assumed velocity of 10 fps in the upstream storm drain network.
2. By using the actual travel time, the resultant THYSYS discharge is slightly different at the downstream design point A-4 and the hydraulic grade line slope is correspondingly different.
3. THYSYS uses a greater number of digits to the right of the decimal point for the hydraulic grade line slope than the rounded numbers used in hand calculations. When this slope is multiplied over the length of a storm drain reach, then a small difference in elevation is introduced.

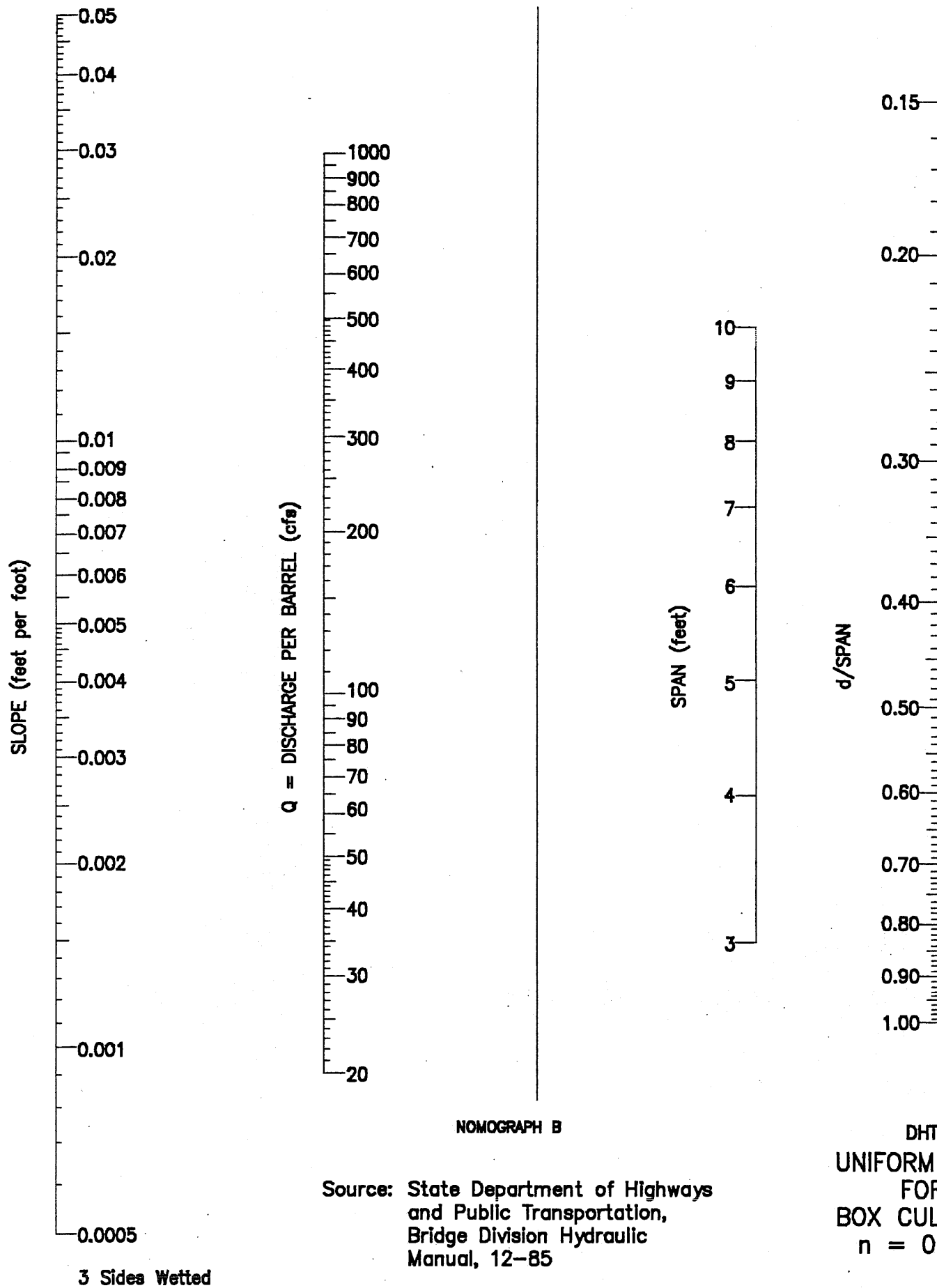
6.6 THYSYS HELPFUL HINTS

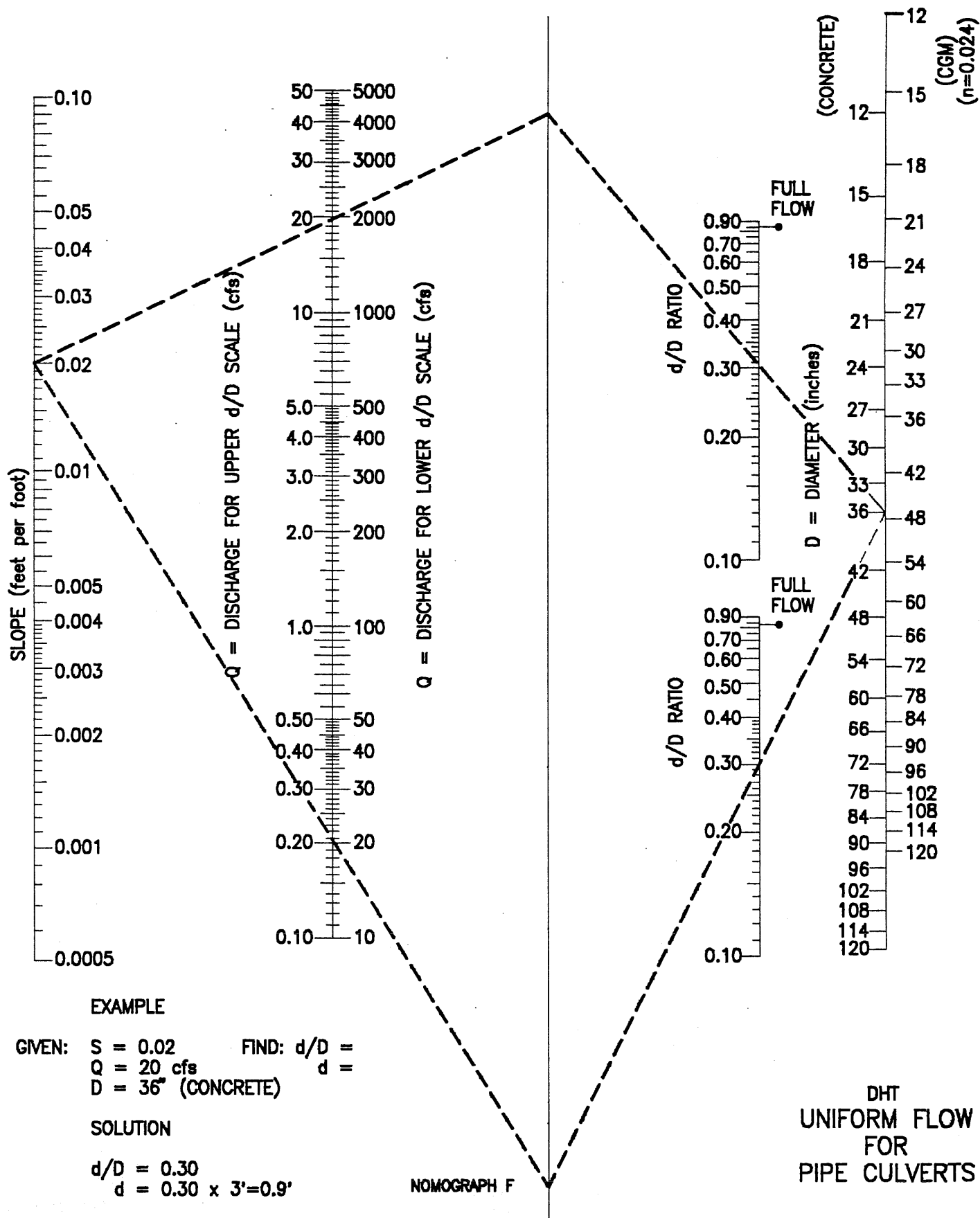
Although the THYSYS User's Manual contains the instructions for using the STORM SEWER subroutine within the program, experience has revealed some additional items of information about this subroutine. This information is presented below as helpful hints to the designer using THYSYS' STORM SEWER subroutine.

1. The DESIGN option is useful for the initial sizing of conduits, however, the program may give a multiple pipe solution for a single reach since THYSYS will not design for surcharged conditions. However, surcharged conditions are recognized when the program is run in the ANALYSIS option and pipe sizes for each run are specified.
2. THYSYS will attenuate peak discharges at downstream design points when the Rational Method information (C value, drainage area, T_o) is placed on the input cards. When baseflow or supply Q is input, no attenuation is performed and the baseflows or supply Q's are directly added together at downstream design points.
3. The input information on the JUNCTION cards will not accommodate parabolic-crowned streets. THYSYS can only recognize straight cross slopes for street definition. Also, inlet designs by THYSYS should always be checked by hand computation according to the criteria in "Section 7: Inlets" of this manual.
4. Actual upstream junction losses have to be calculated by hand and input on the ANALYSIS cards for these losses to be accounted when the STORM SEWER subroutine is run in the analysis option.

END

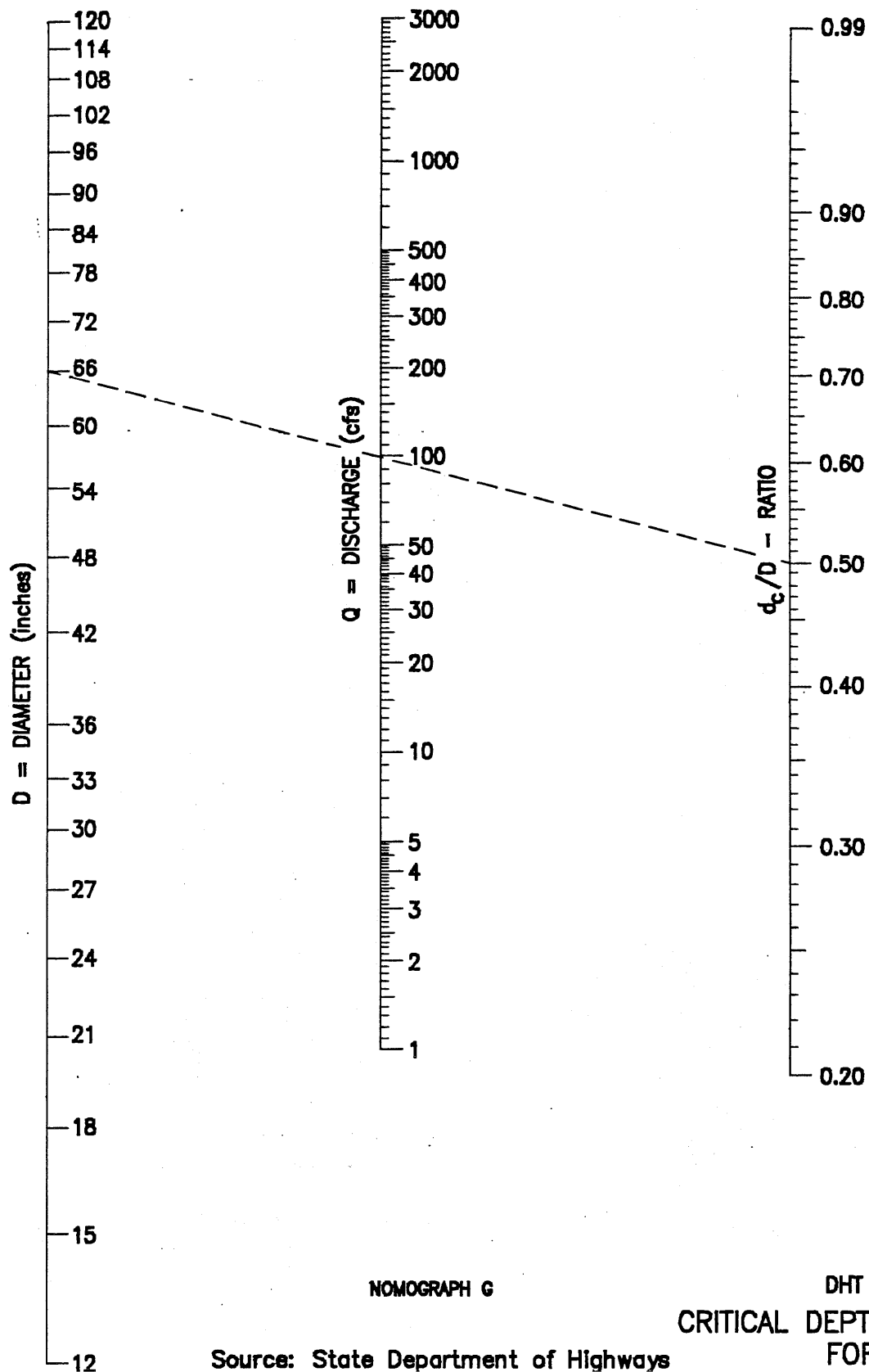






Source: State Department of Highways and Public Transportation,
 Bridge Division Hydraulic Manual, 12-85

FIGURE 6-11

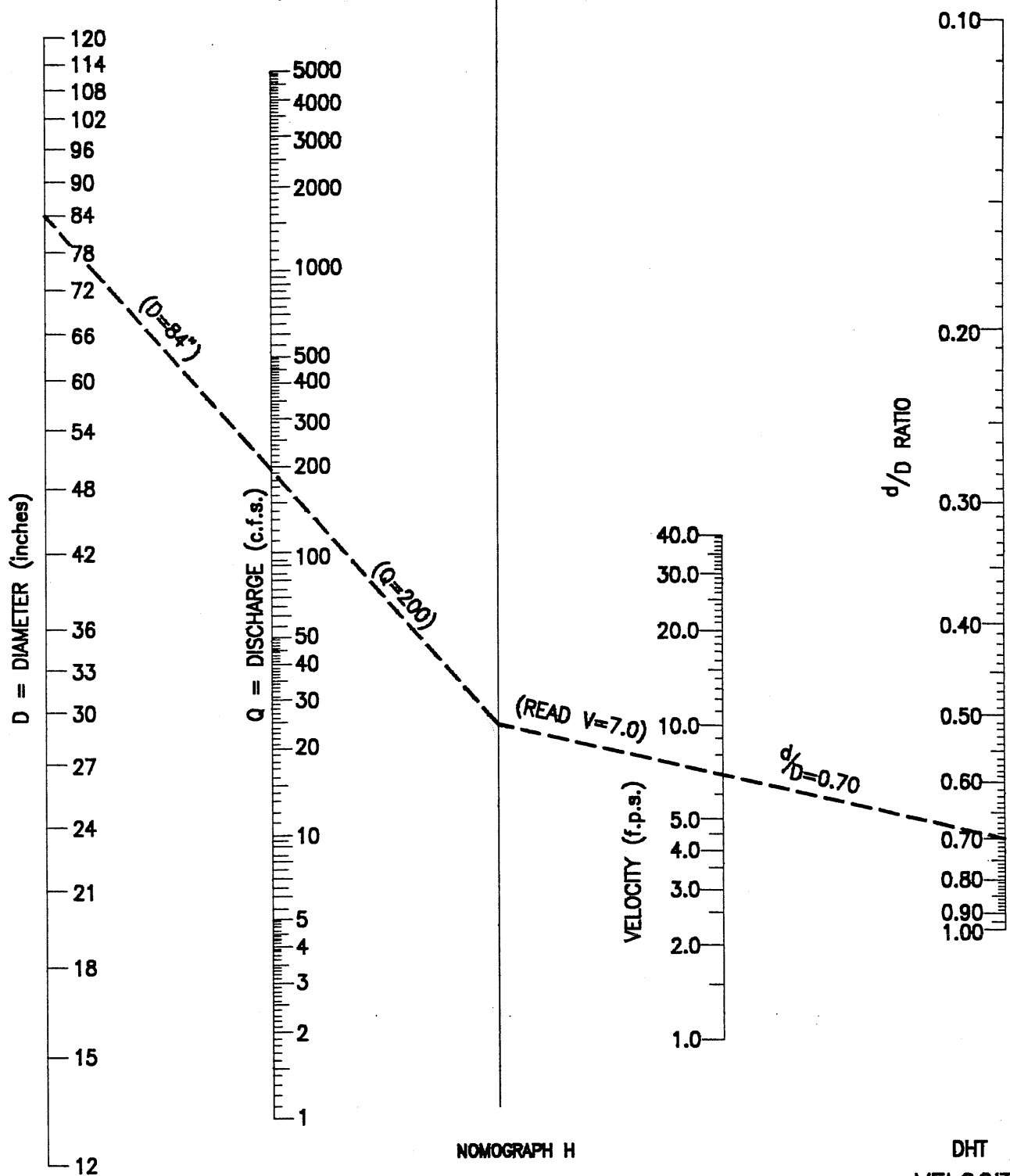


NOMOGRAPH G

Source: State Department of Highways
and Public Transportation,
Bridge Division Hydraulic
Manual, 12-85

DHT
CRITICAL DEPTH OF FLOW
FOR
CIRCULAR CONDUITS

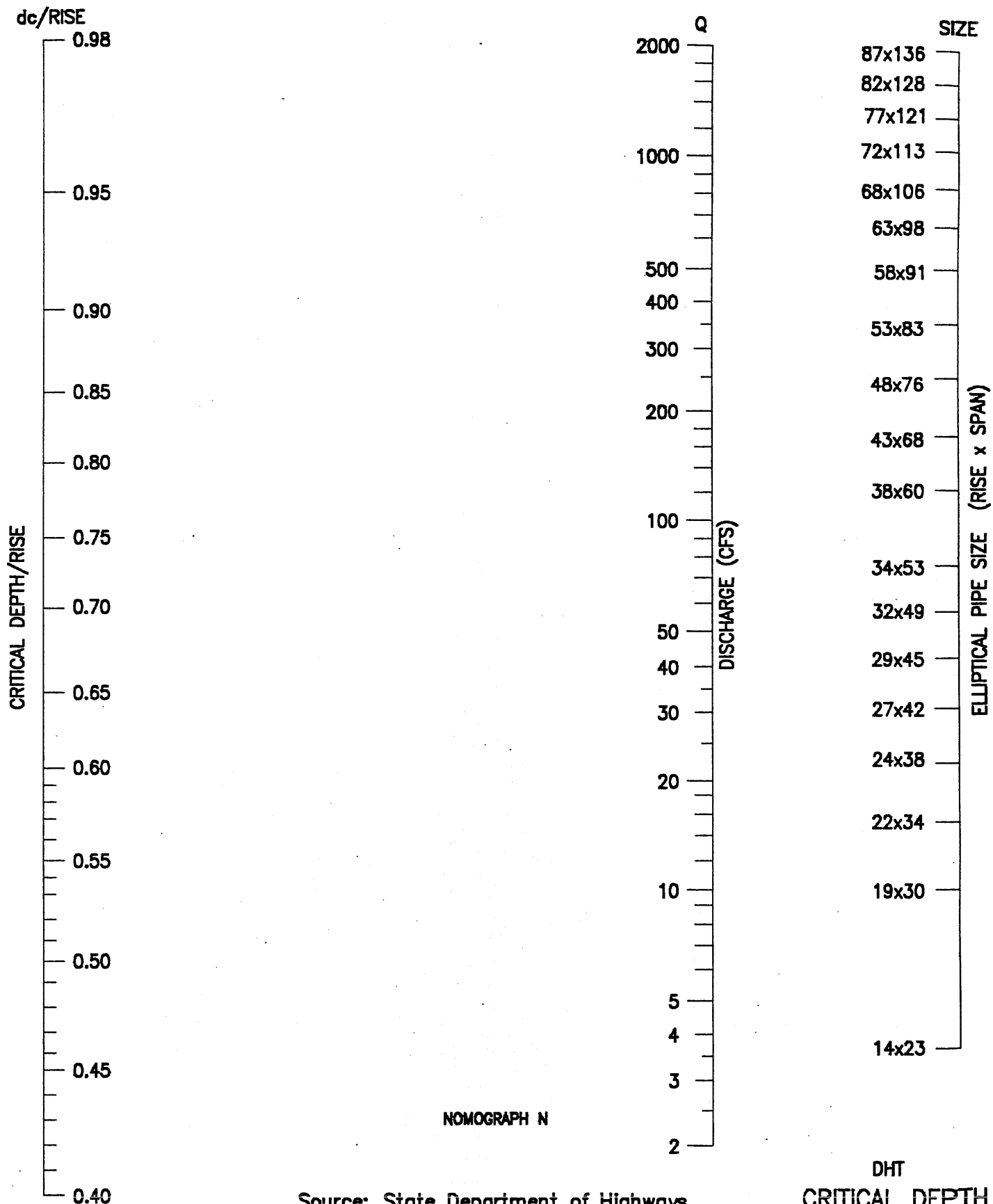
FIGURE 6-12



Source: State Department of Highways
and Public Transportation,
Bridge Division Hydraulic
Manual, 12-85

DHT
VELOCITY
IN
PIPE CONDUITS
BASED ON
 $Q=VA$

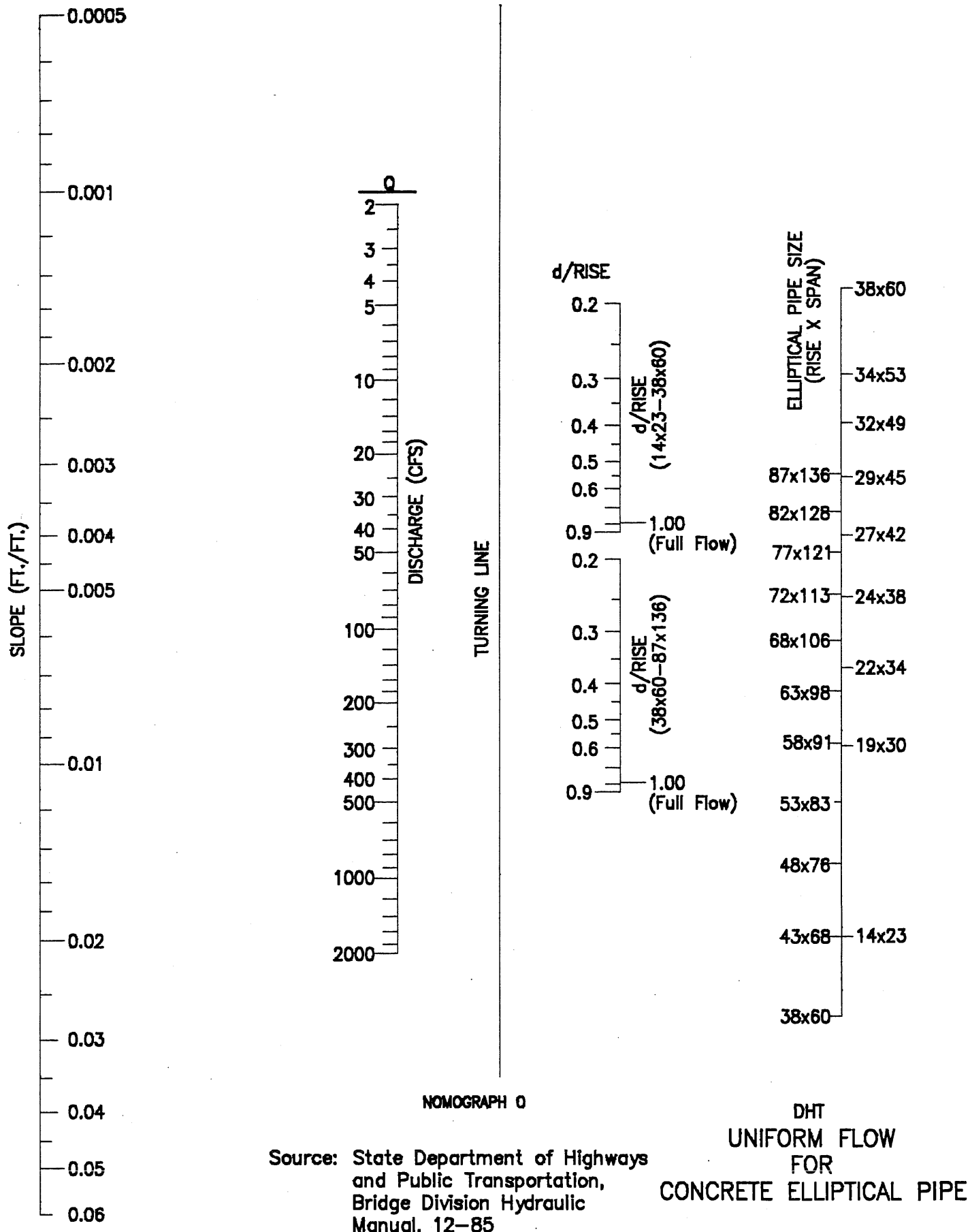
FIGURE 6-13

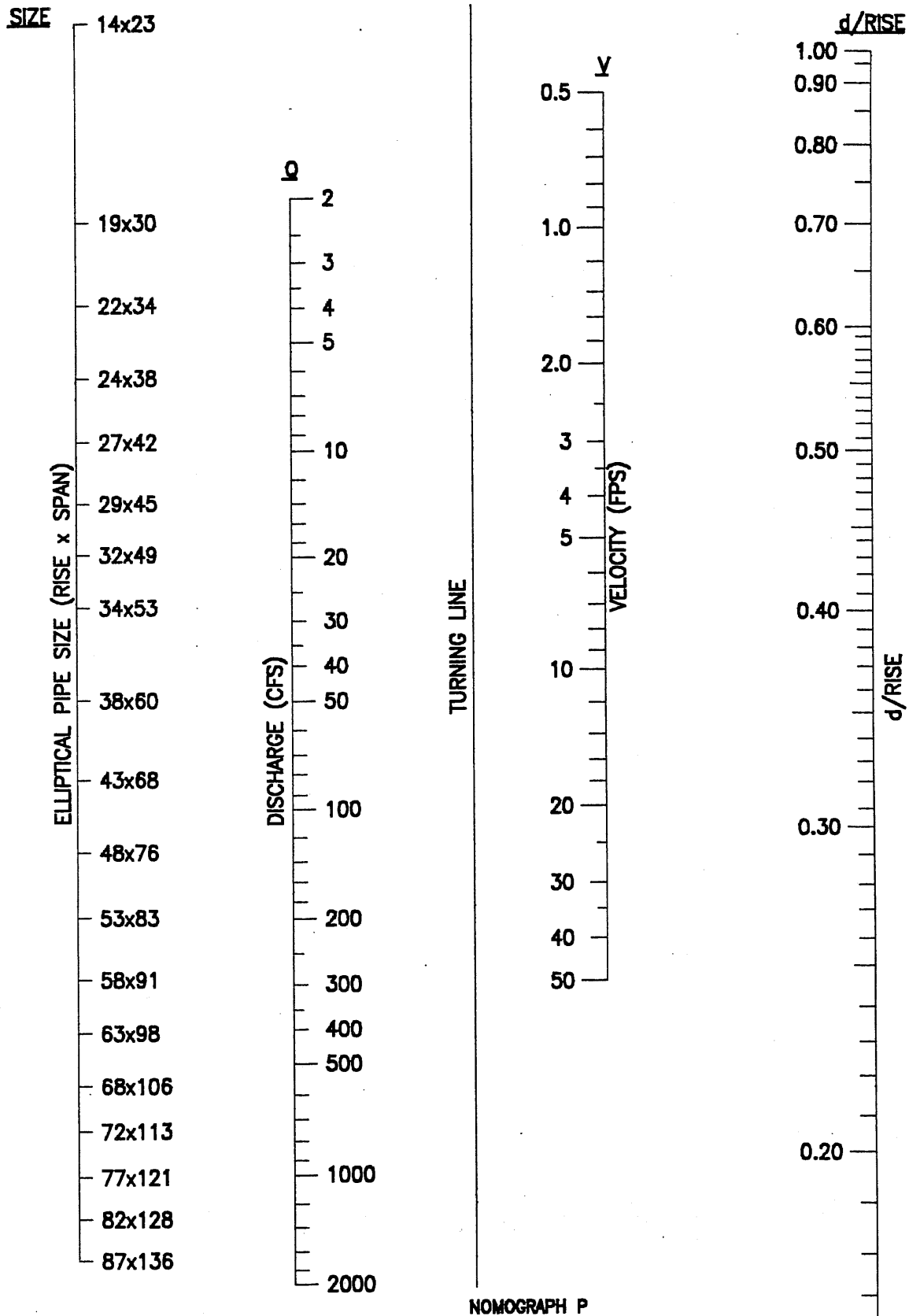


Source: State Department of Highways
and Public Transportation,
Bridge Division Hydraulic
Manual, 12-85

DHT
CRITICAL DEPTH
FOR
ELLIPTICAL PIPE

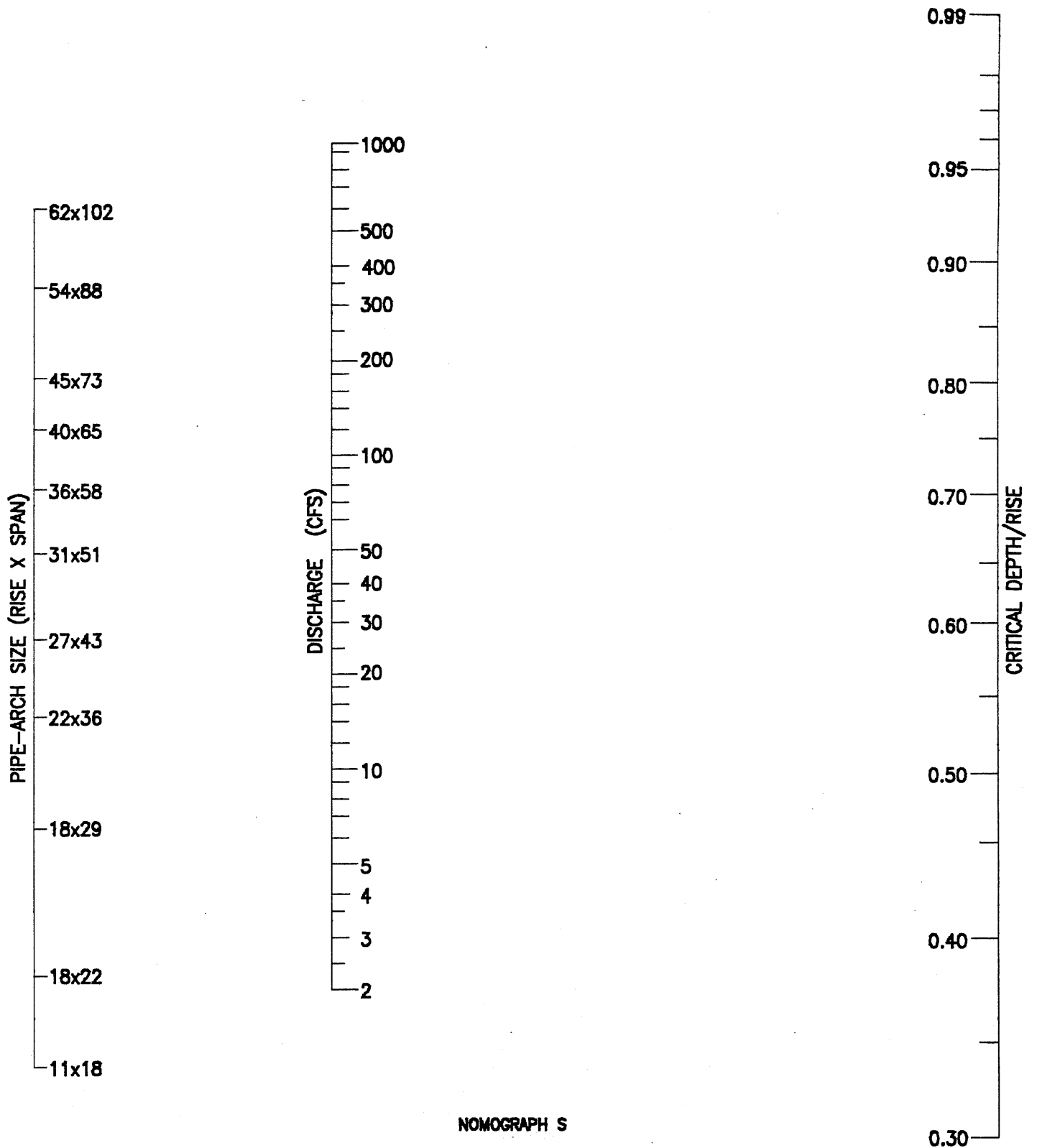
FIGURE 6-14





Source: State Department of Highways
and Public Transportation,
Bridge Division Hydraulic
Manual, 12-85

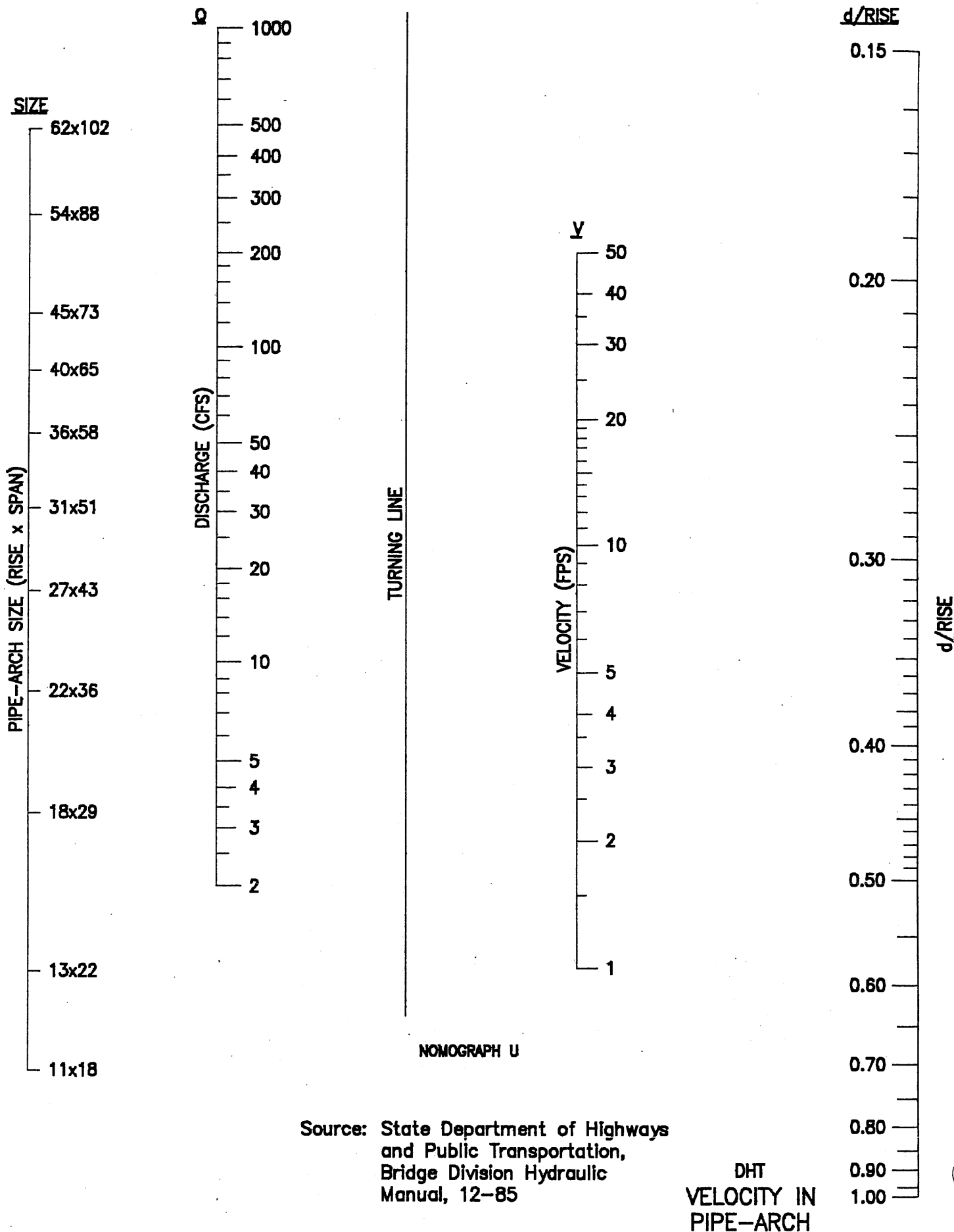
DHT
VELOCITY
IN
ELLIPTICAL PIPE



Source: State Department of Highways
and Public Transportation,
Bridge Division Hydraulic
Manual, 12-85

DHT
CRITICAL DEPTH OF FLOW
FOR
PIPE-ARCH

FIGURE 6-17



Source: State Department of Highways
and Public Transportation,
Bridge Division Hydraulic
Manual, 12-85

FIGURE 6-18
6-32

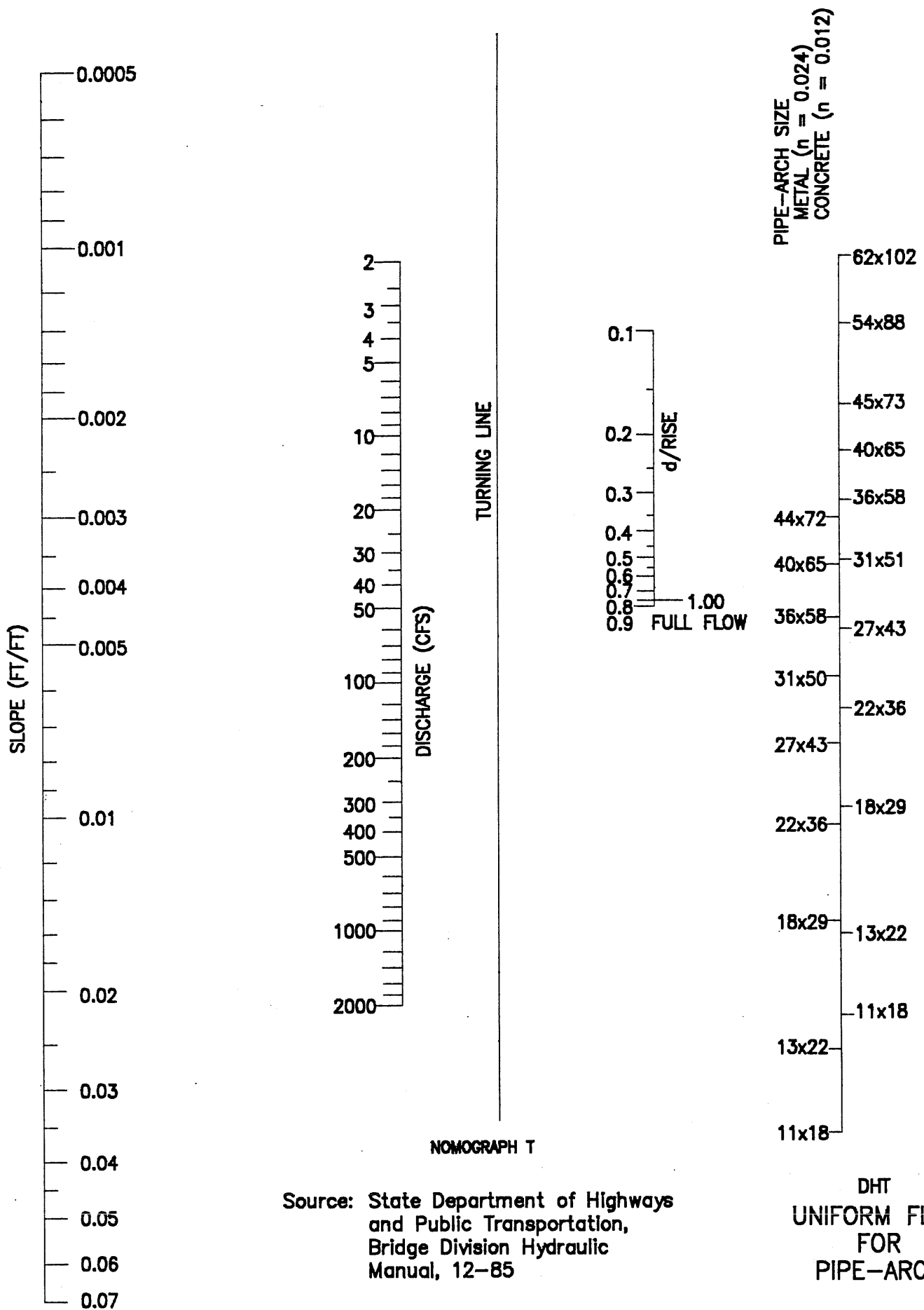


FIGURE 6-19

This page intentionally blank.

This page intentionally blank.

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

```
*****
*                                     *
*               THYSYS               *
*                                     *
*   TEXAS HYDRAULICS SYSTEM         *
*                                     *
*****
```

ATTACHMENT 1 TO SECTION 6: STORM DRAINS
THYSYS EXAMPLE

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

\$EXAMPLE PROBLEM FOR MIDLAND DRAINAGE MANUAL

SEWER	ANALYSIS	RUNOFF	INLET	SEWER	FREQUENCY=25 YR	1
RAT COEF	.60 .70 .60		MIN TC =	10.000.788	71 10.5	
DA A 1	4.00 0 0	0 0 0		T 20	24	6
DA A 2	4.00 0 0	0 0 0		T 20	24	
DA B 1	0 6.00 0	0 0 0		T 15	24	
DA B 2	0 6.00 0	0 0 0		T 15	24	
DA C 1	0 0 5.00	0 0 0		T 30	24	
DA C 2	0 0 5.00	0 0 0		T 30	24	
JUNC A 1	TYPE= CSAG	20.0208.0208	50.02080.013	.25	10	10
JUNC A 2	TYPE= CSAG	20.0208.0208	50.02080.013	.25	10	10
JUNC B 1	TYPE= CSAG	20.0208.0208	50.02080.013	.25	10	10
JUNC B 2	TYPE= CSAG	20.0208.0208	50.02080.013	.25	10	10
JUNC C 1	TYPE= CSAG	20.0208.0208	50.02080.013	.25	10	10
JUNC C 2	TYPE= CSAG	20.0208.0208	50.02080.013	.25	10	10
JUNC A 3	TYPE=JUNCT					
JUNC B 3	TYPE=JUNCT					
JUNC C 3	TYPE=JUNCT					
JUNC A 4	TYPE=JUNCT					
OUTLET	STATIONING	1500.00 T.W. ELEV	2798.40	0	1	
DSGN 001	A 1 A 3	US2801.24 DS2801.18	40	.015	24	CIRC
DSGN 002	A 2 A 3	US2801.24 DS2801.18	40	.015	24	CIRC
DSGN 003	A 3 A 4	US2801.18 DS2800.65	350	.015	36	CIRC
DSGN 004	B 1 B 3	US2801.31 DS2801.25	40	.015	36	CIRC
DSGN 005	B 2 B 3	US2801.31 DS2801.25	40	.015	36	CIRC
DSGN 006	B 3 A 4	US2801.25 DS2800.65	400	.015	42	CIRC
DSGN 007	C 1 C 3	US2801.61 DS2801.55	40	.015	24	CIRC
DSGN 008	C 2 C 3	US2801.61 DS2801.55	40	.015	24	CIRC
DSGN 009	C 3 A 4	US2801.55 DS2800.65	600	.015	36	CIRC
DSGN 010	A 4 O 1	US2800.65 DS 2798.4	1500	.015	48	CIRC
ANAL 001	A 1 A 3	1 24 24	0.260			
ANAL 002	A 2 A 3	1 24 24	0.260			
ANAL 003	A 3 A 4	1 36 36	0.130			
ANAL 004	B 1 B 3	1 36 36	0.210			
ANAL 005	B 2 B 3	1 36 36	0.210			
ANAL 006	B 3 A 4	1 42 42	0.280			
ANAL 007	C 1 C 3	1 24 24	0.260			
ANAL 008	C 2 C 3	1 24 24	0.260			
ANAL 009	C 3 A 4	1 36 36	0.130			
ANAL 010	A 4 O 1	1 48 48	0.470			

ENDATA

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(INPUT DATA)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

SEWER

RUNOFF CALCULATIONS

RAINFALL FREQUENCY = 25 YR.

SURFACE DESCRIPTION OF RATIONAL COEFFICIENTS

A	B	C	D	E	F
.6000	.7000	.6000	.0000	.0000	.0000

MINIMUM TIME OF CONCENTRATION = 10.0 MINUTES

E = .788 B = 71. D = 10.5

I.D.	CA	TC	SUPPLY Q	INTENSITY	TOTAL FLOW
A 1	2.40	20.00	.0	4.80	11.5
A 2	2.40	20.00	.0	4.80	11.5
B 1	4.20	15.00	.0	5.53	23.2
B 2	4.20	15.00	.0	5.53	23.2
C 1	3.00	30.00	.0	3.84	11.5
C 2	3.00	30.00	.0	3.84	11.5
A 3	.00	.00	.0	.00	.0
B 3	.00	.00	.0	.00	.0
C 3	.00	.00	.0	.00	.0
A 4	.00	.00	.0	.00	.0
O 1	.00	.00	.0	.00	.0

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(OUTPUT)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

SEWER

INLET ANALYSIS

INLET I.D.	FLOW TYPE	INLET CAPACITY (CSF)	CARRYOVER ASSIGNMENT (CSF)	CARRYOVER INLET I.D.	CALCULATED POND WIDTH (FT)	ACTUAL LENGTH (FT)	MINIMUM COMPUTED LENGTH REQUIRED (FT)	ACTUAL AREA (SQ FT)	MINIMUM AREA REQUIRED (SQ FT)	ACTUAL HEAD (SQ FT/SEC)	
A 1	CSAG	11.5	34.81	.00	---	.00	10.0	3.3	.00	.00	.52
A 2	CSAG	11.5	34.81	.00	---	.00	10.0	3.3	.00	.00	.52
B 1	CSAG	23.2	34.81	.00	---	.00	10.0	6.7	.00	.00	.83
B 2	CSAG	23.2	34.81	.00	---	.00	10.0	6.7	.00	.00	.83
C 1	CSAG	11.5	34.81	.00	---	.00	10.0	3.3	.00	.00	.52
C 2	CSAG	11.5	34.81	.00	---	.00	10.0	3.3	.00	.00	.52

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(OUTPUT)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

SEWER

SEWER ANALYSIS

CONFIGURATION DATA

RUN	U.S. ID	D.S. ID	U.S. F.L. ELEV	D.S. F.L. ELEV	LENGTH FEET	SLOPE	BBLS	RISE	SPAN	SHAPE
001	A 1	A 3	2799.24	2799.18	40	.00150	1	24	24	CIRC
002	A 2	A 3	2799.24	2799.18	40	.00150	1	24	24	CIRC
003	A 3	A 4	2798.18	2797.65	350	.00151	1	36	36	CIRC
004	B 1	B 3	2798.31	2798.25	40	.00150	1	36	36	CIRC
005	B 2	B 3	2798.31	2798.25	40	.00150	1	36	36	CIRC
006	B 3	A 4	2797.75	2797.15	400	.00150	1	42	42	CIRC
007	C 1	C 3	2799.61	2799.55	40	.00150	1	24	24	CIRC
008	C 2	C 3	2799.61	2799.55	40	.00150	1	24	24	CIRC
009	C 3	A 4	2798.55	2797.65	600	.00150	1	36	36	CIRC
010	A 4	O 1	2796.65	2794.40	1500	.00150	1	48	48	CIRC

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(OUTPUT)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

HYDRAULIC DATA

RUN	U.S. ID	D.S. ID	'N'	JUNC LOSS	FLOW	U.S. HEAD	D.S. HEAD	HYDR. GRAD	DEPTH	VELOC.	PIPE CAPAC.
001	A 1	A 3	.015	.26	11.53	2804.61	2804.21	.00346	1.00	3.7	7.6**
002	A 2	A 3	.015	.26	11.53	2804.61	2804.21	.00346	1.00	3.7	7.6**
003	A 3	A 4	.015	.13	22.95	2804.21	2803.53	.00158	1.00	3.2	22.5**
004	B 1	B 3	.015	.21	23.24	2805.21	2804.93	.00162	1.00	3.3	22.4**
005	B 2	B 3	.015	.21	23.24	2805.21	2804.93	.00162	1.00	3.3	22.4**
006	B 3	A 4	.015	.28	46.18	2804.93	2803.53	.00281	1.00	4.8	33.8**
007	C 1	C 3	.015	.26	11.53	2805.01	2804.61	.00346	1.00	3.7	7.6**
008	C 2	C 3	.015	.26	11.53	2805.01	2804.61	.00346	1.00	3.7	7.6**
009	C 3	A 4	.015	.13	22.97	2804.61	2803.53	.00158	1.00	3.2	22.4**
010	A 4	O 1	.015	.47	69.41	2803.53	2798.40	.00311	1.00	5.5	48.2**

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(OUTPUT)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

SEW0008--CAPACITY OF RUN 001 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 002 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 003 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 004 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 005 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 006 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 007 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 008 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 009 IS EXCEEDED.
SEW0008--CAPACITY OF RUN 010 IS EXCEEDED.

(Note: The above warning messages indicate surcharged flow conditions for the identified storm drain reach.)

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(OUTPUT)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PTHYSYS

TEXAS HYDRAULIC SYSTEM - 221108

VER 2.3 JAN 89

DATE: 1/05/92 TIME: 13:01:16

THYSYS

STATIONING

RUN	UPSTREAM JUNCTION ID	STATIONING
001	A 1	3390
002	A 2	3390
003	A 3	3350
004	B 1	3440
005	B 2	3440
006	B 3	3400
007	C 1	3640
008	C 2	3640
009	C 3	3600
010	A 4	3000

Stop - Program terminated.

ATTACHMENT 1 TO SECTION 6: STORM DRAINS

THYSYS EXAMPLE

(OUTPUT)

SECTION 6

BIBLIOGRAPHY

1. American Iron and Steel Institute, Handbook of Steel Drainage and Highway Construction Products, Washington, D.C. 1976.
2. City of Dallas, Texas, Department of Public Works, Design Manual for Storm Drainage Facilities, Undated.
3. City of Fort Worth, Texas, Department of Development, Development Procedures Manual, Adopted September 1975.
4. City of Austin, Texas, Drainage Criteria Manual, June 1988.
5. Texas State Department of Highways and Public Transportation, Bridge Division, Hydraulic Manual, Third Edition, December 1985.
6. American Association of State Highway and Transportation Officials, Highway Drainage Guidelines, 1982.
7. U.S. Department of Transportation, Federal highway Administration, Hydraulic Engineering Circular No. 12: Drainage of Highway Pavements, March 1984.
8. U.S. Department of Transportation, Federal Highway Administration Offices of Research and Development Implementation Division, Design of Urban Highway Drainage: The State of the Art, August 1979, Reprinted September 1983.
9. Texas State Department of Highways and Public Transportation, User Manual for Texas Hydraulic System (THYSYS), 1977.
10. City of Plano, Texas, Storm Drainage Design Manual, 1982.
11. Portland Cement Association, Handbook of Concrete Culvert Pipe Hydraulics, 1964.
12. American Concrete Pipe Association, Concrete Pipe Handbook, 1980.

SECTION 7

INLETS

7.1 General

7.2 Inlet Classifications

7.3 Storm Water Inlet Hydraulics

7.3.1 Curb Inlet at Sag Capacity

7.3.2 Curb Inlet on Grade Capacity

7.3.3 Recessed Curb Inlets

7.3.4 Grate Inlet at Sag Capacity

7.3.5 Grate Inlet on Grade Capacity

Curb Inlet Design Worksheet

Bibliography

SECTION 7

INLETS

7.1 GENERAL

The primary purpose of storm drain inlets is to intercept excess surface storm water runoff and deposit it in a drainage system. This reduces the possibility of surface flooding where such flooding poses a hazard to traffic or property.

Inlets may be located in streets, ditches, medians or ponding areas. Inlets located in streets must be designed so that they will not conflict with traffic.

The following guidelines shall be used in the design of inlets to be located in streets:

- A. Grated curb inlets are discouraged from use due to their increased tendency to clog, problems with replacement and increased pavement maintenance in the immediate vicinity of the inlet. In all instances where a curb inlet can be used instead of a grated curb inlet, it shall be required unless prior approval is given by the City of Midland Engineering Department.
- B. The minimum curb transition for recessed inlets shall be ten (10) feet in accordance with the City of Midland standard detail for recessed inlets.
- C. All curb inlets (whether in a sag or on-grade location) incorporate a standard 3-inch depression which must be constructed in accordance with the city's standard detail for curb inlets.
- D. When recessed inlets are used, they shall not decrease the width of the sidewalk back of the curb. Also, it should be noted that recessed inlets are optional for all streets.
- E. The design and location of inlets shall take into consideration pedestrian and bicycle traffic as well as drive openings in the curb line. In particular, grate inlets located near sidewalks, in streets or in residential areas shall be designed to assure safe passage of bicycles.
- F. Inlet design and location must be compatible with the design criteria established in "Section 5: Street Drainage" and "Section 6: Storm Drains" of this manual.
- G. The use of slotted drain is acceptable for nuisance water control. If used, the manufacturer's design guidelines should be followed. The installation of slotted drain shall be in accordance with the City of Midland's standard construction details. Nuisance water is that runoff produced from sprinklers and other irrigation systems on landscaped areas. Slotted drains and their associated pipes are not

acceptable for major runoff carrying capacity, nor shall the pipes serve as trunk storm drains.

- H. Grate inlets located at sags or low points are preferred over slotted drains at low points.

7.2 INLET CLASSIFICATIONS

The City of Midland has adopted certain inlet classifications: 1) inlets at low points or sags (Type L), and 2) inlets on grade or on a slope (Type S). These groups are further subdivided by the inlet construction with a "C" denoting a curb inlet and a "G" denoting a grate inlet. For example, an inlet designation of CL-10 means a curb inlet at a low point which has a ten-foot long inlet opening. A summary of the inlet designations is contained in Table 7-1.

The inlet classification for grate inlets uses a further descriptive suffix of "T" or "D". A "T" suffix indicates a grate inlet which has a traffic grate suitable for vehicular loads and bicycle traffic. A "D" suffix indicates a ditch grate inlet which can use a fabricated safety grate in lieu of a traffic grate. The openings in the ditch inlet grating are usually larger and less prone to clogging than traffic grating.

TABLE 7-1 INLET DESIGNATIONS	
INLET TYPE	DESCRIPTION
CS-5, CS-10, CS-15, CS-20	Curb inlets in paved areas on grade, or a slope, with 5-, 10-, 15- or 20-foot long openings.
CL-5, CL-10, CL-15, CL-20	Curb inlets in paved areas at low points with 5-, 10-, 15- or 20-foot long openings
GS-T	Grate inlet in a paved area on grade, or a slope, with traffic grate
GL-T	Grate inlet in a paved area at sag or low point with traffic grate
GL-D	Grate inlet at sag or low point of a ditch with a non-traffic safety grate.

Grates for traffic conditions are available from various vendors and are built to withstand various wheel loads up to H-20 truck axle loads and are bicycle safe. Grates for non-traffic areas in ditches are usually shop fabricated of structural steel shapes on an individual inlet basis. The clear space between grating bars is greater than that for traffic areas, but usually the grating bars are no more than two inches apart center-to-center. This additional clear space reduces the amount of clogging on the grate due to trash

and debris. Figures 7-1 through 7-5 illustrate the conditions for the inlet classifications listed in Table 7-1.

7.3 STORM WATER INLET HYDRAULICS

Inlets in sags are inlets at low points with flow contributing from two or more sides. The capacity of inlets at sags must be known in order to determine the depth and width of ponding for a given discharge. A worksheet has been included at the end of this section for designing curb inlets. Copies of the worksheet may be made by the designer for design use and inclusion in submittals.

Inlets on grade normally receive storm water runoff only from the upgradient side of the inlet. Some storm water will bypass an inlet on grade and continue downgradient to the next inlet. Inlets on grade can be used to control width of ponding on streets, and reduce the likelihood of exceeding the capacity of an inlet located further downgradient.

7.3.1 Curb Inlet at Sag Capacity

Unsubmerged curb opening inlets located at a sag, or low point, (Type CL) operate as rectangular weirs with a coefficient of discharge of 3.0. The capacity of a sag curb inlet is determined as follows:

$$Q = 3.0 h^{1.5} L \quad (\text{Eq. 7-1})$$

where:

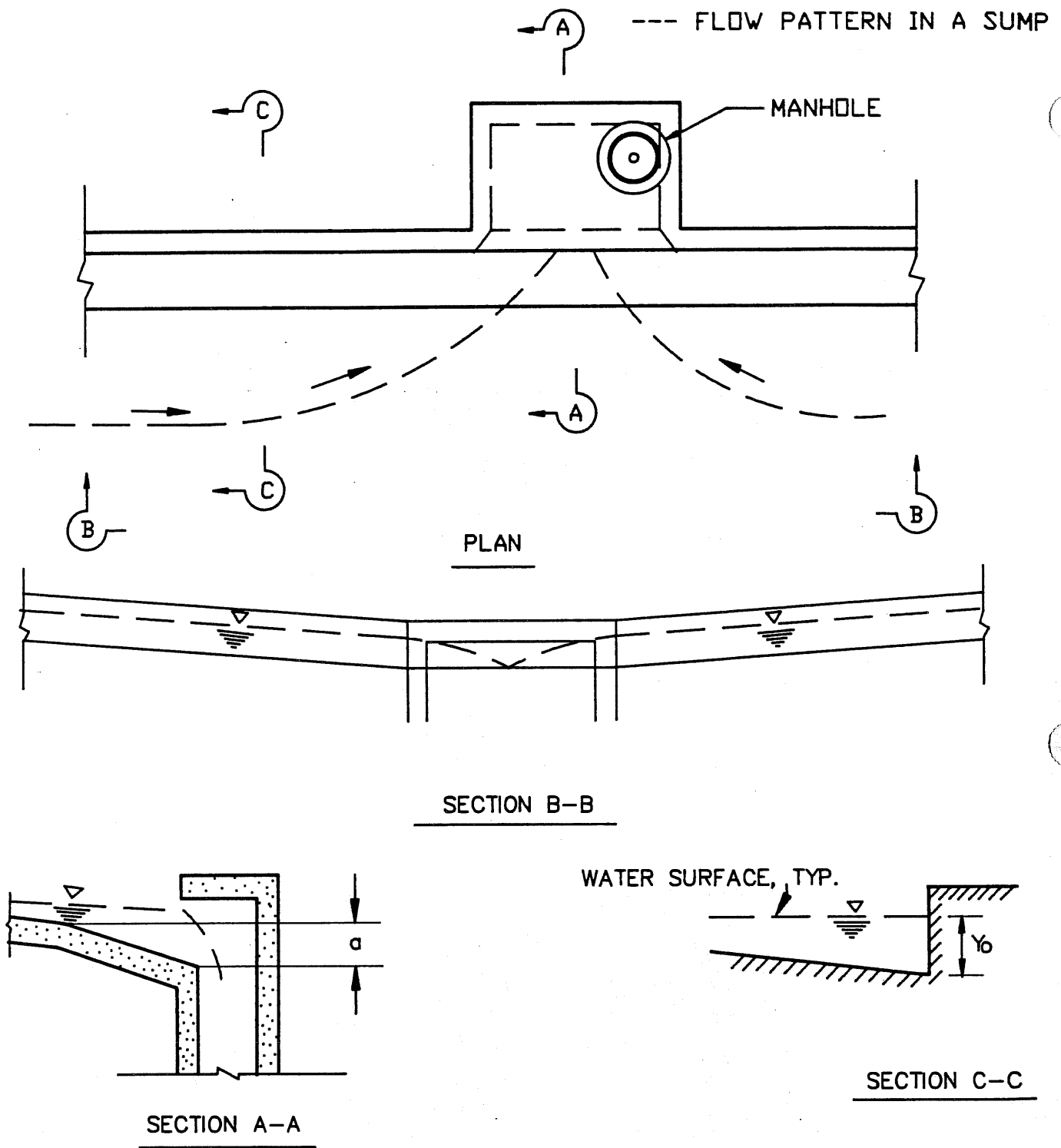
Q	=	Capacity of curb inlet at sag, cfs
h	=	Head at the inlet, feet, $a + Y_o$
L	=	Length of opening through which water enters the inlet, feet
a	=	Gutter depression at the inlet, feet
Y_o	=	Depth of water above the normal gutter flow line, feet.

Curb inlets at sags have a tendency to collect debris at their entrances. To allow for blockage of flow into the inlet by this debris, the calculated inlet capacity shall be reduced by 15 percent.

Example: The 25-year storm water discharge to a curb inlet located at a sag in a street vertical curve is 12.2 cubic feet per second. What length of inlet opening is required to accommodate this flow rate? Assume for this example that ponding width limits for this street restrict Y_o to a maximum depth of four inches (0.33 feet) and that the gutter depression is three inches (0.25 feet) at the inlet opening.

The inlet capacity is reduced by 15 percent for debris, therefore design flow must be increased.

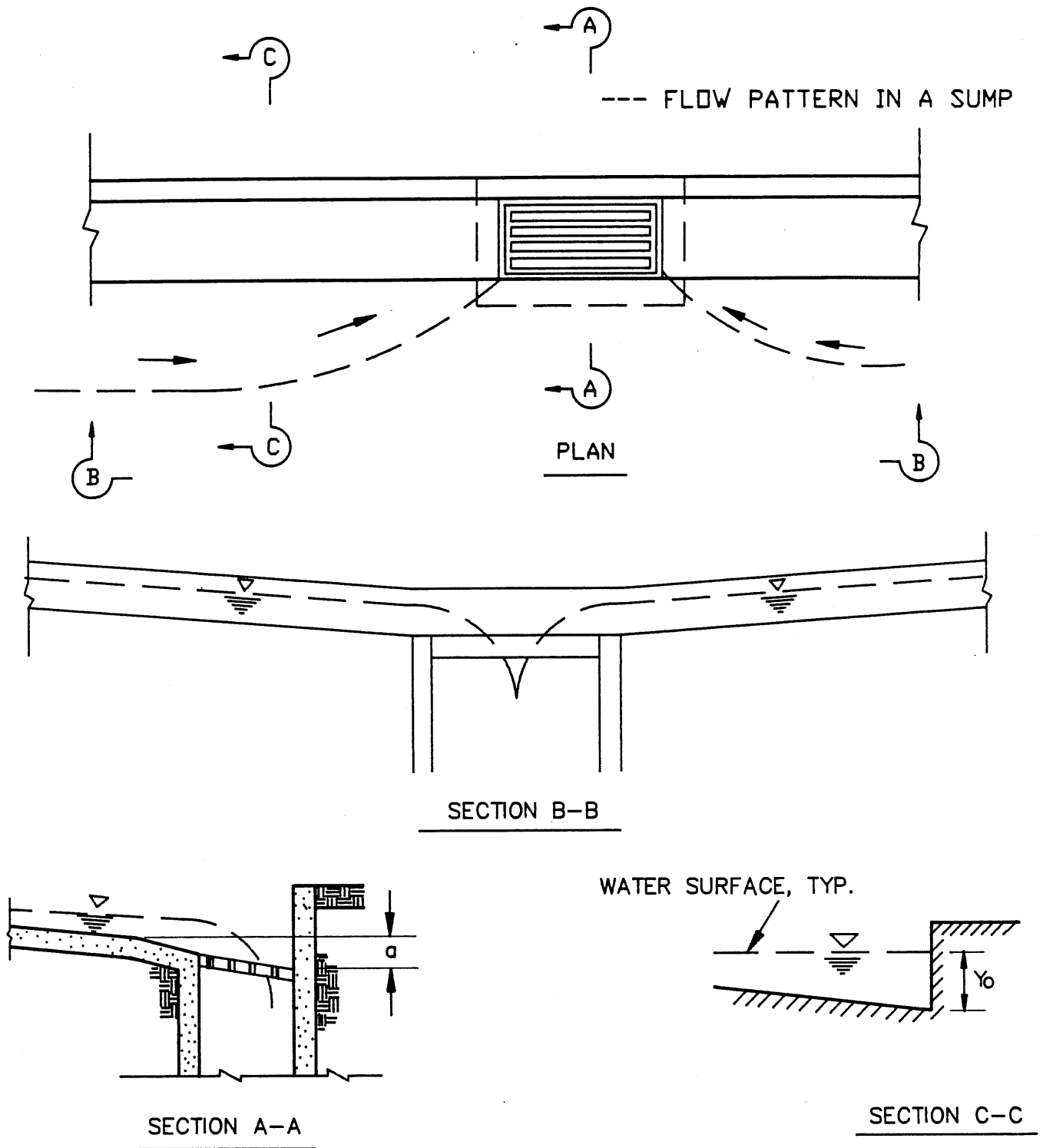
$$\begin{aligned} 12.2 \text{ cfs} + 0.85 &= 14.35 \text{ cfs design flow rate} \\ Q &= 3.0 h^{1.5} L \\ 14.35 \text{ cfs} &= (3.0)(0.33 + 0.25)^{1.5} L \\ \text{Solving algebraically: } L &= 10.8 \text{ feet} \end{aligned}$$



y_0 : WATER DEPTH IN THE APPROACH GUTTER.
 a : GUTTER DEPRESSION.

CURB INLET AT SAG OR LOW POINT (TYPE CL)

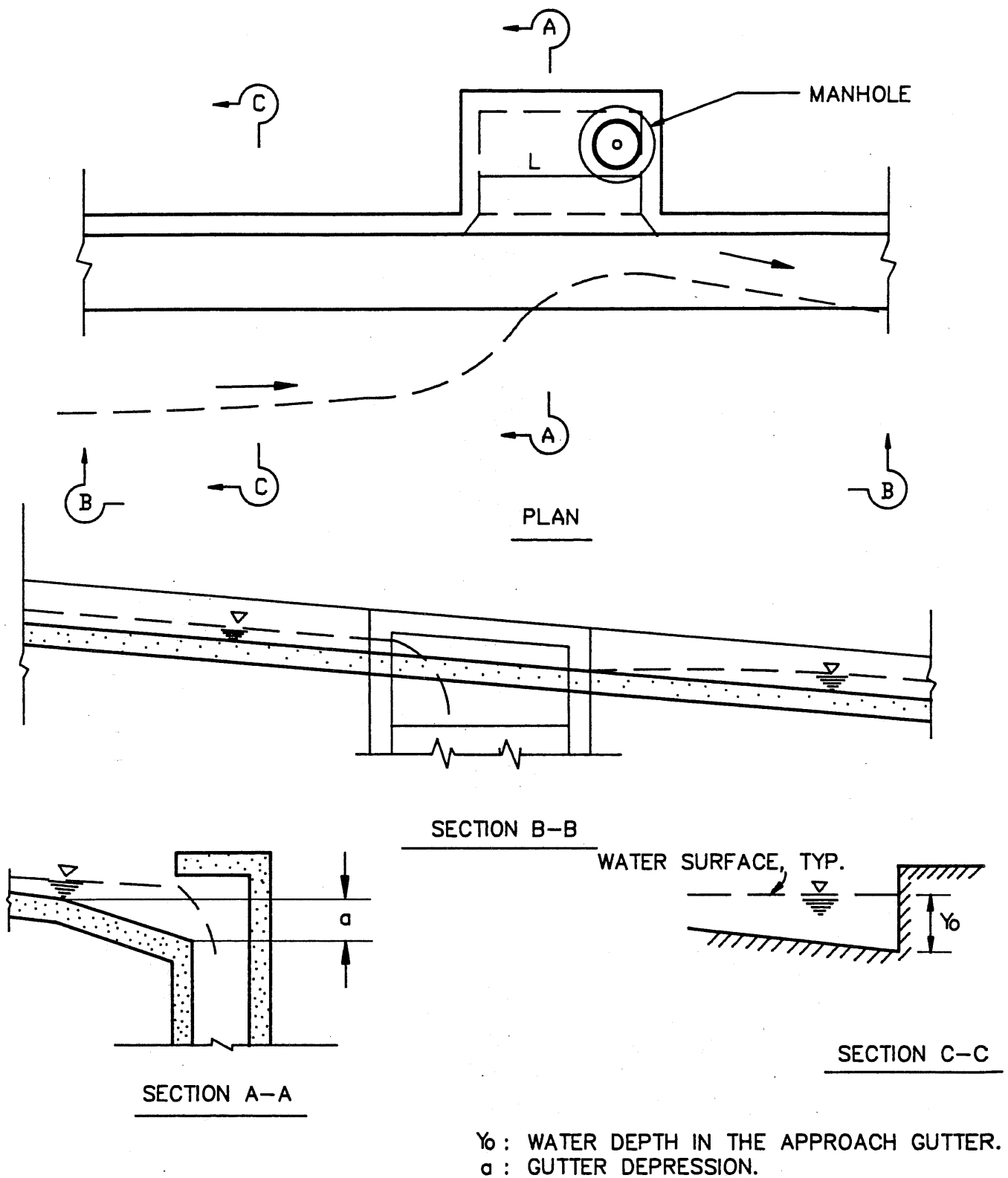
FIGURE 7-1



Y_0 : WATER DEPTH IN THE APPROACH GUTTER.
 a : GUTTER DEPRESSION.

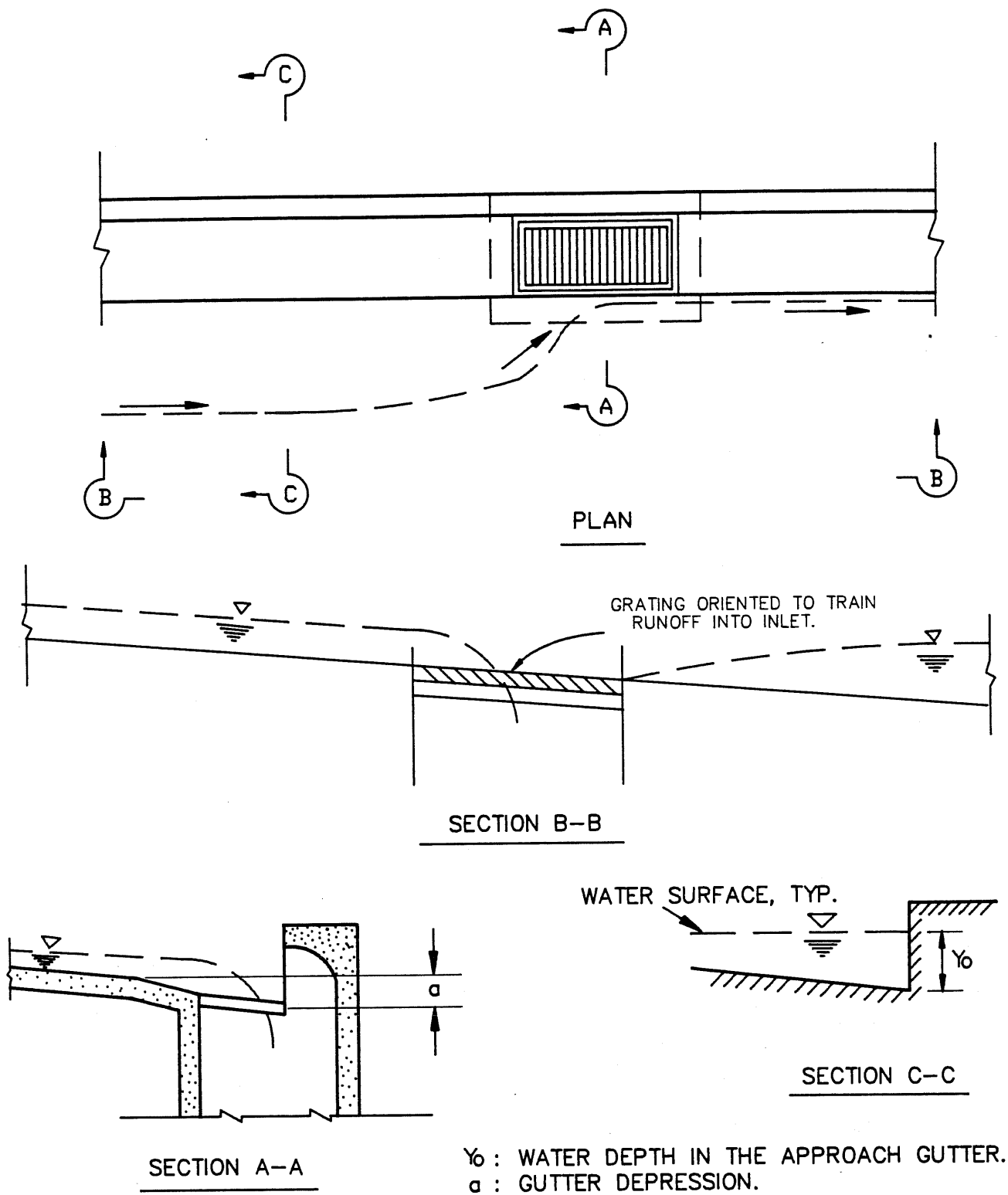
GRATE INLET AT SAG OR LOW POINT (TYPE GL-T)

FIGURE 7-2



CURB INLET ON GRADE OR SLOPE (TYPE CS)

FIGURE 7-3



GRATE INLET ON GRADE OR SLOPE (TYPE GS)

FIGURE 7-4

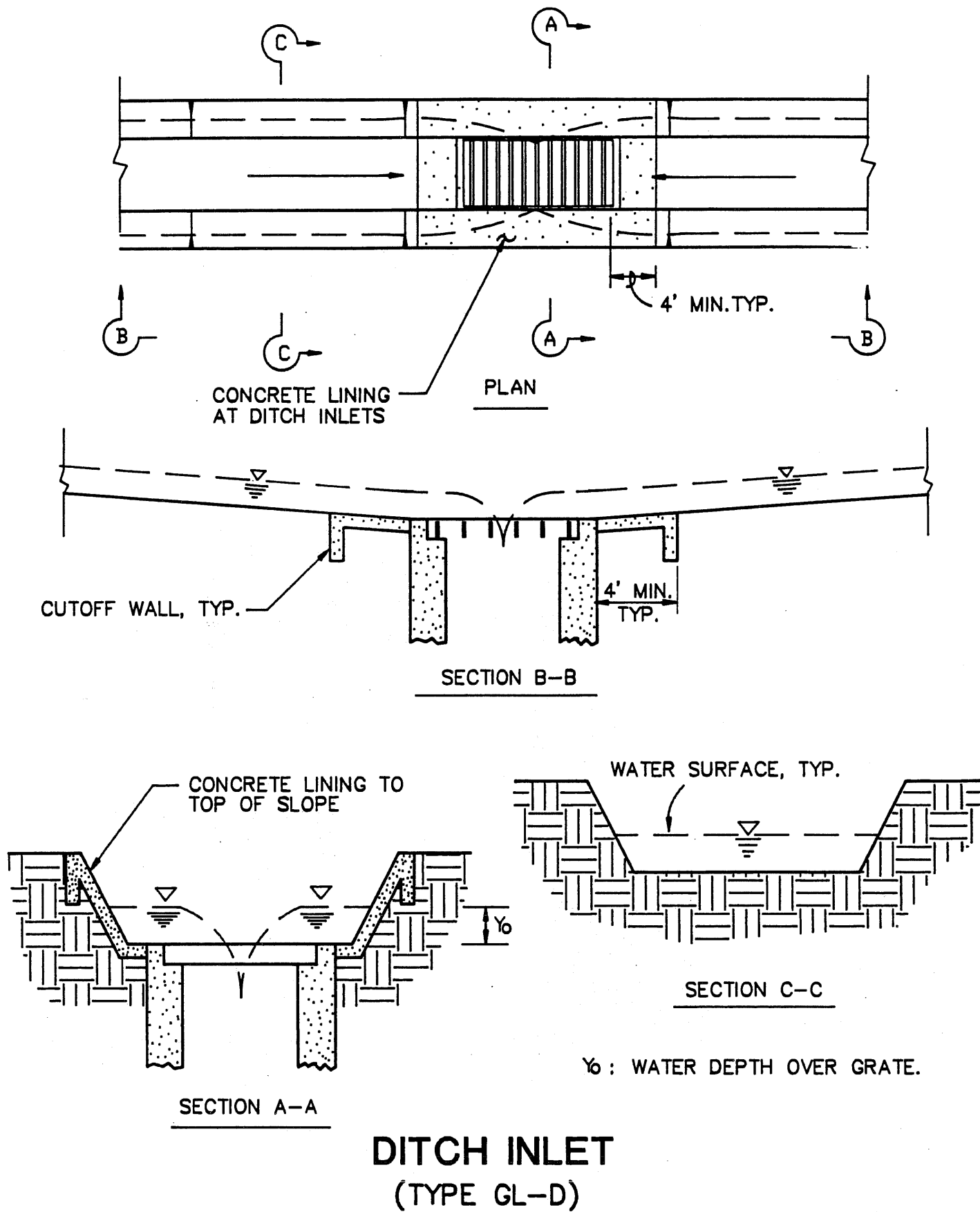


FIGURE 7-5

A CL-10 inlet has only ten feet of opening. This is not permissible. Use a CL-15 inlet with a 15-foot opening length. This example is also shown on the Figure 7-14 worksheet at the end of this chapter.

When the water depth at the curb inlet opening exceeds $1.4h$, then the inlet opening acts as an orifice and capacity may be determined by the equation:

$$Q = 0.67A [2g (d_1 - h/2)]^{0.5} \quad (\text{Eq. 7-2})$$

where:

- Q = Capacity of the inlet, cfs
- A = Area of the inlet opening, sq. ft.
- h = Height of the inlet opening, ft.
- g = 32.2 ft/sec/sec
- d_1 = Depth of water above the inlet lip, ft., $(Y_o + a)$

Designing for a curb inlet to operate under orifice flow conditions is not good practice. The depth of water at the curb face for orifice flow conditions usually covers street driving lanes with an unacceptable depth of water. The designer shall use the rectangular weir equation, or an appropriate inlet nomograph such as Figure 7-6, for the design of curb inlets at low points.

7.3.2 Curb Inlet on Grade Capacity

In the design of curb inlets on grade (Type CS), it is not always necessary or desirable to intercept all of the water at any given point. In fact, some studies indicate that a curb inlet on grade functions more efficiently when a small fraction of the storm water runoff flowing in the gutter is allowed to bypass the inlet and continue downstream to the next inlet. It is also uneconomical to design a curb inlet on grade to intercept one-hundred percent of the flow since such an inlet requires an unusually long inlet opening. Because debris is normally carried downstream of the inlet in the carryover flow, reductions in inlet capacity due to clogging are not required.

The hydraulic design of a curb inlet on grade is accomplished through the use of the following equation:

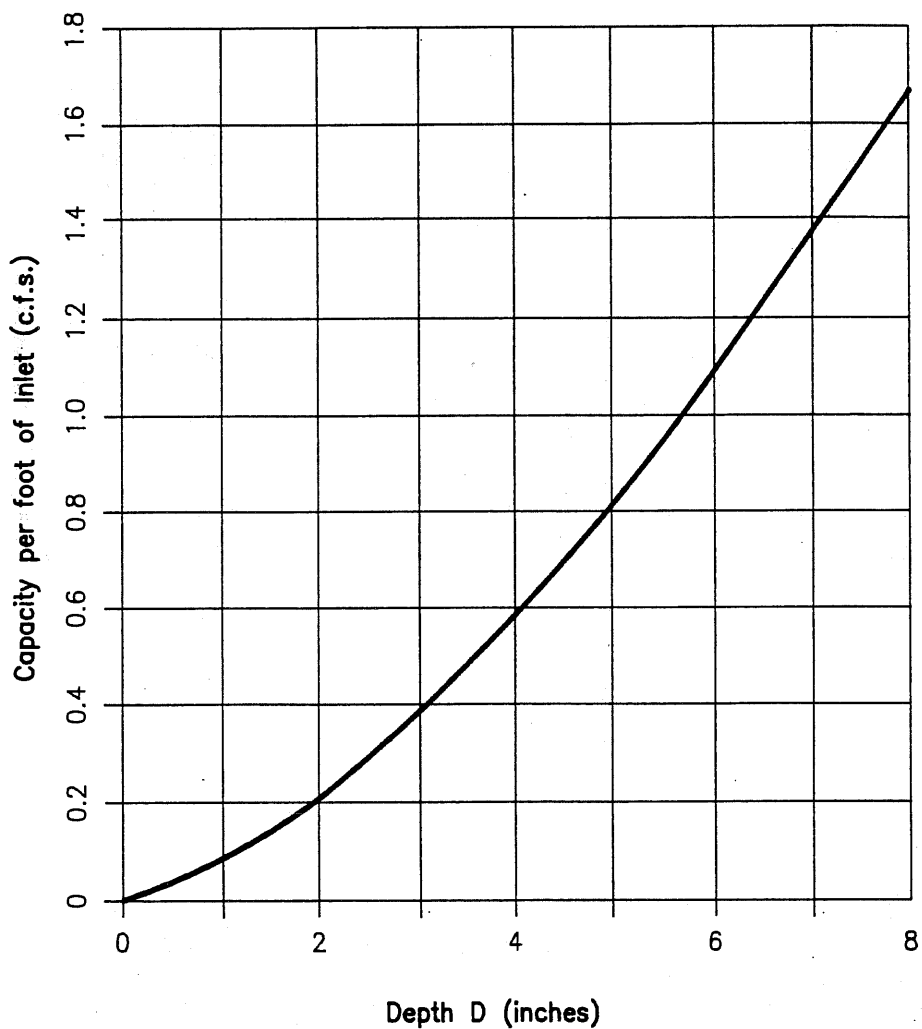
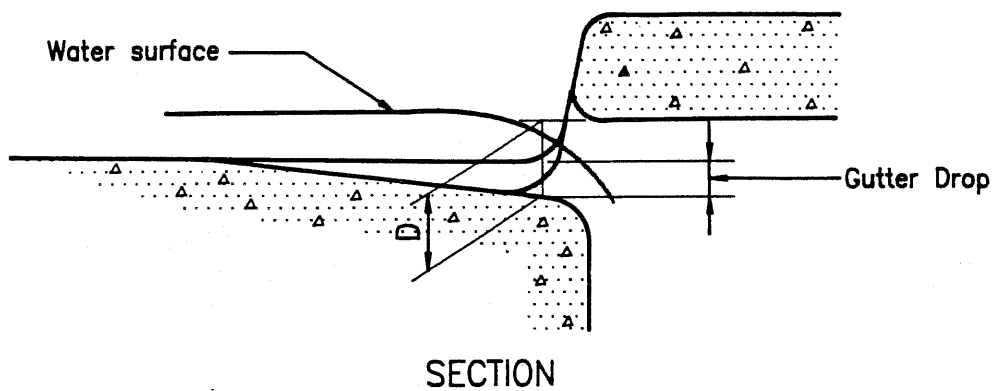
$$Q/L = 0.7 \left[\frac{1}{H_1 - H_2} \right] \left[(H_1)^{5/2} - (H_2)^{5/2} \right] \quad (\text{Eq. 7-3})$$

where:

- Q/L = Inlet capacity per foot of opening, cfs/ft
- H_1 = $a + Y_o$
- H_2 = a = Gutter depression, ft.
- Y_o = Depth of water above the normal gutter flow line, ft.

Nomographs contained in Figures 7-7 and 7-8 are based on the above equation and may be used for design.

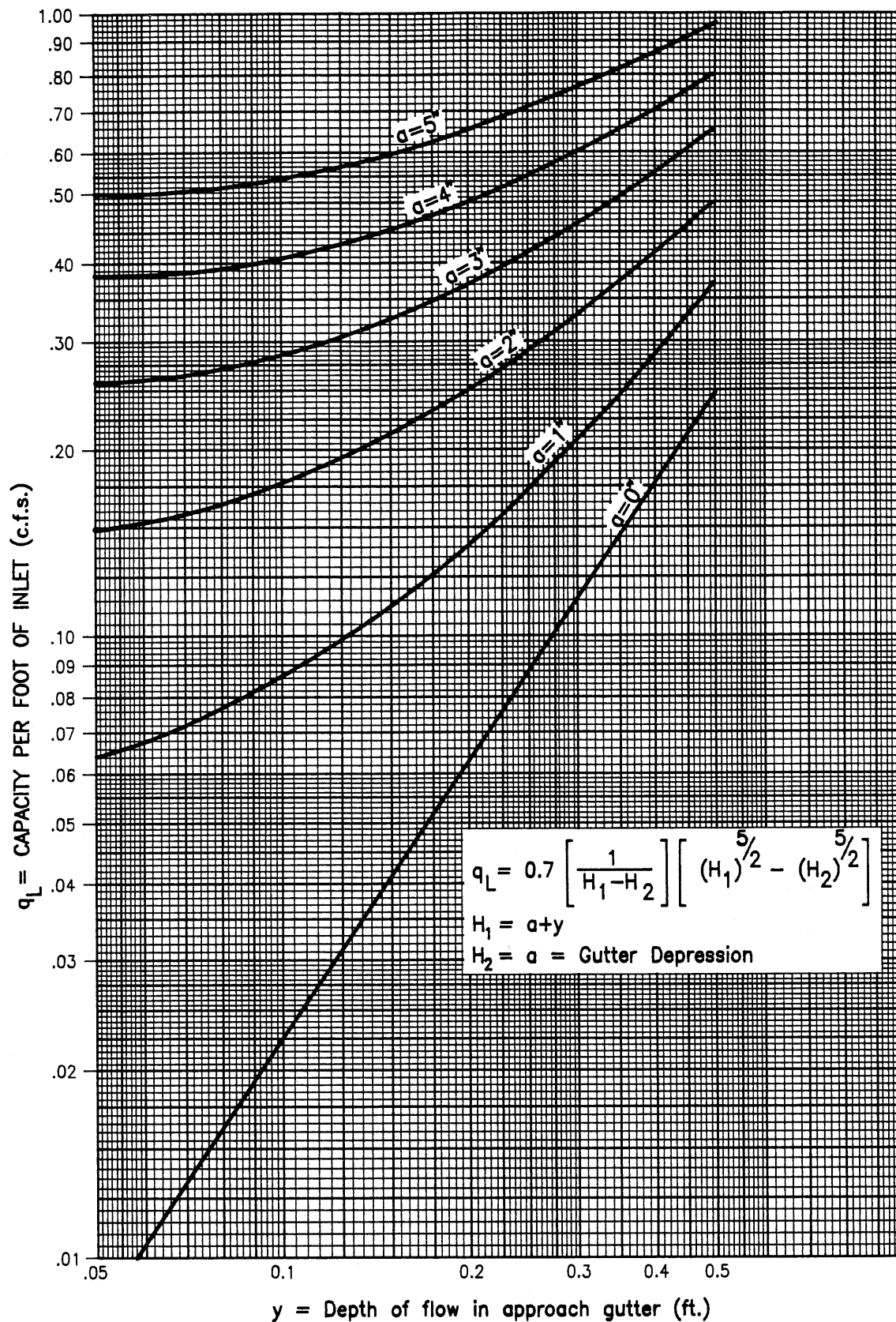
Example: A curb inlet on grade is needed to intercept storm water flow to prevent excessive flow to an inlet located downstream at a low point and for control of the ponding width on the street. For purposes of this example, gutter flow depth, Y_o , is five inches (0.42 feet). The gutter depression at the inlet is three



INLET CAPACITY FOR LOW POINT INLETS

SOURCE: STATE DEPARTMENT OF HIGHWAY AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

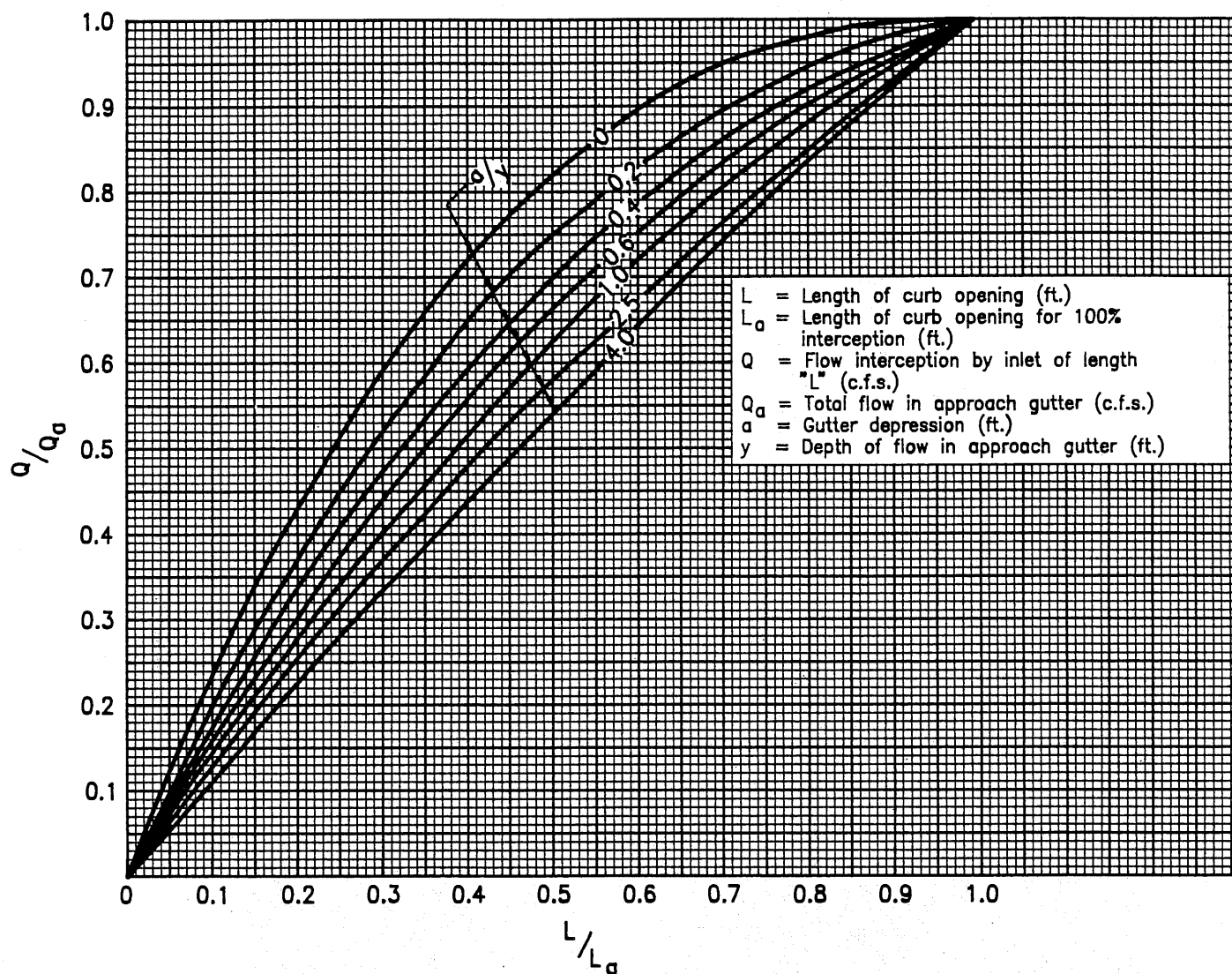
FIGURE 7-6



CAPACITY FOR INLETS ON GRADE

FIGURE 7-7

SOURCE: STATE DEPARTMENT OF HIGHWAY AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85



RATIO OF INTERCEPTED TO TOTAL FLOW INLETS ON GRADE

SOURCE: STATE DEPARTMENT OF HIGHWAY AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85

FIGURE 7-8

inches (0.25 feet). What length of opening is required to intercept 100 percent of the gutter flow at 8 cubic feet per second, and what length of opening is required to intercept 70 percent of the flow?

For 100 percent interception:

$$Q/L = 0.7 \left[\frac{1}{0.67-0.25} \right] \left[(0.67)^{5/2} - (0.25)^{5/2} \right]$$

$$Q/L = 0.56 \text{ cfs/ft}$$

$$L = 8/0.56 = 14.3 \text{ feet}$$

Use a CS-15 inlet.

For 70 percent interception:

Enter Figure 7-8 with $Q/Q_a = 0.7$ and

$$a/y = 0.25 \text{ ft}/0.42 \text{ ft} = 0.60.$$

Read $L/L_a = 0.54$.

Then $L = 0.54 L_a$

$$L = (0.54)(14.3 \text{ feet}) = 7.7 \text{ feet}$$

Use a CS-10 inlet.

Now, use the nomographs in Figures 7-7 and 7-8 to also solve this example.

Entering Figure 7-7 with $Y_o = 0.42$ feet and a gutter depression of 3 inches, read $q_L = 0.58$ cfs/ft.

For 100 percent interception:

$$L = 8 \text{ cfs}/0.58 \text{ cfs per ft.} = 13.8 \text{ feet.}$$

Use a CS-15 inlet.

For 70 percent interception:

Enter Figure 7-8 with $Q/Q_a = 0.7$ and

$$a/y = 0.25 \text{ ft}/0.42 \text{ ft} = 0.60.$$

Read $L/L_a = 0.54$.

Then $L = 0.54 L_a$

$$L = (0.54)(13.8 \text{ feet}) = 7.5 \text{ feet}$$

Use a CS-10 inlet.

Note that by using the design nomographs the difference for the 100 percent interception length is 14.3 minus 13.8, or 0.5 feet. The difference in inlet length for 70 percent interception is 7.7 minus 7.5, or 0.2 feet. This is primarily expected due to the "smoothing" of the nomograph curves, however the final result is not significantly affected. This example is also shown at the end of this chapter on Figure 7-14. A blank worksheet has also been included as Figure 7-15. Copies of the worksheet may be made for design use.

7.3.3 Recessed Curb Inlets

Capacities for recessed curb inlets on grade shall be calculated as 0.75 times the capacity for non-recessed inlets. Capacities for recessed curb

inlets at sags or low points shall be calculated the same as for non-recessed inlets at sags. The clogging factor for recessed curb inlets at low points shall remain the same as for non-recessed inlets.

7.3.4 Grate Inlet at Sag Capacity

Grate inlets located at low points, or sags, (Types GL-T and GL-D) operate under either weir flow or orifice flow conditions. For weir flow conditions, the flow rate through the grating follows the equation:

$$Q = 3.0 LH^{1.5} \quad (\text{Eq. 7-4})$$

where: Q = Inlet flow rate cfs
3.0 = Weir discharge coefficient
 L = Perimeter length open for flow, ft
 H = Depth of water above inlet, ft

Note that the perimeter length open for flow must be reduced if one side of the inlet is against a curb or other obstruction. To allow for blockage by trash, the size of the grate inlet selected, with respect to area, will be increased by 100 percent. The weir flow regime for a grate inlet usually occurs at water depths above the inlet of 0.4 feet or less.

Weir Flow Example: Storm water runoff from a small drainage area has a peak flow rate of 15 cfs to a proposed ditch grate inlet at a sag (Type GL-D). Flow is accessible to all four sides of the rectangular inlet. Maintain weir flow conditions at 0.4 feet of head. Find the required grate dimensions.

Step 1: Find the required perimeter length.
 $15 \text{ cfs} = (3.0)(L)(0.4^{1.5})$
 $L = 19.8 \text{ feet}$

Step 2: Increase grate size by 100 percent and select final dimensions.
19.8 feet perimeter length can be satisfied by a 4.95 foot x 4.95 foot grate. This results in a grate area of 24.5 square feet. A 100 percent increase in grate size results in a grate area of 39.6 square feet. This grate size when converted to perimeter length, results in a 6.33-foot by 6.33-foot grate, or 25.3 feet of perimeter length. Select a grate, or have one fabricated, which yields a minimum of 25.3 feet of perimeter length.

As head on a grate increases, a transition from weir flow to orifice flow conditions occurs. True orifice flow conditions can be predicted to occur at approximately 1.4 feet of head. Between the weir flow head at 0.4 feet and the orifice flow head at 1.4 feet, the controlling flow regime is uncertain. Both weir flow head requirements and orifice flow head requirements should be checked when in the design head range of 0.4 to 1.4 feet. The most conservative (highest) head requirement should be used as a check against the maximum allowable head for the site conditions. The orifice flow equation for design purposes is:

$Q = 0.6A (2gH)^{0.5}$ (Eq. 7-5)
 which reduces to $Q = 4.82 A H^{0.5}$ (Eq. 7-6)
 where Q = Discharge of grate, cfs
 0.6 = Orifice discharge constant
 A = Open area of grate, square feet
 g = Gravitational acceleration constant, 32.2 ft/sec/sec
 H = Head on grate, feet

Orifice Flow Example: Storm water runoff to a ditch grate inlet location is 35 cfs. Maintain orifice flow conditions at 2.0 feet of head. Find the required grate dimensions when the grating is constructed of 0.25-inch thick structural bars on 1.5-inch centers.

- Step 1: Find the required grate open area.
 35 cfs = $4.82 A (2.0)^{0.5}$
 $A = 5.13$ sq. ft.
 Step 2: Increase open area 100 percent
 Required Area = $5.13 + 5.13 = 10.26$ sq. ft.
 Step 3: Find required gross area of the grate.
 0.25-inch thick structural bars on 1.5-inch centers
 leave a net open area of 0.81 square feet per gross
 square-foot.
 Gross Area Required = $10.26/0.81 = 12.67$ square feet.
 A grate installation measuring 3.5 feet by 3.67 feet
 would satisfy the area requirement.

Figure 7-9 can be used for the design of grate inlets in sag conditions. The design curves on Figure 7-9 follow the equations listed earlier in this section.

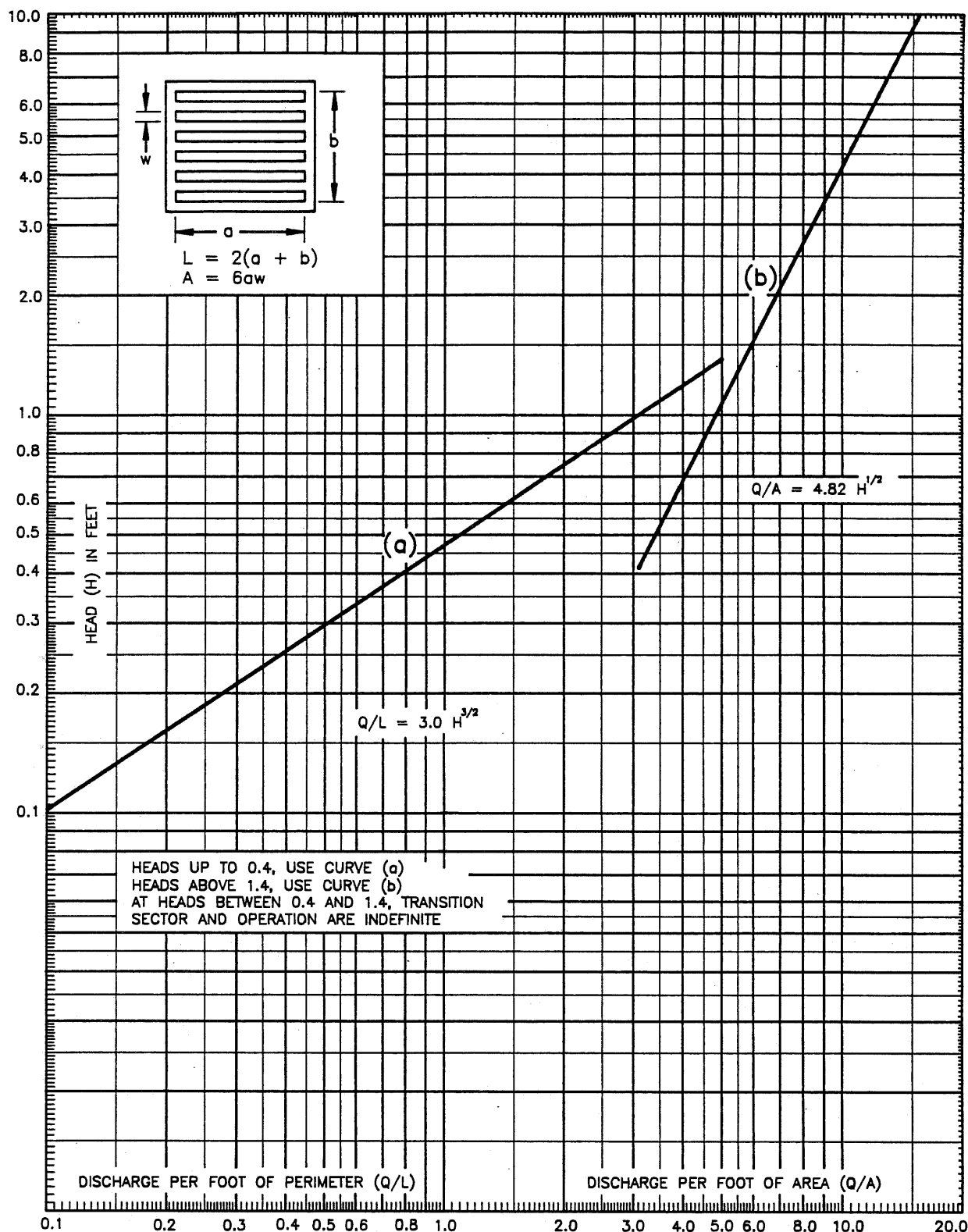
7.3.5 Grate Inlet on Grade Capacity

A grate inlet on grade should be of the curved vane or tilted vane type shown in Figure 7-10 so that storm water is directed into the inlet itself. The curved vane and tilted vane grates have been proven, in studies performed for the Federal Highway Administration, to have higher interception efficiencies than comparable straight bar grates.

The grates shown in Figure 7-10 are commercially available from manufacturers that specialize in street and drainage castings. Some manufacturers have also run tests on their grate configurations and have developed capacity curves for their products. The manufacturer's capacity curves are acceptable for design. However, the same manufacturer's grate will be expected in the constructed project as was used for design.

In the absence of manufacturer's data, Figures 7-11 through 7-13 may be used for design purposes. These figures are graphical forms of equations derived from the experimental observations performed in the Federal Highway Administration studies discussed earlier in this section.

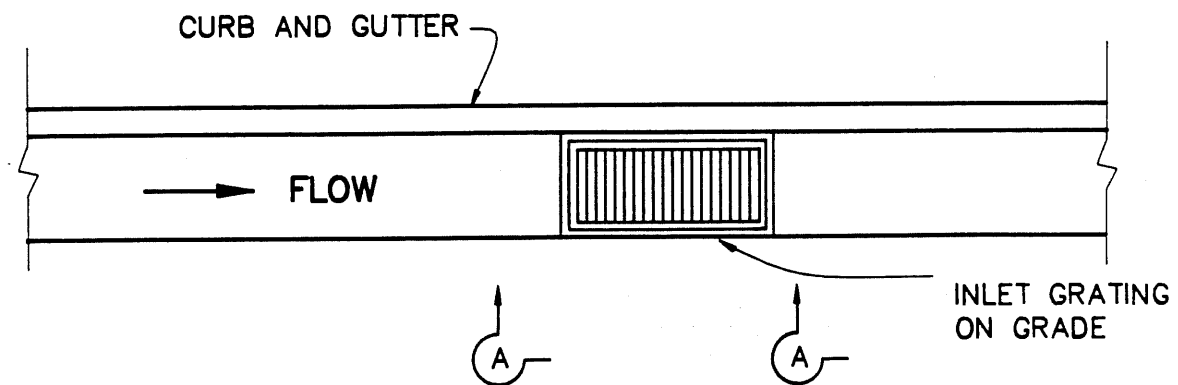
There are several aspects which have to be considered when designing grate inlets on grade. The hydraulic design of a grate inlet on grade is dependent on the ratio of frontal flow to total gutter flow, the ratio of side interception to frontal interception and the velocity at which splash-over



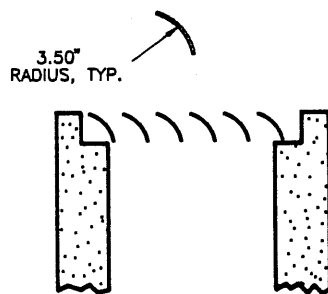
GRATE INLET AT SAG

FIGURE 7-9

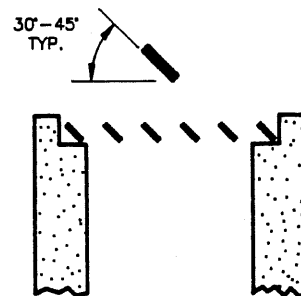
SOURCE: U.S. ARMY CORPS OF ENGINEERS
TECHNICAL MANUAL 5-820-4



PLAN



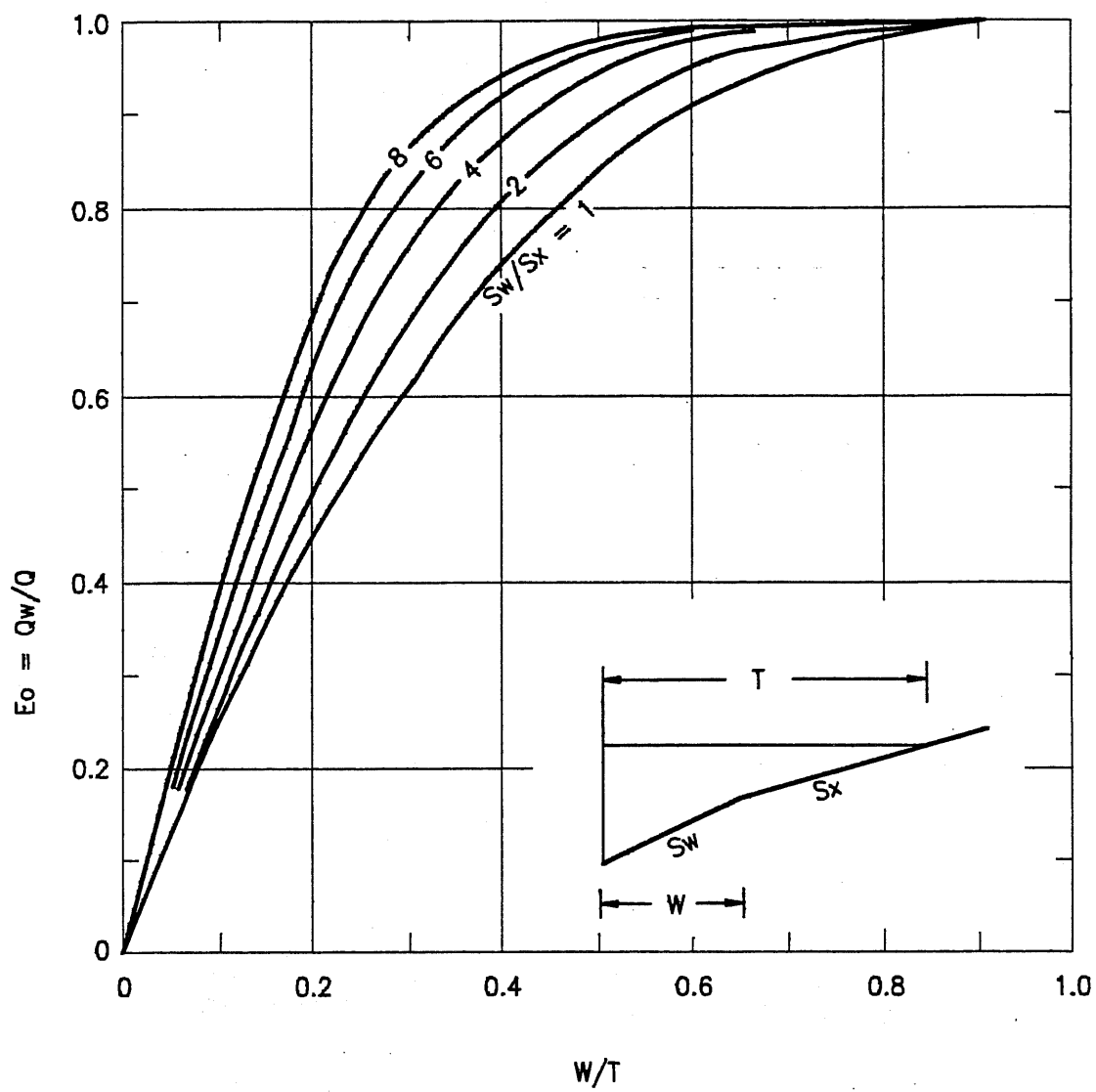
SECTION A-A
CURVED VANE



SECTION A-A
TILTED VANE

CURVED VANE AND TILTED VANE GRATE INLETS

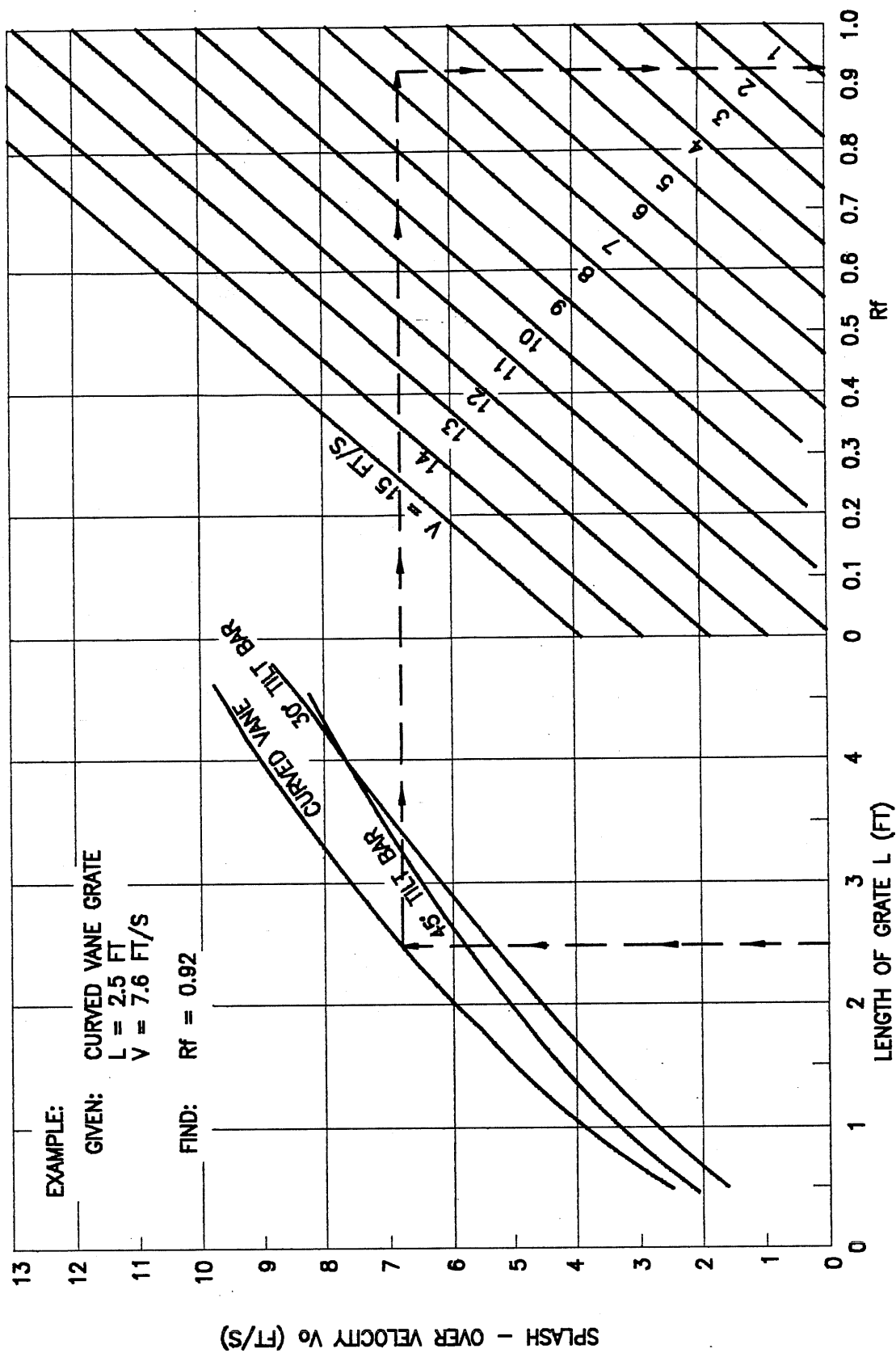
FIGURE 7-10



SOURCE: FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 12, MARCH 1984.

RATIO OF FRONTAL FLOW TO TOTAL GUTTER FLOW.

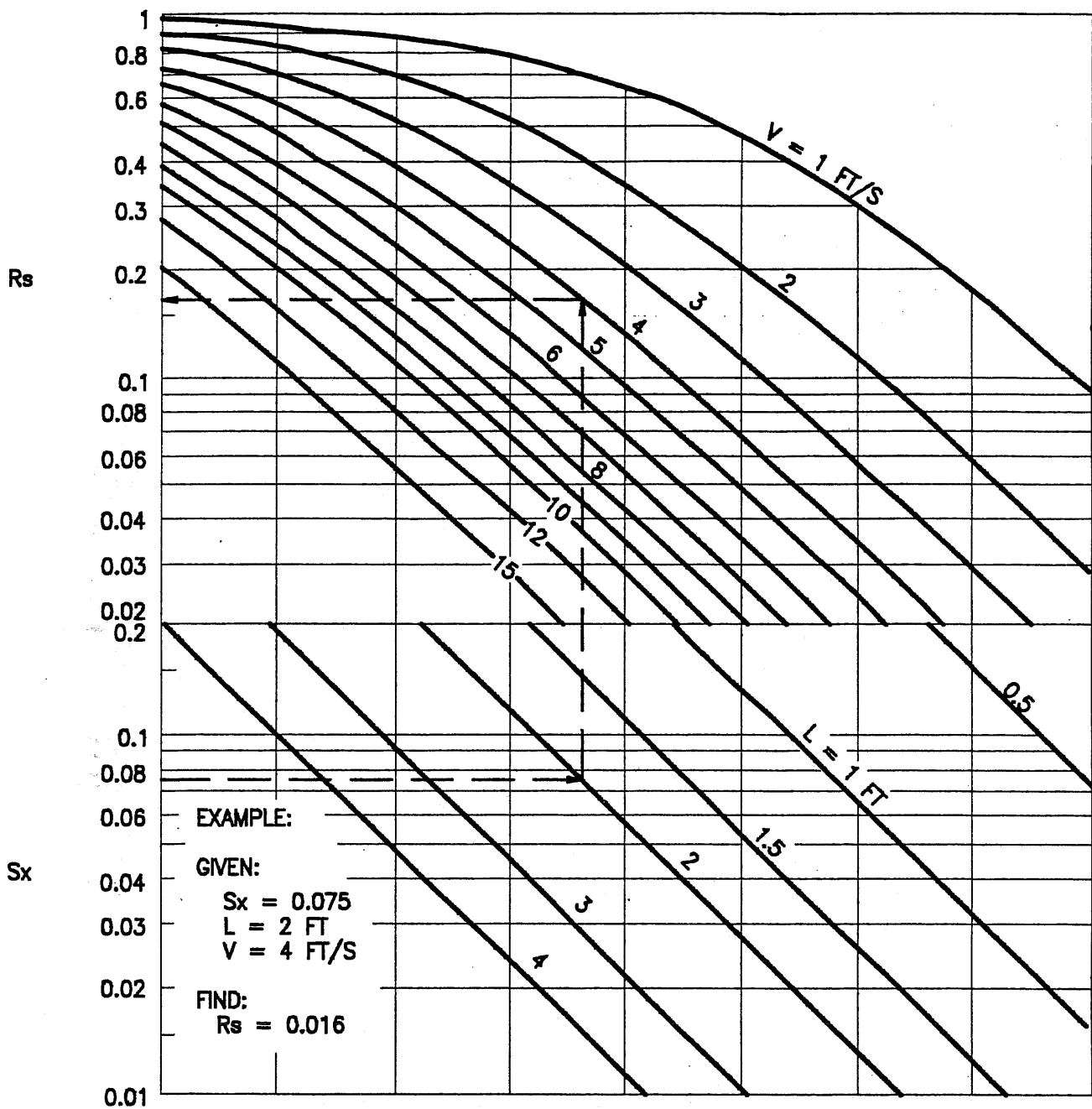
FIGURE 7 - 11



SOURCE: FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 12, MARCH 1984.

GRATE INLET FRONTAL FLOW INTERCEPTION EFFICIENCY.

FIGURE 7 - 12



SOURCE: FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 12, MARCH 1984.

GRATE INLET SIDE FLOW INTERCEPTION EFFICIENCY.

FIGURE 7 - 13

occurs. The following definitions will help clarify these terms used in designing grate inlets on grade. Frontal flow is that runoff flow in the street gutter that corresponds to a width equal to the width of the grate. The total gutter flow is that runoff flow in the entire street gutter including the water spread in the driving or parking lanes. The side interception of a grate is that flow which is captured by water falling into the grate openings in a direction parallel to the grating bars and perpendicular to the street gutter. Frontal interception is that flow captured in the grate inlet due to water flowing parallel to the gutter (perpendicular to the grating bars). Finally, the gutter flow can travel at such a velocity that the water "skips" across the grating bars and this is known as splash-over. The use of these hydraulic functions are discussed in the following paragraphs, equations and design example.

The ratio of frontal flow to total gutter flow (E_o) for a straight cross slope is:

$$E_o = \frac{Q_w}{Q} = 1 - (1 - W/T)^{2.67} \quad (\text{Eq. 7-7})$$

where: Q = Total gutter flow, cfs
 Q_w = Flow in width W , cfs
 W = Width of grate, ft.
 T = Total spread of water in the gutter, ft.

Figure 7-11 provides a graphical solution for E_o . Converting a parabolic-crowned street to an approximate straight-crowned street should provide answers sufficiently accurate for design purposes.

The ratio of side flow (Q_s) to total gutter flow is defined as:

$$Q_s/Q = 1 - Q_w/Q = 1 - E_o \quad (\text{Eq. 7-8})$$

with Q , Q_w and E_o the same as defined earlier. The ratio of frontal flow intercepted to total frontal flow (R_f) is:

$$R_f = 1 - 0.09(V - V_o) \quad (\text{Eq. 7-9})$$

where: V = Velocity of flow in the gutter, fps
 V_o = Gutter velocity where splash-over first occurs, fps

This ratio is equivalent to the frontal flow interception efficiency. Figure 7-12 provides a solution for Equation 7-9 which takes into account grate length, bar configuration and the gutter velocity at which splash-over occurs. The gutter velocity needed for use in Figure 7-12 is the total gutter flow divided by the area of flow. For parabolic crowned streets in Midland, the velocity from Figure 4-3 in "Section 4: Determination of Storm Runoff" will suffice for design.

The ratio of side flow intercepted to total side flow, or side flow interception efficiency is expressed as:

$$R_s = 1/(1 + (0.15V^{1.8}/S_x L^{2.3})) \quad (\text{Eq. 7-10})$$

where R_s = Ratio of side flow intercepted to total side flow
 V = Velocity of gutter flow, fps

S_x = Pavement cross slope, ft/ft

L = Length of grate, feet

Figure 7-13 can be used to solve Equation 7-10. The efficiency, E , of a grate is found by Equation 7-11.

$$E = R_f E_o + R_s (1 - E_o) \quad (\text{Eq. 7-11})$$

where the terms are defined the same as in previous equations. The interception capacity of a grate inlet on grade is equal to the efficiency of the grate multiplied by the total gutter flow:

$$Q_i = EQ = Q [R_f E_o + R_s (1 - E_o)] \quad (\text{Eq. 7-12})$$

There is a deficiency in developing empirical equations and charts from experimental data. The fact that a grate will intercept all or almost all of the side flow where the velocity is low and the spread only slightly exceeds the grate width is not reflected in Figures 7-11 through 7-13. Error due to this deficiency is very small. Where velocities are high, side flow interception can be neglected entirely without significant error. The following examples will illustrate the use of Figures 7-11 through 7-13.

Example One: A 68-foot wide back-to-back parabolic crowned street carries 8 cfs in one gutter on a 0.4 percent slope. From the lip of the gutter to the flow line of the gutter is a drop of 3/4-inches (0.0625 feet) in a width of 15 inches (1.25 feet). The top of curb is 4.5 inches (0.38 feet) wide with the overall curb and gutter width being 2 feet. A curved vane grate of 14-inch width and 48-inch length is planned for installation. Determine whether the grate size is sufficient to intercept the entire 8 cfs flow rate without construction of a gutter depression or the installation of an additional grate.

Step 1: Find the top width, T , of gutter spread.
Entering Figure 5-16 in "Section 5: Street and Alley Drainage", read at 8 cfs and 0.004 feet per foot slope a depth of flow, Y_o , of approximately 0.54 feet and a flow width from back of curb of approximately 18.9 feet.

$$Y_o = \text{Depth of Flow} = 0.54 \text{ feet}$$

$$T = \text{Top Width of Flow} = 18.9 \text{ feet} - 0.38 \text{ feet curb} \\ = 18.5 \text{ feet}$$

Step 2: Calculate the velocity of gutter flow. From Figure 4-3 in "Section 4: Determination of Storm Runoff", use either the equation for crowned street velocity or read the velocity directly from the curve.

$$V = 30S^{0.5} = (30)(0.004^{0.5}) \\ = 1.9 \text{ fps}$$

Step 3: Determine pavement cross slopes.
Gutter $S_w = 0.0625 \text{ ft}/1.25 \text{ ft} = 0.05 \text{ ft/ft}$

Determine pavement S_x from quarter point of street crown. Figure 5-9 in "Section 5: Street and Alley Drainage" shows the geometric relationship for Midland's crowned streets.

$$\begin{aligned}\text{Quarter-point Distance} &= (68 \text{ feet} - 4 \text{ feet})/4 \\ &= 16 \text{ feet distance from lip of gutter} \\ C = w/100 &= 68 \text{ feet}/100 \\ &= 0.68 \text{ feet above lip of curb and gutter} \\ \text{Quarter-point height} &= 2C/3 = (2)(0.68 \text{ feet})/3 \\ &= 0.45 \text{ feet above lip of curb and gutter} \\ \text{Pavement } S_x &= 0.45 \text{ feet}/16 \text{ feet} \\ &= 0.028 \text{ ft/ft} \\ \text{Ratio of } S_w/S_x &= 0.05/0.028 = 1.79\end{aligned}$$

Step 4: Enter Figure 7-11 with the following.

$$\begin{aligned}W &= 14 \text{ inches, width of the grate} \\ W/T &= (14 \text{ inches}/12 \text{ inches})/18.5 \text{ ft} = 0.06 \\ S_w/S_x &= 1.79\end{aligned}$$

Note that the above values are very close to the lower left limit of the graph. Use Equation 7-7 instead of the graph.

$$\begin{aligned}E_o &= 1 - (1 - W/T)^{2.67} \\ &= 1 - (1 - 0.06)^{2.67} \\ &= 0.15 \text{ (Fig. 7-11 will yield this value)}\end{aligned}$$

Step 5: Enter Figure 7-12 with $L = 4$ feet and $V = 1.9$ fps, read $R_f = 1.0$

Note that the limiting value is 1.0 at the right edge of Figure 7-12 since the velocity curve is not intercepted. Also, the left scale of Figure 7-12 shows that the splash-over velocity for this grate is approximately 9 fps.

Step 6: Enter Figure 7-13 with $S_x = 0.028$ ft/ft, $L = 4$ feet and $V = 1.9$ fps, read $R_s = 0.62$

Step 7: Calculate inlet interception capacity.

$$\begin{aligned}Q_i &= Q [R_f E_o + R_s (1 - E_o)] \\ &= 8 \text{ cfs } [(1.0)(0.15) + (0.62)(1 - 0.15)] \\ &= \underline{5.4 \text{ cfs}} \text{ (Inlet cannot intercept all of the flow.) ans.}\end{aligned}$$

It can be seen from the above example that a grate inlet on grade cannot effectively collect one hundred percent of the flow when the gutter spread is wide relative to the inlet width, however it can be used effectively to reduce gutter spread and improve the trafficability of streets during storm events. For comparison, the same example is worked below with only the street slope and grate length changed.

Example Two: Same conditions and requirements as Example One, except the street slope is increased from 0.4 percent to 5.0 percent and the grate length is reduced to 2.0 feet.

Step 1: Find the top width, T, of gutter spread.
Figure 5-16, 0.05 ft/ft, read flow depth as 0.36 ft and flow width from back of curb as 11.3 feet.

$$Y_o = \text{Depth of Flow} = 0.36 \text{ feet}$$

$$T = \text{Top Width of Flow} = 11.3 \text{ feet} - 0.38 \text{ feet curb} \\ = 10.9 \text{ feet}$$

Step 2: Calculate the velocity of gutter flow.

$$V = 30S^{0.5} = (30)(0.05^{0.5})$$

$$V = 6.7 \text{ fps}$$

Step 3: Determine pavement cross slopes. These remain the same as for the previous example.

$$S_w = 0.05 \text{ ft/ft}$$

$$S_x = 0.028 \text{ ft/ft}$$

$$\text{Ratio of } S_w/S_x = 1.79$$

Step 4: Enter Figure 7-11 with the following.

$$W/T = (14 \text{ inches}/12 \text{ inches})/10.9 \text{ ft} = 0.11$$

$$S_w/S_x = 1.7$$

Again, use Equation 7-7 since the above values are near the lower left limit of Figure 7-11.

$$E_o = 1 - (1 - W/T)^{2.67}$$

$$= 1 - (1 - 0.11)^{2.67}$$

$$= 0.27 \text{ (Fig. 7-11 will yield this value)}$$

Step 5: Enter Figure 7-12 with L = 2.0 feet and V = 6.7 fps, read $R_f = 0.93$.

Note that the splash-over velocity for this grate length is approximately 6 fps.

Step 6: Enter Figure 7-13 with $S_x = 0.028 \text{ ft/ft}$, L = 2.0 feet and V = 6.7 fps, read $R_s = 0.029$

Step 7: Calculate inlet interception capacity.

$$Q_i = Q [R_f E_o + R_s (1 - E_o)]$$

$$= 8 \text{ cfs } [(0.93)(0.27) + (0.029)(1 - 0.27)]$$

$$= \underline{2 \text{ cfs}}$$

ans.

Again, the inlet cannot intercept 100 percent of the flow. Note that R_s is equal to 0.029 in the above example. Since this very low number represents the multiplier for side flow interception, and results in a very low number, the side flow interception can be ignored for all practical purposes for short grates on relatively steep street slopes.

END

FIGURE 7-14
CITY OF MIDLAND
CURB INLET FLOW CALCULATION TABLE
EXAMPLES

INLET FLOW CALCULATION TABLE																		
INLET NUMBER	DRAINAGE AREA NO.	Q (CFS)	Q PASS (CFS)	Q TOTAL (Qa/CFS)	SLOPE (%)	a (IN)	Y _c (FT)	PONDED WIDTH (FT)	R.F. (%)	Qa/La	L _a (FT)	LENGTH (FT)	L/La	a/Y _c	Q/Qa	Q (CFS)	Q PASS (CFS)	REMARK
CURB INLET AT SAG EXAMPLE																		
K-2	105	12.2	0	12.2	0	3	0.33	N/A	15	1.13	10.8	15	N/A	N/A	N/A	12.2	0	
CURB INLET ON GRADE EXAMPLE, 100% FLOW INTERCEPTION																		
K-3	104	8	0	8	1%	3	0.42	N/A	0	0.56	14.3	15	1.05	0.60	1.0	8	0	
CURB INLET ON GRADE EXAMPLE, 70% FLOW INTERCEPTION																		
K-3	104	8	0	8	1%	3	0.42	N/A	0	0.56	7.7	10.0	0.54	0.60	1.4	5.6	2.4	

DRAINAGE

7 - 26

SECTION 7
BIBLIOGRAPHY

1. Texas State Department of Highways and Public Transportation, Bridge Division, Hydraulic Manual, Third Edition, December 1985.
2. U.S. Department of Transportation, Federal Highway Administration, Hydraulic Engineering Circular No. 12: Drainage of Highway Pavements, March 1984.
3. American Association of State Highway and Transportation Officials, Highway Drainage Guidelines, 1982.
4. The Johns Hopkins University, Department of Sanitary Engineering and Water Resources, Storm Drainage Research Committee, The Design of Storm Water Inlets, June 1956.
5. Departments of the Army and the Air Force, Technical Manual: Drainage for Areas Other Than Airfields, October 1983.
6. City of Austin, Texas, Drainage Criteria Manual, May 1989.
7. U.S. Department of Transportation, Federal Highway Administration, Offices of Research and Development Implementation Division (HDV-21), Design of Urban Highway Drainage: The State of the Art, August 1979, Reprinted September 1983.
8. City of Dallas, Texas, Department of Public Works, Design Manual for Storm Drainage Facilities, Undated.
9. City of Fort Worth, Texas, Department of Development, Development Procedures Manual, September 1975.

SECTION 8
OPEN CHANNELS

8.1 General

- 8.1.1 Natural Channels
- 8.1.2 New or Altered Channels
- 8.1.3 Section 404 Permit

8.2 Open Channel Hydraulics

- 8.2.1 Steady Flow
- 8.2.2 Uniform Flow
- 8.2.3 Varied Flow
 - 8.2.3.1 Gradually Varied Flow
 - 8.2.3.2 Rapidly Varied Flow
- 8.2.4 Subcritical, Critical and Supercritical Flow

8.3 Manning's Roughness Coefficients

8.4 Design Consideration

8.4.1 Grass-Lined Channels

- A. Design Methods
- B. Velocity
- C. Roughness Coefficient
- D. Slope
- E. Side Slopes
- F. Bottom Width
- G. Freeboard
- H. Intersections
- I. Curvature

8.4.2 Concrete-Lined Channels

- A. Design Method
- B. Velocity
- C. Freeboard
- D. Curvature
- E. Slope
- F. Superelevation
- G. Side Slopes
- H. Intersections

8.5 Right-of-Way Requirements

- 8.5.1 Minimum Access Road Width
- 8.5.2 Maintenance Access Ramps to Channel Bottom

8.6 Channel Drop Structures

8.6.1 Sloping Channel Drop

- A. Approach Apron
- B. Chute
- C. Downstream Apron

8.6.2 Vertical Channel Drops

- A. Approach Channel
- B. Approach Apron
- C. Chute Apron

8.6.3 Hydraulic Jump

8.7 Energy Dissipation

8.7.1 Baffled Apron (U.S. Bureau of Reclamation Type IX)

- A. Design Discharge
- B. Chute Entrance
- C. Chute Design
- D. Heights and Spacing of Baffle Pier

8.7.2 Baffled Outlet

8.8 Structure Aesthetics

8.9 Step Backwater Analysis

8.9.1 HEC-2

8.9.2 WSP2

8.9.3 THYSYS

8.9.4 Recommended Software

8.9.5 Helpful Hints on HEC-2

Bibliography

SECTION 8

OPEN CHANNELS

8.1 GENERAL

Open channels for use in a major drainage system have significant advantages related to cost, capacity, multiple use for recreational and aesthetic purposes and potential for detention storage. Disadvantages include right of way needs and maintenance costs. Careful planning and design are needed to minimize the disadvantages and to increase the benefits.

The general classifications for open channels are: (1) Natural channels, which include all water courses that have been carved by nature through erosion; and (2) New or altered channels, which are constructed or existing channels that have been significantly altered by human effort. New or altered channels can be lined with grass, concrete, mortared rocks, rock riprap or other materials. The channels should be designed for the 100-year storm.

8.1.1 Natural Channels

The ideal natural channel has the following benefits:

- A. Velocities are usually low, resulting in longer concentration times and lower downstream peak discharges.
- B. Maintenance needs are usually low because the channel is somewhat stabilized.
- C. The channel provides a desirable green belt and recreational area adding significant social benefits.

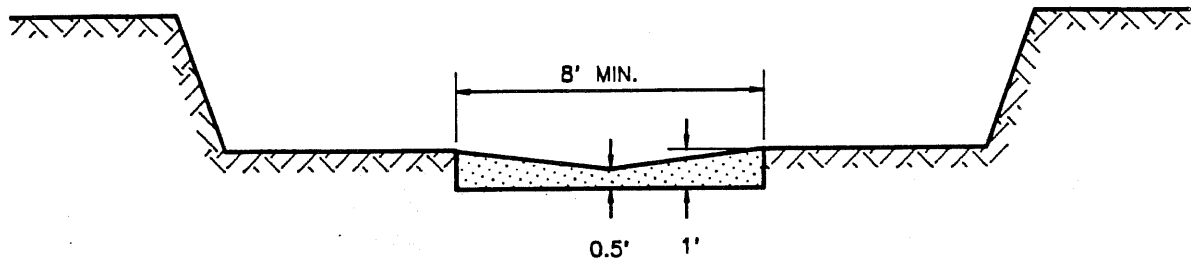
8.1.2 New or Altered Channels

Grass channels are the most desirable of the various types of new channels for the following reasons:

- A. The grass can stabilize the body of the channel.
- B. The grass consolidates the soil mass of the bed.
- C. The grass controls the movement of soil particles along the channel bottom.

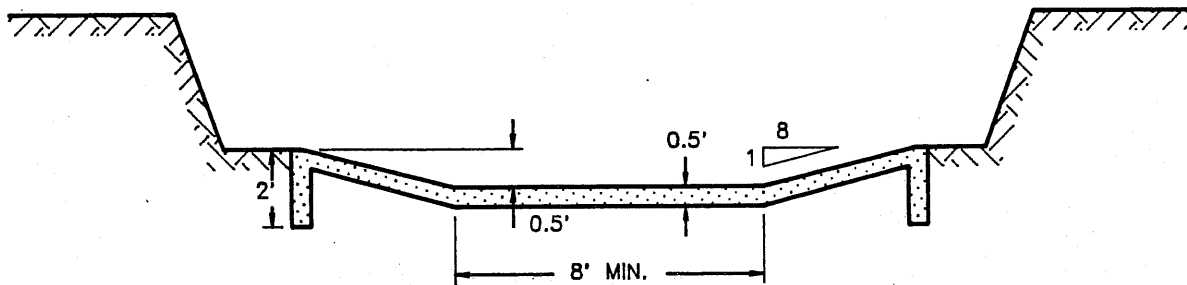
New grass or bare earth channels will be required to have a low-flow section to prevent erosion causing by meandering low flows. Typical low-flow sections are shown in Figure 8-1. General channel geometry relationships are shown in Figure 8-2.

Concrete lined channels are designed to protect the channel body from the erosive potential of high velocities. In addition to concrete-lined channels, other methods may be proposed to combat erosive velocities in channels and should be submitted for review.



NOTE: STEEL REINFORCEMENT
NOT SHOWN

SHALLOW CONCRETE INVERT WITH THICKENED EDGES

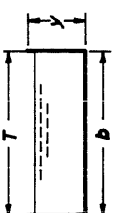
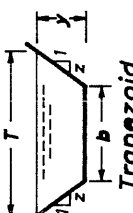
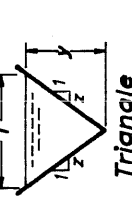
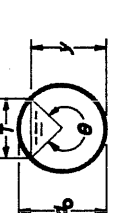
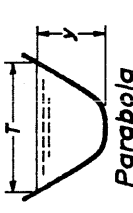


NOTE: STEEL REINFORCEMENT
NOT SHOWN

EXCAVATED LOW-FLOW SECTION WITH CONCRETE LINING

TYPICAL LOW-FLOW TREATMENTS FOR CHANNELS

FIGURE 8-1

Section	Area A	Wetted perimeter P	Hydraulic radius R	Top width T	Hydraulic depth D	Section factor Z
 Rectangle	by	$b + 2y$	$\frac{by}{b + 2y}$	b	y	$by^{1.5}$
 Trapezoid	$(b + zy)y$	$b + 2y\sqrt{1 + z^2}$	$\frac{(b + zy)y}{b + 2y\sqrt{1 + z^2}}$	$b + 2zy$	$\frac{(b + zy)y}{b + 2zy}$	$\frac{[(b + zy)y]^{1.5}}{\sqrt{b + 2zy}}$
 Triangle	zy^2	$2y\sqrt{1 + z^2}$	$\frac{zy}{2\sqrt{1 + z^2}}$	$2zy$	$\frac{1}{2}y$	$\frac{\sqrt{2}}{2}zy^{2.5}$
 Circle	$\theta = \text{radians}$ $\frac{1}{8}(\theta - \sin\theta)d_0^2$	$\frac{1}{2}\theta d_0$	$\frac{1}{4}\left(1 - \frac{\sin\theta}{\theta}\right)d_0$	$\frac{(\sin \frac{1}{2}\theta)d_0}{\text{or } 2\sqrt{y(d_0 - y)}}$	$\frac{1}{8}\left(\frac{\theta - \sin\theta}{\sin \frac{1}{2}\theta}\right)d_0$	$\frac{\sqrt{2}}{32}\frac{(\theta - \sin\theta)^{1.5}}{(\sin \frac{1}{2}\theta)^{0.5}}d_0^{2.5}$
 Parabola	$\frac{2}{3}Ty$	$T + \frac{8}{3}\frac{y^2}{T}$	$\frac{2T^2y}{3T^2 + 8y^2}$	$\frac{3}{2}\frac{A}{y}$	$\frac{2}{3}y$	$\frac{2}{5}\sqrt{\theta}Ty^{1.5}$

* Satisfactory approximation for the interval $0 < x \leq 1$, where $x = 4y/T$. When $x > 1$, use the exact expression $P = (T/2)[\sqrt{1 + x^2} + 1/x \ln(x + \sqrt{1 + x^2})]$
 $Z = \text{Section Factor} = AR^{2/3}$

Source: Ven Te Chow, *Open Channel Hydraulics*.

GEOMETRIC ELEMENTS OF CHANNEL SECTIONS

FIGURE 8-2

8.1.3 Section 404 Permit

When a project to modify a natural channel is proposed, the design engineer should check the requirements of Section 404 of the Clean Water Act. If required, a permit should be obtained from the U.S. Army Corps of Engineers by the design engineer. The application procedures and detailed information on nationwide permits are described in Appendix B, however the designer should consult with the Fort Worth District of the Corps of Engineers for the most up-to-date permit requirements.

8.2 OPEN CHANNEL HYDRAULICS

An open channel is a conduit in which water flows with a free surface. The classification of open channel flow is made according to the change in flow depth with respect to time and space. There are several terms used to describe flow in open channel hydraulics. These terms are steady flow, uniform flow, varied flow, subcritical flow, critical flow and supercritical flow.

With these varying conditions, open channel hydraulics can be very complex encompassing many different flow conditions from steady uniform flow to unsteady rapidly varied flow. Most of the problems in stormwater drainage involve uniform, gradually varied or rapidly varied flow situations. In this section, the basic equation and computational procedures for uniform, gradually varied and rapidly varied flows are presented.

8.2.1 Steady Flow

Flow in an open channel is said to be "steady" if the depth of flow does not change or if it can be assumed to be constant during the time interval under consideration. The flow is "unsteady" if the depth changes with time.

8.2.2 Uniform Flow

Open channel flow is said to be "uniform" if the depth of flow is the same at every section of the channel. A uniform flow may theoretically be steady or unsteady, depending on whether or not the depth changes with time. The establishment of unsteady uniform flow requires that the water surface fluctuate with time while remaining parallel to the channel bottom. Since it is impossible for this condition to occur within a channel, steady uniform flow is the fundamental type of flow treated in open channel hydraulics.

For a given channel condition of roughness, discharge and slope, there is only one (1) possible depth for maintaining a uniform flow. This depth is referred to as normal depth.

The Manning's Equation is used to determine the normal depth for a given discharge.

$$Q = (1.486/n) A R^{0.67} S^{0.5} \quad (\text{Eq. 8-1})$$

where,

- Q = Total discharge, cfs
- n = Roughness coefficient
- A = Cross-sectional area of channel, ft²
- R = Hydraulic radius of channel, feet (R=A/P)
- S = Slope of the frictional gradient, ft/ft
- P = Wetted perimeter, feet

Uniform flow is more often a theoretical abstraction than an actuality. True uniform flow is difficult to find in nature or to obtain in the laboratory. The designer must be aware of the fact that uniform flow computations provide only an approximation of what will occur but that such computations are usually adequate and useful and, therefore, necessary for planning.

8.2.3 Varied Flow

Flow is "varied" if the depth of flow changes along the length of the channel. Varied flow may be either steady or unsteady. Since unsteady uniform flow is rare, the term "unsteady flow" is used to designate unsteady varied flow exclusively.

Varied flow may be further classified as either "rapidly" or "gradually" varied. The flow is rapidly varied if the depth changes abruptly over a comparatively short distance; otherwise, it is gradually varied. Rapidly varied flow is also known as a local phenomenon; an example of which is the hydraulic jump.

8.2.3.1 Gradually Varied Flow

The most common example of gradually varied flow in urban drainage systems occurs in the backwater of bridge openings, culverts, storm drain inlets and channel constrictions. Under these conditions, gradually varied flow will be created and the flow depth will be greater than normal depth in the channel. Backwater techniques would need to be applied to determine the water surface profile.

8.2.3.2 Rapidly Varied Flow

Rapidly varied flow is characterized by abrupt changes in the water surface elevation for a constant flow. The change in elevation may become so abrupt that the flow profile is virtually broken, resulting in a state of high turbulence. Some common causes of rapidly varied flow in urban drainage systems are side-spill weirs, weirs and spillways of detention basins.

8.2.4 Subcritical, Critical and Supercritical Flow

For a particular flow rate Q in a particular channel, there are two possible water depths for a given energy level E , where

$$E = y + \frac{1}{2g} \frac{q^2}{y^2} \quad (\text{Eq. 8-2})$$

where,

q = flow per foot width of channel, cfs
 g = acceleration due to gravity, 32.2 ft/sec²
 y = depth of flow, feet.

Equation 8-2 may be rewritten as:

$$(E - y) y^2 = q^2/2g = \text{constant} \quad (\text{Eq. 8-3})$$

Equation 8-3 is a cubic equation with three roots. The third root, being negative, has no physical meaning. The two alternate depths represent two totally different flow regimes. The larger value represents a flow that is slow and deep, called subcritical flow. The smaller value represents a flow that is fast and shallow, called supercritical flow. When the two positive roots are

equal, the value is called critical depth, denoted as y_c , and the flow is called critical flow.

Critical flow can be achieved when the channel slope equals the critical slope. Critical slope may be found by using equation 8-4.

$$S_c = \frac{g n^2}{(1.486)^2 y_c^{1/3}} \quad (\text{Eq. 8-4})$$

where,

$$y_c = q^{2/3} / g^{1/3}$$

n = Manning's roughness coefficient.

Supercritical flow happens when the channel slope is steeper than the critical slope. When the slope is milder than the critical slope, subcritical flow occurs. One case in which subcritical flow can occur on a supercritical slope is where a downstream obstruction forces water to flow at a depth greater than critical depth.

8.3 MANNING'S ROUGHNESS COEFFICIENTS

Midland does not have any natural channels due to the characteristics of the region. Although Midland Draw and Jal Draw concentrate runoff into the northern and western portions of the City, well defined channels are not evident in either of these watersheds.

Since any channelization is likely to be of a man-made nature, Manning's roughness coefficients have been developed for open channel designs. These roughness coefficients, or Manning's "n" values, are contained in Table 8-1. The bare earth roughness coefficient should be used only for checking the maximum velocity in the channel.

TABLE 8-1 MAN-MADE CHANNELS	
TYPE OF CHANNEL AND DESCRIPTION	MANNING'S "n"
Bare Earth (Note 1)	0.035
Grass Lined (Bermuda grass)	0.045
Concrete	
a. Concrete lined (rough finish)	0.020
b. Concrete lined (smooth finish-culverts)	0.015
c. Concrete riprap (exposed rubble)	0.025
Gabion	0.035
Rock-cut	0.025

Note 1: For maximum velocity check only. Use grass lined value for design capacity.

Source: Ven Te Chow, Open Channel Hydraulics, 1959. WRC Engineering, Inc., Boulder County Storm Drainage Criteria Manual, 1984.

8.4 DESIGN CONSIDERATION

Channel design involves the determination of the channel cross-section required to accommodate a given design discharge. The design parameters for grass and concrete-lined channels are discussed in the following paragraphs.

8.4.1 Grass-Lined Channels

Key parameters in grass-lined channel design include permissible velocity, roughness coefficient, side slope, curvature, bottom width, and freeboard. The roughness coefficient for bare earth should only be used for checking maximum permissible velocity. Bare earth channels will normally collect sediment and plant seeds and have some vegetative growth. The capacity of proposed bare earth channels will be determined using the grass-lined Manning's coefficient.

- A. Design Methods: Small roadside-type ditches may be designed using normal depth, uniform flow methods as long as the flow rate does not exceed 100 cubic feet per second and the flow area does not exceed 20 square feet. Ditches and channels which exceed these limits must be designed with the standard-step method.
- B. Velocity: The maximum permissible velocity for grass-lined channels is eight (8) feet per second for the 100-year storm. The designer shall use uniform depth in the channel when checking the velocity. All grass-lined channels shall be designed to convey the 100-year flood without levees.
Note: Flow velocities shall not exceed eight (8) feet per second for the 100-year storm when exiting a riprap section or culvert apron back onto grass-lined or bare earth channels. Appropriate energy dissipator designs shall be used if these velocities are exceeded.
- C. Roughness Coefficient: The roughness coefficient selected for grass-lined channels is based on the degree of retardance of vegetation. Table 8-1 provides Manning's "n" for grass-lined channel design.
- D. Slope: The slope of the channel should be 0.002 feet per foot (0.2 percent) or greater. A maximum slope has not been established, however velocities exceeding eight (8) feet per second may require channel lining.
- E. Side Slopes: Side slopes shall be four (4) horizontal to one (1) vertical or flatter.
- F. Bottom Width: The minimum bottom width for a trapezoidal channel less than three (3) feet deep is six (6) feet. When the constructed channel exceeds three (3) feet deep, the minimum bottom width for a trapezoidal channel will be eight (8) feet for maintenance purposes.
- G. Freeboard: The design water surface in a grass-lined channel for the 100-year storm event will be contained within the

excavated channel cross section without the use of levees. Freeboard is not required for subcritical flow.

- H. Intersections: The intersection of one open channel with another should not be made with an intersection angle of 90 degrees. The angle between the channels should not exceed 75 degrees, with an angle in the range of 45 to 60 degrees being the most desirable. Such an intersection angle can be accomplished by curving one of the channels upstream of the intersection.
- I. Curvature: The center line curvature shall have a minimum radius of three times the top width of the channel unless analysis is furnished that the channel cross section has sufficient freeboard to contain the superelevated water surface.

8.4.2 Concrete-Lined Channels

Concrete-lined channels may be needed in channel reaches where the velocities are excessive or where the channel characteristics require such use.

- A. Design Method: The standard-step method is required for design and analysis.
- B. Velocity: In concrete-lined channels the probability of supercritical flow is greatly increased. The designer must take care to insure against the possibility of unanticipated hydraulic jumps forming in the channel in considering the 50 and 100-year storms. Flow with a Froude number equal to or greater than one (1) is unstable and should be avoided. If supercritical flow does occur, then freeboard and superelevation must be determined. In addition, all channels carrying supercritical flow shall be continuously lined with reinforced concrete within the supercritical flow regime.

$$F = \frac{V}{(gL)^{0.5}} \quad \text{where} \quad \begin{array}{l} F = \text{Froude number} \\ L = \text{depth of flow, ft} \\ g = 32.16 \text{ ft/sec/sec} \\ V = \text{Velocity of flow, fps} \end{array} \quad (\text{Eq. 8-6})$$

- C. Freeboard: Adequate channel freeboard shall be provided for the 100-year storm in reaches flowing at supercritical depth by Equation 8-7 or using the energy grade line, whichever is less.

$$H_{FB} = 2.0 + 0.025V (d)^{1/3} \quad (\text{Eq. 8-7})$$

where,

$$\begin{array}{ll} H_{FB} &= \text{Freeboard height, ft} \\ V &= \text{Velocity, ft/sec} \\ d &= \text{Depth of flow, ft} \end{array}$$

Freeboard shall be in addition to superelevation, standing waves and/or other water surface disturbances. Concrete side slopes shall be extended to provide freeboard. Freeboard shall not be obtained by the construction of levees.

- D. Curvature: The center line curvature shall have a minimum radius of three times the top width of the channel unless analysis is furnished that the channel cross section has sufficient freeboard to contain the superelevated water surface.
- E. Slope: The minimum slope for a concrete-lined channel shall be 0.02 feet per foot (2.0 percent).
- F. Superelevation: Superelevation of supercritical water surfaces shall be determined at all horizontal curves which deviate more than 45 degrees off the projected centerline. An approximation of the superelevation at a channel bend can be obtained from the following equation:

$$h = V^2 T_w / g r_c \quad (\text{Eq. 8-8})$$

where,

- h = Superelevation, ft
- V = Flow velocity, ft/sec
- T_w = Top width of channel, ft
- r_c = Centerline radius of curvature, ft
- g = Acceleration due to gravity, 32.16 ft/sec/sec

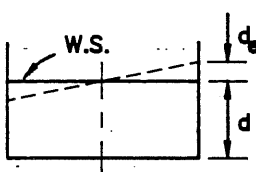
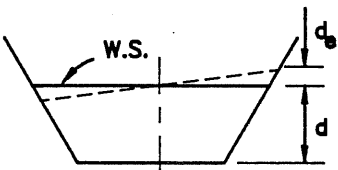
The freeboard shall be measured above the superelevation water surface. Figure 8-3 illustrates a superelevated water surface and also contains additional equations.

- G. Side Slopes: For concrete-lined channel sections the side slopes may not be steeper than three horizontal to one vertical. Side slopes steeper than three to one will be evaluated on a case-by-case basis.
- H. Intersections: The intersection of one open channel with another should not be made with an intersection angle of 90 degrees. The angle between the channels should not exceed 75 degrees, with an angle in the range of 45 to 60 degrees being the most desirable. Such an intersection angle can be accomplished by curving one of the channels upstream of the intersection.

8.5 RIGHT-OF-WAY REQUIREMENTS

Easements for storm drainage facilities shall be provided at locations containing proposed or existing drainageways and playas or reservoirs. Where natural channels exist, the minimum right-of-way will be dedication of the floodway. Where a man-made channel is constructed, the total ultimate right-of-way requirement, including maintenance access, will be dedicated.

Storm drainage easements along proposed or existing man-made channels shall provide sufficient width for the required channel and such additional width as may be required to provide ingress and egress of maintenance equipment. The right-of-way shall be of sufficient width to provide clearance from fences and space for utility poles while still allowing the ingress and egress of maintenance equipment. Figure 8-4 illustrates the right-of-way and maintenance access requirements.

DEPTH $> d_c$ SUBCRITICAL FLOW	SECTION	DEPTH $< d_c$ SUPERCRITICAL FLOW
$d_e = \frac{V^2 T}{2gR_c}$ $Ht = d + \text{F.B.} + d_e$	 HORIZONTAL INVERT NO SPIRAL	$d'_e = \frac{V^2 T}{gR_c}$ $Ht = d + \text{F.B.} + d_e$
$d_e = \frac{V^2 T}{2gR_c}$ $Ht = d + \text{F.B.} + d_e$	 HORIZONTAL INVERT WITH OR WITHOUT SPIRAL TRANSITION †	$d'_e = \frac{V^2 T}{gR_c}$ $Ht = d + \text{F.B.} + d_e$

LEGEND

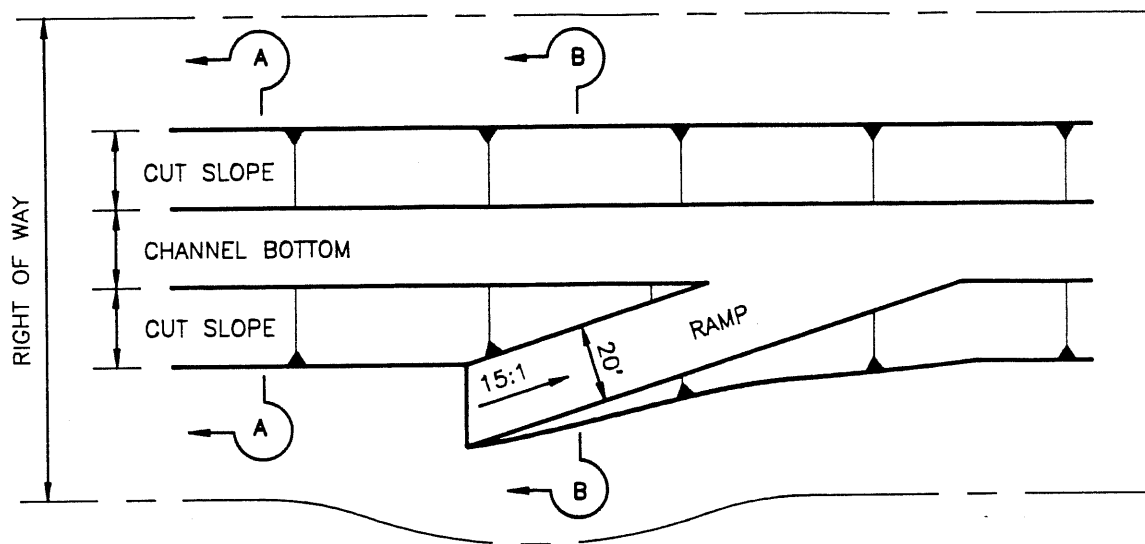
- F.B. FREEBOARD IN FEET, USUALLY ZERO FOR SUBCRITICAL FLOW
V VELOCITY IN FEET PER SECOND
d DEPTH IN FEET
 d_e RISE ABOVE d DUE TO CENTRIFUGAL FORCE
 d'_e RISE ABOVE d DUE TO CENTRIFUGAL FORCE AND TRANSVERSE WAVES IN FEET
T TOP WIDTH AT WATER SURFACE IN FEET
 R_c RADIUS OF CURVATURE CENTER LINE OF CHANNEL IN FEET
Ht WALL HEIGHT IN FEET
g ACCELERATION OF GRAVITY IN FEET PER SECOND²

† IF MODEL STUDIES INDICATE THAT THE SPIRAL TRANSITION CURVE ELIMINATES THE TRANSVERSE WAVES FOR SUPERCRITICAL FLOW, USE d_e INSTEAD OF d'_e .

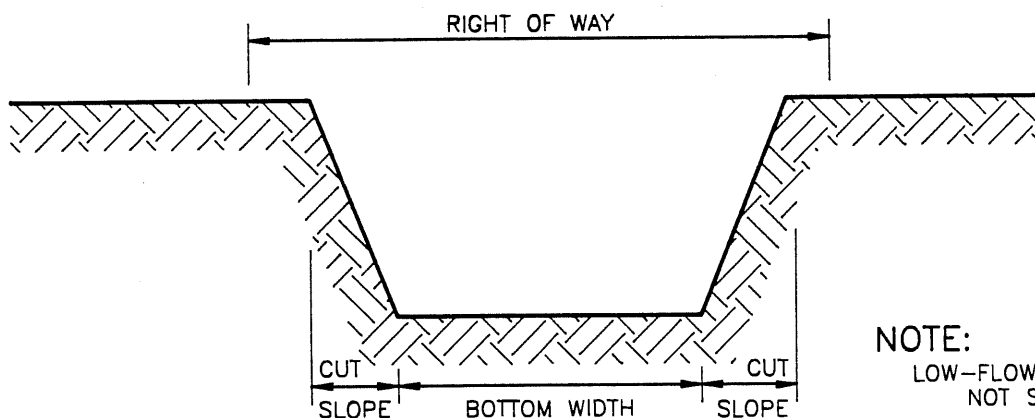
CHANNEL SUPERELEVATION

SOURCE: U.S. ARMY CORPS OF ENGINEERS
TECHNICAL MANUAL 5

FIGURE 8-3

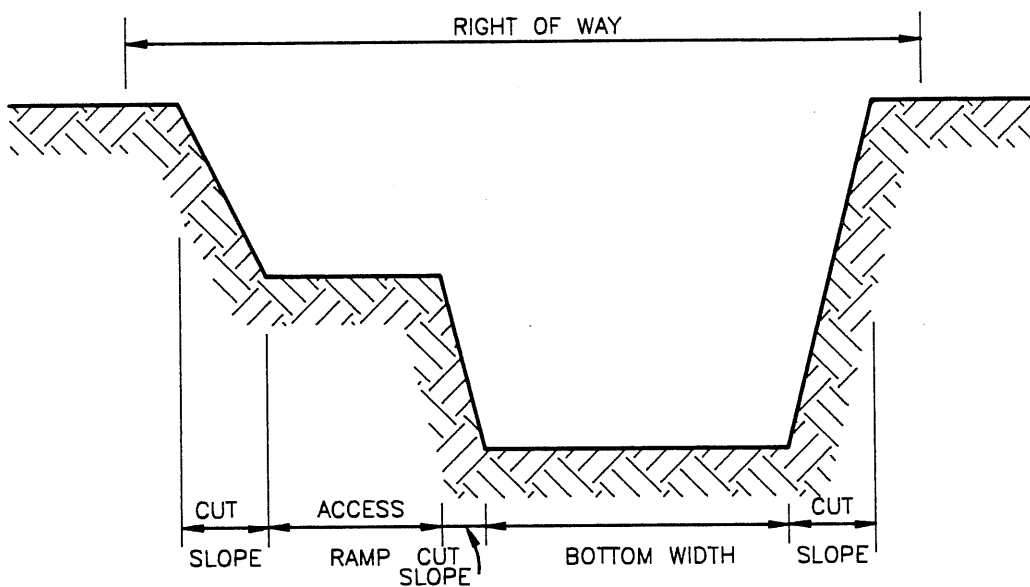


PLAN



SECTION A - A

NOTE:
LOW-FLOW SECTIONS
NOT SHOWN



SECTION B - B

TYPICAL CHANNEL WITH ACCESS RAMP

FIGURE 8-4

8.5.1 Minimum Access Road Width

The access road shall not be less than 20 feet wide adjacent to the top bank on both sides of the channel.

8.5.2 Maintenance Access Ramps to Channel Bottom

- A. Minimum Width - The access ramp shall not be less than 20 feet wide.
- B. Maximum Slope - The driving surface of the access ramp shall not exceed a slope of fifteen (15) horizontal to one (1) vertical.
- C. Maintenance ramps shall provide access to all portions of the channel.
- D. Maintenance ramps shall not infringe on the channel cross section. Additional right-of-way will be provided at access ramps as shown on Figure 8-4.

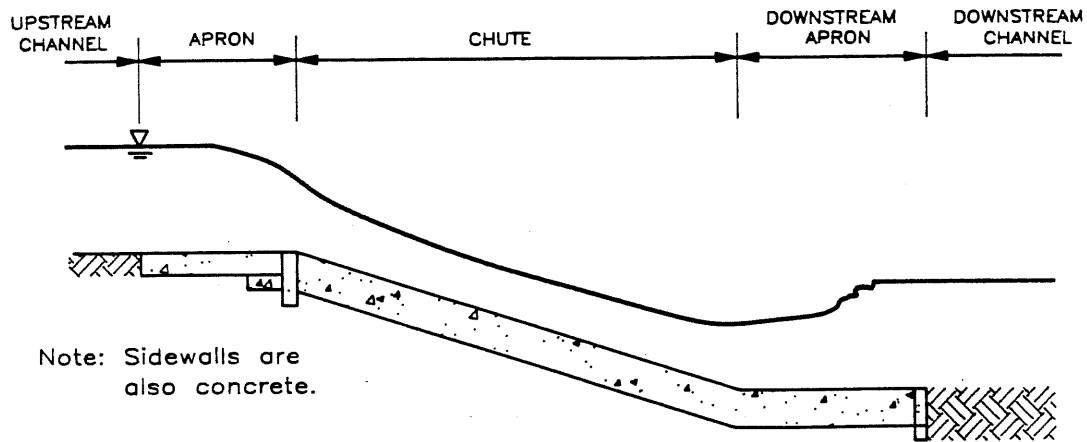
8.6 CHANNEL DROP STRUCTURES

The function of a drop structure is to reduce channel velocities by allowing for flatter upstream and downstream channel slopes. Two commonly used drop structures are shown in Figure 8-5.

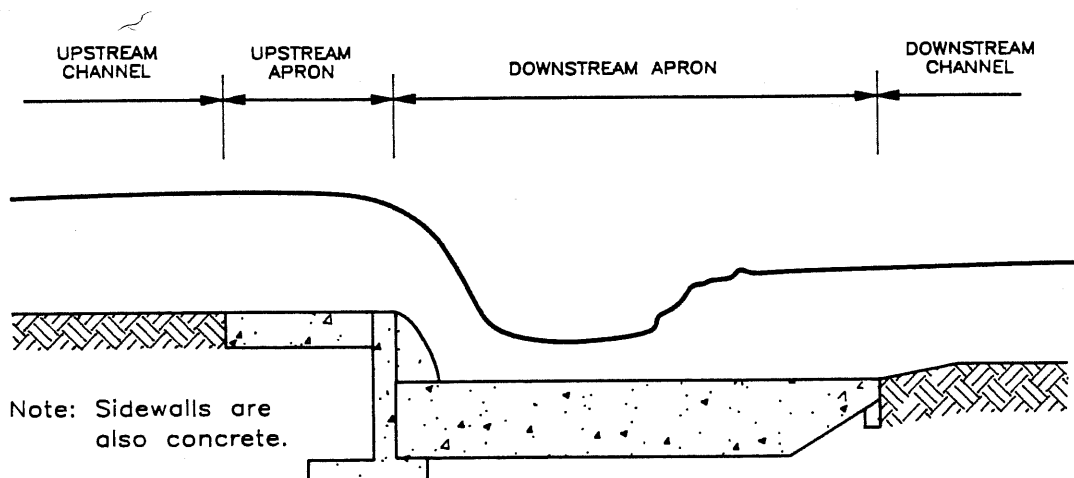
The flow velocities in the upstream and downstream channels of the drop structure need to satisfy the permissible velocities allowed for channels. The design parameters for the sloping channel drop and the vertical channel drop are given below.

8.6.1 Sloping Channel Drop

- A. Approach Apron: A minimum ten (10) foot long riprap apron should be constructed immediately upstream of the drop to protect against the increasing velocities and turbulence which result as the water approaches the sloping portion of the drop structure. The same riprap and bedding design should be used as specified for the portion of the drop structure immediately downstream of the drop.
- B. Chute: The chute shall have roughened faces and shall be no steeper than 2:1, usually with vertical side walls. The length, L, of the chute depends upon the hydraulic characteristics of the channel and drop. For a unit 100-year discharge, q, of 30 cubic feet per second per foot, L would be about 15 feet, that is, about 1/2 of the q value. The L should not be less than ten (10) feet, even for low q values.
- C. Downstream Apron: The length of the downstream apron shall be sized according to Table 8-2 and shall be constructed of reinforced concrete or riprap depending on structural requirements.



A. SLOPING CHANNEL DROP, CONCRETE



B. VERTICAL CHANNEL DROP, CONCRETE

Source: U.S. Bureau of Reclamation, "Hydraulic Design of Stilling Basins and Energy Dissipators," Engineering Nomograph No. 25, Eighth Printing, Denver, May, 1984.

SLOPING AND VERTICAL CHANNEL DROPS

FIGURE 8-5

TABLE 8-2 LENGTH OF DOWNSTREAM APRON	
Maximum Unit Discharge q (cfs/ft)	Length of Downstream Apron, L_B (ft)
0-14	10
15	15
20	20
25	20
30	25

8.6.2 Vertical Channel Drops

The design criteria for the vertical channel drop is based upon the height of the drop and the normal depth and velocity of the approach and exit channels. The channel must be prismatic throughout, from the upstream channel through the drop to the downstream channel.

The steepest allowable side slope for the riprap stilling basin is 4:1. The riprap should extend up the side slopes to a depth equal to one (1) foot above the normal depth projected upstream from the downstream channel. The maximum fall allowed at any one drop structure is four (4) feet from the upper channel bottom to the lower channel bottom.

A description of the drop structure and the design procedure, going from upstream to downstream, is given below and shown on Figure 8-4.

- A. Approach Channel: The upstream and downstream channels will normally be grass-lined trapezoidal channels.
- B. Approach Apron: A minimum ten (10) foot long riprap apron is provided upstream of the drop to protect against the increasing velocities and turbulence which result as the water approaches the vertical drop.
- C. Chute Apron: The riprap stilling basin is designed to force the hydraulic jump to occur within the basin and is designed for essentially zero scour. A detailed analysis of the hydraulic jump is required to determine the length of the riprap stilling basin.

8.6.3 Hydraulic Jump

An important non-uniform flow phenomena is the hydraulic jump. This occurs when a supercritical flow has its velocity reduced to a subcritical range. There is no ordinary means of having a smooth transition from supercritical flow to subcritical flow, therefore, there is a drastic change in water surface profile. The hydraulic jump is characterized by a steep upward slope of the profile with a great turbulent action. A poorly formed hydraulic jump is called an adular jump.

8.7 ENERGY DISSIPATION

Energy dissipators are used to dissipate excessive kinetic energy in flowing water that could promote erosion. An effective energy dissipator must be able to retard the flow of fast moving water without damage to the structure or to the channel below the structure.

Impact-type energy dissipators direct the water into an obstruction that diverts the flow in many directions and in this manner dissipates the energy in the flow. Baffled outlets and baffled aprons are two impact-type energy dissipators.

Other energy dissipators use the hydraulic jump to dissipate the excess head. In this type of structure, water flowing at a higher than critical velocity is forced into a hydraulic jump, and energy is dissipated in the resulting turbulence. Stilling basins are this type of dissipator, where energy is diffused as flow plunges into a pool of water.

Generally, the impact-type of energy dissipator is considered to be more efficient than the hydraulic jump-type. Also the impact-type energy dissipator results in smaller and more economical structures.

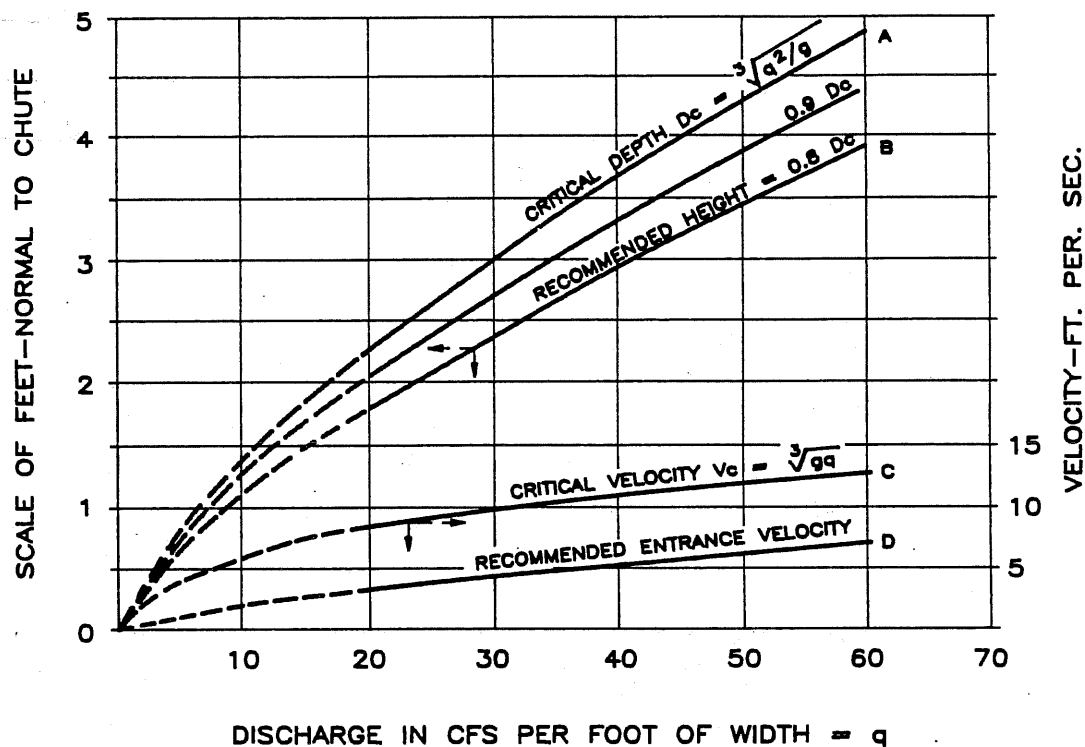
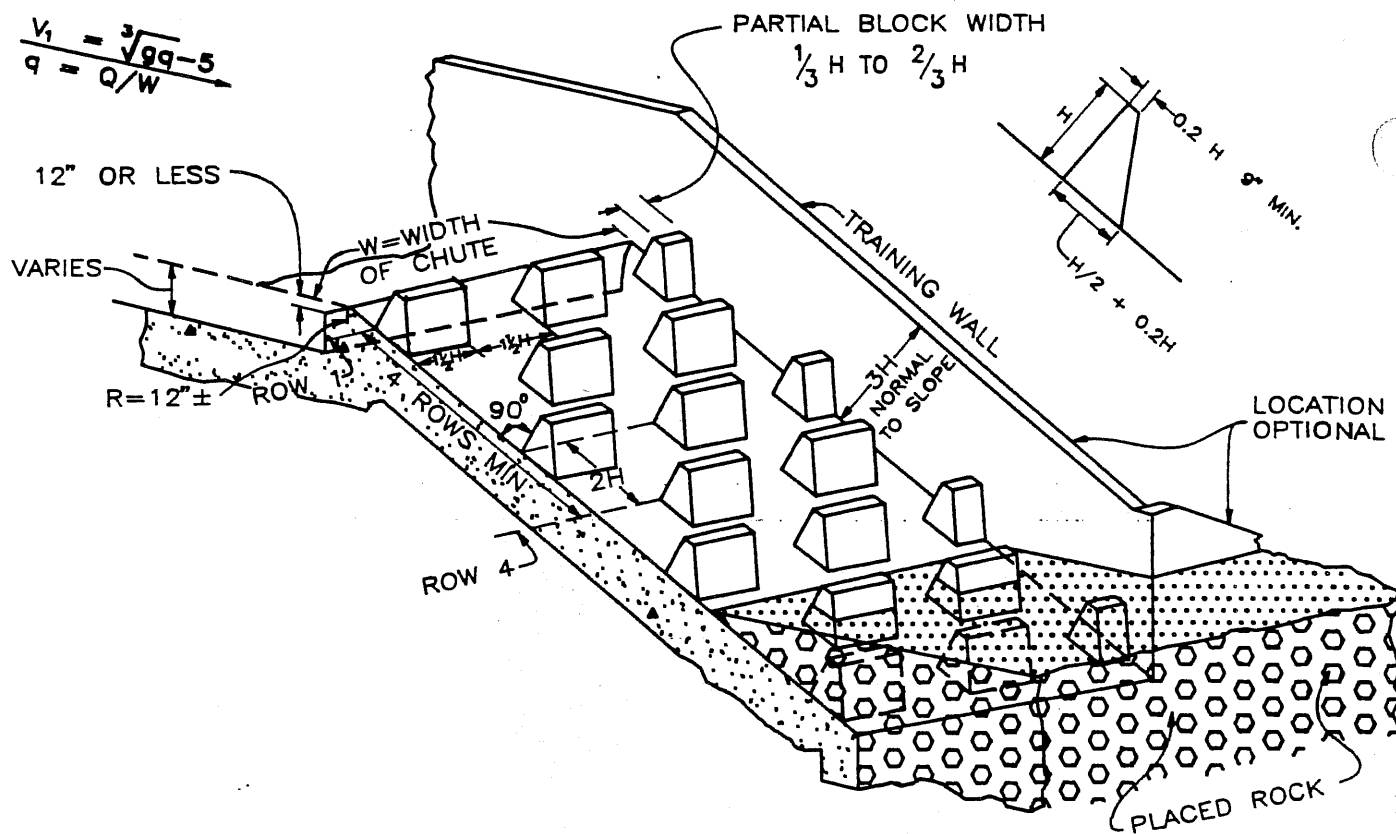
The design of energy dissipators is based on the empirical data resulting from a comprehensive series of model structure studies by the U.S. Bureau of Reclamation, as detailed in its book Hydraulic Design of Stilling Basins and Energy Dissipators. Two impact-type energy dissipators are briefly explained here.

8.7.1 Baffled Apron (U.S. Bureau of Reclamation Type IX)

Baffled aprons are used to dissipate the energy in the flow at a drop. They require no initial tailwater to be effective, although channel bed scour is not as deep and is less extensive when the tailwater forms a pool into which the flow discharges. The chutes are constructed on a slope that is 2:1 or flatter and extends below the channel bottom. Backfill is placed over one or more bottom rows of baffles to restore the original streambed elevation. When scour or downstream channel degradation occurs, successive rows of baffle piers are exposed to prevent excessive acceleration of the flow entering the channel. If degradation does not occur, the scour creates a stilling pool at the downstream end of the chute, stabilizing the scour pattern. The simplified hydraulic design of the baffled apron is shown in Figure 8-6.

The general rules of hydraulic design of a baffled apron are as follows:

- A. Design Discharge - The chute should be designed for the full capacity expected to be passed through the structure. The maximum unit discharge may be as high as 60 cfs per foot for the 100-year storm.
- B. Chute Entrance - The flow entering into the chute should be well distributed laterally across the width of the chute. The velocity should be well below the critical velocity, preferably the value shown in the graph on Figure 8-6. The graph value is the critical velocity in a rectangular channel, $V_c = (gq)^{1/3}$.



Source: U.S. Bureau of Reclamation, "Hydraulic Design of Stilling Basins and Energy Dissipators," Engineering Nomograph No. 25, Eighth Printing, Denver, May, 1984.

BAFFLED APRON AND ITS DESIGN CURVE

FIGURE 8-6

- C. Chute Design - The chute is usually constructed on a 2:1 slope. The upstream end of the chute floor should be joined to the horizontal floor by a curve to prevent excessive vertical contraction of the flow. The upstream face of the first row should be no more than one (1) foot (vertically) below the high point of the chute.

Based on the results of U.S. Bureau of Reclamation experiments, the greatest tendency to overtop the training walls occurs in the vicinity of the second and third rows of baffles. To prevent this overtopping, a partial baffle (1/3 to 2/3 of the width of a full baffle) should be placed against the training walls in the first row. This will place a space of the same width adjacent to the walls in the second row. Alternate rows are then made identical (i.e., rows 1, 3, 5, 7, etc., are identical; Rows 2, 4, 6, 8, etc., are identical).

Four (4) rows of baffles are necessary to establish the expected flow pattern at the base of the chute.

The height of the training walls on the chute should be three (3) or more times the baffle height, measured normal to the chute floor. Several rows of baffle pairs are usually constructed below the channel grade to establish full control of the flow. At least one (1) row of baffles should be buried in the backfill which is used to restore the original bottom topography.

- D. Heights and Spacing of Baffle Pier - Baffle pier height, H, should be about 0.8 D_c to 0.9 D_c , as shown in Figure 8-6. D_c is the critical depth in a rectangular channel and determined by:

$$D_c = (q^2/g)^{1/3} \quad (\text{Eq. 8-9})$$

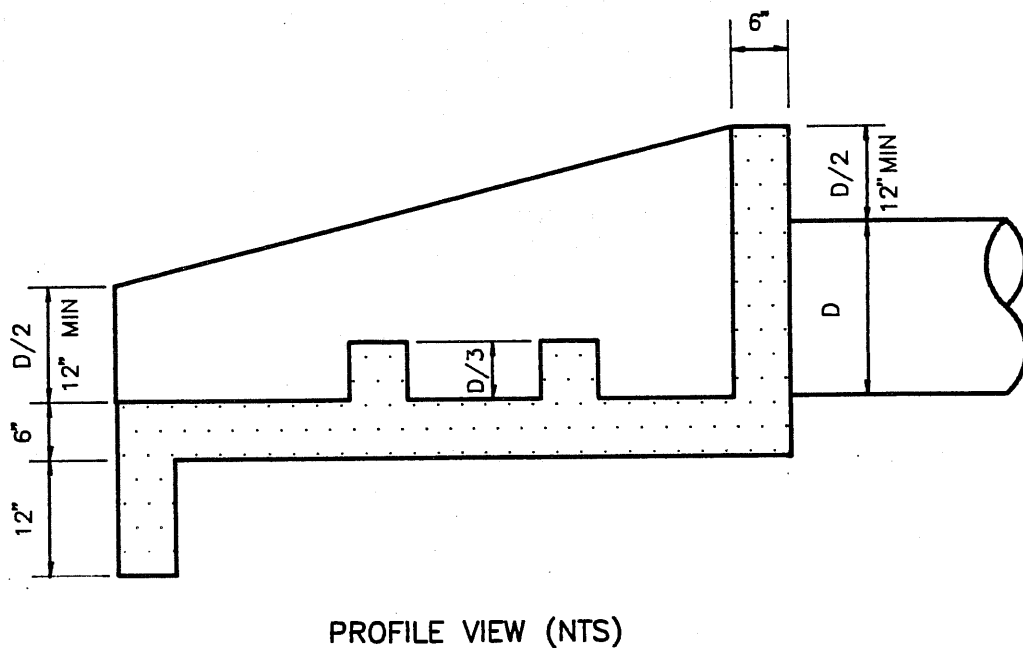
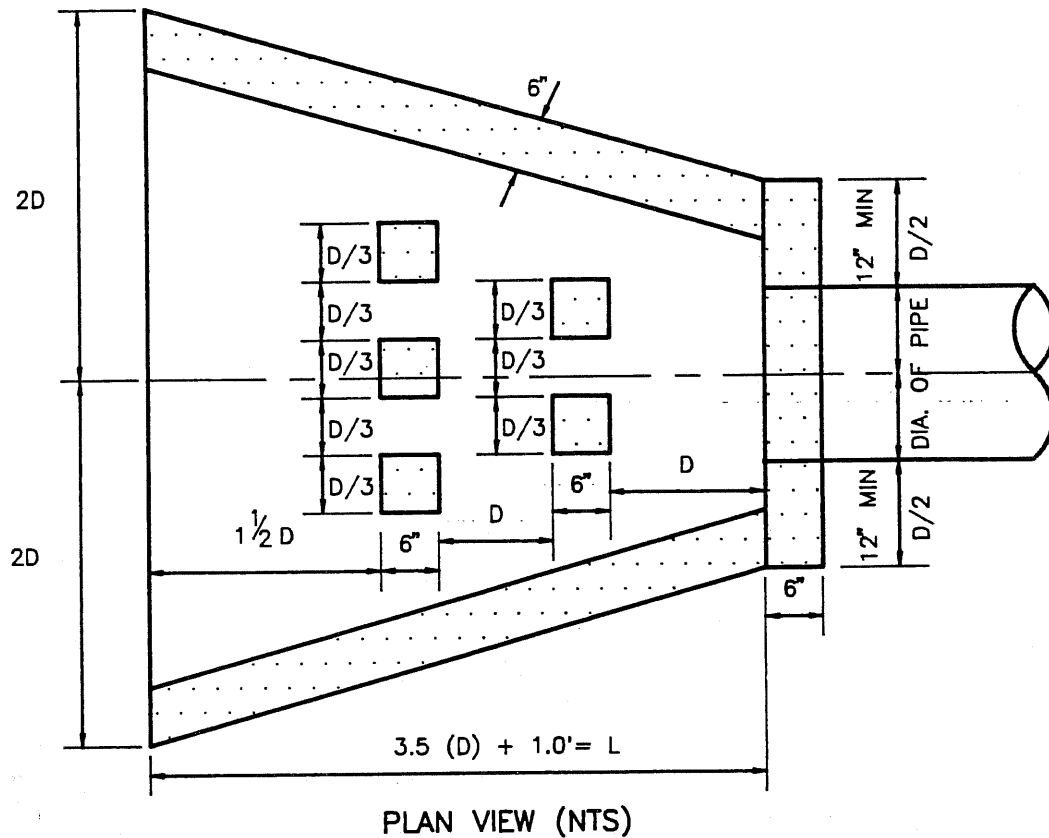
Baffle pier widths and spaces should be equal, up to 1.5 H but no less than H. The slope distance between rows of baffle piers should be 2H, twice the baffle height.

8.7.2 Baffled Outlet

Baffled outlets are used to dissipate the discharge energy from flow in a pipe. They are normally used at outlets from detention ponds or storm drainage systems. The baffles are intended to decrease the discharge velocities and subsequent erosion of the receiving system. General dimensions for a baffled outlet are shown in Figure 8-7.

8.8 STRUCTURE AESTHETICS

The design of hydraulic structures in the urban environment requires an approach not encountered elsewhere because appearance must be an integral part of the design. The treatment of the exterior appearance should not be considered of minor importance.



BAFFLED OUTLET

SOURCE: CITY OF AUSTIN, DRAINAGE CRITERIA MANUAL.
DEPARTMENT OF PUBLIC WORKS.
AUSTIN, TEXAS, JANUARY 1977.

FIGURE 8-7

Parks: Hydraulic structures should not detract from the pleasures enjoyed in an urban park. Furthermore, parks and green belts may later be developed in an urban area in which the structure will play a dominant environmental role.

Play Areas: An important consideration is that drainage structures often are an attraction for neighborhood children. It is almost impossible to make drainage works inaccessible to children, and therefore what is constructed should be made as safe as is reasonably possible. Hazards to children's safety should be avoided whenever possible.

Concrete Surface Treatment: The use of textured concrete presents a pleasing appearance and removes form marks. Exposed aggregate concrete is also attractive but may require special control of the aggregate used in the concrete.

Rails and Fences: The use of rails and fences along concrete walls provides a pleasing topping to an otherwise stark wall, yet provides a safety measure against the hazard of falling from an unprotected wall.

8.9 STEP BACKWATER ANALYSIS

Calculations of water surface profiles can be accomplished by using standard backwater methods or acceptable computer routines which take into consideration all losses due to changes in velocity, drops, bridge openings and other obstructions in open channels.

There are several acceptable methods for backwater calculations. The most common hand calculation method for prismatic channels and irregular-uniform channels is the Standard Step Method. The computational procedure is based on the solution of the one-dimensional energy equation with the energy loss due to friction evaluated with Manning's equation.

The most commonly used computer programs for calculating water surface profiles are HEC-2, WSP2, and THYSYS. These programs can compute water surface profiles for natural, existing man-made and proposed man-made channels. Each of the computer models rely on the following common assumptions:

- (1) Flow is steady,
- (2) Flow is gradually varied,
- (3) Flow is one dimensional (i.e., velocity components in directions other than in the direction of flow are unaccounted), and
- (4) The channels have small slopes (0.100 ft/ft maximum for HEC-2)

Flow is assumed to be steady because time-dependent terms are not included in the energy equation. Flow is assumed to be gradually varied because the energy equation is based on the premise that a hydrostatic pressure distribution exists at each section. Small channel slopes are assumed because the pressure head which is a component of the energy equation is represented by the water depth measured vertically.

8.9.1 HEC-2

HEC-2 is intended for calculating water surface profiles for steady gradually varied flow in natural or man-made channels. Both subcritical and supercritical flow profiles can be calculated. The effects of various obstructions such as bridges, culverts, weirs, and structures in the flood plain may be considered in the computations. The program is also designed for application in flood plain management and flood insurance studies to evaluate floodway encroachments. Also, capabilities are available for assessing the effects of channel improvements and levees on water surface profiles. Input and output may be in either English or metric units.

The HEC-2 program will accept multiple values of n for a single cross section. It will also handle split flow conditions, i.e. multiple stream forks. HEC-2 can also analyze supercritical as well as subcritical flows.

The program does not have the ability to deal with movable boundaries such as are encountered in sediment transfer.

8.9.2 WSP2

The WSP2 (Water Surface Profiles 2) computer program can aid in the determination of flow characteristics for a given set of stream and flood-plain conditions. More specifically, it can compute water surface elevations in open channels. The program also can estimate head losses at restrictive sections, including roadways with either a bridge opening or culverts.

All profiles are computed in the upstream direction, therefore only subcritical flow can be analyzed. When supercritical flow occurs, WSP2 uses the critical depth of flow to be that cross section's water surface elevation. WSP2 continues upstream in this manner until subcritical flow resumes. WSP2 does not recompute downstream sections to determine supercritical flow elevations.

Because the input sequence was made as flexible as possible, WP2 cannot check for many sources of input errors.

8.9.3 THYSYS

The Texas Hydraulic System (THYSYS) allows the analysis of channels by three methods which are:

- (1) Single section stage-discharge (Slope-Area method).
- (2) Two-section slope-determination method.
- (3) Multi-section water surface profile (Step-Backwater method).

It is generally required to use the step-backwater method in open channel analysis. THYSYS's step-backwater method is a one-dimensional method based on Bernoulli's energy equation.

THYSYS will analyze channels including the effects of channel constrictions and structures. THYSYS will make available a two-dimensional channel analysis, but the user must have a rather sophisticated knowledge of fluid mechanics, hydraulics, and computer science to use the two-dimensional analysis. It is recommended that a one-dimensional method be employed to analyze channel flow.

8.9.4 Recommended Software

It is recommended that HEC-2 be used to perform channel analysis because of its wide use and acceptance. HEC-2 also appears to be the most flexible and best documented computer program of the three. Water surface profile analyses are required for all new channel designs except for minor drainage ditches. Water surface profiles will be reviewed by the City using HEC-2 as the standard. The designer is responsible for defending analyses which differ substantially from the HEC-2 standard. HEC-2 analyses are required where floodplain limits are under consideration for revision through either a Letter of Map Revision (LOMR) or a Letter of Map Amendment (LOMA).

8.9.5 Helpful Hints on HEC-2

The following suggestions should provide the user of HEC-2 with some help in avoiding some common errors and mistakes when design analyses are performed.

- A. Left bank and right bank are defined as when viewing the channel in a downstream direction.
- B. If a step-backwater analysis (downstream to upstream computation sequence) cannot balance the energy gradient, then the flow is probably supercritical and a supercritical analysis (upstream to downstream computation sequence) should be performed.
- C. Cross section locations should not be spaced more than 1,000 feet apart for uniform channel shapes, uniform channel slopes and uniform Manning's "n" values. Closer cross section intervals will be necessary for bridge openings, culverts, and channel transitions as well as the shorter channel segments located in the smaller watershed subareas.
- D. HEC-2 has an effective flow area option for use at bridges. Only the portion of the channel cross section equal to the gross area of the bridge opening effectively carries flow through the bridge. To eliminate the portions of the channel outside of the bridge opening without redefinition of the cross section, X3 records are used as part of the input data. One effect of using the X3 records is that it reduces the channel storage volume calculated by the HEC-2 model. If the Modified Puls valley storage routing method is being used, then the X3 records may be deleted and replaced with very high Manning's "n" values outside of the bridge opening to correct the storage volume calculated.
- E. The starting water surface elevation for a step-backwater analysis depends on the size of channel for which the profile is computed. For a small local drainage ditch in which flows would be expected to peak well before the peak of the main channel, HEC-2 computations can begin at normal depth in the tributary channel. The water surface profile for this tributary should be a flat extension of the main channel peak elevation

upstream to the point where the main channel peak elevation intersects the tributary profile. For major channels where peak flow times will be close together, the starting water surface elevation for the tributary should equal the peak elevation in the main channel.

END

SECTION 8
BIBLIOGRAPHY

1. City of Austin, Texas, Drainage Criteria Manual, June 1988.
2. City of Dallas, Texas, Department of Public Works, Design Manual for Storm Drainage Facilities, Undated.
3. City of Fort Worth, Texas, Department of Development, Development Procedures Manual, Adopted September 1975.
4. Daugherty, Robert L., et.al.: Fluid Mechanics with Engineering Applications, 8th ed., McGraw-Hill Book Co., New York, 1985.
5. U.S. Army Corps of Engineers, Hydraulic Engineering Center, HEC-2 Water Surface Profiles: User's Manual, September 1990.
6. U.S. Department of Agriculture, Soil Conservation Service, Technical Release 61, WSP2 Computer Program, Revised September 1982.
7. Texas State Department of Highways and Public Transportation, User Manual for Texas Hydraulic System (THYSYS), 1977.
8. U.S. Department of Transportation, Federal Highway Administration, Hydraulic Engineering Circular No. 14: Hydraulic Design of Energy Dissipators for Culverts and Channels, December 1975.
9. Ven Te Chow, Open-Channel Hydraulics, McGraw-Hill, 1959.
10. Richard H. French, Open-Channel Hydraulics, McGraw-Hill, 1985.
11. Andrew L. Simon, Hydraulics, Third Edition, John Wiley and Sons, 1986.
12. Texas State Department of Highways and Public Transportation, Bridge Division, Hydraulic Manual, Third Edition, December 1985.
13. American Association of State Highway and Transportation Officials, Highway Drainage Guidelines, 1982.

SECTION 9
CULVERTS

9.1 General

9.2 Culvert Headwalls and Entrance Structures

9.2.1 General

9.2.2 Conditions at Entrance

9.2.3 Type of Headwall

9.2.4 Debris Fins

9.2.5 Safety End Treatments

9.3 Culvert Endwalls and Outlet Structures

9.3.1 General

9.3.2 Types of Outlet Structures

9.4 Energy Dissipation

9.4.1 General

9.4.2 USBR Impact Basin

9.4.3 Baffled Outlet

9.5 Selection of Culvert Size and Flow Classification

9.5.1 General

9.5.2 Design Methods

9.5.3 Instruction for Using Nomographs

9.5.4 Nomographs Example

References

SECTION 9

CULVERTS

9.1 GENERAL

The purpose of a culvert is to allow the design storm flow to pass a roadway or similar feature without causing excessive backwater or overtopping of the structure as well as preventing the creation of excessive downstream velocities. The design of the culvert shall maintain the energy losses and discharge velocities within allowable limits. The design storm flow shall be determined by the hydrologic methods set forth in "Section 4: Determination of Storm Runoff."

At a minimum, culverts shall be designed for a 50-year frequency storm, with 0.5- to 1-foot overtopping allowed for a 100-year storm event. However, in some cases a 100-year frequency capacity will be required, particularly for major thoroughfares. The culverts shall also be designed to meet the peak discharge guidelines and other requirements established in "Section 1: Storm Water Drainage Policy."

9.2 CULVERT HEADWALLS AND ENTRANCE STRUCTURES

9.2.1 General

Headwalls and endwalls shall be used on culverts to control the erosion and scour resulting from excessive velocities and turbulence, to prevent the adjacent soil from sloughing into the culvert waterway opening as well as to prevent movement of the culvert due to hydraulic pressures. Headwalls and endwalls with or without wingwalls and aprons shall be constructed of reinforced concrete, and in accordance with the standard drawings as required by the physical conditions of the particular installation.

9.2.2 Conditions at Entrance

The entrance geometry of a culvert is a controlling factor in the amount of flow a culvert may pass. The design of culverts shall involve the consideration of energy head losses that may occur at the entrance. Entrance head losses may be determined by the following equation:

$$h_e = C_e (V_2^2 - V_1^2)/2g \quad (\text{Eq. 9-1})$$

Where: h_e = Entrance Head Loss, Feet
 V_2 = Velocity of Flow in Culvert, ft/sec
 V_1 = Velocity of Flow Approaching Culvert, ft/sec
 C_e = Entrance Loss Coefficient as Shown in Table 9-1
 g = Acceleration Due to Gravity, 32.2 ft/sec

TABLE 9-1
ENTRANCE LOSS COEFFICIENTS

Type of Structure and Design of Entrance	Coefficient, C _e
Pipe, Concrete	
Projecting from fill, groove end	0.2
Projecting from fill, square cut end	0.5
Headwall or headwall and wingwalls	
Groove end of pipe	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.1
Mitered to conform to fill slope	0.7
End-section conforming to fill slope*	0.5
Pipe or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall of headwall and wingwalls	
Square-edge	0.5
Mitered to conform to fill slope	0.7
End-section conforming to fill slope*	0.5
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension	0.2
Wingwalls at 10° to 30° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7

*Note: "End Section conforming to fill slope", made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper have a superior hydraulic performance.

Source: American Concrete Pipe Association, Concrete Pipe Handbook, 1980.

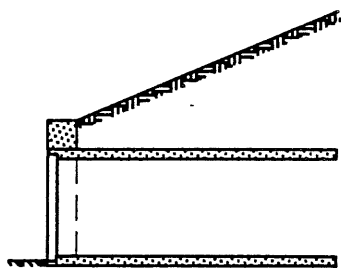
9.2.3 Type of Headwall

Several types of headwall entrances are shown in Figure 9-1. The approach velocity is the determining factor in the type of headwall or entrance structure chosen. Approach velocities below 6 feet per second generally warrant only a parallel or straight headwall as described under paragraph A. Where velocities from 6 to 12 feet per second are encountered, wingwalls and apron structures should be added to the entrance. Special headwalls and wingwalls may be required where approach velocities exceed 12 to 15 feet per second. This requirement varies according to the axis of the approach velocity with respect to the culvert entrance. The following is a description of some of the types of headwalls and the conditions for their use.

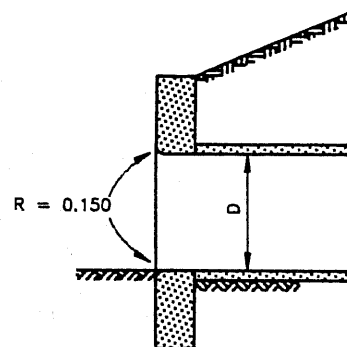
- A. Parallel Headwall - Parallel or straight headwalls are generally constructed parallel with the roadway above, and provide stability against embankment erosion. They should be used in locations where the approach velocities in the channel are below 6 feet per second, and headwater pools are permitted.
- B. Flared Wingwalls - Flared wingwalls help to further retain and protect the embankment by acting as a funnel or guide for the flow. Situations in which approach velocities from 6 to 12 feet per second are encountered generally require flared wingwalls, or skewed wingwalls as described below, and the addition of a concrete apron.
- C. Skewed Wingwalls - Skewed wingwalls are basically the same as flared wingwalls, except the wingwalls are skewed toward the direction of flow relative to the orientation of the culvert. Skewed wingwalls should be utilized where the approaching flow is not parallel with the culvert.
- D. Parallel Wingwalls - Parallel wingwalls are oriented parallel with the direction of flow through the culvert, and are normally used to reduce the wingwall length required to protect the embankment. Parallel wingwalls will typically adversely affect the hydraulic operation of the culvert, and should only be used on special non-hydraulic adaptations of culverts where drainage is a minor factor. Headwall designs based on the dimensions and reinforcement requirements of the Texas SDHPT design standards will be suitable for construction as long as the remaining requirements (such as velocity limits) of this section are also satisfied.

9.2.4 Debris Fins

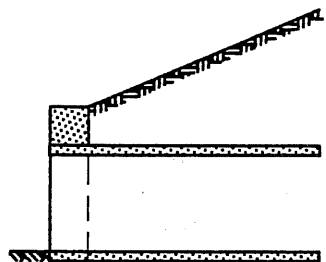
On culvert structures which consist of more than one (1) box culvert, and where the possibility of debris flow exists, debris fins may be required by the City Engineer. The debris fin is an extension of the interior walls of multiple-box culverts. The thickness of the extended wall shall be



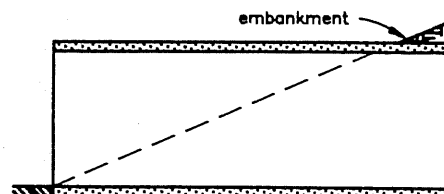
(a) flush headwall entrance



(b) rounded-tip entrance with radius of rounding = 0.150

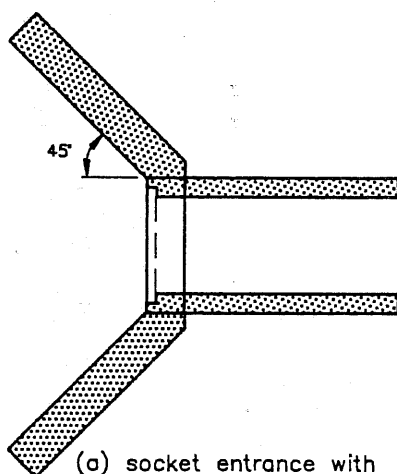


(c) square-edged entrance

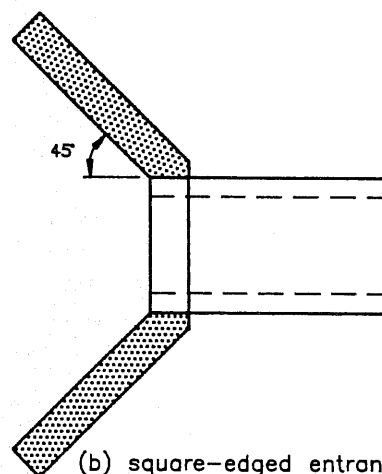


(d) square-edged projecting thickwall pipe

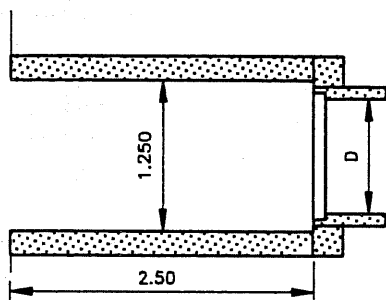
Common types of headwall entrances



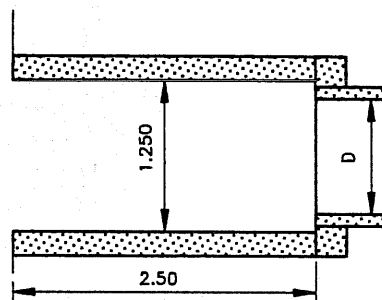
(a) socket entrance with 45° wingwalls



(b) square-edged entrance with 45° wingwalls



(c) socket entrance with parallel wingwalls



(d) square-edged entrance with parallel wingwalls

Common types of wingwall entrances

HEADWALL ENTRANCES

SOURCE: HANDBOOK OF CONCRETE
CULVERT PIPE HYDRAULICS

FIGURE 9-1

designed to meet structural requirements as well as limit interference with the flow capacity of the culvert.

The debris fin shall be the same height as the wall at the structure and shall slope away from the culvert such that the length of the debris fin is one and one-half (1.5) times the height of the wall of the culvert. Figure 9-2 shows a typical debris fin.

9.2.5 Safety End Treatments

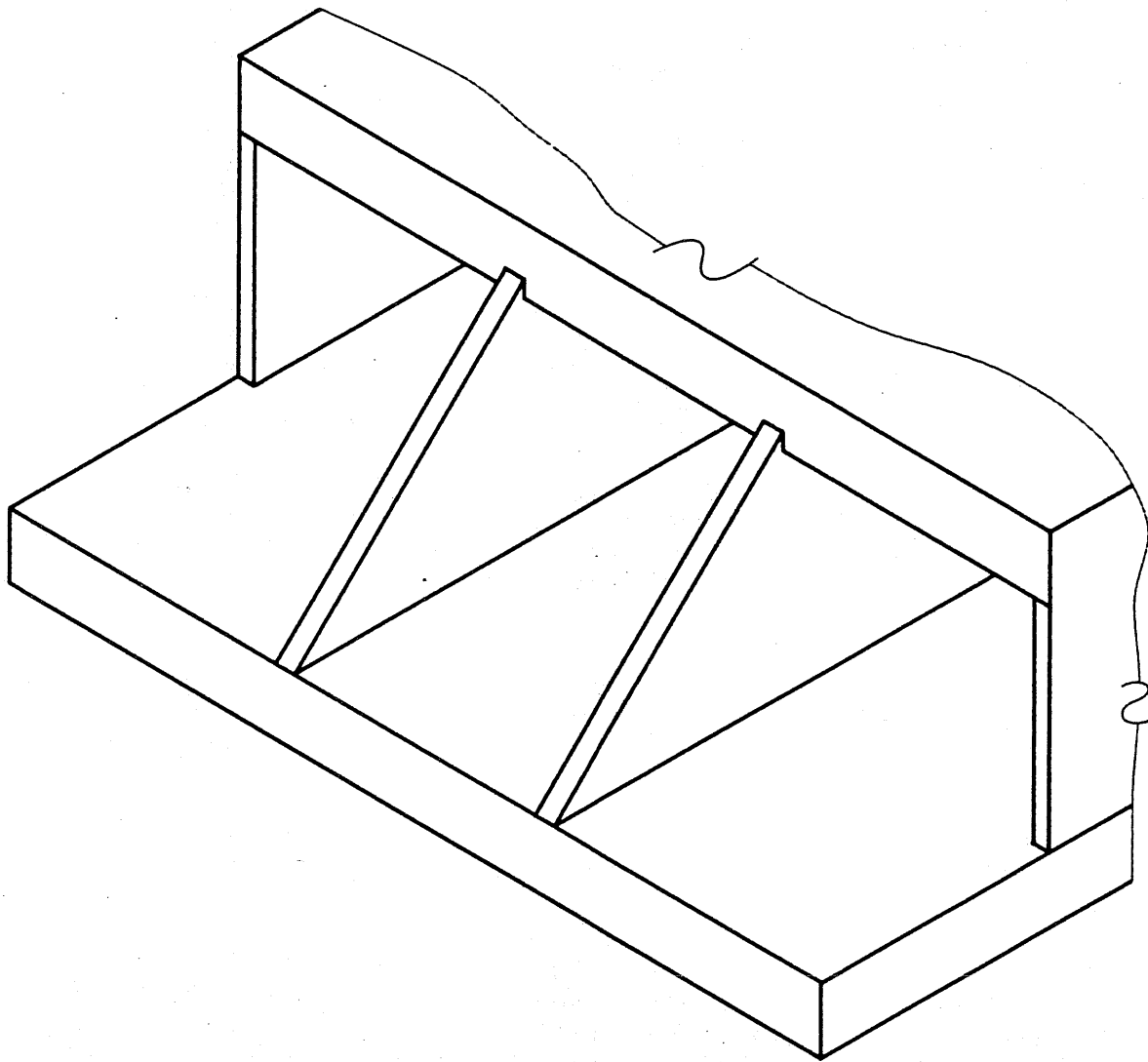
Culverts will have safety end treatments installed to protect the traffic on the crossing roadway where necessary to comply with State Department of Highways and Public Transportation (SDHPT) criteria. For isolated instances where the culvert installation does not fit one of the categories below, the City Engineer shall specify the culvert end treatment to be used. The end treatments shall consist of one of the following:

- For circular or arched culverts less than or equal to 24-inch diameter, where the vertical distance from the roadway edge to the flowline of the stream or channel is less than 3 feet, the ends of the culvert shall be sloped with the embankment at a slope not greater than 6 feet horizontal to 1 foot vertical.
- For circular or arched culverts which do not meet the criteria above or cannot be sloped as required, and for box culverts, metal beam guard fence shall be installed in accordance with the State Department of Highways and Public Transportation (SDHPT) Standards.
- Culverts may also use pipe runners or metal gratings designed after SDHPT standards. To use pipe runners or metal gratings as safety end treatments in lieu of metal beam guard fence, the end of the culvert must be at least 12 feet from the edge of the nearest traffic lane.

9.3 CULVERT ENDWALLS AND OUTLET STRUCTURES

9.3.1 General

Outlet protection of culverts shall be employed to prevent scour and erosion damage to the structure, stream bed and embankment. Endwalls are the downstream companions of headwalls, and can duplicate the embankment and culvert protection features of headwalls. Endwalls and associated structures should provide an efficient flow transition from potentially higher velocity pipe flow to the less concentrated stream or ditch flow. The designed structure required for this transition thus depends on an examination of the expected exit velocity from the culvert, and the ability of the surrounding soils or earth to withstand the erosive aspects of the flow. Velocities in culverts are normally limited to the maximum allowed in the downstream channel. However, the concentrated flow exiting from a culvert can still produce scour and eddy currents that can undermine the endwall structures, and damage the stream bed and the embankment.



DEBRIS FINS

FIGURE 9-2

9.3.2 Types of Outlet Structures

Structures that attempt to decrease the erosive qualities of exiting flow include rip-rap, aprons, endwalls and wingwalls. Various outlet structures are shown on Figure 9-3. The minimum outlet protection used will involve either riprap or an apron, and will be based on the discharge velocity.

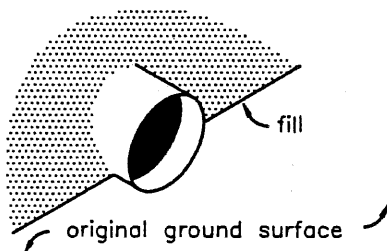
- A. Riprap - For outlet velocities below 6 feet per second, riprap protection consisting of a 4-inch minimum thickness of concrete or alternate approved material will be required. The length shall be as computed under paragraph B, and the riprap width should cover at least two pipe diameters on each side of the outlet.
- B. Aprons - For outlet velocities above 6 feet per second, a 6-inch minimum reinforced concrete apron structure with a toewall will be required. The minimum length of the apron or riprap shall be the maximum of the length of any wingwalls included in the culvert design, or the length determined from the following equation, whichever is greater:

$$L = (VD)/5 \quad (\text{Eq. 9-2})$$

Where:

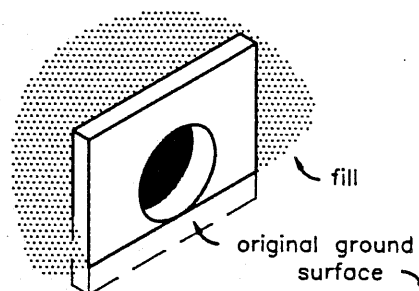
- L = Length of Apron, feet
- V = Discharge Velocity, feet/second
- D = Height of Box Culvert or Diameter of Pipe Culvert, feet

- C. Endwalls - A typical endwall structure is shown on Figure 9-3 (b). The endwall size should be sufficient to support the culvert end, and act as a retaining wall for the surrounding earth if necessary. To avoid scour behind the endwall, the face should extend as high as the expected tailwater depth, and the endwall face width should preferably be wider than the low-water downstream channel. Also, at a minimum, the endwall should extend into the stream bed below the invert to a depth below the frost line.
- D. Wingwalls - Wingwalls can be used as retaining walls, and/or to contain erosive eddy currents at higher tailwater depths. If high tailwater depths are expected, the installation of an apron is also required to reduce the hazard of undercutting the walls. The wingwall length shall match the designed apron, while the orientation of the walls is generally determined by site conditions.



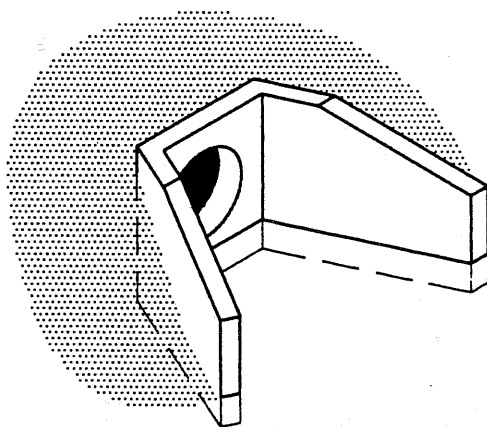
PROJECTING OUTLET

A.



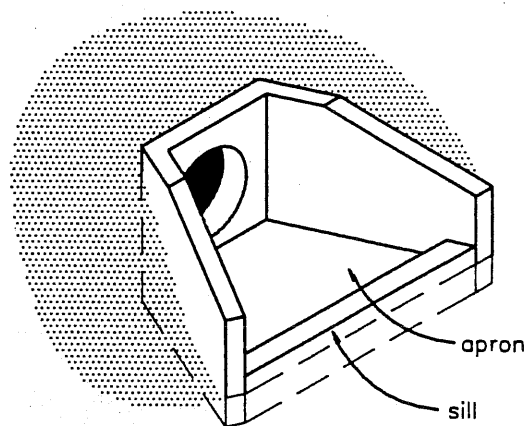
ENDWALL STRUCTURE

B.



ENDWALL AND WINGWALL

C.



ENDWALL AND WINGWALL
WITH AN APRON AND SILL

D.

OUTLET STRUCTURES

SOURCE: HANDBOOK OF CONCRETE
CULVERT PIPE HYDRAULICS

FIGURE 9-3

9.4 ENERGY DISSIPATION

9.4.1 General

Energy dissipators shall be used if the hydraulic characteristics of the culvert cannot be modified to reduce the discharge velocities. When the discharge velocity is greater than 12 feet per second, energy dissipators shall be used to control downstream erosion. Two types of energy dissipators are the USBR Impact Basin and Baffled Outlets.

9.4.2 USBR Impact Basin

The USBR Impact Basin provides control of flow over the complete discharge range and has been found to be very efficient. Figure 9-4 shows a typical Impact Basin. The principal of operation is to produce energy dissipation by causing the flow to strike the vertical hanging baffle. The flow is turned upstream by the horizontal portion of the baffle and the floor.

The design of the impact basin depends on the discharge rate and is independent of outlet velocity and culvert size as long as outlet velocities are less than 30 feet per second.

The dimensions of the basin are related to the width which is determined from the discharge. Figure 9-5 shall be used to determine the width of the basin. The dimensions of the basin shall be determined from the following equations:

$$H = 3W/4 \quad (\text{Eq. 9-3})$$

$$L = 4W/3 \quad (\text{Eq. 9-4})$$

$$d = W/6 \quad (\text{Eq. 9-5})$$

$$g = 3W/8 \quad (\text{Eq. 9-6})$$

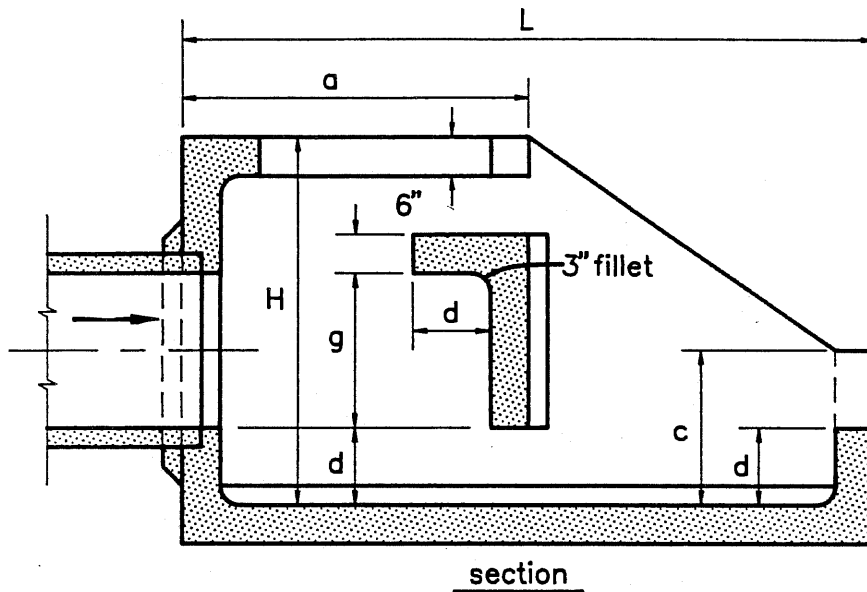
$$c = 5W/12 \quad (\text{Eq. 9-7})$$

$$a = 4W/7 \quad (\text{Eq. 9-8})$$

9.4.3 Baffled Outlet

A hydraulic jump provides an excellent means of controlling high velocity culvert discharge. In a hydraulic jump, the flow changes from high velocity at a shallow depth to tranquil flow at a much greater relative depth. This transition is usually accompanied by a violent and rapidly fluctuating water surface resulting from the loss of a great amount of kinetic energy in a very short distance.

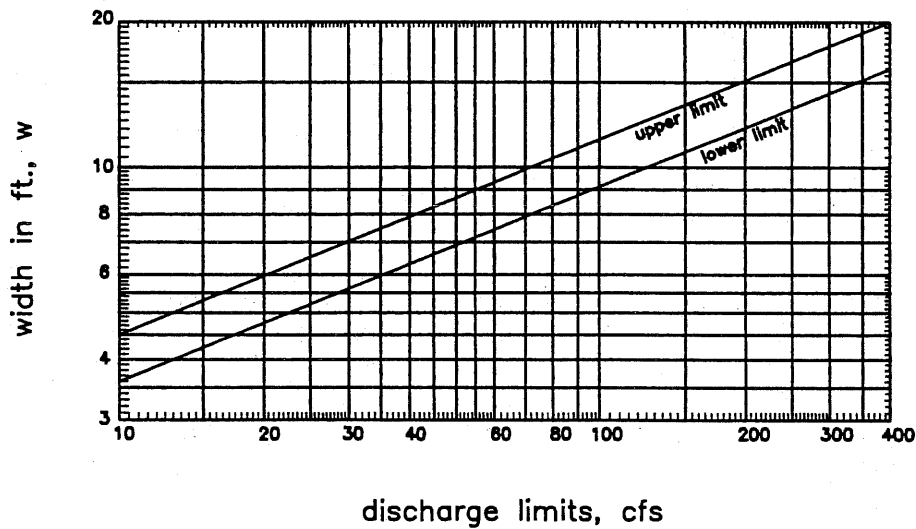
One method of assuring the formation of a hydraulic jump is the addition of baffle blocks in the apron immediately past the outlet. The apron should be of sufficient length to contain approximately 30 per cent of the hydraulic jump. Figure 9-6 shows a typical baffled outlet using baffle blocks. Another variation on the baffled outlet is also shown in this manual in "Section 8: Open Channels."



USBR IMPACT BASIN

SOURCE: HANDBOOK OF CONCRETE
CULVERT PIPE HYDRAULICS

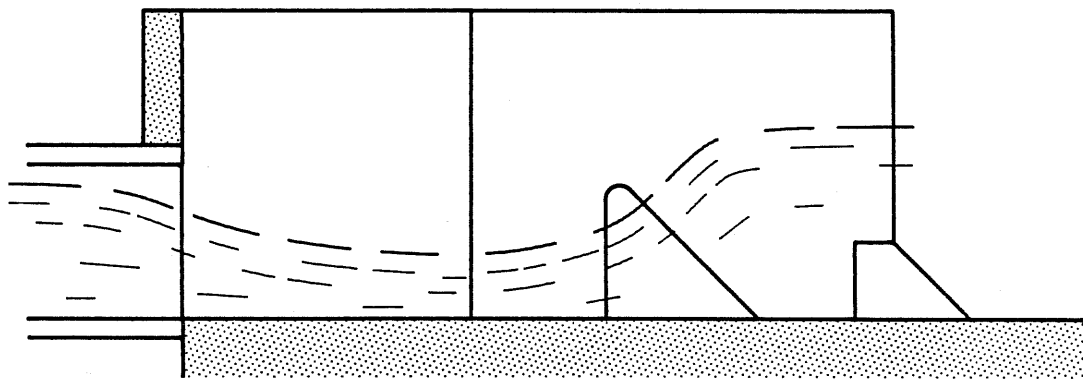
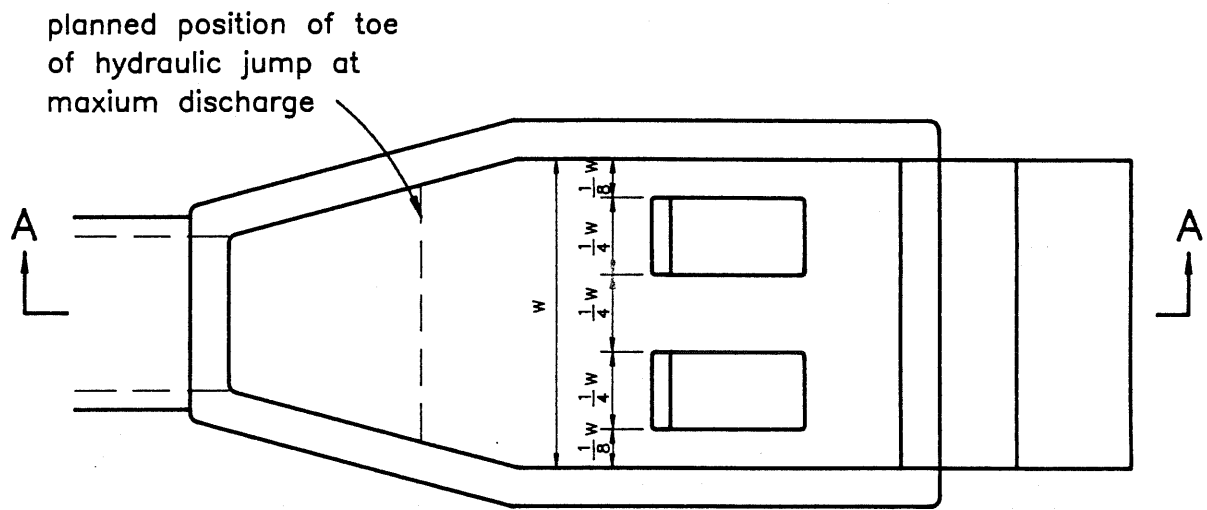
FIGURE 9-4



USBR IMPACT BASIN WIDTH

SOURCE: HANDBOOK OF CONCRETE
CULVERT PIPE HYDRAULICS

FIGURE 9-5



SECTION A-A

BAFFLED OUTLET

SOURCE: HANDBOOK OF CONCRETE
CULVERT PIPE HYDRAULICS

FIGURE 9-6

9.5 SELECTION OF CULVERT SIZE AND FLOW CLASSIFICATION

9.5.1 General

The flow in culverts is controlled in one of two ways: (1) Inlet Control or (2) Outlet Control. Under inlet control, the discharge rate is independent of the length of pipe, the slope, or the roughness of the pipe wall. The discharge will be dependent only upon the depth of the headwater elevation above the invert at the entrance, the pipe size and the entrance geometry. In Outlet Control, the discharge rate is affected by all hydraulic factors upstream of the outlet. These factors are headwater elevation, entrance geometry, pipe size, wall roughness, barrel length and slope. Tailwater elevation will be a factor if the tailwater depth is greater than critical depth.

9.5.2 Design Methods

Four methods of culvert design may be used: 1) Nomographs, 2) THYSYS, 3) HEC-2, or 4) WSP-2. The first method utilizes nomographs or charts to design a culvert. Nomographs are contained in the HYDRAULIC MANUAL prepared by the State Department of Highways and Public Transportation (SDHPT). The Federal Highway Administration (FHWA) design curves, as prepared by Dodson and Associates, are also acceptable for design. During the design process, culvert flow characteristics are determined from the nomographs until all the flow parameters have been developed. The resulting headwater depth found for the design is compared to the allowable headwater. If the headwater found is greater than the allowable, a change to the initial culvert design is made and the process is repeated to determine the headwater for the new design. This iterative process continues until a satisfactory culvert has been designed. A Lotus 123 spreadsheet which utilizes the formulas used to generate the nomographs can be used to design the culvert. This spreadsheet is available from the City of Midland Engineering.

The last three design methods are computer programs. The THYSYS program was developed by the Texas State Department of Highways and Public Transportation and performs a wide variety of hydraulic functions under various subsystems within the overall program. THYSYS is a complete design and analysis tool, and can calculate the hydrologic runoff quantities needed in culvert design. The THYSYS subsystem which relates specifically to culverts is called CULBRG, and deals with culverts and bridges. The CULBRG system will attempt to design and choose culverts based on a given set of input data. The program undertakes a process wherein commonly available culvert sizes are checked for compatibility with the allowable input parameters. Sizes that fall out of the allowable ranges are listed in the output along with the indicated preferable design.

It is worth noting that the THYSYS CULBRG subsystem can both design new culverts and bridges, and analyze existing ones. Therefore, not all of the program input cards will apply to a given situation. Also, some of the input parameters are input as elevations instead of a particular footage depth.

The HEC-2 program was developed by the U.S. Army Corps of Engineers. The program is intended for calculating water surface profiles for steady, gradually-varied flow in natural or man-made channels. The program offers three methods for computing head losses through bridge or culvert structures: the Normal Bridge Method, the Special Bridge Method, and the Special Culvert Method. Due to the similarities between culverts and various types of bridges, the Normal Bridge and Special Bridge methods can be applied to culverts. However, the Special Culvert Method is thought to be preferable because of reduced data requirements, and the possibility of verifying computed results by hand using FHWA nomographs.

The culvert design process utilizing HEC-2 involves a trial and error procedure wherein an initial culvert configuration is input, then the resulting water surface profiles are evaluated by the user to insure that the water depths and other elements are within acceptable limits. If the output is unacceptable, the culvert parameters are changed, and another computer run is obtained until an acceptable design has been found. The Special Culvert method is limited to culverts with constant cross-sections, flow rates, and slopes. Also, no negative (uphill) slope sections are allowed. The Special Culvert option may be used in subcritical profile computations only.

9.5.3 Instruction for Using Nomographs

Figure 9-7 indicates the general parameters involved in culvert design.

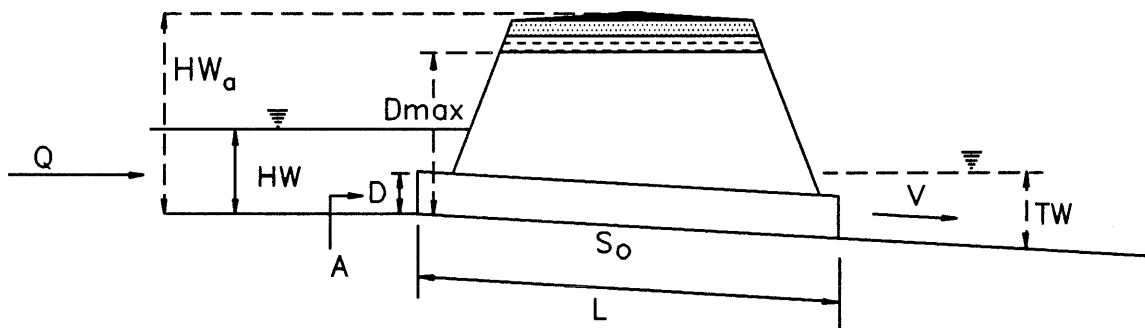


Figure 9-7 Culvert Design Parameters

The various parameters are described below.

-Previously determined by analysis and site conditions:

Q = Peak Discharge
HW_a = Allowable Headwater Depth
Dmax = Maximum Allowable Vertical Opening of Culvert
TW = Tailwater Depth
So = Slope of Culvert
L = Length of Culvert

-Determined in culvert design procedure:

HW = Calculated Headwater Depth
V = Velocity of Flow Within the Culvert and at Culvert Outlet
A = D*W or culvert area

Where:

Q (cfs) - The design runoff flow through the culvert. The value would be previously determined by the methods outlined in Section 4. Determination of Storm Runoff.

HW_a (Ft.) - The allowable headwater depth is the elevation above which damage may be caused to the roadway or adjacent property. The Hwa is the primary factor in culvert design.

Dmax (Ft.) - The maximum allowable barrel height or vertical opening. Dmax should not be greater than Hwa, and may be affected by such factors as pavement depth sections, and minimum cover requirements over a given culvert.

TW (Ft.) - The depth of the tailwater on the downstream side of the culvert. TW is an assumed or allowable value with similar constraints as Hwa. For a series of successive culverts, TW from an upstream structure cannot exceed the Hwa of a subsequent downstream structure.

So (Ft./Ft.) - The culvert flow line slope.

L (Ft.) - The culvert length.

HW (Ft.) - The calculated water depth for a given culvert configuration.

V (Ft./sec) - The outlet velocity would be determined by analysis, and dictates the type of outlet protection required as stated in Section 9.3.2 Types of Outlet Structures.

A (SF) - The culvert opening area.

Figure 9-8 is a flowchart to be used in the design of culverts. Figures 9-9 through 9-31 illustrate the nomographs to be used in the design process. The referenced nomographs are based on 'n values' or material roughness coefficients of 0.012 for concrete, and 0.024 for corrugated metal. These coefficients are standard in culvert design, but there exists the possibility of using materials possessing different roughness values. The nomographs can be adapted to any 'n value' through the following conversion equations:

$$Q_c = 0.012 Q_n / n_c \quad \text{For 0.012 n nomographs} \quad (\text{Eq. 9-9})$$

or

$$Q_c = 0.024 Q_n / n_c \quad \text{For 0.024 n nomographs} \quad (\text{Eq. 9-10})$$

Where:

n_c = 'n' value other than the nomograph base 'n'.

Q_c = Flow based upon n_c

Q_n = Flow from standard $n=0.012$ or 0.024 nomograph.

The important aspect to note in using a conversion equation is to be certain that the nomograph is entered with figures derived using the 'n' value stated on the given nomograph. In other words, do not enter a nomograph with known values that are based upon an 'n' other than that stated on the nomograph. If Q_c is known, Q_c should be converted to the base or stated 'n' before entering the nomograph. If Q_c is unknown, the resulting Q_n should be converted from the base or stated 'n' after leaving the nomograph. The Manning's ' n_c ' values for various culvert materials will be the same as those shown in this manual for storm drains in "Section 6: Storm Drains."

The following steps can be used to design a culvert with the use of the Nomographs.

Initial Trial Size

1. Divide the allowable headwater HW_a by the maximum allowable depth D_{max} .
2. (a) Box Culvert - Enter Figure 9-11 with $D = D_{max}$ and $HW/D = HW_a/D_{max}$ to determine the discharge per box q . Using this q , calculate the total width in feet of box required by dividing the total flow required Q , by q ($W = Q/q$). The total width of box culvert W should be rounded up to a value which will provide a whole number of boxes, N , when the total width is divided by a standard span width S , for each box. ($N = W/S$)
- (b) Pipe Culvert - Enter Figure 9-17 (for circular), Figure 9-24 (for elliptical), Figure 9-30 (for pipe arch) with $D=D_{max}$ and $HW/D = HW_a/D_{max}$ and determine the flow per barrel q . Divide the

total flow required Q , by q , (Q/q) to obtain the number of barrels of diameter D (or rise for oval or arch).

Critical Depth

3. (a) Box Culvert - Enter Figure 9-9 with span width and discharge per barrel and determine the critical depth d_c .
- (b) Pipe Culvert - Enter Figure 9-15 (Figure 9-22 for Elliptical, Figure 9-27 for pipe arch) with the diameter (or rise and span) and the discharge per barrel to determine the ratio of the critical depth to diameter (or rise for oval and pipe-arch) d_c/D .

Uniform Depth

4. (a) Box Culvert - Enter Figure 9-10 with culvert slope, discharge per barrel and span to determine the uniform depth per span, d_u/Span .
- (b) Pipe Culvert - Enter Figure 9-14 (Figure 9-28 for pipe-arch) with culvert slope, discharge per barrel and pipe size (with appropriate roughness coefficient) and determine the ratio of the uniform depth to the diameter (or rise for arch pipe) d_u/D .

The next step in the design procedure is to determine the most likely type of culvert control operation and calculate the headwater elevation and outlet velocity.

Confirmation of Trial Size

5. If the culvert selection is not a box culvert, skip to step 5B; otherwise, go to step 5A.
- 5A. If the critical depth d_c , is less than the barrel depth D , then go to step 5B. If the critical depth d_c is greater than the barrel depth D but less than the uniform depth d_u , then go to step 10. If the uniform depth d_u , is greater than the barrel depth D , then go to step 10. Otherwise, go to step 6.
- 5B. If critical depth d_c , is less than the uniform depth d_u , skip to step 11, otherwise;

6. If the tailwater depth TW, is greater than or equal to the culvert flowline drop plus the critical depth ($TW > S_0L + d_c$), skip to step 8, otherwise;
7. Determine the headwater depth, HW, based on entrance control. Use Figure 9-11 for box culverts, Figures 9-17 or 9-18 for circular pipes, Figures 9-25 for elliptical pipes and Figure 9-30 for pipe-arch. Skip to step 17.
8. If the tailwater depth TW is greater than or equal to culvert flowline drop plus barrel depth ($TW > S_0L + D$), then skip to step 10, otherwise;
9. Calculate the headwater, HW, for both entrance control and outlet control. For entrance control, use nomograph Q for elliptical pipe and Figure 9-30 for pipe-arch. For outlet control, use the following equations:

$$\text{For } TW > D, HW = H + TW - S_0L \quad (\text{Eq. 9-11})$$

$$\text{For } TW < D, HW = H + P - S_0L \quad (\text{Eq. 9-12})$$

Where: $P = (d_c + D)/2$ if $TW < d_c$ (Eq. 9-13)

$P = TW$ if $TW > d_c$ (Eq. 9-14)

H is obtained from:

Figure 9-12 for box culverts

Figure 9-19 or 9-20 for circular pipes

Figure 9-26 for elliptical pipe

Figure 9-31 for pipe-arch

Calculate the outlet velocity by dividing the design discharge by the area of flow at the outlet. Skip to step 17.

10. The headwater is based on outlet control, the culvert is on a mild slope and the outlet is submerged by the tailwater, or the culvert is on a steep slope and the entire culvert is submerged by the tailwater.

$$HW = H + TW - S_0L \quad (\text{Eq. 9-11})$$

H is determined from Figure 9-12 for box culvert, Figures 9-19 or 9-20 for circular pipe or Figure 9-31 for pipe-arch. Outlet velocity is based on design discharge and full flow at the outlet. Skip to step 17.

11. If the tailwater TW, is greater than critical depth d_c , skip to step 13, otherwise;

12. Calculate headwater by the following:

$$HW = d_c + V_c^2/(2g) + h_e + h_f - S_oL \quad (\text{Eq. 9-15})$$

Where:

d_c = Critical Depth

V_c = Critical Velocity (based on d_c)

g = 32.2 ft/sec²

h_e = Entrance Head = $C_e V_c^2/(2g)$

C_e = Entrance Coefficient

h_f = Friction Head = $S_f L$

S_f = That Slope at Which 1.1 d_c Would be Uniform Depth

L = Length of the Culvert

$S_o L$ = Drop in Culvert from Upstream Flowline to Downstream Flowline.

The outlet velocity equals the critical velocity V_c .
Skip to step 15.

13. If the tailwater TW, is greater than the depth of the culvert D, the outlet is submerged and the culvert is on a mild slope, go to step 10, otherwise;

14. Calculate the headwater by the following:

$$HW = TW + V_{tw}^2/(2g) + h_e + h_f - S_oL \quad (\text{Eq. 9-16})$$

Where:

TW = Tailwater Depth

V_{tw} = Velocity Based on Tailwater Depth

g = 32.2 ft/sec²

h_e = Entrance Head = $C_e V_{tw}^2/(2g)$

C_e = Entrance Coefficient

h_f = Friction Head = $S_f L$

S_f = That Slope at Which TW Would be Uniform Depth

L = Length of the Culvert

$S_o L$ = Drop in Culvert from Upstream Flowline to Downstream Flowline.

Outlet velocity equals the design discharge rate divided by the area of flow at the tailwater depth.

15. If the headwater is less than 1.5D, skip to step 17, otherwise;

16. Calculate a new headwater HW, based on $HW = H + P - S_0L$

Where: H is based on Figure 9-12 for box culverts, Figure 9-19 or 9-20 for circular pipes, Figure 9-26 for elliptical pipe or Figure 9-31 for pipe-arch.

$P = (d_c + D)/2$ for $TW < d_c$, or

$P = TW$ for $TW > d_c$

Outlet velocity is based on d_c if the tailwater is less than the critical depth or based on tailwater if the tailwater is greater than the critical depth.

17. If the headwater calculated is less than or equal to the headwater allowable and is not appreciably lower than the headwater allowable, the design is complete. If the above conditions are met and the culvert is under entrance control, skip to step 19. If the operation is not entrance control, the culvert geometry design is complete, skip to step 18. If the headwater is greater than the headwater allowable, the trial culvert size should be increased or the slope of the culvert adjusted. Go to step 3.

If the headwater is considerably lower than the headwater allowable, the trial culvert size should be reduced. Go to step 3.

18. Since the culvert is under outlet control, the discharge velocity must be checked to determine if erosion control devices may be necessary.

19. Design Complete.

9.5.4 Nomographs Example

The following example utilizes the nomographs and the above design procedures:

Given: Concrete Box Culvert
Concrete $n = 0.012$
 Q (total flow) = 250 cubic feet per second
 S_0 (slope) = 0.003 ft/ft
 L (length) = 56 feet
 HW_a = 3 feet
 TW = 2.8 feet
Flared Wingwalls - 45°
 C_e = 0.40

Initial Trial Size - Try 5' wide by 3' high

1. $HW_a/D_{max} = 3'/3' = 1'$
2. $D = D_{max} = 3$, $HW/D = HW_a/D_{max} = 1$
From Figure 9-11, $Q_b/W = 15$ cfs/foot
Therefore, $W = 250/15 = 17'$ total culvert width

Using a span of 5', the number of barrels $N = 17/5 = 3.4$.
Must round up to 4 barrels
4 - 5'x3'x56' box culverts
 $q = 250/4 = 62.5$ cfs per barrel

Critical Depth

3. From Figure 9-9, using $W = \text{span width} = 5'$ and $q = 62.5$ cfs, find $d_c = 1.7'$

Uniform Depth

4. From Figure 9-10, using slope = 0.003, $q = 62.5$ cfs and span = 5', find $d_u/\text{span} = 0.36$, $d_u = (0.36)(5) = 1.80'$

Confirmation of Trial Size

5. From step 3, $d_c = 1.7'$ which is less than barrel depth $D = 3'$.
From step 4, $d_u = 1.80'$ which is greater than $d_c = 1.7'$.
Therefore, skip to step 11.
11. Given $TW = 2.8'$ and from step 3, $d_c = 1.7'$. Therefore, tailwater is greater than critical depth, skip to step 13.
13. $D = 3'$ and $TW = 2.8'$. Therefore tailwater is less than culvert depth.

14. Find HW:

$$HW = TW + V_{tw}^2/(2g) + h_e + h_f - S_oL$$

Given $TW = 2.8'$

$$A = \text{"Wet" Area at } T_w \text{ depth (one barrel)} = 2.8' \times 5' = 14 \text{ sf}$$

$$V_{tw} = q/A = 62.5/14 = 4.46 \text{ ft/sec}$$

$$h_e = C_e V_{tw}^2/(2g) = (0.40)(4.46)^2/2(32.2) = 0.124$$

$$h_f = S_f L; \text{ Use Figure 9-10 to find the friction slope } (S_f)$$

$$d_u = TW = 2.8, \text{ span} = 5', d_u/\text{span} = 2.8/5 = 0.56, q = 62.5 \text{ cfs}, S_f = 0.00088, h_f = (0.00088)(56) = 0.049$$

$$S_oL = (0.003)(56) = 0.168$$

$$\text{Therefore, } HW = 2.8 + (4.46)^2/2(32.2) + 0.124 + 0.049 - 0.168 = 3.11'$$

15. From step 14, $HW = 3.11'$. $1.5D = (1.5)(3) = 4.5'$ Therefore, headwater is less than 1.5 times the culvert depth, skip to step 17.
17. The headwater allowable is $3.0'$. The headwater for the trial size is $3.11'$. This indicates that a change in culvert geometry is necessary to lower the headwater at or below allowable. Recalculate using $6'$ span ($4 - 6' \times 3' \times 56'$).

Critical Depth

3. From Figure 9-9, using $W = \text{span width} = 6'$ and $q = 62.5 \text{ cfs}$, find $d_c = 1.5'$

Uniform Depth

4. From Figure 9-10, using slope $= 0.003$, $q = 62.5 \text{ cfs}$ and span $= 6'$, find $d_u/\text{span} = 0.255$, $d_u = (0.255)(6) = 1.53'$

Confirmation of Trial Size

5. From step 3, $d_c = 1.7'$ which is less than barrel depth $D = 3'$. From step 4, $d_u = 1.53'$ which is greater than $d_c = 1.5'$. Therefore, skip to step 11.
11. Given $TW = 2.8'$ and from step 3, $d_c = 1.5'$ Therefore, tailwater is greater than critical depth, skip to step 13.
13. $D = 3'$ and $TW = 2.8'$ Therefore tailwater is less than culvert depth.
14. $HW = TW + V_{tw}^2/(2g) + h_e + h_f - S_oL$

Given $TW = 2.8'$

$A = 2.8 \times 6 = 16.8$

$V_{tw} = q/A = 62.5/16.8 = 3.72 \text{ ft/sec}$

$h_e = C_e V_{tw}^2/(2g) = (0.40)(3.72)^2/2(32.2) = 0.086$

$h_f = S_f L$; Using Figure 9-10, $d_u = TW = 2.8$, span $= 6'$, $d_u/\text{span} = 2.8/6 = 0.467$, $q = 62.5 \text{ cfs}$, $S_f = 0.00055$, $h_f = (0.00055)(56) = 0.031$

$S_oL = (0.003)(56) = 0.168$

Therefore, $HW = 2.8 + (3.72)^2/2(32.2) + 0.086 + 0.031 - 0.168 = 2.96'$.

15. From step 14, $HW = 2.96'$. $1.5D = (1.5)(3) = 4.5'$. Therefore, headwater is less than 1.5 times the culverts depth, skip to step 17.

17., 18. The headwater allowable is 3.0'. The headwater for the trial size is 2.96'. Since the culvert is under outlet control, a check of the outlet velocity is necessary. $V_{tw} = 3.72$ ft/sec. Therefore, only riprap protection is necessary in accordance with Sub-Section 9.3.

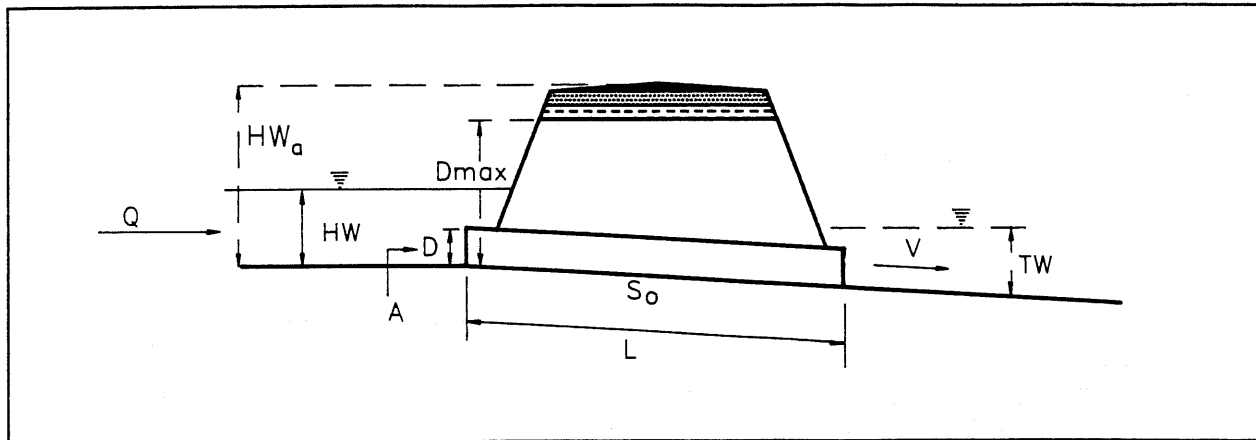
19. Design complete. Use 4 - 6'x3'x56' box culverts.

Example 1 illustrates the previous design example using the culvert design worksheets. The blank worksheets contained on the pages following Example 1 can be used to centralize the required design parameters and variables. Space is provided on the final sheet for the particular parameters of the designed culvert.

END

EXAMPLE 1

CULVERT DESIGN WORKSHEET



Culvert Type	Box Culvert	Q	250 cfs.
Culvert Material	Concrete	L	56 ft.
'n' Value	$n = 0.012$	So	0.003 ft./ft.
Entrance C Value	$C_e = 0.40$	TW	2.8 ft.
Wingwalls? (Y/N)	Yes	D_{max}	$= HW_a = 3$ ft.
Flare Angle	45°	HWa	3 ft.

TRIAL SIZE: 5' Wide by 3' High
1. $HW_a/D_{max} = 3'/3' = 1$
2. $D = D_{max} = 3$, $HW/D = HW_a/D_{max} = 1$
from Fig. 9-11 (Nomograph C), $Q_d/W = 15$ cfs./ft.
Therefore, $W(\text{total width}) = Q/15 = 250/15 = 16.7$ or 17 ft.
Using a span of 5', the number of barrels $N = 17'/5' = 3.4$
Must round up to 4 barrels
4 - 5' x 3' x 56' Box Culverts
Discharge per barrel $q = 250/4 = 62.5$ cfs./barrel
3. Critical Depth:
From Fig. 9-9(Nomograph A), using $W = \text{span width} = 5$ ft.,
$q = 62.5$ cfs.,
Find $d_c = 1.7$ ft.
4. Uniform Depth:
From Fig. 9-10(Nomograph B), using slope = 0.003,
$q = 62.5$ cfs., and span = 5',
Find $d_u/\text{span} = 0.36$, d_u therefore = $(0.36)(5') = 1.80'$
CONFIRMATION:
5. From step 3, $d_c = 1.7'$ which is less than barrel depth $D = 3'$.
From step 4, $d_u = 1.80$ ft. which is greater than $d_c = 1.7'$,
Skip to step 11.
11. Given $TW = 2.8'$ and from step 3, $d_c = 1.7'$. Therefore, tailwater is
greater than critical depth,
Skip to step 13.

EXAMPLE 1

CULVERT DESIGN WORKSHEET

CONTINUED

pg. 2

13. $D = 3'$ and $TW = 2.8'$
Therefore, tailwater is less than culvert depth.
14. Find HW:
$HW = TW + V_{tw}^2/(2g) + h_e + h_f - SoL$
Given $TW = 2.8'$
$A = \text{"Wet" Area at TW depth (one barrel)} = 2.8' \times 5' = 14 \text{ sf.}$
$V_{tw} = q/A = 62.5/14 = 4.46 \text{ ft/sec}$
$h_e = C_e V_{tw}^2/(2g) = (0.40)(4.46)^2/2(32.2) = 0.124$
$h_f = SfL$; Use Fig. 9-10 to find friction slope (S_f)
$du = TW = 2.8'$, span = 5', $du/\text{span} = 2.8'/5' = 0.56$,
$q = 62.5 \text{ cfs}$, $sf = 0.00088$, $h_f = (0.00088)(56) = 0.049$
$SoL = (0.003)(56) = 0.168$
Therefore,
$HW = 2.8 + (4.46)^2/2(32.2) + 0.124 + 0.49 - 0.168 = 3.11'$
15. From step 14. $HW = 3.11'$, $1.50 = (1.5)(3) = 4.5$,
Therefore HW is less than 1.5 times the culvert depth,
Skip to step 17.
17. The headwater allowable is 3.0'. The computed headwater
is 3.11'. This indicates that a change in culvert geometry is
necessary to lower the headwater at or below allowable.
Recalculate using a 6' span (4 - 6' x 3' x 56')
Critical Depth
3. From Fig. 9-9(Nomograph A). Using $W = \text{span width} = 6'$
and $q = 62.5 \text{ cfs}$.
Find $dc = 1.5'$
Uniform Depth
4. From Fig. 9-10(Nomograph B). Using slope = 0.003,
$q = 62.5 \text{ cfs}$ and span = 6',
Find $du/\text{span} = 0.255$, $du = (0.225)(6) = 1.53'$
Confirmation
5. From step 3, $dc = 1.7'$ which is less than barrel depth $D = 3'$
From step 4. $du = 1.53'$ which is greater than $dc = 1.5'$
Therefore, skip to step 11.
11. Given $TW = 2.8'$ and from step 3. $dc = 1.5'$. Therefore, tailwater
is greater than critical depth,
Skip to step 13.

EXAMPLE 1

pg. 3

Therefore, tailwater is less than culvert depth.

Given TW = 2.8'

$$V_{tw} = q/A = 62.5/16.8 = 3.72 \text{ ft/sec}$$

$$h_e = C_e V t w^2 / (2g) = (0.40)(3.72)^2 / 2(32.2) = 0.086$$

$hf = SfL$; Using Fig. 9-10(Nomograph B), $du = TW = 2.8'$,

$$\text{span} = 6', \text{ du/span} = 2.8'/6' = 0.467, q = 62.5 \text{ cfs,}$$

$$S_f = 0.00055, \quad h_f = (0.00055)(56') = 0.031'$$

$$\text{SoL} = (0.003)(56') = 0.168'$$

$$HW = 2.8' + (3.72)/2(32.2) + 0.086' + 0.031' - 0.168' = 2.96'$$

Therefore headwater is less than 1.5 times the culvert depth.

Skip to step 17.

$$V_{tw} = 3.72 \text{ ft/sec.}$$

Therefore, only riprap protection is necessary in accordance with Sub-Section 9.3.

19. Design complete.

Configuration

4 - 6' x 3' x 56' Box Culverts

HW

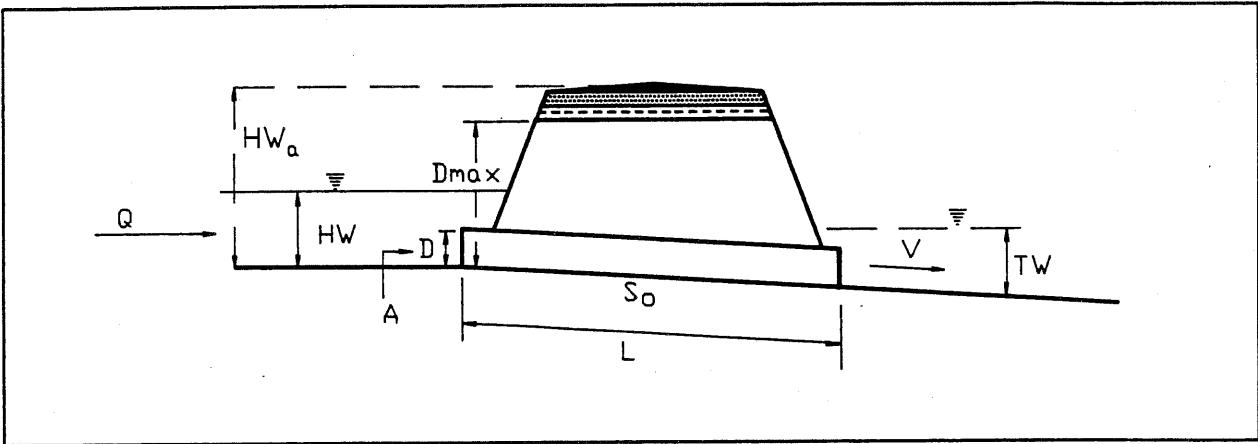
2.96 ft.

Exit Velocity

3.72 ft/sec

Other

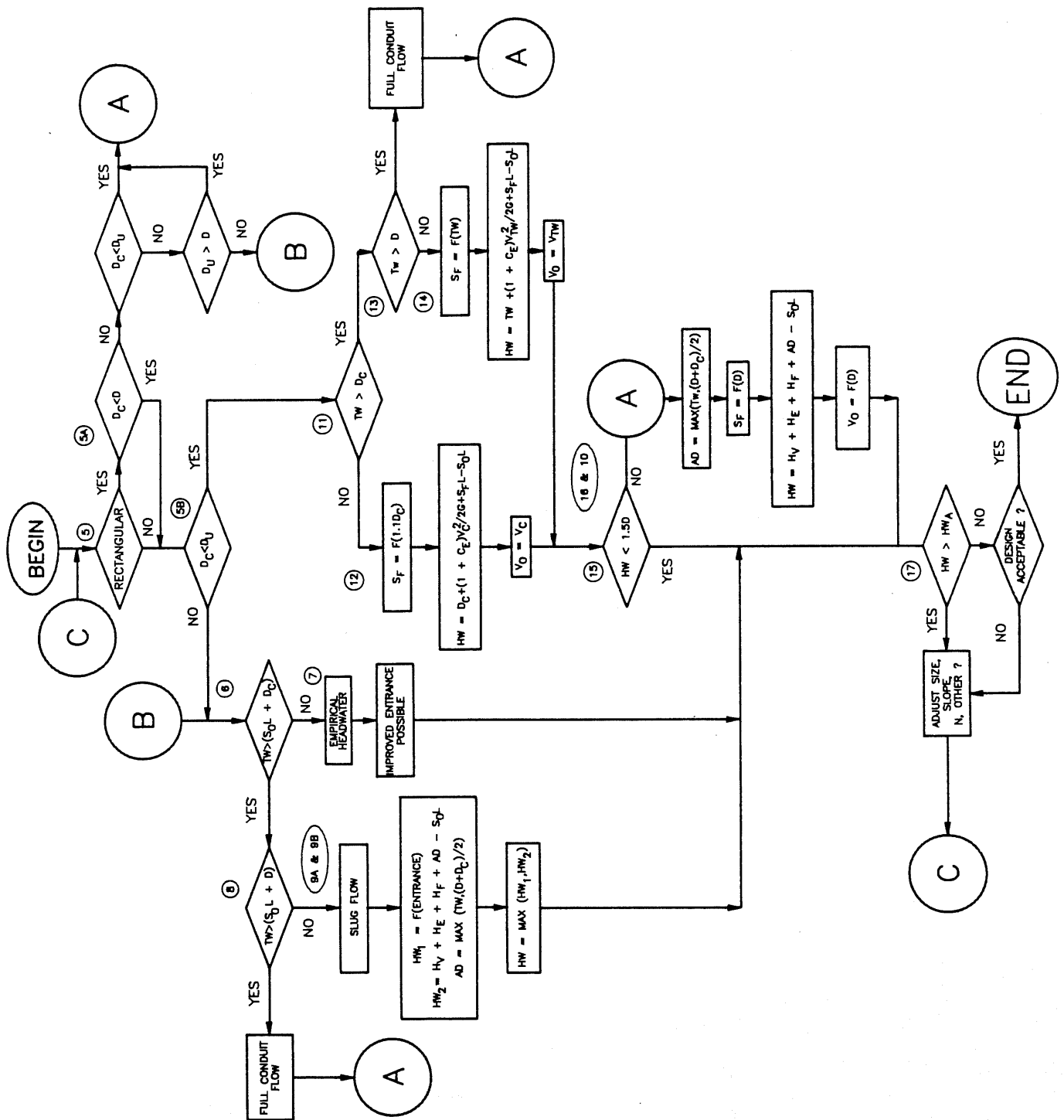
CULVERT DESIGN WORKSHEET



Culvert Type _____
Culvert Material _____
'n' Value _____
Entrance C Value _____
Wingwalls? (Y/N) _____
Flare Angle _____

Q _____
L _____
So _____
TW _____
Dmax _____
HWa _____

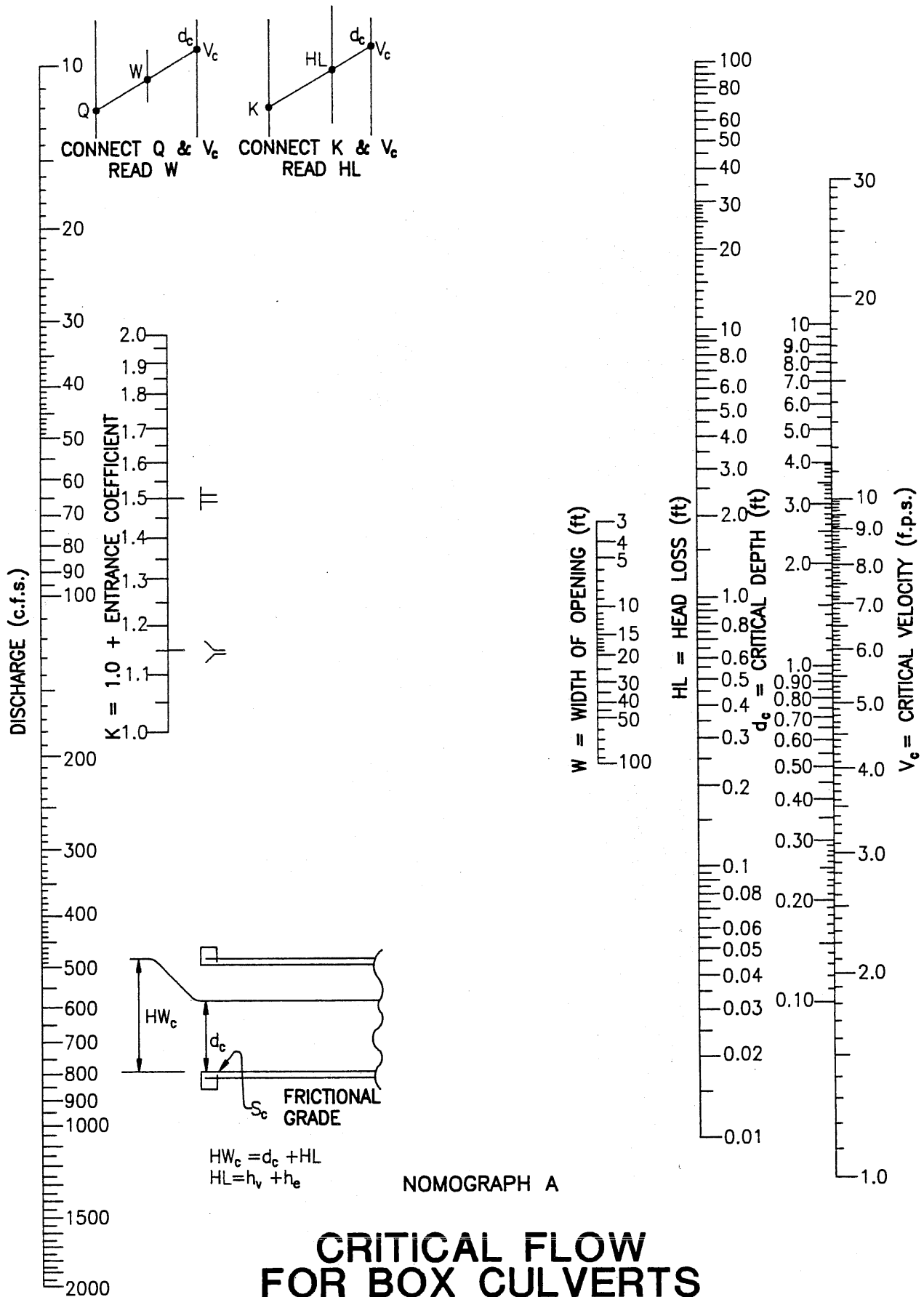
[illegible]



NOMOGRAPH FLOW CHART

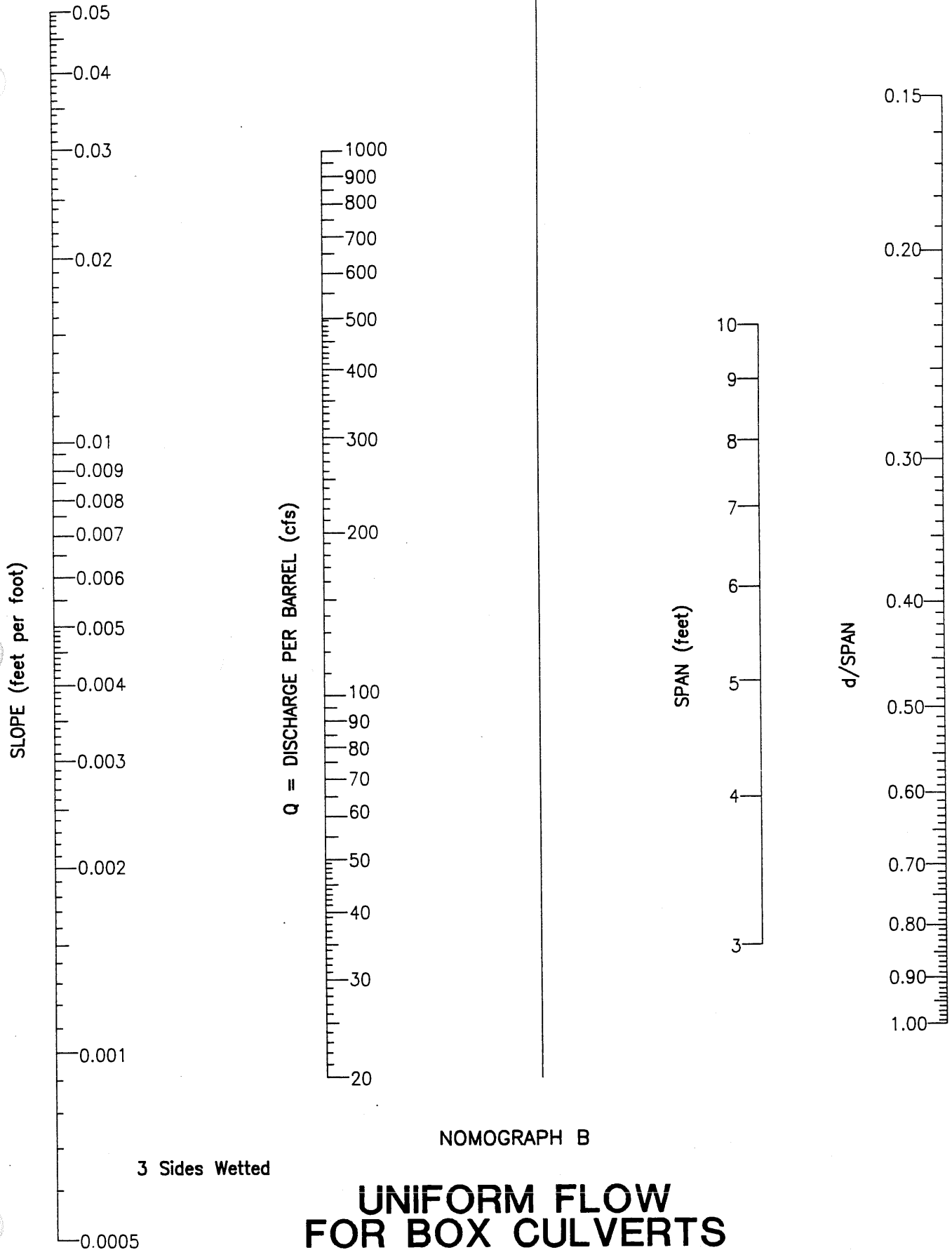
SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION BRIDGE
DIVISION, HYDRAULIC MANUAL, 12-85

FIGURE 9-8



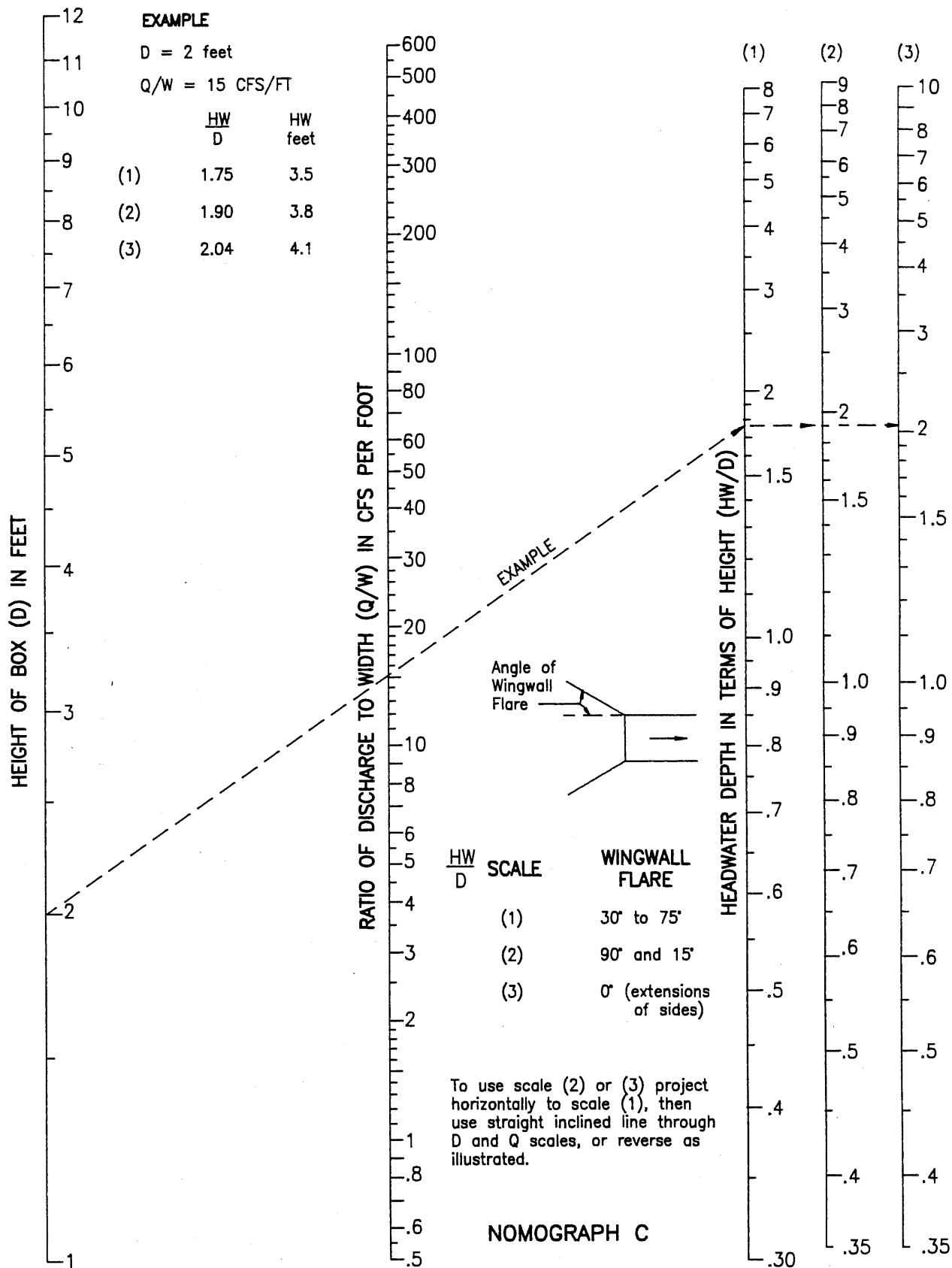
SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL, 12-85

FIGURE 9-9



SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

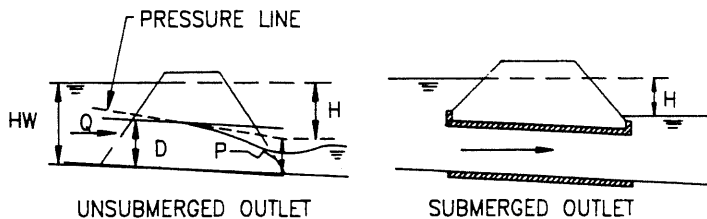
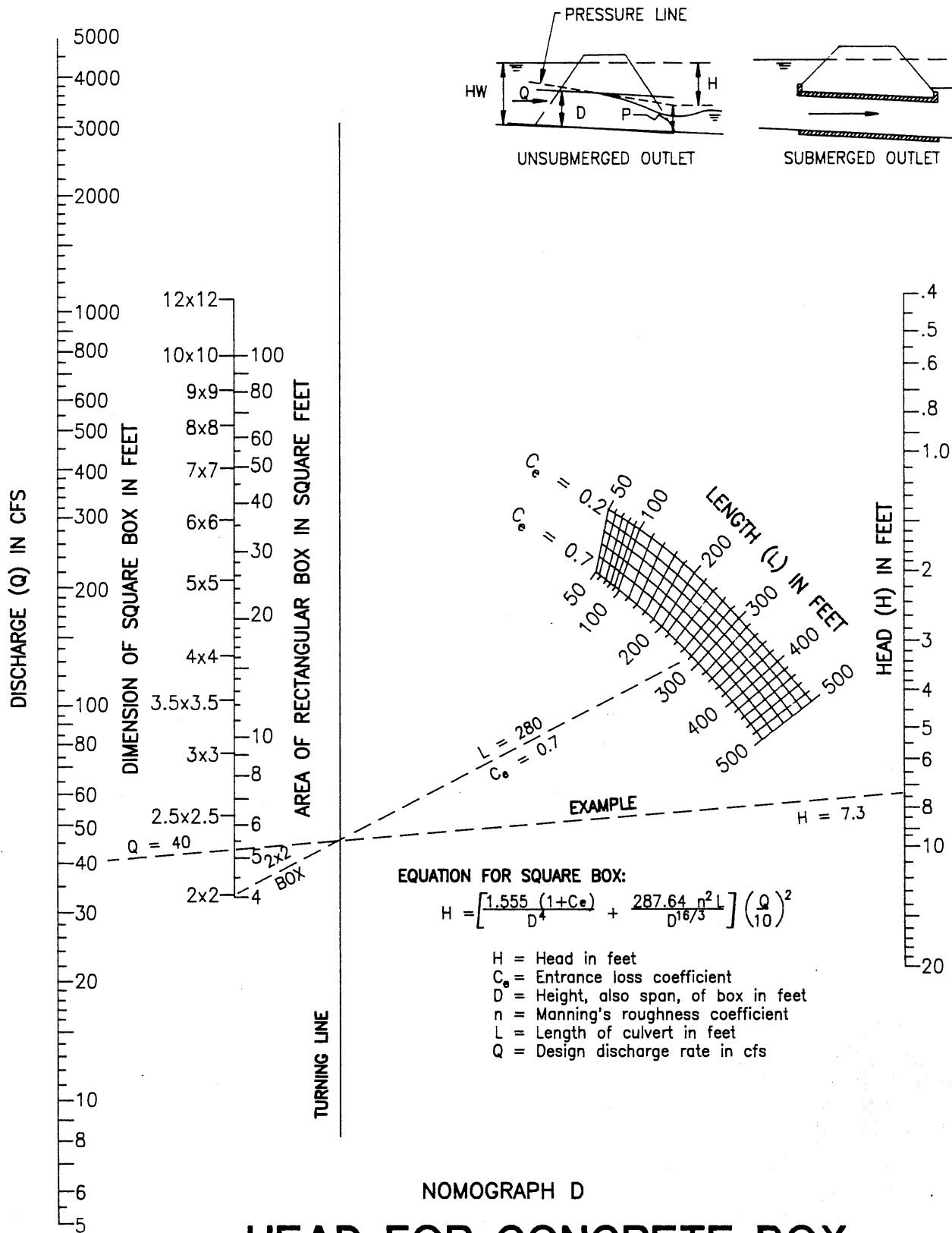
FIGURE 9-10



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-11



NOMOGRAPH D

HEAD FOR CONCRETE BOX CULVERTS FLOWING FULL

N = 0.012

FIGURE 9-12

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION, BRIDGE DIVISION HYDRAULIC MANUAL, 12-85

EXAMPLE

B=7 FT. D=5 FT. Q=500 CFS

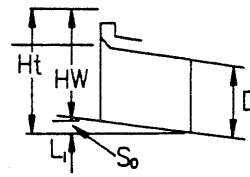
$$\frac{Q}{B} = 71.5$$

$$\frac{H_t}{D} = 1.66$$

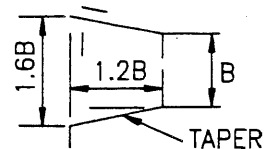
$$H_t = 8.3 \text{ FT.}$$

STRAIGHT FLOOR

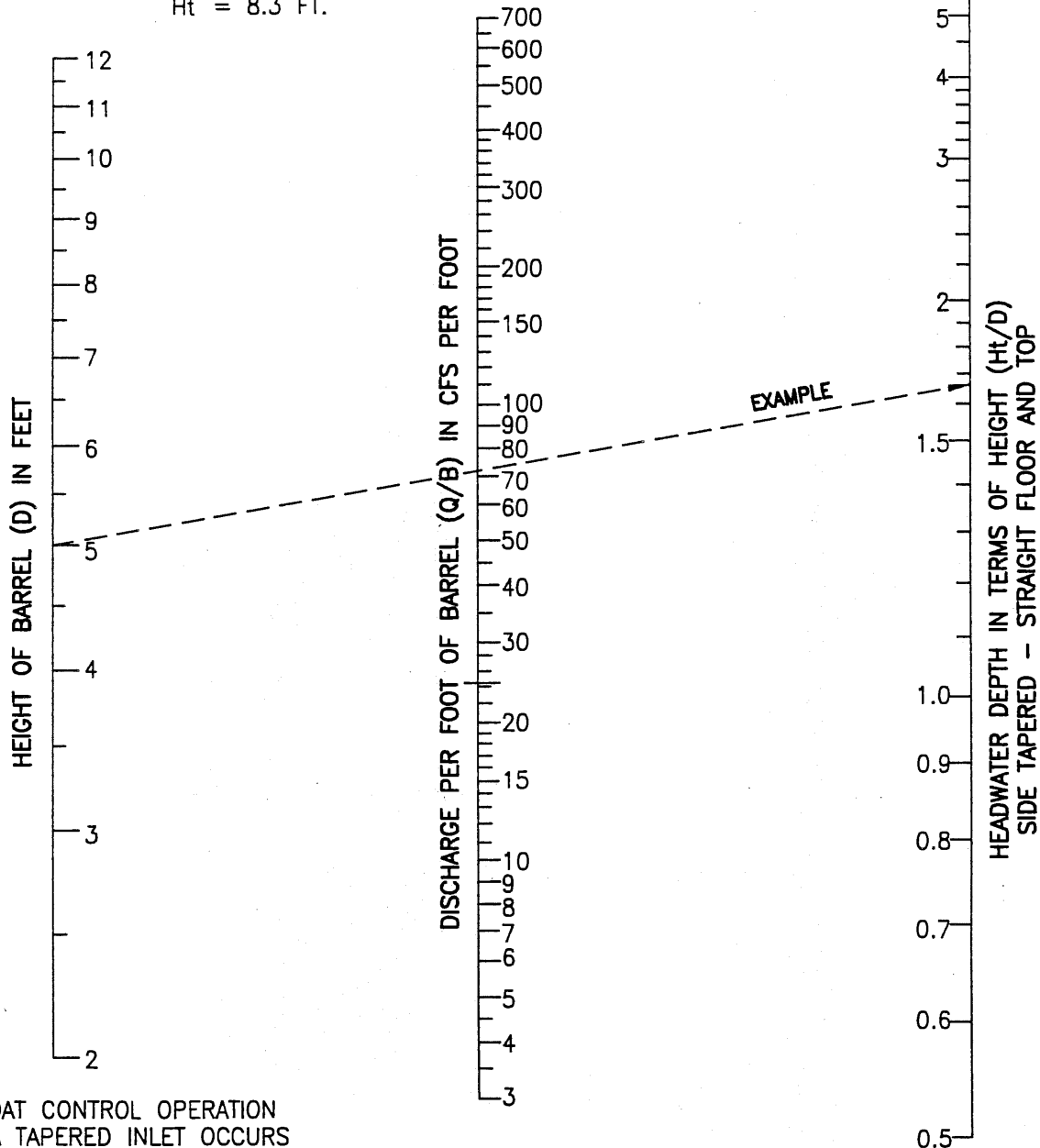
(FHWA)



VERTICAL SECTION



PLAN



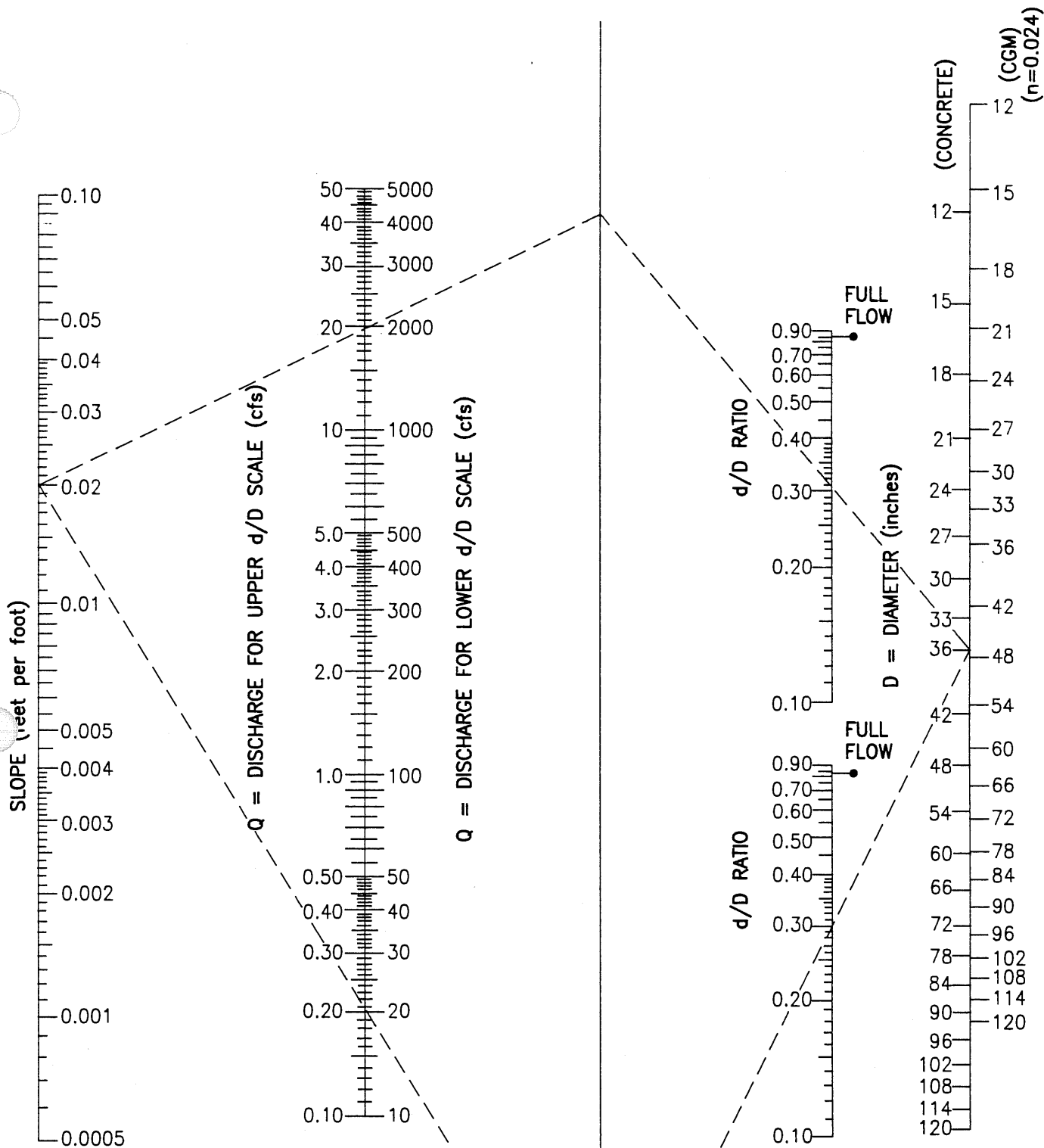
THROAT CONTROL OPERATION OF A TAPERED INLET OCCURS ONLY FOR DIMENSIONS AND DISCHARGE RATES FOR WHICH $H_t - L_1 S_0$ OR $H_t - \text{FALL}$ EXCEEDS HW FOR THE FACE SECTION. USE THE SPECIAL INSTRUCTIONS FOR DESIGN OF TAPERED INLETS.

NOMOGRAPH E

TAPERED-SIDE INLETS ON BOX CULVERTS

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION, BRIDGE DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-13



EXAMPLE

GIVEN: $S = 0.02$ FIND: $d/D =$
 $Q = 20$ cfs $d =$
 $D = 36"$ (CONCRETE)

SOLUTION

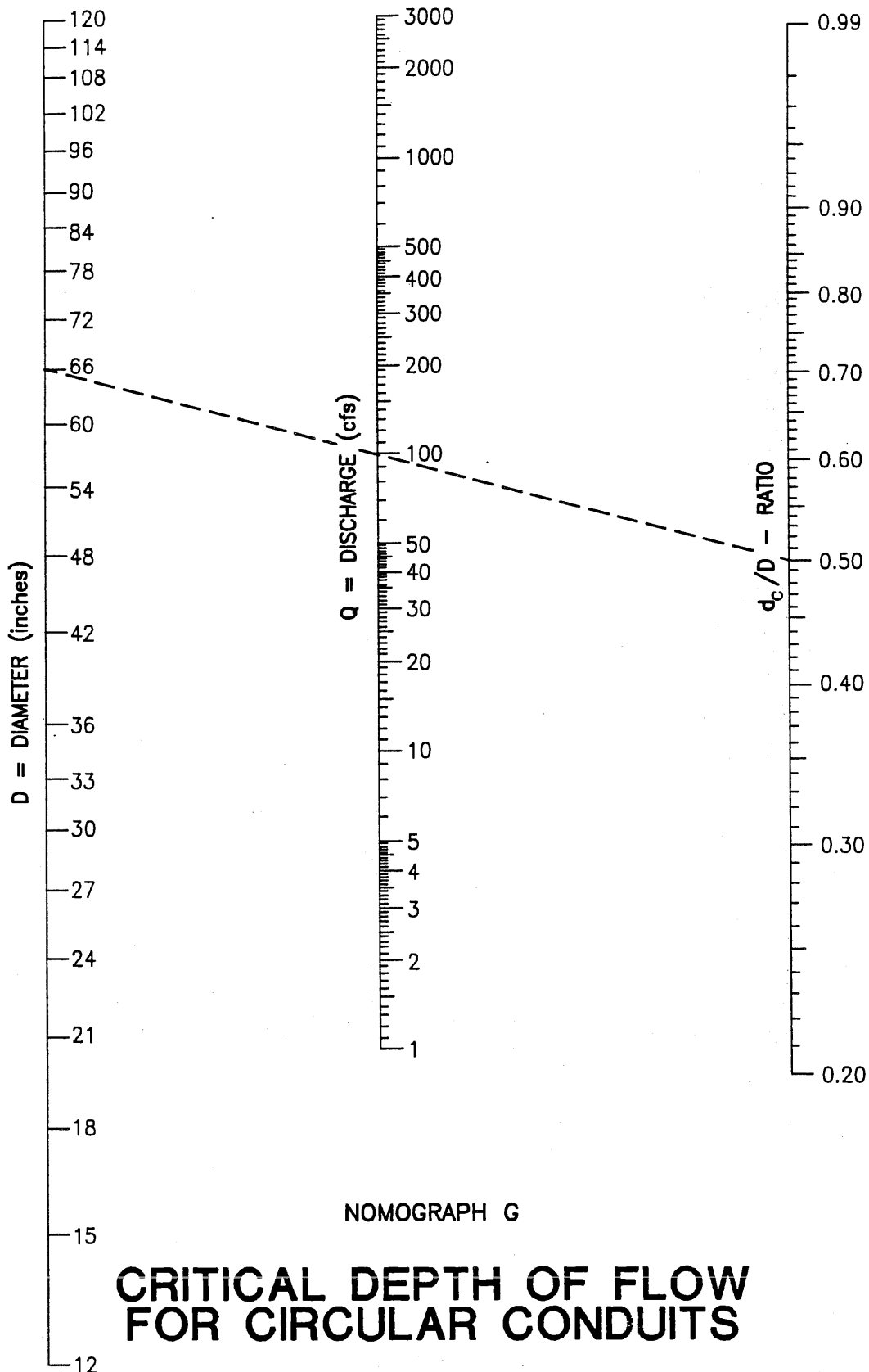
$d/D = 0.30$
 $d = 0.30 \times 3' = 0.9'$

NOMOGRAPH F

UNIFORM FLOW FOR PIPE CULVERTS

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
 PUBLIC TRANSPORTATION, BRIDGE
 DIVISION HYDRAULIC MANUAL, 12-85

FIGURE 9-14

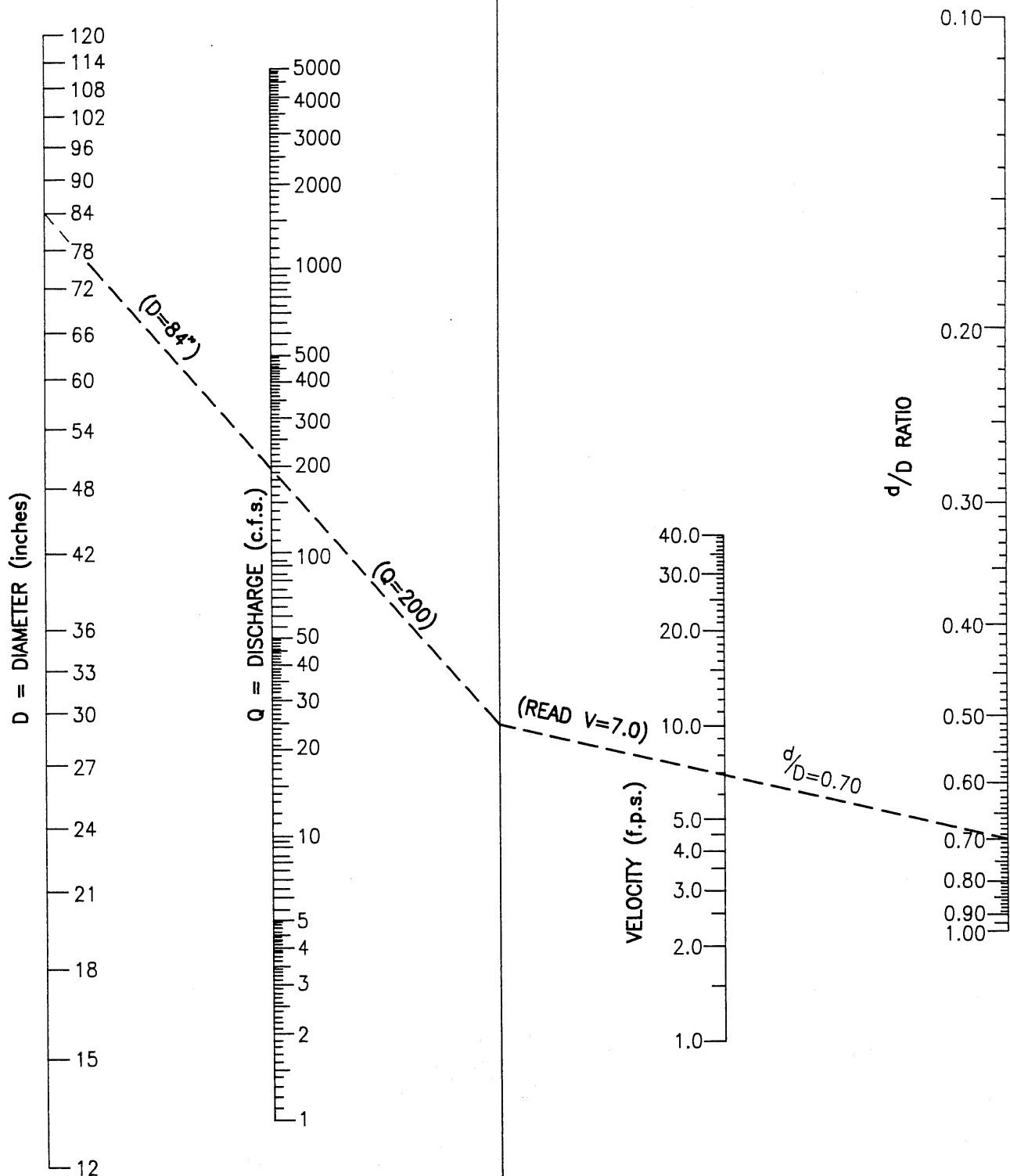


NOMOGRAPH G

CRITICAL DEPTH OF FLOW FOR CIRCULAR CONDUITS

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-15



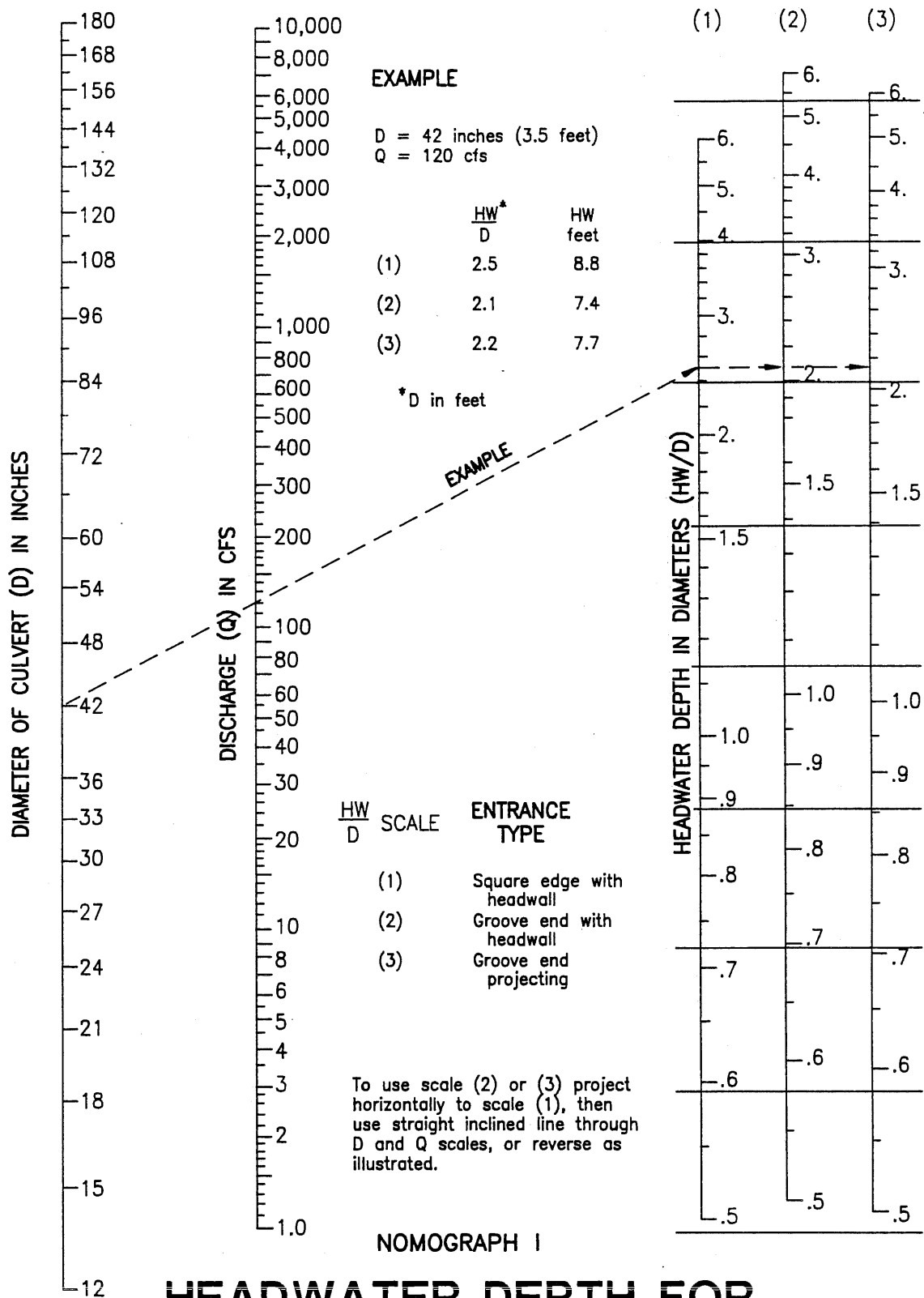
NOMOGRAPH H

VELOCITY IN PIPE CONDUITS

BASED ON $Q = VA$

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL, 12-85

FIGURE 9-16

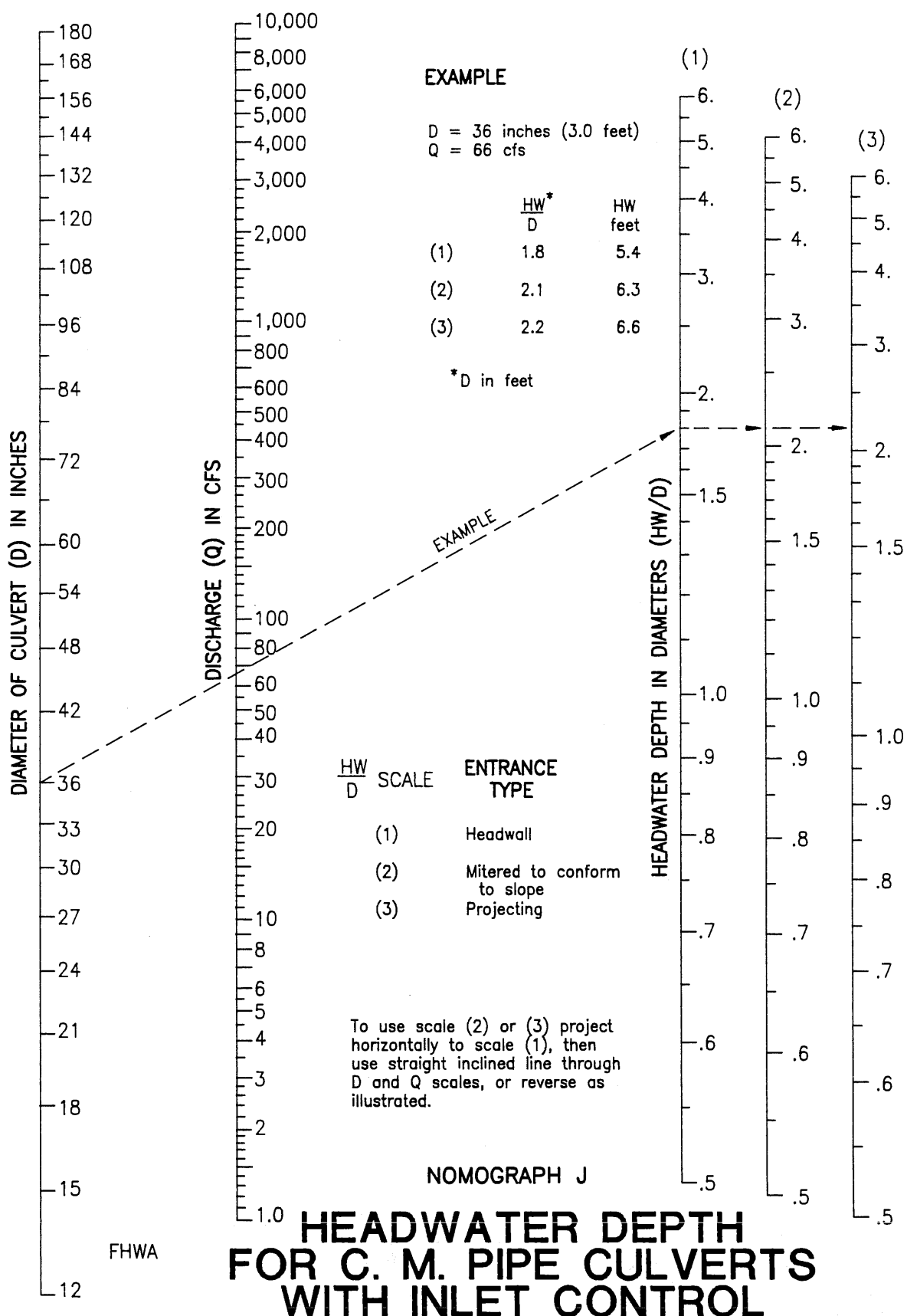


HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

FHWA

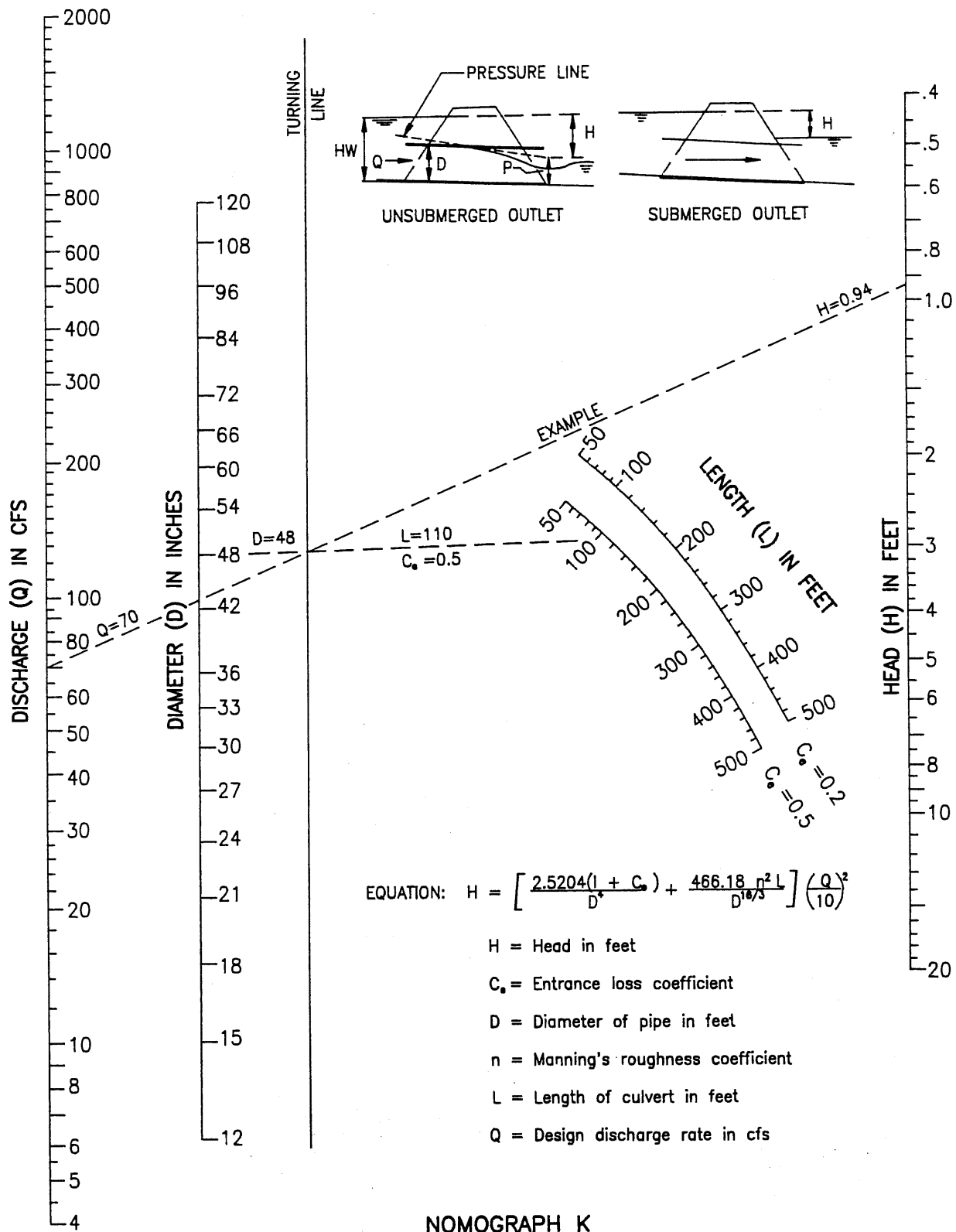
SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-17



SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85

FIGURE 9-18

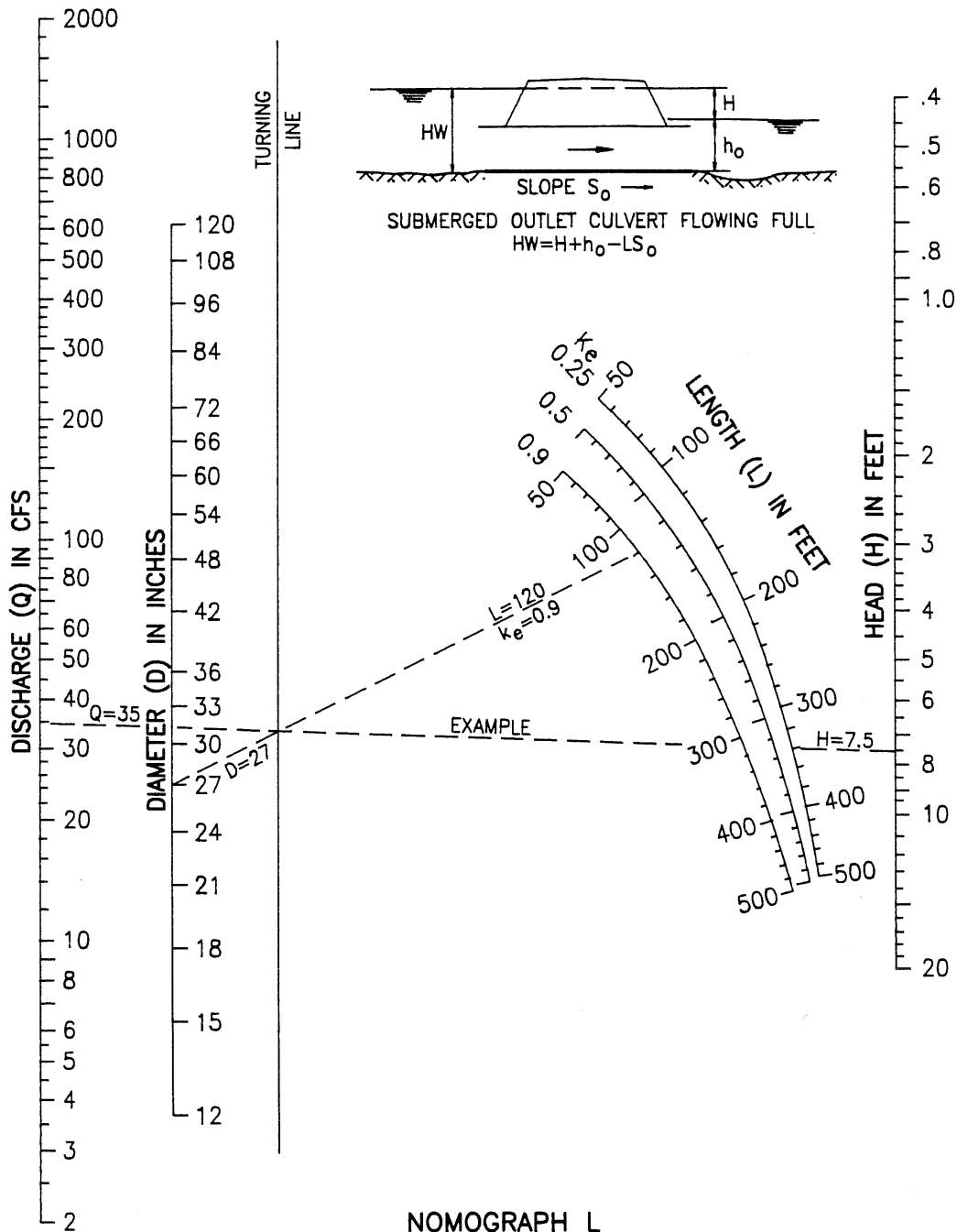


FHWA

HEAD FOR CONCRETE PIPE CULVERTS FLOWING FULL N = 0.012

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
 PUBLIC TRANSPORTATION, BRIDGE
 DIVISION HYDRAULIC MANUAL. 12-85

FIGURE 9-19

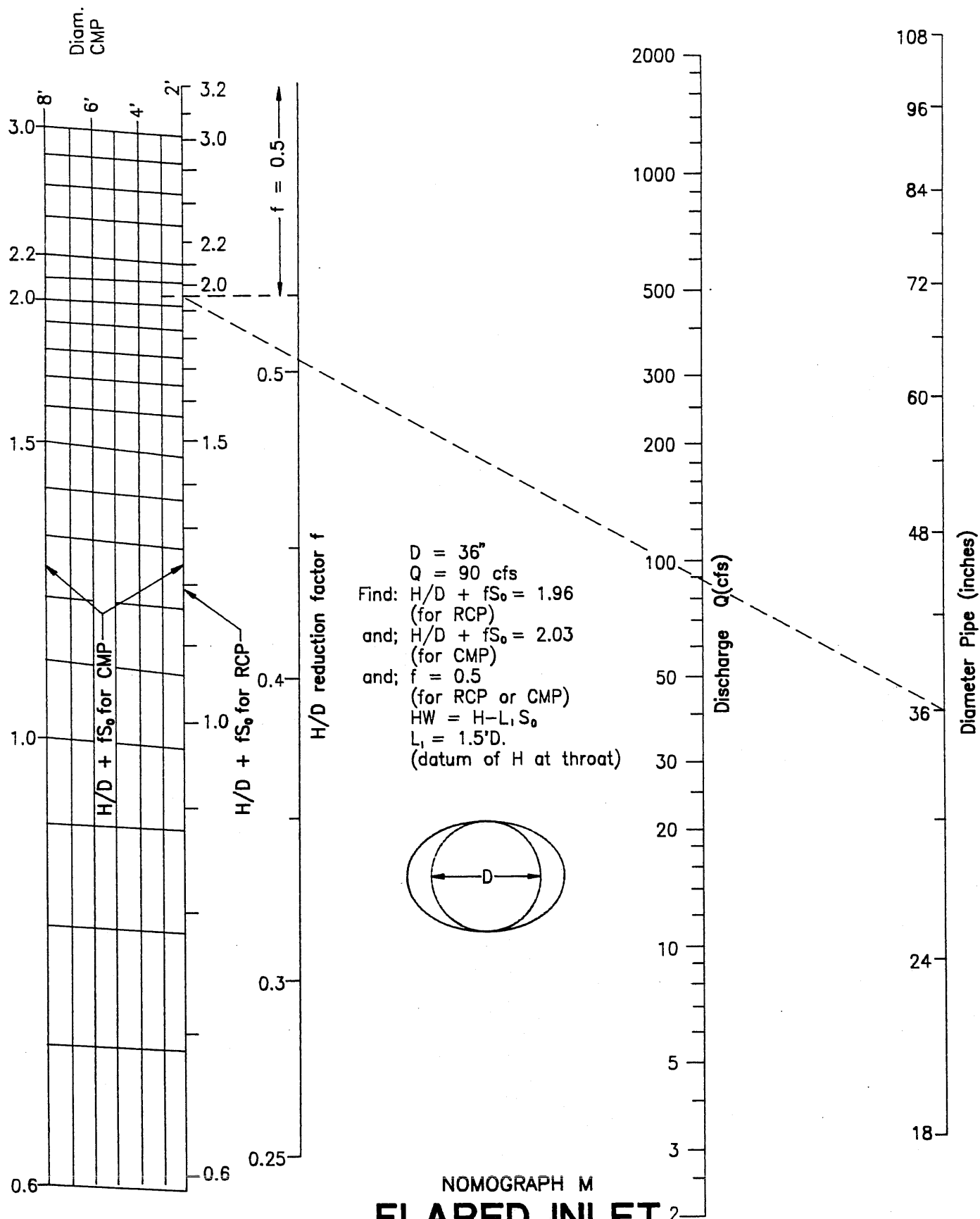


FHWA

HEAD FOR STANDARD C. M. PIPE CULVERTS FLOWING FULL N = 0.024

FIGURE 9-20

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85



SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
 PUBLIC TRANSPORTATION, BRIDGE
 DIVISION HYDRAULIC MANUAL 12-85

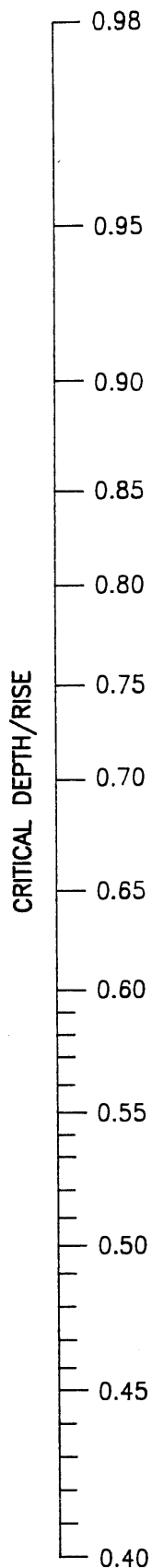
DRAINAGE

FIGURE 9-21

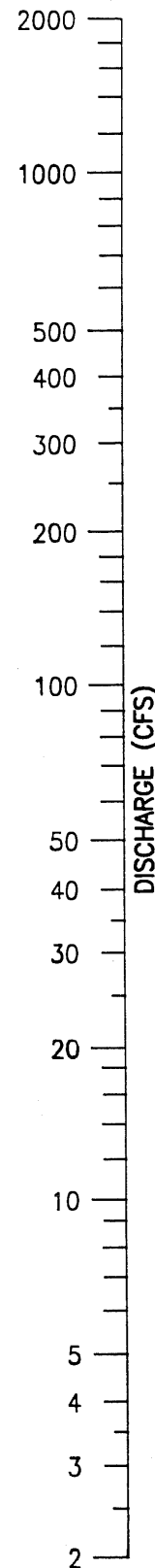
9-42

6/92

dc/RISE



Q



SIZE

87x136
82x128
77x121
72x113
68x106
63x98
58x91
53x83
48x76
43x68
38x60
34x53
32x49
29x45
27x42
24x38
22x34
19x30
14x23

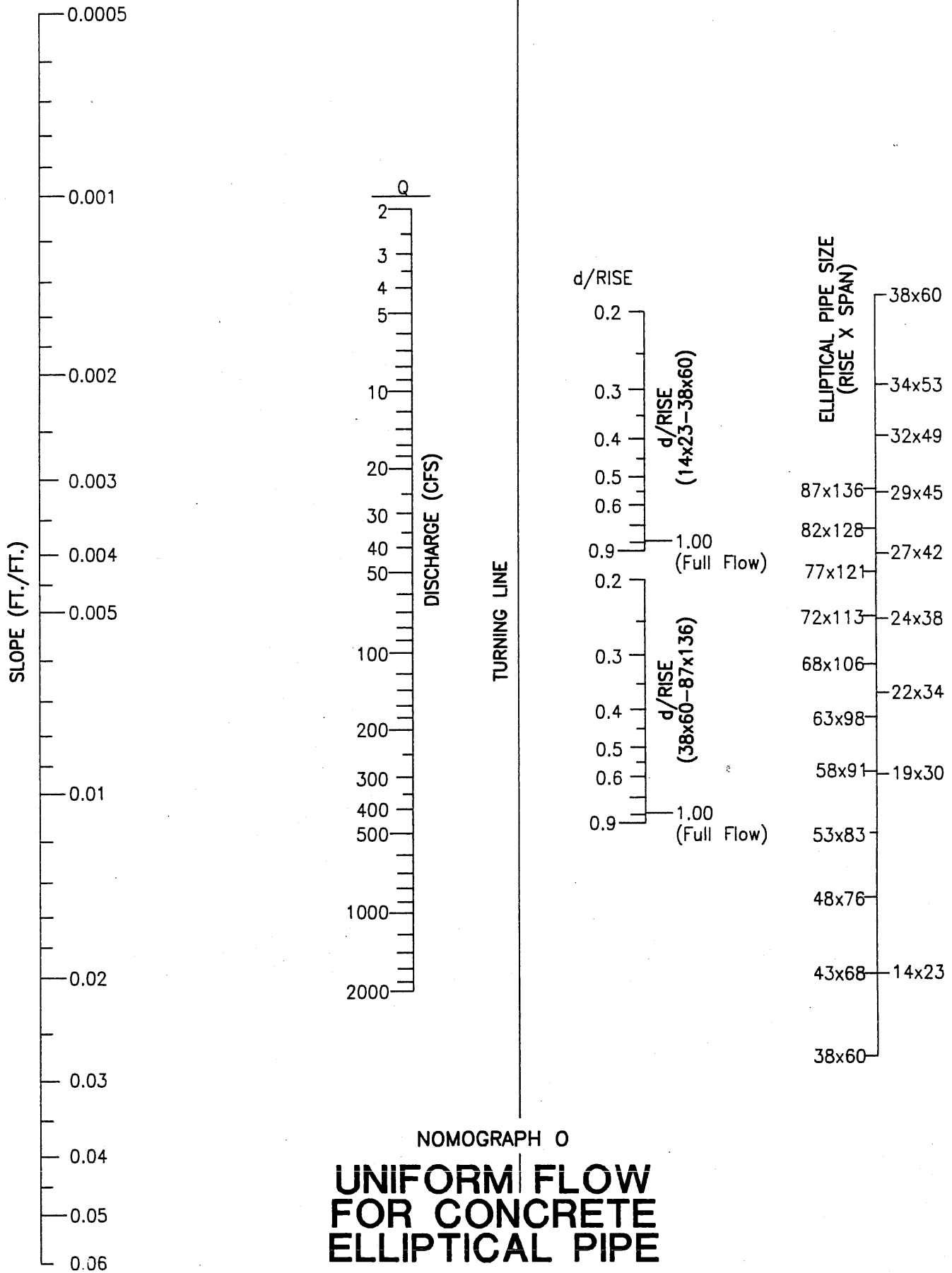
ELLIPTICAL PIPE SIZE (RISE x SPAN)

NOMOGRAPH N

CRITICAL DEPTH FOR ELLIPTICAL PIPE

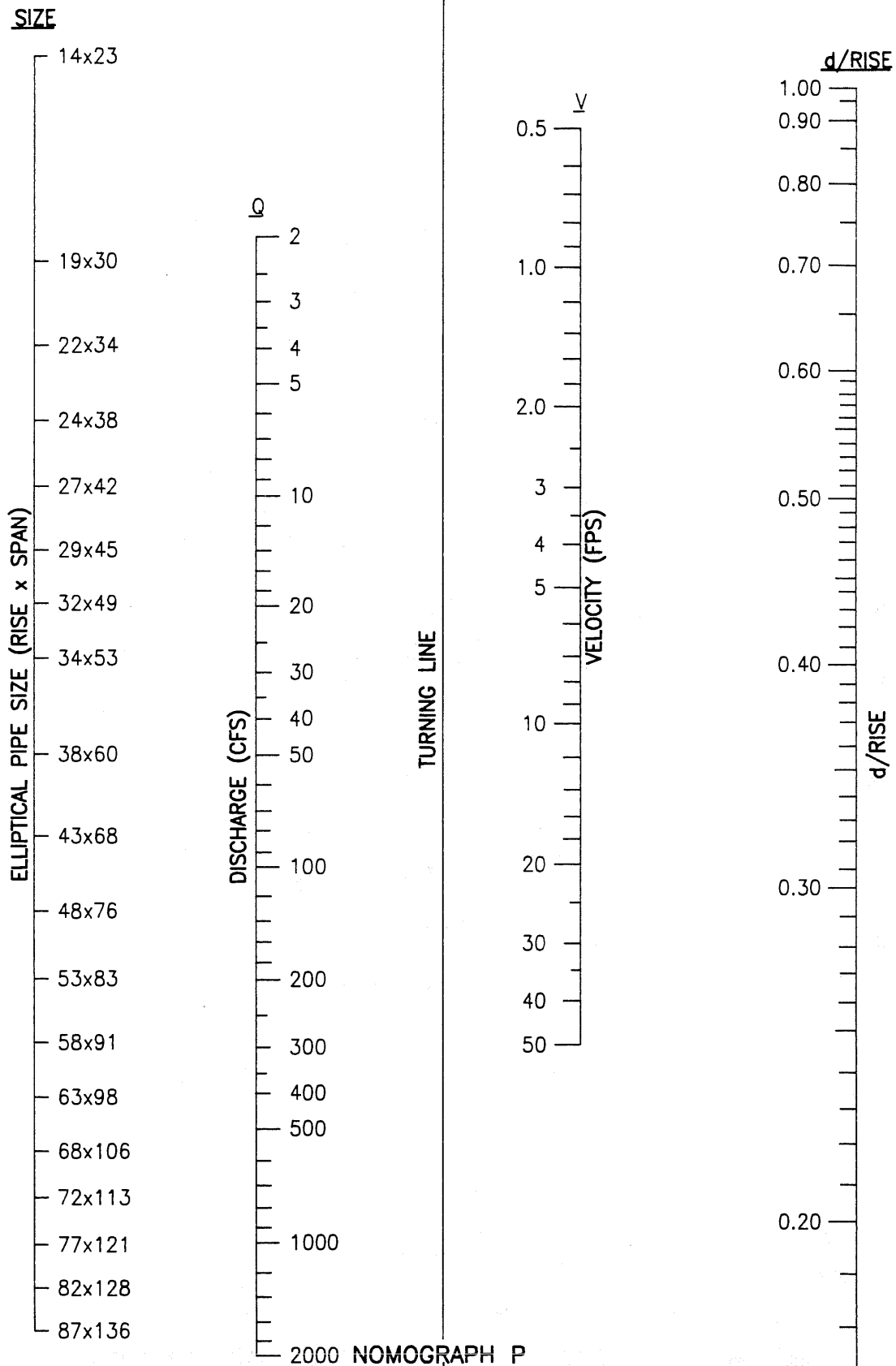
SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-22



SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL, 12-85

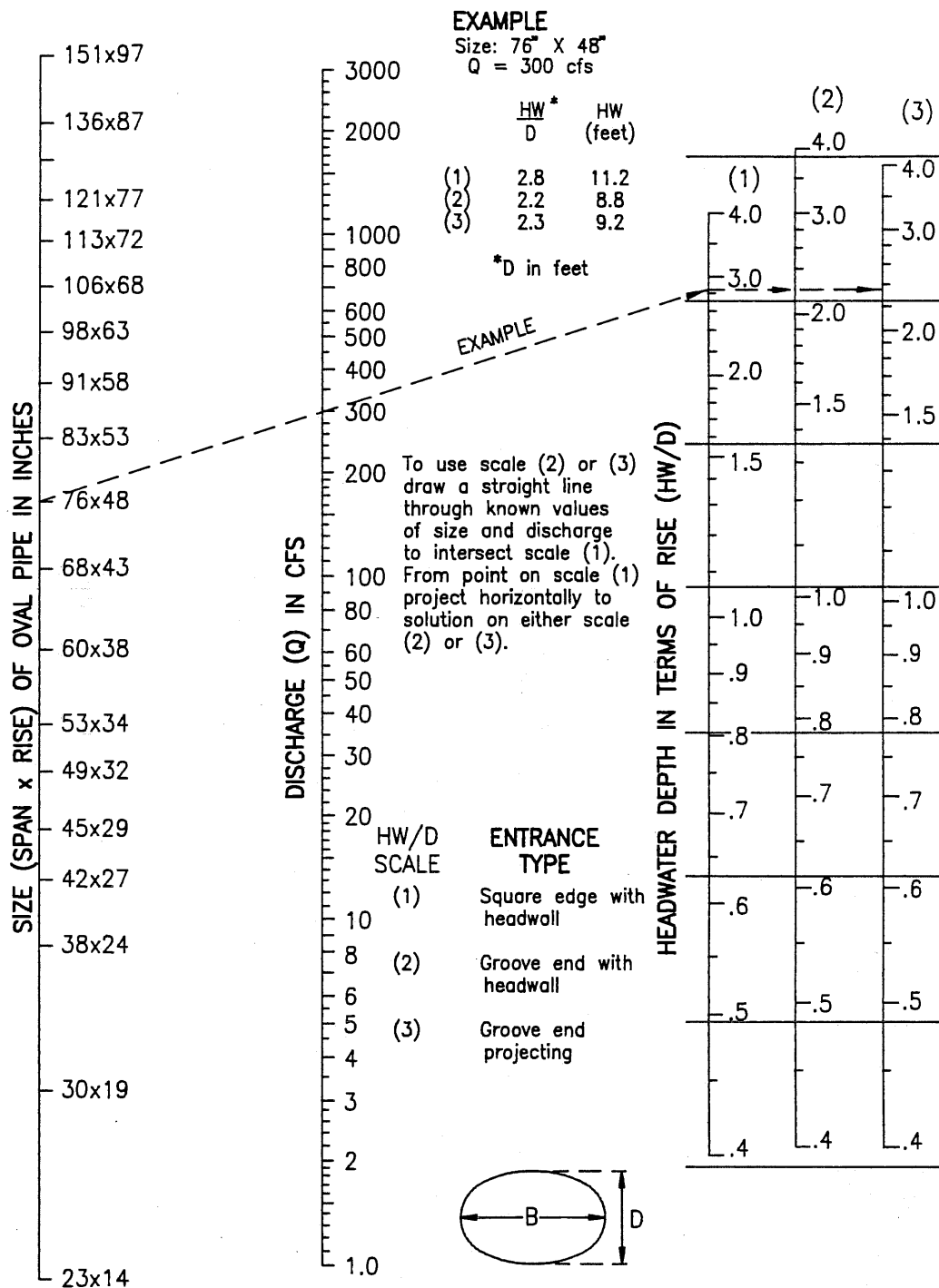
FIGURE 9-23



VELOCITY IN ELLIPTICAL PIPE

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85

FIGURE 9-24



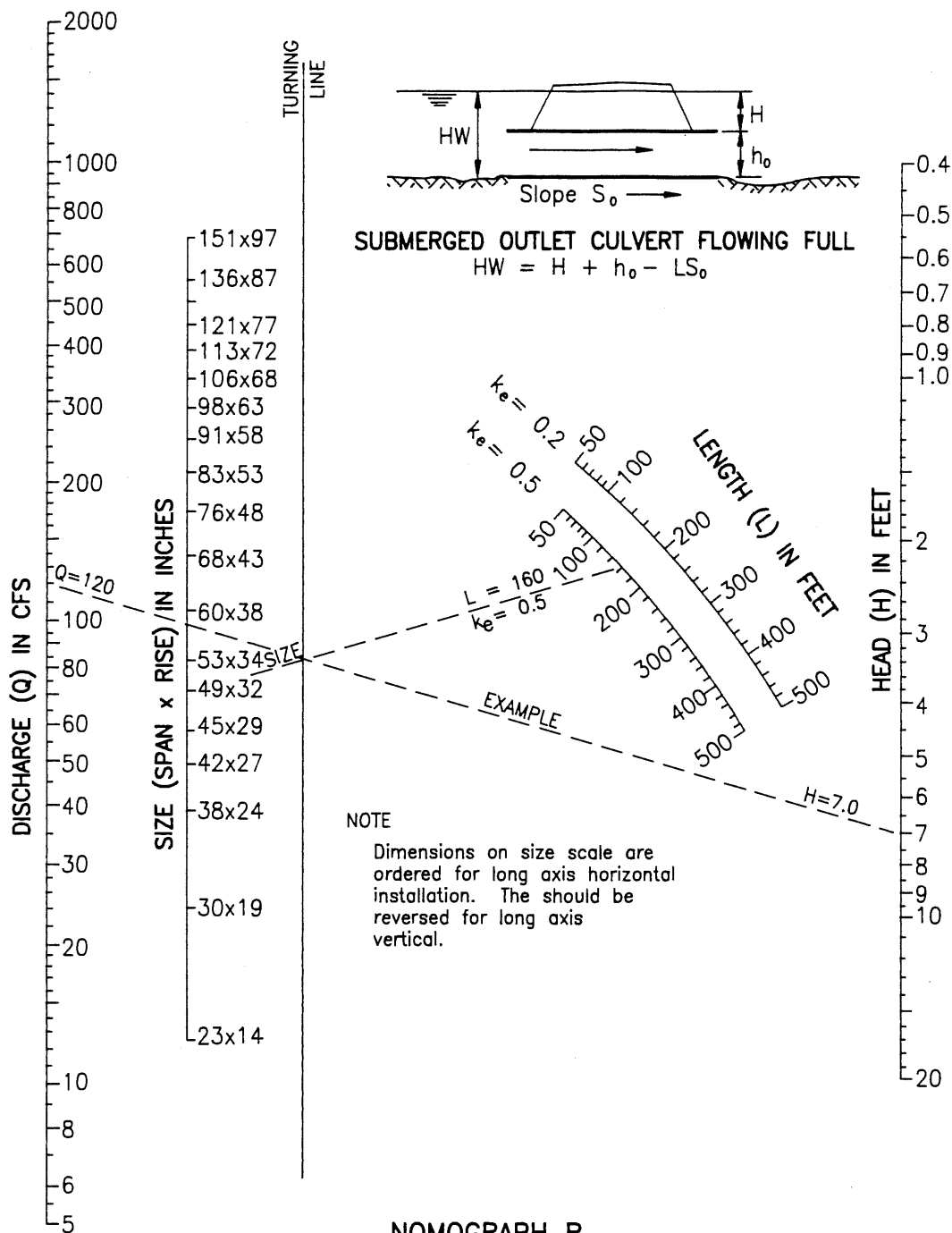
FHWA

NOMOGRAPH Q

HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL WITH INLET CONTROL

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-25



NOMOGRAPH R

**HEAD FOR ELLIPTICAL
 CONCRETE PIPE CULVERTS
 LONG AXIS HORIZONTAL OR
 VERTICAL FLOWING FULL
 $N = 0.012$**

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
 PUBLIC TRANSPORTATION, BRIDGE
 DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-26

PIPE-ARCH SIZE (RISE X SPAN)

62x102

54x88

45x73

40x65

36x58

31x51

27x43

22x36

18x29

18x22

11x18

DISCHARGE (CFS)

1000

500

400

300

200

100

50

40

30

20

10

5

4

3

2

CRITICAL DEPTH/RISE

0.99

0.95

0.90

0.80

0.70

0.60

0.50

0.40

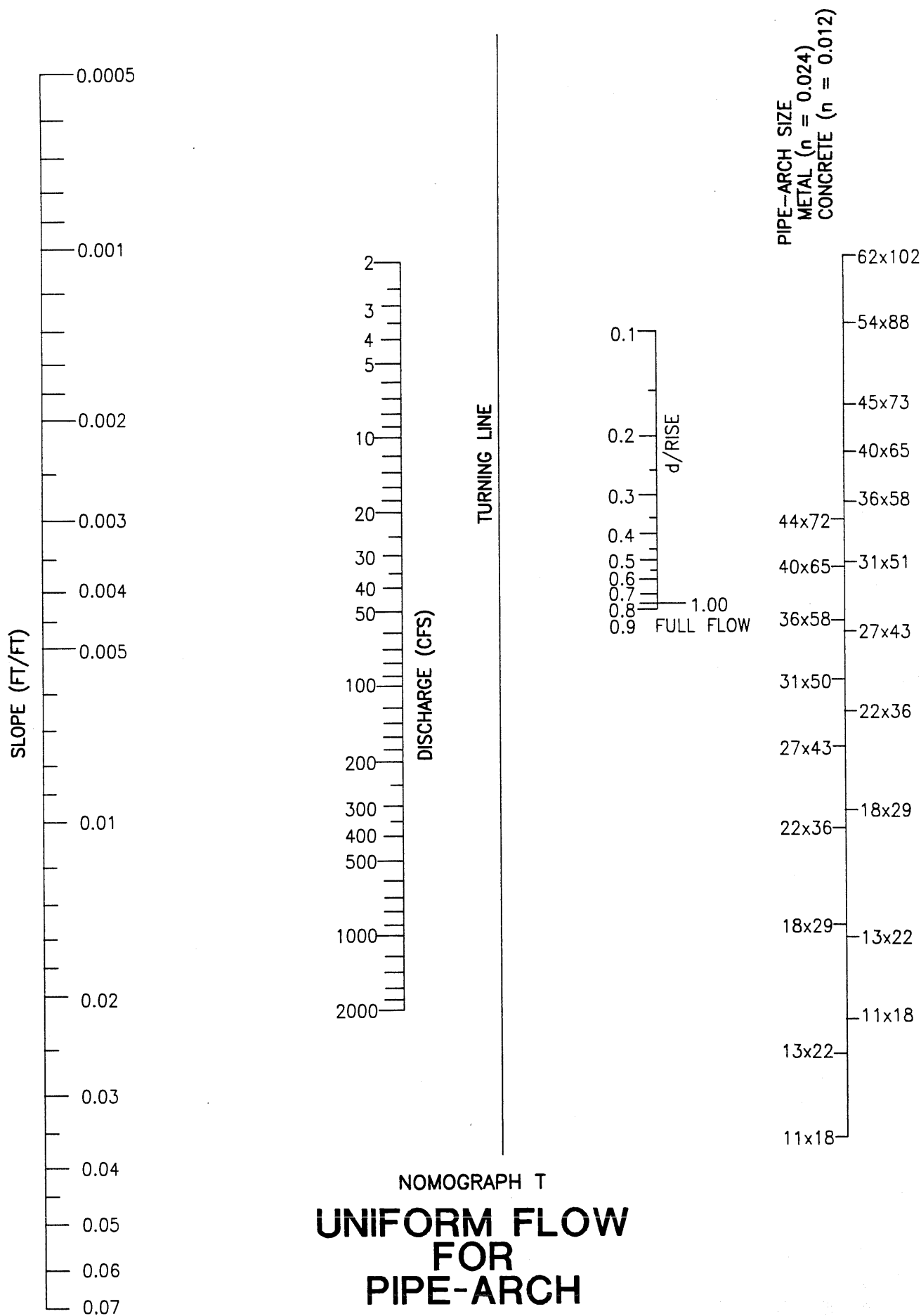
0.30

NOMOGRAPH S

CRITICAL DEPTH OF FLOW FOR PIPE-ARCH

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

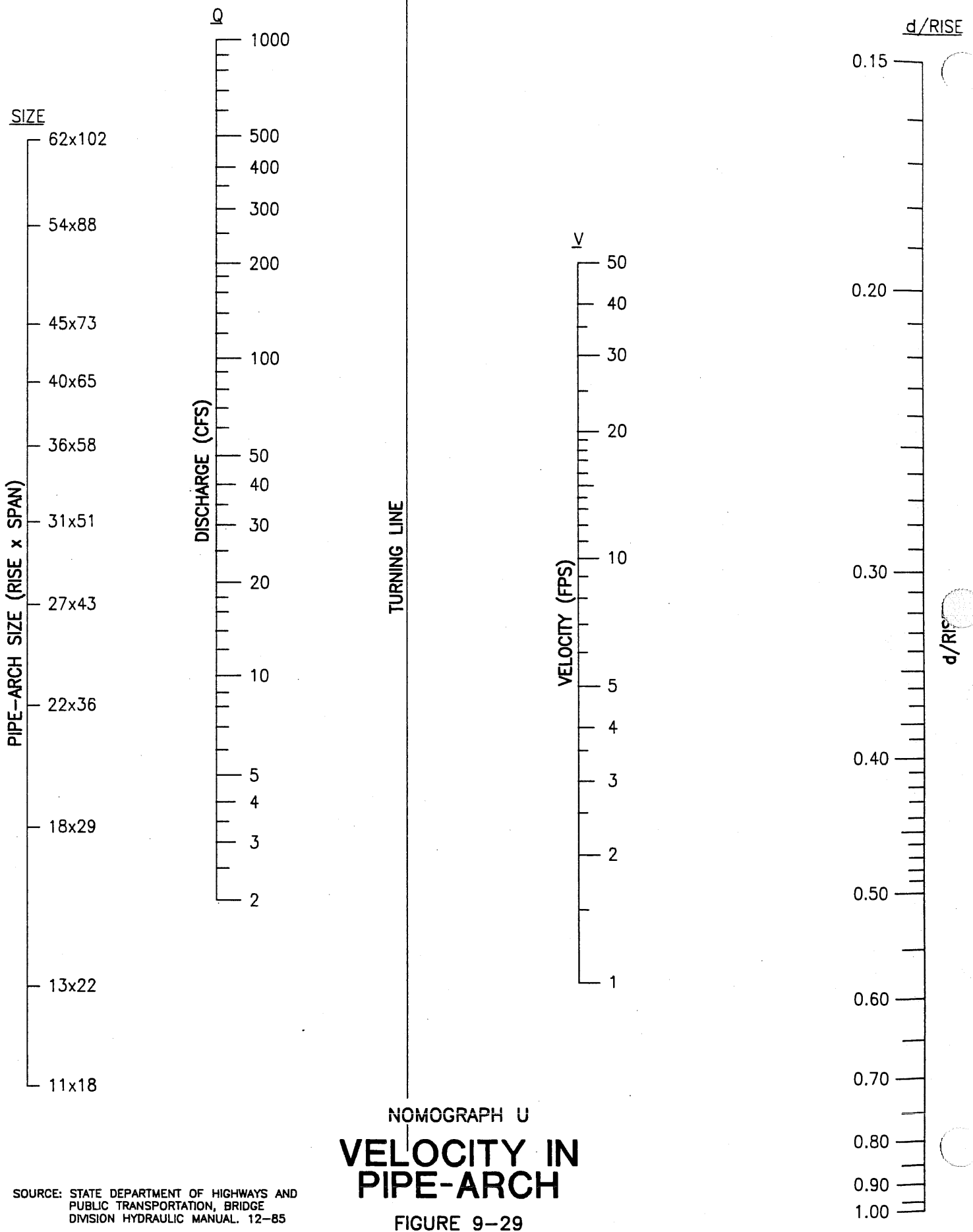
FIGURE 9-27



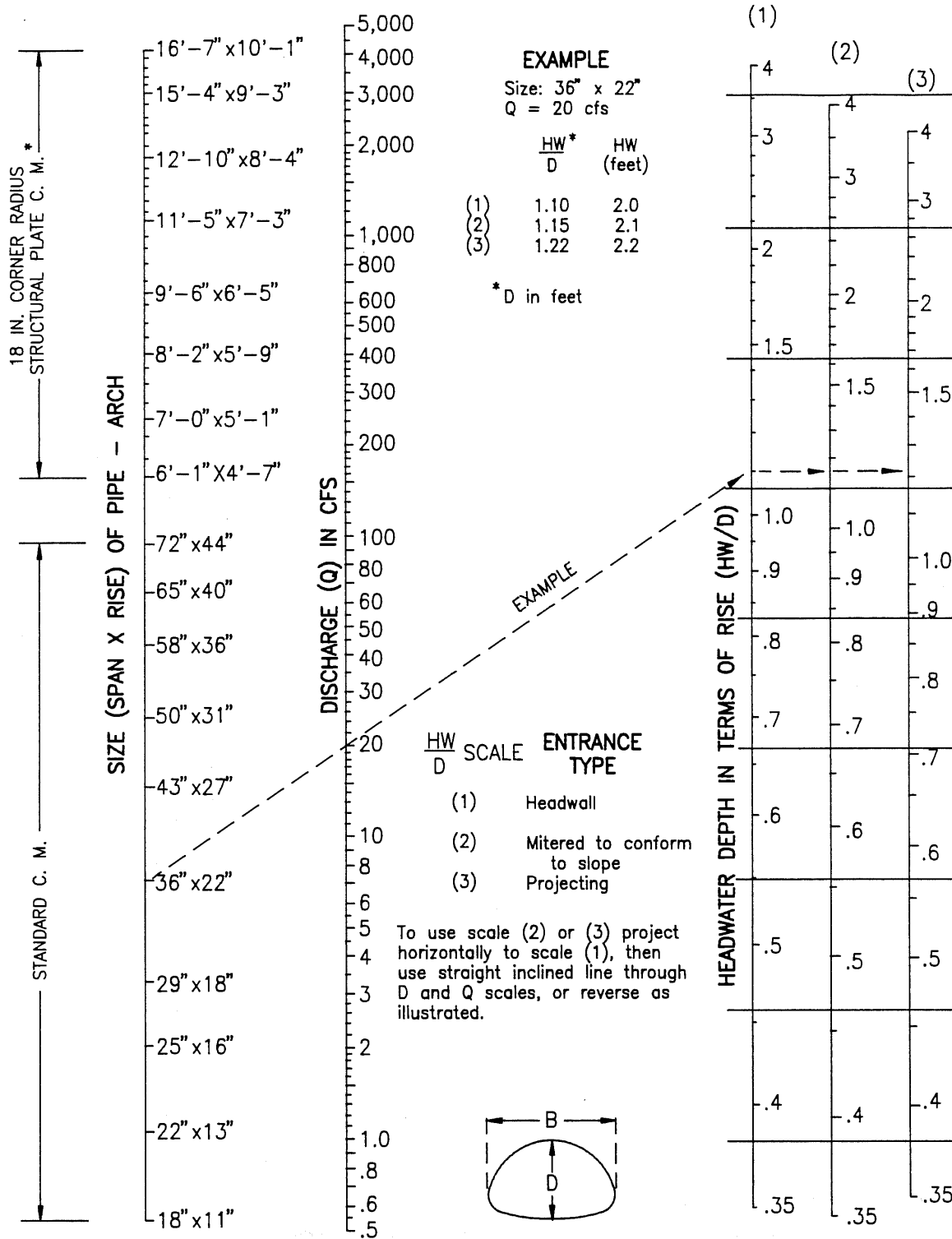
NOMOGRAPH T
**UNIFORM FLOW
 FOR
 PIPE-ARCH**

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
 PUBLIC TRANSPORTATION, BRIDGE
 DIVISION HYDRAULIC MANUAL. 12-85

FIGURE 9-28



SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85

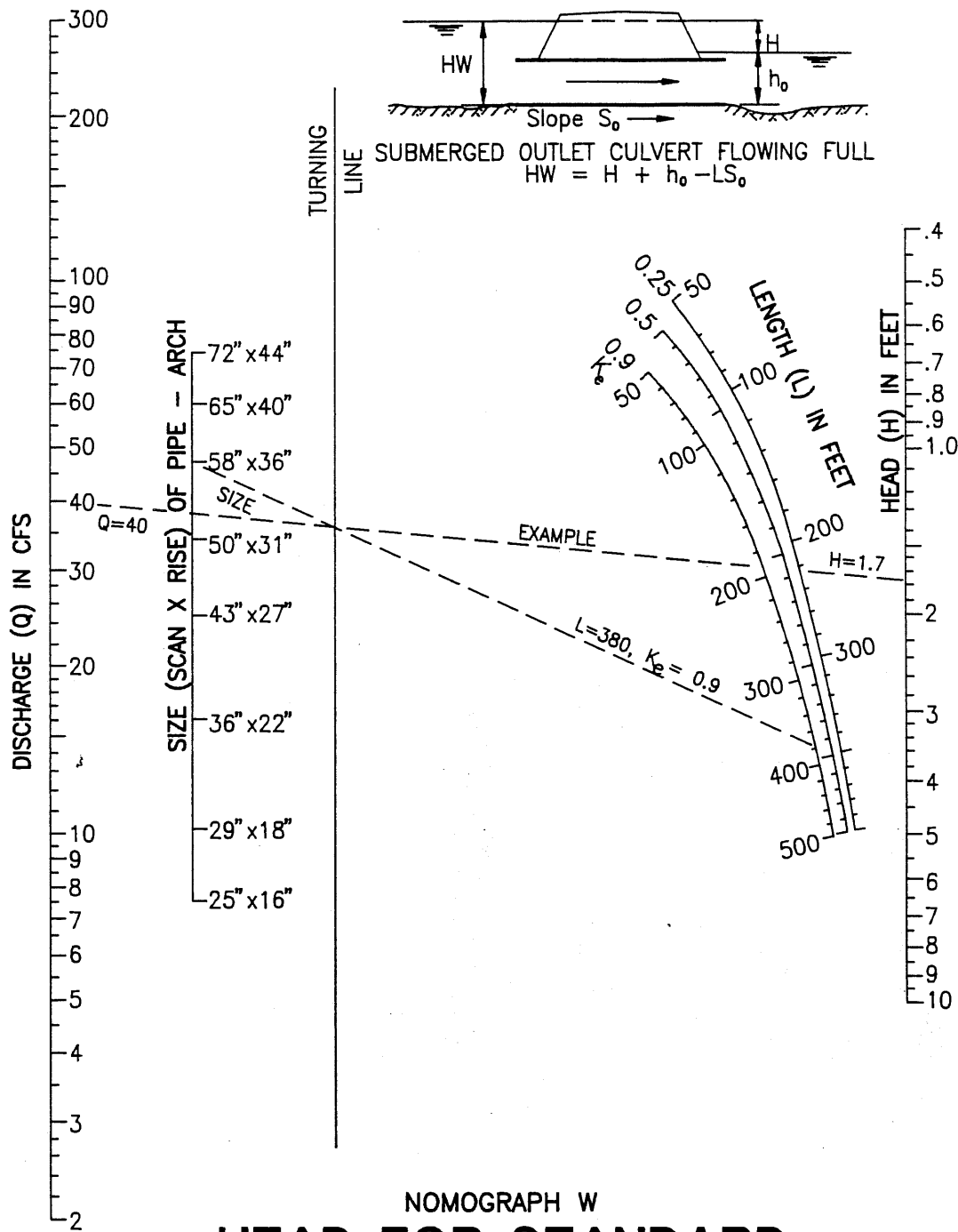


NOMOGRAPH V

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL. 12-85

FIGURE 9-30



NOMOGRAPH W

HEAD FOR STANDARD

C. M. PIPE-ARCH CULVERTS

FLOWING FULL

$N = 0.024$

SOURCE: STATE DEPARTMENT OF HIGHWAYS AND
PUBLIC TRANSPORTATION, BRIDGE
DIVISION HYDRAULIC MANUAL 12-85

FIGURE 9-31

REFERENCES

1. Portland Cement Association, Handbook of Concrete Culvert Pipe Hydraulics, 1964.
2. Texas State Department of Highways and Public Transportation, Hydraulic Manual, December 1985.
3. Texas State Department of Highways and Public Transportation, User Manual for Texas Hydraulic System (THYSYS), 1977.
4. Corps of Engineers, HEC-2 Water Surface Profiles User's Manual, September 1982.
5. Soil Conservation Service, Technical Release 61. WSP-2 Computer Program, May 1976.
6. American Concrete Pipe Association, Concrete Pipe Handbook, 1980.

SECTION 10

STORM WATER DETENTION

- 10.1 General
- 10.2 Regional Storm Water Management
- 10.3 On-Site Detention
 - 10.3.1 General Criteria for On-Site Detention
 - 10.3.2 Outlet Structure Design
- 10.4 Types of Detention Storage
 - 10.4.1 In-Line Detention
 - 10.4.2 Off-Line Detention
 - 10.4.3 Parking Lot Detention
- 10.5 Total Runoff Retention
- 10.6 Detention Pond Storage Determination
 - 10.6.1 Empirical Method
 - 10.6.2 Empirical Method Example
 - 10.6.3 Triangular Hydrograph Method
 - 10.6.4 Triangular Hydrograph Method Example
 - 10.6.5 SCS TR-55 Method
 - 10.6.6 Hydrograph Methods
- 10.7 Retention Pond Storage Determination
 - 10.7.1 Rational Method Retention
 - 10.7.2 Curve Number Method Retention
 - 10.7.3 Hydrograph Method Retention
- 10.8 Right-of-Way Requirements
 - 10.8.1 Minimum Access Road Width
 - 10.8.2 Maintenance Access Ramps to Detention Pond or Basin Bottom
- 10.9 Playa Lakes
- Bibliography

SECTION 10

STORM WATER DETENTION

10.1 GENERAL

Storm water management programs aimed at controlling increased urban runoff generated by development are a top priority in Midland's urban watershed planning. More frequent flooding, increased rates and volumes of runoff, increased channel erosion and degradation, increased sedimentation and increased water pollution are all problems intensified by development. One of the primary methods used in preventing downstream damages resulting from increased urban runoff is through the use of storm water detention facilities. Storm water detention can significantly reduce downstream flooding while providing some sediment and debris collection which can benefit water quality.

The purpose of detention is to provide for a temporary storage of the excess flows, which are then released at a controlled rate not to exceed the capacities of the existing downstream drainage systems, or the predeveloped peak runoff rate of the site, whichever is less. In some cases such as playa lakes, total retention of the runoff may be necessary.

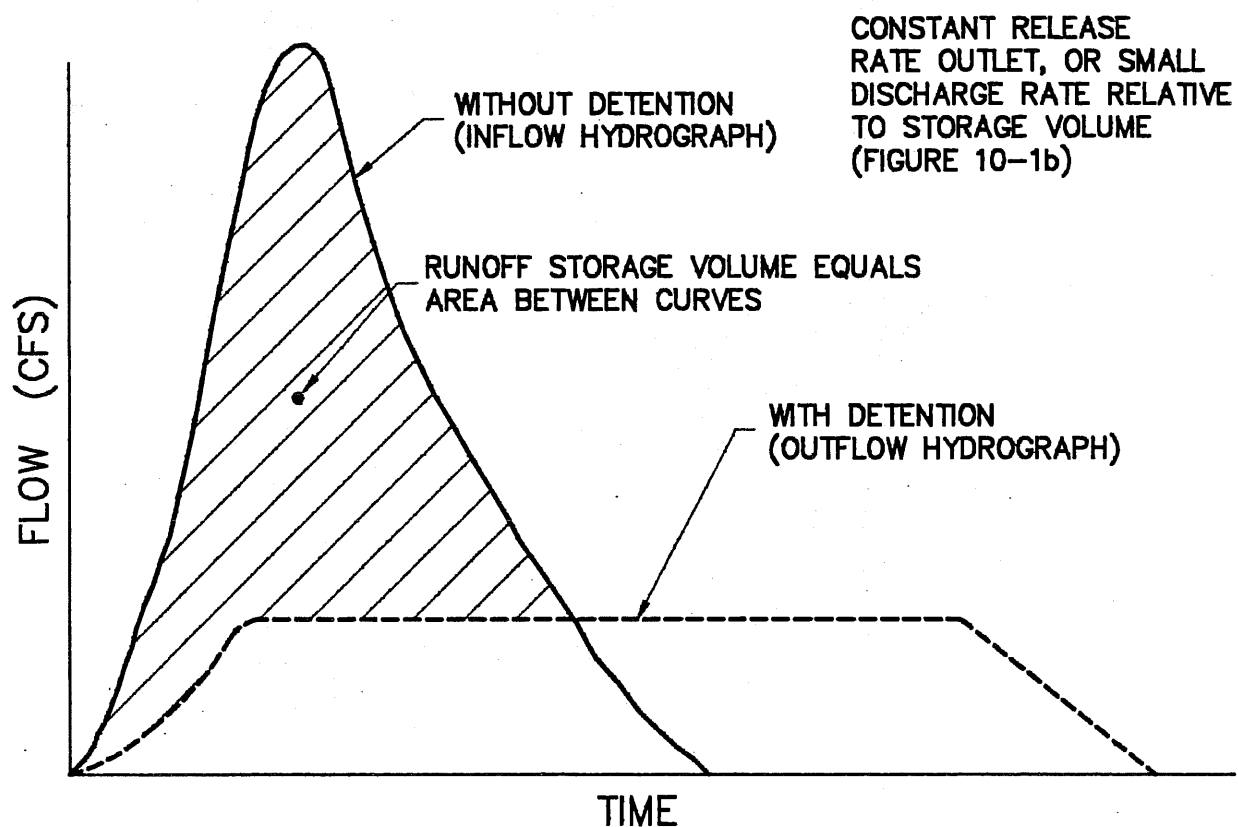
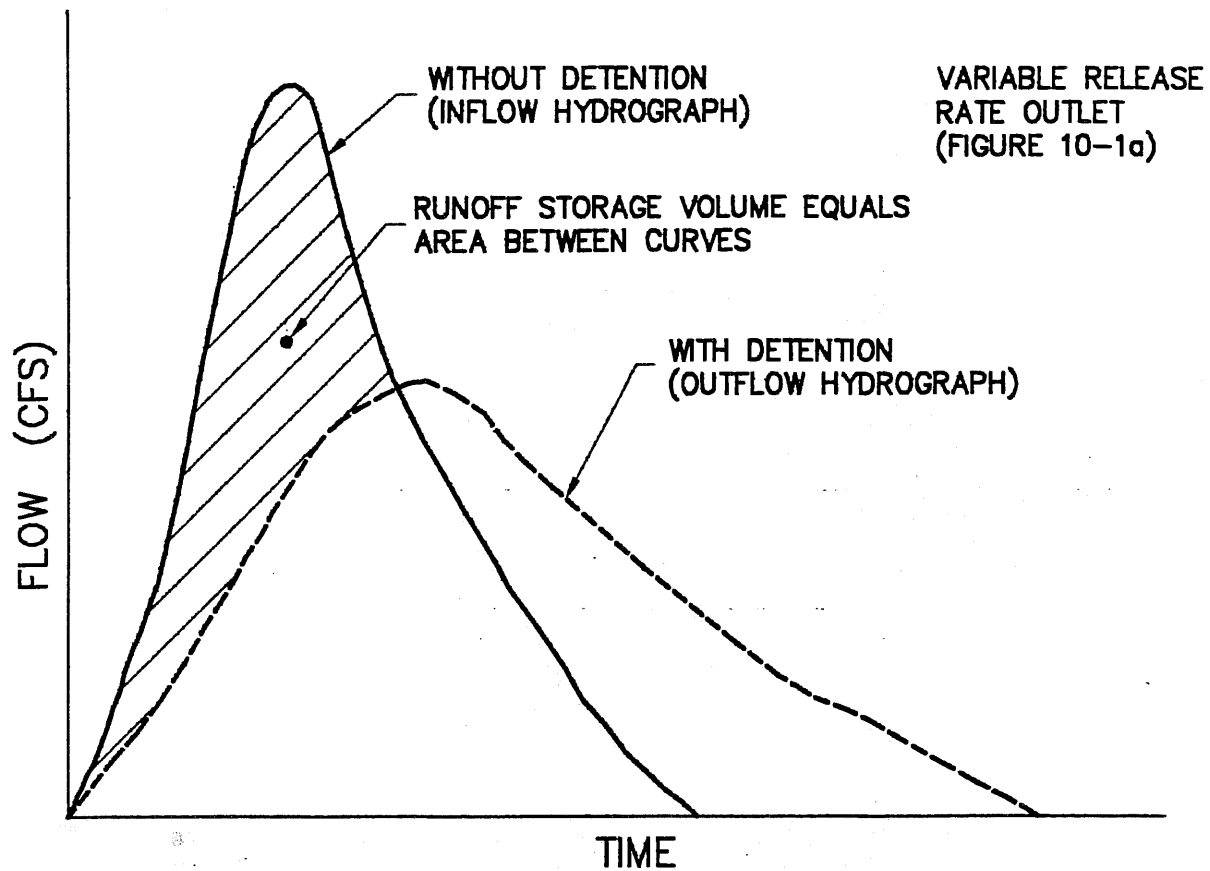
The solid lined hydrographs shown in Figure 10-1 represent typical events of storm runoff without detention, while the dashed lines depict the same events with detention. The peak flow of the uncontrolled hydrograph could exceed the capacity of the downstream conveyance system and thereby cause surcharging and flooding problems. With the introduction of the detention facility, the solid lined hydrograph is spread over a longer time period and its shape is transferred into the reduced peak of the dashed hydrograph. The area between the two curves to the left of their intersection represents the volume of stored runoff, as well as the minimum required volume for the detention pond. It should be emphasized that the function of a detention pond is to merely reduce the peak flow rate of the inflow hydrograph to an acceptable level but does not reduce the total volume.

The City of Midland approaches the control of excess flows through the application of both on-site and regional detention. Essentially, the distinction between the two approaches to control is that on-site detention is generally limited to relatively small areas involving site specific criteria, while regional detention incorporates a basin-wide hydrologic analysis which covers a much larger area with much more diversified land use. However, both on-site and regional detention designs shall be based on attenuation of the peak discharge resulting from the 100-year, 24-hour storm.

10.2 REGIONAL STORM WATER MANAGEMENT PROGRAM

Wherever feasible, a regional storm water detention facility is preferred over on-site detention. The advantages of a regional facility are:

A. A higher level of confidence in the hydrologic analysis is obtained because the analysis can readily determine each detention pond's interrelationship within a given basin.



TYPICAL DETENTION HYDROGRAPHS

FIGURE 10-1

B. Maintenance is more assured due to the City's vested interest and responsibility in the program.

C. The unit cost of construction along with the total land requirement can be considerably less than that needed for comparable on-site detention.

D. The expanded land area required for regional detention lends itself to other uses such as parks, nature areas and playing fields.

10.3 ON-SITE DETENTION

On-site detention facilities have the single purpose of controlling the excess runoff from a particular site or subdivision. Their use is particularly beneficial in situations where a site's storm water runoff discharges into a system with limited flow capacity. There are, however, certain minimum standards that must be followed with any design. The following is a listing of the general as well as some of the specific design criteria for on-site detention ponds.

10.3.1 General Criteria for On-Site Detention

A. The rate of outflow shall, at a minimum, be based on the predeveloped peak flow of the 100-year, 24-hour storm. In addition, the capacity of the existing downstream systems must be considered in determining the need for detaining any more frequent storms. This requirement is not intended to force an infinite number of storm investigations, but rather to assure the designer's understanding of the hydrologic and hydraulic relationship of the development to adjoining and downstream properties.

B. The rate of inflow to the storage facility must be calculated based on the assumption of full development of the site.

C. The outlet structures should be designed on the basis of inlet or outlet control, whichever is applicable. The structures should be capable of safely and properly passing the flow range of the design storm frequencies.

D. No outlet structures from detention, filtration and/or sedimentation ponds, parking detention or other concentrating structures shall be designed to discharge concentrated flow directly onto arterial or collector streets. Such discharges shall be conveyed by a closed conduit to the nearest existing storm sewer. If there is not an existing storm sewer within 300 feet, the outlet design shall revert the discharge back to sheet flow, following as near as possible the direction of the gutter.

E. When a site is situated such that off-site runoff will be draining through the property and into the detention site, provisions must also be made in the overflow system for this runoff. The designer should understand that any mixing of on-site with off-site flows tends to produce inefficiencies in the pond. This criteria should not be confused with in-channel detention which is discussed in F below.

F. A detention site that is placed within an existing channel that is accessed by more than one development shall be referred to as an in-channel detention pond. In this situation the designer is required to perform a 100-year, 24-hour hydrograph analysis which details the relationship of the

existing site, the developed site with detention, and the channel. This should be reviewed with the City to determine if additional analysis is required. The review will emphasize hydrograph timing to see if any adverse effects occur. If adverse effects do occur, then measures must be incorporated which mitigate those effects.

G. When designing detention sites in series (i.e., when the discharge of one site becomes the inflow of a downstream site), the designer must submit a hydrologic analysis which demonstrates the system's adequacy. This analysis must incorporate the construction of hydrographs for all inflow and outflow components.

H. Areas which do not discharge into a detention or sedimentation area (uncontrolled flows) must be accounted for by a reduction in the allowable release rate from the detention pond equal to the discharge from the uncontrolled area.

I. All pipes discharging into a public storm sewer system shall have a minimum diameter of 24 inches and shall be constructed of the materials allowable for storm drains in "Section 6: Storm Drains."

J. On-site detention shall be limited on size by land use.

<u>Land Use</u>	<u>Detention Facility Site</u>
Contiguous Commercial Site (e.g. shopping mall)	≤ 25 acres
Industrial	≤ 10 acres
Individual Multi-Family Housing	≤ 15 acres
Single Family Housing	≤ 5 acres

10.3.2. Outlet Structure Design

There are three basic types of outlet control structures: those incorporating orifice flow, those incorporating pipe flow, and those incorporating weir flow as shown on Figure 10-2. Weir flow is additionally broken down into two categories: the rectangular and the V-notch types. In each type, the bottom edge of the weir over which the water flows is called the crest. Two cases, sharp-crested and broad-crested weirs, are the most common cases.

Generally, if the weir crest thickness is more than 60% of the nappe thickness, the weir should be considered broad-crested. The coefficients for sharp-crested and broad-crested weirs vary. The respective weir and orifice flow equations follow.

A. Rectangular Weir Flow Equation

With end contractions and free discharge.

$$Q = CH^{1.5}(L-0.2H) \quad (\text{Eq. 10-1})$$

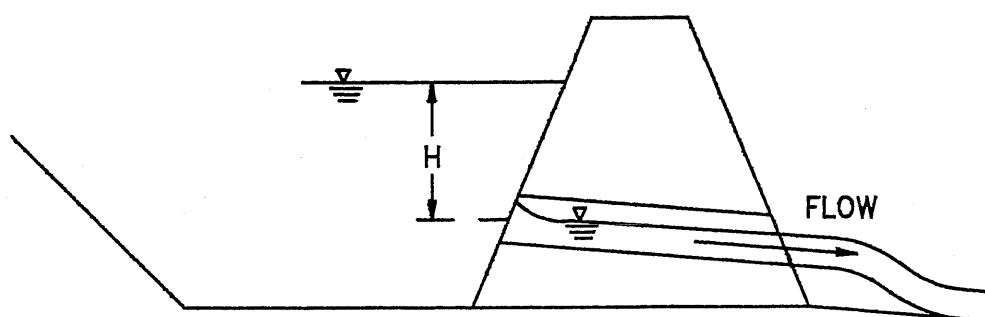
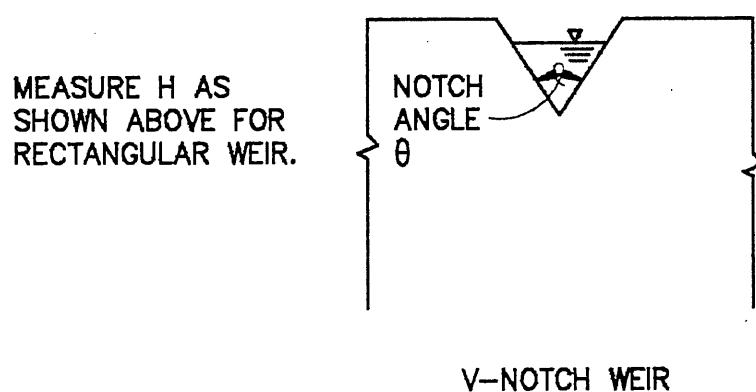
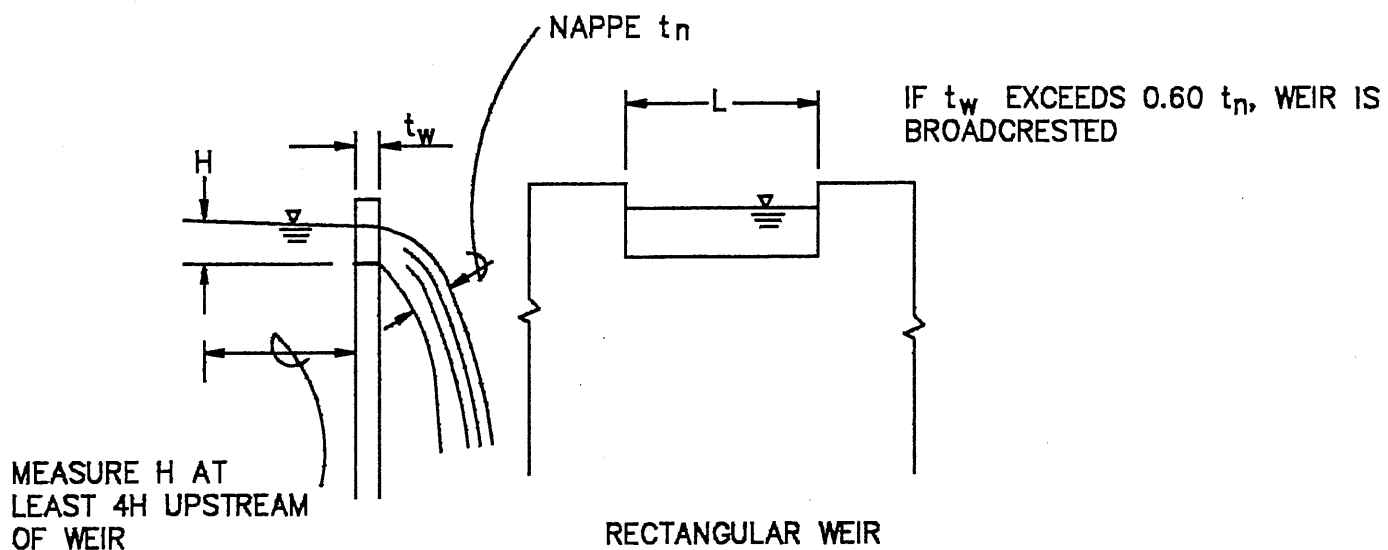
where

Q = Weir discharge, cfs

C = Weir Coefficient, usually 3.33 for sharp-crested weir. References 8 and 9 contain weir coefficients for broad-crested weirs.

L = Horizontal length of weir crest, ft.

H = Depth of ponded water above weir crest elevation, ft.



TYPICAL WEIR AND ORIFICE FLOWS

FIGURE 10-2

B. V - Notch Weir Flow Equation

$$Q = C_v \tan (\theta/2) H^{2.5} \quad (\text{Eq. 10-2})$$

where

Q = Weir discharge, cfs

C_v = Weir Coefficient. References 8, 9, and 10 contain coefficients for use with V-notch weirs.

θ = Angle of the notch at the apex, degrees

H = Depth of ponded water above weir crest elevation, ft.

C. Orifice Flow Equation

$$Q = C_o A (2gH)^{0.5} \quad (\text{Eq. 10-3})$$

where

Q = Orifice discharge, cfs

C_o = Orifice Coefficient (use 0.6)

A = Orifice Area, sq. ft.

g = Gravitational constant, 32.2 ft/sec/sec

H = Head on orifice measured from orifice centerline, ft.

10.4 TYPES OF DETENTION STORAGE

10.4.1 In-Line Detention

In-line detention refers to runoff storage in facilities that are connected in-line with the storm water conveyance system. Examples of in-line runoff storage facilities include, but are not limited to:

- (1) concrete basins,
- (2) pipe packages,
- (3) tunnels,
- (4) underground caverns, and
- (5) surface ponds.

10.4.2 Off-Line Detention

Off-line detention refers to runoff that is diverted from the conveyance system and temporarily stored when a predetermined flow rate is exceeded. The diverted runoff is stored in the off-line facility until such time as the conveyance system has sufficient capacity to handle the release of the diverted water.

With off-line detention, several factors must be considered during design. These include:

- (1) holding time needed to avoid odor or public health problems,
- (2) hydraulic capacity of the downstream system,
- (3) hydraulic load on the downstream system at any given time, and

- (4) the possibility for additional inflow before the storage is empty.

10.4.3 Parking Lot Detention

Parking lots and other paved surfaces can be used for storm water detention. An advantage to this system of detention in a commercial development is that very little additional land needs to be dedicated to the detention of the storm water. The following considerations should be utilized when designing a parking lot detention facility:

- (1) Keep the frequency of ponding to a minimum. The parking lot should not have ponding more than once in 5 or 10 years.
- (2) The maximum depth of ponding should not exceed 8 inches.
- (3) The lot should drain quickly, preferably in less than 30 minutes.
- (4) The deepest areas of ponding should be located in the least used portions of the lot.
- (5) The flow restrictors at the detention discharge location should be located out of easy reach in order to reduce possible vandalism and to deter the restrictors removal.

10.5 TOTAL RUNOFF RETENTION

In some cases total runoff retention will be necessary because of a lack of outlets, because the discharge of storm water runoff to downstream areas would be detrimental, or because predeveloped conditions show that a nondischarge situation exists (especially in playa lake situations as discussed later in paragraph 10.9). Total runoff retention means that all runoff associated with a drainage area or watershed must be collected and impounded in a pond or basin. The usual water releases from the retention pond or basin are only through evaporation and through seepage into strata underlying the pond's bottom surface.

There may also be circumstances in which a downstream outlet is available, but the release rate through the hydraulic outlet structure is so low that the pond or basin design is essentially for total retention. For one hypothetical example, a pond with an outlet that takes 20 days for total drainage is a total retention design for all practical purposes. Where a pond has an outfall pipe equipped with a valve which is planned to generally remain closed, the basin should be sized as a total retention basin.

10.6 DETENTION POND STORAGE DETERMINATION

There are four methods considered acceptable for determination of the storage requirements for a detention site. These are (1) the Empirical Method, (2) the Triangular Hydrograph Method, (3) SCS TR-55 Method, and (4) Hydrograph Methods. The choice of which method to use is governed by the size and the discharge rate of the area being analyzed, as well as whether the results must be included in downstream routing. The most noticeable difference between the Triangular Hydrograph Method and the Hydrograph Method is that the Triangular Hydrograph Method is a simplified approximation of the dynamic routing procedure used in the Hydrograph Methods. Required storage estimates may vary widely and

some methods may also over-estimate detention needs. It is not necessary to use the highest value in all cases. However, an actual hydrograph routing is the best and most accurate method, especially if the pond outfall is under outlet control.

The Empirical Method may be used for areas of 30 acres or less. The Triangular Hydrograph Method may be used for on-site detention and drainage areas of 100 acres or less. The SCS TR-55 Methods are restricted to drainage areas of one square mile for hand calculations or three square miles for computer model versions. Of course, there are no limits on the Hydrograph Methods since they employ HEC-1 and TR-20 computer models.

10.6.1 Empirical Method

For drainage areas of less than 30 acres, the following formula may be used to calculate the required storage area. Preliminary investigations by the City of Midland Engineering Department indicate that this is a conservative estimate where the outlet structure operates under inlet control. All submittals using this method will be checked by other methods until more data is accumulated. The peak discharge from the site is limited to predeveloped conditions.

$$V_s = 0.2 A \quad (\text{Eq. 10-4})$$

where,

$$\begin{aligned} V_s &= \text{Required storage, acre-feet} \\ A &= \text{Drainage area, acres} \end{aligned}$$

10.6.2 Empirical Method Example

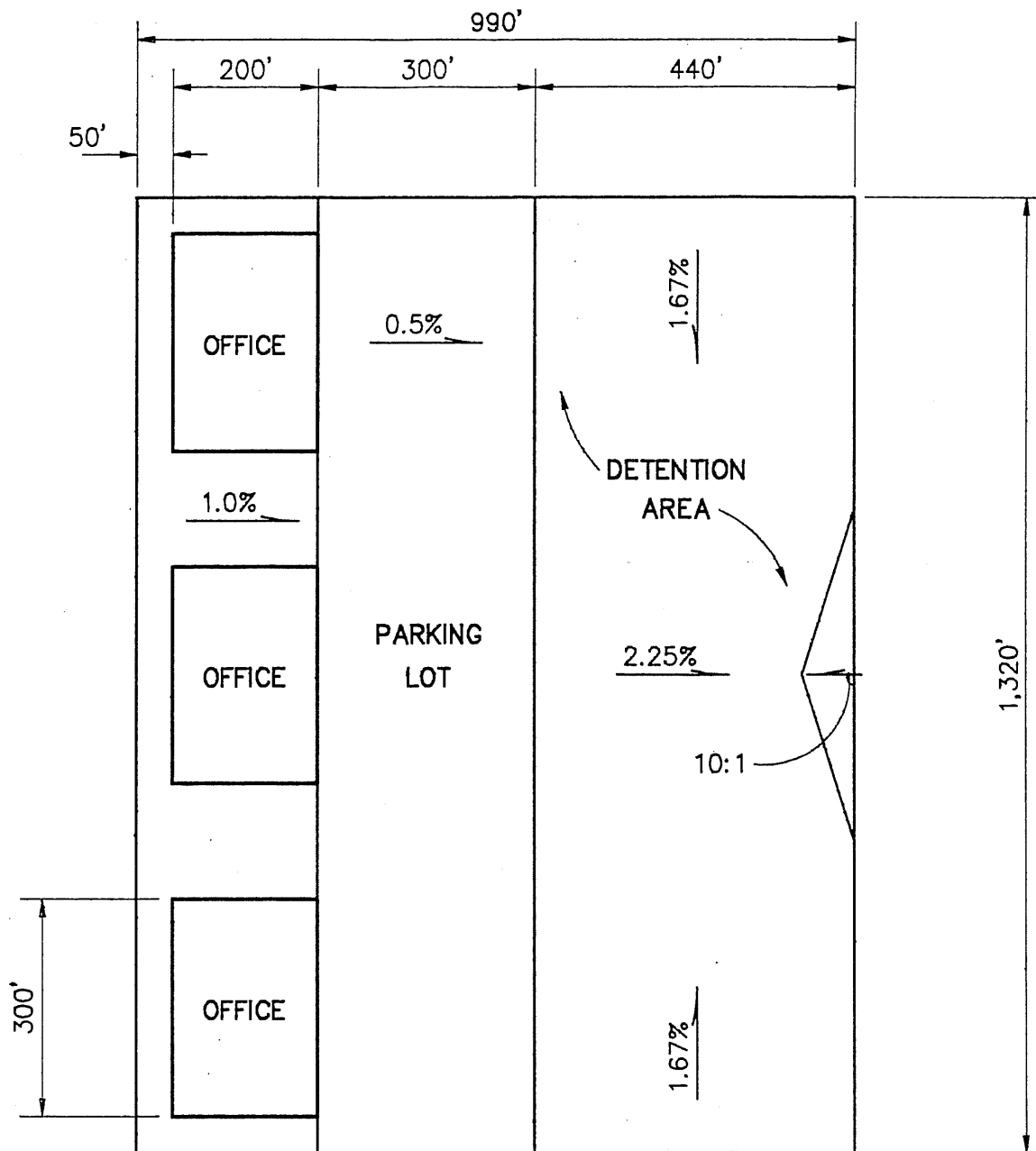
A 1,320-foot by 300-foot parking lot is located adjacent to three commercial office buildings as shown in Figure 10-3. The total dimensions of the site are 1,320 feet by 990 feet. The area shown with the 1,320-foot by 440-foot dimensions is available for a detention area. The parking lot slopes away from the office buildings at a 0.5% grade and no off-site runoff affects the location. The required storage for this site, according to the Empirical Method, is:

$$\begin{aligned} \text{Area} &= (1,320 \text{ ft})(990 \text{ ft})/43,560 \text{ sq. ft. per ac.} = 30 \text{ acres} \\ V_s &= 0.2(30 \text{ acres}) = \underline{6 \text{ ac.-ft.}} \quad \text{ans.} \end{aligned}$$

The outflow from this example detention basin must be such that the peak discharge of predeveloped conditions is not exceeded. The detention area must provide at least six acre-feet of storage at the same elevation that the peak outflow rate occurs.

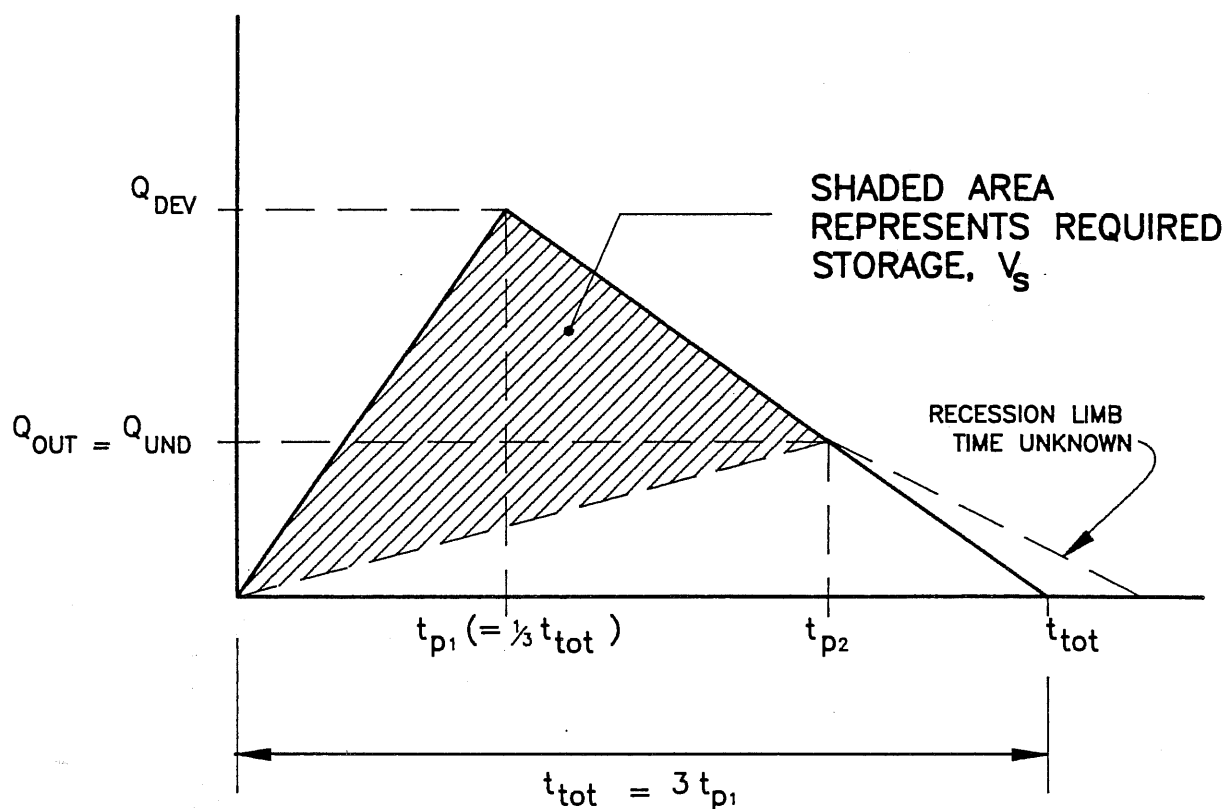
10.6.3 Triangular Hydrograph Method

The Triangular Hydrograph Method assumes a triangular shaped inflow hydrograph, for post-developed conditions, with a peak flow rate at time t_{p1} as shown on Figure 10-4. The results from this method may be substantially higher than results using other methods. The peak time of the post-developed drainage area hydrograph is calculated as:



SITE FOR DETENTION EXAMPLE

FIGURE 10-3



Q_{DEV} = PEAK DISCHARGE FROM DEVELOPED DRAINAGE AREA, CFS

Q_{OUT} = PEAK DISCHARGE FROM PREDEVELOPED DRAINAGE AREA, CFS

t_{p1} = TIME TO PEAK OF DEVELOPED TRIANGULAR HYDROGRAPH, MINUTES

$t_{p1} = 40.33 \text{ AR}/Q_{DEV}$

t_{p2} = TIME TO PEAK OF PREDEVELOPED OUTFLOW HYDROGRAPH, MINUTES

$t_{p2} = 3t_{p1} - 2t_{p1}(Q_{OUT}/Q_{DEV})$

V_S = STORAGE REQUIREMENT, ACRE-Feet

$V_S = \text{AR}(1 - Q_{OUT}/Q_{DEV})/12$

TRIANGULAR HYDROGRAPH METHOD FOR DETENTION DESIGN

FIGURE 10-4

$$t_{p1} = 40.33 A R / Q_{dev} \quad (\text{Eq. 10-5})$$

where,

$$t_{p1} = \text{Time to peak of the inflow hydrograph, minutes}$$

$$A = \text{Drainage area, acres}$$

$$R = \text{runoff, inches where}$$

$$R = \text{Rational developed area } C \times \text{Precipitation in inches}$$

$$Q_{dev} = \text{Developed drainage area peak discharge, cfs}$$

The length of the base of the hydrograph triangle, t_{tot} , is assumed to be 3 times the time to peak, t_{p1} .

$$t_{tot} = 3t_{p1}, \text{ or} \quad (\text{Eq. 10-6})$$

$$t_{tot} = 121 A R / Q_{dev} \quad (\text{Eq. 10-7})$$

where,

$$t_{tot} = \text{Base length of the hydrograph, minutes}$$

$$t_{p1} = \text{Time to peak of the inflow hydrograph, minutes}$$

The time to peak of the outflow hydrograph, the peak discharge of which is limited to predeveloped conditions, is assumed to occur at time t_{p2} and intersect the recession limb of the inflow hydrograph. The time-to-peak of the outflow hydrograph is:

$$t_{p2} = 3t_{p1} - 2t_{p1}(Q_{out}/Q_{dev}) \quad (\text{Eq. 10-8})$$

where,

$$t_{p2} = \text{Time to peak of outflow hydrograph, minutes}$$

$$Q_{out} = \text{Allowable peak discharge from detention pond, cfs}$$

$$t_{p1} = \text{Time to peak of the inflow hydrograph, minutes}$$

The storage required is shown graphically in Figure 10-4 as the area bounded by the inflow hydrograph and the outflow hydrograph. This area may be expressed by the formula:

$$V_s = A R (1 - Q_{out}/Q_{dev})/12 \quad (\text{Eq. 10-9})$$

where,

$$V_s = \text{Required storage, acre-feet}$$

$$A = \text{Drainage Area, acres}$$

$$R = \text{Runoff, inches, where}$$

$$R = \text{Rational developed area } C \times \text{Precipitation in inches}$$

$$Q_{out} = \text{Peak discharge from detention pond, cfs}$$

$$Q_{dev} = \text{Peak discharge from developed drainage area, cfs}$$

10.6.4 Triangular Hydrograph Method Example

Using the previous drainage area example from the Empirical Method, find the required storage volume for the 100-year, 24-hour storm event. Assume that the time of concentration for predeveloped conditions is 20 minutes and for post-developed conditions is 12 minutes.

Step 1: Determine the peak discharge for predeveloped conditions. From "Section 4: Determination of Storm Runoff," the 100-year frequency intensity (I) for a T_c of 20 minutes is 6.18 inches per hour. The undeveloped composite rational coefficient, C, is 0.41 for this example.

$$\begin{aligned}
 Q_{out} &= C I A \\
 &= (0.41)(6.18 \text{ iph})(30 \text{ acres}) \\
 &= 76.0 \text{ cfs}
 \end{aligned}$$

Outflow from the detention area is through a berm by way of six-inch diameter pipes spaced 20 feet on center along the lower edge of the detention area. The pipe inverts are flush with the surface of the outlet area. For this example assume that if the water is ponded to a depth of 12 inches at the lower end of the parking lot, the combined outflow through the pipes will be 76.0 cfs.

Step 2: From Table 4-9 in "Section 4: Determination of Storm Runoff," the 100-year, 24-hour storm produces 6.83 inches of rainfall. The post-developed composite Rational Method coefficient is taken as 0.97 for this example. The value of R then becomes:

$$\begin{aligned}
 R &= C \times P \\
 &= (0.97)(6.83 \text{ inches}) \\
 &= 6.63 \text{ inches}
 \end{aligned}$$

Step 3: The post-development peak discharge can also be determined. From "Section 4: Determination of Storm Runoff", the intensity (I) for a T_c of 12 minutes is 7.91 inches per hour. The composite rational coefficient from Step 2 is also used here.

$$\begin{aligned}
 Q_{dev} &= C I A \\
 &= (0.97)(7.91 \text{ iph})(30 \text{ acres}) \\
 &= 230.2 \text{ cfs}
 \end{aligned}$$

Step 4: The triangular hydrograph relationships can now be calculated.

$$\begin{aligned}
 T_{p1} &= 40.33 A R / Q_{dev} \\
 &= (40.33)(30 \text{ acres})(6.63 \text{ inches})/230.2 \text{ cfs} \\
 &= 34.8 \text{ minutes} \\
 T_{p2} &= 3t_{p1} - 2t_{p1}(1 - Q_{out}/Q_{dev}) \\
 &= (3)(34.8 \text{ min}) - 2(34.8 \text{ min})(1 - 76.0 \text{ cfs}/230.2 \text{ cfs}) \\
 &= 57.8 \text{ minutes} \\
 T_{tot} &= 3t_{p1} \\
 &= (3)(34.8 \text{ minutes}) \\
 &= 104.4 \text{ minutes}
 \end{aligned}$$

Step 5: The volume of storage required is:

$$\begin{aligned}
 V_s &= A R (1 - Q_{out}/Q_{dev})/12 \\
 &= (30 \text{ ac.})(6.63 \text{ in.})(1 - 76.0 \text{ cfs}/230.2 \text{ cfs})/12 \\
 &= \underline{11.1 \text{ acre-ft}} \quad (\text{ans.})
 \end{aligned}$$

This example for the Triangular Hydrograph Method assumes that the allowable peak discharge from the detention facility can be equal to the undeveloped peak flow and is not limited by some other factor. For this example,

11.1 acre-feet of storage must be provided by the time the water surface elevation on the discharge pipes is twelve inches deep.

10.6.5 SCS TR-55 Graphical Method

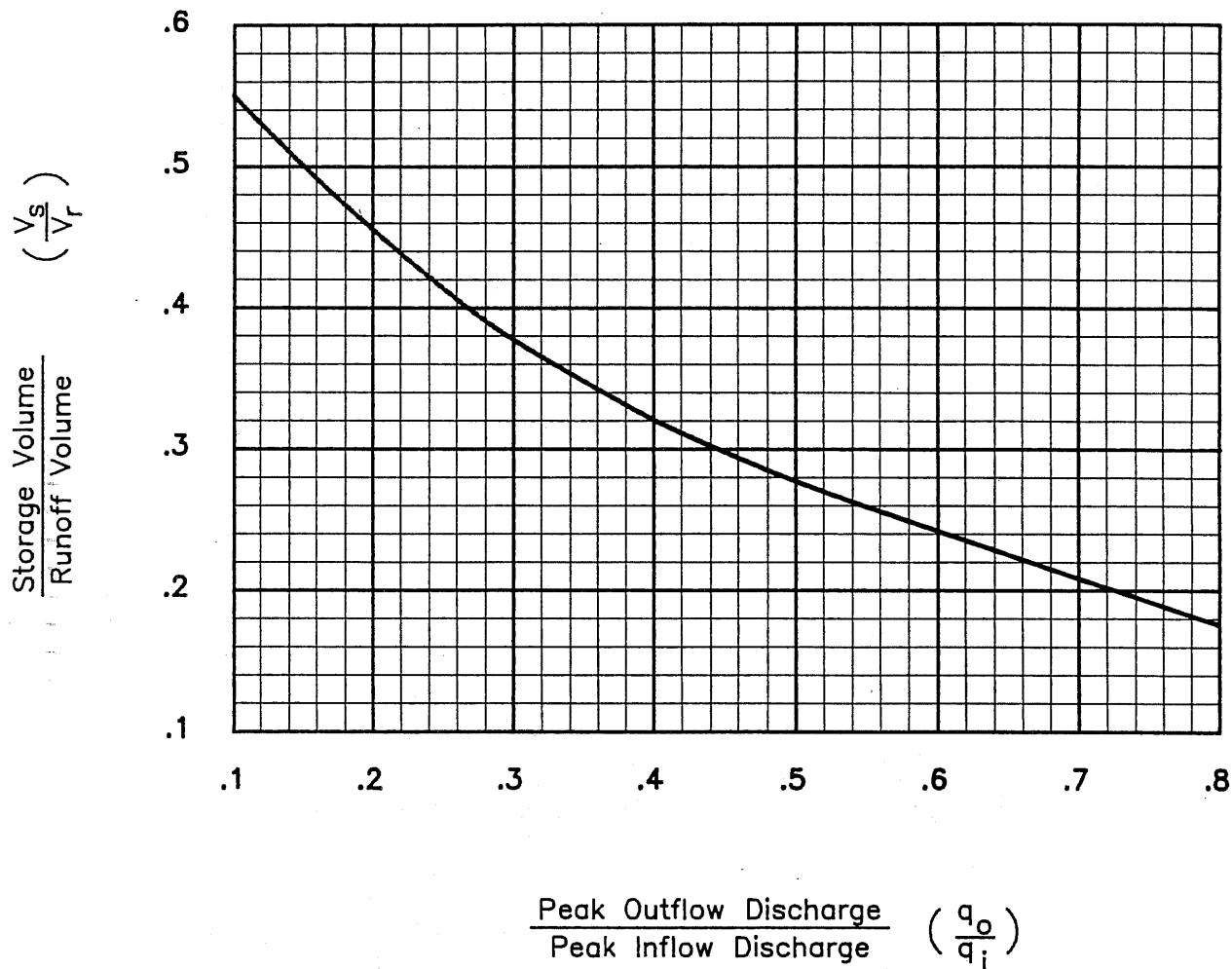
The Soil Conservation Service (SCS) Technical Release 55 (TR-55), June 1986 edition, has a graphical method for determining the required storage in a detention facility based on SCS rationale. The method utilizes a volume ratio and a peak discharge ratio to estimate the required detention storage volume. The curve shown in Figure 10-5, reproduced from TR-55, is based on numerous tests with single stage outflow devices including weirs and pipes. Runs with multiple stage outflow devices were made and showed similar variances, so this method can also be used to size detention ponds that incorporate multiple stage outflow devices. The SCS states that the curve in Figure 10-5 is less accurate as it approaches either end limit of the curve, and where the peak outflow approaches the peak inflow. The TR-55 method for storage determination should not be used for final design if an error in storage of 25 percent is unacceptable. The use of the SCS TR-55 method is limited to areas of one square mile for hand-calculated TR-55 runoff and three square miles for computer models of TR-55. The TR-55 detention method uses these basic steps:

- (1) Determine A, the drainage area in square miles,
- (2) Determine CN, the runoff curve numbers for predeveloped and post-developed conditions,
- (3) Determine P, the precipitation depth in inches,
- (4) Determine q_0 , the detention facility release rate in cfs as the predeveloped peak discharge, using TR-55 methods only.
- (5) Determine V_r , the developed condition volume of runoff in inches,
- (6) Determine q_i , the developed peak discharge into the detention basin in cfs, using TR-55 methods only,
- (7) Determine the ratio of q_0/q_i ,
- (8) From Figure 10-5, read the ratio of V_s/V_r corresponding to q_0/q_i ,
- (9) Determine V_s , storage volume in inches from $V_s = (V_s/V_r)V_r$ from the above ratio, and
- (10) Convert V_s to appropriate units.

Example: Use the parking lot example from the earlier Triangular Hydrograph Method.

Step 1: Area = 30 acres/640 acres per sq.mi
= 0.0469 sq. miles

Step 2: Post-developed CN = 98, Predeveloped CN = 58 (AMC I.4)



APPROXIMATE DETENTION BASIN ROUTING FOR SCS RAINFALL DISTRIBUTION TYPE II

SOURCE: SCS TR-55, JUNE 1986.

FIGURE 10-5

Step 3: Precipitation, $P = 6.83$ inches (100-yr, 24-hr storm)

Step 4: Predeveloped Peak Discharge:

Time of Concentration, $T_c = 20$ minutes as derived earlier
equal to 0.33 hours

Runoff curve number, $CN = 58$ (AMC I.4)

$$S = (1000/CN) - 10 = (1000/58) - 10 = 7.24$$

$$I_a = 0.2S = (0.2)(7.24) = 1.4$$

Can use TR-55 Graphical Method for peak discharge.

$$\begin{aligned} V_r &= (P - 0.2S)^2 / (P + 0.8S) \\ &= ((6.83 - (0.2)(7.24))^2 / ((6.83 + (0.8)(7.24))) \\ &= 2.29 \text{ inches (Figure 4-7 in Section 4 can also be} \\ &\quad \text{used for runoff depth)} \end{aligned}$$

From TR-55 peak discharge graphs, Section 4, Figure 4-9:

$$I_a/P = 1.4/6.83 = 0.20 \text{ and } T_c = 0.33 \text{ hours}$$

$$q_u = 625 \text{ csm/inch, Figure 4-9}$$

$$\begin{aligned} q_o &= (625 \text{ csm/inch})(0.0469 \text{ sq.mi.})(2.29 \text{ inches}) \\ &= 67.1 \text{ cfs, therefore limit outflow to approximately} \\ &\quad 67 \text{ cfs} \end{aligned}$$

Step 5: Find the post-developed volume of runoff, $CN = 98$.

$$S = (1000/CN) - 10 = (1000/98) - 10 = 0.20$$

$$I_a = 0.2S = (0.2)(0.20) = 0.04$$

$$\begin{aligned} V_r &= (P - 0.2S)^2 / (P + 0.8S) \\ &= ((6.83 - (0.2)(0.2))^2 / ((6.83 + (0.8)(0.20))) \end{aligned}$$

$$V_r = 6.60 \text{ inches}$$

Step 6: Determine the developed peak discharge:

$$T_c = 12 \text{ minutes (0.20 hours)}$$

$$I_a/P = 0.04/6.83 = 0.006 \text{ use } I_a/P \text{ limit of 0.10}$$

$$q_i = 810 \text{ csm/inch from Figure 4-9}$$

$$q_i = 810 \text{ csm/inch} \times 0.0469 \text{ sq.mi.} \times 6.60 \text{ inches}$$

$$Q_i = 250.7 \text{ cfs}$$

Step 7: Find the peak discharge ratio.

$$q_o/q_i = 67 \text{ cfs}/250.7 \text{ cfs} = 0.27$$

Step 8: Entering Figure 10-5 with $q_o/q_i = 0.27$, read up to intersect the structure discharge line, then left to the volume ratio index and read:

$$V_s/V_r = 0.4$$

Step 9: Solve for V_s .

$$\begin{aligned} V_s &= (V_s/V_r)V_r \\ &= (0.4)(6.60 \text{ inches}) \\ &= 2.64 \text{ inches} \end{aligned}$$

Step 10: Solve for detention storage volume.

$$\begin{aligned} V_s &= A V_s / 12 \\ &= (30 \text{ ac.})(2.64 \text{ in.}) / 12 \text{ in. per ft.} \\ &= \underline{6.6 \text{ acre-feet}} \end{aligned} \quad (\text{ans.})$$

Step 11: Provide 6.6 acre-feet of storage at the elevation where permissible outflow is at maximum. Notice that this value is close to the 6 acre-feet estimated by the Empirical Method, but is less than the 11.1 acre-feet obtained with the Triangular Hydrograph Method.

10.6.6 Hydrograph Methods

The Hydrograph Methods available for detention site routing usually involve the use of either HEC-1 or TR-20. HEC-1 is the preferred model since it closely matches the City's Flood Insurance Study. Both of these computer models use the storage-indication method for hydraulic routing through detention sites. The HEC-1 user's manual refers to the storage-indication routing method as the level-pool method, however both methods are identical.

The storage-indication, or level pool, detention routing method balances the following equation for small time intervals within the total hydrograph time base:

$$(I_1 + I_2)/2 - (O_2 + O_1)/2 = (S_2 - S_1)/\Delta t \quad (\text{Eq. 10-10})$$

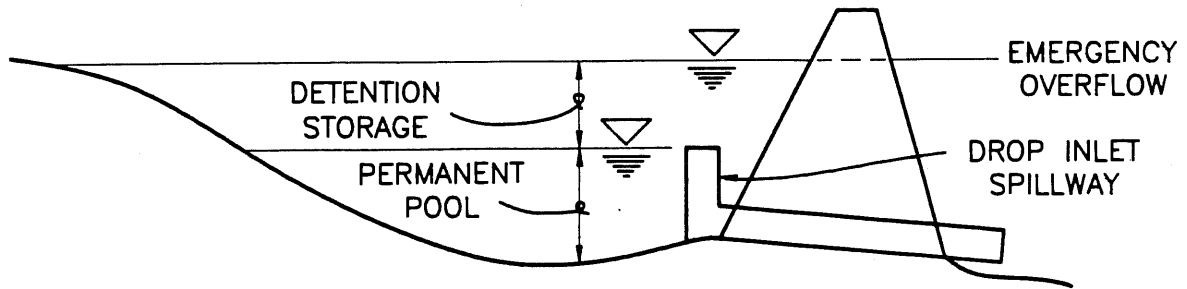
where

$$\begin{aligned} I_1 &= \text{Inflow at beginning of time increment} \\ I_2 &= \text{Inflow at end of time increment} \\ O_1 &= \text{Outflow at beginning of time increment} \\ O_2 &= \text{Outflow at end of time increment} \\ S_1 &= \text{Storage at beginning of time increment} \\ S_2 &= \text{Storage at end of time increment} \\ \Delta t &= \text{Time increment} \end{aligned}$$

The above equation is iterated until the maximum number of hydrograph ordinates are calculated. For example, if a computer model has a maximum limit of 300 ordinates for one hydrograph, and the time increment is defined as 0.25 hours by the user, then a hydrograph which spans 75 hours will be generated.

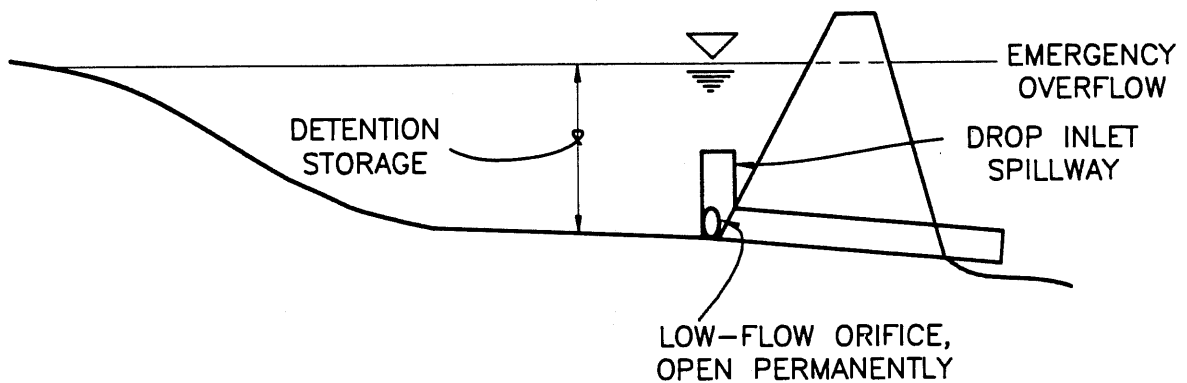
In order to properly route storm water runoff through a detention site, the user must define the pond characteristics by providing input information which correlates pond water surface elevations to pond storage and pond discharge.

Figure 10-6 illustrates two cases where detention occurs at a site relative to spillway construction. In both cases of Figure 10-6, detention storage occurs above the elevation of the lowest ungated outlet. If a sluice gate was installed which permitted discretionary closure of the low-flow orifice in Case B, then the detention storage would be the same elevation interval as Case A.



CASE A

DETENTION WITH PERMANENT POOL



CASE B

DETENTION WITHOUT PERMANENT POOL

EFFECT OF SPILLWAY CONSTRUCTION ON AVAILABLE DETENTION STORAGE

FIGURE 10-6

10.7 RETENTION POND STORAGE DETERMINATION

10.7.1 Rational Method Retention

The Rational Method may be used to determine the volume of runoff to be retained, however its use is limited to drainage areas of 100 acres or less. The volume of runoff to be retained, or stored, is determined by:

$$V = CPA/12 \quad (\text{Eq. 10-11})$$

where

V = Storage volume requirement, acre-feet

C = Composite Rational Method runoff coefficient

P = Precipitation depth for the selected storm event, normally the 100-year event, Table 4-10, inches

A = Drainage area, acres

Example: A drainage area consists of 80 acres of single family homes zoned 1F with an average watershed slope of one percent. Analysis of the drainage area shows that the percent imperviousness matches that given in Table 4-3 in "Section 4: Determination of Storm Runoff", or 60 percent. Find the volume of storage required to totally retain the 100-year frequency storm event.

Step 1: Enter Table 4-3 with Zone 1F and find the 100-year runoff coefficient for a slope range of 0-2 percent. The Rational method composite runoff coefficient listed in Table 4-3 for the defined condition is 0.73.

Step 2: Read the 100-year frequency rainfall depth from Table 4-10 in "Section 4: Determination of Storm Runoff". The rainfall depth is 6.83 inches for this example.

Step 3: Determine the retention pond storage requirement.

$$V = CPA/12$$

$$V = (0.73)(6.83 \text{ inches})(80 \text{ acres})/12$$

$$V = \underline{33.2 \text{ acre-feet, use 34 acre-feet}} \quad (\text{ans.})$$

A retention pond site with a minimum storage volume of 34 acre-feet would be required for the above example. The City Engineer may also require additional storage volume to offset sediment accumulation within the pond.

10.7.2 Curve Number Method Retention

The Soil Conservation Service (SCS) curve number method may also be used for retention volume determination and this method is not restricted by drainage area size. The runoff depth can be calculated using the method contained in SCS Technical Release 55 (TR-55). "Section 4: Determination of Storm Runoff" in this manual also contains a more complete discussion of calculating runoff using the SCS method. The following example illustrates retention volume calculations using SCS methods.

Example: A retention pond for a developed drainage area must be designed to hold all of the expected runoff from its 250-acre watershed. The composite curve number for the drainage area is 85 and the 100-

year design storm event (Table 4-10) is 6.83 inches. Find the required minimum volume for the retention pond.

Step 1: Determine the drainage area's runoff depth.

Enter Figure 4-7 with 6.83 inches of rainfall depth and the defined curve number of 85. Read the runoff depth of 5.1 inches (Equations 4-9 and 4-10 in Section 4 may also be used to calculate runoff depth).

Step 2: Convert runoff depth to storage volume.

$$V = RA/12$$

where

V = Storage volume, acre-feet

R = Runoff depth, inches

A = Drainage area, acres

$$V = (5.1 \text{ inches})(250 \text{ acres})/12$$

$$V = \underline{106.3 \text{ acre-feet, use 107 acre-feet}} \quad (\text{ans.})$$

A retention pond with a minimum storage volume of 107 acre-feet is required for retention of all the predicted runoff. This storage volume, if achieved entirely through excavation of a pond site, would involve the excavation of approximately 173,000 cubic yards of material (1 acre-foot = 1,613.33 cubic yards). As stated in paragraph 10.7.1, the City Engineer may require additional storage volume to offset sediment accumulation within the pond.

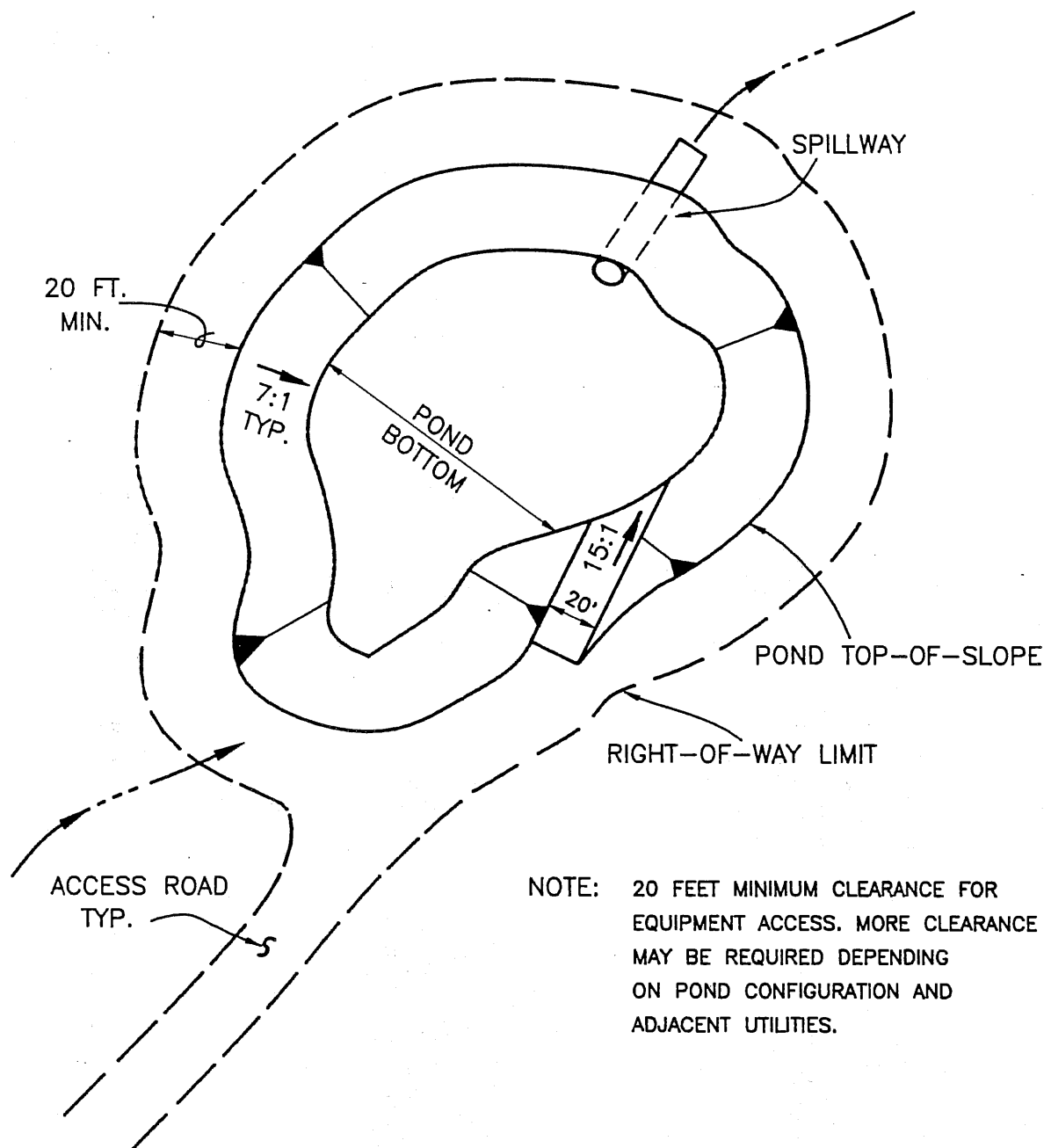
10.7.3 Hydrograph Method Retention

Runoff volumes determined by hydrographs may not accurately define the total drainage area contribution to a retention pond site. The runoff volumes are determined in hydrograph methods using each time increment of the hydrograph and the average peak discharge within each time increment. These average peak discharges and time increments are then mathematically integrated to arrive at a total runoff volume.

The primary problem with using a hydrograph for volume calculation is that the total hydrograph time base may not totally encompass the runoff event. For example, a hydrograph may need 400 ordinates at a time increment of 0.15 hours (60-hour time base) to totally encompass all runoff from a drainage area, however the computer models have a limit of 300 ordinates per hydrograph. The runoff beyond the 300th ordinate is unaccounted. Conversely, if the time increment is expanded to 0.25 hours (240 ordinates, 60-hour time base), then the average peak discharge within each time increment is altered and may not fully account for all of the runoff volume. Because of these limitations, hydrograph methods will not be permissible for retention pond design.

10.8 RIGHT-OF-WAY REQUIREMENTS

All detention sites should be easily maintained. Therefore, dedicated easements for storm water detention ponds shall be provided and shall include easy access for maintenance equipment. Figure 10-7 illustrates a typical detention pond with a maintenance ramp and right-of-way for an access road.



TYPICAL EXCAVATED POND RIGHT-OF-WAY AND ACCESS REQUIREMENT

FIGURE 10-7

Storm water detention pond easements along proposed or existing detention ponds shall provide sufficient width for the required pond and such additional width as may be required to provide ingress and egress of maintenance equipment. The easement shall include sufficient width to provide clearance from fences and space for utility poles. There shall be sufficient width to allow for maintenance of pond slopes, and to provide adequate side slopes for the pond itself. For safety reasons the side slopes of an excavated detention pond or basin, as well as any additional excavation to playa lakes, should be no steeper than seven horizontal to one vertical (7:1). Where side slopes as allowed by the City Engineer are steeper than 7:1, then the entire pond or basin shall be fenced in to prevent public access.

10.8.1 Minimum Access Road Width

The minimum access road width shall be 20 feet, however the City may require additional width due to adjacent utilities, equipment maneuverability and irregular pond configuration. The owner should consult with the City Engineer for specific requirements at each site.

10.8.2 Maintenance Access Ramps to Detention Pond or Basin Bottom

- A. Minimum ramp width shall be 20 feet.
- B. Maximum slope for the access ramp shall not be steeper than 15 horizontal to one vertical (15:1).

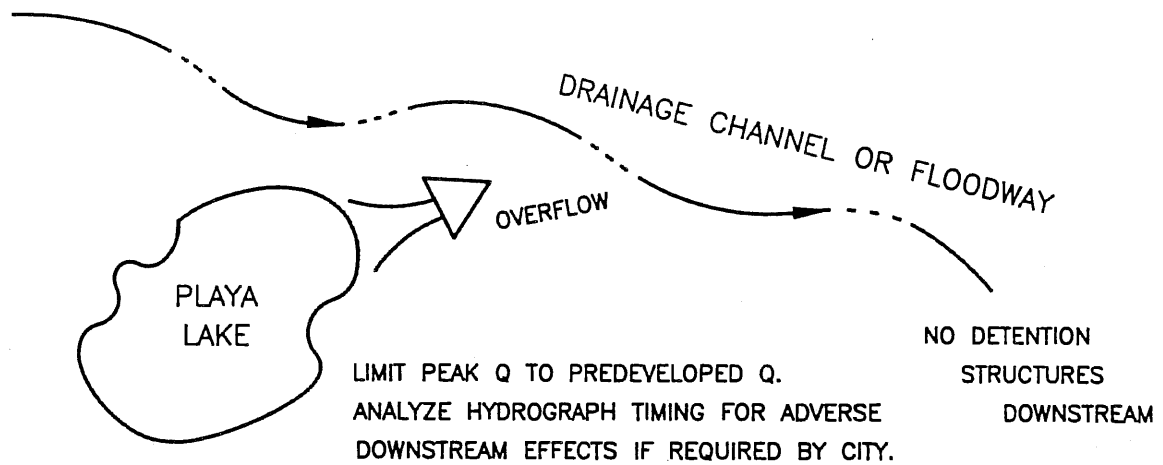
10.9 PLAYA LAKES

The playa lakes which occur naturally in the area present a special case for storm water detention and retention. Playa lakes, or simply referred to as playas, were formed by natural geological and meteorological processes and constitute primary runoff storage areas.

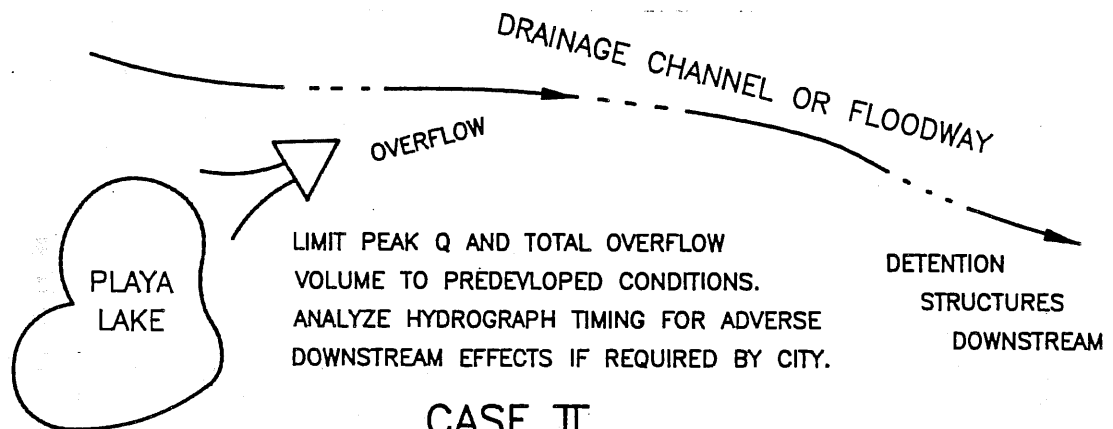
In some instances, a playa lake may be sufficiently large and deep to totally retain the runoff from both predeveloped and post-developed conditions. This situation provides the simplest solution to storm water control since downstream effects are not of principal concern.

Other playas, however, do not have sufficient storage capacity to totally retain the runoff from either predeveloped or post-developed conditions. It is these types of playas that present the greatest challenge when incorporating them into a storm water control plan. Each playa normally has a natural overflow section for when the runoff volume exceeds the playa's storage capacity. These playas fall into three basic circumstances as shown on Figure 10-8.

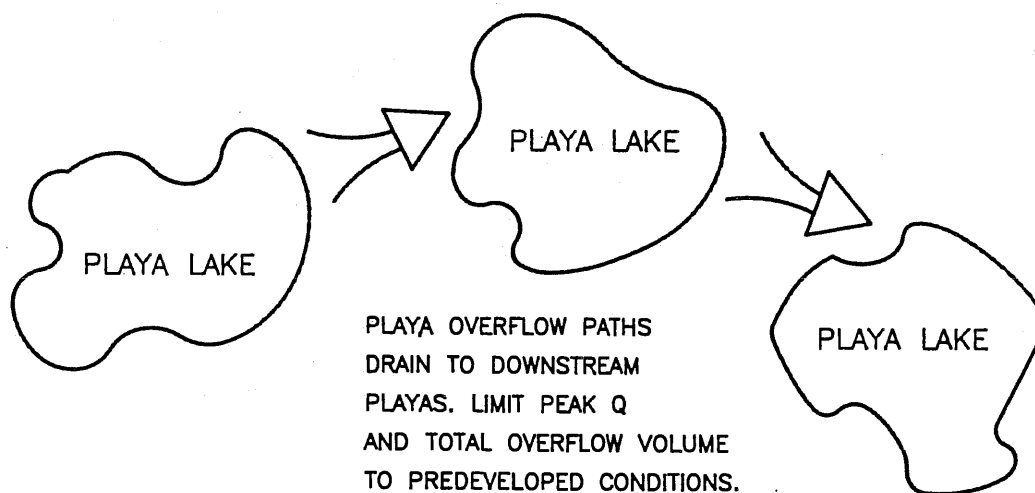
Case I: Case I in Figure 10-8 illustrates a playa where the drainage path from its overflow section contributes to a natural or man-made drainage channel. The drainage channel itself does not have any detention structures downstream of the playa's contributing overflow. In this case the peak discharge from the playa overflow is limited to that peak discharge which would occur from predeveloped conditions. The playa overflow as well as the drainage path downstream of the overflow section are usually limited in capacity, hence the need to restrict peak discharges to



CASE I



CASE II



CASE III

FIGURE 10-8

predeveloped conditions. The outflow hydrograph from the playa should be routed downstream, if required by the City, to see if it adversely affects the downstream peak discharges and elevations.

Case II: The second situation to which a playa overflow normally contributes is to a drainage channel which does have a detention structure existing downstream of the playa's contribution. When this occurs the peak discharge from the playa overflow, as well as the total overflow volume, are limited to predeveloped conditions. The outflow hydrograph from the playa should be routed downstream to see if it adversely affects downstream peak discharges, water surface elevations and overall operation of the downstream detention facility.

Case III: The third case in Figure 10-8 illustrates the most common situation in Midland County, which is where one playa's overflow contributes to another downstream playa. This often occurs in a "chain" of several playas. Where this situation exists, the playa overflow peak discharge and total overflow volume will be limited to predeveloped conditions.

The designer's plan to use a playa as part of a storm water control plan may require excavation of the lake to increase the playa's storage volume. Some fill will be allowed in a playa lake, under special circumstances, to fit development requirements. However, compensatory excavation to replace the lost lake storage because of the allowed fill will be required. In no instance will a playa's storage capacity be reduced.

The designer is encouraged to monitor federal and state regulations. Playas may be defined as wetlands and any excavation or fill may require a Corps of Engineers Section 404 permit.

End

SECTION 10

BIBLIOGRAPHY

1. City of Austin, Texas, Drainage Criteria Manual, February 1991 edition.
2. William DeGroot, Editor, Proceedings of the Conference on Stormwater Detention Facilities: Planning, Design, Operation and Maintenance, American Society of Civil Engineers, New York, NY, 1982.
3. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package User's Manual, Davis, CA, 1990.
4. City of Fort Worth, Texas, Department of Development, Development Procedures Manual, Adopted 1975.
5. U.S. Department of Agriculture, Soil Conservation Service, User's Manual, Draft TR-20 Project Formulation Hydrology, Washington, D.C., May 1983.
6. Peter Stahre and Ben Urbonas, Stormwater Detention for Drainage, Water Quality, and CSO Management, Prentice Hall, Englewood Cliffs, NJ, 1990.
7. Richard H. McCuen, A Guide to Hydrologic Analysis Using SCS Methods, Prentice-Hall, Englewood Cliffs, NJ, 1982.
8. Ernest F. Brater and Horace Williams King, Handbook of Hydraulics, McGraw-Hill, New York, NY, 1976.
9. Andrew L. Simon, Hydraulics, Third Edition, John Wiley and Sons, Inc., New York, NY, 1986.
10. U.S. Department of the Interior, Bureau of Reclamation, Water Measurement Manual, Washington, D.C., 1975.
11. U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, Washington, D.C., 1977.
12. Richard H. McCuen, Hydrologic Analysis and Design, Prentice-Hall, Englewood Cliffs, NJ, 1989.
13. Philip B. Bedient and Wayne C. Huber, Hydrology and Floodplain Analysis, Addison-Wesley Publishing Company, New York, NY, 1988.
14. United States Department of Agriculture, Soil Conservation Service, Technical Release 55: Urban Hydrology for Small Watersheds, Washington, D.C., June 1986.
15. Philip Bedient and Wayne Huber, Hydrology and Floodplain Analysis, Addison-Wesley Publishing Company, New York, NY 1988.

SECTION 11

STORM WATER PUMP STATIONS

11.1 General

11.2 Pump Station Components

11.2.1 Wet Well Sump

- A. Wet Well Sump
- B. Approach Channel
- C. Inlet Conditions
- D. Sump Storage

11.2.2 Pumps

11.2.3 Controls

11.2.4 Motors

- A. Electric Motors

11.3 Pump Station Types

11.4 Miscellaneous

11.5 Design Frequency

Bibliography

SECTION 11

STORM WATER PUMP STATIONS

11.1 GENERAL

The primary purpose of a storm water pumping station is to mechanically lift the storm water inflow a required vertical distance from a gravity flow inlet to a gravity outfall. Pumping stations for storm water are usually preferred over gravity lines when a long, deep gravity outfall is required to remove the storm water runoff from a low lying area or outlets which cannot be reached through gravity means. Although gravity outfalls are preferable, they can be physically impracticable or uneconomical to build. The pump station should be designed to be unobtrusive, efficient, and reliable where the pump station is located in an area of high public visibility.

11.2 PUMP STATION COMPONENTS

The pump station usually refers to the entire facility for the pumping of storm water. This normally includes a wet well sump, pumps, controls, and motors. The pump station should be protected and secured by the use of fences, gates, locks, and other security devices.

11.2.1 Wet Well Sump

A. Trash and Debris Screening

Screens for preventing trash and debris which are capable of clogging the storm water pumps should be installed upstream of the approach channel. Access to the wet well sump for the removal of the accumulated trash and debris on the screens should be provided.

B. Approach Channel

The influent flow to the pump intake should ideally be uniform steady flow with the absence of entrained air or other gases. Uniform steady flow insures a uniform influent velocity profile in the approach channel and at the pump intake. Access to the approach channel will be necessary to periodically remove any deposits of sediment which may accumulate. The approach channel may also serve as a storage facility for the influent flow to lower the number of pump starts per hour.

C. Inlet Conditions

The inlet velocities to the pump should be low enough to prevent air entrainment and vortexing at the inlet while remaining high enough to prevent sedimentation at the intake. Air entrainment and vortexing may be eliminated by providing adequate submergence of the inlet or by providing equipment at the pump intake which dampens the effects of a vortex. Minimum submergence for each pump is usually specified by the pump's manufacturer. The net positive suction head should also be checked against minimum submergence. A lack of sufficient submergence to offset the net positive suction head requirement will permit cavitation in the pump.

D. Sump Storage

The sizing of the sump for the proper storage volume for each pump is commonly based on the number of desired pump starts per hour and the number of pumps in the pump station. Also included in the sump storage is the storage volume in the system which delivers the storm water runoff. The system storage usually consists of piping volumes and ponding at the inlets upstream of the pump station. The dimensions of the sump may be altered to minimize the cost difference between additional pumps and motors versus an increased depth and size of the wet well.

11.2.2 Pumps

A. Storm water pumping stations are typically relatively low head high flow installations. Axial flow, propeller and mixed flow pumps have successfully been used successfully for storm water pumping. Usually the mixed flow pumps involve relatively high-head, low-volume conditions when compared with propeller pumps. The pumps should be capable of passing three-inch diameter spherical debris and be constructed of materials resistant to abrasion.

B. Two or more pumps are usually required to provide variable evacuation rates and for backup against failure of an individual pump. The backup pump should be as large as the largest pump in the station and is usually provided to insure uninterrupted service when the largest unit is out of service.

C. Installation of a storm water pumping station to prevent flash flooding, life threatening conditions, or possible property damage may require two separate sources of power to the pump station. Emergency generators or electricity from separate sources reduces the possibility of total station failure due to a loss of electrical power.

D. Pump inlet location should be set so as to optimize the sump intake conditions, as described in the inlet conditions section above. For multi-pump installations the inlet flow should be directed toward the inlet of each pump. A configuration of pumps which allows the influent to pass the intake of an upstream pump before reaching the next pump or which induces a vortex or any other undesirable hydraulic conditions at the intake should be avoided.

11.2.3 Controls

Controls and instrumentation for a storm water pumping station to control the starting and stopping of the pumps is normally done by using float switches or pressure transducers which monitor the water surface elevation in the wet well. For multi-pump installations a duty rotation controller will be used to insure even running time all of the pumps and motors. The standby pump should be included in the duty rotation. Alarms for pump stations are common and cover almost every component of the pump station. Some of the more commonly monitored items with alarms are: high water, motor bearings and stator temperature, water intrusion into the stator, any water intrusion into any gear boxes and water intrusion into any oil-holding reservoirs for bearing lubrication. These alarms may trigger something as simple as an indicator light or as complex as a telephone dialup. These alarms are normally monitored at a manned location. Annunciators which show which of the pumps are operating are normally located on the control panel at the pump station. Large pump stations at critical or possibly remote installations should have a controller with instrumentation to monitor the utility power supply and to start a backup generator if necessary.

The amount of controls and instrumentation for a given pump station depends on the number of motors, backup equipment, and the importance of the station's uninterrupted operation. The requirement for various controllers and monitoring devices will be decided on a case-by-case basis by the City Engineer.

11.2.4 Motors

Electric motors are the most frequently used drivers in pumping stations, primarily because of their versatility, compactness, and low maintenance. Reliability and inexpensive costs, when compared to engines, are just some of the benefits of electric motors. Electric motor driven pumps are required for Midland, Texas installations. Engine driven installations which utilize propane, butane, gasoline, diesel or natural gas will not be permitted. Electric motors may be mounted either horizontally or vertically depending on the pump station configuration, and can be manufactured to meet the individual needs of each pump station. Motors may be ordered with many different features built into them. Some of these features include: a nonreverse ratchet for the shaft which is normally required for pumps with a large backflow after the pump is turned off, and for pumps with long shafts an additional set of thrust bearings may be necessary. Electric motors are required to have a service factor 1.15 designed into them to act as a safety factor. All motors used for pump applications should have class F insulation. Many of the other features for motors have been mentioned in the controls section above.

11.3 PUMP STATION TYPES

For storm water pumping the most common pump station construction is a concrete station with only a wet well that has submersible pumps. This type of design takes up less space than the conventional dry well/wet well type of pump station because of the elimination of one of the wells. Access hatches that allow the removal of the pumps and are capable of supporting the weight of the largest pump in the station are required. All information concerning the dimensioning of the wet well, spacing of the pumps, and all other technical information concerning the interaction of the pumps and the wet well can usually be found in the pump manufacturer's catalog. If the information is not available from the pump manufacturer's catalog then the specifications of the Hydraulic Institute should be used. All storm water pump station designs will include analyses for adequate wet well storage and critical number of starts per hour.

11.4 MISCELLANEOUS

Each pump in the station will have a check valve and a gate valve on the discharge side of the pump. A flap gate should be located at the discharge of the pumping station if the discharge is submerged, or may be submerged in the future, to the extent that backflow into the station can occur. The interior of the wet well should have permanent lighting to be used during maintenance and repair of the pumps and the wet well. Exterior lighting should illuminate the doors, control panel, and access hatches of the pump station at night.

11.5 DESIGN FREQUENCY

The City Engineer will decide the storm event design frequency, or return period, to be used for pump station designs. Usually, pump stations serving

storm drain systems should be designed for 10-year or 25-year storm events. Pump stations which drain storage areas, such as playa lakes, should be capable of removing the 100-year post-developed runoff volume within five days.

END

SECTION 11
BIBLIOGRAPHY

1. Vincenzo Bixio, New Concepts in the Design of Propeller Pumping Stations, Cleup, Padova, November 1985.
2. M.J. Prosser, British Hydromechanics Research Association, The Hydraulic Design of Pump Sumps and Intakes, Cranfield, Bedford, July 1977.
3. Robert L. Sanks, Editor, Pumping Station Design, Butterworth Publishers, Boston 1989.
4. Hydraulic Institute, Engineering Data book, First Edition, Cleveland 1979.

SECTION 12

STORM WATER QUALITY

12.1 General

12.2 NPDES Permits (Construction Activity)

12.3 Sources of Pollutants

- A. Atmospheric Deposition
- B. Erosion
- C. Construction Materials
- D. Manufactured Products
- E. Plants and Animals
- F. Accidental Spills and Unintentional Discharges

12.4 Pollutants in Storm Water

- A. Sediment
- B. Organics
- C. Nutrients
- D. Toxic Substances
- E. Oil and Grease
- F. Bacteria

12.5 Permanent Best Management Practices (BMPs)

- A. Structural BMPs
- B. Non-Structural BMPs

12.6 Summary

Bibliography

SECTION 12

STORM WATER QUALITY

12.1 GENERAL

During the past several years, findings from major research and demonstration programs have shown that typical urban storm water can carry pollutants that limit the use of the collected storm water as a resource and/or may lead to impacts when it is discharged to receiving waters. At present, the City of Midland is not required to meet storm water quality standards. It is expected that the City will have to comply with storm water quality standards before the year 2000.

The increased awareness of the pollution potential of urban storm water runoff has lead to several important regulatory developments which include the requirement for municipalities and industries, as well as some construction projects to obtain storm water discharge permits in accordance with provisions set forth by the National Pollutant Discharge Elimination System (NPDES).

Every pollution control strategy must begin with an assessment of the problems themselves. Because of the variability in storm water quality, this can be a difficult task. Generally, pollutants that are carried in urban storm water runoff can be considered as "problem pollutants" if they result in any of the following impacts:

- Interference with any desired beneficial uses of the receiving waters of the runoff,
- any significant adverse impacts on aquatic ecosystems which result from degradation of the water quality, or
- any significant increase in the frequency, duration and/or degree of exceedance of water quality standards or water quality criteria.

New NPDES storm water regulations require municipal dischargers to collect and report a variety of information on their respective agencies, systems and dischargers; however, they are not specifically required to define or evaluate local water quality problems associated with storm water discharge. It is important to analyze the sources and types of pollutants that are generally considered to be "problems" in order to develop a plan of action that will reduce these constituents in the storm water discharges.

12.2 NPDES PERMITS (CONSTRUCTION ACTIVITY)

The Environmental Protection Agency (EPA) has proposed permit requirements for lands disturbed by construction activity. At the time this chapter was published the final regulations had not been promulgated. The only construction activity anticipated to be exempt from permitting is that activity which will disturb less than five acres and which is not part of a larger plan of development or activity. The EPA may require either an individual permit or a general permit depending on the final regulations.

The presently proposed requirements for an individual construction permit application are:

1. Map which indicates the site location and name of the receiving waters.
2. Nature of the construction activities.
3. Total area of site and area expected to undergo excavation during permit life.
4. Proposed methods to control pollutants in storm water discharges during construction including a brief description of state and local erosion and sediment control requirements.
5. Proposed measures to control pollutants in storm water discharges after construction operations have been completed.
6. Estimate of the runoff coefficient of the site and the increase in impervious area after construction.
7. Description of the nature of fill material and existing data describing the soil or quality of the discharge.

Should the EPA not require individual permits for activities in Texas, then a general permit may be required. Under a general permit a Notice of Intent (NOI) must be filed which contains the following information:

1. Name, mailing address and location of facility.
2. 4 digit Standard Industrial Classification (SIC) code (if applicable).
3. Operators name, address, telephone number, ownership status and status as federal, state, private, public or other entity.
4. Latitude and longitude of the facility to the nearest 15 seconds or the nearest quarter-section (if section, township and range is provided) in which the facility is located.
5. Name of the receiving water(s) or if discharge is through a municipal separate storm sewer, name of municipal operator and ultimate receiving waters.
6. Existing quantitative data describing the concentration of pollutants in storm water dischargers. Note: Testing is not required.
7. Brief description of the project.
8. Size and duration of project.
9. Estimate of the number of acres per site on which soil will be disturbed.

10. Storm water pollution prevention plan is required for each project.
11. Certification that the storm water pollution prevention plan provides compliance with approved state or local sediment and erosion plans or storm water management plans. State and local sediment and erosion plans are incorporated by reference.

Again, the EPA had not yet promulgated final disturbed lands permit regulations at the time that this chapter was published. Also, the updates to this chapter may not always be as timely as the government's publication of final regulations. The Owner or other responsible party is encouraged to consult government publications for timely information on regulatory changes and new regulations.

12.3 SOURCES OF POLLUTANTS

The following is a discussion of the principle sources of pollutants that are discharged from municipal storm water collection and conveyance systems.

A. Atmospheric Deposition

Atmospheric Deposition in the form of wetfall and dryfall is a significant source of pollution in urban areas and some industrial sites. A portion of the atmospheric pollutants attach to and remain on urban surfaces, but a significant fraction may be removed from the surfaces during storm events and are carried to the receiving waters with the runoff.

B. Erosion

Erosion can result from natural activity such as eroding stream banks or from human activity such as construction or renovation. Without adequate erosion control, large quantities of sediment, which typically carries attached nutrients, organic matter and often other absorbed pollutants, can be deposited into storm sewers, drainage channels, streams and receiving waters.

C. Construction Materials

Materials used in construction and maintenance of buildings are major sources of pollution. Many heavy metals are common materials in many structures. Over time, surfaces including those of flashing, gutters, paints, copper and metal piping, etc. dissolve, decay or are subject to leaching and thus are susceptible to being carried away in urban runoff. This process can be exacerbated if the rainfall is acidic in nature.

D. Manufactured Products

Heavy metals and synthetic organic compounds are present in the following types of products: fertilizers, insecticides, algicides and fungicides, automobile brake linings, clutch facings, tire compounds, lubricants and hydraulic fluids. All can be deposited to urban surfaces and are susceptible to deposition through urban runoff.

E. Plants and Animals

Other sources of pollutants that accumulate and are washed off of urban surfaces are plant debris and animal excrement. During the growing season

nutrients leach from tree leaves and stems during storms and ultimately are deposited into the receiving waters. Also, trees and other plants deposit leaves, branches and fruits that are washed away by storm runoff.

F. Accidental Spills and Unintended Discharges

Other sources of pollution in storm water are accidentally spilled pollutants that are not contained. These could be from a number of sources such as leaking underground storage tanks, faulty septic systems and sanitary landfills.

There are two other sources of pollution that are carried through urban conveyance systems. These are designated by the EPA as illicit connections and illegal dumping. Illicit connections include both deliberate and inadvertent discharges of sewage or industrial flows to storm drains. Illegal dumping refers to the dumping of solid or liquid wastes. These types of pollutants have been identified as a widespread problem and the detection and elimination of such discharges are major focuses of the NPDES storm water permits.

12.4 POLLUTANTS IN STORM WATER

The principle types of pollutants found in storm water and their potential adverse effects on receiving waters are the following:

A. Sediment

Suspended sediment can lead to numerous adverse effects on aquatic ecosystems. Reduced sunlight penetration, clogging of gills and filter systems in aquatic organisms, interference with egg deposition and hatching, and the potential of the sediment to transport trace amounts of pesticides and other chemicals are all potential adverse effects caused by sedimentation.

B. Organics

Decomposition of organic materials depletes the dissolved oxygen levels in receiving waters. This is especially true in slower moving waters, estuaries and lakes.

C. Nutrients

Increased levels of phosphorous and nitrogen, from such things as fertilizers, in runoff can lead to accelerated eutrophication in receiving waters. Among the problems associated with high nutrient levels are surface algal scums, algal blooms, water discoloration, unpleasant tastes and odors, depressed oxygen levels and the release of toxins.

D. Toxic Substances

Heavy metals and organic toxic compounds are both concerns because of their potential for contaminating drinking water supplies. Heavy metals, such as copper, lead, zinc and cadmium, are generally found in storm water in the highest concentrations. Organic toxins found in storm water are generally those associated with pesticides and fertilizers.

E. Oil and Grease

The oil and grease category includes a wide variety of hydrocarbon compounds, some of which are known to accumulate in sediments and are toxic to aquatic life in low concentrations.

F. Bacteria

Fecal coliform levels in urban runoff can usually be expected to exceed standards for water contact, recreation and shell fish harvesting. Also, if the concentration of coliforms is in excess of public health standards, water cannot be used for these purposes.

12.5 BEST MANAGEMENT PRACTICES

Best management practices (BMPs) are defined by the EPA as structural or non-structural controls, or a combination of both, designed to reduce the amount of pollution in storm water runoff.

A. Structural BMPs

Structural controls collect and treat runoff pollution in order to decrease the amount of pollution reaching receiving waters. Typical structural BMPs include infiltration devices, wet detention basins, and extended dry detention basins. Also, locating and removing illegal sanitary sewer connections, overflow structures and industrial drains are considered structural BMPs.

Infiltration devices capture the storm water and allow it to percolate through the soil profile. Pollutants are removed by the natural filtration process of the soil. Even though these devices are the most effective structural storm water controls, they are effective only where soil conditions allow the captured volume of water to percolate through the profile before the next storm event.

Wet detention basins consist of a permanent water pool, an overlying zone that can hold the design runoff volume temporarily so that it can be discharged at the design discharge rate, and a shallow vegetated zone which serves as a biological filter during discharge. For wet detention basins, the storm water runoff is treated by allowing suspended particles to settle and by removing dissolved pollutants through biological processes such as the uptake by aquatic plants.

An extended dry detention basin captures the storm water and detains it long enough to allow suspended pollutants to settle. In order to remove the suspended pollutants, relatively long detention times of 20 to 40 hours are required. Unlike wet detention basins, dry detention basins do not remove dissolved pollutants.

B. Non-structural BMPs

Non-structural BMPs are developed primarily to reduce pollution resulting from construction and to reduce pollutants from roadways; commercial, industrial and residential areas; flood management projects; landfills and other municipal waste facilities; and areas associated with the application of herbicides, pesticides and other potentially harmful chemicals.

Non-structural BMPs include such practices as street cleaning, fertilizer application control, and limiting population densities through use of zoning restrictions. An example of the non-structural BMP approach is the

requirement of either a minimum lot size for a single-family residential development or the development of an area of greater population density balanced by a large portion of the site being designated as natural open space.

12.6 SUMMARY

At the present time, the City of Midland does not exceed the lower population limit set by the EPA which would force the City to meet the requirements of a storm water discharge permit. However, it is possible that the City will be required to implement structural or non-structural BMPs, or a combination of both, in the near future in order to meet State or Federal regulations. Should these practices be necessary, City personnel, developers, engineers and other persons responsible for the management of storm water runoff will be required to implement and maintain BMPs as set forth in this criteria manual. This short discussion on storm water quality has been included to give the user some idea that future design requirements are likely to be more stringent.

END

SECTION 12
BIBLIOGRAPHY

1. Boyd, G. and N. Gardiner, "Urban Storm Water: An Overview for Municipalities", PUBLIC WORKS, December 1990.
2. Roesner, L. and R. Matthews, "Storm Water Management For The 1990s", AMERICAN CITY & COUNTY, February 1990.
3. EPA. Federal Register, 40 CFR Parts 122, 123 and 124, "National Pollution Discharge Elimination System Permit Application Regulations for Storm Water Discharges; Final Rule, Part II", November 16, 1990.
4. EPA, Federal Register, 40 CFR Part 122, NPDES General Permits and Reporting Requirements for Storm Water Discharges Associated with Industrial Activity, Proposed Rule, August 16, 1991.
5. EPA, Federal Register, 40 CFR Part 122, National Pollutant Discharge Elimination System Permit Application Regulations for Storm Water Discharges, Application Deadlines, Final Rule and Proposed Rule, November 5, 1991.

APPENDIX A
FEDERAL EMERGENCY MANAGEMENT AGENCY
GUIDELINES AND CRITERIA



Federal Emergency Management Agency

Washington, D.C. 20472

April 1990

CONDITIONS AND CRITERIA FOR ISSUING LETTERS OF MAP REVISION (LOMRs) BASED ON FILL

These conditions and criteria set forth the policy of the Federal Emergency Management Agency (FEMA) concerning the processing of a request to determine whether a structure(s), proposed structure(s), or legally definable property that has been elevated by fill is located within a Special Flood Hazard Area (SFHA), as shown on a National Flood Insurance Program (NFIP) map. In order for FEMA to issue a Letter of Map Revision (LOMR) under the NFIP regulations, a property owner or lessee must submit documentation, routed through the Chief Executive Officer (CEO) of the community or an official designated by the CEO, that satisfies the criteria set forth below. Compliance with these criteria may result in the issuance of a LOMR based on fill, which will remove the property or structure(s) from the SFHA and revise the currently effective NFIP map. The policy discussed in this document does not address requests based on fill placed on property prior to the effective date of the first NFIP map that identified the property as being within the SFHA, nor does it pertain to LOMRs effecting changes in base (100-year) flood elevations (BFEs), floodway designations, coastal high hazard areas (V zones), and alluvial fan areas.

1. Definitions

The terms used in this document have the same meanings as those defined in Section 59.1 of the NFIP regulations at Title 44 of the Code of Federal Regulations (CFR), Chapter I, Part 59 et seq. SFHAs comprise all lands subject to inundation by the flood having a 1-percent or greater chance of being equaled or exceeded in any given year -- hereafter called the base flood. The elevation associated with this flood is called the BFE and the unit of measure is usually feet above the National Geodetic Vertical Datum (NGVD) of 1929. Fill is defined as material placed to raise the ground to or above the BFE. The common construction practice of removing unsuitable existing material (topsoil) and backfilling with select structural material is not considered the placement of fill if the practice does not alter the existing elevation, which is at or above the BFE. A property is that which may be legally defined by township and range lines, metes and bounds, or subdivision plats, the latter of which can include blocks and lots.

2. Criteria for Revision and Technical Supporting Data Required

Any request for a LOMR based on fill must be supported by sufficient technical data to demonstrate that the entire area within the legal bounds of a property or the structure(s) has been elevated by fill to or above the BFE and is not subject to inundation by the base flood. It must be shown that both the lowest floor (including basement) of a structure(s) and the lowest adjacent grade to the structure(s) have been

elevated by fill to or above the BFE. A request for a LOMR based on fill must be submitted through the community CEO to ensure community acknowledgment and review of the request. The following documentation should be submitted for each LOMR request:

- a. A copy of the recorded deed indicating the legal description of the property and the official recordation information (deed book volume and page number) and bearing the seal of the appropriate recordation official (e.g., County Clerk or Recorder of Deeds).
- b. If the property is recorded on a plat map, a copy of the recorded plat indicating both the location of the property and the official recordation information (plat book volume and page number) and bearing the seal of the appropriate recordation official (e.g., County Clerk or Recorder of Deeds); if the property is not recorded on a plat map, copies of the tax assessor's map or other suitable maps that will aid FEMA in accurately locating the property.
- c. If the entire property is to be removed from the SFHA, a topographic map, certified by a registered professional engineer or licensed land surveyor, indicating the lowest elevations on the property and the date of fill. It should be noted that when fill has been placed to remove a property from an SFHA, and a structure(s) is not involved at the time of the request, FEMA encourages the community to require that the lowest adjacent grade(s) and lowest floor(s) (including basement) of any structure(s) placed on that property in the future be elevated to a level at or above the BFE.
- d. If a structure is to be removed from the SFHA, a map, certified by a registered professional engineer or licensed land surveyor, showing the location of the structure(s), the elevation of lowest floor (including basement), and the elevation of the lowest adjacent grade to the structure(s). FEMA's determination as to whether a structure(s) may be removed from the SFHA will be based upon a comparison of the elevation of the lowest floor (including basement) and the elevation of the lowest adjacent grade with the elevation of the base flood. If the lowest floor (including basement) and the lowest adjacent grade are at or above the elevation of the base flood, the structure(s) may be removed from the SFHA.
- e. Data to substantiate the BFE. If FEMA has completed a Flood Insurance Study (FIS), those data will be used. If an FIS is underway, preliminary data cannot be used to make a determination until the 90-day appeal period has ended, and a final BFE has been determined. If FEMA has not performed an FIS, data should be obtained from an authoritative source such as the U.S. Army Corps of Engineers, U.S. Geological Survey, U.S. Soil Conservation Service, or other Federal agency; a State or local water resource department; or a registered professional engineer. If BFEs have not been established previously on the NFIP maps, hydraulic

calculations may also be available from one of the above authoritative sources. NFIP maps are available for review at all participating local government offices (generally in the Planning or Public Works Departments). A photocopy (not reduced) of the part of the NFIP map that depicts the property and includes the panel number and date of the effective map should be submitted.

- f. A signed copy of the statement certifying the accuracy of the information submitted. (See attached form entitled "Request for Letter of Map Revision Based on Fill.")
- g. A signed copy of the statement by the community certifying that the revision request has been acknowledged and reviewed. (See attached form entitled "Community Acknowledgment of Request for Letter of Map Revision Based on Fill.")

In addition, if the request is for more than one lot or structure, the following additional documentation should be submitted:

- a. A currently effective NFIP map, or photographic copy, on which the legal metes and bounds of the property, including each lot within a subdivision, have been drawn as accurately as possible. The map submitted must include the panel number and date of the effective map and must bear the seal of a licensed land surveyor or registered professional engineer to certify that the property is correctly located on the NFIP map based on the legal description of the property. The location of the structures on any lot or tract of property that has a flood boundary running through the bounds of that property should also be drawn accurately. A reproduction from a photocopy of the NFIP map is unacceptable because the size of the map may be distorted.
- b. A signed copy of the statement by the community's permit official or a registered professional engineer or soils engineer, certifying that the following statements are true (form entitled "Certification of Fill Compaction"):
 - (1) The fill has been or will be compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test method issued by the American Society for Testing and Materials (ASTM Standard D-698) or an acceptable equivalent method for fill pads prepared for residential or commercial structure foundations.
 - (2) Fill slopes for granular materials are not steeper than 1 vertical on 1-1/2 horizontal.
 - (3) Adequate erosion protection is provided for fill slopes exposed to moving flood waters. (Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year

flood must, at a minimum, be protected by stone or rock riprap.)

- (4) The fill has not been placed within an established regulatory floodway.

In certain instances, additional data may be required in order for FEMA to make a determination. These data may consist of, but may not be limited to, certification by a registered professional engineer or licensed land surveyor as to the type of structure and whether it is elevated on posts, piers, pilings, or primary frontal sand dunes; hydraulic calculations on the flooding condition; and development plans indicating dates and extent of fill placement.

3. Conditional LOMRs

A conditional LOMR may be issued for a proposed structure(s) on property that has been or will be elevated above the BFE by fill or for a legally defined property which is proposed to be elevated by fill entirely at or above the BFE. To qualify for a conditional LOMR, the proposed structure(s) must meet the same criteria as those required for an existing structure(s) located on land elevated by fill. After construction is completed and fill has been placed, certified as-built information must be submitted to FEMA in order for a LOMR to be issued.

FEMA has initiated a reimbursement procedure to allow for the recovery of costs associated with the review of requests for conditional LOMRs, thereby reducing the expense to the general taxpayer. Further information regarding this procedure is located in Part 72 of the NFIP regulations, published at 44 CFR 72.

Property owners and developers should note that a conditional LOMR merely provides comment on the proposed plan and does not revise the map. It also does not relieve Federal agencies of the need to comply in carrying out their responsibilities for providing federally undertaken, financed, or assisted construction and improvements or in their regulating and licensing activities, in accordance with Executive Order 11988.

4. Special Considerations

As previously stated, a property and/or structure may be removed from the SFHA if information is submitted which indicates that the entire property has been filled to or above the BFE and/or that a structure(s) elevated by fill has the lowest adjacent grade and lowest floor

(including basement) at or above the BFE. However, the following special considerations provide exceptions to this rule.

a. Sheetflow Flooding (AO Zones)

In areas of sheetflow flooding (AO Zones), except those areas subject to alluvial fan flooding, technical data must be submitted to indicate that the lowest adjacent grade(s) and lowest floor(s)

(including basement(s)) of the structure(s) have been elevated above the depth of shallow flooding, while adequate drainage paths to guide floodwaters around and away from the structure(s) have been maintained.

b. Floodways

The floodway is the channel of a river or other watercourse that must be reserved to carry the floodwaters efficiently. Any appeal of a floodway designation should be directed to community officials because the floodway is designated and adopted by the community.

A request for a LOMR for a property and/or structure(s) that has been elevated by fill placed within a floodway will not be issued under these procedures. Such requests must be submitted to FEMA by the community in accordance with the Conditions and Criteria for Floodway Revisions and Part 65 of the NFIP regulations, published at 44 CFR 65, specifically, Section 65.7.

c. Elevated Structures

If the lowest floor of a building has been elevated on posts, piers, or pilings above the BFE in the SFHA and any portion of the structure (i.e., posts or piers) is still in the SFHA, the building will not be removed from the SFHA.

5. FEMA Evaluation and Response

After the required data have been received and reviewed by FEMA, the community will be notified of the findings. Should a review of the evidence indicate that a change in NFIP maps is needed, a LOMR will be issued and copies will be transmitted to the State Coordinator and the owner of the property, if applicable. The time required for FEMA to review a request of this nature will generally depend on the quality and completeness of the data submitted. In accordance with Part 65 procedures, the community will be notified in writing of the determination within 90 days of the date of receipt of all requested data.

6. Appropriate Address

A request for a LOMR referenced in these Conditions and Criteria should be submitted through the community to the appropriate FEMA Regional Office. If the request is for a determination involving a single lot or a single structure, the Regional Office will make the determination and issue the LOMR. (See attached list of Regional Office addresses and telephone numbers.)

A request for an unimproved parcel of land, a subdivision, or multiple structures should be forwarded to the following address for disposition:

Federal Emergency Management Agency
Federal Insurance Administration
Office of Risk Assessment
Technical Operations Division
500 C Street, SW.
Washington, D.C. 20472

More specific information relating to LOMRs may be obtained by contacting FEMA's Washington Office at (202) 646-2764.

Attachments

FEMA REGIONAL OFFICES

REGION I

(Connecticut, Maine, Massachusetts,
New Hampshire, Rhode Island, and Vermont)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
J.W. McCormack Post Office and
Courthouse Building, Room 462
Boston, Massachusetts 02109

(617) 223-9561

REGION II

(New York, Puerto Rico, New Jersey,
and Virgin Islands)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
26 Federal Plaza, Room 1349
New York, New York 10278

(212) 238-8200

REGION III

(Delaware, District of Columbia,
Maryland, Pennsylvania, Virginia,
and West Virginia)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
Liberty Square Building
(Second Floor)
105 South Seventh Street
Philadelphia, Pennsylvania 19106

(215) 931-5737

Region IV

(Alabama, Florida, Georgia, Kentucky,
Mississippi, North Carolina, South
Carolina, and Tennessee)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
1371 Peachtree Street, Northeast
Suite 735
Atlanta, Georgia 30309

(404) 853-4400

REGION V

(Illinois, Indiana, Michigan,
Minnesota, Ohio, and Wisconsin)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
175 West Jackson Boulevard
(Fourth Floor)
Chicago, Illinois 60606

(312) 408-5552

April 1990

REGION VI

(Arkansas, Louisiana, New Mexico,
Oklahoma, and Texas)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
Federal Regional Center
809 North Loop 288
Denton, Texas 76201-3698

(817) 898-9127

REGION VII

(Iowa, Kansas, Missouri, and
Nebraska)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
Federal Office Building
911 Walnut Street
Kansas City, Missouri 64106

(816) 283-7009

REGION VIII

(Colorado, Montana, North Dakota,
South Dakota, Utah, and Wyoming)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
Denver Federal Center
Box 25267, Building 710
Denver, Colorado 80225-0267

(303) 235-4830

REGION IX

(Arizona, California, Guam, Hawaii, and
Nevada)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
Building 105
Presidio of San Francisco
San Francisco, California 94129

(415) 923-7177

REGION X

(Alaska, Idaho, Oregon, and Washington)

Federal Emergency Management Agency
Natural and Technological Hazards
Division
Federal Regional Center
130 228th Street, SW.
Bothell, Washington 98021-9796

(206) 487-4678



Federal Emergency Management Agency

Washington, D.C. 20472

COMMUNITY ACKNOWLEDGMENT OF REQUEST FOR LETTER OF MAP REVISION BASED ON FIRM

Community Name

Property

We hereby acknowledge receipt and review of this Letter of Map Revision request and have found that the project meets all of the community's applicable floodplain management regulations. We understand that this request is being forwarded to FEMA for a possible map revision.

Community Official's Name: _____

(please print or type)

Address: _____

(please print or type)

Daytime Telephone Number: _____

Community Official's Signature

Date

Community Official's Title

April 1990



Federal Emergency Management Agency

Washington, D.C. 20472

REQUEST FOR LETTER OF MAP REVISION BASED ON FILL

This is to request that a determination be made as to whether or not a certain land area(s) or structure(s) is within a Special Flood Hazard Area. Fill has been placed, or will be placed, to elevate the property and/or structure(s) to or above the base flood elevation.

All documents submitted in support of this appeal are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Applicant's Name: _____
(please print or type)

Address: _____

(please print or type)

Daytime Telephone Number: _____

Date

Signature of Applicant

April 1990



Federal Emergency Management Agency

Washington, D.C. 20472

COMMUNITY ACKNOWLEDGMENT OF REQUEST FOR CONDITIONAL LETTER OF MAP REVISION

Community Name

Flooding Source and Name of Proposed Project

This request () is based on fill () is not based on fill

We hereby acknowledge receipt and review of this conditional Letter of Map Revision request and have found that the proposed project is designed to meet all of our community's applicable floodplain management regulations. We understand that this request for review of the proposed project is being forwarded so that FEMA may comment on the potential effects of this project on the flood hazards of our community.

Community Official's Name and Title

Address: _____

(please print or type)

Community Official's Signature

Date

Community comments on the proposed project: _____

April 1990



Federal Emergency Management Agency

Washington, D.C. 20472

REQUEST FOR CONDITIONAL LETTER OF MAP AMENDMENT (LOMA) OR CONDITIONAL LETTER OF MAP REVISION (LOMR) BASED ON FILL

This is to request that a determination be made as to whether or not a certain land area or structure is within a Special Flood Hazard Area.

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

The applicant understands that FEMA has implemented a reimbursement procedure to allow for the recovery of costs associated with the review of requests for conditional LOMAs and conditional LOMRs, thereby reducing the expense to the general taxpayer (Title 44, Code of Federal Regulations, Chapter 1, Part 72).

The applicant further understands and agrees that the initial fee is \$150.00 for single-lot requests and \$210 for multi-lot or subdivision requests. The initial fee is the minimum charge for the review of the submitted documentation. Additional costs could be required upon completion of the review and prior to the issuance of a conditional LOMA or conditional LOMR, depending upon the complexity of the review.

The applicant agrees to reimburse FEMA for both the initial fee as referenced above, and any additional costs incurred by FEMA in a total amount not to exceed \$500.00. FEMA agrees that if the total cost will exceed \$500.00, the applicant will be advised before additional costs in excess of \$500.00 are incurred.

This request is () based on fill () is not based on fill

The initial fee associated with this request is

- () \$150 (single-lot request)
- () \$210 (multi-lot request or subdivision request)

Applicant's name, address, and daytime phone number

Date

Signature of Applicant

Applicant's comments regarding the request: _____

April 1990

All



Federal Emergency Management Agency

Region VI, Federal Center, 800 North Loop 288
Denton, Texas 76201-3698

CONFIRMATION OF ELIGIBILITY FOR EXEMPTION FROM FILL COMPACTION CERTIFICATION

I hereby certify that existing or planned development of the property described in this LOMR request does not exceed a single residential structure and is, therefore, exempt from the requirements for certification of fill compaction and protection as described at 44 CFR Part 65.5(a) (6).

Signature

Date

February 1988



Federal Emergency Management Agency

Washington, D.C. 20472

CERTIFICATION OF FILL COMPACTION

Community

Property

I hereby certify that fill placed on the property to raise the ground surface to or above the Base (100-year) Flood Elevation in order to gain exclusion from a Special Flood Hazard Area (100-year floodplain) meets the criteria of Title 44 of the Code of Federal Regulations, Part 65.5(a)(6), listed below. For proposed fill, I hereby certify that it is designed in accordance with these criteria. Note: Any modifications or additions to this form will render it void.

1. That the fill has been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test method for (check one of the following):

- _____ a. Fill pads prepared for the foundations of residential or commercial structures
- _____ b. Entire legally defined parcel (Note: If the location of fill pads has not been determined, the fill over the entire legally defined parcel must be compacted to the above criteria)

2. That fill slopes for granular materials are not steeper than one vertical on one-and-one-half horizontal (steeper slopes must be justified); and

3. That adequate erosion protection is provided for fill slopes exposed to moving flood waters (Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap).

Signature

Date

Community Official's Title
or Engineer's Seal

November 1989

**DATA REQUEST CHECKLIST
FOR A LETTER OF MAP REVISION INVOLVING FILL**

Requestor: _____ Date: _____

Community: _____ Property: _____

The information checked below in Column 1 is required to process your request for a Letter of Map Revision Involving Fill. Information checked in Column 2 has been received and should not be resubmitted unless specifically requested. Failure to submit the required data could delay the processing of your request.

(1) <u>Required</u>	(2) <u>Received</u>	
_____	_____	1. A copy of the recorded Deed giving the legal description of your property, bearing the seal of the County Clerk or Recorder of Deeds, and indicating the official recordation data (deed book volume and page number).
_____	_____	2. A copy of the recorded plat map showing the location of your property, bearing the seal of the County Clerk or Recorder of Deeds, and indicating the official recordation data (plat book volume and page number).
_____	_____	3. Tax assessor's maps or other suitable maps showing the surveyed location of the property (only in cases where a recorded plat is not available).
_____	_____	4. Street address(es) of the property.
_____	_____	5. If your request is for more than one lot or structure, then a photographic or original copy of an official currently effective National Flood Insurance Program map (FIRM or FHBK) showing the accurately plotted legal metes and bounds of the property and certified by a professional engineer or licensed land surveyor.
_____	_____	6. Certified planimetric information indicating the location of structures on the property.
_____	_____	7. Certification by a registered professional engineer or licensed land surveyor stating:
_____	_____	a. The elevation of the lowest adjacent grade to the structure. (Include datum.) The lowest adjacent grade to the structure is the lowest ground elevation touching the structure. The "average low grade" from the Elevation Certificate is unacceptable.



Federal Emergency Management Agency

Washington, D.C. 20472

April 1990

CONDITIONS AND CRITERIA FOR LETTERS OF MAP AMENDMENT (LOMAs)

These conditions and criteria set forth the policy of the Federal Emergency Management Agency (FEMA) concerning the processing of a request to determine whether a structure(s), proposed structure(s), or legally definable property has been inadvertently included in a Special Flood Hazard Area (SFHA), as shown on the National Flood Insurance Program (NFIP) map. In order for FEMA to issue a Letter of Map Amendment (LOMA) under Title 44 of the Code of Federal Regulations (CFR), Chapter I, Part 70, a property owner or lessee must submit documentation to satisfy the criteria set forth below. Compliance with these criteria may result in the issuance of a LOMA, which will remove the property or structure(s) from the SFHA and amend the currently effective NFIP map. A LOMA will not be issued if the elevations of the property or of the ground surrounding the structure(s) have been altered by fill placed since the effective date of the first NFIP map that identified the property as being within the SFHA. The policy discussed in this document does not address requests based on fill placed on property after the effective date of the first NFIP map that identified the property as being within the SFHA, nor does it pertain to Letters of Map Revision effecting changes in base (100-year) flood elevations (BFEs), floodway designations, coastal high hazard areas (V zones), and alluvial fan areas.

1. Definitions

The terms used in this document have the same meanings as those defined in Section 59.1 of the NFIP regulations at 44 CFR 59 et seq. SFHAs comprise all lands subject to inundation by the flood having a 1-percent or greater chance of being equaled or exceeded in any given year -- hereafter called the base flood. The elevation associated with this flood is called the BFE and is usually measured in feet above the National Geodetic Vertical Datum (NGVD) of 1929. A property is that which may be legally defined by township and range lines, metes and bounds, or subdivision plats, the latter of which can include blocks and lots.

2. Criteria for Amendment and Technical Supporting Data Required

Any request for a LOMA must be supported by sufficient technical data to demonstrate that the entire area within the legal bounds of a property or the structure(s) is not subject to inundation by the base flood. FEMA's determination as to whether a structure(s) may be removed from the SFHA will be based upon a comparison of the elevation of the lowest adjacent grade with the elevation of the base flood. If the lowest adjacent grade is at or above the elevation of the base flood, the structure(s) may be removed from the SFHA. In order for a legally defined property that does not have a structure on it to be removed from

the SFHA, the entire property must be at or above the BFE. The following documentation should be submitted for each LOMA request:

- a. If the property is recorded on a plat map, a copy of the recorded plat indicating both the location of the property and the official recordation information (plat-book volume and page number) and bearing the seal of the appropriate recordation official (e.g., County Clerk or Recorder of Deeds); if the property is not recorded on a plat map, copies of the tax assessor's map or other suitable maps that will aid FEMA in accurately locating the property.
- b. A copy of the recorded deed indicating the legal description of the property and the official recordation information (deed book volume and page number) and bearing the seal of the appropriate recordation official (e.g., County Clerk or Recorder of Deeds).
- c. A topographic map of the total area of the property in question, certified by a registered professional engineer or licensed land surveyor, showing ground elevation contours in relation to the NGVD of 1929, the location of the structure(s), the elevation of the lowest adjacent grade to the structure(s), and the curvilinear boundary that designates the area subject to inundation by the base flood.
- d. Data to substantiate the BFE. If FEMA has completed a Flood Insurance Study (FIS), those data will be used. If an FIS is underway, preliminary data cannot be used to make a determination until the 90-day appeal period has ended and a final BFE has been determined. If FEMA has not performed an FIS, data should be obtained from an authoritative source such as the U.S. Army Corps of Engineers, U.S. Geological Survey, U.S. Soil Conservation Service, or other Federal agency; a State or local water resource department; or a registered professional engineer. If BFEs have not been established previously on the NFIP maps, hydraulic calculations may also be available from one of the above authoritative sources. NFIP maps are available for review at all participating local government offices (generally in the Planning or Public Works Departments). A photocopy (not reduced) of the part of the NFIP map that depicts the property and includes the panel number and date of the effective map should be submitted.
- e. A signed copy of the statement asserting the accuracy of the information submitted. (See attached form entitled "Request for Letter of Map Amendment.")
- f. If the request is for more than one lot or structure, a currently effective NFIP map, or photographic copy, on which the legal metes and bounds of the property, including each lot within a subdivision, have been drawn as accurately as possible. The map submitted must include the panel number and date of the effective map and must bear the seal of a licensed land surveyor or registered professional engineer to certify that the property is

correctly located on the NFIP map based on the legal description of the property. The location of the structure(s) on any lot or tract of property that has a flood boundary running through the bounds of that property should also be drawn accurately. A reproduction from a photocopy of the NFIP map is unacceptable because the size of the map may be distorted.

In certain instances, additional data may be required in order for FEMA to make a determination. These data may consist of, but may not be limited to, certification by a registered professional engineer or licensed land surveyor as to the type of structure and whether it is elevated on posts, piers, pilings, or primary frontal sand dunes; hydraulic calculations on the flooding condition; and development plans indicating dates and extent of fill placement.

3. Conditional LOMAs

A conditional LOMA may be issued for a proposed structure(s) on property that is partially inundated by the base flood. It must be shown that the structure(s) will be located on natural high ground, or on compacted fill that was placed prior to the effective date of the first NFIP map that identified the property as being within the SFHA. To qualify for a conditional LOMA, the proposed structure(s) must meet the same criteria as those required for a LOMA. After construction is completed, certified as-built information must be submitted to FEMA in order for a LOMA to be issued.

FEMA has initiated a reimbursement procedure to allow for the recovery of costs associated with the review of requests for conditional LOMAs, thereby reducing the expense to the general taxpayer. Further information regarding this procedure is located in Part 72 of the NFIP regulations, published at 44 CFR 72.

Property owners and developers should note that a conditional LOMA merely provides comment on the proposed plan and does not amend the map. It also does not relieve Federal agencies of the need to comply in carrying out their responsibilities for providing federally undertaken, financed, or assisted construction and improvements or in their regulating and licensing activities, in accordance with the provisions of Executive Order 11988.

4. Special Considerations

As previously stated, individuals who furnish technical data indicating that the elevation of a legally defined property that does not have a structure on it or of the lowest adjacent grade to a structure(s) is at or above the BFE and that the property or structure(s) is located on natural high ground or on fill placed prior to the effective date of the first NFIP map that identified the property as being within the SFHA usually may have the structure removed from the floodplain shown on the

map. However, the following special considerations provide exceptions to this rule:

a. Sheetflow Flooding (AO Zones)

In areas of sheetflow flooding (AO Zones), except those areas subject to alluvial fan flooding, technical data must be submitted to indicate that the lowest adjacent grade(s) of the structure(s) is above the depth of shallow flooding, while adequate drainage paths to guide floodwaters around and away from the structure(s) have been maintained.

b. Elevated Structures

If the lowest floor of a building has been elevated on posts, piers, or pilings above the BFE in the SFHA and any portion of the structure (i.e., posts or piers) is still below the BFE, the building will not be removed from the SFHA.

5. FEMA Evaluation and Response

After the required data have been received and evaluated by FEMA, the individual(s) who submitted the request will be notified of the findings. Should a review of the evidence indicate that a change in NFIP maps is needed, a LOMA will be issued and copies will be transmitted to the NFIP State Coordinator and the community. The time required for FEMA to review a request for a LOMA will generally depend on the quality and completeness of the data submitted. In accordance with Part 70 procedures, the requestor will be notified in writing of the determination within 60 days of the date of receipt of all required data.

6. Insurance Purchase and Premium Refund After Issuance of a LOMA

Property owners are required to purchase flood insurance as a condition of direct Federal or federally related financial assistance on a structure located in a designated SFHA on an NFIP map. An individual seeking a LOMA should check with the lending institution that originally imposed the flood insurance requirement to ensure that, if a LOMA is issued by FEMA, the lending institution will waive the insurance purchase requirement. Although FEMA may issue a LOMA removing a structure(s) from the SFHA, it is the lending institution's prerogative to require flood insurance if it deems such action appropriate. If, however, the lending institution agrees to waive the flood insurance purchase requirement, the property owner is eligible for a full refund of the premium paid for the current policy year, provided that no claim is pending or has been paid on the policy in question during the same policy year. If the property owner has been required to renew his or her policy during a period when a revised map was being printed, the premium will be refunded for an additional year. To initiate processing of the refund, the property owner should provide the LOMA and evidence of the waiver of the flood insurance requirement from the lending institution to the insurance agent or broker who sold the policy.

7. Appropriate Address

A request for a single-lot or single-structure LOMA should be sent to the appropriate FEMA Regional Office. (See attached list of Regional Office addresses and telephone numbers.)

A request for multiple lots, multiple structures, or a subdivision should be sent directly to the following address for disposition:

Federal Emergency Management Agency
Federal Insurance Administration
Office of Risk Assessment
Technical Operations Division
500 C Street, SW.
Washington, D.C. 20472

More specific information relating to LOMAs may be obtained by contacting FEMA's Washington Office at (202) 646-2764.

Attachments

FEMA REGIONAL OFFICES

REGION I

(Connecticut, Maine, Massachusetts,
New Hampshire, Rhode Island, and Vermont)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

J.W. McCormack Post Office and
Courthouse Building, Room 462
Boston, Massachusetts 02109

(617) 223-9561

REGION II

(New York, Puerto Rico, New Jersey,
and Virgin Islands)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

26 Federal Plaza, Room 1349
New York, New York 10278

(212) 238-8200

REGION III

(Delaware, District of Columbia,
Maryland, Pennsylvania, Virginia,
and West Virginia)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

Liberty Square Building
(Second Floor)
105 South Seventh Street
Philadelphia, Pennsylvania 19106

(215) 931-5737

Region IV

(Alabama, Florida, Georgia, Kentucky,
Mississippi, North Carolina, South
Carolina, and Tennessee)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

1371 Peachtree Street, Northeast
Suite 735
Atlanta, Georgia 30309

(404) 853-4400

REGION V

(Illinois, Indiana, Michigan,
Minnesota, Ohio, and Wisconsin)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

175 West Jackson Boulevard
(Fourth Floor)
Chicago, Illinois 60606

(312) 408-5552

April 1990

REGION VI

(Arkansas, Louisiana, New Mexico,
Oklahoma, and Texas)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

Federal Regional Center
800 North Loop 288
Denton, Texas 76201-3698

(817) 898-9127

REGION VII

(Iowa, Kansas, Missouri, and
Nebraska)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

Federal Office Building
911 Walnut Street
Kansas City, Missouri 64106

(816) 283-7009

REGION VIII

(Colorado, Montana, North Dakota,
South Dakota, Utah, and Wyoming)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

Denver Federal Center
Box 25267, Building 710
Denver, Colorado 80225-0267

(303) 235-4830

REGION IX

(Arizona, California, Guam, Hawaii, and
Nevada)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

Building 105
Presidio of San Francisco
San Francisco, California 94129

(415) 923-7177

REGION X

(Alaska, Idaho, Oregon, and Washington)

Federal Emergency Management Agency
Natural and Technological Hazards
Division

Federal Regional Center
130 228th Street, SW.
Bothell, Washington 98021-9796

(206) 487-4678



Federal Emergency Management Agency

Washington, D.C. 20472

REQUEST FOR LETTER OF MAP AMENDMENT

This is to request that a determination be made as to whether or not a certain land area or structure is within a Special Flood Hazard Area.

I hereby certify that, to the best of my knowledge, fill has not been placed to elevate this land or structure since the date it was first identified as being in a Special Flood Hazard Area.

All documents submitted in support of this appeal are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Applicant's Name: _____
(please print or type)

Address: _____

(please print or type)

Daytime Telephone Number: _____

Date

Signature of Applicant

April 1990



Federal Emergency Management Agency

Washington, D.C. 20472

REQUEST FOR CONDITIONAL LETTER OF MAP AMENDMENT (LOMA)
OR CONDITIONAL LETTER OF MAP REVISION (LOMR) BASED ON FILL

This is to request that a determination be made as to whether or not a certain land area or structure is within a Special Flood Hazard Area.

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

The applicant understands that FEMA has implemented a reimbursement procedure to allow for the recovery of costs associated with the review of requests for conditional LOMAs and conditional LOMRs, thereby reducing the expense to the general taxpayer (Title 44, Code of Federal Regulations, Chapter 1, Part 72).

The applicant further understands and agrees that the initial fee is \$150.00 for single-lot requests and \$210 for multi-lot or subdivision requests. The initial fee is the minimum charge for the review of the submitted documentation. Additional costs could be required upon completion of the review and prior to the issuance of a conditional LOMA or conditional LOMR, depending upon the complexity of the review.

The applicant agrees to reimburse FEMA for both the initial fee as referenced above, and any additional costs incurred by FEMA in a total amount not to exceed \$500.00. FEMA agrees that if the total cost will exceed \$500.00, the applicant will be advised before additional costs in excess of \$500.00 are incurred.

This request is () based on fill () is not based on fill

The initial fee associated with this request is

- () \$150 (single-lot request)
() \$210 (multi-lot request or subdivision request)

Applicant's name, address, and daytime phone number

Date

Signature of Applicant

Applicant's comments regarding the request: _____

DATA REQUEST CHECKLIST
FOR A LETTER OF MAP AMENDMENT

Requestor: _____ Date: _____

Community: _____ Property: _____

The information checked below in Column 1 is required to process your request for a Letter of Map Amendment. Information checked in Column 2 has been received and should not be resubmitted unless specifically requested. Failure to submit the required data could delay the processing of your request.

(1) <u>Required</u>	(2) <u>Received</u>	
_____	_____	1. A copy of the recorded Deed giving the legal description of your property, bearing the seal of the County Clerk or Recorder of Deeds, and indicating the official recordation data (deed book volume and page number).
_____	_____	2. A copy of the recorded plat map showing the location of your property, bearing the seal of the County Clerk or Recorder of Deeds, and indicating the official recordation data (plat book volume and page number).
_____	_____	3. Tax assessor's maps or other suitable maps showing the surveyed location of the property (only in cases where a recorded plat is not available).
_____	_____	4. Street address(es) of the property.
_____	_____	5. If your request is for more than one lot or structure, then a photographic or original copy of an official currently effective National Flood Insurance Program map (FIRM or FHBM) showing the accurately plotted legal metes and bounds of the property and certified by a professional engineer or licensed land surveyor.
_____	_____	6. Certified planimetric information indicating the location of structures on the property.
_____	_____	7. Certification by a registered professional engineer or licensed land surveyor stating the elevation of the lowest adjacent grade to the structure. (Include datum.) The lowest adjacent grade to the structure is the lowest ground elevation touching the structure. The "average low grade" from the Elevation Certificate is unacceptable.
_____	_____	8. Hydraulic calculations for: _____

(1)	(2)	
<u>Required</u>	<u>Received</u>	

- | | | |
|-------|-------|--|
| _____ | _____ | 9. The signed and dated "Request for Letter of Map Amendment" form (attached). |
| _____ | _____ | 10. Daytime telephone number. |
| _____ | _____ | 11. Provide the Base Flood Elevation (BFE) at the location of your property from an authoritative source. (i.e., Community Floodplain Administrator) |
| _____ | _____ | 12. Mark the location of your property on a copy of a Flood Insurance Rate Map. |
| _____ | _____ | 13. Other: _____ |

The information checked in Column 1 should be sent to the following address:

FEMA - Region VI
Federal Regional Center
800 North Loop 288
Denton, Texas 76201-3698

Revised October 1989

FEDERAL EMERGENCY MANAGEMENT AGENCY

Appeals, Revisions, and Amendments to Flood Insurance Maps

A GUIDE FOR COMMUNITY OFFICIALS

January 1990



Preface

The Federal Emergency Management Agency (FEMA), as the agency responsible for administration of the National Flood Insurance Program (NFIP), conducts hydrologic and hydraulic analyses to determine the magnitude of the flood risk in communities throughout the United States. Those analyses, performed under FEMA guidelines by private engineering firms and Federal and State agencies, are based on standard engineering practices and yield the flood risk information (including base (100-year) flood elevations, flood risk zones, and floodplain and floodway boundary delineations) shown on NFIP maps.

Nearly 18,000 communities now participate in the NFIP. Using the flood risk information presented on NFIP maps, participating communities design and adopt floodplain management measures aimed at reducing future flood losses, and FEMA makes actuarially based flood insurance available to the millions of property owners in those communities.

FEMA recognizes that NFIP maps require changes from time to time as a result of proposed development in previously unstudied areas, floodplain and watershed changes, or improvements in the techniques used for assessing flood risk. Citizens and local governments play an important role in keeping NFIP maps technically sound and up to date as conditions change in their communities.

This Guide provides basic information about the technical standards to be applied and the administrative procedures to be followed by local officials and others who request changes to NFIP maps. This Guide is intended not only to discuss those standards and procedures but also to help local officials understand how they can be most effective in maintaining the accuracy of the flood risk information developed for their communities.

Since the first publication of this Guide in September 1985, over 13,000 copies have been distributed to community officials and other interested parties. The information presented in the Guide has enabled those who wish to update NFIP maps to identify the appropriate process, collect and submit the necessary supporting data, and ultimately help FEMA respond efficiently to the needs of NFIP map

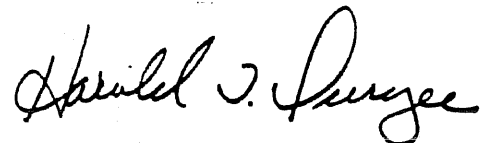
users. By increasing the efficiency of the appeal, map revision, conditional map revision, and map amendment processes in this way, the Guide has proved to be as useful as it is popular.

The NFIP has not remained static, however. Over the years, the NFIP and related regulations have evolved to meet new needs--those of the Program as well as those of participating communities.

With increasing land-development pressure, the growth of community awareness of flood risks and the need for adequate flood-mitigation measures, and the advent of new techniques for assessing flood risks, concomitant changes have been made in the NFIP regulations, particularly in those related to the appeal, revision, and amendment processes. Clearly, to remain a useful tool, this Guide must provide the latest information about those processes; it is to meet this need that this updated Guide has been prepared.

This Guide is designed for readers who do not need refined technical or legal explanations but do need a basic understanding of the processes by which NFIP maps may be changed. The use of technical terms in this Guide has therefore been kept to a minimum, and the information presented is not intended to serve as legal definitions.

Readers who need additional technical information may obtain copies of the FEMA Conditions and Criteria documents listed in Appendix C. For information about legal requirements, readers should refer to Title 44, Chapter I, Parts 59-77 of the Code of Federal Regulations (44 CFR, 59-77), which govern the operation of the NFIP. Parts 65, 67, 70, and 72 apply specifically to the map change processes described in this Guide. In the event of any conflict between the information presented herein and that set forth at 44 CFR, 59-77, the latter takes precedence.



Harold T. Duryee
Administrator
Federal Insurance Administration

Table of Contents

Chapters	Page
Chapter 1	
Introduction	1
National Flood Insurance Program	1
Need for Documentation	2
Appeals, Map Revisions, and Map Amendments	3
Chapter 2	
How To Use This Guide	5
Step 1--Determining Map to be Changed and Changes Needed	5
Step 2--Selecting a Revision Process	7
Chapter 3	
Appeals	11
Background	11
How To Appeal	11
Required Supporting Data	12
Scientifically Incorrect BFEs	13
Technically Incorrect BFEs	13
General Technical Guidance	14
Appeal Resolution Procedures	17
Chapter 4	
Map Revisions	19
Background	19
How To Request a Map Revision	19
Required Supporting Data	20
General Technical Guidance	24
Map Revision Procedures	27
Chapter 5	
Conditional Map Revisions	31
Background	31
How To Request a Conditional Map Revision	31
Required Supporting Data and General Technical Guidance	32
Conditional Map Revision Procedures	33
Chapter 6	
Map Amendments	35
Background	35
How To Request an Amendment	35
Required Supporting Data	36
General Technical Guidance	36
Map Amendment Procedures	38
Chapter 7	
Floodway Revisions	39
Background	39
How To Request a Floodway Revision	40

Table of Contents (cont.)

Chapters (cont.)

	Page
Chapter 7	
Floodway Revisions (cont.)	
Required Supporting Data	41
General Technical Guidance	42
Floodway Revision Procedures	42

Figures

Figure 1 - Title Blocks of NFIP Maps	6
Figure 2 - Summary of NFIP Map Change Processes	8

Appendixes

Appendix A - Protests

Appendix B - Glossary and Abbreviation Index

Appendix C - How To Obtain FEMA Publications and Backup Data for NFIP Maps

Appendix D - FEMA Offices

Chapter 1

Introduction

This Guide has been designed to provide community officials, planners, and engineers with information about how to request changes to National Flood Insurance Program (NFIP) maps and other flood risk information prepared by the Federal Emergency Management Agency (FEMA).

In the past, FEMA has expended a great deal of time and effort to obtain the technical information needed to evaluate requests for changes to NFIP maps. The goal of this Guide is to provide general information about the types of supporting data that FEMA needs to review and evaluate such requests. Background information about the NFIP, including the regulations and procedures under which requests for changes are handled by FEMA, has also been provided herein.

National Flood Insurance Program

The U.S. Congress established the NFIP in 1968. Communities participating in the NFIP do so in two phases--the Emergency and Regular Phases. In communities participating in the initial phase of the NFIP, the Emergency Phase, limited amounts of flood insurance are available to local property owners. In communities participating in the Regular Phase, full flood insurance coverage is available. The NFIP and related regulations, which define responsibilities and requirements for both FEMA and each participating community, are set forth at Title 44, Chapter I, Parts 59-77, Code of Federal Regulations (CFR).

The NFIP was designed to benefit both individual property owners and communities. It enables property owners to purchase flood insurance at reasonable rates, and it assists communities by requiring that they adopt and administer local floodplain management measures aimed at protecting lives and new construction from future flooding. All communities that have the authority to adopt, administer, and enforce floodplain

management regulations can participate in the NFIP.

Under the Emergency Phase of the NFIP, FEMA issued Flood Hazard Boundary Maps (FHBM) for more than 19,000 flood-prone communities in the United States. FHBM provide approximate delineations of areas subject to inundation by the base (100-year) flood; in the NFIP, these areas are known as Special Flood Hazard Areas (SFHAs). The base flood is the flood that has a 1-percent probability of being equaled or exceeded in any given year and has been adopted as a regulatory standard by Federal agencies, and most States, for use in the administration of floodplain management programs.

The boundaries of the SFHAs (referred to as 100-year floodplain boundaries) shown on an FHBM are based on one or more of the following: information about past floods, regional flood depth/drainage area relationships, floodplain maps published by other Federal agencies, and simplified hydrologic and hydraulic calculations. Detailed analyses and field surveys are generally not performed for the preparation of an FHBM. As a result, the floodplain boundaries shown are considered approximate, and the SFHAs are designated "Zone A."

Generally, at some point after an FHBM has been issued for a community, a detailed engineering study of the flood hazards in that community--a Flood Insurance Study (FIS)--is conducted. The purpose of the FIS is to refine the 100-year floodplain boundaries shown on the FHBM and to develop new, detailed flood risk information. That information usually consists of base flood elevations (BFEs), which may be presented as either water-surface elevations referenced to the National Geodetic Vertical Datum of 1929 (NGVD) or average depths of flow in feet above the ground surface; 10-, 50-, and 500-year water-surface elevations; 100-year floodway boundaries; and 500-year floodplain boundaries. The results of the FIS are presented on a Flood Insurance Rate Map (FIRM) and, usually, in an FIS report.

A FIRM depicts 100- and 500-year floodplain boundaries, flood insurance rate zones, BFEs, base flood depths, and, occasionally, 100-year floodway boundaries. The FIS report describes the analyses performed for the FIS and provides tables and figures that present the study results.

The information presented on a FIRM and in an FIS report is usually the result of detailed engineering analyses performed as part of an FIS. Those analyses include hydrologic analyses that yield flood discharge-frequency relationships and hydraulic analyses that yield computed flood elevations and depths. The hydrologic analyses usually involve the use of statistical analyses of recorded stream gage data, regional discharge-drainage area relationships, or rainfall-runoff models.

For riverine flooding sources, the hydraulic analyses usually involve backwater computations or other hydraulic computations that are based on the computed flood discharges and the results of field surveys. Special techniques are used for the analysis of coastal flooding, alluvial fan flooding, and ice jams.

SFHAs identified through the use of detailed engineering analyses are assigned "detailed" zone designations (Zone AO, Zone AH, Zones A1-A30 or Zone AE, Zones V1-V30 or Zone VE). A FIRM may also depict approximate SFHAs, which may have been taken directly from an effective FFBM or developed by the FIS Contractor using approximate engineering analyses.

The 100- and 500-year floodplain and 100-year floodway boundaries may be shown on a separate Flood Boundary and Floodway Map (FBFM) published as an exhibit in the FIS report. For most recent FISs, FFBMs are not prepared, and all flood risk information, including information related to the 100-year floodway, is shown on the FIRM.

Occasionally, an entire FIRM is created directly from an FFBM; no detailed engineering analyses are performed. Such a FIRM does not present the detailed flood risk information usually shown on FIRMs, but it does enable the mapped community to participate in the Regular Phase of the NFIP.

Additional information about the various types of FIRMs now in effect is provided in a separate FEMA publication, Guide to Flood Insurance Rate Maps, which describes the key elements of FIRMs and explains how to use a FIRM. See Appendix C for information about how to obtain copies of Guide to Flood Insurance Rate Maps and other FEMA publications.

Before entering the Emergency and Regular Phases of the NFIP, the community must, if it has not already done so, adopt and enforce floodplain management regulations that are aimed at reducing future flood losses and that meet the minimum standards of the NFIP.

Need for Documentation

The flood risk information presented on NFIP maps and in FIS reports forms the technical basis for the administration of the NFIP. Participating communities use the information to develop the floodplain management ordinances required under the NFIP, and FEMA uses the information to establish actuarial rates for flood insurance. Because of the importance of that information, FEMA exercises great care to ensure that the analytical methods employed in FISs are scientifically and technically correct, that the engineering procedures followed meet professional standards, and, ultimately, that the results of the FIS are accurate.

Although NFIP maps and FIS reports are prepared according to rigorous technical standards, FEMA recognizes that improvements in the techniques used in assessing flood risks, changes in physical conditions in floodplains or watersheds, and the availability of new scientific or technical data may necessitate changes to the maps and reports. In addition, the limitations imposed by the scales at which the maps are prepared may result in individual properties being inadvertently included in SFHAs.

Therefore, the NFIP regulations allow FEMA to revise and amend NFIP maps and FIS reports, as warranted, at its discretion or after it receives requests from community officials and individual property owners. Indeed, to help FEMA ensure that the maps and reports present information that accurately reflects existing flood risks, the NFIP regulations (Section 65.3)

require that each participating community inform FEMA of any physical changes that affect BFEs in the community and, within 6 months of the date such changes occur, submit data that show the effects of those changes.

In making revisions and amendments, FEMA must adhere to the same engineering standards applied in the preparation of the original NFIP maps and reports. When requesting changes to NFIP maps and reports, community officials and property owners must submit adequate supporting data. Those data, which are described in the following chapters and in the NFIP regulations, enable FEMA to review and evaluate the requests and to carry out its responsibility to ensure that the flood risk information presented is scientifically and technically correct. Over the years, the majority of community requests for such changes have been found to be warranted, but FEMA cannot make changes without adequate supporting data.

Appeals, Map Revisions, and Map Amendments

The following terms are encountered during the processing of NFIP map changes:

- **Appeal**--A challenge to proposed BFE determinations during a formal 90-day appeal period. The changes that result from successful appeals are incorporated into the FIRM, FIS report, and/or FBFM before publication. If the challenge does not address BFEs, but does address other flood risk information, such as the 100-year floodway, it is considered a "protest." (See Appendix A.)
- **Map Revision**--A change to an effective NFIP map. The effective map for a community is the latest map issued by FEMA for that community. NFIP maps, including the BFEs, base flood depths, floodways, and other flood risk information they may contain, become effective after they are published and distributed. The effective date is shown in the title box of each panel of the map and may be labeled as "Effective Date," "Revised," or "Map Revised."

When a map revision is warranted, FEMA will either revise and republish the affected map panels (and, if necessary, the FIS report) or issue a letter, referred to as a Letter of Map Revision (LOMR), that describes the changes and officially revises the effective map.

- **Conditional Map Revision**--A response to a request that FEMA determine whether a proposed project, such as a flood-control structure, would warrant a revision to an effective NFIP map after the project is completed. A proposed structural modification could consist of a proposed floodplain improvement project or simply the proposed placement of fill for the elevation of one or more structures or parcels of land.

As discussed further in Chapters 2 and 5 of this Guide, fees are charged for the review of requests that are based on proposed or future actions. FEMA's comments on such requests are known as conditional determinations. When such conditional determinations are warranted, they are issued in letters, referred to as Conditional Letters of Map Revision (CLOMRs). CLOMRs describe the effect(s) that the proposed project would have on the effective NFIP map. A conditional determination does not revise an effective NFIP map.

- **Map Amendment**--The exclusion of an individual structure and/or a legally described parcel of land that was inadvertently included in the SFHA shown on an effective FIRM or FBFM. When FEMA determines that the structure or parcel has been inadvertently included in the SFHA, FEMA issues a letter, referred to as a Letter of Map Amendment (LOMA). A LOMA excludes the structure and/or parcel of land that was inadvertently included in the SFHA and officially amends the effective NFIP map.

The terms defined above refer not only to types of changes to NFIP maps and reports but also to the processes under which FEMA will address

requests for such changes. Chapter 2 of this Guide will help requestors determine which process applies to particular requests. The remaining chapters discuss the scientific and technical data that must be submitted in support of requests for various types of changes and describe the procedures by which those changes are made.

Chapter 2

How To Use This Guide

As indicated by the descriptions of appeals, map revisions, conditional map revisions, and map amendments in Chapter 1, the appropriate process for changing a specific NFIP map is determined by the type of map, the status of the map (e.g., effective, in a statutory 90-day appeal period), and the types of changes to be made. For example, for changes to proposed BFEs during a statutory 90-day appeal period, the appeal process would be appropriate; for changes to the BFEs shown on an effective NFIP map, the map revision process would be appropriate.

Therefore, to determine which of the three processes for changing NFIP maps is applicable to your needs, you should follow the two steps outlined in this chapter. In Step 1, you answer the following questions:

- What type of NFIP map is to be changed?
- What is the status of that map?
- What types of changes are to be made?

The information you need to answer those questions is provided below.

In Step 2, you use the answers from Step 1 to choose the appropriate process. The detailed information provided in Step 2 concerning the conditions under which each process is applicable will enable you to make that determination.

Once you have identified the appropriate process, you can refer to the chapter in which that process is discussed for additional information concerning procedures and supporting data.

Step 1--Determining Map To Be Changed and Changes Needed

Type of map to be changed. Changes can be made to FHBMs, FIRMs, and FBFMs; however,

because the regulations, processing procedures, and required supporting data vary according to

the type of map to be changed, it is important that you identify the type of map in question and understand how the information presented on the map was developed. The descriptions of FHBMs, FIRMs, and FBFMs in Chapter 1 and the sample map title blocks shown in Figure 1 will help you.

Status of the map. When an initial or revised FHBM, FIRM, or FBFM is prepared for a community, it must be reviewed in preliminary form by that community before being published and becoming effective. The status of the map is the stage in the review and publication process that the map has reached.

An FHBM presented less information than a FIRM and FBFM, and the information that is presented is the result of analyses that are less rigorous than those employed in the preparation of the FIRM and FBFM. Therefore, the NFIP regulations that apply to a community for which only an FHBM had been issued are less comprehensive, and the ordinances that were adopted by the community were less complex, than those required after a FIRM and FBFM had been issued. Consequently, the review periods and processing procedures varied according to map type.

A more lengthy and complex procedure is followed for the community review of a FIRM or a FIRM accompanied by an FBFM. Preliminary copies of the FIRM, and FBFM as necessary, are sent to the community for an initial review. The review is followed by a formal coordination meeting at which community officials and residents may comment on the FIRM and/or FBFM. After any significant problems identified at the meeting are resolved, a notice of the BFEs shown on the FIRM is published in a local newspaper and in the Federal Register. At that point, the BFEs are considered proposed.

As discussed in Chapter 3, NFIP regulations require that when BFEs are established or changed for a community, the community must be given a statutory 90-day appeal period, during which community officials or property

FLOOD HAZARD BOUNDARY MAP

**MARIPOSA COUNTY,
CALIFORNIA**
UNINCORPORATED AREA
PAGE 2 OF 19
(SEE MAP INDEX FOR PAGES NOT PRINTED)

EFFECTIVE DATE:
NOVEMBER 29, 1977

COMMUNITY - PANEL NO.
060634 0002 A

 U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**NAPA COUNTY,
CALIFORNIA**
(UNINCORPORATED AREAS)

PANEL 410 OF 500
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060205 0410B

MAP REVISED:
SEPTEMBER 15, 1989

 Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY
FLOOD BOUNDARY AND
FLOODWAY MAP

**NAPA COUNTY,
CALIFORNIA**
(UNINCORPORATED AREAS)

PANEL 410 OF 500
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060205 0410

MAP REVISED:
SEPTEMBER 15, 1989

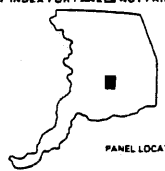
 Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**SACRAMENTO
COUNTY,
CALIFORNIA**
(UNINCORPORATED AREAS)

PANEL 345 OF 705
(SEE MAP INDEX FOR PANELS NOT PRINTED)


PANEL LOCATION

COMMUNITY-PANEL NUMBER
060262 0345 C

MAP REVISED:
SEPTEMBER 30, 1988

 Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**BOISE COUNTY,
IDAHO AND
INCORPORATED AREAS**

PANEL 419 OF 575


PANEL LOCATION

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
IDAHO CITY, CITY OF	160227	0419	B
UNINCORPORATED AREAS	160205	0419	B

MAP NUMBER
16015C0419B

EFFECTIVE DATE:
APRIL 5, 1988

 Federal Emergency Management Agency

FIGURE 1
Title Blocks of NFIP Maps

owners may appeal the proposed BFEs. Such appeals must be based on scientific or technical data.

After the appeal period has ended and all appeals have been resolved, the Administrator of the Federal Insurance Administration will issue a final BFE determination. The Administrator makes the BFEs final by publishing them in the Federal Register and sending a final BFE determination letter to the Chief Executive Officer (CEO) of the community. The final determination letter informs the CEO that the community is being given 6 months to enact the ordinances required for participation in the Regular Phase of the NFIP. During this 6-month period, the FIRM and, if appropriate, FBFM and FIS report are printed. At the end of the 6-month period, the FIRM and FBFM become effective.

If an effective FHBM, FIRM, or FBFM is revised and republished as a result of a FEMA Flood Insurance Restudy (RFIS) or through the Map Revision process (Chapter 4), the community is given review periods similar to those described previously for the initial FHBM, FIRM, and FBFM, with the following exceptions. When a revision to an effective NFIP map does not include new or revised BFEs, no 90-day appeal period is required. The affected community is given only a 30-day review period, after which the map is printed.

When an effective FIRM is revised through the LOMR process, the FIRM will not be revised and republished. The LOMR officially revises the FIRM and the revision becomes effective immediately, on the date of the LOMR. When BFEs are revised by LOMR a 90-day appeal period is provided to the community after the LOMR is issued. As explained in Chapter 4, FEMA issues LOMRs to lower or eliminate BFEs, but not to raise or add BFEs.

FEMA notifies community officials by letter as specific milestones in the previously described processes are reached. Any questions concerning the status of the NFIP map that cannot be answered from the information provided routinely by FEMA can be answered by staff members of the appropriate FEMA Regional Office. (See Appendix D.)

If you need a copy of the effective NFIP map for your community or simply want to verify that a map you may already have is the effective map, you may place an order or ascertain the needed information by calling the Flood Map Distribution Center at 1-800-333-1363. Appendix C provides additional information about how to obtain a copy of an effective NFIP map.

Type(s) of change(s) being requested.

NFIP maps present various types of flooding information: floodplain boundaries, floodways, flood insurance rate zones, and BFEs. The maps also depict planimetric features such as streams and lakes, roads, railroads, major buildings, and the boundaries of incorporated communities, counties, and Federal and State lands.

Requests for changes to NFIP maps may involve one or more type of flooding information and may also involve other planimetric features shown on the map. Often, because much of the information presented on the map is interrelated, a change to one type of information will necessitate changes to others. Each of the four processes for changing NFIP maps (Appeals, Map Revisions, Conditional Map Revisions, and Map Amendments) is applicable only to a specific type of change. Therefore, you should not only consider the type of change being requested but also determine whether changes to related map information will be necessary and what those changes are.

In making that determination, you must consider the basis for the requested change. For example, a request for a change to a 100-year floodplain boundary delineation may be based on the effects of a channelization project. However, such a project is also likely to affect the BFEs, floodway boundary, and stream configuration shown on the map. You will not always be able to identify every change that may be necessary; however, by attempting to do so, you will ensure that your request is processed as quickly and efficiently as possible.

After completing Step 1, you will have identified the type of map to be changed, the status of the map, and the types of change(s) to be made. In Step 2, you will determine which of the four processes is applicable to your request. General descriptions of the conditions under which each

process is applicable are provided in the following portion of this chapter. The chart shown in Figure 2 summarizes the information provided in Steps 1 and 2 and may be used as a guide for choosing the appropriate process.

Step 2--Selecting a Revision Process

More-detailed information about each process, including the types and amounts of data that you must submit, are provided in Chapters 3, 4, 5, 6, and 7. This Guide is applicable only to changes that may be made under the Appeal, Map Revision, Conditional Map Revision, and Map Amendment processes. If the conditions under which a change is to be made are not the same as those specified for one of the four processes described in this section, you should discuss the requested change with a representative of the appropriate FEMA Regional Office.

Appeals (Part 67). Under Title 44, Chapter I, Part 67, CFR, Appeals are defined as requests for changes to proposed BFEs. To qualify as Appeals, such requests must be submitted to FEMA during the formal 90-day appeal period and must be supported by data that show that the proposed BFEs are either scientifically or technically incorrect.

A formal 90-day appeal period is provided to a community only when new or revised BFEs are being proposed for the community and may therefore be required in only two situations: (1) when a community is being converted to the Regular Phase of the NFIP with a FIRM that presents new BFEs or (2) when the BFEs shown on an effective FIRM for a community are being revised by an RFIS or through the Map Revision process.

Because BFEs are not shown on FHBMs, the appeal process applies only to FIRMs. In addition, although changes to map information other than proposed BFEs (e.g., floodplain boundaries, floodway boundaries, flood insurance rate zones) may be necessary as part of the resolution of an Appeal, requests that do not involve BFEs do not qualify as Appeals. Requests of this type, when submitted during the 90-day appeal period, are called Protests.

The FEMA policy concerning the processing of Protests is discussed in Appendix A.

Map Revisions (Part 65). Under Title 44, Chapter I, Part 65, CFR, changes may be made to the information depicted on effective FHBMs, FIRMs, and FBFMs. Changes to floodplain boundaries, floodway boundaries, flood insurance rate zones, BFEs, flood depths, and other information shown on the maps may be requested under this process.

Such changes may be based only on existing conditions; in general, the effects of proposed projects and future floodplain or watershed conditions cannot be shown on NFIP maps and, therefore, do not warrant map revisions. Refer to Chapter 4, "Map Revisions", for information about exceptions to this general rule.

Occasionally, because of the limitations of the scale at which NFIP maps are prepared, the SFHA boundaries cannot accurately reflect the existence of individual structures or small parcels of land that are above the BFE. This situation can occur when fill has been placed to elevate the structure or parcel or when the structure or parcel is on unaltered high ground.

Although such structures and parcels of land can be removed from the SFHA, the process by which they are removed depends on whether fill was placed and when. If the structure or parcel of land is elevated by fill placed after the effective date of the first NFIP map that showed the property to be within the SFHA, the request is processed as a request for a map revision. Where fill has not been placed, or was placed before that date, the structure or parcel is considered to have been inadvertently included in the SFHA and the request is processed as a request for a Map Amendment (Part 70).

Requests for the removal of structures or parcels of land inadvertently included in both the SFHA and regulatory floodway are always processed as requests for Map Revisions.

Conditional Map Revisions (Part 72). Under Title 44, Chapter I, Part 72, CFR, FEMA may issue a conditional determination regarding the effects of proposed projects, such as modifications of stream channels and floodplains, and the proposed elevation of

Type of Map To Be Changed	Status of Map	Type of Change	Process (Authority)	Method of Change	Chapter of This Guide
FIRM FIRM FBFM	In 90-Day Appeal Period	Change to BFE _____ Changes to Any Information Other Than BFEs	Appeal (44 CFR, Part 67) _____ Protest	Map and Report Revised Before Publication	3 _____ Appendix A
FHBM FIRM FBFM	Effective	Changes to Any Flood Hazard Information _____ Exclusion From SFHA of Structures and Legally Described Parcels of Land Elevated By Fill Placed After the Effective Date of the First NFIP Map That Showed the Structure or Parcel To Be Within the SFHA	Map Revision (44 CFR, Part 65)	Publication of Revised Map or Issuance of LOMR _____ Issuance of LOMR	4
FHBM FIRM FBFM	Effective	Conditional Determinations Regarding Proposed Projects, Future Conditions, and the Proposed Elevation of Structures and Legally Described Parcels of Land By Fill	Map Revision (44 CFR, Part 72)	Issuance of Conditional LOMR	5
FIRM	Effective	Exclusion From SFHA of Structures and Legally Described Parcels of Land Where Topographic Alterations Have Not Occurred Since the Date of the First NFIP Map That Showed the Structure or Parcel To Be Within the SFHA	Map Amendment (44 CFR, Part 70)	Issuance of LOMA	6

FIGURE 2. Summary of NFIP Map Change Processes

individual structures and parcels of land. Under the conditional map revision process, scientific or technical data may be submitted for a proposed action and a request may be made that FEMA review the data and issue a CLOMR. The CLOMR describes the revisions that could be made to the NFIP map in the future, after the modification is in place and functioning effectively.

To recoup the costs associated with the review of such requests, FEMA has established fees for specific types of conditional determinations. The fee requirement is discussed further in Chapter 7, and the fees are listed in Section 72.3 of the NFIP regulations.

Map Amendments (Part 70). Under Title 44, Chapter I, Part 70, CFR, FEMA may revise an effective NFIP map, by a LOMA, to exclude an individual structure or legally described parcel of land from the SFHA. Occasionally, individual structures or parcels of land may be inadvertently included in the SFHA on an NFIP map, or it may be difficult for a property owner to determine from the map whether a structure or parcel of land is in the SFHA. A property owner who believes that a specific structure or parcel of land has been incorrectly shown in the SFHA or who cannot determine whether the structure or parcel of land is in the SFHA can request that FEMA make that determination.

The map amendment process is not applicable to requests that involve changes to the flooding information shown on an NFIP map or requests based on alterations of topography that were made after the date of the first NFIP map that showed the structure or parcel of land to be within the SFHA. Therefore, LOMA requests cannot be based on new topographic, hydrologic, or hydraulic conditions.

Chapter 3

Appeals

The BFEs shown on FIRMs and on the Flood Profiles in FIS reports are the basis for the detailed floodplain boundaries, detailed flood insurance rate zones, and floodway boundaries shown on FIRMs and FBFMs. That information, including the BFEs, is used for floodplain management and insurance purposes by Federal, State, and local agencies. Because of the significance of the BFEs, FEMA is careful to ensure their accuracy. In addition to applying rigorous standards in developing and updating flood risk information, FEMA provides communities with an opportunity to appeal new or revised BFEs before they become final.

Background

In preparing initial FIRMs and in processing revised FISs and FIRM revisions, FEMA may determine new BFEs for flooding sources for which it has not previously determined BFEs or may revise previously determined BFEs shown on effective FIRMs. When it determines new or revised BFEs for a community, FEMA must, by law, provide the community with a statutory 90-day appeal period.

FEMA starts the appeal period by publishing a notice of the proposed new or revised BFEs in a local newspaper and in the Federal Register. The newspaper notice is published twice; the second publication usually takes place 1 week after the first. On the date of the second publication, the 90-day appeal period begins.

During the appeal period, community officials and individual property owners may appeal the proposed BFEs by submitting data that show that the BFEs are scientifically or technically incorrect. After the 90-day appeal period has elapsed and any appeals have been resolved, FEMA issues a final BFE determination.

New BFEs and revised BFEs that result from an FIS or an RFIS are presented in a Preliminary FIS report and FIRM, which are sent to the affected community before the start of the appeal

period. New BFEs that result from a FIRM revision are also presented in a Preliminary FIS

report and FIRM that are sent to the community before the start of the appeal period. However, revised BFEs that result from a FIRM revision, depending on whether they are higher or lower than those on the effective FIRM, may be presented in one of two ways.

Revisions that result in higher BFEs are made through the physical map revision process, in which the FIRM and FIS report are revised and reprinted and a Preliminary FIRM and FIS report are sent to the community before the start of the appeal period. Revisions that result in lower BFEs, however, may be made by a LOMR; no revised FIRM or FIS report is prepared. The LOMR, which is sent to the community, describes the revisions, including those made to the BFEs; officially revises the FIRM; and informs the community of the publication dates for the notice of the revised BFEs. The appeal period begins on the second of the two publication dates cited in the LOMR.

How to Appeal

Because the Chief Executive Officer (CEO) of the community is responsible for ensuring that the community meets its obligations as a participant in the NFIP, FEMA consults and confers with the CEO, or with a local official designated by the CEO (e.g., a floodplain administrator, city planner, or city engineer), to resolve appeals. Therefore, any individual property owner who wishes to appeal the proposed BFEs must submit the appeal to the CEO or to the designated local official. So that the community will be aware of all appeals and the CEO can comply with the requirements of Part 67 of the NFIP regulations, individual property owners should submit appeals to the CEO or the designated community official.

The CEO or designated community official should review each appeal and, when forwarding it to FEMA, should state whether the community supports the appeal. The CEO or

designee may also appeal on behalf of the community.

Appeals must be submitted during the formal 90-day appeal period; however, when the CEO receives or expects to receive numerous appeals, they should be collected and forwarded to FEMA at the end of the appeal period. It is in the interest of the community for the CEO or designee to notify FEMA of any appeals before the end of the appeal period; otherwise, FEMA might be unaware of legitimate appeals and might proceed with the final BFE determination.

All appeals should be sent to the following:

Chief, Risk Studies Division
Federal Insurance Administration
Federal Emergency Management Agency
500 C Street, SW.
Washington, D.C. 20472

Required Supporting Data

An appeal must be based on data that show the proposed BFEs to be scientifically or technically incorrect. The distinction between "scientifically incorrect" and "technically incorrect" is important because of the differences in the types and amounts of data that an appellant must submit to demonstrate one versus the other. Definitions of those terms are provided later in this section. First, however, it is appropriate to discuss the meaning of the word "correct" as it applies to the BFEs.

The BFEs presented on FIRMs and in FIS reports are the result of engineering methodologies that are used by FEMA FIS Contractors and others whose data FEMA approves and uses. Because numerous methodologies have been developed for estimating flood discharges and flood elevations under a variety of conditions, FIS Contractors and others use their professional judgment in selecting methodologies that are appropriate for the conditions in a particular community.

In general, because the methodologies are the result of attempts to reduce complex physical processes to mathematical models, the methodologies include simplifying assumptions.

Usually, the methodologies are used with data developed specifically for the FIS. Therefore, the results of the methodologies are affected by the amount of data collected and the precision of any measurements made.

Because of the judgments and assumptions that must be made and the limits imposed by cost considerations, the "correctness" of the BFEs is often a matter of degree, rather than absolute. For that reason, appellants who contend that the BFEs are incorrect because better methodologies could have been used, better assumptions could have been made, or better data could have been used must provide alternative analyses that incorporate such methodologies, assumptions, or data and that quantify the effect on the BFEs. FEMA will review the alternative analyses and determine whether they are superior to those used for the FIS.

The BFEs are said to be scientifically incorrect if the methodology used in the determination of the BFEs is inappropriate or incorrect, or if the assumptions made as part of the methodology are inappropriate or incorrect. An appeal that is based on the BFEs being scientifically incorrect would therefore contend that the use of a different methodology or different assumptions would produce more accurate results (i.e., BFEs that are more correct).

The BFEs are said to be technically incorrect if at least one of the following is true:

- The methodology was not applied properly.
- The methodology was based on insufficient or poor-quality data.
- The application of the methodology included mathematical or measurement errors.
- The methodology did not account for the effects of physical changes that have occurred in the floodplain.

The data that must be submitted in support of various types of appeals are discussed in the subsections that follow.

Scientifically Incorrect BFEs--Appeals Based on Contention That Methodology Is Inappropriate or Incorrect

To show that an inappropriate or incorrect hydrologic methodology has been used, the appellant must submit the following data:

- New hydrologic analysis based on an alternative methodology
- Explanation for superiority of alternative methodology
- New hydraulic analysis based on flood discharge values from new hydrologic analysis
- Revised flood profiles
- Revised delineations of floodplain and floodway boundaries

To show that an inappropriate or incorrect hydraulic methodology has been used, the appellant must submit the following data:

- New hydraulic analysis based on alternative methodology and original flood discharge values
- Explanation for superiority of alternative methodology
- Revised flood profiles
- Revised delineations of floodplain and floodway boundaries

Technically Incorrect BFEs

Appeals Based on Contention That Methodology Has Not Been Applied Correctly

To show that the hydrologic methodology was not applied correctly, the appellant must submit the following data:

- New hydrologic analysis in which original methodology has been applied differently
- Explanation for superiority of new application

- New hydraulic analysis based on flood discharge values from new hydrologic analysis
- Revised flood profiles
- Revised delineations of floodplain and floodway boundaries

To show that the hydraulic methodology was not applied correctly, the appellant must submit the following data:

- New hydraulic analysis, based on original flood discharge values, in which original methodology has been applied differently
- Explanation for superiority of new application
- Revised flood profiles
- Revised delineations of floodplain and floodway boundaries

Appeals Based on Contention That Insufficient or Poor-Quality Data Were Used

To show that insufficient or poor-quality hydrologic data were used, the appellant must submit the following data:

- Data believed to be better than those used in original hydrologic analysis
- Documentation for source of data
- Explanation for improvement resulting from use of new data
- New hydrologic analysis based on better data
- New hydraulic analysis based on flood discharge values resulting from new hydrologic analysis
- Revised flood profiles
- Revised delineations of floodplain and floodway boundaries

To show that insufficient or poor-quality hydraulic data were used, the appellant must submit the following data:

- Data believed to be better than those used in original hydraulic analysis
- Documentation for source of new data
- Explanation for improvement resulting from use of new data
- New hydraulic analysis based on the better data and the original flood discharge values
- Revised delineations of floodplain and floodway boundaries

Appeals Based on Contention That Analysis Contains Indisputable Errors

To show that a mathematical error was made, the appellant must identify the error. FEMA will perform any required calculations and make the necessary changes to the FIRM, FBFM, and FIS report.

To show that a measurement error (e.g., an incorrect surveyed elevation used in the FIS) was made, the appellant must identify the error and provide the correct measurement. Any new survey data provided must be certified by a registered professional engineer or licensed land surveyor. FEMA will perform any required calculations and make the necessary changes to the FIRM, FBFM, and FIS report.

Appeals Based on Effects of Physical Changes That Have Occurred in Floodplain

The appellant must identify the changes that have occurred and provide the data FEMA needs to perform a reanalysis. The data may include topographic maps, grading plans, new stream channel and floodplain cross sections, and dimensions of structures.

Among the types of physical changes on which an appeal may be based is the construction of earthfill levees and similar structures. FEMA has established minimum requirements for structural stability, maintenance, and operation that a levee must meet before it can be recognized as providing 100-year flood

protection. The data that an appellant must provide in support of an appeal based on the effects of a levee are described in the following section, "General Technical Guidance."

In general, appeals based on the effects of flood-control structures must demonstrate that the structures are complete and functional. The only exception is for systems that involve Federal funds, where the construction of the system meets the requirement for "adequate progress" as defined in Section 61.12 of the NFIP regulations. The specific data that an appellant must provide in support of an appeal based on the ultimate effects of such a system are also described in "General Technical Guidance."

General Technical Guidance

When developing technical supporting data, appellants should consider the points below:

- Unless appeals are based on indisputable mathematical or measurement errors or the effects of physical changes that have occurred in the floodplain, they must be accompanied by all the data that FEMA needs to revise the FIRM, FBFM, and FIS report. The appellant should therefore be prepared to perform hydrologic and hydraulic analyses, to plot revised flood profiles, and to delineate revised floodplain and floodway boundaries as necessary.

In addition, new flooding information cannot be added to an NFIP map in such a way as to create mismatches with the flooding information shown for unrevised areas. Therefore, in performing new analyses and developing revised flooding information, the appellant must tie the new flood elevations, floodplain boundaries, and floodway boundaries into those shown for areas not affected by the appeal. When appeals involve new flood discharge values, extensive changes in hydraulic conditions, or complex situations in which changes made to the flooding information developed for one flooding source will affect that developed for others, the

appellant may be required to provide new information for a large portion of the map.

- All analyses and data submitted by the appellant, including those that show mathematical or measurement errors, must be certified by a registered professional engineer or licensed land surveyor, as appropriate.
- Appeals, except for those based on the effects of flood protection systems under construction that meet the previously listed requirements, cannot be based on the effects of proposed projects or future conditions. Therefore, any maps, plans, drawings, measurements, or ground elevation data submitted by the appellant must be certified as representing existing, or as-built, conditions.
- Generally, when an appellant is required to submit hydrologic or hydraulic analyses, those analyses must be performed for the same recurrence interval floods studied in the FIS. For riverine, lacustrine, and coastal flooding sources studied by detailed methods, FISs include analyses of the 100-year flood and, usually, the 10-, 50-, and 500-year floods. Often, a hydraulic analysis of the 100-year floodway is performed for riverine flooding sources. For sheetflow and alluvial fan flooding sources studied by detailed methods, most FISs include analyses of only the 100-year flood. Therefore, the extent of the hydrologic and hydraulic analyses an appellant may be required to submit is determined not only by the basis of the appeal but also the type of flooding source and the scope of the FIS.
- Unless the appeal is based on the use of alternative models or methodologies, the hydrologic and hydraulic analyses an appellant submits must be performed with the models used for the FIS. FIS hydrologic analyses for riverine flooding sources are usually performed with standard engineering methodologies, such as flood-frequency analyses of

stream gage data, or with computer models that are in the public domain, such as the U.S. Army Corps of Engineers (COE) HEC-1 model or the U.S. Soil Conservation Service (SCS) TR-20 model.

FIS hydraulic analyses for riverine flooding sources are usually performed with the COE HEC-2 step-backwater model or a similar and widely accepted model, such as the SCS WSP-2 model, or the U.S. Geological Survey (USGS) WSPRO model.

For the analysis of alluvial fan flood hazards and the hazards associated with coastal storm surge and wave action, including wave height and wave runup, FEMA has established or adopted special methodologies and computer models. For analyses of lacustrine and sheetflow flood hazards, FEMA uses a variety of standard engineering models and methodologies.

Appellants may request from FEMA copies of the input and output data from the model(s) used in a specific FIS or copies of other calculations or analyses performed for the FIS. (See Appendix C.)

- As required by Paragraph 65.6(a)(6) of the NFIP regulations, when an appeal is based on the use of an alternative hydrologic or hydraulic model, the appellant must show that the model used has been reviewed and approved for general use by a Federal agency responsible for water resources activities or a notable scientific body, is well documented (with a user's manual that includes source codes), and is available to the general user (i.e., in the public domain and nonproprietary).
- Although requests for revisions to floodways do not qualify as appeals, the data on which successful appeals are based often include new floodway analyses. For information concerning additional data that must be submitted in support of appeals that involve changes to floodways, refer to Chapter 7, "Floodway Revisions".

- Generally, when an appellant is required to submit delineations of floodplain boundaries, both the 100- and 500-year floodplain boundaries must be submitted. If the FIS includes analyses of only the 100-year flood for the flooding source that is the subject of the appeal, only the 100-year floodplain boundaries must be submitted. The boundaries should be shown on a topographic map whose scale and contour interval are sufficient to provide reasonable accuracy.
- To support an appeal based on the effects of earthfill levees or similar structures, the appellant must submit the following data to show that the structural stability, operation, and maintenance requirements of Section 65.10 of the NFIP regulations have been met:
 1. Freeboard -- For a riverine levee, evidence that the levee provides a minimum of 3 feet of freeboard above the BFE
 2. Freeboard -- For a coastal levee, evidence that the levee provides a minimum of 1 foot of freeboard above the height of the 1-percent wave or the maximum wave runoff (whichever is greater) associated with the 100-year stillwater surge elevation, but in no case less than 2 feet of freeboard above the 100-year stillwater surge elevation
 3. Closures -- Evidence that shows that all drainage structures that penetrate the levee are fitted with closure devices that are structural parts of the levee during operation and designed according to sound engineering practice
 4. Erosion Protection -- An engineering analysis that demonstrates that no appreciable erosion of the levee embankment can be expected during the 100-year flood
 5. Stability -- An engineering analysis that evaluates the stability of the levee embankment and foundation
 6. Settlement -- An engineering analysis that assesses the potential for, and magnitude of, losses of freeboard that may result from settlement of the levee and that demonstrates that the minimum required freeboard will be maintained
 7. Operations -- A formal levee operation plan
 8. Maintenance -- A formal levee maintenance plan

Exceptions to the minimum freeboard requirements cited in Items 1 and 2 for riverine and coastal levees may be approved under certain conditions. Any request for an exception must be supported by appropriate engineering analyses which show that even with the lesser freeboard, a high level of certainty for 100-year flood protection exists. For riverine levees, the supporting analyses must evaluate the uncertainty in the estimated BFE and must assess, at a minimum, the statistical confidence limits of the 100-year peak discharge; stage-discharge relationships for floods larger than the 100-year flood; and the sources, potential, and magnitude of debris, sediment, and ice accumulation that may affect those relationships. The analyses must also show that the levee will remain structurally stable during the base flood, when such additional loading conditions are imposed. Freeboards of less than 2 feet will not be accepted.

For coastal levees, the supporting analyses must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee. Freeboards of less than 2 feet above the computed stillwater surge elevation will not be accepted.

In lieu of the data described in Items 1 through 6, an appellant may submit a certification by a Federal agency with the responsibility for levee design that the levee has been adequately designed and constructed to provide 100-year flood protection.

- To support an appeal based on the effects of a flood protection system that involves Federal funds and is under construction at the time of the appeal, an appellant must submit the following data to show that the requirements of Section 61.12 of the NFIP regulations have been met:

1. Evidence that adequate progress has been made on construction (i.e., evidence that shows that 100 percent of the total cost of the complete system has been authorized, at least 60 percent of the total cost has been appropriated, at least 50 percent of the total cost has been expended, all critical features are under construction and each is 50 percent completed as measured by the expenditure of budget funds, and the community has not been responsible for any delay in the completion of the system)
2. A complete statement of all relevant facts concerning the flood protection system, including, but not limited to, supporting technical data, cost schedules, budget appropriation data, and extent of Federal funding of construction of system. The statement must include information that identifies all persons affected by the system or by the appeal, a full and precise statement of the purpose of the system, and a detailed description of the system, including construction completion target dates.
3. True copies of all contracts, agreements, leases, instruments, and other documents related to system

4. Analysis that shows how the statement of facts (Item 2) and the documents (Item 3) bear on the evidence of adequate progress

5. Statement of whether flood protection system is subject of litigation before any Federal, State, or local court or administrative agency and, if so, purpose of that litigation

6. Statement of whether community previously requested a determination concerning same subject and, if so, disposition of request

The procedure described above does not apply when the flood protection system under construction is being financed without Federal funds.

Appeal Resolution Procedures

By a letter to the CEO, FEMA will acknowledge receipt of all appeals submitted. Copies of the acknowledgment letter will be sent to each appellant unless the number of appellants is so great that to do so would not be practical. In such cases, the CEO is responsible for informing the appellants that FEMA has received the appeals.

FEMA will review the appeals and the supporting data submitted with them. If any questions or problems arise, FEMA will work with the CEO, the community official designated by the CEO, or the appellant to resolve them.

If FEMA determines that additional supporting data are required, it will request those data by letter. The letter will be sent to the CEO. A copy of the letter will be sent to the community official designated by the CEO, if appropriate. Copies will also be sent to the individual appellants, if it is practical to do so.

To avoid delaying the resolution of appeals, FEMA allows 30 days for the CEO to provide the requested data. If the data are not provided within the allotted time, FEMA will resolve the appeals using the data originally submitted. If

the requested data are provided in a timely manner, FEMA will consider them before resolving the appeals.

Although the appeal period is the appropriate time to submit scientific or technical data concerning the BFEs, if a community is unable to obtain and submit such data at that time, it may pursue a Map Revision under the provisions of Part 65 of the NFIP regulations after the FIRM has become effective. (See Chapter 4.)

If the appeals are not supported by the data that have been submitted, FEMA will inform the CEO by letter that the appeals are denied. If the appeals are adequately supported, FEMA will revise the BFEs and any other information affected by the appeals, such as floodplain boundaries, floodway boundaries, and flood insurance rate zones.

If the appeals involved the proposed BFEs shown on a new FIRM or a revised FIRM, FEMA will revise the FIRM and, if necessary, the accompanying FIS report and FBFM. Copies of the revised materials will be sent to the CEO with a letter that explains the resolution of the appeals. The community will have 30 days to review those materials and comment on the resolution. At the end of the review period, FEMA will make a final BFE determination and publish the BFEs in the Federal Register. FEMA will notify the CEO by letter of the final BFE determination.

If the appeals involve BFEs proposed in a LOMR, FEMA will explain the resolution of the appeals in a letter to the CEO. The community will have 30 days to review and comment on the resolution, after which FEMA will make a final BFE determination and publish the BFEs in the Federal Register. FEMA will notify the CEO by letter of the final BFE determination.

Under the provisions of Section 67.12 of the NFIP regulations, an appellant who is aggrieved by the final determination may, within 60 days of receipt of the final determination letter, appeal the determination to the U.S. District Court for the district in which the community is located.

Chapter 4

Map Revisions

To provide a sound basis for floodplain management and insurance rating, NFIP maps must present flood risk information that is correct and up to date. Because flood risk information is subject to change, FEMA has developed the map revision process, under which communities may request that effective FHBMs, FIRMs, and FBFMs be revised to incorporate new or corrected flooding information.

Background

The information depicted on effective NFIP maps may be revised by a physical revision of the map or by a LOMR. A physical map revision involves revising and republishing the individual map panels affected by the requested changes. When NFIP maps are revised by a LOMR, the changes made to the maps are described in the LOMR; revised map panels are not printed. (However, when revisions cannot be adequately described in writing, marked-up photocopies of the affected map panels may be provided with the LOMR.)

Because of the costs involved in printing new map panels, FEMA generally publishes revised maps only when it is necessary to show changes involving a large area of land or increased flood risks. Changes that involve increased flood risks include adding new SFHAs and/or floodways, enlarging existing SFHAs and/or floodways, shifting existing SFHAs and/or floodways to areas not previously within the SFHAs and/or floodways, and raising BFEs. To make other types of map changes, FEMA usually issues LOMRs.

LOMRs may be used for revisions that decrease the size of SFHAs and/or floodways but cannot be used for revisions that shift existing SFHAs and/or floodways to areas not previously within the SFHAs or floodways, even when the size of the SFHA is generally being decreased. LOMRs are especially well suited to changes that involve only small areas within a community, particularly

those involving individual structures and parcels of land.

When warranted, FEMA will issue LOMRs to remove from SFHAs individual structures elevated on fill and individual, legally defined parcels of land elevated by the placement of fill. FEMA will also issue LOMRs to remove from regulatory floodways individual structures and parcels of land that were inadvertently included in the floodways (i.e., structures or parcels for which no fill was placed after the effective date of the first NFIP map that showed the structure or parcel to be within the SFHA) provided that community concurrence is obtained.

Although changes may be made to any of the information shown on an effective NFIP map, FEMA generally will not revise an effective map unless the changes involve 100-year flooding information. Requests for changes that involve other information (e.g., roads, road names, community boundaries) will usually be kept on file; if a physical revision becomes necessary as a result of a request for changes to flooding information, all requests on file will be addressed at that time.

How to Request a Map Revision

At any time after an NFIP map has become effective, a community or private party may request that the map be revised. Also, as noted in Chapter 1 of this Guide, Section 65.3 of the NFIP regulations requires that each participating community inform FEMA of any physical changes that affect BFEs in the community and submit data that show the effects of those changes within 6 months of the date the changes occur.

Because the CEO of the community is responsible for ensuring that the community meets its obligations as a participant in the NFIP, either the CEO or a community official designated by the CEO, such as a floodplain administrator, city planner or city engineer, must be aware of all requests for map revisions. Therefore, any individual property owner, developer, or other private party who wishes to

have the NFIP map revised, must submit the request to the CEO or the designated community official and ask that the request be forwarded to FEMA.

The CEO or the designated official should review the request and, when forwarding it to FEMA, should state whether the community supports it. If FEMA receives a map revision request directly from a private party, without community concurrence, FEMA will ask the requestor to provide evidence that the request was first submitted to the CEO or designated official.

CEOs or the officials they designate should submit all requests for map revisions to the appropriate FEMA Regional Office. If the request is for a determination involving a single structure or single lot, the Regional Office will make the determination. All other requests will be reviewed by the Regional Office and forwarded to the FEMA Headquarters office in Washington, D.C., for disposition. Regional Offices and their addresses are listed in Appendix D.

Required Supporting Data

The type and amount of supporting data that must be submitted largely depend on the reason for the revision and the type of changes to be made.

Revisions to effective NFIP maps are usually requested because of changes that have taken place in the floodplain. Such changes include, but are not limited to, the construction of new bridges, culverts, levees, or channel improvements and the grading and filling normally associated with development (including the placement of fill to elevate individual structures and lots above the BFE). Occasionally, revisions will be requested because the analyses used by FEMA to develop the data shown on the effective NFIP map are found to contain errors or because a requestor believes that the use of alternative methodologies or better data will provide superior results.

To support requests based on the effects of physical changes that have occurred in the floodplain or on the use of alternative methodologies or better data, the requestor

must provide new analyses, in which the alternative methodologies or better data are used, and all other data FEMA would need to revise the effective map. FEMA will not perform any analyses to determine either the nature or extent of the changes that might be necessitated by those types of requests.

To support requests based on the contention that mathematical or measurement errors have been made, the requestor need only identify the errors and provide the new data FEMA would need to perform new analyses and correct the maps.

The data that must be submitted in support of various types of revision requests are detailed in the subsections that follow.

Revisions Based on Effects of Physical Changes That Have Occurred in Floodplain

For changes that affect hydrologic conditions, the following data must be submitted:

- General description of changes (e.g., dam, diversion channel, detention basin)
- Construction plans for as-built condition, if applicable
- New hydrologic analysis that accounts for effects of changes
- New hydraulic analysis based on flood discharge values from new hydrologic analysis
- Revised delineations of floodplain and floodway boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, Flood Profiles, and FIS report tables, as appropriate, that show requested revisions

For changes that affect hydraulic conditions, the following data must be submitted:

- General description of changes (e.g., channelization, new bridge, culvert, levee)

- Construction plans for as-built condition, if applicable
- New hydraulic analysis, based on original flood discharge values, that accounts for effects of changes
- Revised delineations of floodplain and floodway boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, Flood Profiles, and FIS report tables, as appropriate, that show requested revisions

For changes that affect topographic conditions, the following data must be submitted:

- General description of changes (e.g., grading, filling)
- New topographic information, (e.g., spot elevations, grading plans, or contour maps)
- Revised delineations of floodplain boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, Flood Profiles, and FIS report tables, as appropriate, that show requested revisions

Revisions Based on Use of Better Data

For revisions based on better hydrologic data, the following data must be submitted:

- Data that are believed to be better than those used in original hydrologic analysis (e.g., additional years of stream gage data)
- Documentation of source of data
- Explanation for improvement resulting from use of new data
- New hydrologic analysis based on better data
- New hydraulic analysis based on flood discharge values from new hydrologic analysis

- Revised delineations of floodplain and floodway boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, Flood Profiles, and FIS report tables, as appropriate, that show requested revisions

For revisions based on better hydraulic data, the following data must be submitted:

- Data that are believed to be better than those used in original hydraulic analysis (e.g., supplementary floodplain and stream channel cross sections)
- Documentation of source of data
- Explanation for improvement resulting from use of new data
- New hydraulic analysis based on better data and original flood discharge values
- Revised delineations of floodplain and floodway boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, flood profiles, and FIS report tables, as appropriate, that show requested revisions

For revisions based on better topographic data, the following data must be submitted:

- Data that are believed to be better than those used in plotting original floodplain boundaries (e.g., detailed topographic maps, grading plans, spot elevations)
- Documentation of source of data
- Revised delineations of floodplain boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, Flood Profiles, and FIS report tables, as appropriate, that show requested revisions

Revisions Based on Use of an Alternative Methodology

For an alternative hydrologic methodology, the following data must be submitted:

- New hydrologic analysis based on alternative methodology
- Explanation for superiority of alternative methodology
- New hydraulic analysis based on flood discharge values from new hydrologic analysis
- Revised delineations of floodplain and floodway boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, Flood Profiles, and FIS report tables, as appropriate, that show requested revisions

For an alternative hydraulic methodology, the following data must be submitted:

- New hydraulic analysis based on alternative methodology and original flood discharge values
- Explanation for superiority of alternative methodology
- Revised delineations of floodplain and floodway boundaries on a topographic map
- Annotated copies of FHBM, FIRM, FBFM, flood profiles, and FIS report tables, as appropriate, that show requested revisions

Revisions to Correct Indisputable Errors in Original Analysis

For a mathematical error, the requestor must identify the error; FEMA will perform new calculations to correct the error.

For a measurement error, the requestor must identify the error and provide the correct

measurement; FEMA will perform new calculations to correct the error.

Revisions to Exclude Individual Structures and Legally Described Parcels of Land From SFHA Based on Altered Topography (Placement of Fill)

The determinations and changes made by FEMA will be similar to those described in Chapter 6. The requestor must provide data that verify the location of the structure or parcel of land and show that the structure or parcel of land is not subject to flooding during the base flood. Therefore, the required supporting data generally will be the same as those for a request for a map amendment.

However, because the requests will involve alterations of topography that occurred after the effective date of the first NFIP map that showed the structure or parcel of land to be within the SFHA, the following additional requirements will also apply:

- For all such revision requests, the requestor must demonstrate that the placement of fill has not resulted in an encroachment within the regulatory floodway.
- When the revision request involves more than a single structure or a single parcel of land, the requestor must demonstrate that the fill placed to elevate the structures or parcels will not settle below the BFE and that the fill is adequately protected from the forces of erosion, scour, or differential settlement. Therefore, data must be submitted which show that the requirements below have been met.
 1. All fill placed for pads for residential and commercial structure foundations must be compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test method developed by the American Society for Testing and Materials (ASTM Standard D-698).
 2. Fill slopes for granular materials must not be steeper than one

vertical on one-and-one-half horizontal (unless data are submitted that justify the use of steeper slopes).

3. Adequate erosion protection, in the form of grass, vines, weeds, or similar vegetation, must be provided for fill slopes that will be subject to flow velocities of 5 feet per second (fps) or less during the 100-year flood.
 4. Adequate protection, in the form of stone or rock armoring, must be provided for fill slopes that will be subject to flow velocities of greater than 5 fps during the 100-year flood.
- When the revision request involves the exclusion from the SFHA of one or more structures elevated by the placement of fill, the requestor must submit data which show that the elevation of the lowest floor, including basement, of each structure, as well as the elevation of the lowest grade adjacent to each structure, is at or above the BFE.
 - When the revision request involves the exclusion from the SFHA of a parcel of land that has been filled, the requestor must submit data which show that all land within the legally described limits of the parcel is at or above the BFE.

Note, however, that topographic alterations alone, whether made by the placement of fill or other means, will not serve as the basis for removing individual structures or parcels of land from coastal SFHAs subject to velocity hazards (designated Zone V1-V30, VE, or V) or from alluvial fan SFHAs (usually designated Zone AO, with a depth and a velocity shown). For such alterations to be considered, it must first be shown that velocity hazards or alluvial fan flood hazards, as appropriate, do not exist at the site.

Revisions Based on Effects of Proposed Projects or Future Conditions

In general, FEMA will not revise an effective NFIP map to show the effects of physical changes that will occur in the floodplain as a result of proposed projects or future conditions. Most

requests concerning such changes are handled under the conditional map revision process, which is described in Chapter 5 of this Guide.

However, a revision request may be based on the ultimate effect of a flood protection system that is under construction at the time of the request and involves Federal funds. To support a request for such a revision, the requestor must submit the following data to show that the requirements of Section 61.12 of the NFIP regulations have been met:

1. Evidence that adequate progress has been made on construction (i.e., evidence which shows that 100 percent of the total cost of the complete system has been authorized, at least 60 percent of the total cost has been appropriated, at least 50 percent of the total cost has been expended, all critical features are under construction and each is 50 percent completed as measured by the expenditure of budget funds, and the community has not been responsible for any delay in the completion of the system)
2. A complete statement of all relevant facts concerning the flood protection system, including, but not limited to, supporting technical data, cost schedules, budget appropriation data, and extent of Federal funding of the construction of the system. The statement must include information that identifies all persons affected by the system, a full and precise statement of the purpose of the system, and a detailed description of the system, including construction completion target dates.
3. True copies of all contracts, agreements, leases, instruments, and other documents related to the system
4. Analysis that shows how the statement of facts (Item 2) and the documents (Item 3) bear on the evidence of adequate progress (Item 1)
5. Statement of whether the flood protection system is the subject of

litigation before any Federal, State, or local court or administrative agency and, if so, the purpose of the litigation

6. Statement of whether the community has previously requested a determination concerning the same subject and, if so, the disposition of that request

General Technical Guidance

When developing technical supporting data, requestors should consider the following points:

- Unless Map Revision requests are based on indisputable and clearly defined mathematical or measurement errors in the original FEMA analyses, the requests must be accompanied by all the data that FEMA needs to revise the FHBM or the FIRM, FBFM, and FIS report. The requestor should therefore be prepared to perform new hydrologic and hydraulic analyses and delineate new floodplain and floodway boundaries as necessary.

In addition, new flooding information cannot be added to an NFIP map in such a way as to create mismatches with the flooding information shown for unrevised areas. Therefore, in performing new analyses and developing revised flooding information, the requestor must tie the new flood elevations, floodplain boundaries, and floodway boundaries into those shown for areas not affected by the revision.

When requests involve new flood discharge values, extensive changes in hydraulic conditions, or complex situations in which changes made to the flooding information developed for one flooding source will affect that developed for others, the requestor may be required to provide new information for a large portion of the map.

- All analyses and data submitted by the requestor, including those that show mathematical or measurement errors, must be certified by a registered professional engineer or licensed land surveyor, as appropriate.
- Revisions, except for those based on the effects of flood protection systems under construction that meet the previously listed requirements, cannot be made based on the effects of proposed projects or future conditions; therefore, any maps, plans, drawings, measurements, or ground elevation data submitted by the requestor must be certified as representing existing, or as-built, conditions.
- NFIP maps may be revised when flood discharges change as a result of structural improvements, such as dams or other significant retention facilities. However, NFIP maps will not be revised when discharges change as a result of the use of an alternative methodology or additional data unless the change is statistically significant.

The criteria that the requestor must use in determining whether a change is statistically significant are discussed in Section 2-6, "Hydrologic Analyses," of Flood Insurance Study Guidelines and Specifications for Study Contractors, dated September 1985. When requesting a Map Revision based on new flood discharges, the requestor should determine the significance of the change before proceeding with new hydraulic analyses. When the statistical significance test does not apply, a determination by a Federal or State agency that the change is significant may be accepted as the basis for a revision.

- Generally, when a requestor is required to submit hydrologic or hydraulic analyses for flooding sources studied by detailed methods, those analyses must be performed for the same floods studied for the preparation of the effective NFIP map.

For riverine, lacustrine, and coastal flooding sources studied by detailed methods, FEMA performs analyses of the 100-year flood and, usually, the 10-, 50-, and 500-year floods. Often a hydraulic analysis of the 100-year floodway is performed for riverine flooding sources. For sheetflow and alluvial fan flooding sources studied by detailed methods, and for all flooding sources studied by approximate methods, FEMA usually performs analyses of only the 100-year flood.

Therefore, the extent of the hydrologic and hydraulic analyses that a revision requestor may be required to submit is determined not only by the basis of the revision request, but also by the type of flooding source and the scope of the study on which the effective NFIP map is based.

- Unless the revision request is based on the use of alternative models or methodologies, the hydrologic and hydraulic analyses that the revision requestor submits must be performed with the models used in the preparation of the effective NFIP map. For riverine flooding sources studied by detailed methods, the hydrologic analyses on which NFIP maps are based are usually performed with standard engineering methodologies, such as flood-frequency analyses of stream gage data, or with widely accepted computer models, such as the COE HEC-1 model or the SCS TR-20 model.

The hydraulic analyses for riverine flooding sources are usually performed with the COE HEC-2 step-backwater model or a similar and widely accepted model, such as the SCS WSP-2 model or the USGS WSPRO model.

For the analysis of alluvial fan flood hazards and the hazards associated with coastal storm surge and wave action, including wave height and wave runup, FEMA has established or adopted special methodologies and computer models.

For detailed analyses of lacustrine and sheetflow flood hazards, and for approximate analyses of all types of flooding sources, FEMA uses a variety of standard engineering models and methodologies.

The revision requestor may ask FEMA for copies of the input and output data from the model(s) used, or copies of other calculations or analyses performed, in the preparation of a specific NFIP map. (See Appendix C.)

- As required by Paragraph 65.6(a)(6) of the NFIP regulations, when a revision request is based on the use of an alternative hydrologic or hydraulic model, the requestor must show that the model used has been reviewed and approved for general use by a Federal agency responsible for water resources activities or a notable scientific body, is well documented (with a user's manual that includes source codes), and is available to the general user (i.e., in the public domain and non-proprietary).
- When the requestor is required to submit a new model, all differences between the conditions represented by the original and revised models must be justified by physical changes that have occurred, or the use of better hydraulic data or revised discharges. The new model should also account for all encroachments that have occurred in the floodplain since the original model was developed.
- When a hydrologic or hydraulic analysis is submitted to FEMA, copies of the input and output data from the original and revised computer models must be submitted.
- For information concerning additional data that must be submitted in support of requests that involve changes to floodways, refer to Chapter 7.
- When a request for a revision to floodplain boundaries is based on data that show changed topographic

conditions, the requestor must verify that revisions made to the floodplain boundaries do not necessitate revisions to the existing floodway boundaries. When such floodway revisions are necessary, the requestor may also be required to submit a revised floodway analysis.

In addition, the requestor must verify that the new topographic data do not reflect hydraulic conditions that are significantly different from those modeled in the original hydraulic analysis. When hydraulic conditions have changed significantly, a new hydraulic analysis may be required.

- Generally, when the requestor is required to submit delineations of floodplain boundaries for a flooding source that was originally studied by detailed methods, both the 100- and 500-year floodplain boundaries must be submitted. If the original analyses for that flooding source address only the 100-year flood, only the 100-year floodplain boundaries need be submitted. For flooding sources originally studied by approximate methods, only 100-year floodplain boundaries need be submitted. The boundaries should be shown on a topographic map whose scale and contour interval are sufficient to provide reasonable accuracy.
- As noted in Paragraph 60.3(b)(7) of the NFIP regulations, communities participating in the NFIP must, as part of their program responsibilities, ensure that the flood-carrying capacity of any altered or relocated watercourse is maintained. Therefore, when a Map Revision request is based on a channel alteration or relocation, FEMA expects that the affected community will ensure that the channel is routinely maintained so that its flood-carrying capacity is not diminished by natural processes or human activity.

However, if FEMA has any concerns about the type and frequency of the

required maintenance activities for a channel alteration or relocation project, FEMA may, according to the provisions of Paragraph 65.6(a)(12) of the NFIP regulations, require that the community submit specific documentation that describes how the requirement stated in Paragraph 60.3(b)(7) will be met.

- To support a request for a revision based on the effects of earthfill levees or similar structures, the requestor must submit the data listed below to show that the structural stability, operation, and maintenance requirements of Section 65.10 of the NFIP regulations have been met.

1. Freeboard -- For a riverine levee, evidence that the levee provides a minimum of 3 feet of freeboard above the BFE
2. Freeboard -- For a coastal levee, evidence that the levee provides a minimum of 1 foot of freeboard above the height of the 1-percent wave or the maximum wave runoff (whichever is greater) associated with the 100-year stillwater surge elevation, but in no case less than 2 feet of freeboard above the 100-year stillwater surge elevation
3. Closures -- Evidence that shows that all drainage structures that penetrate the levee are fitted with closure devices that are (1) structural parts of the levee during operation and (2) designed according to sound engineering practice
4. Erosion Protection -- An engineering analysis that demonstrates that no appreciable erosion of the levee embankment can be expected during the 100-year flood
5. Stability -- An engineering analysis that evaluates the stability of the levee embankment and foundation
6. Settlement -- An engineering analysis that assesses the potential

for, and magnitude of, losses of freeboard that may result from settlement of the levee and that demonstrates that the minimum required freeboard will be maintained

7. Interior Drainage -- An engineering analysis of the potential hazards associated with floodwaters that originate on the landward side of the levee
8. Operations -- A formal levee operation plan
9. Maintenance -- A formal levee maintenance plan

Occasionally, exceptions to the minimum freeboard requirements cited in Items 1 and 2 for riverine and coastal levees may be approved. Any request for an exception must be supported by appropriate engineering analyses which show that, even with the lesser freeboard, a high level of certainty for 100-year flood protection exists.

For riverine levees, the supporting analyses must evaluate the uncertainty in the estimated BFE and must assess, at a minimum, the statistical confidence limits of the 100-year peak discharge; stage-discharge relationships for floods larger than the 100-year flood; and the sources, potential, and magnitude of debris, sediment, and ice accumulation that may affect those relationships. The analyses must also show that the levee will remain structurally stable during the base flood, when such additional loading conditions are imposed. Freeboards of less than 2 feet will not be accepted.

For coastal levees, the supporting analyses must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee. Freeboards of less than 2 feet above the computed stillwater surge elevation will not be accepted.

In lieu of the data described in Items 1 through 6 above, the requestor may submit a certification by a Federal agency with the responsibility for levee design that the levee has been adequately designed and constructed to provide 100-year flood protection. Although a Federal agency certification may be submitted in lieu of Items 1 through 6, it will not satisfy the requirement for an interior drainage analysis (Item 7). Therefore, if a Federal agency certification is submitted it must be accompanied by one of the following:

1. An additional certification -- also by a Federal agency with the responsibility for levee-design -- that either states that no 100-year flood hazard associated with interior drainage exists in the protected area or identifies areas subject to 100-year flooding caused by inadequate interior drainage.
2. A complete interior drainage analysis as described in Item 7.

In addition, a certification by a Federal agency does not waive the requirement for the levee operations and maintenance plans (Items 8 and 9).

Map Revision Procedures

In its review of a Map Revision request, FEMA will communicate by letter and, as necessary, by telephone directly with the person who submitted the request. If that person is a private party, copies of all letters to that person from FEMA will be sent to the CEO.

After a revision request has been received from the CEO or from a private party, FEMA will perform a preliminary review of the request and the supporting data submitted with it. The purpose of the preliminary review is to determine whether at least the basic supporting data required for a Map Revision have been provided and, if the request was submitted to

FEMA by a private party, whether the community is aware of the request.

If the required supporting data have not been provided, FEMA will send a letter to the person who submitted the request. The letter will be accompanied by a checklist that identifies any basic supporting data that the requestor has not submitted. Until the requested data are submitted, FEMA will not undertake a detailed review of the request and will take no further action concerning the request.

If FEMA determines from its preliminary review that the basic supporting data have been provided, it will acknowledge receipt of the request by letter. The acknowledgment letter will inform the requestor of the amount of time FEMA will need to complete a detailed review of the request and supporting data (usually 90 days).

After completing the detailed review, FEMA will inform the requestor by letter of any additional supporting data that must be submitted. Again, no further action will be taken on the request until the required supporting data are received.

Once all the required data have been received, FEMA will complete its review and determine whether changes are warranted. If the data submitted do not warrant any changes to the information shown on the effective map, FEMA will inform the requestor by letter. If changes are warranted, FEMA will either physically revise the effective map or issue a LOMR.

For physical map revisions, only the map panels affected by the changes are revised. When a FIRM is revised, the corresponding FBFM panels and FIS report are also revised as necessary. The revised materials are sent to the community for a 30-day review period. When FIRM revisions involve new or changed BFEs, the 30-day period will be followed by a formal 90-day appeal period, during which the BFEs may be appealed. (See Chapter 3.)

When the BFEs have been lowered, FEMA may print the revised FIRM during the appeal period. If an Appeal is submitted, FEMA will either delay the printing of the new FIRM or, if necessary, revise the new FIRM after it has been printed. Because Appeals are rarely submitted when BFEs

have been lowered, this procedure has proved to be a fast and effective method of providing the community with its revised maps. When BFEs have been added or raised, the FIRM will not be printed until after the appeal period has ended and any Appeals have been resolved.

When physical map revisions do not involve new or changed BFEs, no appeal period is necessary; the maps are printed after the 30-day review period has ended. In all cases, the revised maps do not become effective until they are printed and distributed to the community.

Generally, FEMA will revise and republish an effective NFIP map only when increased flood hazards (e.g., higher BFEs, new or enlarged SFHAs) will be shown or when the revision is significant. The significance of the revision will be determined by the size of the area, and/or the number of interests, that will be affected by the revision.

The LOMR, which is usually issued when the revision will reflect decreased flood hazards, is sent to the CEO and takes the place of a physical map revision. The LOMR describes the changes that have been made and officially revises the effective NFIP map. The LOMR is to be kept in the community map repository as an official revision to the FIRM. When necessary, hand-revised maps illustrating the changes are sent with the LOMR.

The revision is effective as of the date of the LOMR. A LOMR cannot be issued to add or raise BFEs. LOMRs that decrease BFEs will be followed by a formal 90-day appeal period. No appeal period is necessary for LOMRs that do not involve changes to the BFEs.

As can be seen from the discussion above, an advantage of revising an NFIP map through the LOMR process is that the revision becomes effective on the date the LOMR is issued. By comparison, a revision made through the physical map revision process will not become effective until the revised map has been issued in preliminary form, passed through the appropriate review periods, printed, and distributed.

When FEMA is preparing and intends to publish a new or revised flood hazard map for a

community, with flood risk data developed by a map revision requestor or by FEMA in an FIS or RFIS, FEMA may receive a request for a LOMR based on a portion of those data. If the changes that would result from the data are of the type that may appropriately be made by a LOMR, FEMA can issue the LOMR as requested but only as described below.

- If the requested changes involve only areas designated Zone A or Zone V on the effective NFIP map, the LOMR can be issued as soon as FEMA has determined that the new flood risk data are the best available for the area in question.
- If the requested changes involve areas designated Zone A1 - A30, AE, AH, AO, VI-V30, or VE on the effective NFIP map, the LOMR will not be issued until the new or revised map has been issued in preliminary form and all new or revised BFEs shown on that map have been proposed and made final by issuing the letter of final determination.

In either case, however, the restrictions described previously in this chapter for properties in alluvial fan SFHAs would still apply. (See the section entitled "Revisions to Exclude Parcels of Land From SFHA Based on Altered Topography (Placement of Fill).")

Chapter 5

Conditional Map Revisions

Background

Communities, regional agencies, developers, and individual property owners often undertake floodplain modifications intended to reduce the flood risk in specific areas. Such modifications can range in scope from the simple placement of fill to large-scale flood protection projects. Before proceeding with such modifications, those who propose them often wish to receive some assurance from FEMA that the modifications may eventually be credited with providing flood protection under the NFIP.

In carrying out their responsibilities under the NFIP, community officials may wish FEMA to verify that such modifications will not aggravate existing flood hazards. In addition, developers and property owners who intend to construct buildings in or near an SFHA usually must prove to lending institutions and local officials that the placement of fill or other modifications will ensure that after the buildings are constructed, they will not be within the SFHA.

It has become common practice for persons who are planning to undertake floodplain modifications to submit design plans and other engineering data to FEMA and request that FEMA review them. FEMA responses to such requests are to provide comments concerning changes that may eventually be made to the effective NFIP map and are called Conditional Letters of Map Revision (CLOMRs).

For communities that propose floodplain modifications, requesting Conditional Map Revisions is not only prudent but, in some circumstances, required by the NFIP regulations (Section 65.12). When a participating community proposes to permit an encroachment into a 100-year floodplain where no floodway has been established, and the encroachment will cause a rise of more than 1.0 foot in the BFE, the community must first obtain FEMA's conditional approval of the proposed encroachment under the conditional map revision process.

Similarly, the community must also obtain conditional approval from FEMA before permitting an

encroachment into a regulatory floodway that could cause any rise in the BFE. (The data that the community must provide to obtain FEMA's conditional approval for such proposed encroachments are described in the section of this chapter entitled "Required Supporting Data and General Technical Guidance.")

With the exception of the federally funded flood protection systems discussed in Chapter 4, floodplain modifications that have not been completed do not warrant revisions to effective NFIP maps. Therefore, CLOMRs, unlike map revisions, do not actually revise an effective NFIP map. In the conditional map revision process, as in the map revision process, FEMA will generally not issue a CLOMR unless the proposed modifications involve changes to 100-year flood hazard information.

The number of requests for conditional determinations has grown steadily through the years and, consequently, so has the amount of time devoted by FEMA staff to making such determinations. To recoup the costs involved in evaluating proposed floodplain modifications, many of which are never actually completed, FEMA has found it necessary to charge fees for conditional determinations. A list of those fees can be found in Section 72.3 of the NFIP regulations.

How To Request a Conditional Map Revision

A Conditional Map Revision may be requested at any time, either by a community or a private party. Because the CEO of the community is responsible for ensuring that the community meets its obligations as a participant in the NFIP, either the CEO or a community official designated by the CEO (e.g., floodplain administrator, city planner, or city engineer) should be aware of proposed floodplain modifications that could eventually affect flooding conditions within the community.

Therefore, any individual property owner, developer, or other private party who wishes to request a Conditional Map Revision should submit the request to the CEO or the designated community official.

The CEO or the designated official should review the request and, when forwarding it to the FEMA Regional Office, should state whether the community supports it. When FEMA receives a conditional map revision request directly from a private party, without community concurrence, FEMA will ask the requestor to provide evidence that the CEO or designated official is aware of the proposed modifications on which the request is based.

Requests for Conditional Map Revisions should be submitted to the appropriate FEMA Regional Office. The Regional Office will review the request and forward it to the FEMA Headquarters Office in Washington, D.C., for disposition. The FEMA Regional Offices and their addresses are listed in Appendix D.

Required Supporting Data and General Technical Guidance

The types and amounts of technical supporting data that must be submitted in support of a request for a Conditional Map Revision are essentially the same as the supporting data described for Map Revisions in Chapter 4. Therefore, to identify the technical supporting data that must be submitted, you should refer to Chapter 4--particularly, the sections entitled "Required Supporting Data" and "General Technical Guidance."

The main difference between the types of supporting data required for Map Revisions and Conditional Map Revisions is that any maps, plans, drawings, measurements, or ground elevation data submitted in support of a request for a conditional map revision will not reflect existing conditions and consequently cannot be certified "as-built." In addition, the operations and maintenance plans that are to be formally adopted by a community, which are part of the required supporting information for a Map Revision request based on the effects of a levee or other flood protection system, are not

required when a request is made for a Conditional Map Revision.

All data submitted in support of a request for a Conditional Map Revision must, however, reflect final design conditions. The requestor should not interpret the lack of a requirement for certified as-built supporting data to mean that incomplete data and vague descriptions of proposed projects will provide FEMA with an adequate basis for a conditional determination. In addition, although an as built certification would not apply to design plans and other supporting data for a Conditional Map Revision, all data submitted must still be stamped and signed with the seal of a registered professional engineer or licensed land surveyor, as appropriate.

As noted previously, fees are charged for the review of conditional map revision requests. The initial fee, which FEMA must receive before it will review the request, varies according to the nature of the proposed modifications. Specific fees have been established and are listed in Section 72.3 of the NFIP regulations for the following types of proposed modifications:

- Alteration of topography for single lots and single structures
- Alteration of topography for multiple lots and multiple structures
- New bridge or culvert (no channelization)
- Channel modification only
- Channel modification and new bridge or culvert
- Levee, berm, or other structural measure
- Structural measures on alluvial fans

For requests based on a combination of proposed modifications, the initial fee will be determined by the one modification, out of those proposed, for which the highest fee has been established. FEMA will inform the requestor of the fee after receiving the request.

Although many proposed flood protection projects are intended to reduce flood hazards so that floodplain areas can be developed, FEMA recognizes that projects undertaken by Federal, State, and local governments are often intended to reduce the risks to lives and property in areas that have already been developed. Because projects of the latter type will benefit the general public and the NFIP by protecting existing development from future floods, fees are not charged for conditional determinations for such projects.

Therefore, when a Federal, State, or local government or its agency requests a Conditional Map Revision, it may submit, in lieu of the required fee, a certification that the proposed project is intended primarily to reduce flood losses to existing development in identified flood hazard areas and request that the fee be waived. If appropriate FEMA will waive the fee requirement.

When a community proposes to permit an encroachment into a 100-year floodplain where no floodway has been established, and the encroachment will cause a rise of more than 1.0 foot in the BFE at any point, or when the community proposes to permit an encroachment into a regulatory floodway that would cause any rise in the BFE, the community must apply to FEMA for conditional approval of the proposed project before permitting the encroachments. The following data must be submitted as part of the community's application:

- The appropriate initial fee, as listed in Section 72.3 of the NFIP regulations, above, based on the nature of the encroachment, or a request that the fee be waived and the required certification, as described above
- An evaluation of alternatives that would not result in increases in the BFE greater than 1.0 foot where no floodway has been established, or 0.0 foot where a floodway has been established. The evaluation must demonstrate why the alternatives are not feasible.
- Documentation of individual legal notice to all affected property owners, within and outside of the community,

which explains the effect of the proposed action on their properties

- Concurrence of the CEOs of all other communities affected by the proposed action
- Certification that no insurable structures are in areas that would be affected by the increased BFE
- A request for revision of the effective BFEs, accompanied by the required technical supporting data described in Chapter 4, "Map Revisions"
- A request for a floodway revision, accompanied by the required supporting data described in Chapter 7, "Floodway Revisions"

Upon receipt of conditional approval from FEMA, but before permitting the proposed encroachment, the community must provide evidence that it has adopted floodplain management ordinances that incorporate the increased BFEs and/or revised floodway resulting from the post-project condition. Upon completion of the encroachments, the community must provide as-built certifications for the project, as discussed in Chapter 4. After receiving the as-built certifications, FEMA will begin a Map Revision, as described in Chapter 4.

Conditional Map Revision Procedures

In its review of a Conditional Map Revision request, FEMA will communicate by letter and, as necessary, by telephone directly with the person who submitted the request. If that person is a private party, copies of all letters to that person from FEMA will be sent to the CEO.

After a Conditional Map Revision request has been received from the CEO or from a private party, FEMA will perform a preliminary review of the request and the supporting data submitted with it. The purpose of the preliminary review is to determine whether at least the basic supporting data and initial fee or request for fee waiver have been provided and, if the request was submitted to FEMA by a private party, whether the community is aware of the request.

If the required supporting data, fee, or fee waiver have not been provided, FEMA will send a letter to the person who submitted the request. The letter will be accompanied by a checklist that identifies any basic supporting data that the requestor has not submitted, including the initial fee, if applicable. Until the requested data and/or fee are submitted, FEMA will not undertake a detailed review of the request and will not take any further action concerning the request.

If FEMA determines from its preliminary review that the basic supporting data have been provided and that either the required initial fee has been provided or it is appropriate to waive the fee requirement, FEMA will acknowledge receipt of the request by letter. The acknowledgment letter will inform the requestor of the amount of time FEMA will need to complete a detailed review of the request and supporting data.

After completing its detailed review, FEMA will inform the requestor by letter of any additional supporting data that must be submitted. Again, no further action will be taken on the request until the required supporting data are received. Also, depending on the complexity of the request, FEMA may incur review costs that exceed those covered by the initial fee. When the total review costs are expected to exceed \$1,500 (\$500 for cases involving fill only), FEMA will inform the requestor in writing and suspend the processing of the request until the requestor provides written authorization to proceed.

Once all the required data and/or the authorization have been provided, FEMA will complete the review and make a determination concerning the effects of the proposed modifications. If the review costs exceed those covered by the initial fee, FEMA will send the requestor an invoice letter that requests the additional fee required. Until the requested fee is submitted, a letter stating the conditional determination will not be sent.

Once it receives the additional required fee, FEMA will issue either a CLOMR, which describes the changes that could be made to the FIRM and/or FBFM after the proposed modifications are complete, or a letter that explains why FEMA

could not recognize the effects of the proposed modifications if those modifications were completed as planned.

Chapter 6

Map Amendments

The accuracy of the floodplain boundaries shown on the NFIP maps depends, in part, on the scales at which the maps are prepared and by the accuracy of available topographic data. Map users may find it difficult to determine whether a specific structure or parcel of land is within the SFHA. Also, small areas of high ground may be included in the SFHA because they are too small to be shown to scale. When this happens, structures or parcels of land may be inadvertently included in the SFHA when the map is prepared.

Because the requirement for the purchase of flood insurance and the Federal and local regulations governing construction in the SFHA are important to persons who own or plan to build structures, FEMA has developed the map amendment process. Under this process, property owners may request that FEMA determine whether specific structures or legally described parcels of land are in the SFHA and, if necessary, issue a Letter of Map Amendment (LOMA).

Background

Under the map amendment process, FEMA will make determinations for single or multiple structures on one or more lots and for parcels of land that can be legally described. In making such determinations, FEMA will use the best available data (usually the effective NFIP map) and information provided by the requestor concerning the locations and elevations of structures or the locations and elevations of legally described parcels of land.

The map amendment process is applicable only to requests for determinations based on topographic conditions that existed on the effective date of the first NFIP map that showed the structure or parcel of land to be within the SFHA. All other requests for determinations will be processed as requests for Map Revisions. (See Chapter 4.)

The following determinations may be made for structures and parcels of land under the map amendment process:

- Out of the SFHA as shown on the effective FEMA map. No amendment to the map is necessary.
- Out of the SFHA because the structure or parcel of land is above the BFE (inadvertent inclusion). FEMA will issue a LOMA to exclude the existing structure or the parcel of land from the SFHA.
- In the SFHA because the structure or parcel of land is below the BFE. If necessary, FEMA will issue a LOMA to include the structure in the SFHA.

Only the effective NFIP map may be amended by a LOMA.

How to Request an Amendment

Any owner or lessee of property may request that a determination be made concerning a structure or parcel of land and that, if necessary, FEMA issue a LOMA. Because such requests concern structures and parcels of land that were inadvertently included in the SFHA and do not involve recent alterations of topography or result in significant changes to the flooding information depicted on the NFIP map, they may be submitted directly to FEMA and are not subject to the review and approval of the community. However, if the structure or land was also included in a floodway, removal of the structure or land from the floodway must be with community concurrence and is accomplished under the map revision process. (see Chapter 4.)

Requests for determinations concerning multiple structures on multiple lots should be sent to the FEMA Headquarters office at the following address:

Federal Emergency Management Agency
Federal Insurance Administration
Office of Risk Assessment
Technical Operations Division
500 C Street, SW., Room 422
Washington, D.C. 20472

Requests for determinations concerning single structures on single lots and parcels of land should be sent to the appropriate FEMA Regional Office for processing. The Regional Offices and their addresses are listed in Appendix D.

Required Supporting Data

The requestor must provide data that are sufficient to allow FEMA to verify the location of the structure or parcel of land and that the structure or parcel of land is not subject to inundation during the base flood. For determinations for structures, the following data must be submitted:

- A copy of the recorded deed with the legal description of the property and the deed book volume and page number, bearing the seal of the Recorder of Deeds
 - A copy of the recorded plat showing both the location of the property and the plat book volume and page number, bearing the seal of the Recorder of Deeds. If the property is not recorded on a plat map, the requestor must provide copies of a tax map or other suitable maps to help FEMA accurately locate the property.
 - A topographic map, certified as-built by a registered professional engineer or licensed land surveyor, showing structure locations (if applicable), ground elevations, and the elevations of the lowest finished grades adjacent to the structures (if applicable). If the request concerns an undeveloped parcel of land, the submitted data must include the elevation of the lowest ground point within the parcel.
 - Data to substantiate the BFE. These data may be taken from an authoritative source, such as the COE, USGS, SCS, any other Federal agency; State and local water resource or planning departments, a FEMA FIS, or information prepared by a registered professional engineer.
5. A signed statement asserting the accuracy of the information submitted

General Technical Guidance

When developing technical supporting data, the requestor should consider the following points:

- If an entire legally described parcel of land is shown to be inadvertently included in the SFHA, the LOMA will be issued for the parcel.
- If the request is for more than one lot or structure, the requestor must provide an effective FIRM or FHBM, or a photographic copy of it, on which the legal metes and bounds of the property, including each lot, have been drawn as accurately as possible. The map submitted must bear the seal of a registered professional engineer or licensed land surveyor to certify that the property is correctly located on the NFIP map based on the legal description of the property.

If a floodplain boundary runs through a lot or tract of property, the location(s) of the structure(s) on the lot or tract should be accurately drawn. A photocopy of the NFIP map is unacceptable because the size of the map may be distorted.

- In some instances, FEMA may need additional data to make a determination. These data may consist of, but are not limited to, certifications by a registered professional engineer or licensed land surveyor as to the type of structure and whether it is elevated on posts, piers, pilings, or frontal sand dunes, or a hydraulic analysis of the flooding conditions.
- To support a request involving fill that was placed before the effective date of the first NFIP map showing the structure or parcel of land to be within the SFHA, a requestor may be required to submit a

certification to that effect. This certification may be made by a community official, registered professional engineer, or licensed land surveyor.

- When the effective NFIP map is an FHBM, BFEs will not be shown. The requestor may either determine an approximate BFE using standard engineering techniques or request that FEMA determine an approximate BFE. FEMA will either check the BFE determined by the requestor or, if necessary, determine an approximate BFE using the supporting data for the FHBM or the best available data.

When a Preliminary or Revised Preliminary FIRM has been issued and the BFEs shown on the FIRM have been made final by FEMA, those BFEs must be used as best available data.

- When the effective NFIP map is a FIRM, FEMA will base the determination concerning the structure or parcel of land on the BFEs shown on the FIRM. Determinations cannot be made using other flood elevations, unless FEMA first revises the effective FIRM to incorporate the new elevations. (See Chapter 4.)
- When the effective FIRM shows an average depth of flooding rather than a BFE, the determination will be made by comparing the elevation of the lowest grade adjacent to the structure to the elevation of the surrounding terrain where sheetflow would be conveyed. If the difference in these elevations is equal to or greater than the flood depth shown on the effective FIRM, such that floodwaters cannot be conveyed to the structure, the structure can be excluded from the SFHA.
- When the SFHA on an effective FIRM is designated Zone A, no BFEs are shown. In this situation, a BFE may be determined by the same method as that used when the effective NFIP map is an FHBM.

- Structures that have been elevated above the BFE on posts, piers, or pilings cannot be excluded from the SFHA if any portion of the structure (including the posts, piers, or pilings) is still in the SFHA.
- If a structure and/or parcel of land has been inadvertently included in both the SFHA and the regulatory floodway, it will be excluded from the SFHA and floodway by a LOMR under the map revision process rather than by a LOMA. (See Chapter 4.)
- Neither structures nor parcels of land will be removed from an alluvial fan SFHA -- usually designated Zone AO, with a depth and a velocity shown -- regardless of the elevations of the lowest floor, lowest adjacent grade, or lowest grade point. No determinations can be made for such structures or parcels of land unless it is demonstrated through the map revision process (Chapter 4) or the appeal process (Chapter 3), as appropriate, that alluvial fan flood hazards do not exist at the site in question.
- Neither structures nor parcels of land will be removed from an SFHA subject to velocity hazards, designated Zone V1 - V30, VE, or V, regardless of the elevations of the lowest floor, lowest adjacent grade, or lowest grade point. No determinations can be made for such structures or parcels of land unless the zone designation is changed. Changes to zone designations shown on effective maps are made under the map revision process (Chapter 4).

When a new or revised NFIP map becomes effective for a community, that map supersedes all LOMAs previously issued for properties in that community. Once a LOMA has been superseded, it is no longer effective. Therefore, a requestor who wishes a previously issued LOMA to remain in effect must request that it be re-issued. FEMA will base its determination concerning such requests on the latest effective NFIP map. If that map presents new flood hazard information for the area where the property in question is situated, the

determination stated in the previously issued LOMA could be modified.

When FEMA is preparing and intends to publish a new or revised NFIP map for a community, with flood risk data developed by a map revision requestor or by FEMA as part of an FIS or RFIS, FEMA may receive a request for a LOMA based on a portion of those data. FEMA can issue a LOMA on the basis of such data but only as described below.

- If the LOMA request involves property shown in an SFHA designated Zone A or Zone V on the effective NFIP map, the LOMR can be issued as soon as FEMA has determined that the new flood risk data are the best available for the area in question.
- If the LOMA request involves property in an SFHA designated Zone A1-A30, AE, AH, AO, V1-V30, or VE on the effective NFIP map, the LOMA will not be issued until the new or revised map has been issued in preliminary form, an appeal period has been held, all appeals have been resolved, and a final BFE determination has been made.

In either case, however, the restrictions described previously in this chapter for properties in Zones V1-V30, VE, or V and properties in alluvial fan SFHAs would still apply. (See the section entitled "General Technical Guidance.")

Map Amendment Procedures

After a request has been received, FEMA will acknowledge receipt of the request by letter to the requestor. The acknowledgment letter will be accompanied by a checklist that identifies any basic data the requestor may have neglected to submit. If sufficient data have been provided with the request, FEMA will review the request and the supporting data. If any questions or problems arise during this review, FEMA will work with the requestor to resolve them.

If the missing data identified on the checklist are not provided within 30 days of the date of the acknowledgment letter, a letter requesting the

data will be sent to the requestor. This letter will allow the requestor 30 more days to provide the necessary data. If the data are not provided within the allotted time, FEMA will generally suspend the processing of the request. If the requested data are provided, FEMA will complete its review and issue the appropriate LOMA.

Generally, single-lot and single-structure LOMAs will be issued within 4 weeks of the date that all the required supporting data are received. Multiple-lot and multiple-structure LOMAs will generally be issued within 8 weeks of that date.

When FEMA determines, from the legal description or recorded plat, that the structure or parcel of land is outside the SFHA shown on the effective NFIP map, a LOMA will be issued stating that the structure or parcel is "out as shown."

When the elevation of the lowest grade adjacent to the structure or the elevation of the lowest portion of a parcel of land is determined to be at or above the effective BFE, FEMA will issue a LOMA stating that the effective map has been amended and that the structure or parcel of land has been excluded from the SFHA. Otherwise, the LOMA will state that the structure or parcel of land is below the BFE and, therefore, in the SFHA.

A prevalent determination for both a LOMA and a LOMR-Based on Fill is the "Partially Inundated Structure Exempt" determination. This determination means the structure has been found to be above, and therefore out of, the SFHA. However, the rest of the parcel of land is still subject to flooding and is still in the SFHA. Therefore, any future improvements to that parcel would require an additional map change request.

When an effective NFIP map is amended by a LOMA, the amendment is effective as of the date of the LOMA. Copies of LOMAs that amend an effective map are sent to the CEO of the affected community, the State coordinating agency, and the Regional Office.

Chapter 7

Floodway Revisions

The floodways shown on NFIP maps are developed as part of detailed FISs and are adopted by communities for use in establishing sound floodplain management programs. By restricting development in the floodway, a community can preserve the conveyance area necessary for the passage of floodwaters and avoid significant increases in flood elevations.

The boundaries of the floodway are intended to remain unchanged once they are established and adopted by the community. In response to extraordinary circumstances, however, a community may find it necessary to change the configuration of the floodway. The purpose of this chapter is to discuss FEMA policy concerning floodway revisions and to describe the information that must be submitted in support of a request for a floodway revision.

Background

Even though fill may be placed or construction carried out in floodplains in such a way that the flood hazards to the new development will be minimal, the effect of such activities on existing development, both upstream and downstream must be considered. Encroachments, such as construction and the placement of fill, within the 100-year floodplain can increase flood levels by blocking areas of the floodplain that would otherwise be open and able to convey floodwaters.

To achieve a balance between any benefits to be gained from floodplain development and the resulting increase in the flood hazard, and to help communities regulate such development and avoid significant increases in BFEs, FEMA establishes floodways. A floodway identifies the portion of the 100-year floodplain that must be kept free of encroachment. The limits of the floodway are determined through a hydraulic analysis in which the rise in the BFE (the surcharge) due to encroachment within the 100-year floodplain is calculated.

FEMA has established as a standard a maximum allowable surcharge of 1.0 foot. Because the surcharge

generally increases as the amount of encroachment increases, setting a limit on the magnitude of the surcharge sets limits on the amount of encroachment that may take place. A floodway based on a maximum allowable surcharge of 1.0 foot is therefore the channel of a stream plus the portion of the floodplain adjacent to it that must be kept free of encroachment so that the entire 100-year flood discharge can be passed with no greater than a 1.0 foot increase in the BFE.

The portions of the floodplain outside the floodway are referred to as the floodway fringe. Once a floodway has been established, the community may allow development in the floodway fringe with the assurance that flood hazards will not be increased significantly. However, all such development must meet the minimum floodplain management standards required for participation in the NFIP.

Several States have adopted requirements that limit the allowable surcharge to less than 1.0 foot. For States that have adopted more stringent standards by legally enforceable statutes or regulations, FEMA computes floodways using those standards. In addition, some individual communities have established and enforce more stringent standards. Although the NFIP maps for such communities usually depict floodways based on a 1.0-foot surcharge, FEMA encourages the adoption of more stringent standards. Once a floodway has been adopted by the community, any encroachments within the floodway that would increase the BFEs during the 100-year flood are prohibited. Such encroachments could include fill, new construction, substantial improvements, and other types of development.

Hereafter in this Guide, when a 1.0-foot surcharge is referred to, the assumption has been made that there is no more stringent State or local surcharge standard. Where such a standard exists, the allowable surcharge is limited to that standard. In addition, where a stream with a regulatory floodway forms the

boundary between two communities or two states, the allowable rise in the BFE due to encroachment in one community or state is limited to 0.5 foot, unless a more stringent, State standard has been established.

Floodways are developed for streams studied by detailed methods as part of the hydraulic analyses performed for those streams. The most common method FEMA uses to develop floodways is referred to as the "equal conveyance reduction method," in which the hydraulic computer model is modified so that equal amounts of hydraulic conveyance are eliminated from opposite sides of the 100-year floodplain until the allowable rise in the BFE is reached.

When it is necessary to develop floodways with specific configurations requested by the community, unequal reductions of conveyance area may be used. A floodway is a reasonable depiction of the area that must be kept open to convey floodwaters and is not necessarily the minimum area required to meet FEMA or State standards.

Once adopted by the community, a particular floodway configuration becomes administratively established, as much the same as other community regulations do, and the limits of the floodway are intended to remain unchanged. However, in one situation, a community must request conditional approval of a floodway revision; in two other situations, a community may find it necessary to request a floodway revision.

A community must request a floodway revision before permitting an encroachment into a regulatory floodway that would cause any rise in the BFE. Before FEMA can grant such a request, the community must apply to FEMA for conditional approval of the proposed project. The data the community must submit in support of such an application, and the procedures FEMA will follow in reviewing and responding to the application, are discussed in Chapter 5, "Conditional Map Revisions."

A community may request a floodway revision in the following situations:

- When an Appeal or a Map Revision results in changes to effective BFEs
- When, for good cause, the community wishes to shift the floodway or change its configuration in some way

Appeals and Map Revisions that result in changes to BFEs are generally supported by new or revised hydraulic analyses that involve modification of the original hydraulic computer model. (See Chapters 3 and 4.) Because the floodway is developed with that model and the floodway width depends on a specified rise in the BFEs, changes to floodways may be a part of any Appeal or Map Revision that results in changes to BFEs.

A floodway revision request may be submitted during the 90-day appeal period or after the NFIP map on which the floodway is shown has become effective. Requests submitted during the appeal period will be handled as Protests. (See Appendix A.) Requests submitted after the effective date of the NFIP map will be handled under the map revision process.

How to Request a Floodway Revision

Because the community selects and adopts the floodway, all requests for changes to floodways must be made or approved by the community. FEMA will not revise a floodway without the approval of the community. Because the CEO of the community is responsible for ensuring that the community meets the obligation to regulate floodways, FEMA will work with the CEO or a local official designated by the CEO, such as a city planner or city engineer, in evaluating requests that involve changes to floodways.

Therefore, any individual property owner, developer, or other person who wishes to request a map change that involves the floodway must submit the request to the CEO or the designated official. The CEO or other community official should review the request and, when forwarding it to FEMA, should state whether the community approves the requested change.

All requests that involve changes to floodways should be submitted to the appropriate FEMA Regional Office. The Regional Offices and their addresses are listed in Appendix D.

Required Supporting Data

Floodway revisions cannot be made without adequate supporting data. Because many States require communities to follow administrative procedures for establishing and revising floodways and because the limits of the floodway are established through engineering analyses, both legal documentation and technical data must be submitted. Also, it is important to note that as the floodway fringe is developed, an increasing amount (if not all) of the allowable surcharge is used. Therefore, a revised floodway must be configured in such a way that it will continue to convey the 100-year flood discharge with no greater than a 1.0-foot increase in the original BFEs (i.e., the BFEs on which the unrevised floodway is based) at any point. If the floodway revision is part of a revision that results in BFEs lower than those on the map that is to be revised, the 1.0-foot surcharge limit applies to those lower BFEs.

In the following are descriptions of the documentation and data that the requestor must submit to support each type of floodway revision.

All Floodway Revisions

The following documentation must be submitted as evidence that the community is prepared to adopt the revised floodway and that all legal requirements will have been met before the floodway is revised:

- Copy of a public notice stating the community's intent to revise the floodway and a statement that the community has notified any affected property owners or adjacent jurisdictions.
- Copy of a letter notifying the State of the floodway revision
- Documentation of the approval of the revised floodway by the appropriate

State agency (for communities where the State has jurisdiction over the floodway or its adoption by communities participating in the NFIP)

Floodway Revisions Made as Part of an Appeal or Map Revision

The following data must be submitted:

- Engineering analysis for the revised floodway, performed according to the steps below:
 1. The floodway analysis should be performed for the desired floodway limits with the hydraulic computer model used for the determination of the new BFEs for the Appeal or Map Revision. (See Chapter 3 or 4.)
 2. The floodway limits should be set so the combined effects of past encroachments, the changes on which the Appeal or Map Revision is based, and the new floodway limits do not increase the original BFEs or those resulting from the Appeal or Map Revision by more than the amount allowed by FEMA and the State.

(Copies of the input and output data from the original, modified, and floodway computer models must be submitted.)

- Delineation of the revised floodway on the same topographic map used for the delineation of the revised floodplain boundaries resulting from the appeal or map revision.

Floodway Revisions Made Independently of Appeals of Map Revisions

The following data must be submitted:

1. Engineering analysis for the revised floodway, performed according to the steps below:
 1. The original hydraulic computer model should be modified so that it includes all encroachments that have occurred in the floodplain since the original floodway was developed.
 2. The floodway analysis should be performed for the desired floodway limits with the modified computer model.
 3. The floodway limits should be set so that the combined effects of the past encroachments and the new floodway limits do not increase the original BFEs by more than the amounts allowed by FEMA and the State.

Copies of the input and output data from the original, modified, and floodway computer models must be submitted.

- Delineation of the revised floodway on a copy of the effective NFIP map.

General Technical Guidance

When developing technical supporting data, the requestor should consider the following points:

- All analyses and data submitted by the requestor must be certified by a registered professional engineer; survey data may be certified by a licensed land surveyor.
- Input and output data from the original hydraulic computer model may be requested through the appropriate FEMA Regional Office. (See Appendix D.)

- FEMA policies concerning floodway revisions based on changes in flood discharges or the effects of earthfill levees or other structures are the same as those outlined for Map Revisions in Chapter 4.

Floodway Revision Procedures

As explained earlier, a request for a floodway revision may be part of either an Appeal or a Map Revision that results in changes to BFEs, or it may be submitted independently as a Map Revision request that involves only the floodway. If the floodway revision request is submitted as part of an Appeal or Map Revision request, or is submitted as a separate Map Revision request, it will be handled according to the procedures outlined in Chapter 3 or 4. If the request is submitted during the 90-day appeal period, it will be handled as described below.

After receiving the request, FEMA will send an acknowledgment letter to the CEO. If the request is submitted by a private party, a copy of the acknowledgment letter will be sent to the requestor. During its review of the request, FEMA will communicate by letter with the CEO or the community official designated by the CEO. If the request was submitted by a private party, copies of all letters will be sent to the requestor.

If FEMA determines that it needs additional data to support the request, it will request data by letter. The letter will be sent to the CEO. To avoid spending time reviewing poorly documented requests, FEMA allows 30 days for the CEO to provide the requested data.

If the data are not provided within the allotted time, FEMA will complete the review using the data originally submitted. If the requested data are provided, FEMA will consider them in the review. After reviewing all the supporting data, FEMA will determine whether the revision is warranted.

If no revision is warranted, FEMA will inform the CEO by letter that the request is denied. If a revision is warranted, the revised floodway will be incorporated into the map at the time it is

printed. The revised floodway data will be incorporated into the FIS report at the same time.

Appendix A

Protests

During the formal 90-day appeal period, a community official or an individual property owner may wish to object to information shown on the FIRM, FBFM, or FIS report. If the objection does not involve the proposed BFEs, it does not, according to Part 67 of the NFIP regulations, constitute an Appeal. Such objections are called Protests.

Like Appeals, Protests should not be submitted directly to FEMA by individual property owners; they are to be submitted to the CEO or a community official designated by the CEO. The CEO or designated community official should review the Protests and, when forwarding them to FEMA, should state whether the community supports them. Protests should be sent to the FEMA Headquarters office at the address shown in Chapter 3.

Protests will generally involve changes to one of the following:

- Floodplain Boundaries
- Corporate Limits
- Roads and Road Names

The various types of Protests and the data that must be submitted to support them are discussed in the Sections that follow. Changes that must be made to the FIRM, FBFM, and FIS report as a result of Protests are usually incorporated into the maps and FIS report at the time they are printed. Generally, the letter that informs the CEO of the final BFE determination will also explain the resolution of any Protests that have been submitted.

Changes to Floodplain Boundaries (Flooding Sources Studied by Detailed Methods)

Usually, detailed floodplain boundaries are delineated with topographic maps and the BFEs

resulting from the hydraulic analysis performed for the FIS. If topographic maps or other ground elevation data are submitted that are of greater detail than those used by FEMA or that show more recent topographic conditions, FEMA will

use them to revise the floodplain boundaries shown on the FIRM and FBFM.

All maps and other supporting data submitted must be certified by a registered professional engineer or a licensed land surveyor and must reflect existing conditions. Maps prepared by an authoritative source, such as the COE, USGS, U.S. Bureau of Reclamation, or a State department of highways and transportation, are acceptable without certification as long as the sources and dates of the maps are identified.

Changes to Floodplain Boundaries (Flooding Sources Studied by Approximate Methods)

Usually, approximate floodplain boundaries are delineated with the best available data, including flood maps published by other agencies, information on past floods, and simplified hydrologic and hydraulic analyses. If more-detailed data or analyses are submitted, FEMA will use them to revise the floodplain boundaries shown on the FIRM and FBFM. Such data and analyses would include the following:

- Published flood maps that are more recent or more detailed than those used by FEMA
- Analyses that are more detailed than those performed by FEMA or that are based on better data than those used by FEMA

All data and analyses submitted must be certified by a registered professional engineer or licensed land surveyor.

Changes to Corporate Limits

The corporate limits shown on NFIP maps are taken from community maps obtained by FIS Contractors during the course of the FIS. When changes to the corporate limits shown on the NFIP map are necessary, an up-to-date community map should be submitted. FEMA may use the map to revise the corporate limits shown on the FIRM and FBFM.

Changes to Roads and Road Names

In general, FEMA shows on its maps all roads that are in or adjacent to floodplains. If maps are submitted that show new or revised information concerning the locations and names of roads in or adjacent to floodplains, FEMA will revise the FIRM and FBFM as appropriate.

Appendix B

Glossary and Abbreviations Index

The terms highlighted in the paragraphs that follow are commonly encountered during the processing of appeals, revisions, and amendments to NFIP maps.

An **Amendment** is a change to an effective NFIP map that results in the exclusion from the Special Flood Hazard Area (SFHA) of an individual structure or a legally described parcel of land that has been inadvertently included in the SFHA (i.e., no alterations of topography have occurred since the date of the first NFIP map that showed the structure or parcel to be within the SFHA).

An **Appeal** is a formal objection to proposed BFEs, submitted by a community or individual resident during the 90-day appeal period, that is based on data that show the proposed base flood elevations are scientifically or technically incorrect.

The **Base Flood** is the flood that has a 1-percent probability of being equaled or exceeded in any given year (also referred to as 100-year flood).

The **Base Flood Elevation (BFE)** is the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929, or depth of the base flood, usually in feet, above the ground surface.

The **Chief Executive Officer (CEO)** is the official of a community who is charged with the authority to implement and administer laws, ordinances, and regulations for that community.

The **Code of Federal Regulations (CFR)** is the codification of the general and permanent rules published in the Federal Register by the Executive Departments and agencies of the Federal Government. NFIP regulations are printed in Parts 59 through 77 of Title 44 of the CFR.

A **Conditional Letter of Map Revision (CLOMR)** is the Federal Emergency Management Agency's comment on a proposed project that would affect the hydrologic and/or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway or effective BFEs.

An **Effective Map** is the latest NFIP map issued by FEMA, which is in effect as of the date shown in the title box of the map as "Effective Date," "Revised," or "Map Revised."

An **Encroachment** is construction, placement of fill, or similar alteration of topography in the floodplain that reduces the area available to convey floodwaters.

The **Federal Emergency Management Agency (FEMA)** is the independent Federal agency that, in addition to carrying out many other responsibilities, oversees the administration of the National Flood Insurance Program.

The **Federal Insurance Administration (FIA)** is the component of FEMA that has direct responsibilities for administering the National Flood Insurance Program.

The **Federal Register** is the document published daily by the U.S. Government, that presents regulations and legal notices issued by Federal agencies.

The **Final Elevation Determination** is the final determination of BFEs made by the Administrator of FIA after the 90-day appeal period has ended and all appeals have been resolved. Final BFE determinations are published in the Federal Register.

The **Flood Boundary and Floodway Map (FBFM)** is the floodplain management map issued by FEMA that depicts, on the basis of detailed analyses, the boundaries of the 100- and 500-year floodplain and the regulatory 100-year floodway.

The Flood Hazard Boundary Map (FHBM) is the initial insurance map issued by FEMA that identifies, on the basis of approximate analyses, the areas of 100-year flood hazard in a community.

The Flood Insurance Rate Map (FIRM) is the insurance and floodplain management map issued by FEMA that identifies, on the basis of detailed or approximate analyses, the areas of 100-year flood hazard in a community. Actuarial insurance rate zones are also shown. In areas studied by detailed analyses, the FIRM shows BFEs and, occasionally, 500-year floodplain boundaries, and, on some FIRMs, delineations of the 100-year floodway boundaries.

A Flood Insurance Restudy (RFIS) is a detailed re-evaluation of the flood hazard in a community, which is funded by and performed under contract with FEMA.

A Flood Insurance Study (FIS) is an engineering study performed under contract to FEMA to identify flood-prone areas and to determine BFEs, flood insurance rate zones, and other flood risk data for a community.

An FIS Contractor is an architectural and engineering firm or Federal, State, or local agency under contract to FEMA to perform an FIS.

The floodplain is the area subject to inundation by floodwaters from any source.

Floodplain Management is the operation of a program of corrective and preventive measures for reducing flood damage, including emergency preparedness plans, flood-control works, and floodplain management regulations.

The Floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood discharge can be conveyed without increases of more than a specified amount in the BFE.

The Floodway Fringe is the portion of the 100-year floodplain that is not within the floodway and in which development and other forms of encroachment may be permitted under certain circumstances.

A hydraulic computer model is a computer program that uses flood discharge values and data concerning floodplain characteristics to simulate flow conditions and determine flood elevations.

Hydraulic methodology is used for assessing the movements and behavior of flood waters and determining flood elevations and floodway data.

Hydrologic methodology is used for conducting an analysis that determines peak flood discharges and their frequencies.

A legally described parcel of land is a parcel of land for which a metes and bounds description or a plat has been recorded and on which no structures have been built.

A Letter of Map Amendment (LOMA) is an official amendment to an effective NFIP map. A LOMA establishes a property's location in relation to the SFHA.

A Letter of Map Revision (LOMR) is an official revision to an effective NFIP map. A LOMR may change flood insurance rate zones, floodplain boundary delineations, planimetric features, and BFEs.

The local newspaper is the community newspaper, identified by the CEO, in which FEMA publishes notices at the beginning of an FIS and notices of proposed BFEs.

A lot is a parcel of land for which a metes and bounds description or a plat has been recorded and on which one or more structures may have been built.

The National Flood Insurance Program (NFIP) is the Federal program that enables property owners to purchase flood insurance. The insurance is designed to provide an alternative to disaster assistance for meeting the costs of repairing damage to buildings and their contents caused by floods. The NFIP is based on an agreement between the Federal Government and participating communities which states that if a community will carry out measures for reducing future flood risks to new construction in SFHAs, the Federal Government will make flood insurance available within the community.

as financial protection against flood losses that do occur.

The **90-day appeal period** is the statutory period, beginning on the date of second publication of the proposed BFEs in the local newspaper, during which community officials and individual residents may appeal the proposed BFEs by submitting data to show that the BFEs are scientifically or technically incorrect.

A **physical map revision** is the revision and republication of an NFIP map.

Proposed BFEs are those BFEs published in the Federal Register and local newspaper at the start of the 90-day appeal period.

A **Protest** is an objection to any information, other than BFEs, shown on an NFIP map that is submitted by a community or individual resident during the 90-day appeal period.

A **Revision** is a change to an effective NFIP map, which is accomplished by a LOMR or by a physical map revision.

Scientifically incorrect BFEs are BFEs determined through analyses in which the methodologies used and/or assumptions made are inappropriate for the physical processes being evaluated or are otherwise erroneous.

The **6-month compliance period** is the period, beginning with the date of the final BFE determination and ending with the effective date of the FIRM, during which the community must enact and adopt the ordinances required for continued participation in the NFIP.

Special Flood Hazard Areas (SFHAs) are the areas delineated on an NFIP map as being subject to inundation by the base (100-year) flood. SFHAs may be designated Zone A, AO, AH, A1-A30, AE, V, V1-V30, or VE.

Technically incorrect BFEs are BFEs determined through analyses in which the methodologies used have not been properly applied, are based on insufficient or poor quality data, or do not account for the effects of physical changes that have occurred in the floodplain.

Appendix C

How to Obtain FEMA Publications and Backup Data for NFIP Maps

To comply with the supporting data requirements discussed in this Guide, community officials and others who wish to submit appeals or request Map Revisions or Map Amendments to NFIP maps may find it necessary to obtain copies of FHBMs, FIRMs, FBFMs, FIS reports, backup data for NFIP maps, or FEMA publications that further explain the appeal, map revision, and map amendment processes. As discussed below, those materials generally are available from the FEMA Flood Map Distribution Center or the FEMA Regional Offices. (See Appendix D.)

FEMA Publications

After an NFIP map for a community has been issued in preliminary form, and again after it has been published, copies of the map and, if applicable, the accompanying FIS report are sent to the community. The community stores the copies in an official, local repository, where they are to be made available for community residents and other interested parties to review.

The community map repository is often in the office of a floodplain administrator, community engineer, planner, or clerk. FEMA also sends copies of LOMAs that amend NFIP maps and copies of all LOMRs to the local map repository.

Copies of effective NFIP maps can also be obtained from the FEMA Flood Map Distribution Center. Requests for copies of effective maps should be sent to the following address:

Federal Emergency Management Agency
Flood Map Distribution Center
6930 (A-F) San Tomas Road
Baltimore, Maryland 21227-6227

Requestors can also place an order for NFIP maps by calling the Flood Map Distribution Center toll free at 1 (800) 333-1363.

When ordering a copy of a map, the requestor must specify the full name of the community and the NFIP community number or map number shown in the title box of the map. When the map consists of more than one panel, the Flood Map Distribution Center will provide copies of individual panels rather than the entire map; therefore, the requestor may also be required to specify panel numbers.

Requestors will be charged for maps unless they are representatives of Federal, State, and local governments; lending institutions; insurance agents; insurance brokers; and Write Your Own Insurance companies who are directly involved in the NFIP. Payment may be made by VISA or MASTERCARD or by personal check made payable to "NFIP."

To help communities and individual map users, FEMA has prepared the following documents that provide additional information about the NFIP, NFIP maps, and the appeal, map revision, and map amendment processes:

- National Flood Insurance Program and Related Regulations -- Reprints the regulations that govern the administration of the NFIP including the appeal, map revision, and map amendment processes
- Questions and Answers on the National Flood Insurance Program -- Provides answers to frequently asked questions about the purpose and operation of the NFIP, flood insurance and floodplain management requirements, and the mapping of flood hazards under the NFIP

- Guide to Flood Insurance Rate Maps --
Describes the key elements and use of FIRMs

Also available are the following "Conditions and Criteria" documents that describe the appeal, map revision, and map amendment processes and the required supporting data in more technical terms and in greater detail than does this guide.

- "Conditions and Criteria for Map Revisions"
- "Conditions and Criteria for Floodway Revisions"
- "Conditions and Criteria for Letters of Map Amendment (LOMAs)"
- "Conditions and Criteria for Issuing Letters of Map Revision (LOMRs) Based on Fill"

Requests for any of the documents listed above should be directed to the appropriate FEMA Regional Office.

Backup Data for NFIP Maps

While an NFIP map is being processed for publication, copies of the data on which the map is based are available through the appropriate FEMA Regional Office. Such data could include copies of calculations performed as part of hydrologic and/or hydraulic analyses (including printouts from computer models) and topographic maps and other ground elevation data. One free copy of the supporting documentation will be made available to the CEO or his designee upon request. All other requestors must pay a fee for search and duplication costs.

After an NFIP map has been published and distributed, the backup data for that map are microfilmed under the FEMA Engineering Studies Data Package (ESDP) Project. Copies of those data can be provided on microfiche. Requests for ESDP data should also be directed to the appropriate FEMA Regional Office. A fee will be charged by FEMA for providing backup data on microfiche.

Appendix D

FEMA Offices

The addresses and telephone numbers of the FEMA Headquarters office and the various Regional Offices are provided in the subsections that follow.

FEMA Headquarters Office

Inquiries to FEMA Headquarters should be addressed to the Risk Studies Division or Technical Operations Division at the following address:

Federal Emergency Management Agency
Federal Insurance Administration
Office of Risk Assessment
500 C Street, SW.
Washington, D.C. 20472

(202) 646-2767 RSD
(202) 646-2758 TOD

FEMA Regional Offices

Region I

For communities in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
J.W. McCormack Post Office and Courthouse
Building
Boston, Massachusetts 02109

(617) 233-9561

Region II

For communities in New Jersey and New York, Puerto Rico, and the U.S. Virgin Islands, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
26 Federal Plaza, Room 1349
New York, New York 10278

(212) 238-8203

Region III

For communities in Delaware, Maryland, Pennsylvania, Virginia, and West Virginia, as well as the District of Columbia, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
Liberty Square Building, Second Floor
105 South Seventh Street
Philadelphia, Pennsylvania 19106

(215) 931-5750

Region IV

For communities in Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
1371 Peachtree Street, NE., Suite 735
Atlanta, Georgia 30309

(404) 853-4400

Region V

For communities in **Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin**, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
175 West Jackson Boulevard, 4th Floor
Chicago, Illinois 60606

(312) 408-5500

Region VI

For communities in **Arkansas, Louisiana, New Mexico, Oklahoma, and Texas**, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
Federal Regional Center
North Loop 288
Denton, Texas 76201-3698

(817) 898-9127

Region VII

For communities in **Iowa, Kansas, Missouri, and Nebraska**, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
Federal Office Building
911 Walnut Street
Kansas City, Missouri 64106

(816) 283-7002

Region VIII

For communities in **Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming**, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
Denver Federal Center
Building 710, Box 25267
Denver, Colorado 80225-0267

(303) 235-4830

Region IX

For communities in **Arizona, California, Hawaii, and Nevada**, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
Presidio of San Francisco
Building 105
San Francisco, California 94129

(415) 923-7177

Region X

For communities in **Alaska, Idaho, Oregon, and Washington**, inquiries should be directed to

Federal Emergency Management Agency
Chief, Natural and Technological Hazards
Division
Federal Regional Center
130 228th Street, SW.
Bothell, Washington 98021-9796

(206) 487-4682



FEDERAL EMERGENCY MANAGEMENT AGENCY

NATIONAL FLOOD INSURANCE PROGRAM

ELEVATION CERTIFICATE

AND

INSTRUCTIONS

ELEVATION CERTIFICATE
FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM

OMB 3067-0077

ATTENTION: Use of this certificate does not provide a waiver of the flood insurance purchase requirement. This form is used only to provide elevation information necessary to ensure compliance with applicable community floodplain management ordinances, to determine the proper insurance premium rate, and/or to support a request for a Letter of Map Amendment or Revision (LOMA or LOMR). Instructions for completing this form can be found on the following pages.

SECTION A PROPERTY INFORMATION		FOR INSURANCE COMPANY USE
BUILDING OWNER'S NAME		POLICY NUMBER
STREET ADDRESS (Including Apt., Unit, Suite and/or Bldg. Number) OR P.O. ROUTE AND BOX NUMBER		COMPANY NAIC NUMBER
OTHER DESCRIPTION (Lot and Block Numbers, etc.)		
CITY	STATE	ZIP CODE

SECTION B FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM (See Instructions):

1. COMMUNITY NUMBER	2. PANEL NUMBER	3. SUFFIX	4. DATE OF FIRM INDEX	5. FIRM ZONE	6. BASE FLOOD ELEVATION (in AO Zones, use depth)

7. Indicate the elevation datum system used on the FIRM for Base Flood Elevations (BFE): ☐ NGVD '29 ☐ Other (describe on back)
8. For Zones A or V, where no BFE is provided on the FIRM, and the community has established a BFE for this building site, indicate the community's BFE: feet NGVD (or other FIRM datum—see Section B, Item 7).

SECTION C BUILDING ELEVATION INFORMATION

1. Using the Elevation Certificate Instructions, indicate the diagram number from the diagrams found on Pages 5 and 6 that best describes the subject building's reference level ____.
- 2(a). FIRM Zones A1-A30, AE, AH, and A (with BFE). The top of the reference level floor from the selected diagram is at an elevation of feet NGVD (or other FIRM datum—see Section B, Item 7).
- (b). FIRM Zones V1-V30, VE, and V (with BFE). The bottom of the lowest horizontal structural member of the reference level from the selected diagram, is at an elevation of feet NGVD (or other FIRM datum—see Section B, Item 7).
- (c). FIRM Zone A (without BFE). The floor used as the reference level from the selected diagram is feet above ☐ or below ☐ (check one) the highest grade adjacent to the building.
- (d). FIRM Zone AO. The floor used as the reference level from the selected diagram is feet above ☐ or below ☐ (check one) the highest grade adjacent to the building. If no flood depth number is available, is the building's lowest floor (reference level) elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown
3. Indicate the elevation datum system used in determining the above reference level elevations: ☐ NGVD '29 ☐ Other (describe under Comments on Page 2). (NOTE: If the elevation datum used in measuring the elevations is different than that used on the FIRM [see Section B, Item 7], then convert the elevations to the datum system used on the FIRM and show the conversion equation under Comments on Page 2.)
4. Elevation reference mark used appears on FIRM: ☐ Yes ☐ No (See Instructions on Page 4)
5. The reference level elevation is based on: ☐ actual construction ☐ construction drawings
(NOTE: Use of construction drawings is only valid if the building does not yet have the reference level floor in place, in which case this certificate will only be valid for the building during the course of construction. A post-construction Elevation Certificate will be required once construction is complete.)
6. The elevation of the lowest grade immediately adjacent to the building is: feet NGVD (or other FIRM datum—see Section B, Item 7).

SECTION D COMMUNITY INFORMATION

1. If the community official responsible for verifying building elevations specifies that the reference level indicated in Section C, Item 1 is not the "lowest floor" as defined in the community's floodplain management ordinance, the elevation of the building's "lowest floor" as defined by the ordinance is: feet NGVD (or other FIRM datum—see Section B, Item 7).
2. Date of the start of construction or substantial improvement _____

SEE REVERSE SIDE FOR CONTINUATION

SECTION E CERTIFICATION

This certification is to be signed by a land surveyor, engineer, or architect who is authorized by state or local law to certify elevation information when the elevation information for Zones A1-A30, AE, AH, A (with BFE), V1-V30, VE, and V (with BFE) is required. Community officials who are authorized by local law or ordinance to provide floodplain management information, may also sign the certification. In the case of Zones AO and A (without a FEMA or community issued BFE), a building official, a property owner, or an owner's representative may also sign the certification.

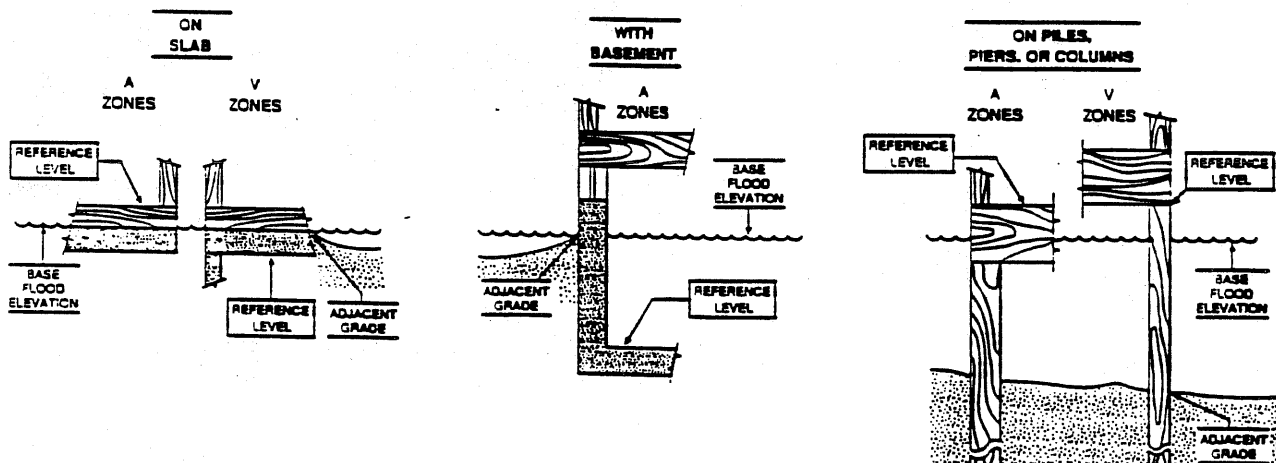
Reference level diagrams 6, 7 and 8 - Distinguishing Features—If the certifier is unable to certify to breakaway/non-breakaway wall, enclosure size, location of servicing equipment, area use, wall openings, or unfinished area Feature(s), then list the Feature(s) not included in the certification under Comments below. The diagram number, Section C, Item 1, must still be entered.

*I certify that the information in Sections B and C on this certificate represents my best efforts to interpret the data available.
I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

CERTIFIER'S NAME	LICENSE NUMBER (or Affix Seal)		
TITLE	COMPANY NAME		
ADDRESS	CITY	STATE	ZIP
SIGNATURE	DATE	PHONE	

Copies should be made of this Certificate for: 1) community official, 2) insurance agent/company, and 3) building owner.

COMMENTS: _____



The diagrams above illustrate the points at which the elevations should be measured in A Zones and V Zones.

Elevations for all A Zones should be measured at the top of the reference level floor.

Elevations for all V Zones should be measured at the bottom of the lowest horizontal structural member.

THE NATIONAL FLOOD INSURANCE PROGRAM ELEVATION CERTIFICATE

PURPOSE OF THE ELEVATION CERTIFICATE

The Elevation Certificate is an important administrative tool of the National Flood Insurance Program (NFIP).

As part of the agreement for making flood insurance available in a community, the NFIP requires the community to adopt a floodplain management ordinance containing certain minimum requirements intended to reduce future flood losses. One such requirement is that the community "obtain the elevation of the lowest floor (including basement) of all new and substantially improved structures, and maintain a record of all such information." The Elevation Certificate is one way for a community to comply with this requirement.

The Elevation Certificate is also required to properly rate post-FIRM structures, which are buildings constructed after publication of the Flood Insurance Rate Map (FIRM), for flood insurance in FIRM Zones A1-A30, AE, AO, AH, A (with Base Flood Elevations (BFE's)), V1-V30, VE, and V (with BFE's). In addition, the Elevation Certificate is also needed for pre-FIRM structures being rated under post-FIRM flood insurance rules.

Use of this certificate does not in any way alter the flood insurance purchase requirement. The Elevation Certificate is only used to provide information necessary to ensure compliance with applicable community floodplain management ordinances, to determine the proper flood insurance premium rate, and/or to support a request for a Letter of Map Amendment or Revision (LOMA or LOMR). Only a LOMA or LOMR from the Federal Emergency Management Agency (FEMA) can amend the FIRM and remove the Federal requirement for a lending institution to require the purchase of flood insurance. Note that the lending institution may still require flood insurance.

This certificate is only used to certify the elevation of the reference level of a building. If a non-residential building is being floodproofed, then a Floodproofing Certificate must be completed in addition to certifying the building's elevation. Floodproofing of a residential building does not alter a community's floodplain management elevation requirements or affect the insurance rating unless the community has been issued an exception by FEMA to allow floodproofed residential basements.

INSTRUCTIONS FOR COMPLETING THE ELEVATION CERTIFICATE

The Elevation Certificate is to be completed by a land surveyor, engineer, or architect who is authorized by state or local law to certify elevation information when the elevation information for Zones A1-A30, AE, AH, A (with BFE's), V1-V30, VE, and V (with BFE's) is required. Community officials who are authorized by local law or ordinance to provide floodplain management information may also complete this form. For Zones AO and A (without BFE's), a building official, a property owner, or an owner's representative may also provide the information on this certification.

SECTION A Property Information

The Elevation Certificate identifies the building, its owner and its location. Provide the building owner's name(s), the building's complete street address, and lot and block number. If the property address is a rural route or PO box number, provide a legal description or an abbreviated location description based on distance from a reference point.

SECTION B Flood Insurance Rate Map Information

In order to properly complete the Elevation Certificate, it is necessary to locate the building on the appropriate FIRM, and record the appropriate information. To obtain a FIRM, contact the community or call 1-800-333-1363.

The Elevation Certificate may be completed based on either the FIRM in effect at the time of the certification or the FIRM in effect when construction of the building was started.

Items 1 - 6. Using the FIRM Index and the appropriate FIRM panel for the community, record the community number, panel (or page) number, suffix, and index date. From the appropriate FIRM panel, locate the property and record the zone and the BFE (or flood depth number) at the building site. BFE's are shown on a FIRM for Zones A1-A30, AE, AH, V1-V30, and VE; flood depth numbers are shown for Zone AO.

Item 7. Record the vertical datum system to which the elevations on the applicable FIRM are referenced. The datum is specified in the upper right corner of the title block of the FIRM.

Item 8. In A or V Zones where BFE's are not provided on the FIRM, the community may have established BFE's based on data from other sources. For subdivisions and other development greater than 50 lots or 5 acres, establishment of BFE's is required by community floodplain management ordinance. When this is the case, complete this item.

SECTION C Building Elevation Information

Item 1. The Elevation Certificate uses a building's reference level as the point for measuring its elevation. Pages 5 and 6 of this Elevation Certificate package contain a series of eight diagrams of various building types that are to be used to help determine the reference level. Choose the diagram that best represents this building, record the diagram number, and use the indicated reference level to measure the elevation as requested in Items 2a-d.

Item 2. Depending on the property location's FIRM Zone, complete Item 2a, 2b, 2c, or 2d. Use the reference level shown in the appropriate building diagram as the point of measurement. As shown in the diagram on the back of the Certificate, for all A Zones, the elevation should be measured at the top of the reference level floor. For all V Zones, the elevation should be measured at the bottom of the lowest horizontal structural member of the reference level floor. Reporting of elevations in Items 2a and 2b should be to the nearest tenth of a foot, or alternatively, unless prohibited by state or local ordinance, the reference level elevation may be "rounded down" to the nearest whole foot ("rounding up" is prohibited).

Item 2(a). For structures located in FIRM Zones A1-A30, AE, AH, and A (with BFE's), record the elevation (to the nearest tenth of a foot) of the top of the floor identified as the reference level in the applicable diagram.

Item 2(b). For structures located in FIRM Zones V1-V30, VE, and V (with BFE's), record the elevation (to the nearest tenth of a foot) of the bottom of the lowest horizontal structural member of the floor identified as the reference level in the applicable diagram.

Item 2(c). For structures located in FIRM Zone A (without BFE's), record the height (to the nearest tenth of a foot) of the top of the floor indicated as the reference level (from the applicable diagram) above or below the highest adjacent grade immediately next to the building.

Item 2(d). For structures located in FIRM Zone AO, the FIRM will show the base flood depth. For locations in FIRM Zone AO record the height (to the nearest tenth of a foot) of the top of the floor identified as the reference level (from the applicable diagram) above or below the highest adjacent grade immediately next to the building. For post-FIRM buildings, the community's floodplain management ordinance requires that this value equal or exceed the base flood depth provided on the FIRM. For those few communities where this base flood depth is not available, the community will need to determine if the lowest floor is elevated in accordance with their floodplain management ordinance.

Item 3. Record the vertical datum system used in identifying the reference level elevations for all buildings. If the datum used in measuring the elevations is different than that used on the FIRM, then convert the elevations in Items 2a-d to the datum used on the FIRM, and show the conversion equation under the Comments section on Page 2.

Item 4. Indicate if the elevation reference mark used appears on the FIRM. Reference marks other than those shown on the FIRM may be used for elevation determinations. In areas experiencing ground subsidence, the most recently adjusted reference mark elevations must be used for reference level elevation determinations.

Item 5. Indicate if the reference level used in making the elevation measurement is based on actual construction or construction drawings. Construction drawings should only be used if the building does not yet have the reference level floor in place, in which case the Elevation Certificate will only be valid for the building during the course of construction. A post-construction Elevation Certificate will be needed once construction is complete.

Item 6. Record the elevation measurement of the lowest grade adjacent to the building (to the nearest tenth of a foot). Adjacent grade is defined as the elevation of the ground, sidewalk, patio, deck support, or basement entryway immediately next to the structure. This measurement should be to the nearest tenth of a foot if this Certificate is being used to support a request for a LOMA/LOMR.

SECTION D Community Information

Completion of this section may be required by the community in order to meet the minimum floodplain management requirements of the NFIP. Otherwise, completion of this section is not required.

Item 1. The community's floodplain management ordinance requires elevation of the building's "lowest floor" above the BFE. For the vast majority of building types, the reference level and the lowest floor will be the same. If the community determines that there is a discrepancy, record the elevation of the lowest floor.

Item 2. Enter date. These terms are defined by local ordinance.

SECTION E Certification

Complete as indicated. The Elevation Certificate may only be signed by a land surveyor, engineer, or architect who is authorized by state or local law to certify elevation information when the elevation information for Zones A1-A30, AE, AH, A (with BFE's), V1-V30, VE, and V (with BFE's) is required. Community officials who are authorized by local law or ordinance to provide floodplain management information may also sign this certification. In the case of Zones AO and A (without BFE's), a building official, a property owner, or an owner's representative may sign this certification.

Certification is normally to the information provided in Sections B and C. If the certifier is unable to certify to the selection of reference level diagram 6, 7 or 8 (Section C, Item 1), e.g., because of difficulty in obtaining construction or building use information needed to determine the Distinguishing Feature(s), the certifier must list the Feature(s) excluded from the certification under Comments on Page 2. The diagram number used for the Reference level must still be entered in Section C, Item 1.

INSTRUCTIONS

The following 8 diagrams contain descriptions of various types of buildings. Compare the features of your building with those shown in the diagrams and select the diagram most applicable. Indicate the diagram number on the Elevation Certificate (Section C, Item 1) and complete the Certificate. The reference level floor is that level of the building used for underwriting purposes.

NOTE: In all A Zones, the reference level is the top of the lowest floor; in V Zones the reference level is the bottom of the lowest horizontal structural member (see diagram on page 2). Agents should refer to the Flood Insurance Manual for instruction on lowest floor definition.

DIAGRAM NUMBER 1

ALL SINGLE AND MULTIPLE FLOOR BUILDINGS (OTHER THAN SPLIT LEVEL), INCLUDING MANUFACTURED (MOBILE) HOUSING AND HIGH RISE BUILDINGS, EITHER DETACHED OR ROW TYPE (E.G., TOWNHOUSE, ETC.); WITH OR WITHOUT ATTACHED GARAGE.

Distinguishing Feature - The first floor is *not* below ground level (grade) on *all* sides*. This includes "walkout" basements, where at least one side is at or above grade. (Not illustrated)

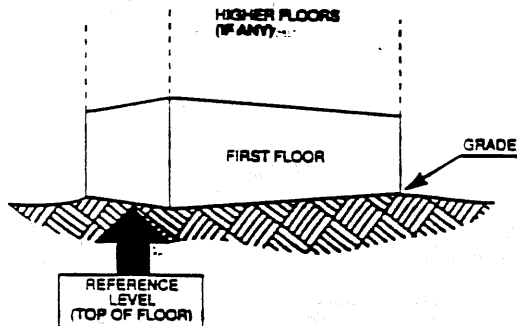


DIAGRAM NUMBER 2

ALL SINGLE AND MULTIPLE FLOOR BUILDINGS (OTHER THAN SPLIT LEVEL), INCLUDING MANUFACTURED (MOBILE) HOUSING AND HIGH RISE BUILDINGS, EITHER DETACHED OR ROW TYPE (E.G., TOWNHOUSES, ETC.); WITH OR WITHOUT ATTACHED GARAGE.

Distinguishing Feature - The first floor or basement (including an underground garage*) is below ground level (grade) on *all* sides*.

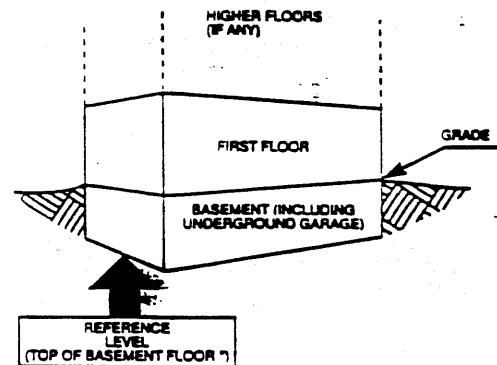


DIAGRAM NUMBER 3

ALL SPLIT LEVEL BUILDINGS, EITHER DETACHED OR ROW TYPE (E.G., TOWNHOUSES, ETC.); WITH OR WITHOUT ATTACHED GARAGE.

Distinguishing Feature - The lower level is *not* below ground level (grade) on *all* sides*. This includes "walkout" basements, where at least one side is at or above grade.

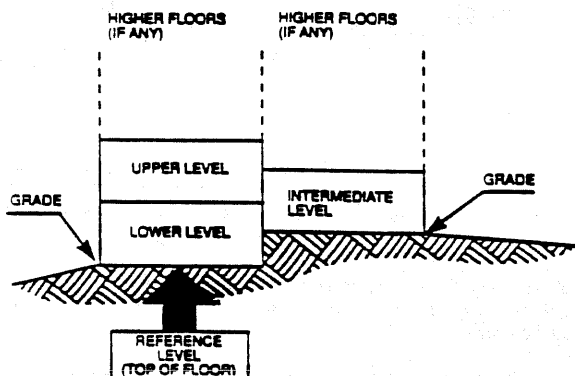
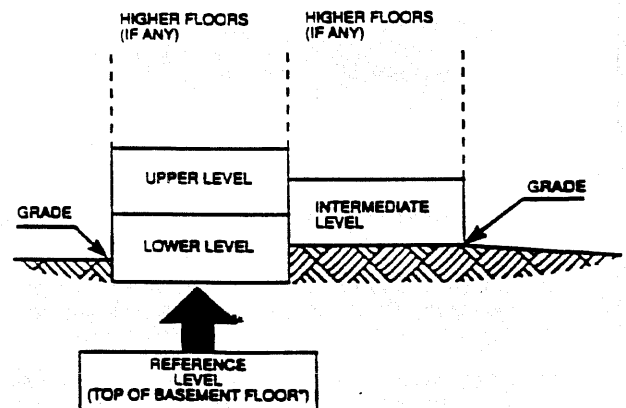


DIAGRAM NUMBER 4

ALL SPLIT LEVEL BUILDINGS, EITHER DETACHED OR ROW TYPE (E.G., TOWNHOUSES, ETC.); WITH OR WITHOUT ATTACHED GARAGE.

Distinguishing Feature - The lower level (or intermediate level) is below ground level (grade) on *all* sides*.



* Under the National Flood Insurance Program's risk classification and insurance coverage, a floor that is below ground level (grade) on all sides is considered a basement even though the floor is used for living purposes, or as an office, garage, workshop, etc.

Note: In all A Zones, the reference level is the top of the lowest floor; in V Zones the reference level is the bottom of the lowest horizontal structural member (see diagram on page 2). Agents should refer to the Flood Insurance Manual for instruction on lowest floor definition.

DIAGRAM NUMBER 5

ALL BUILDINGS, INCLUDING MANUFACTURED (MOBILE) HOMES ELEVATED ON PIERS, POSTS, COLUMNS, SHEAR WALLS, WITH OR WITHOUT PARKING AREA BELOW ELEVATED FLOOR.

Distinguishing Feature - For all zones, the area below the elevated floor is open, with no obstruction to the flow of flood waters (open wood lattice work or readily removable insect screening is permissible).

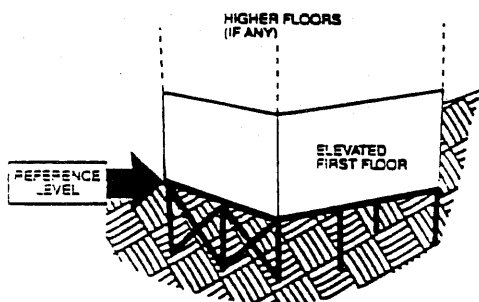


DIAGRAM NUMBER 6

ALL BUILDINGS, INCLUDING MANUFACTURED (MOBILE) HOMES ELEVATED ON PIERS, POSTS, COLUMNS, SHEAR WALLS, WITH OR WITHOUT PARKING AREA BELOW ELEVATED FLOOR.

Distinguishing Feature - For V Zones only, the area below the elevated floor is enclosed, either partially or fully, by solid breakaway walls.** When enclosed area is greater than 300 square feet or contains equipment servicing the building, use Diagram Number 7; this will result in a higher insurance rate. The enclosed area can be used for parking, building access or limited storage.

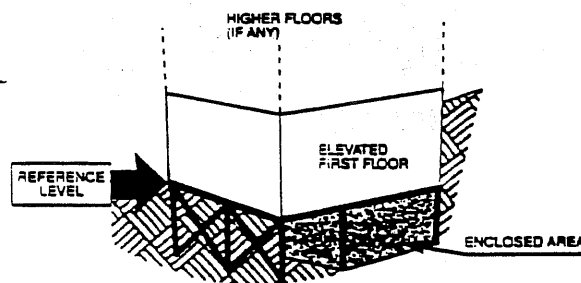


DIAGRAM NUMBER 7

ALL BUILDINGS, INCLUDING MANUFACTURED (MOBILE) HOMES ELEVATED ON PIERS, POSTS, COLUMNS, SHEAR WALLS, SOLID NON-BREAKAWAY WALLS, WITH OR WITHOUT PARKING AREA BELOW ELEVATED FLOOR.

Distinguishing Feature - For all zones, the area below the elevated floor is enclosed, either partially or fully, by solid non-breakaway walls, or contains equipment servicing the building. For V Zones only, the area is enclosed, either partially or fully, by solid breakaway walls*** having an enclosed area greater than 300 square feet. For A Zones only, with an area enclosed by solid walls having proper openings,*** and used only for parking, building access, or limited storage, use Diagram Number 8 to determine the reference level.

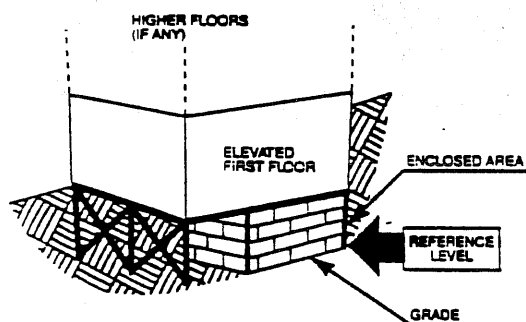
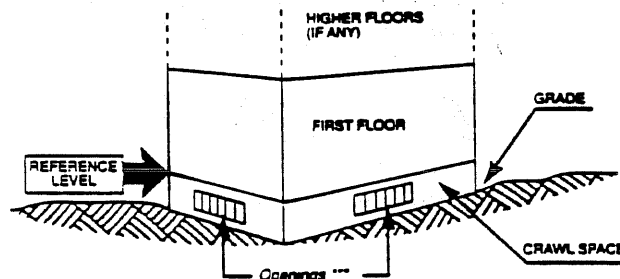


DIAGRAM NUMBER 8

ALL BUILDINGS CONSTRUCTED ABOVE AN UNFINISHED SPACE, INCLUDING CRAWL SPACE.

Distinguishing Feature - For A Zones only, the area below the first floor is enclosed by solid or partial perimeter walls, is unfinished, and contains no equipment servicing the structure. The area can be used for parking, building access, or limited storage.



* Under the National Flood Insurance Program's risk classification and insurance coverage, a floor that is below ground level (grade) on all sides is considered a basement even though the floor is used for living purposes, or as an office, garage, workshop, etc.

** Solid breakaway walls are walls that are not an integral part of the structural support of a building and are intended through their design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation. An area so enclosed is not secure against forceable entry.

*** If the area below the lowest floor is fully enclosed, then a minimum of two openings are required with a total net area of at least one square inch for every square foot of area enclosed with the bottom of the openings no more than one foot above grade. Alternatively, certification may be provided by a registered professional engineer or architect that the design will allow equalization of hydrostatic flood forces on exterior walls. If neither of these criteria are met, then the reference level is the lowest grade adjacent to the structure.

FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM

CMS 3067-0077

FLOODPROOFING CERTIFICATE
FOR NON-RESIDENTIAL STRUCTURES

The floodproofing of non-residential buildings may be permitted as an alternative to elevating to or above the Base Flood Elevation; however, a floodproofing design certification is required. This form is to be used for that certification. Floodproofing of a residential building does not alter a community's floodplain management elevation requirements or effect the insurance rating unless the community has been issued an exception by FEMA to allow floodproofed residential basements. The permitting of a floodproofed residential basement requires a separate certification specifying that the design complies with the local floodplain management ordinance.

BUILDING OWNER'S NAME	FOR INSURANCE COMPANY USE		
	POLICY NUMBER		
STREET ADDRESS (Including Apt., Unit, Suite and/or Bldg. Number) OR P.O. ROUTE AND BOX NUMBER	COMPANY NAIC NUMBER		
OTHER DESCRIPTION (Lot and Block Numbers, etc.)			
CITY	STATE	ZIP CODE	

SECTION I FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM:

COMMUNITY NUMBER	PANEL NUMBER	SUFFIX	DATE OF FIRM INDEX	FIRM ZONE	BASE FLOOD ELEVATION (in AO Zones, use depth)
------------------	--------------	--------	--------------------	-----------	--

SECTION II FLOODPROOFING INFORMATION (By a Registered Professional Engineer or Architect)

Floodproofing Design Elevation Information:

Building is floodproofed to an elevation of feet NGVD. (Elevation datum used must be the same as that on the FIRM.)

Height of floodproofing on the building above the lowest adjacent grade is feet.

(NOTE: for insurance rating purposes, the building's floodproofed design elevation must be at least one foot above the Base Flood Elevation to receive rating credit. If the building is floodproofed only to the Base Flood Elevation, then the building's insurance rating will result in a higher premium.)

SECTION III CERTIFICATION (By a Registered Professional Engineer or Architect)

Non-Residential Floodproofed Construction Certification:

I certify that based upon development and/or review of structural design, specifications, and plans for construction that the design and methods of construction are in accordance with accepted standards of practice for meeting the following provisions:

The structure, together with attendant utilities and sanitary facilities, is watertight to the floodproofed design elevation indicated above, with walls that are substantially impermeable to the passage of water.

All structural components are capable of resisting hydrostatic and hydrodynamic flood forces, including the effects of buoyancy, and anticipated debris impact forces.

I certify that the information on this certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

CERTIFIER'S NAME	LICENSE NUMBER (or Affix Seal)		
TITLE	COMPANY NAME		
ADDRESS	CITY	STATE	ZIP
SIGNATURE	DATE	PHONE	

Copies should be made of this Certificate for: 1) community official, 2) insurance agent/company, and 3) building owner.

APPENDIX B
CORPS OF ENGINEERS 404 PERMITS

This page intentionally blank.



US Army Corps
of Engineers
Fort Worth District

Public Notice

Applicant: N/A

Permit Application No.: N/A

Date: April 26, 1991

The purpose of this public notice is to inform you of a proposal for work in which you might be interested. It is also to solicit your comments and information to better enable us to make a reasonable decision on factors affecting the public interest. We hope you will participate in this process.

Regulatory Program

Since its early history the US Army Corps of Engineers has played an important role in development of the nation's water resources. Originally this involved construction of harbor fortifications and coastal defenses. Later duties included the improvement of waterways to provide avenues of commerce. An important part of our mission today is the protection of the nation's waterways through the administration of the US Army Corps of Engineers Regulatory Program.

Section 10

The US Army Corps of Engineers is directed by Congress under Section 10 of the River and Harbor Act of 1899 (33 USC 403) to regulate *all work or structures in or affecting the course, condition or capacity of navigable waters of the United States*. The intent of this law is to protect the navigable capacity of waters important to interstate commerce.

Section 404

The US Army Corps of Engineers is directed by Congress under Section 404 of the Clean Water Act (33 USC 1344) to regulate the *discharge of dredged and fill material into all waters of the United States including wetlands*. The intent of this law is to protect the nation's waters from the indiscriminate discharge of material capable of causing pollution and to restore and maintain their chemical, physical and biological integrity.

Contact

Name The Permits Section

Phone Number (817) 334-2681

JOINT PUBLIC NOTICE
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
AND
TEXAS WATER COMMISSION
NATIONWIDE PERMITS

On 10 April 1990, in Part IV of the Federal Register, pages 14598-14618, the Corps of Engineers proposed to change its nationwide permit regulations (33 CFR 330), reissue the existing nationwide permits, some with changes, and issue 13 new nationwide permits. Attached is a list of the proposed nationwide permits and nationwide permit special conditions.

Nationwide permits are general permits issued on a nationwide basis to authorize minor activities with little or no paperwork. A few of the nationwide permits will require prior notification. This notification is required where a review by the district engineer is necessary to ensure that activities authorized by those nationwide permits have minimal individual and cumulative adverse impact on the aquatic environment.

This is notice of the public's opportunity to comment on the proposed regulations, nationwide permits, and nationwide permit conditions. Comments on the proposed regulations and the nationwide permits on a national basis should be sent to the Regulatory Branch (CECW-OR), Washington, D.C. 20314-1000. Comments on regional issues and regional conditions within the State of Texas should be sent to the Fort Worth District Engineer, ATTN: CESWF-OD-O, Post Office Box 17300, Fort Worth, Texas 76102-0300. All such comments must be received by June 10, 1991. This is also the public's opportunity to request a public hearing. A public hearing has been scheduled in Washington, D.C. on May 10, 1991, from 1:00 p.m. to 5:00 p.m. at The Quality Hotel Capitol Hill, 415 New Jersey Avenue, NW, Washington, D.C. For information on the public hearing contact Ed Bonner or Sam Collinson at (202) 272-0199.

A State Section 401 water quality certification or waiver is required for the nationwide permits that may result in a discharge. The Corps believes that the nationwide permits comply with State water quality standards. Concurrent with the publication of this joint public notice, the Texas Water Commission (TWC) is reviewing this proposal under Section 401 of the Clean Water Act, and Title 31, Texas Administrative Code Section 279.1-.13 to determine if the proposal would comply with State water quality standards. By virtue of an agreement between the U.S. Army Corps of Engineers and the TWC, this public notice is also issued for the purpose of advising all known interested persons that there is pending before the TWC a decision on water

quality certification under such authorities. Any comments concerning such a decision may be submitted to the Executive Director, Attention: Wastewater Permits Section, Texas Water Commission, 1700 North Congress, P.O. Box 13087, Capitol Station, Austin, Texas 78711. The public comment period for the TWC decision extends 30 days from the date of publication of this notice. A copy of the public notice with a description of the proposal is made available for review in the Texas Water Commission's Austin Office. Additional documentation on this proposal may be reviewed in the U.S. Army Corps of Engineers' offices as discussed below in the last paragraph. The TWC may conduct a public hearing to consider all comments concerning water quality if requested in writing. A request for a public hearing must contain the following information: name, mailing address, a recognizable reference to this proposal, a brief description of the interest of the requestor, or of persons represented by the requestor; and a brief description of how the proposal, if adopted, would adversely affect such interest.

A provisional determination including environmental documents has been prepared indicating that the nationwide permits comply with the requirements for issuance under general permit authority. These documents as well as the proposed regulation and nationwide permit changes are available for viewing at the Fort Worth District's Permits Section in Room 4A17 of the Federal Building at 819 Taylor Street in Fort Worth between 8:00 A.M. and 3:30 P.M., Monday through Friday.

DISTRICT ENGINEER
FORT WORTH DISTRICT
CORPS OF ENGINEERS

NATIONWIDE PERMITS

1. Aids to Navigation
2. Structures in Artificial Canals
3. Maintenance
4. Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities
5. Scientific Measurement Devices
6. Survey Activities
7. Outfall Structures
8. Oil and Gas Structures
9. Structures in Fleeting and Anchorage Areas
10. Mooring Buoys
11. Temporary Recreational Structures
12. Utility Line Backfill and Bedding
13. Bank Stabilization
14. Road Crossing
15. U.S. Coast Guard Approved Bridges
16. Return Water from Upland Contained Disposal Areas
17. Hydropower Projects
18. Minor Discharges
19. 30 Cubic Yard Dredging
20. Oil Spill Cleanup
21. Surface Mining Activities
22. Removal of Vessels
23. Approved Catagorical Exclusions
24. State Administered Section 404 Programs
25. Structural Discharge
26. Headwaters and Isolated Waters Discharges
27. Wetland Restoration Activities
28. Modifications of Existing Marinas
29. Reserved
30. Dewatering Construction Areas
31. Small Docks and Piers
32. Completed Enforcement Actions
33. Temporary Construction and Access
34. Cranberry Production Activities
35. Maintenance Dredging of Existing Basins
36. Boat Ramps
37. Emergency Watershed Protection
38. Cleanup of Hazardous and Toxic Waste
39. Agricultural Discharges
40. Farm Buildings

NATIONWIDE PERMIT CONDITIONS GENERAL CONDITIONS:

1. Navigation
2. Proper Maintenance
3. Erosion and Siltation Controls
4. Aquatic Life Movements
5. Equipment
6. Regional and Case-by-Case Conditions
7. Wild and Scenic Rivers
8. Tribal Rights
9. Water Quality Certification
10. Coastal Zone Management
11. Endangered Species
12. Historic Properties
13. Notification

SECTION 404 ONLY CONDITIONS:

1. Water Supply Intakes
2. Shellfish Production
3. Suitable Material
4. Minimization
5. Spawning Areas
6. Obstruction of High Flows
7. Adverse Impacts from Impoundments
8. Waterfowl Breeding Areas
9. Removal of Temporary Fills

DEPARTMENT OF THE ARMY
JS ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
PO BOX 17300
FORT WORTH, TEXAS 76102-0300

OFFICIAL BUSINESS
CESWF-OD-GRF(C)

PUBLIC NOTICE

This page intentionally blank.

**United States
Federal Register**

**Wednesday
April 10, 1991**

Part IV

**Department of
Defense**

**Corps of Engineers, Department of the
Army**

33 Part 330

**Proposal To Amend Nationwide Permit
Program Regulations and Issue, Reissue
and Modify Nationwide Permits; Hearing;
Proposed Rule**

DEPARTMENT OF DEFENSE

Corps of Engineers, Department of the Army

33 CFR Part 330

Proposal To Amend Nationwide Permit Program Regulations and Issue, Reissue, and Modify Nationwide Permits

AGENCY: U.S. Army Corps of Engineers, DOD.

ACTION: Proposed rule.

SUMMARY: The Corps of Engineers proposes to amend its nationwide permit program regulations presently codified as 33 CFR part 330. The amendments are intended to simplify and clarify the nationwide permit program and to reduce the effort expended in regulating activities with minimal impacts.

The Corps also proposes to reissue the existing nationwide permits, to issue 13 new nationwide permits, and to add new conditions to all of the nationwide permits. The Corps is also proposing to modify some of the existing nationwide permits. The public is invited to provide comments on these proposals and is being given the opportunity to request a public hearing on the nationwide permits.

DATES: Comments must be received on or before June 10, 1991.

ADDRESSES: Comments should be submitted in writing to: The Chief of Engineers, U.S. Army Corps of Engineers, ATTN: CECW-OR, Washington, DC 20314-1000. Comments will be available for examination at the Office of the Chief of Engineers, room 6225, Pulaski Building, 20 Massachusetts Avenue NW, Washington, DC.

FOR FURTHER INFORMATION CONTACT: Mr. Sam Collinson or Mr. John Studt at (202) 272-1782.

SUPPLEMENTARY INFORMATION:**Substantive Changes**

The Corps proposes to restructure the regulations governing the nationwide permit (NWP) program. These changes would allow the district engineer (DE) to assert a discretionary authority to modify, suspend, or revoke NWPs for individual activities; broaden the basis for asserting discretionary authority to include all public interest factors; provide that the DE require an individual permit whenever he determines an activity would have more than minimal adverse impact on the aquatic environment; and, modify the pre-discharge notification (PDN) process required by some NWPs.

The Corps also proposes to reissue the existing NWPs; to issue 13 new NWPs; to modify some of the existing NWPs; to convert the best management practices (BMPs) to permit conditions to increase their enforceability; and, to clarify recurring questions about the applicability of some of the NWPs to certain situations.

Why Revisions Are Being Proposed

The Corps is amending its NWP regulations to reduce the effort expended in regulating activities with minimal impacts and to simplify and clarify the NWP program. Simplifying and clarifying the regulations will provide for more effective and efficient administration of the NWP program and for a more knowledgeable public.

The proposed changes respond to complaints from our field staff and the public that the NWP program has become overly confusing and unduly burdensome. The PDN process for NWP 28, in particular, has become so burdensome as to essentially preclude the utility of that NWP in some areas. Some changes to the program, particularly eliminating the existing PDN process are relevant to the terms of the *National Wildlife Federation, et al. v. Marsh* consent agreement.

Part 330—General

We propose to rename part 330 from "Nationwide Permits" to "Nationwide Permit Program." This Part will contain policies for administration of the NWP program and the procedures the Corps must follow for issuing, modifying, suspending, or revoking NWPs and authorizations.

Section 330.1 Purpose and Policy: We propose to revise this section for greater clarity. We have also expanded the discussion of existing policy and added discussions concerning "Discretionary Authority," "Notifications," and "Individual Applications." We note in this section that the NWPs and conditions currently in effect, including the best management practices at 33 CFR 330.6, will remain in effect until they expire or are modified or revoked in accordance with applicable procedures.

Section 330.2 Definitions: In this section we define the terms "nationwide permit," "authorization," "isolated waters," "filled area," "currently serviceable," "single and complete project," "special aquatic sites," and "terms and conditions." We have modified the definition of discretionary authority to be consistent with the proposed change to discretionary authority at 33 CFR 330.4(e).

Section 330.3 Activities occurring before certain dates: We do not propose any substantive changes to this section. This section will continue to provide information on those activities permitted by NWPs issued on July 19, 1977.

Section 330.4 Conditions, Limitations and Restrictions: This section currently contains information on public notice procedures for NWPs. This information would be moved to Section 330.5 with other NWP procedures. Section 330.4 will now contain information on the conditions, limitations, and restrictions applying to NWPs. Much of this information is currently published at 33 CFR 330.8, 330.9, and 330.10.

Section 330.4(a): This paragraph provides a general introduction to section 330.4.

Section 330.4(b): This paragraph is currently located at 33 CFR 330.5(c). We have not proposed any substantive change to this paragraph.

Sections 330.4 (c) and (d): These paragraphs contain the information and procedures on state 401 water quality certifications and coastal zone management consistency determinations for the NWPs, now located at 33 CFR 330.9 and 330.10. We have reorganized these paragraphs to make them more understandable. We have deleted from the regulations the list of the NWP activities which require 401 water quality certification. This list appears with the discussion of the proposed NWPs later in this Preamble.

Section 330.4(e): This paragraph contains a discussion of the discretionary authority of division and district engineers. This subject is currently covered at 33 CFR 330.8. As part of the *National Wildlife Federation v. Marsh* consent agreement, discretionary authority is currently vested in the division engineer level. However, we are proposing to change it to the DE for specific activities because a recent survey of Corps district offices showed that division engineers have agreed with DE recommendations for discretionary authority about 95% of the time. Giving the DE discretionary authority to require individual permits would also provide for more timely decisions, since a major coordination step would be eliminated. Under the proposed rule, the DE would be authorized to assert discretionary authority over individual activities otherwise meeting the terms and conditions of a NWP. DEs would also have a discretionary authority to modify NWPs for specific activities by requiring special conditions on a case-by-case basis. Also, we would change the language to make it mandatory that DEs

require individual permits whenever they determine that the individual actions proposed to be covered by NWP would have more than minimal individual or cumulative adverse impacts on the aquatic environment. This would provide for more uniformity among districts. Discretionary authority to add conditions on a regional basis, for certain types of activities, for specific types of waters, or for specific geographic areas would remain with the division engineer. In addition we propose to increase the factors that the DE may consider with respect to his discretionary authority, now limited to only "concerns for the aquatic environment as expressed in the guidelines published by EPA pursuant to section 404(b)(1)," by adding all factors of the public interest.

Section 330.4(f): This paragraph outlines procedures to be followed when the DE determines that an activity meeting the terms of a NWP may affect an endangered or threatened species or their critical habitat as identified under the Endangered Species Act (ESA). Federal permittees will follow their own procedures to comply with the ESA. While the Federal permittee's procedures will normally satisfy the ESA, this does not remove the Corps responsibility to ensure that the Federal permittee's action also satisfies the Corps responsibilities under the ESA. This paragraph informs prospective permittees that they may contact the U.S. Fish and Wildlife Service or National Marine Fisheries Service for information concerning the presence of threatened or endangered species or their critical habitat.

Section 330.4(g): This paragraph outlines procedures to be followed when an activity meeting the terms of a NWP is identified as having the potential for adversely affecting historic properties listed or eligible for listing on the National Register of Historic Places. Federal permittees will follow their own procedures to comply with section 106 of the National Historic Preservation Act. While the Federal permittee's procedures will normally satisfy the NHPA, this does not remove the Corps responsibility to ensure that the Federal permittee's action also satisfies the Corps responsibilities under the NHPA.

Section 330.5: Issuing, Modifying, Suspending or Revoking Nationwide Permits and Authorizations: This section presently contains the NWPs and conditions. The NWPs and conditions are published separately in appendix A. We propose that section 330.5 contain the procedures the Chief of Engineers will follow when issuing, modifying,

suspending, or revoking NWPs and the procedures division or district engineers will follow for asserting discretionary authority. These procedures reflect the change allowing DEs to exercise discretionary authority for specific projects. Applicable information previously at 33 CFR 330.4, 33 CFR 330.5(d), and 33 CFR 330.8, would be relocated to this section. The procedures DEs will follow incorporate the relevant portions of 33 CFR 325.7 regarding coordination with the permittee and due process provisions.

Section 330.6 Authorization by nationwide permit: This section presently contains the Best Management Practices associated with NWPs. The regulations for verification of NWPs, now located at 33 CFR 330.11, and expiration of NWPs, now located at 33 CFR 330.12, would be relocated to paragraphs 330.6 (a) and (b) respectively. We have made minor changes to remain consistent with other proposed changes.

Section 330.6(c): This paragraph clarifies that NWPs can be combined in cases where two or more activities of the same project each qualify for a NWP. For example, a project that includes both streambank stabilization and a minor road crossing could be authorized under NWPs 13 and 14, provided the terms and conditions of those authorizations are met. Similarly, a project occurring in headwaters that involves a minor road crossing fill and other filled areas of up to ten acres (not including the fill required for the road crossing), could be authorized by a combination of NWPs 14 and 28, provided the terms and conditions of those NWPs are met. As with any NWP authorization, the combined impacts of the activities must be minimal.

Section 330.6(d): This new paragraph clarifies that it may be appropriate, in some cases, to allow independent parts of a larger project to proceed under a NWP while the DE evaluates an application for an individual permit for the rest of the project. However, the portions meeting the terms and conditions of the NWPs must be able to function or meet their purpose without the portion requiring an individual permit. In cases where the NWP activity cannot function independently or meet its purpose without the total project, the NWPs do not apply and all portions of the project requiring a Department of the Army permit must be evaluated as an individual permit. This paragraph also provides that the individual permit documentation should discuss the environmental impacts of the entire

project, including portions authorized by the individual permit and NWPs.

Appendix A—Nationwide Permits and Conditions: We propose to move the optional nationwide permits and conditions from 33 CFR 330.5(a) and (b) to a new Appendix A. We also propose to reissue the 26 existing nationwide permits, some with modifications, and to issue 13 new nationwide permits. In addition, we propose to add the existing best management practices now found at 33 CFR 330.6 as conditions to the nationwide permits and to add two new conditions.

Nationwide permits (NWPs) are a type of general permit issued by the Chief of Engineers and designed to regulate certain activities having minimal impacts, in a manner entailing little, if any, delay or paperwork. If the project does not comply with the terms and conditions of the NWP and can not be or is not modified to comply with the terms and conditions of the NWP, then the proposed project is not authorized by NWP but may be evaluated for authorization under a regional general or individual permit. These nationwide permits are proposed, issued, modified, reissued (extended) and revoked from time to time by publication in the Federal Register. Proposed new NWPs or modification to or reissuance of existing NWPs will be adopted only after public comment, the opportunity to request a public hearing, and a finding of compliance with applicable standards. The Corps will give full consideration to all comments received prior to reaching a final decision.

We propose, upon the expiration of the NWPs in five years from their effective date, to remove appendix A from the CFR and issue the NWPs separately from the regulations governing their use. In this way, issuance of the NWPs will follow procedures similar to those for individual and regional general permits. The proposed issuance, reissuance, modification, and revocation of NWPs would be published in the Federal Register concurrent with regional public notices issued by district engineers, to solicit comments and to provide the opportunity to request a public hearing. All comments would be included in the administrative record, and substantive comments addressed in a decision document for each NWP. The final decisions on the NWPs will be announced by publication in the Federal Register concurrent with regional public notices issued by district engineers.

All the changes taken together should result in an overall increase in protection of the aquatic environment

and an overall decrease in workload. Any workload savings will be devoted to more efficient individual permit processing and increased enforcement and compliance activities.

The *National Wildlife Federation, et al. v. Marsh* settlement agreement resulted in the establishment of a predischARGE notification (PDN) process for NWP 26 and instituted activity specific decisions that the impacts associated with NWPs 7, 17, and 21 will be minimal. The PDN process and the activity specific decisions were intended to provide a safeguard against discharges that could result in more than minimal adverse impacts on the aquatic environment. The PDN process established the basic information that must be submitted, the DE's review and coordination with Federal and state resource agencies, and the division engineer's review and decision regarding applicability of the NWP, all to be accomplished in 20 calendar days. If the DE did not act within the 20 days, the discharge was automatically authorized by NWP 26. Complaints from the public and the Corps field offices indicate that this PDN process has become so burdensome as to essentially preclude the utility of the NWP in some parts of the country. The PDN process is also unnecessarily taking Corps resources away from more essential work efforts. Therefore, the Corps proposes to replace the existing PDN process with a notification to the DE and a 30 day review period prior to discharge. This change would replace the required coordination with Federal and state resource agencies with an internal review by the DE. During this review the DE will evaluate the proposed action to determine if it has minimal individual and cumulative adverse impacts on aquatic resources. Proposals that have more than minimal adverse impacts will not be authorized by the NWP unless the prospective permittee elects to propose mitigation so that the impacts would be minimal. The proposed changes would also lower the decision level regarding applicability of the NWPs 7, 17, 21, and 26 from the division engineer to the DE. The district is the most knowledgeable office concerning the aquatic resources in the district and the impacts that would result from discharges under the NWPs.

We propose to transfer the discretionary authority from the division engineer to the DE for case specific activities. The division engineer would retain the discretionary authority for adding regional conditions or requiring individual permits for a class of activities or a geographic area. In

addition, we are expanding the basis for asserting discretionary authority from concerns for the aquatic environment based on the section 404(b)(1) Guidelines to factors of the public interest. Presently, in over half of the states, division engineers have added regional conditions or required individual permits for classes of activities or a geographic area, including a statewide basis. These are based on local concerns which differ across the country. We expect that, based on experience gained since the NWPs were issued in 1986, there will be an increase in regional conditions to reflect local concerns. We believe that these changes to the discretionary authority will make it easier for division and district engineers to exercise discretionary authority to enhance environmental protection without increasing the regulatory burden on the public or on limited Corps regulatory resources.

The requirement for a predischARGE notification (PDN) would be added to several NWPs where we feel there may be a potential for some activities authorized by the NWP to have more than minimal adverse impacts on the aquatic environment or aspects of the public interest. The PDN will allow the DE to review the proposed activity to ensure that the activity will not have more than minimal adverse impacts and that it will comply with the terms and conditions of the NWP. If an activity will have more than minimal adverse impacts the DE will either add case specific conditions so that the impacts will be minimal or instruct the prospective permittee that the activity is not authorized by NWP and provide information on the procedures to seek authorization under regional general or individual permit. In some cases the permittee must submit a delineation of special aquatic sites. In addition, the prospective permittee may submit a mitigation or restoration plan. In such cases, the DE will determine if the proposed mitigation or restoration plan is acceptable or if additional mitigation or other measures would be necessary so that impacts would be minimal.

Mitigation Options

The activities authorized by nationwide permits must have minimal impact both individually and cumulatively. The terms and conditions of the NWPs are imposed to help ensure that the impacts are minimal. In addition, district and division engineers can impose additional conditions, including mitigation, to ensure that activities authorized by NWPs have minimal impacts. The Council on Environmental Quality has defined

mitigation in its regulations at 40 CFR 1508.20 to include avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts. In appropriate cases, mitigation banking or contributions to a wetland trust fund may be an acceptable form of mitigation. Currently, DEs are not required to add mitigation. If they do not and the impacts are more than minimal then an individual permit must be obtained. The Corps is proposing to retain this current approach to mitigation; however it is requesting comment on adding a requirement that DEs require mitigation of losses of special aquatic sites for those NWPs which have the most potential for more than minimal losses of special aquatic sites. The Corps is considering 2 options and is requesting public comment on these options.

Option 1

For NWPs 14, 15, 17, 18, 21, 23, 38, and 39 a predischARGE notification would be required for discharges of dredged or fill material that cause the loss of special aquatic sites, including wetlands, and for NWP 26 discharges that cause the loss of 1 to 10 acres of water of the United States. The predischARGE notification must include the applicant's proposed mitigation. The DE would determine the level of mitigation and require that level of mitigation up to a limit of the lost functional ecological value based on what is appropriate and practicable. The DE would allow the activity to proceed if all appropriate & practicable mitigation is agreed to unless the DE determines that after considering the mitigation, the impacts remain more than minimal or the DE exercises discretionary authority for some other reason.

Option 2

This option would also include for NWPs 14, 15, 17, 18, 21, 23, 38, and 39 a predischARGE notification that would be required for discharges of dredged or fill material that cause the loss of special aquatic sites and for NWP 26 discharges that cause the loss of 1 to 10 acres of a water of the United States. The DE would review the predischARGE notification and determine whether the impacts are minimal and whether the permittee may proceed under the nationwide permit. When the impacts are more than minimal the prospective permittee must either submit a mitigation plan or an individual permit application. The prospective permittee may, at his/her option, submit a proposed mitigation plan with the

predischARGE notification to expedite the process. The DE would allow the activity to proceed under the relevant NWP when the mitigation reduces the impacts to the minimal impact level, unless the DE exercises discretionary authority for some other reason.

Several of the proposed new NWPs such as the proposed NWP for boat launching ramps, are for activities that many districts have already authorized by regional general permits (GPs), and are, therefore, good candidates for NWPs due to their broad geographic applicability and minimal impacts. We have defined the terms of these NWPs to reflect those of the regional GPs as much as possible without overly restricting their utility.

The NWPs at 33 CFR 330.5 (a)(7), (15), (17), and (21) cover activities that are adequately regulated by other federal regulatory programs that place constraints on these activities that should have the effect of minimizing adverse impacts on the aquatic environment. These NWPs will require the permittee to notify the DE 30 days prior to discharge. The notification requirement, the DE's discretionary authority, and the requirement that the DE not authorize activities by NWP when he determines that a specific activity would have more than minimal adverse impacts on the aquatic environment will ensure that activities authorized under the NWPs would not have more than minimal adverse individual or cumulative impacts. Paragraph 101(f) of the Clean Water Act states, "It is the national policy that to the maximum extent possible the procedures utilized for implementing this Act shall encourage the drastic minimization of paperwork and interagency decision procedures, and the best use of available manpower and funds, so as to prevent needless duplication and unnecessary delays at all levels of government."

The NWPs are proposed under the authority of section 10 of the Rivers and Harbors Act of 1899, section 404 of the Clean Water Act, and section 103 of the Marine Protection, Research, and Sanctuaries Act. Relevant authorities are enclosed in parentheses after each NWP. Issuance of the NWPs is in accordance with the procedures in 33 CFR part 330.

To qualify for NWP authorization, the activities must meet the terms and conditions of the NWPs. DEs have the authority to determine if an activity complies with the terms and conditions of a NWP. In addition, NWPs do not obviate the need to obtain other Federal, state or local authorizations required by law; NWPs do not grant any property

rights or exclusive privileges; NWPs do not authorize any injury to the property or rights of others; and, NWPs do not authorize interference with any existing or proposed Federal project.

Furthermore, NWPs do not authorize discharges that EPA has prohibited or restricted under section 404(c) of the Clean Water Act; nor for activities that are integrally related to a project, portions of which require an individual permit (See proposed 33 CFR 330.6(d)); nor for activities for which the DE has denied a permit.

Discretionary Authority

Concurrent with this Federal Register notice district engineers are issuing local public notices. In addition to the NWP conditions being proposed by the Chief of Engineers, the division and district engineers may propose regional conditions or propose revocation of NWP authorization for some of or portions of the NWPs. Regional conditions may also be required by state section 401 water quality certification or for state coastal zone consistency. Comments on this Federal Register notice should address national concerns and the NWPs themselves. Comments on regional issues and regional conditions should be sent to the appropriate district engineer as indicated below.

Alabama

Mobile District Engineer, ATTN: CESAM-OP-S, P.O. Box 2288, Mobile, AL 36628-0001.

Alaska

Alaska District Engineer, ATTN: CENPA-CO-R, P.O. Box 898, Anchorage, AK 99508-0398.

Arizona

Los Angeles District Engineer, ATTN: CESPL-CO-R, P.O. Box 2711, Los Angeles, CA 90053-2325.

Arkansas

Little Rock District Engineer, ATTN: CESWL-CO-P, P.O. Box 887, Little Rock, AR 72203-0887.

California

Sacramento District Engineer, ATTN: CESPCK-CO-O, 650 Capitol Mall, Sacramento, CA 95814-4794.

Colorado

Albuquerque District Engineer, ATTN: CESWA-CO-R, P.O. Box 1580, Albuquerque, NM 87103-1580.

Connecticut

New England Division Engineer, ATTN: CENED-OD-R, 424 Trapelo Road, Waltham, MA 02254-0149.

Delaware

Philadelphia District Engineer, ATTN: CENAP-OP-R, U.S. Custom House, 2nd and Chestnut Street, Philadelphia, PA 19106-2991.

Florida

Jacksonville District Engineer, ATTN: CESAJ-RD, P.O. Box 4970, Jacksonville, FL 32232-0019.

Georgia

Savannah District Engineer, ATTN: CESAS-OP-F, P.O. Box 889, Savannah, GA 31402-0889.

Hawaii

Honolulu District Engineer, ATTN: CEPDO-CO-O, Building 230 Fort Shafter, Honolulu, HI 96958-5440.

Idaho

Walla Walla District Engineer, ATTN: CENPW-OP-RF, Building 602, City-County Airport, Walla Walla, WA 99362-9265.

Illinois

Rock Island District Engineer, ATTN: CENCR-OD-S, Clock Tower Building, Rock Island, IL 61201-2004.

Indiana

Louisville District Engineer, ATTN: CEORL-OR-F, P.O. Box 59, Louisville, KY 40201-0059.

Iowa

Rock Island District Engineer, ATTN: CENCR-OD-S, Clock Tower Building, Rock Island, IL 61201-2004.

Kansas

Kansas City District Engineer, ATTN: CEMRK-OD-P, 700 Federal Building, 601 E. 12th Street, Kansas City, MO 64106-2898.

Kentucky

Louisville District Engineer, ATTN: CEORL-OR-F, P.O. Box 59, Louisville, KY 40201-0059.

Louisiana

New Orleans District Engineer, ATTN: CELMN-OD-S, P.O. Box 60287, New Orleans, LA 70160-0287.

Maine

New England Division Engineer, ATTN: CENED-OD-R, 424 Trapelo Road, Waltham, MA 02254-0149.

Maryland

Baltimore District Engineer, ATTN: CENAB-OP-R, P.O. Box 1715, Baltimore, MD 21203-1715.

Massachusetts

New England Division Engineer, ATTN: CENED-OD-R, 424 Trapelo Road, Waltham, MA 02254-9149.

Michigan

Detroit District Engineer, ATTN: CENCE-CO-L, P.O. Box 1027, Detroit, MI 48231-1027.

Minnesota

St. Paul District Engineer, ATTN: CENCS-CO-R, 1421 USPO & Custom House, St. Paul, MN 55101-9906.

Mississippi

Vicksburg District Engineer, ATTN: CELMK-OD-F, P.O. Box 60, Vicksburg, MS 39180-0060.

Missouri

Kansas City District Engineer, ATTN: CEMRK-OD-P, 700 Federal Building, 601 E. 12th Street, Kansas City, MO 64106-2896.

Montana

Omaha District Engineer, ATTN: JEMRO-OP-R, P.O. Box 5, Omaha, NE 68101-0005.

Nebraska

Omaha District Engineer, ATTN: CEMRO-OP-R, P.O. Box 5, Omaha, NE 68101-0005.

Nevada

Sacramento District Engineer, ATTN: CESPK-CO-O, 650 Capitol Mall, Sacramento, CA 95814-4794.

New Hampshire

New England Division Engineer, ATTN: CENED-OD-R, 424 Trapelo Road, Waltham, MA 02254-9149.

New Jersey

Philadelphia District Engineer, ATTN: CENAP-OP-R, U.S. Custom House, 2nd and Chestnut Street, Philadelphia, PA 19106-2991.

New Mexico

Albuquerque District Engineer, ATTN: CESWA-CO-R, P.O. Box 1580, Albuquerque, NM 87103-1580.

New York

New York District Engineer, ATTN: ENAN-OP-R, 26 Federal Plaza, New York, NY 10278-0090.

North Carolina

Wilmington District Engineer, ATTN: CESA-W-CO-E, P.O. Box 1890, Wilmington, NC 28402-1890.

North Dakota

Omaha District Engineer, ATTN: CEMRO-OP-R, P.O. Box 5, Omaha, NE 68101-0005.

Ohio

Huntington District Engineer, ATTN: CEORH-OR-F, 502 8th Street, Huntington, WV 25701-2070.

Oklahoma

Tulsa District Engineer, ATTN: CESWT-OD-RF, P.O. Box 61, Tulsa, OK 74121-0061.

Oregon

Portland District Engineer, ATTN: CENPP-PL-R, P.O. Box 2948, Portland, OR 97208-2948.

Pennsylvania

Baltimore District Engineer, ATTN: CENAB-OP-R, P.O. Box 1715, Baltimore, MD 21203-1715.

Rhode Island

New England Division Engineer, ATTN: CENED-OD-R, 424 Trapelo Road, Waltham, MA 02254-9149.

South Carolina

Charleston District Engineer, ATTN: CESAC-CO-P, P.O. Box 919, Charleston, SC 29402-0919.

South Dakota

Omaha District Engineer, ATTN: CEMRO-OP-R, P.O. Box 5, Omaha, NE 68101-0005.

Tennessee

Nashville District Engineer, ATTN: CEORN-OR-F, P.O. Box 1070, Nashville, TN 37202-1070.

Texas

Ft. Worth District Engineer, ATTN: CESWF-OD-O, P.O. Box 17300, Ft. Worth, TX 76102-0300.

Utah

Sacramento District Engineer, ATTN: CESPK-CO-O, 650 Capitol Mall, Sacramento, CA 95814-4794.

Vermont

New England Division Engineer, ATTN: CENED-OD-R, 424 Trapelo Road, Waltham, MA 02254-9149.

Virginia

Norfolk District Engineer, ATTN: CENAO-OP-P, 803 Front Street, Norfolk, VA 23510-1096.

Washington

Seattle District Engineer, ATTN: CENPS-OP-RG, P.O. Box C-3755, Seattle, WA 98124-2255.

West Virginia

Huntington District Engineer, ATTN: CEORH-OR-F, 502 8th Street, Huntington, WV 25701-2070.

Wisconsin

St. Paul District Engineer, ATTN: CENCS-CO-R, 1421 USPO & Custom House, St. Paul, MN 55101-9806.

Wyoming

Omaha District Engineer, ATTN: CEMRO-OP-R, P.O. Box 5, Omaha, NE 68101-0005.

District of Columbia

Baltimore District Engineer, ATTN: CENAB-OP-R, P.O. Box 1715, Baltimore, MD 21203-1715.

Pacific Territories

Honolulu District Engineer, ATTN: CEPD-CO-O, Building 230, Fort Shafter, Honolulu, HI 96858-5440.

Puerto Rico & Virgin IS

Jacksonville District Engineer, ATTN: CESAJ-RD, P.O. Box 4970, Jacksonville, FL 32232-0919.

State Certification of Nationwide Permits

State water quality certification pursuant to section 401 of the Clean Water Act, or waiver thereof, is required for activities authorized by NWP's which may result in a discharge into waters of the United States. Any state with an approved Coastal Zone Management Plan must concur with the Corps determination that activities authorized by NWP's which are within, or may affect land or water uses in, the state's coastal zone are consistent with the state Coastal Zone Management Plan.

The Corps believes that, in general, the activities authorized by the NWP's will not violate state water quality standards and will be consistent with state Coastal Zone Management Plans. The NWP's are conditioned to ensure that adverse environmental impacts will be minimal and are the types of activities that would be routinely authorized by individual permits. The Corps recognizes that in some states there will be a need to add regional conditions or individual state review for some activities to ensure compliance with state water quality standards or consistency with state Coastal Zone Management Plans. The Corps will work

with the states to develop such conditions when necessary.

This Federal Register notice of these proposed changes serves as the Corps application to the states for 401 water quality certifications and the Corps determination of coastal zone management consistency, where applicable. In some states it may be necessary to add regional conditions to address state water quality standards or to be consistent with state Coastal Zone Plans. The states should consider issuance, denial or waiver of certification of NWP's (new and existing) under section 401 of the Clean Water Act and consider agreeing or disagreeing with our Coastal Zone Management consistency determination under section 307 of the Coastal Zone Management Act (CZMA). Prior to publishing the final NWP's in the Federal Register, the Corps will, by letter to the appropriate state agencies, request that each state submit its final position on the 401 water quality certification and CZMA consistency for each of the NWP's. Each state will be given a minimum of 60 days to submit its positions. If a state fails to provide any response to our letter we will presume a waiver of the 401 water quality certification or presume that the state agrees with the Corps consistency determination. We have added a statement to the regulations clarifying that Federal agencies should follow their own procedures for complying with the CZMA.

Section 401 water quality certification requirements fall into the following general categories:

NWP's numbered 1, 2, 8, 9, 10, 11, 19, 24, 28, 31, and 35, do not require 401 water quality certification since they would authorize activities which, in the opinion of the Corps, could not reasonably be expected to result in a discharge and in the case of NWP 8 is seaward of the territorial seas.

NWP's numbered 3, 4, 5, 6, 7, 13, 14, 18, 20, 21, 22, 23, 27, 30, 32, 33, 36, 37, and 38, involve various activities, some of which may result in a discharge and require 401 water quality certification, and others of which do not. State denial of 401 water quality certification for any specific NWP in this category affects only those activities which may result in a discharge. For those activities not involving discharges, the NWP remains in effect.

NWP's numbered 12, 15, 16, 17, 25, 28, 34, 39, and 40 involve activities which would result in discharges and therefore 401 water quality certification is required.

The Corps CZMA consistency determination only applies to NWP

authorizations for activities that are within, or affect land or water uses in, a state's coastal zone. NWP authorizations for activities that are not within or would not affect a state's coastal zone are not contingent on such state's agreement or disagreement with the Corps consistency determinations.

If the state denies a 401 water quality certification for certain activities within that state, then the Corps will deny authorization for those activities without prejudice. Anyone wanting to perform such activities must first obtain a project specific 401 water quality certification or waiver thereof from the state before proceeding under the nationwide permit. See proposed 33 CFR 330.4(c). If a state disagrees with the Corps CZMA consistency determination for certain activities, then the Corps will deny authorization for those activities without prejudice. Anyone wanting to perform such activities must present a consistency determination to the appropriate state agency. Upon concurrence by the state the activity would be authorized by the nationwide permit. See proposed 33 CFR 330.4(d).

Discussion of Proposed Nationwide Permits

The following is a discussion of our reasons for changing existing NWP's or proposing new NWP's. If an existing NWP is not listed, we are not proposing to change it.

(3) *Maintenance*: (now 33 CFR 330.5(a)(3)) We propose to reword this NWP to clarify that currently serviceable fills or structures recently (within the past two years) destroyed by storms, fire or other such events, qualify. This NWP also allows upgrading the structure or fill to current safety standards, providing there was no substantial change (i.e., no change that would result in more than minimal impacts) in the adverse environmental impacts of the structure or fill on waters of the United States.

(4) *Fish and Wildlife Harvesting, Enhancement and Attraction Devices*: (now 33 CFR 330.5(a)(4)) We propose to modify this NWP to include small fish attraction devices (not artificial reefs). We are seeking comments on whether small aquaculture activities should be added to this NWP; and if so, how to define those small aquaculture activities that have minimal impacts.

(5) *Scientific Measurement Devices*: (now 33 CFR 330.5(a)(5)). We propose to include in this NWP discharges associated with construction of small weirs and flumes to record water quality and velocity.

(6) *Survey Activities*: (now 33 CFR 330.5(a)(6)) We propose to alert

potential users of this NWP that authorization may also be required under section 402 of the Clean Water Act for the discharge of drilling muds and cuttings. We also propose to clarify that neither the discharge from test wells nor any road fills or pads are authorized by this NWP.

(7) *Outfall Structures*: (now 33 CFR 330.5(a)(7)) We propose to clarify that a specific exemption under the National Pollutant Discharge Elimination System (NPDES) would be sufficient to satisfy the requirements of the NWP for outfall structures. The Water Quality Act of 1987 exempts stormwater outfalls from the requirement to obtain a permit under the NPDES on a temporary basis. We also propose to clarify that, where the permitting authority (the Environmental Protection Agency or the state) requires certification to be based on a test of the actual effluent discharging from the plant after construction, the NWP can still apply.

(8) *Oil and Gas Structures*: (now 33 CFR 330.5(a)(8)) We propose to restrict this NWP by not allowing its use in established danger zones or EPA or Corps designated dredged material disposal areas.

(11) *Temporary Recreational Structures*: (now 33 CFR 330.5(a)(11)) We propose to expand this NWP to cover small, temporary floating docks, etc.

(12) *Utility Line Backfill and Bedding*: (now 33 CFR 330.5(a)(12)) We propose to clarify that this NWP does not apply to tile or similar drainage works (although it does apply to pipes conveying drainage collected from another area) and that material resulting from trench excavation can be temporarily sidescast into waters of the United States, provided there is little or no flow to disperse the excavated material. We also propose that all exposed slopes and streambanks must be stabilized immediately on completion of the utility line. We have received frequent questions from the Corps district offices about whether this NWP is restricted to crossing-type situations, as in NWP 14. There is nothing in the language of the NWP to restrict use of this NWP to crossings, nor was there any intention to do so. Control of adverse impacts on the aquatic environment is through the requirement to restore the area to its preconstruction contours, and the other NWP conditions. We also propose that in wetlands the top 6" to 12" of the trench should generally be backfilled with topsoil from the trench. This NWP does not authorize temporary construction or access which may be authorized by NWP 33.

(13) *Bank Stabilization*: (now 33 CFR 330.5(a)(13)) We propose to clarify that the limit of one cubic yard per running foot should be computed below the plane of ordinary high water; that no material could be used in a manner that would be eroded by normal or expected high flows; and that properly anchored trees and treetops may be used in low energy areas. The NWP would allow bank stabilization activities greater than 500 linear feet and greater than 1 cubic yard per running foot provided that the permittee notifies the DE 30 days in advance and the DE determines that the impacts are minimal and that the bank stabilization is necessary.

(14) *Minor Road Crossing*: (now 33 CFR 330.5(a)(14)) We propose to clarify this NWP by reorganizing its terms. We also propose to authorize the crossing (or skirting) of wetlands, ponds, lakes, or any water of the United States, even where there is no flowing waterbody. The original basis for requiring the presence of a flowing waterbody (i.e., the ordinary high water line) was to ensure that there was a genuine need for a crossing, and that the permittee could not just as easily avoid the wetland and use upland portions of his property. However, there are many situations where there may be no stream or river, such as in the case of long, linear wetlands, where the landowner may have a legitimate need to cross a wetland in order to reach upland. The proposed "Minimization" condition should ensure that this NWP is used only where necessary. We also propose to eliminate the maximum volume (200 cubic yards below the plane of OHW) limits and change the maximum linear limits in wetlands to a cumulative total of 200 feet in wetlands. We propose to add a restriction that the filled area in waters of the United States cannot exceed $\frac{1}{4}$ acre. This should better control the extent of individual and cumulative impacts resulting from this NWP. We also propose to add a condition that for discharges in special aquatic sites, including wetlands, the permittee notify the DE 30 days prior to doing the work. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

(15) *U.S. Coast Guard Approved Bridges*: (now 33 CFR 330.5(a)(15)) We propose to expand this NWP to include approach fills that are reviewed and approved by the Coast Guard as part of their permit provided the DE is notified 30 days prior to doing the work. The Coast Guard provides the Federal

resource agencies opportunity to comment, is bound by the Executive Orders on Floodplains (11988) and Wetlands (11990), and must comply with all relevant environmental laws, such as the Clean Water Act, Fish and Wildlife Coordination Act (FWCA), the Endangered Species Act (ESA), and the National Environmental Policy Act (NEPA). The requirement to notify the DE would give him an opportunity to review the proposal and assert discretionary authority. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

(17) *Hydropower Projects*: (now 33 CFR 330.5(a)(17)) We propose to expand this NWP to cover all Federal Energy Regulatory Commission (FERC) licensed hydropower projects, but would require notification to the DE 30 days prior to undertaking the activity unless FERC had granted an exemption from licensing pursuant to section 408 of the Energy Security Act of 1980 (16 U.S.C. 2705 and 2708) and section 30 of the Federal Power Act, as amended. As stated above, Congress made clear its intention that duplication of Federal effort be minimized. Upon review of the notification the DE shall assert discretionary authority over any activity having more than minimal adverse impacts on the aquatic environment or otherwise may be contrary to the public interest. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal. In addition, the U.S. Fish and Wildlife Service consults with FERC and recommends measures to minimize adverse impacts on fish and wildlife resources from these projects as part of their responsibilities under the Fish and Wildlife Coordination Act. EPA reviews and comments on those projects significant enough to require an environmental impact statement as part of their responsibilities under section 309 of the Clean Air Act. These agencies would also provide an alert to the DE for any proposal that would cause more than minimal adverse impacts on the aquatic environment.

(18) *Minor Discharges*: (now 33 CFR 330.5(a)(18)) We propose to modify this NWP to allow minor discharges from 10 to 25 cubic yards and minor discharges into special aquatic sites, including wetlands, provided the permittee notifies the DE 30 days prior to doing the work and the DE determines that the adverse impacts are minimal. If the DE

determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal. The NWP would also restrict minor discharges to 1/10 acre or less.

(19) *20 Cubic Yard Dredging*: (now 33 CFR 330.5(a)(19)) At the suggestion of the Corps district offices, we propose to expand this NWP to cover small spot dredging activities for removal of up to 20 cubic yards of material. This would increase the utility of the NWP greatly but still confine it to covering only activities with minimal individual and cumulative impacts. This NWP is meant to apply to all navigable waters of the United States.

(20) *Oil Spill Cleanup*: (now 33 CFR 330.5(a)(20)) We propose to modify this NWP to only require concurrence of the Regional Response Teams where these teams exist, but continue to require the work be done in accordance with the Spill Control and Countermeasure (SPCC) Plan. Such teams are not available in all areas of the country.

(21) *Surface Mining Activities*: (now 33 CFR 330.5(a)(21)) We propose to modify this NWP by changing the notification process as discussed above. We believe the Department of the Interior's Surface Mining Control and Reclamation Act (SMCRA) program requirements adequately address environmental concerns without duplicating coordination with other agencies through the existing PDN process. According to a study conducted by the Smithsonian Institution, the SMCRA program requirements, which are administered by the Department of the Interior's Office of Surface Mining, should effect similar protections for aquatic resources as the section 404 program requirements. The SMCRA program sets up requirements for use of "best technology currently available" to minimize adverse impacts to fish and wildlife resources, water quality, etc. Wetlands and riparian vegetation are specifically designated in SMCRA regulations as resources for which protection is required. Wetlands are defined as in the Corps regulations. SMCRA regulations also single out habitats of unusually high value for fish and wildlife, including certain "locally important habitats even though they may not be critical habitats of any threatened or endangered species." Such areas would likely include habitats similarly evaluated as "special aquatic sites" under 40 CFR part 230. (See Discussion of Comments and Rules Adopted, 30 CFR parts 816 and 817.) DOI and SMCRA permittees are similarly

bound to consider impacts on historic properties by section 106 of the National Historic Preservation Act; consult on endangered species under the ESA; and coordinate with the U.S. Fish and Wildlife Service under the FWCA, which will provide for the identification and protection of important resources. However, the 30-day notification would ensure that the DE has the opportunity to assert discretionary authority, if necessary. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

(22) *Removal of Vessels:* (now 33 CFR 330.5(a)(22)) We propose to modify this NWP to require compliance with the National Historic Preservation Act pursuant to 33 CFR 330.4(h) for vessels listed or eligible for listing on the National Register of Historic Places.

(23) *Approved Categorical Exclusions:* (now 33 CFR 330.5(a)(23)) We propose to clarify that the Chief of Engineers may require special conditions for authorization of another Federal agency's categorical exclusions under this NWP. A 30-day predischage notification is being added for discharges in special aquatic sites, including wetlands. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

(25) *Structural Discharges:* (now 33 CFR 330.5(a)(25)) We propose to expand this NWP to include the discharge of sand, rock, or other clean materials into tightly sealed forms or cells to be used as a structural member for certain types of projects. We also propose to clarify that this NWP cannot be used to authorize construction of house or other building pads nor for structural members that would support buildings, homes, parking areas, storage areas and other such structures.

(26) *Headwaters and Isolated Waters Discharges:* (now 33 CFR 330.5(a)(26)) The predischage notification (PDN) process and the requirement to make an immediate determination of what constitutes a "loss or substantial adverse modification" has made use of this permit so complicated that it has defeated the purpose of the NWP program; that is, to reduce regulatory delays and burdens on the public, to place greater reliance on state and local controls, and to free our limited resources for more effective regulation of other activities with greater potential to adversely impact the aquatic environment. Therefore, we propose to

drop the 20-day PDN process currently required on this NWP and replace it with a simple 30-day PDN. Furthermore, we propose to modify the acreage measured from the "loss or substantial adverse modification" to the filled area plus flooded and drained areas. These changes should reduce public confusion and make administration of this NWP simpler by making the determination of its general applicability clear-cut, while ensuring that large fills in these waters are not authorized by this NWP.

The Corps is considering changing the acreage limits of NWP 26. Presently, discharges of dredged or fill material that cause the loss or substantial adverse modification of 1 to 10 acres of waters of the United States require a predischage notification. Activities that affect less than one acre may proceed without notifying the Corps. The Corps is proposing 3 options for the acreage limits that would define when a predischage notification must be submitted and is requesting comments on these options. These options are:

Option 1: 1 to 10 acres.

Option 2: 1 to 5 acres.

Option 3: ½ to 5 acres.

There are other acreage limits that could be adopted and the Corps would like comments on those as well. Furthermore, division engineers will be considering adding regional conditions or requiring individual permits in certain locations. If you have comments regarding these limits on a local or regional basis, they should be submitted directly to the district engineer in the appropriate State. In developing comments on these options for NWP 26, the options for requiring mitigation should be carefully studied. For example, mitigation Option 1 or 2 would ensure that losses of special aquatic sites, including wetlands, should be minimized and compensated where appropriate and practicable. With a requirement for mitigation, the option of leaving the acreage limit at 1 to 10 would reduce uncompensated wetland loss.

The term "filled area" refers to the area of waters of the United States actually covered by fill, rather than the area of "substantial adverse modification," in order to simplify administration of this permit. However, by including in the acreage measurement waters of the United States that are flooded or drained, most projects that would cause a "substantial adverse modification" would no longer qualify for the NWP. The notification requirement would ensure that the DE has the opportunity to consider such indirect impacts from the discharge. If the combined effect of direct and such

indirect adverse impacts would cause more than minimal adverse impacts, the DE shall assert discretionary authority and not allow authorization under the NWP unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

We are aware that authorizing even one acre of fill can cause more than minimal adverse individual or cumulative impacts to certain types of wetlands or other aquatic resources, or to overall aquatic resources in certain parts of the country, especially where state or local programs do not exist or provide insufficient protection. Therefore, when division and district engineers determine that such cases exist, they will assert discretionary authority to require regional conditions or revoke the NWP authorization for activities in such areas. We believe the division and district engineers are more familiar with the wetlands and other aquatic resources in their area and can best determine which of these should be subject to individual permit evaluations or regional conditions. On the other hand, we are encouraging districts that have wetland types of low value, where greater than ten acres of fill would not result in more than minimal impacts or that are adequately regulated by state or local agencies, to develop regional general permits for these areas.

(27) *Wetland Restoration Activities:* This proposed new NWP authorizes the discharge of dredged or fill material into altered or degraded non-tidal wetlands that is associated with certain Federally funded or assisted wetland restoration activities. This NWP was requested by the U.S. Fish and Wildlife Service (FWS) and the Soil Conservation Service (SCS) to reduce the administrative burden associated with individual section 404 permits for restoration projects that have minimal adverse environmental effects and to encourage continued participation in these Federal restoration programs. The FWS has restored almost 55,000 acres of wetlands through activities associated with private land wetland restoration and protection initiatives since 1987 and is presently restoring wetlands on approximately 2,000 to 2,500 sites per year. Under the proposed agriculture wetland reserve in the 1990 Farm Bill and other associated private land wetland restoration activities approved by Congress, it is expected that the FWS and these SCS will accomplish 8,000 to 10,000 wetland restoration projects per year.

(28) *Modifications of Existing Marinas:* This proposed new NWP authorizes reconfigurations of existing

docking facilities at authorized marina areas. No dredging, additional slip or dock spaces, or expansion of any kind within waters of the United States are authorized, and all rearranged spaces must be within the limits of the original permit or most recent modification of that permit.

(29) This number is being reserved for a future unspecified NWP.

(30) *Dewatering Construction Sites:* This proposed new NWP authorizes the dewatering of construction sites, provided certain terms are met. The terms of this NWP reflect the types of conditions normally placed on individual permits for such activities, and include maintaining continuous flows downstream, and limiting temporary cofferdams to just over halfway across the waterway and restricting such activities to low-flow seasons.

(31) *Small Docks and Piers:* This proposed new NWP authorizes small private docks and piers in navigable waters of the United States. Such activities are consistently authorized by regional general permits throughout the country. The terms and conditions reflect those generally seen in regional general permits for such activities and limit the size and types of construction materials that can be used.

(32) *Completed Enforcement Actions:* This proposed new NWP authorizes activities in waters of the United States which are required by civil or criminal judicial actions brought by the Corps or EPA. These activities may be the result of judicial decisions, consent agreements, or other civil or criminal proceedings or agreements. Judicial decisions on a case would preclude the opportunity for further review (except through a higher court). Consent agreements are reached after extensive negotiation by the Corps, EPA and/or Department of Justice attorneys on what represents a fair and environmentally acceptable resolution for such unauthorized discharges.

(33) *Temporary Construction and Access.* This proposed new NWP authorizes temporary construction and access fills. The permittee is required to notify the DE 30 days prior to doing the work and include a restoration plan. The DE will add case specific conditions to insure that the impacts are minimal.

(34) *Cranberry Production Activities.* There has been considerable interest, especially from the cranberry growing industry, in a nationwide permit for activities associated with the production of cranberries. There has also been considerable concern expressed regarding potential adverse impacts on aquatic resources of some cranberry

production activities, such as converting existing natural wetlands into cranberry bogs. The operations involve manipulating water levels within the bog and bog reservoirs to maintain high ground- and surface-water levels, even during periods of drought. Typically, fifteen acres of watershed are set aside for each acre of actual bog. The Corps is seeking comments on the detriments and benefits of cranberry production activities, possible conditions or limits that could reduce any adverse impacts, and types of cranberry production activities that should or should not be authorized by nationwide permit.

(35) *Maintenance Dredging of Existing Basins:* This proposed new NWP authorizes maintenance dredging of existing basins, canals, boat slips, etc. The "Erosion and siltation controls" condition requires use of siltation controls, such as a silt curtain or other methods of controlling siltation beyond the work area. This NWP requires that material be disposed of at an upland site.

(36) *Boat Ramps:* This proposed new NWP authorizes small boat ramps. Most Corps districts have regional general permits for boat ramps. We have incorporated common conditions of those regional general permits into the terms of the NWP and specify that no fill may be placed in special aquatic sites as defined at 33 CFR 330.2(i) and 40 CFR 230.40—230.45.

(37) *Emergency Watershed Protection:* This proposed new NWP authorizes certain discharges associated with emergency watershed protection projects done by or funded by the Soil Conservation Service (SCS) under its regulations at 7 CFR part 624, provided the DE is notified 30 days prior to commencing work. Such work is restricted to emergency measures undertaken to remove or reduce hazards to life and property from floods, drought and the products of erosion in the event of a sudden watershed impairment due to a natural occurrence. The SCS state conservationist determines when such a watershed emergency exists. To be eligible for emergency watershed protection assistance and for this NWP, the measures must be limited to the minimum that will reduce applicable threats to a level not to exceed that which existed before the impairment of the watershed. In order to receive emergency watershed protection assistance, those persons undertaking such work must use the least damaging construction techniques and equipment to retain as much of the existing character of the channel and riparian habitat as possible. This NWP requires a notification to the DE 30 days prior to

the discharge in order to give the DE an opportunity to review the proposal and if appropriate, assert discretionary authority.

(38) *Cleanup of Hazardous and Toxic Waste:* This proposed new NWP authorizes specific work needed to contain, stabilize or remove hazardous and toxic wastes, provided such work is done, ordered or sponsored by a government agency with the appropriate authority. This NWP also covers court-ordered remedial actions, but could not be used to construct new sites or expand existing sites. This NWP requires the permittee to notify the DE prior to doing the work. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

(39) *Agricultural Discharges.* This proposed new NWP authorizes discharges necessary for agricultural, silvicultural, or aquacultural activities in "farmed wetlands." A 30 day predischage notification is required. If the DE determines the impacts are more than minimal, he will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal. The NWP will not authorize the filling or draining of wetlands to create upland.

(40) *Farm Buildings.* This proposed new NWP authorizes discharges for foundations or buildings pads for farm buildings or other agricultural related structures necessary for farming activities in wetlands that are currently in agricultural production.

Discussion of Proposed Conditions

Other than minor clarifications or changes we propose to adopt the existing NWP conditions currently published at 33 CFR 330.5(b). We also propose to adopt the best management practices (EMPs), currently published at 33 CFR 330.6, as conditions of the NWPs. In addition, we propose two new conditions; one to address erosion and siltation controls and another containing the notification requirements. We have also divided the conditions into 2 groups to simplify and clarify which conditions apply to all NWPs and those that only apply to discharge activities.

We propose to reword the "Water Supply Intakes" condition to provide an exception to cover those situations where the proposed discharge is for the purpose of repairing or providing additional bank stabilization for water supply intake structures themselves. Such work would be done by the water company, municipality or other provider

who would be unlikely to endanger their own interests by discharging a material or constructing in a manner likely to cause degradation of water quality.

We also propose to reword the "Endangered Species" and "Historic Properties" conditions by moving the language that details the procedures to be followed when such resources would be potentially affected by the permitted activity to 33 CFR 330.4 (g) and (h).

We propose the Best Management Practices (BMPs) now located at 33 CFR 330.6 as conditions to the NWP. The purpose for making the BMPs conditions is to make their enforceability clearer and to eliminate any confusion over the difference between the NWP conditions and the BMPs. The BMPs, as conditions, would allow some flexibility; that is, the measures would be required to the extent practicable and reasonable. However, it would be the DE's judgment as to whether the permittee has complied with these conditions and, thus, users of the NWPs should conscientiously adhere to them. Violation of these or any conditions added by the division or district engineer could be the basis for enforcement actions under 33 CFR part 326 and/or suspension or revocation under 33 CFR 330.5. The "Minimization" condition would combine the BMPs previously at 33 CFR 330.6(a) (1) and (5), change wetlands areas to special aquatic sites, including wetlands, and change the language to avoid any confusion that might result in the 40 CFR 230.10(a) alternative test being erroneously considered as a pass/fail requirement for NWP activities. This would extend additional protection to special aquatic sites, which include wetlands, and ensure that discharges authorized by NWPs do not result in more than minimal individual or cumulative impacts on the aquatic environment. Some of the NWPs specifically prohibit discharges in special aquatic sites. For those NWPs that authorize discharges into special aquatic sites, this condition would ensure that those discharges are minimized to the greatest extent practicable.

We also propose to add a "Notification" condition which states the requirements of an acceptable notification to the DE when required by a NWP. The notification must occur 30 days prior to doing the work. The permittee may proceed with the work unless otherwise notified by the DE. The DE will review the notification to ensure that the activity complies with the terms and conditions of the NWP, the impacts are minimal, and where required, that

appropriate and practicable mitigation is added as a condition for authorization under the NWP.

We also propose to add an "Erosion and siltation controls" condition requiring that erosion and siltation controls must be used at permit sites, and that exposed soil must be stabilized at the earliest date possible.

Environmental Documentation

We have made a preliminary determination that this action does not constitute a major Federal action significantly affecting the quality of the human environment. Preliminary environmental documentation has been prepared for each proposed nationwide permit. This documentation includes a preliminary environmental assessment and, where relevant, a preliminary section 404(b)(1) Guidelines compliance review. Copies of these documents are available for inspection at the office of the Chief of Engineers and at each Corps district office. Based on these documents the Corps has provisionally determined that the proposed NWPs comply with the requirements for issuance under general permit authority.

Note 1: The Department of the Army has determined that this document does not contain a major rule requiring a regulatory impact analysis under Executive Order 12291 because it will not result in an annual effect on the economy of \$100 million or more and it will not result in a major increase in costs or prices.

Note 2: The term "he" and its derivatives used in these regulations are generic and should be considered as applying to both male and female.

I hereby certify that this matter will have no significant negative impact on a substantial number of small entities within the meaning and intent of the Regulatory Flexibility Act, 5 U.S.C. 601 *et seq.*

List of Subjects in 33 CFR Part 330

Navigation, Water pollution control, Waterways.

Approved:

G. Edward Dickey,
Acting Principal Deputy Assistant, Secretary of the Army (Civil Works).

Accordingly, 33 CFR part 330 is proposed to be revised to read as follows:

PART 330—NATIONWIDE PERMIT PROGRAM

Sec.

330.1 Purpose and policy.

330.2 Definitions.

330.3 Activities occurring before certain dates.

Sec.

330.4 Conditions, limitations, and restrictions.

330.5 Issuing, modifying, suspending, or revoking nationwide permits and authorizations.

330.6 Authorization by nationwide permit.

Appendix A to Part 330—Nationwide Permits and Conditions

Authority: 33 U.S.C. 401 *et seq.*; 33 U.S.C. 1344; 33 U.S.C. 1413.

§ 330.1 Purpose and policy.

(a) *Purpose.* This regulation describes the policy and procedures used in the Department of the Army's nationwide permit program to issue, modify, suspend, or revoke nationwide permits; to identify conditions, limitations, and restrictions on the nationwide permits; and, to identify any procedures, whether required or optional, for authorization by nationwide permits.

(b) *Nationwide permits.* Nationwide permits (NWPs) are a type of general permit issued by the Chief of Engineers and are designed to regulate with little, if any, delay or paperwork certain activities having minimal impacts. The NWPs are proposed, issued, modified, reissued (extended), and revoked from time to time by publication in the Notice section of the *Federal Register*. Proposed NWPs or modifications to or reissuance of existing NWPs will be adopted only after the Corps gives notice and allows the public an opportunity to comment on and request a public hearing regarding the proposals. The Corps will give full consideration to all comments received prior to reaching a final decision.

(c) *Terms and Conditions.* A NWP is valid only if a permittee satisfies the NWP's terms and conditions. Activities that fail to comply with a term or condition still may be authorized by an individual or regional permit. The Corps will consider unauthorized any activity that is under construction or completed and that does not comply with the terms and conditions of a NWP or regional general permit. The Corps will evaluate unauthorized activities for enforcement action under 33 CFR part 326. Enforcement proceedings may be suspended if the permittee modifies his project to comply with a NWP or a regional general permit.

(d) *Discretionary Authority.* District and division engineers have been delegated a discretionary authority to suspend, modify, or revoke authorizations under a NWP. This discretionary authority may be used by district and division engineers for cases where they have concerns for the aquatic environment under the section 404(b)(1) guidelines or for any factor of

the public interest. In most cases district and division engineers do not have a legal obligation to review an activity or to exercise such discretionary authority. However, for any activity authorized by NWP, the district engineer (DE) has the discretionary authority to review the activity to determine whether he will modify the authorization or instruct the prospective permittee to apply for an individual permit. In addition, the terms and conditions of certain NWP's require the DE to review the proposed activity before the NWP authorizes its construction. In such cases, if the DE finds that the proposed activity would have more than minimal individual or cumulative net adverse impacts on the aquatic environment or otherwise may be contrary to the public interest, he shall modify the NWP authorization to reduce or eliminate those adverse impacts, or he shall instruct the prospective permittee to apply for an individual permit. Discretionary authority is also discussed at 33 CFR 330.4(e) and 330.5.

(e) *Notifications.* (1) In most cases, permittees may proceed with activities authorized by NWPs without notifying the DE. However, the prospective permittee qualifying for a NWP should carefully review the language of the NWP to ascertain whether he must notify the DE prior to commencing of the authorized activity. For NWPs requiring advance notification, such notification must be made in writing as early as possible but not later than 30 calendar days prior to the proposed discharge. The permittee may presume that his project qualifies for the NWP unless he is otherwise notified by the DE within that 30-day period. The 30-day period starts on the date of receipt of the notification in the Corps district office and ends 30 calendar days later regardless of weekends or holidays. If the DE notifies the prospective permittee that the notification is incomplete, then the 30 day period will start over upon receipt of the revised notification. Permittees may proceed before expiration of the 30-day period if so notified by the DE. If the DE fails to act within the 30-day period, he must use the procedures of 33 CFR 330.5 in order to modify, suspend, or revoke the authorization.

(2) The DE will review the notification and may add activity-specific conditions to ensure that the activity complies with the terms and conditions of the NWP and that the adverse impacts on the aquatic environment and other aspects of the public interest are individually and cumulatively minimal.

(3) For some NWPs involving discharges into special aquatic sites, including wetlands, the notification must include a wetland delineation. The DE will review the notification and determine if the impacts are more than minimal. If the impacts are more than minimal the DE will notify the prospective permittee that an individual permit (or authorization under a regional general permit) would be required or that the prospective permittee may propose appropriate and practicable measures to mitigate the loss of special aquatic sites, including wetlands. The DE can only require appropriate and practicable mitigation, which may or may not reduce the impacts to minimal. However, the prospective permittee may volunteer additional mitigation if necessary to reduce the impacts to minimal. The prospective permittee may elect to propose mitigation with the original notification. The DE will consider that proposed mitigation when deciding if the impacts are minimal. The DE shall add activity-specific conditions to ensure that appropriate and practicable mitigation will be accomplished. If sufficient mitigation cannot be developed to reduce the impacts to the minimal level, the DE will not allow authorization under the NWP and will instruct the prospective permittee on procedures to seek authorization under regional general or individual permit.

(f) *Individual Applications.* DEs should review all incoming applications for individual permits for possible eligibility under regional general permits or NWPs. If the activity complies with the terms and conditions of one or more NWPs, he should verify the authorization and so notify the applicant. If the DE determines that the activity could comply after reasonable project modifications and/or activity-specific conditions, he will notify the applicant of such modifications and conditions. If such modifications and conditions are accepted by the applicant, verbally or in writing, the DE will verify the authorization with the modifications and conditions in accordance with 33 CFR 330.6(a). However, the DE will proceed to evaluate the application, if complete, as an individual permit within 15 calendar days of receipt unless the applicant indicates that he will accept the modifications or conditions.

(g) *Authority.* NWPs can be issued to satisfy the permit requirements of section 10 of the Rivers and Harbors Act of 1899, section 404 of the Clean Water Act, and section 103 of the Marine Protection, Research, and Sanctuaries

Act or some combination thereof. The applicable authority will be indicated at the end of each NWP. NWPs and their conditions formally published at 33 CFR 330.5 and 330.6 will remain in effect until they expire or are modified or revoked in accordance with the procedures of this section.

§ 330.2 Definitions.

(a) The definitions of 33 CFR parts 320-329 are applicable to the terms used in this part.

(b) *Nationwide permit* refers to a type of general permit which authorizes activities on a nationwide basis unless specifically limited. (Another type of general permit is a "regional permit" which is issued by division or district engineers on a regional basis in accordance with 33 CFR part 325). (See 33 CFR 322.2(f) and 323.2(h) for the definition of a general permit.)

(c) *Authorization* means that individual activities that qualify for a NWP may proceed, provided that the terms and conditions of the NWP are met. After determining that the activity complies with all applicable terms and conditions, the permittee may assume an authorization under a NWP. This assumption is subject to the DE's authority to determine if an activity complies with the terms and conditions of a NWP. If requested by the permittee in writing, the DE will verify in writing that the permittee's proposed activity complies with the terms and conditions of the NWPs. A written verification may contain activity-specific conditions and regional conditions which a permittee must satisfy for the authorization to be valid.

(d) *Headwaters* means non-tidal rivers, streams, and their lakes and impoundments, including adjacent wetlands, that are part of a surface tributary system to a navigable water of the United States upstream of the point on the river or stream at which the average annual flow is less than five cubic feet per second. The DE may estimate this point from available data by using the mean annual area precipitation, area drainage basin maps, and the average runoff coefficient, or by similar means. For streams that are dry for long periods of the year, DEs may establish the point where headwaters begin as that point on the stream where a flow of five cubic feet per second is equalled or exceeded 50 percent of the time.

(e) *Isolated waters* means those non-tidal waters of the United States (including wetlands) that are not part of a surface tributary system to navigable waters of the United States or that do

not otherwise meet the definition of "adjacent."

(f) *Filled area* means the area within jurisdictional waters which is eliminated or covered as a direct result of the discharge (i.e., the area actually covered by the discharged material). It does not include areas excavated nor areas impacted as an indirect effect of the fill.

(g) *Discretionary authority* means the authority described in section 330.4(e) which the Chief of Engineers delegates to division or district engineers to modify a NWP authorization by adding conditions, to suspend a NWP authorization, or to revoke a NWP authorization and thus require individual permit authorization.

(h) *Terms and conditions*. The "terms" of a NWP are the limitations and provisions included in the description of the NWP itself. The "conditions" of NWPs are additional provisions which place restrictions or limitations on all of the NWPs. These are published with the NWPs. Other conditions may be imposed by district or division engineers on a geographic, category-of-activity, or activity-specific basis (see 33 CFR 330.4(e)).

(i) *Currently serviceable* means usable as is or with some maintenance, but not so degraded as to essentially require reconstruction. It also includes those structures destroyed within the past two years by storms, floods, fire, or other discrete events, which were serviceable immediately preceding that event.

(j) *Single and complete project* means the total project proposed or accomplished on a single property for a single purpose by one owner/developer or partnership of owners/developers. For example, if construction of a residential development affects several different areas of a headwater or isolated water, or several different headwaters or isolated waters, the cumulative total of all filled areas should be the basis for deciding whether or not the project will be covered by a NWP. For linear projects, the "single and complete project" will apply to each crossing of a separate water of the United States. That is, each waterbody crossed by a linear project will be considered a single and complete crossing at that location. Individual channels in a braided stream or river, or individual arms of a large, irregularly-shaped wetland or lake, etc., are not separate waterbodies. Where a linear project crosses a single waterbody several times, but at separate, distant locations, each crossing is considered a single and complete project.

(k) *Special aquatic sites* means wetlands, mudflats, vegetated shallows,

coral reefs, riffle and pool complexes, sanctuaries, and refuges.

§ 330.3 Activities occurring before certain dates.

The following activities were permitted by NWPs issued on July 19, 1977, and, unless the activities are modified, they do not require further permitting:

(a) Discharges of dredged or fill material into waters of the United States outside the limits of navigable waters of the United States that occurred before the phase-in dates which extended section 404 jurisdiction to all waters of the United States. The phase-in dates were: After July 25, 1975, discharges into navigable waters of the United States and adjacent wetlands; after September 1, 1976, discharges into navigable waters of the United States and their primary tributaries, including adjacent wetlands, and into natural lakes, greater than 5 acres in surface area; and after July 1, 1977, discharges into all waters of the United States, including wetlands. (Section 404)

(b) Structures or work completed before December 18, 1963, or in waterbodies over which the DE had not asserted jurisdiction at the time the activity occurred, provided in both instances, there is no interference with navigation. Activities completed shoreward of applicable Federal Harbor lines before May 27, 1970 do not require specific authorization (Section 10)

§ 330.4 Conditions, limitations, and restrictions.

(a) *General*. A prospective permittee must satisfy all terms and conditions of a NWP for a valid authorization to occur. Some conditions identify a "threshold" that, if met, require additional procedures or provisions contained in other paragraphs in this section. It is important to remember the NWPs only authorize activities from the perspective of the Corps regulatory authorities and that other Federal, state, and local permits may also be required.

(b) *Further information*. (1) DEs have authority to determine if an activity complies with the terms and conditions of a NWP.

(2) NWPs do not obviate the need to obtain other Federal, state, or local authorizations required by law.

(3) NWPs do not grant any property rights or exclusive privileges.

(4) NWPs do not authorize any injury to the property or rights of others.

(5) NWPs do not authorize interference with any existing or proposed Federal project.

(c) *State 401 water quality certification*. (1) State 401 water quality

certification pursuant to section 401 of the Clean Water Act, or waiver thereof, is required prior to the issuance or reissuance of NWPs authorizing activities which may result in a discharge into waters of the United States.

(2) If, prior to the issuance or reissuance of such NWPs, a state issues a 401 water quality certification which includes special conditions, the division engineer will make these special conditions regional conditions of the NWP for activities which may result in a discharge into waters of the United States in that state, unless he determines that such conditions do not comply with the provisions of 33 CFR 325.4. In the latter case, the conditioned 401 water quality certification will be considered a denial of the certification (see paragraph (c)(3) of this section).

(3) If a state denies a required 401 water quality certification for an activity otherwise meeting the terms and conditions of a particular NWP, that NWP's authorization for all such activities within that state is denied without prejudice until the state issues an individual 401 water quality certification or waives its right to do so. State denial of 401 water quality certification for any specific NWP affects only those activities which may result in a discharge. That NWP continues to authorize activities which could not reasonably be expected to result in discharges into waters of the United States.

(4) DEs will take appropriate measures to inform the public of which activities, waterbodies, or regions require an individual 401 water quality certification before authorization by NWP.

(5) The DE will not process an individual permit application for an activity which may result in a discharge and otherwise qualifying for a NWP on the sole basis that the 401 water quality certification has been denied for that NWP. However, the district or division engineer may exercise his discretionary authority.

(6) In instances where a state has denied the 401 water quality certification for discharges under a particular NWP, permittees must furnish the DE with an individual 401 water quality certification or a copy of the application to the state for such certification. If a state fails to act within a reasonable period of time after receipt of the application for certification (generally 60 days) (see 33 CFR 325.2(b)(1)(ii)), the DE will presume state waiver of the certification. Upon receipt of an individual 401 water quality

certification, or if the prospective permittee demonstrates to the DE state waiver of such certification the proposed work is authorized under the NWP. For NWPs requiring a 30-day predischage notification the district engineer will immediately begin, and may complete, his review prior to the state action on the individual section 401 water quality certification. However, the 30-day period will not formally start until the water quality certification condition is satisfied. If a state issues a conditioned individual 401 water quality certification for an individual activity, the DE will include those conditions as activity-specific conditions of the NWP unless he determines that such conditions do not comply with the provisions of 33 CFR 325.4. In the latter case the DE will consider the conditioned 401 water quality certification to be a denial of the certification unless the permittee chooses to comply voluntarily with all the conditions in the 401 water quality certification.

(7) Where a state, after issuing a 401 water quality certification, subsequently withdraws it for substantive reasons, the division engineer will review those reasons and consider whether there is substantial basis for suspension, modification, or revocation as outlined in § 330.5. Otherwise, the withdrawal does not affect the validity of the NWP authorizations until such time as the NWP is reissued.

(d) *Coastal zone management consistency determination.* (1) The Coastal Zone Management Act (CZMA) requires a state coastal zone management consistency determination prior to the issuance and reissuance of NWPs that authorize activities within a state with an approved coastal zone management plan when the activities would occur within that state's coastal zone or affect land or water uses in the coastal zone. This is inapplicable to Federal activities (see paragraph (d)(8) of this section).

(2) If, prior to the issuance or reissuance of such NWPs, a state indicates that additional conditions are necessary for the state to agree with the Corps consistency determination for a particular nationwide permit, the division engineer will make such conditions regional conditions for the NWP in that state, unless he determines that the conditions do not comply with the provisions of 33 CFR 325.4 or believes for some other specific reason it would be inappropriate to include the conditions. In this case, the state's failure to agree without the conditions will be considered that the state has

disagreed with the Corps consistency determination (see paragraph (d)(3) of this section.)

(3) When a state has disagreed with the Corps consistency determination, authorization for all such activities occurring within the state's coastal zone or affecting land or water uses in the state coastal zone agency's area of authority is denied without prejudice until the prospective permittee furnishes the DE an individual coastal zone management consistency determination pursuant to section 307 of the CZMA and demonstrates that the state has concurred in it (either on an individual or generic basis), or that concurrence should be presumed. State disagreement with the Corps consistency determination for any NWP affects only activities occurring within or affecting land or water uses in the state's coastal zone. That NWP continues to authorize activities not occurring within or affecting land or water uses in the state's coastal zone.

(4) DEs will take appropriate measures to inform the public of which activities, water bodies, or regions require prospective permittees to make an individual consistency determination and seek concurrence from the state.

(5) DEs will not require or process an individual permit application for an activity otherwise qualifying for a NWP on the sole basis that a state's coastal zone management agency has disagreed that the activity is consistent with the state's CZM plan. However, the district or division engineer may exercise his discretionary authority.

(6) In instances where a state has disagreed with the Corps consistency determination for activities under a particular NWP, permittees must furnish the DE with an individual consistency concurrence or a copy of the consistency determination provided to the state for concurrence. If a state fails to act on a permittee's consistency determination within six months after receipt by the state, consistency will be presumed. The proposed work is authorized under the NWP upon receipt of an individual consistency concurrence or upon presumed consistency. For NWPs requiring a 30-day predischage notification the DE will immediately begin, and may complete, his review prior to the state action on the individual coastal zone management consistency determination. However, the 30-day period will not formally start until the coastal zone management condition is satisfied. If a state indicates that individual conditions are necessary for consistency with the state's CZM plan for that individual activity, the DE

will include those conditions as activity-specific conditions of the NWP unless he determines that such conditions do not comply with the provisions of 33 CFR 325.4. In the latter case the DE will consider the conditioned concurrence as a nonconcurrence unless the permittee chooses to comply voluntarily with all the conditions in the conditioned concurrence.

(7) Where a state, after agreeing with the Corps consistency determination, subsequently disagrees for substantive reasons, the division engineer will review those reasons and consider whether there is substantial basis for suspension, modification, or revocation as outlined in 33 CFR 330.5. Otherwise, the subsequent disagreement does not affect the validity of the NWP authorization until such time as the NWP is modified or reissued.

(8) Federal activities must be consistent with a state's approved coastal zone plan to the maximum extent practicable. Federal agencies should follow their own procedures to meet the requirements of the CZMA. Therefore, the provisions of 33 CFR 330.4(d) (1)-(7) do not apply to Federal activities. Indian tribes doing work on Indian Reservation lands shall be treated in the same manner as Federal applicants.

(e) *Discretionary authority.* The Corps reserves the right (i.e., discretion) to modify, suspend, or revoke NWP authorizations. Modification means the imposition of additional or revised terms or conditions on the authorization. Suspension means the temporary cancellation of the authorization while a decision is made to either modify, revoke, or reinstate the authorization. Revocation means the cancellation of the authorization. The procedures for modifying, suspending, or revoking NWP authorizations are detailed in § 330.5.

(1) A division engineer may assert discretionary authority by modifying, suspending, or revoking NWP authorizations for a specific geographic area, class of activity, or class of waters within his division, including on a statewide basis, whenever he determines sufficient concerns for the aquatic environment under the section 404(b)(1) Guidelines or any factor of the public interest so requires.

(2) A DE may assert discretionary authority by modifying, suspending, or revoking NWP authorization for a specific activity whenever he determines sufficient concerns for the aquatic environment under the section 404(b)(1) Guidelines or any factor of the public interest so requires. Whenever the DE determines that a proposed

specific activity covered by a NWP would have more than minimal individual or cumulative adverse impacts on the aquatic environment or otherwise may be contrary to the public interest, he must either modify the NWP authorization to reduce or eliminate the adverse impacts, or notify the prospective permittee that the proposed activity is not authorized by NWP and provide instructions on how to seek authorization under a regional general or individual permit.

(3) The division or district engineer will restore authorization under the NWPs at any time he determines that his reason for asserting discretionary authority has been satisfied by a condition, project modification, or new information.

(4) When the Chief of Engineers modifies or reissues a NWP, division engineers must use the procedures of § 330.5 to reassert discretionary authority to reinstate regional conditions or revocation of NWP authorizations for specific geographic areas, class of activities, or class of waters. Division engineers will update existing documentation for each NWP. Upon modification or reissuance of NWPs, previous activity-specific conditions or revocations of NWP authorization will remain in effect unless the DE specifically removes the activity-specific conditions or revocations.

(f) *Endangered Species.* No activity is authorized by a NWP that is likely to jeopardize the continued existence of a threatened or endangered species as identified under the Endangered Species Act (ESA), or to destroy or adversely modify the critical habitat of such species.

(1) Federal agencies should follow their own procedures for complying with the requirements of the ESA.

(2) Non-federal permittees shall notify the DE if any listed endangered or threatened species or critical habitat might be affected or is in the vicinity of the project. In such cases, the permittee will not use the NWP until notified by the district engineer. If the DE determines the activity may affect any listed species or critical habitat, the DE must initiate section 7 consultation in accordance with the ESA. In such cases, the district engineer may:

(i) Initiate section 7 consultation and then, upon completion, authorize the activity under the NWP by adding, if appropriate, activity-specific conditions; or

(ii) Prior to or concurrent with section 7 consultation, assert discretionary authority (see 33 CFR 330.4(e)) to suspend or revoke the NWP

authorization and require an individual permit (see 33 CFR 330.5(d)).

(3) Prospective permittees can obtain information on the location of threatened or endangered species and their critical habitats from the U.S. Fish and Wildlife Service, Endangered Species Office, and the National Marine Fisheries Service.

(g) *Historic Properties.* (1) Federal permittees should follow their own procedures for compliance with the requirements of the National Historic Preservation Act and other Federal historic preservation laws.

(2) Non-federal permittees will notify the DE if the activity may adversely affect historic properties which the National Park Service has listed, or determined eligible for listing, on the National Register of Historic Places. In such cases, the permittee will not use the NWP until notified by the DE. If the DE determines that such historic properties may be adversely affected, he will provide the Advisory Council on Historic Preservation and the State Historic Preservation Officer a reasonable opportunity to comment on the effects on such historic properties before notifying the permittee. In such cases, the district engineer may:

(i) After allowing a reasonable opportunity to comment, authorize the activity under the NWP by adding, if appropriate, activity-specific conditions; or

(ii) Prior to or concurrent with allowing a reasonable opportunity to comment, he may assert discretionary authority (see 33 CFR 330.4(e)), to suspend or revoke the NWP authorization and instruct the prospective permittee of procedures to seek authorization under regional general or individual permit. (See 33 CFR 330.5(d)).

(3) The permittee shall immediately notify the DE, if, before or during prosecution of the work authorized, he encounters an historic property that has not been listed or determined eligible for listing on the National Register, but which may be eligible for listing on the National Register.

(4) Nationwide permittees can obtain information on the location of historic properties from the State Historic Preservation Officer and the National Register of Historic Places.

§ 330.5 Issuing, modifying, suspending, or revoking nationwide permits and authorizations.

(a) *General.* This section sets forth the procedures for issuing and reissuing NWPs and for modifying, suspending, or revoking NWPs and authorizations under NWPs.

(b) *Chief of Engineers.* (1) Anyone may, at any time, suggest to the Chief of Engineers, (ATTN: CECW-OR), any new NWPs or conditions for issuance, or changes to existing NWPs, which he believes to be appropriate for consideration. From time-to-time new NWPs and revocations of or modifications to existing NWPs will be evaluated by the Chief of Engineers following the procedures specified in this section. Within five years of issuance of the NWPs, the Chief of Engineers will review the NWPs and propose, by publication in the Federal Register, modification, revocation, or reissuance.

(2) *Public Notice.* (i) Upon proposed issuance of new NWPs or modification, suspension, revocation, or reissuance of existing NWPs, the Chief of Engineers will publish a notice in the Federal Register seeking public comments, including the opportunity to request a public hearing. This notice will also state that the information supporting the Corps' provisional determination that proposed activities comply with the requirements for issuance under general permit authority is available at the Office of the Chief of Engineers and at all district offices. The Chief of Engineers will prepare this information which will be supplemented, if appropriate, by division engineers.

(ii) Concurrent with publication in the Federal Register of proposed, modified, reissued, or revoked NWPs, district engineers (DEs) will notify the known interested public by a notice issued at the district level. The notice will include proposed regional conditions or proposed revocations of NWP authorizations for specific geographic areas, class of activities, or class of waters, if any, developed by the division engineer.

(3) *Documentation.* The Chief of Engineers will prepare appropriate NEPA documents and, if applicable, 404(b)(1) compliance analyses for proposed NWPs. Documentation for existing NWPs will be modified to reflect any changes in these permits and to reflect the Chief of Engineers' evaluation of the use of the permit since the last issuance. Copies of all comments received on the Federal Register notice will be included in the administrative record. The Chief of Engineers will consider these comments in making his decision on the NWPs, and will prepare a statement of findings outlining his views regarding each NWP and discussing how substantive comments were considered. The Chief of Engineers will also determine the need

to hold a public hearing for the proposed NWP.

(4) *Effective Dates.* The issuance, modification, or revocation of NWPs by the Chief of Engineers will become effective on the day of publication in the Federal Register, unless otherwise specified.

(c) *Division Engineer.* (1) A division engineer may use his discretionary authority to modify, suspend, or revoke NWP authorizations for any specific geographic area, class of activities, or class of waters within his division, including on a statewide basis, by issuing of a public notice or notifying the individuals involved. The notice will state his concerns regarding the aquatic environment under the section 404(b)(1) Guidelines or the relevant factors of the public interest. Before using his discretionary authority to modify or revoke such NWP authorizations, division engineers will:

(i) Give an opportunity for interested parties to express their views on the proposed action (the DE will publish and circulate a notice to the known interested public to solicit comments and provide the opportunity to request a public hearing);

(ii) Consider fully the views of affected parties;

(iii) Prepare supplemental documentation for any modifications or revocations that may result through assertion of discretionary authority. Such documentation will include comments received on the district public notices and a statement of findings showing how substantive comments were considered;

(iv) Provide an equitable grandfathering period for those who have commenced work or made substantial commitments in reliance on the NWP authorization; and

(v) Notify affected parties of the modification, suspension, or revocation, including the effective date (the DE will publish and circulate a notice to the known interested public and to anyone who commented on the proposed action).

(2) The modification, suspension, or revocation of authorizations under a NWP by the division engineer will become effective by issuance of public notice or a notification to the individuals involved.

(3) A copy of all regional conditions imposed by division engineers on activities authorized by NWPs will be forwarded to the Office of the Chief of Engineers, ATTN: CECW-OR.

(d) *District Engineer.* (1) When deciding whether to exercise his discretionary authority to modify, suspend, or revoke a specific activity's

authorization under a NWP, the DE should consider: Changes in circumstances relating to the authorized activity since the NWP itself was issued or since the DE confirmed authorization under the NWP by written verification; the continuing need for, or adequacy of, the specific conditions of the authorization; any significant objections to the authorization not previously considered; progress inspections of individual activities occurring under a NWP; cumulative impacts resulting from activities occurring under the NWP; the extent of the permittee's compliance with the terms and conditions of the NWPs; revisions to applicable statutory or regulatory authorities; the extent to which such actions would adversely affect plans, investments, and actions the permittee has made or taken in reliance on the permit; and other concerns for the aquatic environment under the section 404(b)(1) Guidelines and other relevant factors of the public interest.

(2) *Procedures.* (i) When considering whether to modify or revoke a specific authorization under a NWP, the DE will initially hold informal consultations with the permittee to determine whether special conditions to modify the authorization would be mutually agreeable or to allow the permittee to furnish information which satisfies the DE's concerns. If a mutual agreement is reached, the DE will give the permittee written verification of the authorization, including the special conditions. If the permittee furnishes information which satisfies the DE's concerns, the permittee may proceed. If appropriate, the DE may suspend the NWP authorization while holding informal consultations with the permittee.

(ii) If the DE's concerns remain after the informal consultation, the DE may suspend a specific authorization under a NWP by notifying the permittee in writing by the most expeditious means available that the authorization has been suspended, stating the reasons for the suspension, and ordering the permittee to stop any activities being done in reliance upon the authorization under the NWP. The permittee will be advised that a decision will be made either to reinstate or revoke the authorization under the NWP; or, if appropriate, that the authorization under the NWP may be modified by mutual agreement. The permittee will also be advised that within 10 days of receipt of the notice of suspension, he may request a meeting with the DE, or his designated representative, to present information in this matter. After completion of the meeting (or within a reasonable period of time after suspending the

authorization if no meeting is requested), the DE will take action to reinstate, modify, or revoke the authorization.

(iii) Following completion of the suspension procedures, if the DE determines that sufficient concerns for the aquatic environment under the section 404(b)(1) Guidelines or other relevant factors of the public interest so requires, he will revoke authorization under the NWP. The DE will provide the permittee a written final decision and instruct him on the procedures to seek authorization under a regional, general or individual permit.

(3) The DE need not issue a public notice when asserting discretionary authority over a specific activity. The modification, suspension, or revocation will become effective by notification to the prospective permittee.

§ 330.6 Authorization by nationwide permit.

(a) *Nationwide permit verification.* (1) Nationwide permittees may, and in some cases must, request from a DE confirmation that an activity complies with the terms and conditions of a NWP. DEs will respond promptly to such requests.

(2) If the DE decides that an activity does not comply with the terms or conditions of a NWP, he will notify the person desiring to do the work and instruct him on the procedures to seek authorization under a regional general or individual permit.

(3) If the DE decides that an activity does comply with the terms and conditions of a NWP, he will notify the nationwide permittee. The DE may add conditions on a case-by-case basis to clarify compliance with the terms and conditions of a NWP or to ensure that the activity will have only minimal adverse impacts on the aquatic environment, as discussed in the section 404(b)(1) Guidelines, or on any aspect of the public interest. The DE's response will state that the verification is valid for a period of no more than two years or until the NWP is modified, suspended, or revoked. The response will also include a statement on the grandfathering provision at section 330.6(b). A period less than two years may be used if deemed appropriate. Once the DE has provided such verification, he must use the procedures of 33 CFR 330.5 in order to modify, suspend, or revoke the authorization.

(b) *Expiration of nationwide permits.* The Chief of Engineers will periodically review NWPs and their conditions and will decide to either modify, reissue, or revoke the permits. If a NWP is not

modified or reissued within five years of the effective date as published in the Federal Register, it automatically expires and becomes null and void. Authorization of activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon a NWP will remain authorized provided the activity is completed within twelve months of the date of a NWP's expiration, modification, or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend, or revoke the authorization in accordance with 33 CFR 330.4(e) and 33 CFR 330.5(d). Activities completed under the authorization of a NWP which was in effect at the time the activity was completed continue to be authorized by that NWP.

(c) *Multiple use of nationwide permits.* Two or more different NWPs can be combined to authorize a "single and complete project" as defined at 33 CFR 330.2(j). However, the same NWP cannot be used more than once for a single and complete project.

(d) *Combining nationwide permits with individual permits.* Subject to the following qualifications, portions of a larger project may proceed under the authority of the NWPs while the DE evaluates an individual permit application for other portions of the same project, but only if the portions of the project qualifying for NWP authorization would have independent utility and are able to function or meet their purpose independent of the total project. When the functioning or usefulness of a portion of the total project qualifying for a NWP is dependent on the remainder of the project, the NWP does not apply and all portions of the project must be evaluated as part of the individual permit process.

(1) When a portion of a larger project is authorized to proceed under a NWP, it is with the understanding that its construction will in no way prejudice the decision on the individual permit for the rest of the project. Furthermore, the individual permit documentation must include a discussion of the impacts of the entire project, including related activities authorized by NWP.

(2) NWPs do not apply, even if a portion of the project is not dependent on the rest of the project, when any portion of the project is subject to an enforcement action by the Corps or EPA.

Appendix A to Part 330—Nationwide Permits and Conditions

This Appendix contains the optional nationwide permits and conditions for

authorization of certain activities under section 10 of the Rivers and Harbors Act of 1899 and section 404 of the Clean Water Act.

A. Index of the Nationwide Permits and Conditions

Nationwide Permits

1. Aids to Navigation.
2. Structures in Artificial Canals.
3. Maintenance.
4. Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities.
5. Scientific Measurement Devices.
6. Survey Activities.
7. Outfall Structures.
8. Oil and Gas Structures.
9. Structures in Fleeting and Anchorage Areas.
10. Mooring Buoys.
11. Temporary Recreational Structures.
12. Utility Line Backfill and Bedding.
13. Bank Stabilization.
14. Road Crossing.
15. U.S. Coast Guard Approved Bridges.
16. Return Water From Upland Contained

Disposal Areas.

17. Hydropower Projects.
18. Minor Discharges.
19. 20 Cubic Yard Dredging.
20. Oil Spill Cleanup.
21. Surface Mining Activities.
22. Removal of Vessels.
23. Approved Categorical Exclusions.
24. State Administered Section 404 Programs.
25. Structural Discharge.
26. Headwaters and Isolated Waters Discharges.
27. Wetland Restoration Activities.
28. Modifications of Existing Marinas.
29. Reserved.
30. Dewatering Construction Sites.
31. Small Docks and Piers.
32. Completed Enforcement Actions.
33. Temporary Construction and Access.
34. Cranberry Production Activities.
35. Maintenance Dredging of Existing Basins.
36. Boat Ramps.
37. Emergency Watershed Protection.
38. Cleanup of Hazardous and Toxic Waste.
39. Agricultural Discharges.
40. Farm Buildings.

Nationwide Permit Conditions General Conditions

1. Navigation.
2. Proper Maintenance.
3. Erosion and Siltation Controls.
4. Aquatic Life Movements.
5. Equipment.
6. Regional and Case-by-Case Conditions.
7. Wild and Scenic Rivers.
8. Tribal Rights.
9. Water Quality Certification.
10. Coastal Zone Management.
11. Endangered Species.
12. Historic Properties.
13. Notification.

Section 404 Only Conditions

1. Water Supply Intakes.
2. Shellfish Production.
3. Suitable Material.

4. Minimization.
5. Spawning Areas.
6. Obstruction of High Flows.
7. Adverse Impacts From Impoundments.
8. Waterfowl Breeding Areas.
9. Removal of Temporary Fills.

B. Nationwide Permits

1. *Aids to Navigation.* The placement of aids to navigation and regulatory markers which are approved by and installed in accordance with the requirements of the U.S. Coast Guard. (See 33 CFR part 69, subchapter C.) (Section 10)

2. *Structures in Artificial Canals.* Structures constructed in artificial canals within principally residential developments where the connection of the canal to a navigable water of the United States has been previously authorized (see 33 CFR 322.5(g)). (Section 10)

3. *Maintenance.* The repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that such repair, rehabilitation, or replacement does not result in a substantial change in the structure's configuration or the filled area, or an increase in adverse impacts on waters of the United States, and further provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for it in the original permit or the most recently authorized modification. Minor deviations due to changes in materials or construction techniques which are necessary to make repair, rehabilitation, or replacement to current safety standards are permitted. Currently serviceable means usable as is or with some maintenance, but not so degraded as to essentially require reconstruction. It also includes those structures and fills destroyed within the past two years by storms, floods, fire or other discrete events, but which were serviceable immediately preceding that event. Maintenance dredging and beach restoration are not authorized by this nationwide permit. (Sections 10 and 404)

4. *Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities.* Fish and wildlife harvesting devices and activities such as pound nets, crab traps, crab dredging, eel pots, lobster traps, duck blinds, clam and oyster digging, and small fish attraction devices such as open water fish concentrators (sea kites, etc.). This nationwide permit does not authorize artificial reefs or impoundments and semi-impoundments of waters of the United States, for culture or holding of mobile species such as lobster. (Sections 10 and 404)

5. *Scientific Measurement Devices.* Staff gages, tide gages, water recording devices, water quality testing and improvement devices, small weirs and flumes constructed primarily to record water quantity and velocity, and similar structures. (Sections 10 and 404)

6. *Survey Activities.* Survey activities including core sampling, seismic exploratory operations, and plugging of seismic shot holes and other exploratory-type bore holes. Drilling and the discharge of excavated

material from test wells for oil and gas exploration is not authorized by this nationwide permit; the plugging of such wells is authorized. Fill placed for roads, pads and other similar activities is not authorized by this nationwide permit. The discharge of drilling muds and cuttings may require a permit under section 402 of the Clean Water Act. (Sections 10 and 404)

7. Outfall Structures. Activities related to construction of outfall structures and associated intake structures where the effluent from the outfall is authorized, conditionally authorized, or specifically exempted, or are otherwise in compliance with regulations issued under the National Pollutant Discharge Elimination System Program (section 402 of the Clean Water Act), provided that the nationwide permittee notifies the district engineer in accordance with the "Notification" general condition. (Also see 33 CFR 330.1(e).) Intake structures per se are not included—only those directly associated with an outfall structure. (Sections 10 and 404)

8. Oil and Gas Structures. Structures for the exploration, production, and transportation of oil, gas, and minerals on the Outer Continental Shelf within areas leased for such purposes by the Department of the Interior, Minerals Management Service. Such structures shall not be placed within the limits of any designated shipping safety fairway or traffic separation scheme, except temporary anchors that comply with the fairway regulations in 33 CFR 322.5(l). (Where such limits have not been designated, or where changes are anticipated, district engineers will consider discretionary authority in accordance with 33 CFR 330.4(e) and will also review such proposals to ensure that they comply with the provisions of the fairway regulations in 33 CFR 322.5(l).) Such structures will not be placed in established danger zones or restricted areas as designated in 33 CFR part 334 nor EPA or Corps designated dredged material disposal areas. (Section 10)

9. Structures in Fleeting and Anchorage Areas. Structures, buoys, floats and other devices placed within anchorage or fleeting areas to facilitate moorage of vessels where such areas have been established for that purpose by the U.S. Coast Guard. (Section 10)

10. Mooring Buoys. Non-commercial, single-boat, mooring buoys. (Section 10)

11. Temporary Recreational Structures. Temporary buoys, markers, small floating docks, and similar structures placed for recreational use during specific events such as water skiing competitions and boat races or seasonal use provided that such structures are removed within 30 days after use has been discontinued. At Corps of Engineers reservoirs, the reservoir manager must approve each buoy or marker individually. (Section 10)

12. Utility Line Backfill and Bedding. Discharges of material for backfill or bedding for utility lines, including outfall and intake structures, provided there is no change in preconstruction contours. A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquefiable, or slurry substance, for any purpose, and any cable, line, or wire for the

transmission for any purpose of electrical energy, telephone and telegraph messages, and radio and television communication. The term "utility line" does not include activities which drain a water of the United States, such as, drainage tile. Material resulting from trench excavation may be temporarily (six months) sidecast into waters of the United States provided that the material is not placed in such a manner that it is dispersed by currents or other forces. In wetlands, the top 6" to 12" of the trench should generally be backfilled with topsoil from the trench. Excess material must be removed to upland areas immediately upon completion of construction. Any exposed slopes and streambanks must be stabilized immediately upon completion of the utility line. The utility line itself will require a section 10 permit if in navigable waters of the United States. (See 33 CFR part 322). (Section 404)

13. Bank Stabilization. Bank stabilization activities necessary for erosion prevention provided:

- a. No material is placed in excess of the minimum needed for erosion protection;
- b. The bank stabilization activity is less than 500 feet in length;
- c. The activity will not exceed an average of one cubic yard per running foot placed along the bank below the plane of the ordinary high water mark or the high tide line;
- d. No material is placed in any special aquatic site, including wetlands;
- e. No material is of the type or is placed in any location or in any manner so as to impair surface water flow into or out of any wetland area;
- f. No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored trees and treetops may be used in low energy areas); and,
- g. The activity is part of a single and complete project.

Bank stabilization activities in excess of 500 feet in length or greater than an average of one cubic yard per running foot may be authorized if the permittee notifies the district engineer in accordance with the "Notification" general condition and the district engineer determines the activity complies with the terms and conditions of the nationwide permit and the adverse environmental impacts are minimal both individually and cumulatively. (Sections 10 and 404)

14. Road Crossing. Fills for roads crossing waters of the United States (including wetlands and other special aquatic sites) provided:

- a. The width of the fill is limited to the minimum necessary for the actual crossing;
- b. The fill placed in waters of the United States is limited to a filled area of no more than ½ acre. Furthermore, no more than a total of 200 linear feet of the fill for the roadway can occur in special aquatic sites, including wetlands;
- c. The crossing is culverted, bridged or otherwise designed to prevent the restriction of, and to withstand, expected high flows and tidal flows;
- d. The crossing, including all attendant features, both temporary and permanent, is part of a single and complete project for crossing of a water of the United States; and,

e. For fills in special aquatic sites, including wetlands, the permittee notifies the district engineer in accordance with the "Notification" general condition. The notification must also include a delineation of affected special aquatic sites, including wetlands.

Some road fills may be eligible for an exemption from the need for a section 404 permit altogether (see 33 CFR 323.4). Also, where local circumstances indicate the need, district engineers will define the term "expected high flows" for the purpose of establishing applicability of this nationwide permit. (Sections 10 and 404)

15. U.S. Coast Guard Approved Bridges. Discharges of dredged or fill material incidental to the construction of bridges across navigable waters of the United States, including approach fills, cofferdams, abutments, foundation seals, piers, and temporary construction and access fills provided such discharge has been authorized by the U.S. Coast Guard as part of the bridge permit. For approach fills in special aquatic sites the permittee must notify the district engineer in accordance with the "Notification" general condition. The notification must also include a delineation of affected special aquatic sites, including wetlands. Causeways are not included in this nationwide permit and will require an individual or regional section 404 permit. (Section 404)

16. Return Water From Upland Contained Disposal Areas. Return water from an upland contained dredged material disposal area provided the state had issued a site specific certification or waiver under section 401 of the Clean Water Act (see also 33 CFR 325.2(b)(1)). The dredging itself requires a section 10 permit if located in navigable waters of the United States. The return water from a contained disposal area is administratively defined as a discharge of dredged material by 33 CFR 323.2(d) even though the disposal itself occurs on the upland and thus does not require a section 404 permit. This nationwide permit satisfies the technical requirement for a section 404 permit for the return water where the quality of the return water is controlled by the state through the section 401 certification procedures. (Section 404)

17. Hydropower Projects. Discharges of dredged or fill material associated with hydropower projects where the hydropower project which includes the discharge is authorized by the Federal Energy Regulatory Commission (FERC) under the Federal Power Act of 1920, as amended, provided the permittee notifies the district engineer in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. (Also see 33 CFR 330.1(e)). The Federal Power Act exempts such projects from the need for a section 10 permit. Those projects for which the FERC has granted an exemption from licensing pursuant to section 408 of the Energy Security Act of 1980 (16 U.S.C. 2705 and 2708) and section 30 of the Federal Power Act, as amended, do not

require notification to the district engineer. (Section 404)

18. Minor Discharges. Minor discharges of dredged or fill material into all waters of the United States provided:

a. The discharge does not exceed 25 cubic yards;

b. The discharge will not cause the loss of more than $\frac{1}{16}$ acre of a special aquatic site, including wetlands;

c. If the discharge exceeds 10 cubic yards or the discharge is in a special aquatic site, including wetlands, the permittee notifies the district engineer in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. (Also see 33 CFR 330.1(e).)

d. The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. For the purposes of this nationwide permit, the acreage limitation refers to waters of the United States that are physically covered by the discharge plus waters of the United States that are flooded and waters of the United States that are drained so that they would no longer be a water of the United States as a result of the project. (Sections 10 and 404)

19. 20 Cubic Yard Dredging. Dredging of no more than 20 cubic yards below the plane of the ordinary high water mark or the mean high water mark from navigable waters of the United States as part of a single and complete project. This nationwide permit does not authorize the connection of canals or other artificial waterways to navigable waters of the United States (see section 33 CFR 322.5(g)). (Section 10)

20. Oil Spill Cleanup. Activities required for the containment and cleanup of oil and hazardous substances which are subject to the National Oil and Hazardous Substances Pollution Contingency Plan, (40 CFR part 300), provided that the work is done in accordance with the Spill Control and Countermeasure Plan required by 40 CFR 112.3 and provided that the Regional Response Team (if one exists in the area) concurs with the proposed containment and cleanup action. (Sections 10 and 404)

21. Surface Mining Activities. Activities associated with surface coal mining activities provided they are authorized by the Department of the Interior, Office of Surface Mining, or by states with approved programs under title V of the Surface Mining Control and Reclamation Act of 1977 and provided the permittee notifies the district engineer in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. (Also see 33 CFR 330.1(e)). (Sections 10 and 404)

22. Removal of Vessels. Temporary structures or minor fills required for the removal of wrecked, abandoned, or disabled vessels, or the removal of man-made obstructions to navigation. This nationwide permit does not authorize the removal of vessels listed or determined eligible for

listing on the National Register of Historic Places unless the district engineer is notified and indicates that there is compliance with the "Historic Properties" general condition. This nationwide permit does not authorize maintenance dredging, shoal removal, or river bank snagging. Vessel disposal in waters of the United States may need a permit from EPA (see 40 CFR 229.3). (Sections 10 and 404)

23. Approved Categorical Exclusions. Activities undertaken, assisted, authorized, regulated, funded, or financed, in whole or in part, by another Federal agency or department where that agency or department has determined, pursuant to the Council on Environmental Quality Regulation for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR part 1500 *et seq.*), that the activity, work, or discharge is categorically excluded from environmental documentation because it is included within a category of actions which neither individually nor cumulatively have a significant effect on the human environment, and the Office of the Chief of Engineers (ATTN: CECW-OR) has been furnished notice of the agency's or department's application for the categorical exclusion and concurs with that determination. Prior to approval for purposes of this nationwide permit of any agency's categorical exclusions, the Chief of Engineers will solicit comments through publication in the Federal Register. In addressing these comments, the Chief of Engineers may require certain conditions for authorization of an agency's categorical exclusions under this nationwide permit.

For fills in special aquatic sites, including wetlands, the permittee must notify the district engineer in accordance with the "Notification" general condition. The notification must also include a delineation of affected special aquatic sites, including wetlands. (Sections 10 and 404)

24. State Administered section 404 Program. Any activity permitted by a state administering its own section 404 permit program pursuant to 33 U.S.C. 1344(g)-(1) is permitted pursuant to section 10 of the Rivers and Harbors Act of 1899. Those activities which do not involve a section 404 state permit are not included in this nationwide permit, but certain structures will be exempted by section 154 of Public Law 94-587 (see 33 CFR 322.3(a)(2)). (Section 10)

25. Structural Discharge. Discharges of concrete, sand, rock, etc. into tightly sealed forms or cells where the material will be used as a structural member for standard pile supported structures, such as piers and docks; and for linear projects, such as bridges, transmission line footings, and walkways. The NWP does not authorize filled structural members that would support buildings, homes, parking areas, storage areas and other such structures. Housepads or other building pads are also not included in this nationwide permit. The structure itself may require a section 10 permit if located in navigable waters of the United States. (Section 404)

26. Headwaters and Isolated Waters Discharges. Discharges of dredged or fill material into headwaters and isolated waters provided:

a. The discharge does not cause the loss of more than 10 acres of waters of the United States;

b. The permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. (Also see 33 CFR 330.1(e)); and

c. The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project.

For the purposes of this nationwide permit, the acreage of loss of waters of the United States includes the filled area plus waters of the United States that are flooded and waters of the United States that are drained so that they would no longer be a water of the United States as a result of the project. (Section 404)

Note: For the purposes of this proposed rule, a discussion of options being considered for NWP 26 is provided in the Preamble.

27. Wetland Restoration Activities. Activities associated with the restoration of altered and degraded non-tidal wetlands on private lands in accordance with the terms and conditions of a binding wetland restoration contract between the landowner and the U.S. Fish and Wildlife Service or the Soil Conservation Service; or activities associated with the restoration of altered and degraded non-tidal wetlands on Federal surplus lands (e.g. military lands proposed for disposal), Farmers Home Administration inventory properties, and Resolution Trust Corporation inventory properties that are under Federal control prior to being transferred to the private sector. Such activities include, but are not limited to: installation and maintenance of small water control structures, dikes, and berms; backfilling of existing drainage ditches; removal of existing drainage structures; construction of small nesting islands; and other related activities. This nationwide permit applies only to those restoration projects that serve the purpose of restoring natural wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands. This nationwide permit also authorizes any future discharge of dredged or fill material associated with reversion of a restored wetland on private land to its prior condition and use (i.e. prior to restoration under the contract) within five years after expiration of a limited term wetland restoration contract, even if such discharge occurs after this nationwide permit expires. The prior condition will be documented in the original contract, and the determination of return to prior conditions will be made by the Federal agency executing the contract. (Sections 10 and 404)

28. Modifications of Existing Marinas. Reconfigurations of existing docking facilities within an authorized marina area. No dredging, additional slips or dock spaces, or expansion of any kind within waters of the United States are authorized by this nationwide permit. (Section 10)

29. Reserved.**30. Dewatering Construction Sites.**

Temporary cofferdams placed in a manner that will not be eroded by expected flows for the purpose of dewatering construction sites for up to 6 months. Appropriate measures must be taken to maintain near normal downstream flows and to minimize flooding. Cofferdams must not exceed 55% of the width of the waterway. The cofferdams must be entirely removed to upland areas following completion of the activity requiring dewatering and cannot be used to dewater wetlands or other aquatic areas so as to change their use. Structures left in place after the cofferdams are removed require a section 10 permit if located in navigable waters of the United States. (See 33 CFR part 322). (Sections 10 and 404)

31. Small Docks and Piers. Small private fixed or floating boat docks and piers in navigable waters of the United States meeting the following limitations:

- a. The structure shall not extend more than 50 feet waterward of the ordinary high water mark or mean high water mark, or shall not exceed more than 25 percent of the width of the waterbody (whichever is less);
- b. The dock or pier shall not exceed 6 feet in width;
- c. Configuration of the dock or pier may vary in plan (e.g. straight, T, U, or L shaped) provided the total length of all segments does not exceed 100 feet and the surface area does not exceed 600 square feet;
- d. The height of the dock or pier over wetlands must be one foot in height per each foot of width of the dock or pier unless otherwise authorized by the district engineer.
- e. All structures must be set back a minimum of 10 feet from the common boundary line of adjoining properties;
- f. In addition to the above, a swim raft or swim platform that does not exceed 200 square feet, a boat hoist, and a covered boat shed may be included;
- g. Floation material must be free of chemicals, pesticides, oil, gas or other toxic residues or substances; and
- h. No structure can extend within 25 feet of a Federal Channel or anchorage area, or block customary boating channels unless otherwise authorized by the district engineer.

Private boat docks and piers in excess of the limits above may be authorized, if the permittee notifies the district engineer in accordance with the "Notification" general condition; and the district engineer determines that the dock or pier complies with the appropriate terms and conditions of the nationwide permit and that the adverse environmental impacts are minimal both individually and cumulatively. (Section 10)

32. Completed Enforcement Actions. Any discharge of dredged or fill material, structure or work resulting from a court-ordered consent agreement, court decision, or other civil or criminal judicial proceeding or agreement. (Sections 10 and 404)

33. Temporary Construction and Access. Temporary structures and discharges necessary for construction activities or access fills. The permittee must notify the district engineer in accordance with the "Notification" general condition. The notification must also include a restoration

plan of reasonable measures to avoid and minimize impacts to aquatic resources. The district engineer will add special conditions, where necessary, to ensure that adverse environmental impacts are minimal. Such conditions may include: Limiting the temporary work to the minimum necessary; requiring seasonal restrictions; modifying the restoration plan; and requiring alternative construction methods (e.g. construction mats in wetlands where practicable). (Sections 10 and 404)

34. Cranberry Production Activities.

Note: For the purposes of this proposed rule, a discussion of options being considered for NWP 34 is provided in the Preamble.

35. Maintenance Dredging of Existing Basins. Excavation and removal of accumulated sediment for maintenance of existing marina basins, canals, and boat slips provided the dredged material is disposed of at an upland site or a Corps approved disposal site and proper siltation controls are used. (Section 10)

36. Boat Ramps. Activities required for the construction of boat ramps provided:

- a. The discharge is the minimum necessary but does not exceed 50 cubic yards of concrete, rock, crushed stone or gravel into forms, or placement of pre-cast concrete planks or slabs. (Unsuitable material, such as asphalt, is not authorized);
- b. The boat ramp does not exceed 20 feet in width;
- c. The base material is crushed stone, gravel or other suitable material;
- d. The excavation is limited to the area necessary for site preparation and all excavated material is removed to the upland; and
- e. No material is placed in special aquatic sites, including wetlands.

Dredging to provide access to the boat ramp will require a section 10 permit if located in navigable waters of the United States. (Section 10 and 404)

37. Emergency Watershed Protection. Work done by or funded by the Soil Conservation Service qualifying as an "exigency" situation (requiring immediate action) under its Emergency Watershed Protection Program (7 CFR part 624) provided the district engineer is notified in accordance with the "Notification" general condition. (Also see 33 CFR 330.1(e)). (Sections 10 and 404)

38. Cleanup of Hazardous and Toxic Waste. Specific activities required to effect the containment, stabilization or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority provided the permittee notifies the district engineer in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. Court ordered remedial action plans or related settlements are also authorized by this nationwide permit. This nationwide permit does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste. (Sections 10 and 404)

39. Agricultural Discharges. Discharges of dredged or fill material in "farmed wetlands" provided:

- a. The discharges are necessary for agricultural production;
 - b. The Wetlands that were once in use for agricultural crop production have not lain idle so long that modifications to the hydrologic regime are necessary to resume crop production;
 - c. The discharge does not convert naturally vegetated wetlands to agriculture, such as the conversion of bottomland hardwood wetlands to agriculture;
 - d. The discharge will be limited to the minimum necessary for the agricultural production; and
 - e. The permittee notifies the district engineer in accordance with the "Notification" general conditions. The notification must also include a delineation of affected special aquatic sites, including wetlands. (Also see 33 CFR 330.1(e)).
- "Farmed wetlands" are wetlands that were both manipulated and cropped for agricultural commodities before December 23, 1985. They consist of cropped prairie potholes and playa lakes that meet the wetland criteria and other wetlands that are seasonally flooded or ponded for at least 15 consecutive days during the growing season under average conditions (i.e., 50 percent chance of occurrence).

This nationwide permit does not authorize the filling of wetlands so as to raise the elevation to create upland farm land, nor does it authorize filling that will result in the permanent drainage of wetlands to create upland farm land. (Section 404)

40. Farm Buildings. Discharges of dredged or fill material for foundations and building pads for buildings or agricultural related structures necessary for farming activities into jurisdictional wetlands that were in agricultural crop production prior to December 23, 1985 (i.e. farmed wetlands). The discharge will be limited to the minimum necessary (see the "Minimization" section 404 only condition). (Section 404)

C. Nationwide Permit Conditions**General Conditions**

The following general conditions must be followed in order for any authorization by the nationwide permits to be valid:

1. **Navigation.** No activity may cause more than a minimal effect on navigation.
2. **Proper maintenance.** Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.
3. **Erosion and siltation controls.** Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills must be permanently stabilized at the earliest practicable date.
4. **Aquatic life movements.** No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody unless the primary purpose is to impound water.
5. **Equipment.** Heavy equipment working in wetlands must be placed on mats or other

measures must be taken to minimize soil disturbance.

6. Regional and case-by-case conditions. The activity must comply with any regional conditions which may have been added by the division engineer (see 33 CFR 330.4(e)) and any case specific conditions added by the Corps.

7. Wild and Scenic Rivers. No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status. Information on Wild and Scenic Rivers may be obtained from the National Park Service and the U.S. Forest Service.

8. Tribal rights. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. Water quality certification. In certain states, an individual state water quality certification must be obtained or waived (see 33 CFR 330.4(c)).

10. Coastal zone management. In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see section 330.4(d)).

11. Endangered species. No activity may jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Endangered Species Act, or destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the district engineer if any listed species or critical habitat might be affected or is in the vicinity of the project and shall not begin work on the activity authorized by the nationwide permit until notified by the district engineer (see 33 CFR 330.4(g)). Information on the location of threatened or endangered species and their critical habitat can be obtained from the U.S. Fish and Wildlife Service and National Marine Fisheries Service.

12. Historic properties. The permittee must notify the district engineer if the authorized activity may adversely affect any historic properties listed, eligible, or potentially eligible for listing on the National Register of Historic Places. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places. Where such properties may be affected, the permittee may not begin the authorized activity until notified by the district engineer (see 33 CFR 330.4(h)).

13. Notification. Where required by the terms of the NWP the prospective permittee must notify the district engineer as early as possible but not later than 30 days prior to commencing the activity. If the permittee is not notified otherwise within the 30-day period the permittee may begin the activity. Subsequently the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

The notification must be in writing and include the following information and any required fees:

(a) Name, address and telephone number of the permittee;

(b) Location of the proposed project;
(c) Brief description of the proposed project and its purpose;

(d) Where required by the terms of the NWP a delineation of affected special aquatic sites, including wetlands.

The standard individual permit application form (Form ENG 4345) may be used as the notification.

If, after reviewing the notification for a NWP which requires a delineation of special aquatic sites, including wetlands, the DE determines that the impacts are more than minimal, then the DE will require an individual permit unless the prospective permittee elects to propose mitigation so that the impacts would be minimal.

Wetlands Delineations: Wetland delineations must be prepared in accordance with the Federal Manual for Identifying and Delineating Jurisdictional Wetlands or the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites. There may be some delay if the Corps does the delineation. Furthermore, the 30 day period will not start until the wetland delineation has been completed.

Mitigation: Factors that the DE will consider when determining the acceptability of appropriate and practicable mitigation, include but are not limited to:

(a) To be practicable the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of overall project purposes;

(b) To the extent appropriate, permittees should consider mitigation banking or contributions to wetland trust funds as an acceptable form of "appropriate and practicable mitigation."

Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: reducing the size of the project; incorporating construction practices that minimize erosion and sedimentation; avoiding construction during spawning and migration periods; establishing buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and enhancing similar habitat.

Section 404 Only Conditions

In addition to the General Conditions, the following conditions apply only to activities that involve the discharge of dredged or fill material and must be followed in order for authorization by the nationwide permits to be valid:

1. Water supply intakes. No discharge of dredged or fill material may occur in the proximity of a public water supply intake except where the discharge is for repair of the public water supply intake structures or adjacent bank stabilization.

2. Shellfish production. No discharge of dredged or fill material may occur in areas of concentrated shellfish production, unless the discharge is directly related to a shellfish harvesting activity authorized by nationwide permit 4.

3. Suitable material. No discharge of dredged or fill material may consist of unsuitable material (e.g., trash, debris, car bodies, etc.) and material discharged must be

free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

4. Minimization. Discharges of dredged or fill material into waters of the United States must be minimized at the project site (i.e. on-site) to the maximum extent practicable.

5. Spawning areas. Discharges in spawning areas during spawning seasons must be avoided to the maximum extent practicable.

6. Obstruction of high flows. To the maximum extent practicable, discharges must not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

7. Adverse impacts from impoundments. If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

8. Waterfowl breeding areas. Discharges into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

9. Removal of temporary fills. Any temporary fills must be removed in their entirety and the affected areas returned to their preexisting elevation.

[FR Doc. 91-8202 Filed 4-9-91; 8:45 am]

BILLING CODE 5810-01-M

33 CFR Part 330

Proposal To Amend Nationwide Permit Program Regulations and Issue, Reissue, and Modify Nationwide Permits; Hearing

AGENCY: U.S. Army Corps of Engineers, DoD.

ACTION: Notice of public hearing.

SUMMARY: In the Proposed Rules section of this issue of the Federal Register the Corps of Engineers is publishing its proposal to amend the nationwide permit program regulations and to issue, reissue, and modify nationwide permits. The Corps of Engineers will hold a public hearing on the nationwide permits contained in that proposal. The hearing will be held in Washington, DC on May 10, 1991 at the Quality Hotel Capitol Hill and is open to the public. Comments may be submitted in person at the hearing or in writing to the Office of the Chief of Engineers at the address given below. The hearing record will remain open until May 27, 1991. The legal authority for this hearing is section 404 of the Clean Water Act (33 U.S.C. 1344) and section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

DATES: The hearing will be held from 1 p.m. to 5 p.m. on May 10, 1991.

ADDRESSES: The hearing will be held at the Quality Hotel Capitol Hill, 415 New Jersey Ave. NW., Washington, DC. Written comments may be submitted to HQUSACE, ATTN: CECW-OR, Washington, DC, 20314-1000.

FOR FURTHER INFORMATION CONTACT: Mr. Ed Bonner or Mr. Sam Collinson, Regulatory Branch, Office of the Chief of Engineers, at (202) 272-0199.

SUPPLEMENTARY INFORMATION: The hearing will be held in accordance with the Corps public hearing regulations at 33 CFR part 327. The hearing will be transcribed. Persons desiring to testify at the hearing are requested to limit their statements to 15 minutes. Filing of a written statement at the time of giving the oral statement would be helpful and facilitate the job of the court reporter. Persons wishing to speak at the hearing need only fill out a card that will be available at the entrance to the hearing room. Advance requests to speak may be mailed to the Office of the Chief of Engineers at the address given above.

Dated: March 15, 1991.

Steve Matteson,

*Colonel, Corps of Engineers, Assistant Chief,
Construction and Readiness Division,
Directorate of Civil Works.*

[FR Doc. 91-8203 Filed 4-9-91; 8:45 am]

BILLING CODE 3810-01-M

33 CFR Parts 320 through 330

**Thursday
November 13, 1986**

Part II

**Department of
Defense**

**Corps of Engineers, Department of the
Army**

**33 CFR Parts 320 through 330
Regulatory Programs of the Corps of
Engineers; Final Rule**

DEPARTMENT OF DEFENSE**Corps of Engineers, Department of the Army****33 CFR Parts 320, 321, 322, 323, 324, 325, 326, 327, 328, 329 and 330****Final Rule for Regulatory Programs of the Corps of Engineers****AGENCY:** Corps of Engineers, Army Department, DOD.**ACTION:** Final rule.

SUMMARY: We are hereby issuing final regulations for the regulatory program of the Corps of Engineers. These regulations consolidate earlier final, interim final, and certain proposed regulations along with numerous changes resulting from the consideration of the public comments received. The major changes include modifications that provide for more efficient and effective management of the decision-making processes, clarifications and modifications of the enforcement procedures, modifications to the nationwide permit program, revision of the permit form, and implementation of special procedures for artificial reefs as required by the National Fishing Enhancement Act of 1984.

EFFECTIVE DATE: January 12, 1987.

FOR FURTHER INFORMATION CONTACT: Mr. Sam Collinson or Mr. Bernie Goode, HQDA (DAEN-CWO-N), Washington, DC 20314-1000. (202) 272-0199.

SUPPLEMENTARY INFORMATION:**Consolidation of Corps Permit Regulations**

These final regulations consolidate and complete the six following rulemaking events affecting the Corps regulatory program:

1. *Interim Final Regulations.* These regulations contained Parts 320-330 and were published (47 FR 31794) on July 22, 1982, to incorporate policy and procedural changes resulting from legislative, judicial, and administrative actions that had occurred since the previous final regulations had been published in 1977. Because it had been almost two years since we had proposed changes to the 1977 regulations, we published the 1982 regulations as "interim final" and asked for public comments. We received nearly 200 comments.

2. *Proposed Regulatory Reform Regulations.* On May 12, 1983, we published (48 FR 21466) proposed revisions to the interim final regulations to implement the May 7, 1982, directives of the Presidential Task Force on Regulatory Relief. The Task Force

directed the Army to reduce uncertainty and delay, give the states more authority and responsibility, reduce conflicting and overlapping policies, expand the use of general permits, and redefine and clarify the scope of the permit program. Since these regulations proposed changes to our existing nationwide permits and the addition of two new nationwide permits, a public hearing was held in Washington, DC, on October 12, 1983, to obtain comments on these proposed changes. As a result of the public comments received, nearly 500 in response to the proposed regulations and 22 at the public hearing, we have determined that some of the proposed revisions should be adopted and some should not. We have adopted some of the provisions that were designed to clarify policies for evaluating permit applications, to revise certain permit processing procedures, to add additional conditions to existing nationwide permits, and to modify certain nationwide permit procedures. We have not adopted some of the other proposed changes, including the two proposed new nationwide permits.

3. *Settlement Agreement Final Regulations.* On October 5, 1984, we published (49 FR 39478) final regulations to implement a settlement agreement reached in a suit filed by 18 environmental organizations in December of 1982 against the Department of the Army and the Environmental Protection Agency (*NWF v. Marsh*) concerning several provisions of the July 22, 1982, interim final regulations. The court approved the settlement agreement on February 10, 1984, and on March 29, 1984, we published (49 FR 12660) the implementing proposed regulations. We received over 150 comments on these proposed regulations covering a full range of views. Those comments which were applicable to the provisions of the March 29, 1984, proposals were considered and addressed in the final regulations published on October 5, 1984. The remaining comments have been considered in the development of the final regulations we are issuing today.

In the October 5, 1984, final rule there were several new provisions relating to the 404(b)(1) guidelines. In 33 CFR 320.4(a)(1) we clarified the fact that no 404 permit can be issued unless it complies with the 404(b)(1) guidelines.

If a proposed action complies with the guidelines, a permit will be issued unless the district engineer determines that it will be contrary to the public interest. In 33 CFR 323.8(a) we stated that district engineers will deny permits for discharges which fail to comply with

the 404(b)(1) guidelines, unless the economic impact on navigation and anchorage necessitates permit issuance pursuant to section 404(b)(2) of the Clean Water Act. Although no 404 permit can be issued unless compliance with the 404(b)(1) guidelines is demonstrated (i.e., compliance is a prerequisite to issuance), the 404(b)(1) evaluation is conducted simultaneously with the public interest review set forth in 33 CFR 320.4(a).

4. *Proposed Permit Form Regulations.* On May 23, 1985, we published (50 FR 21311) proposed revisions to 33 CFR Part 325 (Appendix A), which contains the standard permit form used for the issuance of Corps permits and the related provisions concerning special conditions. This proposal provided for the complete revision of the permit form and its related provisions to make them easier for permittees to understand. General permit conditions were written in plain English and greatly reduced in number; unnecessary material was deleted; and material which is informational in nature was reformatted under a "FURTHER INFORMATION" heading. We received 18 comments on this proposal.

5. *Proposed Regulations to Implement the National Fishing Enhancement Act of 1984 (NFEA).* On July 28, 1985, we published (50 FR 30479) proposed regulations to implement a portion of the Corps regulatory responsibilities pursuant to the NFEA. Specialized procedures relative to the processing of Corps permits for artificial reefs were proposed for inclusion in Parts 322 and 325. Eight organizations commented on these proposed regulations. The NFEA also authorizes the Secretary of the Army to assess a civil penalty on any person who, after notice and an opportunity for a hearing, is found to have violated any provision of a permit issued for an artificial reef. Procedures for implementing such civil penalties will be proposed at a later date. In addition, we are hereby notifying potential applicants for artificial reef permits that the procedures contained in Part 323 relating to the discharge of dredged or fill materials and those in Part 324 relating to the transportation of dredged material for the purpose of dumping in ocean waters will be used in the processing of artificial reef permits when applicable.

6. *Proposed Regulations (Portion of Part 323 and All of Part 326).* On March 20, 1986, we published (51 FR 9691) a proposed change to 33 CFR 323.2(d), previously 323.2(j), to reflect the Army's policy regarding *de minimis* or incidental soil movements occurring

during normal dredging operations and a proposed, complete revision of the Corps of Engineers enforcement procedures (33 CFR Part 326). Seventeen comment letters were received on these proposed regulations. These comments and the resulting changes reflected in the final regulations for § 323.2(d) and Part 326 are discussed in detail below.

Environmental Documentation

We have determined that this action does not constitute a major Federal action significantly affecting the quality of the human environment. Appropriate environmental documentation has been prepared for all permit decisions. Environmental assessments for each of the nationwide permits previously issued or being modified today are available from the Corps of Engineers. You may obtain these assessments by writing to the address listed in this preamble. Considering the potential impacts, we have determined that none required an environmental impact statement.

Discussion of Public Comments and Changes

Part 320—General Regulatory Policies

Section 320.1(a)(6): In order to provide clarity to the public, we have added a provision to codify existing practice that when a district engineer makes certain determinations under these regulations, the public can rely on that determination as a Corps final agency action.

Section 320.3(o): The National Fishing Enhancement Act of 1984 has been added to the list of related laws in § 320.3.

Section 320.4: In the May 12, 1983, proposed rule and the March 29, 1984, proposed rule we proposed changes to §§ 320.4(a)(1)—public interest review, 320.4(b)(5)—effect on wetlands, 320.4(c)—fish and wildlife, 320.4(g)—consideration of property ownership, and 320.4(j)—other Federal, state or local requirements. Changes to these paragraphs were adopted in the October 5, 1984, final rule. The various comments relating to these proposals have been fully discussed in the October 5, 1984 final rule (49 FR 39478).

Section 320.4(a)(3): Many commenters objected, some strongly, to the deletion in the October 5, 1984, final regulations of the term "great weight" from § 320.4(c), the paragraph concerning the consideration of opinions expressed by fish and wildlife agencies. Many stated that fish and wildlife agencies had the expertise and knowledge to know the impact of work in wetlands; therefore, their opinions should be given strong

consideration. Some commenters supported removal of the "great weight" statement expecting less value would be given fish and wildlife agency views. It is not our intention to reduce or discount the value or expertise of fish and wildlife agency comments or those of any other experts in any field. Comments also varied from support of to objection to the deletion of the "great weight" statement from the other policy statements such as energy and navigation in § 320.4. Therefore, we added a new paragraph (a)(3) to clarify our position on how we consider comments from the public, including those from persons or agencies with special expertise on particular factors in the public interest review.

Section 320.4(b)(1): One commenter objected to the placement of the word "some" in this paragraph as a rewrite of E.O. 11990 which places no qualifier on "wetlands" indicating that all wetlands are vital. We have found through experience in administering the Section 404 permit program that wetlands vary in value. While some are vital areas, others have very little value; however, most are important. We recognize that "some wetlands are vital . . ." is being read by some people as "Some wetlands are important . . ." This was not our intent. To avoid this confusion we have revised this paragraph by deleting "some wetlands are vital areas . . ." and indicating that "most" wetlands are important.

Section 320.4(b)(2)(vi): We have included in the list of important wetlands those wetlands that are ground water discharge areas that maintain minimum baseflows important to aquatic resources. Scientific research now indicates that wetlands more often serve as discharge areas than recharge areas. Those discharge areas which are necessary to maintain a minimum baseflow necessary for the continued existence of aquatic plants and animals are recognized as important.

Section 320.4(b)(2)(viii): We have included in the list of important wetlands those which are unique in nature or scarce in quantity to the region or local area.

Section 320.4(d): We have revised this paragraph to clarify that impacts from both point source and non-point source pollution are considered in the Corps public interest review. However, section 208 of the Clean Water Act provides for control of non-point sources of pollution by the states.

Section 320.4(j)(1): Clarifying language has been added to this section to eliminate confusion regarding denial procedures when another Federal, state,

and/or local authorization or certification has been denied.

Section 320.4(p): Some commenters felt that environmental considerations should take precedence over other factors. Other commenters believed that guidance should be given as to who determines whether there are environmental benefits to a project. Many commenters indicated that the regulation does not define the possible range of environmental benefits that will be considered. Environmental benefits are determined by the district engineer and the district staff based on responses received from the general public, special interest groups, other government agencies and staff evaluation of the proposed activity. Defining the possible range of environmental benefits would be almost impossible to cover in the rules in sufficient detail, since circumstances vary considerably for each permit application. After considering all the comments we have decided to make the change as proposed on May 12, 1983.

Section 320.4(q): Some commenters believed that this rule would distort review criteria by inserting inappropriate economic assumptions and minimizing environmental criteria. Some commenters suggested that the Corps revise this paragraph to include a provision to challenge an applicant's economic data and that of governmental agencies as well. Other commenters believe that economic factors do not belong in these regulations since the intent of the Clean Water Act is: "to restore and maintain the chemical, physical, and biological integrity of the nation's waters"; therefore, any regulation under the CWA should have, as its primary objective, provisions which give environmental factors the greatest weight. They were concerned that this part may be applied to allow economic benefits to offset negative environmental effects. Some commenters, however, believed that the Corps should assume that projects proposed by state and local governmental interests and private industry are economically viable and are needed in the marketplace. They also believed that the Corps and other governmental agencies should not engage in detailed economic evaluations. Economics has been included in the Corps list of public interest factors since 1970. However, there has never been a specific policy on economics in the regulations. The Corps generally accepts an applicant's determination that a proposed activity is needed and will be economically viable, but makes its own decision on whether

a project should occur in waters of the U.S. The district engineer may determine that the impacts of a proposed project on the public interest may require more than a cursory evaluation of the need for the project. The depth of the evaluation would depend on the significance of the impacts and in unusual circumstances could include an independent economic analysis. The Corps will balance the economic need for a project along with other factors of the public interest. Accordingly, § 320.4(q) has been modified from the proposed rule to provide that the district engineer may make an independent review of the need for a project from the perspective of the public interest.

Section 320.4(r): Many comments were offered as to the intent, scope and implementation of the proposed mitigation policy. Comments were almost equally divided between those who felt that the policy should be expanded and those that felt it should be more limited. The issues that were raised include: mitigation should not be used to outweigh negative public interest factors; mitigation should not be integrated into the public interest review; mitigation should be on-site to the maximum extent practicable; off-site mitigation extends the range of concerns beyond those required by Section 404. A wide range of views were expressed on our proposed mitigation policy, but virtually all commenters expressed need for a policy. The Corps has been requiring mitigation as permit conditions for many years based on our regulations and the 404(b)(1) guidelines. Because of the apparent confusion on this matter, we have decided to clarify our existing policy at 320.4(r).

The concept of "mitigation" is many-faceted, as reflected in the definition provided in the Council on (Environmental Quality (CEQ) NEPA regulations at 40 CFR 1508.20. Viewing "mitigation" in its broadest sense, practically any permit condition or best management practice designed to avoid or reduce adverse effects could be considered "mitigation." Mitigation considerations occur throughout the permit application review process and are conducted in consultation with state and Federal agencies responsible for fish and wildlife resources. District engineers will normally discuss modifications to minimize project impacts with applicants at pre-application meetings (held for large and potentially controversial projects) and during the processing of applications. As a result of these discussions, district engineers may condition permits to

require minor project modifications, even though that project may satisfy all legal requirements and the public interest review test without those modifications.

For applications involving Section 404 authority, mitigation considerations are required as part of the Section 404(b)(1) guidelines analysis; permit conditions requiring mitigation must be added when necessary to ensure that a project complies with the guidelines. To emphasize this, we have included a footnote to § 320.4(r) regarding mitigation requirements for Section 404, Clean Water Act, permit actions. Some types of mitigation measures are enumerated in Subpart H of the guidelines. Other laws such as the Endangered Species Act may also lead to mitigation requirements in order to ensure that the proposal complies with the law. In addition to the mitigation developed in preapplication consultations and through application of the 404(b)(1) guidelines and other laws, these regulations provide for further mitigation should the public interest review so indicate.

One form of mitigation is "compensatory mitigation," defined at 40 CFR 1508.20(e) to mean "compensating for the impact by replacing or providing substitute resources or environments." Federal and state natural resource agencies sometimes ask the Corps to require permit applicants to compensate for wetlands to be destroyed by permitted activities. Such compensatory mitigation might be provided by constructing or enhancing a wetland; by dedicating wetland acreage for public use; or by contributing to the construction, enhancement, acquisition or preservation of such "mitigation lands." Compensatory mitigation of this type is often referred to as "off-site" mitigation. However, it can be provided either on-site or off-site. Such mitigation can be required by permit conditions only in compliance with 33 CFR 325.4, and specifically with 33 CFR 325.4(a)(3). In addition to those restrictions, the Corps has for many years declined to use, and does now decline to use, the public interest review to require permit applicants to provide compensatory mitigation unless that mitigation is required to ensure that an applicant's proposed activity is not contrary to the public interest. If an applicant refuses to provide compensatory mitigation which the district engineer determines to be necessary to ensure that the proposed activity is not contrary to the public interest, the permit must be denied. If an applicant voluntarily offers to provide

compensatory mitigation in excess of the amount needed to find that the project is not contrary to the public interest, the district engineer can incorporate a permit condition to implement that mitigation at the applicant's request.

Part 321—Permits for Dams and Dikes in Navigable Waters of the United States

The Secretary of the Army delegated his authority under Section 9 of the Rivers and Harbors Act of 1899, 33 U.S.C. 401 to the Assistant Secretary of the Army (Civil Works). The Assistant Secretary in turn delegated his authority under Section 9 for structures in intrastate navigable waters of the United States to the Chief of Engineers and his authorized representative. District engineers have been authorized in 33 CFR 325.8 to issue or deny permits for dams or dikes in intrastate navigable waters of the United States" under Section 9 of the Rivers and Harbors Act of 1899. This section of the regulation and §§ 325.5(d) and 325.8(a) have been revised to reflect this delegation.

Part 322—Permits for Structures or Work in or Affecting Navigable Waters of the United States

Section 322.2(a): We have revised the term "navigable waters of the United States" to reference 33 CFR Part 329 since it and all other terms relating to the geographic scope of the Section 10 program are defined at 33 CFR Part 329.

Section 322.2(b): Commenters on the definition of structures indicated that several terms needed further amplification. It was suggested that the term "boom" be defined to exclude a float boom, as would be used in front of a spillway. The term was not redefined because those dams constructed in Section 10 waters do require a permit for a float boom. However, most dams in the United States are constructed in non-Section 10 waters and do not require a permit for a boom (floating or otherwise) unless it involves the discharge of dredged or fill material. It was suggested that the term "obstacle or obstruction" be modified to reinstitute the language from the July 19, 1977, final regulations. We have adopted the suggestion which will clarify our intent that obstacles or obstructions, whether permanent or not, do require a permit; it will also assist in jurisdictional decisions on enforcement. It was suggested that "boat docks" and "boat ramps" be included in the list of structures, since these are frequently proposed structures. These have been included. It was suggested that the term "artificial gravel island" be added, as

Congress, by Section 4(e) of the Outer Continental Shelf Lands Act of 1953, extended the regulatory program to the Outer Continental Shelf, and specifically cited artificial islands as falling under Section 10 jurisdiction. This type of structure is also constructed on state lands within the territorial seas. Accordingly, artificial islands have been included.

Section 322.2(c): Two commenters discussed the definition of "work"; one stated that it was too broad and the other that it should be expanded. The present definition of the term "work" has remained unchanged for many years and has achieved general acceptance by the regulators and those requiring a permit. The present language has been retained.

Sections 322.2(f)(2) and 323.2(n)(2): Both of these sections are concerned with the definition of general permits. Several commenters expressed support for the additional criteria contained in the May 12, 1983 proposed rule. Other commenters expressed concern that the proposed criteria were illegal. Some commenters believed that the proposal would amount to a delegation of the Section 404 program to the states, and that this is not a prerogative of the Corps of Engineers. Many commenters expressed serious concern that state programs were not comprehensive enough to properly represent the public interest review. Still others objected to the proposal because there were no assurances that the state approved projects themselves were "similar in nature" or would have "minimal adverse environmental effects"; those objections extended to the proposal to assess the impacts of the differences in the State/Corps decisions. Some commenters suggested that an automatic "kick-out" provision, whereby concerned agencies could cause the Corps to require an individual application on a case-by-case basis, may provide sufficient safeguards for the proposal to go forward. Some commenters suggested that a preferred approach to reducing duplication would be for the Corps to express, in its regulations, direction for its districts to vigorously pursue joint processing, permit consolidation, pre-application consultation, joint applications, joint public notices and special area management planning. This change was proposed in 1983. At that time we believed that additional flexibility in the types of general permits which could be developed was necessary to effectively administer the regulatory program. Our experience since then has shown that the existing definitions of general permit at both of these sections is flexible

enough to develop satisfactory general permits. Therefore we have decided not to adopt this proposed change. Because several definitions previously found in Part 323 have been moved to Part 328, § 323.2(n) has been redesignated § 323.2(h).

Section 322.2(g): This section adds the definition of the term "artificial reefs" from the National Fishing Enhancement Act and clarifies what activities or structures the term does not include. Two commenters suggested modifications, or clarifications, to this definition to ensure that old oil and gas production platforms can be considered for use as artificial reefs. We agree with their suggestion. The definition would include the use of some production platforms, either abandoned in place or relocated, as artificial reefs as long as they are evaluated and permitted as meeting the standards of Section 203 of the Act.

Section 322.2(h): This section was proposed to add the definition of the term "outer continental shelf" from the Outer Continental Shelf Lands Act (OCSLA). Two commenters suggested that the territorial sea off the Gulf Coast of Florida and Texas is greater than three nautical miles from the coast line. We have determined that this is not the case, and have decided not to include a definition of the term "outer continental shelf" in these regulations and to rely instead on the definition of this term that is already in the OCSLA.

Sections 322.3(a) and 322.4: Activities which do not require a permit have been moved from § 322.3 and included in § 322.4. The limitation of the applicability of Section 154 of the Water Resource Development Act of 1976 in certain waterbodies has been deleted because no such limitation exists in that Act.

Section 322.5(b): This section addresses the policies and procedures for processing artificial reef applications. One commenter suggested that the opportunity for a general permit should not be precluded by this section. A general permit for artificial reefs is not precluded by this regulation change. Furthermore, the opportunity for the issuance of general permits may be enhanced with the implementation of the National Artificial Reef Plan by the Department of Commerce.

Section 322.5(b)(1): This section cites the standards established under section 203 of the National Fishing Enhancement Act. These standards are to be met in the siting and construction, and subsequent monitoring and managing, of artificial reefs. Two commenters insisted that these should

be called goals or objectives, and several commenters said that more specific guidelines or criteria are needed to evaluate proposed artificial reefs against the standards or goals. Section 204 of the Act states that the Department of Commerce will develop a National Artificial Reef Plan which will be consistent with the standards established under Section 203, and will include criteria relating to siting, constructing, monitoring, and managing artificial reefs. Specification of such criteria in these rules would be inappropriate in view of the intent of Congress to have the Department of Commerce perform this function. The National Marine Fisheries Service (NMFS), acting for the Department of Commerce, has consulted with us in developing the National Artificial Reef Plan, and we will continue to consult with them to ensure permits are issued consistent with the criteria established in that plan. The Department of Commerce announced the availability of the National Artificial Reef Plan in the *Federal Register* on November 14, 1985.

The U.S. Coast Guard was particularly concerned that these rules be more specific with regard to information and criteria that will be used to ensure navigation safety and the prevention of navigational obstructions. Section 204 of the National Fishing Enhancement Act requires that the Department of Commerce consult the U.S. Coast Guard in the development of the National Artificial Reef Plan regarding the criteria to be established in the plan. One of the standards with which the criteria must be consistent is the prevention of unreasonable obstructions to navigation. In addition, the district engineer shall consult with any governmental agency or interested party, as appropriate, in issuing permits for artificial reefs. This includes pre-application consultation with the U.S. Coast Guard, and placing conditions in permits recommended by the U.S. Coast Guard to ensure navigational safety.

Section 322.5(b)(2) and (3): These sections state that the district engineer will consider the National Artificial Reef Plan, and that he will consult with governmental agencies and interested parties, as necessary, in evaluating a permit application. Two commenters supported this coordination. The NMFS requested notification of decisions to issue permits which either deviate from or comply with the plan. Paragraph (b)(2) requires the district engineer to notify the Department of Commerce of any need to deviate from the plan. In addition, the NMFS receives a monthly list of permit applications on which the

district engineer has taken final action. This should be sufficient notification for those permits which do not deviate from the plan.

Section 322.5(b)(4): Although some commenters strongly supported this section describing the liability of permittees authorized to build artificial reefs, several expressed concern that this provision was not clearly written or required specific criteria to assist the district engineer in determining financial liability. This paragraph has been rewritten to correspond closely with the wording in the National Fishing Enhancement Act, and examples of ways an applicant can demonstrate financial responsibility have been added.

Section 322.5(g): We have revised this paragraph on canals and other artificial waterways by eliminating procedural-only provisions which are redundant with requirements in 33 CFR Parts 325 and 326.

Section 322.5(l): A new section on fairways and anchorage areas has been added. This section was formerly found at 33 CFR 209.135. We are moving this provision to consolidate all of the permit regulations on structures to this part. We will delete 33 CFR 209.135 by separate notice in the Federal Register.

Part 323—Permits for Discharges of Dredged or Fill Material Into Waters of the United States

Section 323.2: Several commenters supported moving the definitions relating to waters of the United States to a separate paragraph. As proposed on May 12, 1983, we have moved the term "waters of the United States" and all other terms related to the geographic scope of jurisdiction of Section 404 of the CWA to 33 CFR Part 328 which is titled "Definition of the Waters of the United States." We believe that, by setting these definitions apart in a separate and distinct Part of the regulation and including in that Part all of the definitions of terms associated with the scope of the Section 404 permit program, we are better able to clarify the scope of our jurisdiction. We have not changed any existing definitions nor added any definitions proposed on May 12, 1983. Comments related to these definitions are addressed in Part 328 below.

We have not changed the definition of fill material at § 323.2(e). However, the Corps has entered into a Memorandum of Agreement with the Environmental Protection Agency to better identify the difference between section 402 and section 404 discharges under the Clean Water Act.

Section 323.2(d)—Previously 323.2(j): The proposed modification of this paragraph states that "*de minimis* or incidental soil movement occurring during normal dredging operations" is not a "discharge of dredged material," the term defined by this paragraph.

Eight commenters raised concerns relating to this provision. Most of these supported the regulation of "*de minimis* or incidental soil movement occurring during normal dredging operations" in varying degrees. Two specifically expressed a belief that the fallback from dredging operations constituted a discharge within the intent of section 404 of the Clean Water Act. One of these stated that the proposed provision was contrary to a binding decision by the U. S. District Court for the Northern District of Ohio in *Reid v. Marsh*, No. C-81-890 (N. D. Ohio, 1984). Another commenter objected to the provision on the basis that it would force states that perceived a need to regulate dredging operations to regulate such activities under their National Pollutant Discharge Elimination System authority. The recommendations of the above group of commenters included the regulation of dredging activities on an individual or general permit basis or on a selective basis that would take into account the scopes and anticipated effects of the projects involved. Two commenters expressed concern over the fact that discharge activities such as the sidecasting of dredged material might be considered "soil movement" that was "incidental" to a "normal dredging operation." The final concern raised related to the list of dredging equipment cited as examples. This list was seen, alternatively, as too limited or as not limited enough in reference to the types of equipment that may be used in a "normal dredging operation." Four commenters supported the proposed provision as a reasonable interpretation of the section 404 authority of the Corps.

Section 404 clearly directs the Corps to regulate the *discharge* of dredged material, not the dredging itself. Dredging operations cannot be performed without some fallback. However, if we were to define this fallback as a "discharge of dredged material," we would, in effect, be adding the regulation of dredging to section 404 which we do not believe was the intent of Congress. We have consistently provided guidance to our field offices since 1977 that incidental fallback is not an activity regulated under section 404. The purpose of dredging is to remove material from the water, not to discharge material into the water. Therefore, the fallback in a "normal dredging operation" is incidental to the

dredging operation and *de minimis* when compared to the overall quantities removed. If there are tests involved, we believe they should relate to the dredging operator's intent and the result of his dredging operations. If the intent is to remove material from the water and the results support this intent, then the activity involved must be considered as a "normal dredging operation" that is not subject to section 404.

Based on the above discussion, we have not adopted any of the recommendations relating to the revision or deletion of this provision for the purpose of bringing about the regulation of "normal dredging operations" in varying degrees. We have replaced the "or" between the words "*de minimis*" and "incidental" with a comma to more clearly reflect the fact that the incidental fallback from a "normal dredging operation" is considered to be *de minimis* when compared to the overall quantities removed. In addition, we have deleted the examples of dredging equipment at the end of the proposed provision to make it clear that *de minimis* or incidental soil movement occurring during any "normal dredging operation" is not a "discharge of dredged material." However, we wish to also make it clear that this provision applies only to the incidental fallback occurring during "normal dredging operations" and not to the disposal of the dredged material involved. If this material is disposed of in a water of the United States, by sidecasting or by other means, this disposal will be considered to be a "discharge of dredged material" and will be subject to regulation under section 404.

Section 323.4: We have made some minor corrections to this section to be consistent with EPA's permit exemption regulations at 40 CFR Part 233.

Part 324—Ocean Disposal

Section 324.4(c): The language of this section on the EPA review process has been rewritten to clarify the procedures the district engineer will follow when the Regional Administrator advises that a proposed dumping activity does not comply with the criteria established pursuant to section 102(a) of the Marine Protection, Research and Sanctuaries Act (MPRSA), or the restrictions established pursuant to section 102(c) thereof, in accordance with the provisions of 40 CFR 225.2(b).

Part 325—Permit Processing

Several minor changes have been made in this part. These changes involve requesting additional information from

an applicant, providing for a reasonable comment period, combining permit documentation, and documenting issues of national importance.

Section 325.1(b): This section has been rewritten to clarify the pre-application consultation process for major permit applications. No significant changes have been made in the content of this section.

Section 325.1(d)(1): One commenter on this content of applications paragraph asked that where, through experience, it has been found that specific items of additional information are routinely necessary for permit review, the district engineer should be allowed to develop supplemental information forms. Another observed that restricting production of local forms may inhibit joint permit application processes. If it becomes necessary to routinely request additional information, the Corps can change the application form, but that must be done at Corps headquarters with the approval of the Office of Management and Budget. This change does not place any additional restrictions on developing local forms. As is now the case, local forms may be developed for joint processing with a Federal or state agency.

Section 325.1(d)(8): This is a new section requiring an applicant to include provisions for siting, construction, monitoring and managing the artificial reef as part of his application for a permit. One commenter suggested that the criteria for accomplishing these activities must be completed in the National Artificial Reef Plan before establishment of such reefs can be encouraged. Another recommended that the regulation describe more specifically the information to be supplied by an applicant with regard to monitoring and maintaining an artificial reef. The plan includes general mechanisms and methodologies for monitoring the compliance of reefs with permit requirements, and managing the use of those reefs. It can be used as a guide for the information to be supplied by the permit applicant. Specific conditions for monitoring and managing, as well as for maintaining artificial reefs generally need to be site-specific and should be developed during permit processing.

The U.S. Coast Guard requested that they be provided copies of permit applications for artificial reefs, and that a permittee be required to notify the Coast Guard District Commander when reef construction begins and when it is completed so timely information can be included in notices to mariners. The district engineer may elect to consult with the Coast Guard, when appropriate, during the pre-application

phase of the permit process. At any rate, the Coast Guard will receive public notices of permit applications, and may make recommendations to ensure navigational safety on a case-by-case basis. Appropriate conditions can be added to permits to provide for such safety.

Section 325.1(e): Several commenters expressed concern with language changes requiring only additional information "essential to complete an evaluation" rather than the former requirement for information to "assist in evaluation of the application." They felt this change would reduce the data base on which decisions would be made. They indicated further that without necessary additional information, district engineers would not be able to make a reasonable decision, the public's ability to provide meaningful comments would be limited, and resource agencies would have to spend more time contacting the applicant and gathering information. They felt this could increase delays rather than limiting them. Several commenters asked that the regulations be altered to specifically require submission of information necessary for a 404(b)(1) evaluation. Similar concerns were expressed with the change stating that detailed engineering plans and specifications would not be required for a permit application. Commenters advised that without adequate plans or the ability to routinely require supplemental information it may be impossible to insure compliance with applicable water quality criteria or make reasonable permit decisions. Other commenters wanted further restrictions placed on the district engineer's ability to request additional information. Suggestions included altering the regulations to specify the type, need for, and level of detail which could be requested, and requiring the district engineer to prepare an analysis of costs and benefits of such information. Some commenters objected to requirements for providing information on project alternatives and on the source and composition of dredged or fill material.

This paragraph has been changed as proposed. The intent of this change was to assure that information necessary to make a decision would be obtained, while requests for non-essential information and delays associated with such requests would be limited.

Section 325.2(a)(6): The new requirement to document district engineer decisions contrary to state and local decisions was adopted essentially as proposed. The reference to state or local decisions in the middle of this paragraph incorrectly did not reference

§ 320.4(j)(4) in addition to § 320.4(j)(2). The adopted paragraph references state and local decisions in both of these paragraphs.

Section 325.2(b)(1)(ii): The May 12, 1983, proposed regulations sought to speed up the process by reducing the standard 60 day comment/waiver period to 30 days for state water quality certifications. Commenters on this paragraph offered a complete spectrum of views from strong support for the proposed changes to strong opposition to the proposal. Comments within this spectrum included opinions that: states must have 60 days; certification time should be the same as allowed by EPA (i.e. 6 months); the proposal is illegal; it conflicts with some state water quality certification regulations and procedures; and it would reduce state and public input to the decision-making process. Most states objected to this reduction with many citing established water quality certification procedures required by statute and/or regulations which require notice to the public (normally 30 days) and which allow requests for public hearings which cannot be completed within the 30-day period. We have, therefore, retained the 60 day period in the July 22, 1982, regulations. Some Corps districts have developed formal or informal agreements with the states, which identify procedures and time limits for submittal of water quality certifications and waivers. Where these are in effect, problems associated with certifications are minimized.

Many commenters objected to the May 12, 1983, proposal to delete from the July 22, 1982, regulations the statement, "The request for certification must be made in accordance with the regulations of the certifying agency." Deleting this statement will not delete the requirement that valid requests for certification must be made in accordance with State laws. However, we have found that, on a case-by-case basis in some states, the state certifying agency and the district engineer have found it beneficial to have some flexibility to determine what constitutes a valid request. Furthermore, we believe that the state has the responsibility to determine if it has received a valid request. If this statement were retained in the Corps regulation, it would require the Corps to determine if a request has been submitted in accordance with state law. To avoid this problem, we have decided to eliminate this statement.

Section 325.2(d)(2): Numerous commenters expressed concern with comment periods of less than 30 days. They were concerned that, in order to expedite processing times, 15 day

notices would become the norm. These commenters stated that 15 days was insufficient to prepare substantive comments and would not allow the public adequate participation in the permit process as mandated by Section 101 of the CWA. State agencies noted that, with internal and external mail requiring as much as a week each for the Corps and the state, 15 days would not provide any time for consideration of a project. Several commenters noted that such expedited review times might actually be counter-productive, as Federal and state agencies might routinely oppose projects and request permit denial so that they would then have sufficient time to review a project and to work with an applicant to resolve conflicts. We recognize that 15 days is a very short comment period considering internal agency processing and mail time. We expect that comment periods as short as 15 days would be used only for minor projects where experience has shown there would be little or no controversy. Some districts have been routinely using comment periods of less than 30 days (20 and 25 days) while others have used such procedures in only a limited number of special cases. In adopting this provision, we have modified the May 12, 1983, proposal to require the district engineer to consider the nature of the proposal, mail time, the need to obtain comments from remote areas, comments on similar proposals, and the need for site visits before designating public notice periods of less than 30 days. Additionally, after considering the length of the original comment period as well as those items noted above, the district engineer may extend the comment period an additional 30 days if warranted. We believe this provides the desired flexibility with the necessary restraints on when to use comment periods of less than 30 days.

Sections 325.2(e)(1) and 325.5(b)(2): Commenters supporting the use of letters of permission (LOP) for minor section 404 activities stated that applicants will realize significant time savings for minor requests while there will be no loss in environmental protection. Objectors believe that the Corps is seeking administrative expediency at the cost of environmental protection. Issues raised by commenters include: the legality of the 404 LOP procedure without providing for notice and opportunity for public hearing (Section 404(a) of the CWA); the legality of issuing a permit which would become effective upon the receipt or waiver of 401 certification and/or a consistency certification under the CZMA; the need

to be more definitive as to the criteria for making a decision as to the categories of activities eligible for authorization under the LOP; and the lack of coordination with Federal and state resource agencies. A few commenters were concerned that the notice in the May 12, 1983, Proposed Rules was insufficient because it did not give the scope and location of the work to be covered. The commenting states also indicated that the notice was insufficient for water quality certification and coastal zone consistency determination purposes. Other commenters were concerned that, while LOP's would be coordinated with Federal and state fish and wildlife agencies, other resource agencies such as EPA should also review Section 404 LOP's. Based on the comments on the proposed 404 LOP procedures, we have decided not to adopt the 404 LOP procedures as proposed. We are not changing § 325.5(b)(2), LOP format, nor are we changing the section 10 LOP provisions. Rather, we have revised § 325.2(e)(1) to describe a separate section 404 LOP process. Unlike the section 10 LOP process, the section 404 process involves the identification of categories of discharges and a generic public notice. This LOP process is a type of abbreviated permit process which could and has been developed under the July 22, 1982, interim final regulations. These procedures will avoid unnecessary paperwork and delays for many minor section 404 projects in accordance with the intent of Section 101(f) of the Clean Water Act.

Section 325.7(b): We have added a provision that, when considering a modification to a permit, the district engineer will consult with resource agencies when considering a change to terms, conditions, or features in which that agency has expressed a significant interest.

Section 325.9: One commenter generally supported this section on the district engineer's authority to determine jurisdiction but indicated that § 325.9(c) should not be adopted because it reflects the provisions of a Memorandum of Understanding (MOU) with EPA and would not be applicable if the MOU is revised or deleted. We have determined that this paragraph is not now needed and have decided not to adopt it.

Appendix A—Permit Form and Special Conditions

A. Permit Form

Project Description: A comment was received stating that intended use should be specified for all permitted

work and not just for the fills involved. A comment was also received suggesting that we be more specific on what discharges are covered by permit authorizations. We agree with these points and have made appropriate changes to the instructional material relating to project descriptions.

General Conditions

General Condition 1: Several commenters stated that the specified three month lead time on the requesting of permit extensions was too long. We agree with these commenters and have, therefore, reduced this lead time from three to one month.

General Condition 2: One commenter recommended that the wording of this condition, relating to the maintenance of authorized work, be modified to indicate that restoration may be required if the permittee fails to comply with the condition. We agree and have modified the condition accordingly. Another commenter stated that it would not be reasonable to enforce this condition when a permitted underground facility is abandoned. We generally agree with this statement. However, we believe the procedures governing the enforcement of permit conditions are flexible enough to allow a reasonable approach in such situations.

General Condition 3: One commenter indicated that this condition should be modified to require the permittee to halt work that could damage discovered historic resources and to protect those resources from inadvertent damage. That commenter also indicated that under certain circumstances it would not be necessary to notify the Corps or to halt work. This notification requirement has been in effect since 1982, and the continuation of this requirement provides for the Corps to be notified in a timely manner. With this notification, the Corps can react quickly to determine the appropriate course of action. We believe this approach has proven to be satisfactory. Therefore, this condition is being adopted as proposed.

Proposed General Condition 4: In our proposal, we specifically requested comments on this condition, which would require recording the permit on the property deed. More than half the comments received were on this proposal. All but one of the commenters who addressed this condition were critical of it to a greater or lesser degree. Institutional interest observed that this condition would only add to their costs, since once lands were purchased they were seldom sold. Institutional and industrial interests observed that permits often relate to easements and

not to fee simple ownership and that compliance with the proposed condition, in such situations, would not be possible or meaningful in some locations. One commenter stated that a recordation condition should not be necessary, provided permittees complied with proposed General Condition 5, which requires owners to notify the Corps when property is transferred. To strengthen the property transfer condition, we have modified the statement preceding the transferee's signature to specify that the requirement to comply with the terms and conditions of the permit moves with the property. One commenter stated that a general condition requiring recordation where possible would be unfair, since it would not be uniformly applicable to all permittees. Further coordination with our field offices indicates that compliance with and use of the proposed condition probably occurs only in a few locations. This coordination also indicates that for some jurisdictions, where recordation is possible, the cost of recordation may be so great that it exceeds the benefits. Given that recordation may not be practical or appropriate for all Corps permits, we have deleted this general condition from the permit form and renumbered the remaining general conditions accordingly. On the other hand, the recordation requirement is appropriate and useful for many types of structures needing Corps permits, to provide fundamental fairness toward future purchasers of real property and to facilitate enforcement of permit conditions against future purchasers. For example, if the Corps were to issue a permit for a pier, that permit would require the owner to maintain the pier in good condition and in conformance with the terms and conditions of the permit. If the builder of the pier were to allow the pier to deteriorate, he could easily transfer the pier and associated property with no notice to the purchaser of the legal obligation to repair and maintain the pier, unless the permit were recorded along with the title documents relating to the associated property. This failure to give notice to prospective purchasers would be unfair, and would increase the Federal Government's difficulty in enforcing permit conditions against future purchasers. Because of this important notice function, we have added a recordation condition under B. Special Conditions, for use wherever recordation is found to be reasonably practicable and appropriate.

General Condition 4 (Proposed General Condition 5): One commenter suggested that this condition, relating to

the transference of the permit with the property, be modified to provide for notice and approval from the Corps before the permit is transferred. The reason given for this suggestion was that the Corps may have special knowledge of the particular transferee's history and capabilities and may wish to modify the terms and conditions of the permit accordingly. The suggested change would require the issuing office to conduct a review and prepare decision documentation every time property is transferred and there is a Corps permit involved. We believe that such a review in every case involving the transfer of a permit would constitute an inefficient use of available resources. Under the procedures contained in 33 CFR 325.7, a permit is subject to suspension, modification, or revocation at any time the Corps determines such action is warranted. We believe this is a better approach, and have, therefore, retained the proposed wording of this condition.

General Condition 5 (Proposed General Condition 6): One commenter recommended that this proposed condition, which relates to compliance with the provisions of the water quality certification, be changed to provide for the modification of the Corps permit if EPA promulgates a revised Section 307 standard or prohibition which applies to the permitted activity. We agree that permits must be modified when circumstances warrant. Procedures governing modifications are contained in 33 CFR 325.7, and we advise permittees of these procedures in item 5 (Reevaluation of Permit Decision) under the "Further Information" heading. Therefore, since we believe this potential requirement for permit modifications is adequately covered under the "Further Information" heading, we have retained the proposed wording of this condition.

General Condition 6 (Proposed General Condition 7): One commenter noted that compliance inspections should be conducted during normal working hours. As a general rule, this observation seems reasonable. However, since we believe that compliance inspections will be scheduled during normal working hours when possible, we have not made any changes to the proposed wording of this condition.

Further Information

Limits of Federal Liability: One commenter suggested that the Government could, under certain circumstances, be held liable for damages caused by activities authorized by the permit and suggested that Item 3, which limits the Government's liability,

be deleted in its entirety. While it is true that some courts have found the United States liable for damages sustained by the owners of permitted structures or by individuals injured in some way by those structures, it has never been the intent of the Corps to assume either type of liability or to insure that no interference or damage to a permitted structure will occur after it has been built. In permitting structures within navigable waters, the Corps does not assume any duty to guarantee the safety of that structure from damages caused by the permittee's work or by other authorized activities in the water, such as channel maintenance dredging. This is viewed as an acceptable limitation on the privilege of constructing a private structure for private benefit in a public waterway, particularly since insurance is readily available to protect the permittee from any damage his structure may sustain. Accordingly, the language in Item 3 has been further clarified to preclude any inference that the Government assumes any liability for interference with or damage to a permitted structure as a result of work undertaken by or on behalf of the United States in the public interest.

Reevaluation of Permit Decision: One commenter recommended that reevaluations be limited to the three circumstances listed. Although we believe that the vast majority of the reevaluations required will qualify under one of the three listed circumstances, we cannot exclude the possibility of non-qualifying, unique situations where the public's good may require a reevaluation of a permit decision. Therefore, we have retained the wording which states that reevaluations will not necessarily be limited to the circumstances listed. Another commenter recommended that we add to this item that we have the authority to issue administrative orders to require compliance with the terms and conditions of permits and to initiate legal actions where appropriate. The procedures governing these actions are contained in 33 CFR 326.4 and 326.5 and reference was made to these procedures in the proposed wording. However, we agree that it would be helpful to modify the proposed wording to provide permittees with a better understanding of our enforcement options; we have modified the text accordingly.

B. Special Conditions

One commenter suggested that Special Condition 5, which requires permittees authorized to perform certain types of work to provide advance notifications to the National Ocean

Service and the Corps before beginning work, be changed to allow verbal notifications followed by written confirmations. We have determined that this suggestion, if adopted, would greatly increase the chance of errors in notice documents published by the Government and would not be in the best interest of mariners. Two weeks advance notice is a reasonable period of time both for construction scheduling and for Government notification to mariners. Therefore, we have not adopted this suggestion.

One commenter suggested that a special condition be added, for use when appropriate, to require the permittee to carry out a historic preservation plan attached to the permit. The wording of special conditions are normally determined on a case-by-case basis. Only those that are used often and are subject to standardized wording are listed in Appendix A (B. Special Conditions). While we agree that special conditions of this nature may be required, we do not believe they lend themselves sufficiently to standardized wording to warrant adding a specific special condition to Appendix A.

Three comments were received which related to General Condition (n) on the previous permit form. This condition required the permittee to notify the issuing office of the date when the work authorized would start and of any prolonged suspensions before the work was complete. Two of the commenters recommended that this provision be retained as a general condition, and one commenter recommended that it be specified as a special condition. Our research indicates that this condition, as a general condition applicable to all permitted activities, has been virtually unenforceable in most areas and of limited use as a permit monitoring tool. We agree that special conditions requiring permittees to notify the Corps, in advance, of the dates permitted activities will start, are appropriate in certain situations. Two of these situations are covered by Special Condition 3 (maintenance dredging) and Special Condition 5 (charting of activities by National Ocean Service). Since we believe our field offices are in the best position to identify any other situations in which similar special conditions would be appropriate, we have not adopted these recommendations.

As discussed under Proposed General Condition 4 above, we have added a sixth special recordation condition for use where recordation is found to be reasonably practicable.

General: In addition to several editorial changes, we have added

definitions for the word "you" and its derivatives and the term "this office" at the beginning of the permit form. We have substituted the term "this office" for references to the district engineer throughout the form.

Part 326—Enforcement

General: Three commenters objected to what they perceived as a lack of specific requirements and recommended that the word "should" be changed to "shall" throughout Part 326. Another commenter stated that the proposed regulations were too specific and recommended that a significant amount of the procedures in this Part be deleted and addressed in internal guidance. The word "should," where used, allows district engineers to base their enforcement actions on an assessment of what is the best approach on a case-by-case basis. The word "shall" would require district engineers to implement specified actions even though such actions may be obviously inappropriate in relation to a particular case. We believe this flexibility is appropriate and have, therefore, retained the word "should" in most of the places where it occurred in the proposed regulations. However, the word "will" is used at various places in this Part where flexibility is not appropriate. We believe that the proposed language achieves a proper balance between the providing of necessary guidance and flexibility.

Finally, one commenter suggested that Part 326 be rewritten to include only two requirements: orders for immediate restoration of filled wetlands and referrals for legal action if these orders are not complied with. When Congress established the Corps regulatory authorities, it allowed for the issuance of permits as one means of resolving violations would be inappropriate.

Section 326.1: As a result of further internal coordination, we have determined that it would be appropriate to make it clear that nothing in this Part establishes a non-discretionary duty on the part of a district engineer. Further, nothing in this Part should be considered as a basis for a private right of action against a district engineer. Therefore, we have modified this paragraph accordingly.

Section 326.2: One commenter recommended that this statement of general enforcement policy be expanded to provide priority guidance on enforcement actions. Two other commenters recommended strengthening of this paragraph, with one recommending that it cite the firm and fair enforcement of the law to prohibit and deter damage, to require

restoration, and to punish violators as the purpose of the Corps enforcement program. In that we refer in this paragraph to unauthorized activities, we are reflecting the fact that these activities are unauthorized and subject to enforcement actions pursuant to the legal authorities cited at the beginning of this Part. Further, the other recommended changes would simply duplicate the discussions of enforcement methods and procedures already contained in §§ 326.3, 326.4, and 326.5. However, we have added a statement to this provision to reflect the fact that EPA has independent enforcement authorities under the Clean Water Act, and thus, district engineers should normally coordinate with EPA.

Section 326.3(b): One commenter recommended that this paragraph be amended to require the establishment of numbered file systems for violations. Most Corps districts already assign control numbers to enforcement actions, and since this is an administrative function, we have determined that it would be inappropriate to include this requirement in a Federal regulation designed to provide enforcement policy.

Section 326.3(c)(2): One commenter suggested rewording of this paragraph to make it clear that a violation involving a completed activity may or may not be resolved through the issuance of a Corps permit. The reference in the proposed wording to not initiating "any additional work before obtaining required Department of the Army authorizations" apparently led to the commenter misunderstanding this paragraph. The intent of this wording related to warning a violator not to initiate work on other projects before obtaining required Corps permits. Since the violator is in the process of being made aware of the legal requirements for obtaining Corps permits, we have determined that this warning is unnecessary and have, therefore, deleted it.

Section 326.3(c)(3): One commenter recommended that this paragraph be amended to indicate that the information requested will also be used for determining whether legal action is appropriate in addition to determining what initial corrective measures may be required. We agree that the information obtained from violators may provide a basis for enforcement decisions other than those relating to interim corrective measures. Therefore, we have revised this provision to provide for notifying violators of potential enforcement consequences and for the more generalized use of the information provided by violators in the

identification of appropriate enforcement measures.

Section 326.3(c)(4): One commenter recommended that this provision be reworded to indicate that the limitations on unauthorized work of an emergency nature are to be established in conjunction with Federal and state resource agencies. We believe it is understandable that actions of this type will be completed on an expedited basis with the procedures in § 326.3(c-d) being followed concurrently. Since § 326.3(d) already provides for interagency consultations, in appropriate cases, we do not believe it is necessary to duplicate that guidance in this provision.

Section 326.3(d)(1): One commenter recommended that "initial corrective measures" be defined as measures "which substantially eliminate all current and future detrimental impacts resulting from the unauthorized work." This commenter also recommended that the procedures in 33 CFR 320.4 and 40 CFR Part 230 be referenced for use in determining what "initial corrective measures" are required. Essentially, this commenter is recommending that all violators be denied a Corps authorization and required to undertake full corrective measures in the initial stage of an enforcement action. This would not be a reasonable or practical approach, since it would eliminate public participation and would result in the removal of work that may have been permitted under normal circumstances. Another commenter objected to the statement that further enforcement actions "should normally" be unnecessary if the initial corrective measures substantially eliminate all current and future detrimental impacts. This commenter sees this provision as barring legal action in appropriate cases such as those involving willful, flagrant, or repeated violations. This is not the case. To say that such corrective measures "should normally" resolve a violation does not mean that they will "always" resolve a violation. Another commenter stated that consultations with the Fish and Wildlife Service and the National Marine Fisheries Service should be made mandatory in this paragraph pursuant to the Fish and Wildlife Coordination Act. The reason given was that this provision would result in the issuance of permits which would require such consultations. This paragraph deals with initial corrective measures and not with the issuance of permits. These agencies will be given an opportunity to comment in response to a public notice before any decision is made on an after-the-fact permit application. In view of the above

discussion, we have retained the proposed wording of this paragraph.

Section 326.3(d)(2): One commenter recommended that this paragraph be deleted on the basis that it provided the district engineer with too much discretion and questioned the cross-reference to § 326.3(3). This paragraph was intended to provide guidance to district engineers in situations involving prior initiations of litigation or denials of essential authorizations or certifications by other Federal, state or local agencies. We believe district engineers should have the discretionary authority to determine what is a reasonable and practical course of action for the Corps under these circumstances. However, we have revised this paragraph to clarify its intent and to correct the cross-reference.

Section 326.3(d)(3): As a result of further review within the Corps, we have determined that the provision proposed as § 326.3(e)(1)(i), which states that it is not necessary to issue a Corps permit for initial corrective measures, should be moved to § 326.3(d) to more appropriately reflect the sequence of enforcement procedures. Therefore, we have modified this provision and established it as new § 326.3(d)(3).

Section 326.3(e): One commenter objected to the after-the-fact permit process, and observed that the process was generally seen as a mechanism to avoid compliance with the law. Exceptions to the processing of after-the-fact permit applications are contained in § 326.3(e)(i-iv). However, in most cases, the public participation associated with the processing of an application is necessary before a violation can be appropriately resolved.

Section 326.3(e)(1): One commenter recommended that this paragraph be amended to specify the criteria for legal action and to require that public notices associated with after-the-fact permit applications clearly identify that a violation is involved. The criteria for legal actions are given in § 326.5(a), and permit decisions are based on whether an activity complies with the section 404(b)(1) Guidelines, where applicable, and on whether it is or is not found to be contrary to the public interest. Permit decisions are not based on whether a permit application is before or after-the-fact. We have, therefore, retained the proposed wording of this paragraph.

Proposed Section 326.3(e)(1)(i): We have deleted this provision here and have moved a modified version of it to new § 326.3(d)(3); see discussion under § 326.3(d)(3).

Section 326.3(e)(1)(i)—Proposed as 326.3(e)(1)(ii): This provision indicates

that the processing of an after-the-fact permit application will not be necessary "when" detrimental impacts have been eliminated by restoration. One commenter recommended that district engineers be required to consult with EPA before determining that restoration has been completed that eliminates current and future detrimental impacts. We have addressed this comment by modifying § 326.2 and § 326.3(g) to provide for such coordination when the district engineer is aware of an enforcement action being considered by EPA under its independent enforcement authorities. Another commenter observed that the word "when" appeared to be in error and recommended substituting the word "unless." This would indicate that the Corps should process an after-the-fact permit application only after restoration had taken place and there is no work requiring a permit. This obviously would not be reasonable. In view of the above discussion, we have retained the proposed wording of this provision.

Section 326.3(e)(1)(iii)—Proposed as 326.3(e)(1)(iv): One commenter recommended that a provision be added to this paragraph to prohibit the acceptance of an application for a Corps permit where an activity is not in compliance with other Federal, state, or local authorizations or certifications. In essence, this amounts to requiring district engineers to take steps to enforce the terms and conditions of another agency's authorization or certification. We believe this is the issuing agency's responsibility and not the responsibility of the Corps. Of course, where that other agency has denied a requisite authorization, the Corps would not accept an application for processing.

Section 326.3(e)(1)(iv)—Proposed as 326.3(e)(1)(v): Two commenters recommended rewording of this paragraph to prohibit the acceptance or processing of any after-the-fact permit application when the Corps is aware of litigation or other enforcement actions that have been initiated by other Federal, state or local agencies. We believe the Corps should, in appropriate situations, be able to take positions on cases that are in conflict with the viewpoints of other agencies. Therefore, we have retained the wording of this paragraph essentially as proposed. However, since EPA has independent enforcement authorities, we have provided for coordination with EPA in §§ 326.2 and 326.3(g).

Section 326.3(g): One commenter indicated that this paragraph should delineate EPA's responsibility over

recognizing and reporting unpermitted discharges. This paragraph deals only with cases where EPA is considering an enforcement action. The reporting of violations is covered under § 326.3(a). Another commenter recommended that this paragraph be reworded to ensure that Corps actions under Part 326 are not in conflict with EPA enforcement actions. Another commenter, a state agency, suggested that this provision be expanded to require similar consultations with state agencies that have initiated enforcement actions. The reason we have provided for consultations with EPA in this paragraph is due to the fact that both the Corps and EPA have overlapping authorities pursuant to the Clean Water Act. This is not the case with state agencies. Nevertheless, we believe district engineers will wish to consult with state agencies in appropriate circumstances. In any event, as we stated in our discussion relating to the wording of § 326.3(e)(iv), we believe the Corps should have the right to take a position that may conflict with another agency's viewpoint. However, we have revised this provision to emphasize that district engineers should coordinate with EPA when they are aware of enforcement actions being considered by EPA under its independent enforcement authorities.

Section 326.4(a-b): As a result of further internal coordination, we have determined that § 326.4(a) should make it clear that district engineers have the discretionary authority to determine when the inspection of permitted activities is appropriate. We have modified § 326.4(a) accordingly. In addition, we have added a new § 326.4(b) to further discuss inspection limitations.

Section 326.4(d)—Proposed as 326.4(c): One commenter, a state agency, objected to the provisions in this paragraph for attempting to obtain voluntary compliance before issuing a formal compliance order. The rationale given was that the absence of a formal order would make coordination between the Corps and the state difficult. Another state agency recommended consultations with state agencies and with EPA. The proposed, non-compliance procedures do not prohibit early coordination with other regulatory agencies, when appropriate, and presumably, if the permittee quickly brings his work into compliance, such coordination should not be necessary.

One commenter objected to allowing a district engineer to issue a compliance order and to not making the use of Corps suspension/revocation procedures or

legal actions mandatory. Another commenter recommended that suspension/revocation procedures or legal actions be made mandatory if a violator fails to comply with a compliance order. The issuance of a compliance order is provided for in section 404(s) of the Clean Water Act, and in most cases, we believe that the methods available for obtaining voluntary compliance should be used before discretionary consideration is given to using the Corps suspension/revocation procedures or initiating legal action.

Another commenter objected to the term "significantly serious to require an enforcement action" on the basis that all violations are worthy of some enforcement action. Minor deviations from the terms and conditions of a Corps permit may not always warrant an enforcement action. For example, would a dock authorized to be constructed with a length of 50 feet but inadvertently constructed with a length of 51 feet constitute a violation warranting an enforcement action? We agree there may be extenuating circumstances, such as the additional length of the dock being just enough to impact the water access of a neighbor. However, this is a judgment that is best made by the district engineer involved.

One Commenter objected to the term "mutually agreeable solution" on the basis that such a solution could invalidate the prior results of coordination with resource agencies. Since this term refers to bringing the permitted activity into compliance or the resolution of the violation with a permit modification using the modification procedures in 33 CFR 325.7(b), such resolutions would not invalidate prior coordination. In view of the above discussion, we have retained the proposed wording of this paragraph.

Section 326.5(a): One commenter requested that the words "willful" and "repeated" be deleted from this paragraph, the rationale being, apparently, that most violators are not repeat or willful offenders and that the Corps should take the one opportunity it has to bring legal action against these one-time violators. We do not agree with this approach as being either reasonable or practical. Another commenter recommended adding violations that result in substantial impacts to the list of violations that should be considered appropriate for legal action. We agree with this recommendation and have modified the wording of this provision accordingly.

Section 326.5(c): One commenter recommended rewording of this

paragraph to require that copies be provided to EPA of Corps referrals to local U.S. Attorneys. We believe it would be more appropriate to address matters relating to the detailed aspects of interagency coordination in interagency agreements. Therefore, we have retained the proposed wording of this paragraph.

Section 326.5(d)(2): As a result of further internal coordination, we have determined that litigation cases involving isolated water no longer need to be referred to the Washington level on a routine basis. Therefore, we have deleted this provision.

Section 326.5(e): One commenter recommended that the word "may" be replaced with the words "encouraged to" in the provision relating to sending litigation reports to the Office of the Chief of Engineers when the district engineer determines that an enforcement case warrants special attention and the local U.S. Attorney has declined to take legal action. We agree with this recommendation and have made the change.

Another commenter suggested that wording be added to this paragraph to address circumstances in which permits are not required. The fact that a legal option may not be available does not mean that a permit is not required. If the district engineer chooses to close the case record, the activity in question will still be unauthorized and therefore illegal. Such unauthorized activities will be taken into account if the responsible parties become involved in future violations. One commenter suggested that Corps attorneys initiate legal actions as an alternative to actions by local U.S. Attorneys. However, the Corps does not have the authority under existing Federal laws to initiate legal actions on its own.

Another commenter recommended that this paragraph be modified to provide for joint Federal/state prosecution of violators. Since this involves discretionary decisions on the part of the Department of Justice, it would not be appropriate to include a provision of this nature in the Corps enforcement regulations.

Part 326—Definition of Waters of the United States

This part is being added in order to clarify the scope of the Section 404 permit program. This part was added in direct response to many concerns expressed by both the public and the Presidential Task Force on Regulatory Relief. We have not made changes to existing definitions; however, we have provided clarification by simply setting

them apart in a separate and distinct Part 328 of the regulation.

The format for Part 328 has been changed slightly from the proposed regulation in order to improve clarity and reduce duplication. The content of the proposed § 328.2 "General Definitions" has been partially combined with § 328.3 "Definitions." The remainder has been reestablished as § 328.5, "Changes in Limits of Waters of the United States." Section 328.2 has been established as "General Scope." The proposed §§ 328.4 and 328.5 have been combined into § 328.4 and renamed "Limits of Jurisdiction."

A number of commenters appeared to have misinterpreted the intent of this part. Many thought we were trying to reduce the scope of jurisdiction while others believed we were trying to expand the scope of jurisdiction. Neither is the case. The purpose was to clarify the scope of the 404 program by defining the terms in accordance with the way the program is presently being conducted.

Section 328.3: Definitions. This section incorporates the definitions previously found in § 323.3 (a), (c), (d), (f) and (g). Paragraphs (c), (d), (f) and (g) were incorporated without change. EPA has clarified that waters of the United States at 40 CFR 328.3(a)(3) also include the following waters:

- a. Which are or would be used as habitat by birds protected by Migratory Bird Treaties; or
- b. Which are or would be used as habitat by other migratory birds which cross state lines; or
- c. Which are or would be used as habitat for endangered species; or
- d. Used to irrigate crops sold in interstate commerce.

For clarification it should be noted that we generally do not consider the following waters to be "Waters of the United States." However, the Corps reserves the right on a case-by-case basis to determine that a particular waterbody within these categories of waters is a water of the United States. EPA also has the right to determine on a case-by-case basis if any of these waters are "waters of the United States."

- (a) Non-tidal drainage and irrigation ditches excavated on dry land.
- (b) Artificially irrigated areas which would revert to upland if the irrigation ceased.
- (c) Artificial lakes or ponds created by excavating and/or diking dry land to collect and retain water and which are used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing.

(d) Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating and/or diking dry land to retain water for primarily aesthetic reasons.

(e) Waterfilled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States (see 33 CFR 328.3(a)).

The term "navigable waters of the United States" has not been added to this section since it is defined in Part 329.

A number of comments were received concerning the proposed change to the definition of the terms "adjacent" and the proposed definitions for the terms "inundation", "saturated", "prevalence", and "typically adapted." A number of commenters believed that these terms may better define the scope of jurisdiction of the section 404 program, but such definitions should more rightfully be within the province of the Environmental Protection Agency in order to remain consistent with the opinion of Benjamin Civiletti, Attorney General (September 5, 1979). These definitions would require the prior approval of the Environmental Protection Agency, which has not been forthcoming. Therefore, these new proposed definitions will not be adopted at this time.

To respond to requests for clarification, we have added a definition for "tidal waters." The definition is consistent with the way the Corps has traditionally interpreted the term.

Section 328.4: Limits of Jurisdiction. Section 328.4(c)(1) defines the lateral limit of jurisdiction in non-tidal waters as the ordinary high water mark provided the jurisdiction is not extended by the presence of wetlands. Therefore, it should be concluded that in the absence of wetlands the upstream limit of Corps jurisdiction also stops when the ordinary high water mark is no longer perceptible.

Section 328.5: Changes in Limits of Waters of the United States. This section was changed to reflect both natural and man-made changes to the limits of waters of the United States. This change was made for clarification and resulted from consultation with the Environmental Protection Agency.

Section 328.6: Supplemental Clarification. Most commenters favored the Corps plans to give special consideration to unique areas such as Arctic Tundra that do not easily fit the generic "wetlands" definition. Several

commenters indicated that the Corps should clarify its intended use of this section, and one questioned the need to "describe" unique areas in the Federal Register. A number of commenters indicated that criteria should be specified for determining wetland types to be included as unique areas. Some commenters stated that close coordination between the Corps and the Environmental Protection Agency will be necessary when selecting unique areas and developing procedures for making wetland determinations in such areas, since the Environmental Protection Agency has the final authority to determine the scope of "Waters of the United States."

While we believe that supplemental clarification of unique areas will be a positive step in clarifying the scope of jurisdiction under the section 404 permit program, we have determined that such supplemental clarification can be done under existing regulations of the Environmental Protection Agency and the Corps and therefore have deleted this section.

Part 329—Definition of Navigable Waters of the United States

We are currently planning to propose a complete revision of Part 329 in the near future, to simplify and clarify the procedures involved, while retaining the essential aspects of the relevant policy. In the interim, we are making the two minor changes discussed below.

Section 329.11: This section has been modified to clarify that the lateral extent of jurisdiction in rivers and lakes extends to the edge of all such waterbodies as it does in bays and estuaries (§ 329.12(b)).

Section 329.12(a): This section has been corrected to reflect that the territorial seas, for the purpose of Rivers and Harbors Act of 1899 jurisdiction, extend 3 geographic miles everywhere and are measured from the baseline.

Part 330—Nationwide Permits

We are reissuing the 28 nationwide permits at § 330.5(a) as modified and conditioned. The nationwide permits will be in effect for 5 years beginning with the effective date of this regulation, unless sooner revised or revoked.

Section 330.1: This section was restructured and updated in order to improve its readability and technical accuracy. The definition concerning the division engineer's discretionary authority was deleted from this section since similar language appears in § 330.2. "Definitions." The discussion concerning the applicability of nationwide permits as they relate to

other Federal, state, and local authorizations was deleted from this section and relocated to § 330.5(d) "Further Information."

Section 330.2: The definition of the term "headwaters" was deleted from Part 323 and relocated to § 330.2(b), since the definition is used as part of the nationwide permit program. The definition of the term "natural lake" which was proposed at § 330.2(c) has been deleted. Changes to the "headwaters"/"isolated waters" nationwide permit which is found at § 330.5(a)(26) have obviated the need for this definition.

Section 330.5: In order to better inform the public of the statutory authority under which each nationwide permit has been issued, we have added the authority by parenthetical expression at the end of each nationwide permit.

We had proposed nationwide permits for activities funded or authorized by another Federal agency or department and for activities adjacent to Corps of Engineers civil works projects. Most commenters discussed the two proposed nationwide permits together. The most frequent comments questioned whether they would comply with section 404(e) of the CWA. They believed these nationwide permits could authorize a wide variety of Federal projects that would not be similar in nature and projects which could have significant adverse environmental impacts on aquatic resources. Numerous commenters stated that the Corps would be delegating its 404(b)(1) compliance responsibilities to other agencies and that there is a natural tendency of such agencies to be self-serving. Many commenters, including some states, objected that the public and other agencies would not have an opportunity to review some large individual projects. Many commenters encouraged the adoption of these nationwide permits; in most cases they based their opinion upon reduction in duplication and the expediting of project authorization. Based on the comments received we have decided that clarification of activities that could be covered by nationwide permits would be necessary to insure proper understanding and field application. Because of the complexity of doing this and an evaluation of the comments received, we have decided not to adopt these two nationwide permits.

Section 330.5(a)(3): This nationwide permit for repair, rehabilitation, or replacement of existing structures or fill has been clarified to show that beach restoration is not authorized by this nationwide permit.

Section 330.5(a)(6): This nationwide permit for survey activities was clarified to show that it does not authorize the drilling of exploration-type bore holes for oil and gas exploration.

Section 330.5(a)(7): This nationwide permit for outfall structures was clarified by adding language concerning minor excavation, filling and other work which is routinely associated with the installation of intake and outfall structures.

Section 330.5(a)(18): This nationwide permit for discharges up to 10 cubic yards was clarified by indicating that it does not authorize discharges for the purpose of stream diversion. The footnote was deleted because it was redundant with the terms of the nationwide permit itself.

Section 330.5(a)(19): This nationwide permit for dredging up to 10 cubic yards was clarified by indicating that it does not authorize the connection of canals or other artificial waterways to navigable waters of the United States.

Section 330.5(a)(22): This nationwide permit for the removal of obstructions to navigation was clarified by indicating that it does not authorize maintenance dredging, shoal removal, or riverbank snagging.

Section 330.5(b)(3): This condition for the protection of endangered species was modified to set forth more clearly options available to the district engineer to satisfy section 7 of the Endangered Species Act when it has been determined that an activity may adversely affect any listed endangered species or its critical habitat.

Section 330.5(b)(7): This condition for the protection of wild and scenic rivers was modified to define more clearly components of the National Wild and Scenic River System by showing that it includes any Congressionally designated "study river."

Section 330.5(b)(9): This condition for the protection of historic properties was added in response to numerous comments which expressed concern for an apparent lack of consideration which was being given historic properties. This condition outlines the procedures to be followed by both the permittee and the district engineer to provide for modification, suspension, or revocation of a nationwide permit or contact with the Advisory Council on Historic Preservation if an activity authorized by a nationwide permit may adversely affect a historic property.

Section 330.5(b)(10): This condition was added as a result of comments which expressed concern that activities performed under the nationwide permits could impair reserved tribal rights.

Section 330.5(b)(11) and (12): These conditions were adopted as proposed. They provide notification to the public that, within certain states, authorization for the activity may have been denied without prejudice as a result of state 401 water quality certification denial or nonconcurrence with Coastal Zone Management consistency. These conditions trigger the provisions of §§ 330.9 and 330.10.

Section 330.5(b)(13): This condition was added to alert the public that regional conditions may have been added by the division engineer in accordance with § 330.8(a).

Section 330.5(c): The Grandfathering provision included in the October 5, 1984, final regulations expires on April 5, 1986, before the effective date of these regulations and is, therefore, no longer needed and has been deleted. A new paragraph has been added to provide the public further information on nationwide permits as they relate to such things as compliance with conditions, other required authorizations, property rights, Federal projects, and revised or modified water quality standards.

Section 330.5(d): This paragraph has been added to clarify that the Chief of Engineers has the authority to modify, suspend, or revoke any nationwide permit.

Some states indicated in their comments that there might be other ways to reduce burdens on the public within their state other than the nationwide permits. One state suggested that it might be appropriate to revoke all the nationwide permits in favor of regional permits subject to interagency review. The authority exists for the Chief of Engineers to revoke some or all of the nationwide permits within a state. There are also existing provisions in the regulations for district engineers and the states to develop a permit system designed around specific state authorities. These existing provisions include regional general permits, programmatic general permits, transfer of the 404 program (see 33 CFR 323.5), joint processing, permit consolidation, preapplication consultation and special area management planning. Before adopting a permit system designed around specific state authorities, a public notice providing an opportunity for a public hearing would be issued outlining the proposed permit system within the state and the proposal to revoke the nationwide permits. If such a system is developed, the Chief of Engineers will consider revoking all or most of the nationwide permits within a state.

Section 330.8(a): The concept of case-by-case regional conditioning authority received overwhelming support. This new paragraph allows the division engineer through discretionary authority to add activity specific conditions to nationwide permits on a case-by-case basis. The district engineer may do the same when there is mutual agreement with the permittee or when conditions are necessary based on conditions of a state 401 certification.

Section 330.8(c): This paragraph was modified to clarify that, although the division engineer has used discretionary authority to require individual permits, he may subsequently allow the activity to be authorized by nationwide permit if the impediment to using the nationwide permit, which triggered the discretionary authority, has been removed.

Section 330.8(c)(2): This paragraph has been modified to allow division engineers the discretionary authority to require individual permits for categories of activities or specific geographic areas. This authority was previously exercised by the Chief of Engineers. However, the Chief of Engineers is retaining this authority on a statewide or nationwide basis.

Section 330.9: Many commenters objected to the issuance of nationwide permits when a state denies 401 certification. Their objections were based on the Clean Water Act requirement that "No license or permit shall be granted until the certification . . . has been obtained or has been waived." Commenters expressed strong concerns about the validity of such permits, and stated that issuance would constitute a de facto transfer of the administration of this portion of the 401 permit program to the objecting states. An attendant concern was that, if states were unable to respond within the time specified by the Corps, a waiver would be presumed, and the nationwide permit would become effective, whether or not this would have been the intent of the state. Some commenters suggested that states would be forced to deny certifications because of inadequate time to ensure that proposed activities would not violate water quality standards. Most commenters opposed district engineers having discretionary authority over conditions to the 401 certification. One commenter believes this authority conflicts with states' rights. Another suggested that the proposed action could prod states into adopting their own wetland laws and regulatory programs. Several commenters supported the proposal, stating that it was a means of preserving the utility of the general permit program.

Section 330.9 has been modified to provide that, if a state denies a required 401 certification for a particular nationwide permit, then authorization for all discharges covered by the nationwide permit within the state is denied without prejudice until the state issues an individual or generic water quality certification or waives its right to do so. We did not adopt the 30 day waiver period but rather will rely on the language at § 325.2(b)(1) which defines a reasonable period of time. This section was also modified to notify the public that the district engineer will include conditions of the 401 water quality certification as special conditions of the nationwide permit.

Section 330.9(b): This subsection has been added to notify the public of the certification requirements of the various nationwide permits.

Section 330.10: A number of coastal states commented that consistency determination or waiver thereof must have been obtained prior to the promulgation of the nationwide permits. Some commenters asserted that such a requirement is not a statutory prerequisite to permit issuance. Others contend that assuming a waiver of certification preempts the individual state's authority and thwarts Congressional intent that the permit process involves oversight by the state as well as Federal agencies.

Section 330.10 has been modified to state that, in certain instances where a state has not concurred that a particular nationwide permit is consistent with its coastal zone management plan, authorization for all activities subject to such nationwide permit within or affecting the state coastal zone agency's area of authority is denied without prejudice until the applicant has furnished to the district engineer a coastal zone management consistency determination pursuant to section 307 of the Coastal Zone Management Act and the state has either concurred in that determination or waived its right to do so.

Section 330.11: This subsection was added to clarify existing procedures to establish a time limit in which a permittee may rely on confirmation from the district engineer that an activity is covered by a nationwide permit, and to specify procedures to modify, suspend, or revoke the permittee's right to proceed under the nationwide permit after the district engineer notified the permittee that the activity may proceed.

Section 330.12: This subsection was modified to provide a twelve month transition period for projects which may be affected by future changes in

nationwide permits. After considering equity established in reliance on the nationwide permit and that the public will in all likelihood receive ample notice of proposed changes, we believe that this transition period is both reasonable and equitable. In addition, if necessary on a case-by-case basis we can, even though there is a grandfather provision, exercise discretionary authority pursuant to § 330.8 or modify, suspend or revoke individual authorization pursuant to 33 CFR 325.7.

State Certification of Nationwide Permits

Most states have issued or waived 401 certification and/or Coastal Zone Management consistency concurrence for one or more of the twenty six nationwide permits. Many states have issued a conditional certification and some have denied certification/consistency concurrence. Final action is still pending in some of the states but is imminent. The primary mechanism for keeping the public informed of the status and/or changes in state certifications or Coastal Zone Management consistency concurrence will be public notices issued by the district engineers within the affected states. The district engineers will be issuing public notices concurrent with the publication of these regulations. Subsequent notices will be issued as changes occur.

Listed below are those states which, as of the date of this printing, have either denied or conditionally issued 401 certification and/or coastal zone management consistency concurrence for one or more of the nationwide permits. For more current and detailed information you should consult with the appropriate district engineer.

Alaska, California, Connecticut, Florida, Hawaii, Illinois, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Washington, West Virginia and Wisconsin.

Determinations under Executive Order 12291 and the Regulatory Flexibility Act. The Department of the Army has determined that the revisions to these regulations do not contain a major proposal requiring the preparation of a regulatory analysis under E.O. 12291. The Department of the Army certifies, pursuant to section 605(b) of the Regulatory Flexibility Act of 1980, that these regulations will not have a significant economic impact on a substantial number of entities.

Note 1.—The term "he" and its derivatives used in these regulations are generic and should be considered as applying to both male and female.

List of Subjects

33 CFR Part 320

Environmental protection, Intergovernmental relations, Navigation, Water pollution control, Waterways.

33 CFR Part 321

Dams, Intergovernmental relations, Navigation, Waterways.

33 CFR Part 322

Continental shelf, Electric power, Navigation, Water pollution control, Waterways.

33 CFR Part 323

Navigation, Water pollution control, Waterways.

33 CFR Part 324

Water pollution control.

33 CFR Part 325

Administrative practice and procedure, Intergovernmental relations, Environmental protection, Navigation, Water pollution control, Waterways.

33 CFR Part 326

Investigations, Intergovernmental relations, Law enforcement, Navigation, Water pollution control, Waterways.

33 CFR Part 327

Administrative practice and procedure, Navigation, Water pollution control, Waterways.

33 CFR Part 328

Navigation, Water pollution control, Waterways.

33 CFR Part 329

Waterways.

33 CFR Part 330

Navigation, Water pollution control, Waterways.

Dated: November 4, 1986.

Robert K. Dawson,

Assistant Secretary of the Army (Civil Works).

Accordingly, the Department of the Army is revising 33 CFR Parts 320, 321, 322, 323, 324, 325, 326, 327, 329, and 330 and adding Part 328 to read as follows:

PART 320—GENERAL REGULATORY POLICIES

Sec.

320.1 Purpose and scope.

320.2 Authorities to issue permits.

320.3 Related laws.

Sec.

320.4 General policies for evaluating permit applications.

Authority: 33 U.S.C. 401 *et seq.*; 33 U.S.C. 1344; 33 U.S.C. 1413.

§ 320.1 Purpose and scope.

(a) *Regulatory approach of the Corps of Engineers.* (1) The U.S. Army Corps of Engineers has been involved in regulating certain activities in the nation's waters since 1890. Until 1968, the primary thrust of the Corps' regulatory program was the protection of navigation. As a result of several new laws and judicial decisions, the program has evolved to one involving the consideration of the full public interest by balancing the favorable impacts against the detrimental impacts. This is known as the "public interest review." The program is one which reflects the national concerns for both the protection and utilization of important resources.

(2) The Corps is a highly decentralized organization. Most of the authority for administering the regulatory program has been delegated to the thirty-six district engineers and eleven division engineers. If a district or division engineer makes a final decision on a permit application in accordance with the procedures and authorities contained in these regulations (33 CFR Parts 320–330), there is no administrative appeal of that decision.

(3) The Corps seeks to avoid unnecessary regulatory controls. The general permit program described in 33 CFR Parts 325 and 330 is the primary method of eliminating unnecessary federal control over activities which do not justify individual control or which are adequately regulated by another agency.

(4) The Corps is neither a proponent nor opponent of any permit proposal. However, the Corps believes that applicants are due a timely decision. Reducing unnecessary paperwork and delays is a continuing Corps goal.

(5) The Corps believes that state and federal regulatory programs should complement rather than duplicate one another. The Corps uses general permits, joint processing procedures, interagency review, coordination, and authority transfers (where authorized by law) to reduce duplication.

(6) The Corps has authorized its district engineers to issue formal determinations concerning the applicability of the Clean Water Act or the Rivers and Harbors Act of 1899 to activities or tracts of land and the applicability of general permits or statutory exemptions to proposed activities. A determination pursuant to

this authorization shall constitute a Corps final agency action. Nothing contained in this section is intended to affect any authority EPA has under the Clean Water Act.

(b) *Types of activities regulated.* This Part and the Parts that follow (33 CFR Parts 321–330) prescribe the statutory authorities, and general and special policies and procedures applicable to the review of applications for Department of the Army (DA) permits for controlling certain activities in waters of the United States or the oceans. This part identifies the various federal statutes which require that DA permits be issued before these activities can be lawfully undertaken; and related Federal laws and the general policies applicable to the review of those activities. Parts 321–324 and 330 address special policies and procedures applicable to the following specific classes of activities:

(1) Dams or dikes in navigable waters of the United States (Part 321);

(2) Other structures or work including excavation, dredging, and/or disposal activities, in navigable waters of the United States (Part 322);

(3) Activities that alter or modify the course, condition, location, or capacity of a navigable water of the United States (Part 322);

(4) Construction of artificial islands, installations, and other devices on the outer continental shelf (Part 322);

(5) Discharges of dredged or fill material into waters of the United States (Part 323);

(6) Activities involving the transportation of dredged material for the purpose of disposal in ocean waters (Part 324); and

(7) Nationwide general permits for certain categories of activities (Part 330).

(c) *Forms of authorization.* DA permits for the above described activities are issued under various forms of authorization. These include individual permits that are issued following a review of individual applications and general permits that authorize a category or categories of activities in specific geographical regions or nationwide. The term "general permit" as used in these regulations (33 CFR Parts 320–330) refers to both those regional permits issued by district or division engineers on a regional basis and to nationwide permits which are issued by the Chief of Engineers through publication in the Federal Register and are applicable throughout the nation. The nationwide permits are found in 33 CFR Part 330. If an activity is covered by a general permit, an application for a DA permit

does not have to be made. In such cases, a person must only comply with the conditions contained in the general permit to satisfy requirements of law for a DA permit. In certain cases pre-notification may be required before initiating construction. (See 33 CFR 330.7)

(d) *General instructions.* General policies for evaluating permit applications are found in this part. Special policies that relate to particular activities are found in Parts 321 through 324. The procedures for processing individual permits and general permits are contained in 33 CFR Part 325. The terms "navigable waters of the United States" and "waters of the United States" are used frequently throughout these regulations, and it is important from the outset that the reader understand the difference between the two. "Navigable waters of the United States" are defined in 33 CFR Part 329. These are waters that are navigable in the traditional sense where permits are required for certain work or structures pursuant to Sections 9 and 10 of the Rivers and Harbors Act of 1899. "Waters of the United States" are defined in 33 CFR Part 328. These waters include more than navigable waters of the United States and are the waters where permits are required for the discharge of dredged or fill material pursuant to Section 404 of the Clean Water Act.

§ 320.2 Authorities to issue permits.

(a) Section 9 of the Rivers and Harbors Act, approved March 3, 1899 (33 U.S.C. 401) (hereinafter referred to as section 9), prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the waterbody lie wholly within the limits of a single state, the structure may be built under authority of the legislature of that state if the location and plans or any modification thereof are approved by the Chief of Engineers and by the Secretary of the Army. The instrument of authorization is designated a permit (See 33 CFR Part 321.) Section 9 also pertains to bridges and causeways but the authority of the Secretary of the Army and Chief of Engineers with respect to bridges and causeways was transferred to the Secretary of Transportation under the Department of Transportation Act of October 15, 1966 (49 U.S.C. 1155g(6)(A)). A DA permit pursuant to section 404 of the Clean Water Act is required for the discharge of dredged or fill material into

waters of the United States associated with bridges and causeways. (See 33 CFR Part 323.)

(b) Section 10 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 403) (hereinafter referred to as section 10), prohibits the unauthorized obstruction or alteration of any navigable water of the United States. The construction of any structure in or over any navigable water of the United States, the excavating from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The instrument of authorization is designated a permit. The authority of the Secretary of the Army to prevent obstructions to navigation in navigable waters of the United States was extended to artificial islands, installations, and other devices located on the seabed, to the seaward limit of the outer continental shelf, by section 4(f) of the Outer Continental Shelf Lands Act of 1953 as amended (43 U.S.C. 1333(e)). (See 33 CFR Part 322.)

(c) Section 11 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 404), authorizes the Secretary of the Army to establish harbor lines channelward of which no piers, wharves, bulkheads, or other works may be extended or deposits made without approval of the Secretary of the Army. Effective May 27, 1970, permits for work shoreward of those lines must be obtained in accordance with section 10 and, if applicable, section 404 of the Clean Water Act (see § 320.4(o) of this Part).

(d) Section 13 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 407), provides that the Secretary of the Army, whenever the Chief of Engineers determines that anchorage and navigation will not be injured thereby, may permit the discharge of refuse into navigable waters. In the absence of a permit, such discharge of refuse is prohibited. While the prohibition of this section, known as the Refuse Act, is still in effect, the permit authority of the Secretary of the Army has been superseded by the permit authority provided the Administrator, Environmental Protection Agency (EPA), and the states under sections 402 and 405 of the Clean Water Act, (33 U.S.C. 1342 and 1345). (See 40 CFR Parts 124 and 125.)

(e) Section 14 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 408), provides that the Secretary

of the Army, on the recommendation of the Chief of Engineers, may grant permission for the temporary occupation or use of any sea wall, bulkhead, jetty, dike, levee, wharf, pier, or other work built by the United States. This permission will be granted by an appropriate real estate instrument in accordance with existing real estate regulations.

(f) Section 404 of the Clean Water Act (33 U.S.C. 1344) (hereinafter referred to as section 404) authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for the discharge of dredged or fill material into the waters of the United States at specified disposal sites. (See 33 CFR Part 323.) The selection and use of disposal sites will be in accordance with guidelines developed by the Administrator of EPA in conjunction with the Secretary of the Army and published in 40 CFR Part 230. If these guidelines prohibit the selection or use of a disposal site, the Chief of Engineers shall consider the economic impact on navigation and anchorage of such a prohibition in reaching his decision. Furthermore, the Administrator can deny, prohibit, restrict or withdraw the use of any defined area as a disposal site whenever he determines, after notice and opportunity for public hearing and after consultation with the Secretary of the Army, that the discharge of such materials into such areas will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. (See 40 CFR Part 230.)

(g) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (33 U.S.C. 1413) (hereinafter referred to as section 103), authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for the transportation of dredged material for the purpose of disposal in the ocean where it is determined that the disposal will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. The selection of disposal sites will be in accordance with criteria developed by the Administrator of the EPA in consultation with the Secretary of the Army and published in 40 CFR Parts 220-229. However, similar to the EPA Administrator's limiting authority cited in paragraph (f) of this section, the Administrator can prevent the issuance of a permit under this authority if he

finds that the disposal of the material will result in an unacceptable adverse impact on municipal water supplies, shellfish beds, wildlife, fisheries, or recreational areas. (See 33 CFR Part 324).

§ 320.3 Related laws.

(a) Section 401 of the Clean Water Act (33 U.S.C. 1341) requires any applicant for a federal license or permit to conduct any activity that may result in a discharge of a pollutant into waters of the United States to obtain a certification from the State in which the discharge originates or would originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the affected waters at the point where the discharge originates or would originate, that the discharge will comply with the applicable effluent limitations and water quality standards. A certification obtained for the construction of any facility must also pertain to the subsequent operation of the facility.

(b) Section 307(c) of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c)), requires federal agencies conducting activities, including development projects, directly affecting a state's coastal zone, to comply to the maximum extent practicable with an approved state coastal zone management program. Indian tribes doing work on federal lands will be treated as a federal agency for the purpose of the Coastal Zone Management Act. The Act also requires any non-federal applicant for a federal license or permit to conduct an activity affecting land or water uses in the state's coastal zone to furnish a certification that the proposed activity will comply with the state's coastal zone management program. Generally, no permit will be issued until the state has concurred with the non-federal applicant's certification. This provision becomes effective upon approval by the Secretary of Commerce of the state's coastal zone management program. (See 15 CFR Part 930.)

(c) Section 302 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (16 U.S.C. 1432), authorizes the Secretary of Commerce, after consultation with other interested federal agencies and with the approval of the President, to designate as marine sanctuaries those areas of the ocean waters, of the Great Lakes and their connecting waters, or of other coastal waters which he determines necessary for the purpose of preserving or restoring such areas for their conservation, recreational, ecological, or aesthetic values. After designating such

an area, the Secretary of Commerce shall issue regulations to control any activities within the area. Activities in the sanctuary authorized under other authorities are valid only if the Secretary of Commerce certifies that the activities are consistent with the purposes of Title III of the Act and can be carried out within the regulations for the sanctuary.

(d) The National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347) declares the national policy to encourage a productive and enjoyable harmony between man and his environment. Section 102 of that Act directs that "to the fullest extent possible: (1) The policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall . . . insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations . . .". (See Appendix B of 33 CFR Part 325.)

(e) The Fish and Wildlife Act of 1956 (16 U.S.C. 742a, *et seq.*), the Migratory Marine Game-Fish Act (16 U.S.C. 760c-760g), the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c) and other acts express the will of Congress to protect the quality of the aquatic environment as it affects the conservation, improvement and enjoyment of fish and wildlife resources. Reorganization Plan No. 4 of 1970 transferred certain functions, including certain fish and wildlife-water resources coordination responsibilities, from the Secretary of the Interior to the Secretary of Commerce. Under the Fish and Wildlife Coordination Act and Reorganization Plan No. 4, any federal agency that proposes to control or modify any body of water must first consult with the United States Fish and Wildlife Service or the National Marine Fisheries Service, as appropriate, and with the head of the appropriate state agency exercising administration over the wildlife resources of the affected state.

(f) The Federal Power Act of 1920 (16 U.S.C. 791a *et seq.*), as amended, authorizes the Federal Energy Regulatory Agency (FERC) to issue licenses for the construction and the operation and maintenance of dams, water conduits, reservoirs, power houses, transmission lines, and other physical structures of a hydro-power project. However, where such structures will affect the navigable capacity of any navigable water of the United States (as

defined in 16 U.S.C. 796), the plans for the dam or other physical structures affecting navigation must be approved by the Chief of Engineers and the Secretary of the Army. In such cases, the interests of navigation should normally be protected by a DA recommendation to FERC for the inclusion of appropriate provisions in the FERC license rather than the issuance of a separate DA permit under 33 U.S.C. 401 *et seq.* As to any other activities in navigable waters not constituting construction and the operation and maintenance of physical structures licensed by FERC under the Federal Power Act of 1920, as amended, the provisions of 33 U.S.C. 401 *et seq.* remain fully applicable. In all cases involving the discharge of dredged or fill material into waters of the United States or the transportation of dredged material for the purpose of disposal in ocean waters, section 404 or section 103 will be applicable.

(g) The National Historic Preservation Act of 1966 (16 U.S.C. 470) created the Advisory Council on Historic Preservation to advise the President and Congress on matters involving historic preservation. In performing its function the Council is authorized to review and comment upon activities licensed by the Federal Government which will have an effect upon properties listed in the National Register of Historic Places, or eligible for such listing. The concern of Congress for the preservation of significant historical sites is also expressed in the Preservation of Historical and Archeological Data Act of 1974 (16 U.S.C. 469 *et seq.*), which amends the Act of June 27, 1960. By this Act, whenever a federal construction project or federally licensed project, activity, or program alters any terrain such that significant historical or archeological data is threatened, the Secretary of the Interior may take action necessary to recover and preserve the data prior to the commencement of the project.

(h) The Interstate Land Sales Full Disclosure Act (15 U.S.C. 1701 *et seq.*) prohibits any developer or agent from selling or leasing any lot in a subdivision (as defined in 15 U.S.C. 1701(3)) unless the purchaser is furnished in advance a printed property report containing information which the Secretary of Housing and Urban Development may, by rules or regulations, require for the protection of purchasers. In the event the lot in question is part of a project that requires DA authorization, the property report is required by Housing and Urban Development regulation to state whether

or not a permit for the development has been applied for, issued, or denied by the Corps of Engineers under section 10 or section 404. The property report is also required to state whether or not any enforcement action has been taken as a consequence of non-application for or denial of such permit.

(i) The Endangered Species Act (16 U.S.C. 1531 *et seq.*) declares the intention of the Congress to conserve threatened and endangered species and the ecosystems on which those species depend. The Act requires that federal agencies, in consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, use their authorities in furtherance of its purposes by carrying out programs for the conservation of endangered or threatened species, and by taking such action necessary to insure that any action authorized, funded, or carried out by the Agency is not likely to jeopardize the continued existence of such endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of the Interior or Commerce, as appropriate, to be critical. (See 50 CFR Part 17 and 50 CFR Part 402.)

(j) The Deepwater Port Act of 1974 (33 U.S.C. 1501 *et seq.*) prohibits the ownership, construction, or operation of a deepwater port beyond the territorial seas without a license issued by the Secretary of Transportation. The Secretary of Transportation may issue such a license to an applicant if he determines, among other things, that the construction and operation of the deepwater port is in the national interest and consistent with national security and other national policy goals and objectives. An application for a deepwater port license constitutes an application for all federal authorizations required for the ownership, construction, and operation of a deepwater port, including applications for section 10, section 404 and section 103 permits which may also be required pursuant to the authorities listed in section 320.2 and the policies specified in section 320.4 of this Part.

(k) The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 *et seq.*) expresses the intent of Congress that marine mammals be protected and encouraged to develop in order to maintain the health and stability of the marine ecosystem. The Act imposes a perpetual moratorium on the harassment, hunting, capturing, or killing of marine mammals and on the importation of marine mammals and marine mammal products without a

permit from either the Secretary of the Interior or the Secretary of Commerce, depending upon the species of marine mammal involved. Such permits may be issued only for purposes of scientific research and for public display if the purpose is consistent with the policies of the Act. The appropriate Secretary is also empowered in certain restricted circumstances to waive the requirements of the Act.

(l) Section 7(a) of the Wild and Scenic Rivers Act (16 U.S.C. 1278 *et seq.*) provides that no department or agency of the United States shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which such river was established, as determined by the Secretary charged with its administration.

(m) The Ocean Thermal Energy Conversion Act of 1980, (42 U.S.C. section 9101 *et seq.*) establishes a licensing regime administered by the Administrator of NOAA for the ownership, construction, location, and operation of ocean thermal energy conversion (OTEC) facilities and plantships. An application for an OTEC license filed with the Administrator constitutes an application for all federal authorizations required for ownership, construction, location, and operation of an OTEC facility or plantship, except for certain activities within the jurisdiction of the Coast Guard. This includes applications for section 10, section 404, section 103 and other DA authorizations which may be required.

(n) Section 402 of the Clean Water Act authorizes EPA to issue permits under procedures established to implement the National Pollutant Discharge Elimination System (NPDES) program. The administration of this program can be, and in most cases has been, delegated to individual states. Section 402(b)(6) states that no NPDES permit will be issued if the Chief of Engineers, acting for the Secretary of the Army and after consulting with the U.S. Coast Guard, determines that navigation and anchorage in any navigable water will be substantially impaired as a result of a proposed activity.

(o) The National Fishing Enhancement Act of 1984 (Pub. L. 98-623) provides for the development of a National Artificial Reef Plan to promote and facilitate responsible and effective efforts to establish artificial reefs. The Act establishes procedures to be followed by the Corps in issuing DA permits for artificial reefs. The Act also establishes the liability of the permittee and the United States. The Act further creates a

civil penalty for violation of any provision of a permit issued for an artificial reef.

§ 320.4 General policies for evaluating permit applications.

The following policies shall be applicable to the review of all applications for DA permits. Additional policies specifically applicable to certain types of activities are identified in 33 CFR Parts 321-324.

(a) *Public Interest Review.* (1) The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impact which the proposed activity may have on the public interest requires a careful weighing of all those factors which become relevant in each particular case. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The decision whether to authorize a proposal, and if so, the conditions under which it will be allowed to occur, are therefore determined by the outcome of this general balancing process. That decision should reflect the national concern for both protection and utilization of important resources. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof: among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people. For activities involving 404 discharges, a permit will be denied if the discharge that would be authorized by such permit would not comply with the Environmental Protection Agency's 404(b)(1) guidelines. Subject to the preceding sentence and any other applicable guidelines and criteria (see §§ 320.2 and 320.3), a permit will be granted unless the district engineer determines that it would be contrary to the public interest.

(2) The following general criteria will be considered in the evaluation of every application:

(i) The relative extent of the public and private need for the proposed structure or work:

(ii) Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work; and

(iii) The extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited.

(3) The specific weight of each factor is determined by its importance and relevance to the particular proposal. Accordingly, how important a factor is and how much consideration it deserves will vary with each proposal. A specific factor may be given great weight on one proposal, while it may not be present or as important on another. However, full consideration and appropriate weight will be given to all comments, including those of federal, state, and local agencies, and other experts on matters within their expertise.

(b) *Effect on wetlands.* (1) Most wetlands constitute a productive and valuable public resource, the unnecessary alteration or destruction of which should be discouraged as contrary to the public interest. For projects to be undertaken or partially or entirely funded by a federal, state, or local agency, additional requirements on wetlands considerations are stated in Executive Order 11990, dated 24 May 1977.

(2) Wetlands considered to perform functions important to the public interest include:

(i) Wetlands which serve significant natural biological functions, including food chain production, general habitat and nesting, spawning, rearing and resting sites for aquatic or land species;

(ii) Wetlands set aside for study of the aquatic environment or as sanctuaries or refuges;

(iii) Wetlands the destruction or alteration of which would affect detrimentally natural drainage characteristics, sedimentation patterns, salinity distribution, flushing characteristics, current patterns, or other environmental characteristics;

(iv) Wetlands which are significant in shielding other areas from wave action, erosion, or storm damage. Such wetlands are often associated with barrier beaches, islands, reefs and bars;

(v) Wetlands which serve as valuable storage areas for storm and flood waters;

(vi) Wetlands which are ground water discharge areas that maintain minimum baseflows important to aquatic resources and those which are prime natural recharge areas;

(vii) Wetlands which serve significant water purification functions; and

(viii) Wetlands which are unique in nature or scarce in quantity to the region or local area.

(3) Although a particular alteration of a wetland may constitute a minor change, the cumulative effect of numerous piecemeal changes can result in a major impairment of wetland resources. Thus, the particular wetland site for which an application is made will be evaluated with the recognition that it may be part of a complete and interrelated wetland area. In addition, the district engineer may undertake, where appropriate, reviews of particular wetland areas in consultation with the Regional Director of the U. S. Fish and Wildlife Service, the Regional Director of the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration, the Regional Administrator of the Environmental Protection Agency, the local representative of the Soil Conservation Service of the Department of Agriculture, and the head of the appropriate state agency to assess the cumulative effect of activities in such areas.

(4) No permit will be granted which involves the alteration of wetlands identified as important by paragraph (b)(2) of this section or because of provisions of paragraph (b)(3), of this section unless the district engineer concludes, on the basis of the analysis required in paragraph (a) of this section, that the benefits of the proposed alteration outweigh the damage to the wetlands resource. In evaluating whether a particular discharge activity should be permitted, the district engineer shall apply the section 404(b)(1) guidelines (40 CFR Part 230.10(a) (1), (2), (3)).

(5) In addition to the policies expressed in this subpart, the Congressional policy expressed in the Estuary Protection Act, Pub. L. 90-454, and state regulatory laws or programs for classification and protection of wetlands will be considered.

(c) *Fish and wildlife.* In accordance with the Fish and Wildlife Coordination Act (paragraph 320.3(e) of this section) district engineers will consult with the Regional Director, U.S. Fish and Wildlife Service, the Regional Director, National Marine Fisheries Service, and the head of the agency responsible for fish and wildlife for the state in which work is to be performed, with a view to the conservation of wildlife resources by prevention of their direct and indirect loss and damage due to the activity proposed in a permit application. The Army will give full consideration to the

views of those agencies on fish and wildlife matters in deciding on the issuance, denial, or conditioning of individual or general permits.

(d) *Water quality.* Applications for permits for activities which may adversely affect the quality of waters of the United States will be evaluated for compliance with applicable effluent limitations and water quality standards, during the construction and subsequent operation of the proposed activity. The evaluation should include the consideration of both point and non-point sources of pollution. It should be noted, however, that the Clean Water Act assigns responsibility for control of non-point sources of pollution to the states. Certification of compliance with applicable effluent limitations and water quality standards required under provisions of section 401 of the Clean Water Act will be considered conclusive with respect to water quality considerations unless the Regional Administrator, Environmental Protection Agency (EPA), advises of other water quality aspects to be taken into consideration.

(e) *Historic, cultural, scenic, and recreational values.* Applications for DA permits may involve areas which possess recognized historic, cultural, scenic, conservation, recreational or similar values. Full evaluation of the general public interest requires that due consideration be given to the effect which the proposed structure or activity may have on values such as those associated with wild and scenic rivers, historic properties and National Landmarks, National Rivers, National Wilderness Areas, National Seashores, National Recreation Areas, National Lakeshores, National Parks, National Monuments, estuarine and marine sanctuaries, archeological resources, including Indian religious or cultural sites, and such other areas as may be established under federal or state law for similar and related purposes. Recognition of those values is often reflected by state, regional, or local land use classifications, or by similar federal controls or policies. Action on permit applications should, insofar as possible, be consistent with, and avoid significant adverse effects on the values or purposes for which those classifications, controls, or policies were established.

(f) *Effects on limits of the territorial sea.* Structures or work affecting coastal waters may modify the coast line or base line from which the territorial sea is measured for purposes of the Submerged Lands Act and international law. Generally, the coast line or base line is the line of ordinary low water on

the mainland; however, there are exceptions where there are islands or lowtide elevations offshore (the Submerged Lands Act, 43 U.S.C. 1301(a) and *United States v. California*, 381 U.S.C. 139 (1965), 382 U.S. 448 (1966)). Applications for structures or work affecting coastal waters will therefore be reviewed specifically to determine whether the coast line or base line might be altered. If it is determined that such a change might occur, coordination with the Attorney General and the Solicitor of the Department of the Interior is required before final action is taken. The district engineer will submit a description of the proposed work and a copy of the plans to the Solicitor, Department of the Interior, Washington, DC 20240, and request his comments concerning the effects of the proposed work on the outer continental rights of the United States. These comments will be included in the administrative record of the application. After completion of standard processing procedures, the record will be forwarded to the Chief of Engineers. The decision on the application will be made by the Secretary of the Army after coordination with the Attorney General.

(g) *Consideration of property ownership.* Authorization of work or structures by DA does not convey a property right, nor authorize any injury to property or invasion of other rights.

(1) An inherent aspect of property ownership is a right to reasonable private use. However, this right is subject to the rights and interests of the public in the navigable and other waters of the United States, including the federal navigation servitude and federal regulation for environmental protection.

(2) Because a landowner has the general right to protect property from erosion, applications to erect protective structures will usually receive favorable consideration. However, if the protective structure may cause damage to the property of others, adversely affect public health and safety, adversely impact floodplain or wetland values, or otherwise appears contrary to the public interest, the district engineer will so advise the applicant and inform him of possible alternative methods of protecting his property. Such advice will be given in terms of general guidance only so as not to compete with private engineering firms nor require undue use of government resources.

(3) A riparian landowner's general right of access to navigable waters of the United States is subject to the similar rights of access held by nearby riparian landowners and to the general public's right of navigation on the water surface. In the case of proposals which

create undue interference with access to, or use of, navigable waters, the authorization will generally be denied.

(4) Where it is found that the work for which a permit is desired is in navigable waters of the United States (see 33 CFR Part 329) and may interfere with an authorized federal project, the applicant should be apprised in writing of the fact and of the possibility that a federal project which may be constructed in the vicinity of the proposed work might necessitate its removal or reconstruction. The applicant should also be informed that the United States will in no case be liable for any damage or injury to the structures or work authorized by Sections 9 or 10 of the Rivers and Harbors Act of 1899 or by section 404 of the Clean Water Act which may be caused by, or result from, future operations undertaken by the Government for the conservation or improvement of navigation or for other purposes, and no claims or right to compensation will accrue from any such damage.

(5) Proposed activities in the area of a federal project which exists or is under construction will be evaluated to insure that they are compatible with the purposes of the project.

(6) A DA permit does not convey any property rights, either in real estate or material, or any exclusive privileges. Furthermore, a DA permit does not authorize any injury to property or invasion of rights or any infringement of Federal, state or local laws or regulations. The applicant's signature on an application is an affirmation that the applicant possesses or will possess the requisite property interest to undertake the activity proposed in the application. The district engineer will not enter into disputes but will remind the applicant of the above. The dispute over property ownership will not be a factor in the Corps public interest decision.

(h) *Activities affecting coastal zones.* Applications for DA permits for activities affecting the coastal zones of those states having a coastal zone management program approved by the Secretary of Commerce will be evaluated with respect to compliance with that program. No permit will be issued to a non-federal applicant until certification has been provided that the proposed activity complies with the coastal zone management program and the appropriate state agency has concurred with the certification or has waived its right to do so. However, a permit may be issued to a non-federal applicant if the Secretary of Commerce, on his own initiative or upon appeal by the applicant, finds that the proposed activity is consistent with the objectives

of the Coastal Zone Management Act of 1972 or is otherwise necessary in the interest of national security. Federal agency and Indian tribe applicants for DA permits are responsible for complying with the Coastal Zone Management Act's directives for assuring that their activities directly affecting the coastal zone are consistent, to the maximum extent practicable, with approved state coastal zone management programs.

(i) *Activities in marine sanctuaries.* Applications for DA authorization for activities in a marine sanctuary established by the Secretary of Commerce under authority of section 302 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, will be evaluated for impact on the marine sanctuary. No permit will be issued until the applicant provides a certification from the Secretary of Commerce that the proposed activity is consistent with the purposes of Title III of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, and can be carried out within the regulations promulgated by the Secretary of Commerce to control activities within the marine sanctuary.

(j) *Other Federal, state, or local requirements.* (1) Processing of an application for a DA permit normally will proceed concurrently with the processing of other required Federal, state, and/or local authorizations or certifications. Final action on the DA permit will normally not be delayed pending action by another Federal, state or local agency (See 33 CFR 325.2 (d)(4)). However, where the required Federal, state and/or local authorization and/or certification has been denied for activities which also require a Department of the Army permit before final action has been taken on the Army permit application, the district engineer will, after considering the likelihood of subsequent approval of the other authorization and/or certification and the time and effort remaining to complete processing the Army permit application, either immediately deny the Army permit without prejudice or continue processing the application to a conclusion. If the district engineer continues processing the application, he will conclude by either denying the permit as contrary to the public interest, or denying it without prejudice indicating that except for the other Federal, state or local denial the Army permit could, under appropriate conditions, be issued. Denial without prejudice means that there is no prejudice to the right of the applicant to reinstate processing of the Army permit

application if subsequent approval is received from the appropriate Federal, state and/or local agency on a previously denied authorization and/or certification. Even if official certification and/or authorization is not required by state or federal law, but a state, regional, or local agency having jurisdiction or interest over the particular activity comments on the application, due consideration shall be given to those official views as a reflection of local factors of the public interest.

(2) The primary responsibility for determining zoning and land use matters rests with state, local and tribal governments. The district engineer will normally accept decisions by such governments on those matters unless there are significant issues of overriding national importance. Such issues would include but are not necessarily limited to national security, navigation, national economic development, water quality, preservation of special aquatic areas, including wetlands, with significant interstate importance, and national energy needs. Whether a factor has overriding importance will depend on the degree of impact in an individual case.

(3) A proposed activity may result in conflicting comments from several agencies within the same state. Where a state has not designated a single responsible coordinating agency, district engineers will ask the Governor to express his views or to designate one state agency to represent the official state position in the particular case.

(4) In the absence of overriding national factors of the public interest that may be revealed during the evaluation of the permit application, a permit will generally be issued following receipt of a favorable state determination provided the concerns, policies, goals, and requirements as expressed in 33 CFR Parts 320-324, and the applicable statutes have been considered and followed: e.g., the National Environmental Policy Act; the Fish and Wildlife Coordination Act; the Historical and Archeological Preservation Act; the National Historic Preservation Act; the Endangered Species Act; the Coastal Zone Management Act; the Marine Protection, Research and Sanctuaries Act of 1972, as amended; the Clean Water Act, the Archeological Resources Act, and the American Indian Religious Freedom Act. Similarly, a permit will generally be issued for Federal and Federally-authorized activities; another federal agency's determination to proceed is

entitled to substantial consideration in the Corps' public interest review.

(5) Where general permits to avoid duplication are not practical, district engineers shall develop joint procedures with those local, state, and other Federal agencies having ongoing permit programs for activities also regulated by the Department of the Army. In such cases, applications for DA permits may be processed jointly with the state or other federal applications to an independent conclusion and decision by the district engineer and the appropriate Federal or state agency. (See 33 CFR 325.2(e).)

(6) The district engineer shall develop operating procedures for establishing official communications with Indian Tribes within the district. The procedures shall provide for appointment of a tribal representative who will receive all pertinent public notices, and respond to such notices with the official tribal position on the proposed activity. This procedure shall apply only to those tribes which accept this option. Any adopted operating procedures shall be distributed by public notice to inform the tribes of this option.

(k) *Safety of impoundment structures.* To insure that all impoundment structures are designed for safety, non-Federal applicants may be required to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons and, in appropriate cases, that the design has been independently reviewed (and modified as the review would indicate) by similarly qualified persons.

(l) *Floodplain management.* (1) Floodplains possess significant natural values and carry out numerous functions important to the public interest. These include:

(i) Water resources values (natural moderation of floods, water quality maintenance, and groundwater recharge);

(ii) Living resource values (fish, wildlife, and plant resources);

(iii) Cultural resource values (open space, natural beauty, scientific study, outdoor education, and recreation); and

(iv) Cultivated resource values (agriculture, aquaculture, and forestry).

(2) Although a particular alteration to a floodplain may constitute a minor change, the cumulative impact of such changes may result in a significant degradation of floodplain values and functions and in increased potential for harm to upstream and downstream activities. In accordance with the requirements of Executive Order 11988,

district engineers, as part of their public interest review, should avoid to the extent practicable, long and short term significant adverse impacts associated with the occupancy and modification of floodplains, as well as the direct and indirect support of floodplain development whenever there is a practicable alternative. For those activities which in the public interest must occur in or impact upon floodplains, the district engineer shall ensure, to the maximum extent practicable, that the impacts of potential flooding on human health, safety, and welfare are minimized, the risks of flood losses are minimized, and, whenever practicable the natural and beneficial values served by floodplains are restored and preserved.

(3) In accordance with Executive Order 11988, the district engineer should avoid authorizing floodplain developments whenever practicable alternatives exist outside the floodplain. If there are no such practicable alternatives, the district engineer shall consider, as a means of mitigation, alternatives within the floodplain which will lessen any significant adverse impact to the floodplain.

(m) *Water supply and conservation.* Water is an essential resource, basic to human survival, economic growth, and the natural environment. Water conservation requires the efficient use of water resources in all actions which involve the significant use of water or that significantly affect the availability of water for alternative uses including opportunities to reduce demand and improve efficiency in order to minimize new supply requirements. Actions affecting water quantities are subject to Congressional policy as stated in section 101(g) of the Clean Water Act which provides that the authority of states to allocate water quantities shall not be superseded, abrogated, or otherwise impaired.

(n) *Energy conservation and development.* Energy conservation and development are major national objectives. District engineers will give high priority to the processing of permit actions involving energy projects.

(o) *Navigation.* (1) Section 11 of the Rivers and Harbors Act of 1899 authorized establishment of harbor lines shoreward of which no individual permits were required. Because harbor lines were established on the basis of navigation impacts only, the Corps of Engineers published a regulation on 27 May 1970 (33 CFR 209.150) which declared that permits would thereafter be required for activities shoreward of the harbor lines. Review of applications

would be based on a full public interest evaluation and harbor lines would serve as guidance for assessing navigation impacts. Accordingly, activities constructed shoreward of harbor lines prior to 27 May 1970 do not require specific authorization.

(2) The policy of considering harbor lines as guidance for assessing impacts on navigation continues.

(3) Protection of navigation in all navigable waters of the United States continues to be a primary concern of the federal government.

(4) District engineers should protect navigational and anchorage interests in connection with the NPDES program by recommending to EPA or to the state, if the program has been delegated, that a permit be denied unless appropriate conditions can be included to avoid any substantial impairment of navigation and anchorage.

(p) *Environmental benefits.* Some activities that require Department of the Army permits result in beneficial effects to the quality of the environment. The district engineer will weigh these benefits as well as environmental detriments along with other factors of the public interest.

(q) *Economics.* When private enterprise makes application for a permit, it will generally be assumed that appropriate economic evaluations have been completed, the proposal is economically viable, and is needed in the market place. However, the district engineer in appropriate cases, may make an independent review of the need for the project from the perspective of the overall public interest. The economic benefits of many projects are important to the local community and contribute to needed improvements in the local economic base, affecting such factors as employment, tax revenues, community cohesion, community services, and property values. Many projects also contribute to the National Economic Development (NED), (i.e., the increase in the net value of the national output of goods and services).

(r) *Mitigation.*¹ (1) Mitigation is an important aspect of the review and balancing process on many Department of the Army permit applications. Consideration of mitigation will occur throughout the permit application

review process and includes avoiding, minimizing, rectifying, reducing, or compensating for resource losses. Losses will be avoided to the extent practicable. Compensation may occur on-site or at an off-site location. Mitigation requirements generally fall into three categories.

(i) Project modifications to minimize adverse project impacts should be discussed with the applicant at pre-application meetings and during application processing. As a result of these discussions and as the district engineer's evaluation proceeds, the district engineer may require minor project modifications. Minor project modifications are those that are considered feasible (cost, constructability, etc.) to the applicant and that, if adopted, will result in a project that generally meets the applicant's purpose and need. Such modifications can include reductions in scope and size; changes in construction methods, materials or timing; and operation and maintenance practices or other similar modifications that reflect a sensitivity to environmental quality within the context of the work proposed. For example, erosion control features could be required on a fill project to reduce sedimentation impacts or a pier could be reoriented to minimize navigational problems even though those projects may satisfy all legal requirements (paragraph (r)(1)(ii) of this section) and the public interest review test (paragraph (r)(1)(iii) of this section) without such modifications.

(ii) Further mitigation measures may be required to satisfy legal requirements. For Section 404 applications, mitigation shall be required to ensure that the project complies with the 404(b)(1) Guidelines. Some mitigation measures are enumerated at 40 CFR 230.70 through 40 CFR 230.77 (Subpart H of the 404(b)(1) Guidelines).

(iii) Mitigation measures in addition to those under paragraphs (r)(1)(i) and (ii) of this section may be required as a result of the public interest review process. (See 33 CFR 325.4(a).) Mitigation should be developed and incorporated within the public interest review process to the extent that the mitigation is found by the district engineer to be reasonable and justified. Only those measures required to ensure that the project is not contrary to the public interest may be required under this subparagraph.

(2) All compensatory mitigation will be for significant resource losses which are specifically identifiable, reasonably likely to occur, and of importance to the

human or aquatic environment. Also, all mitigation will be directly related to the impacts of the proposal, appropriate to the scope and degree of those impacts, and reasonably enforceable. District engineers will require all forms of mitigation, including compensatory mitigation, only as provided in paragraphs (r)(1)(i) through (iii) of this section. Additional mitigation may be added at the applicants' request.

PART 321—PERMITS FOR DAMS AND DIKES IN NAVIGABLE WATERS OF THE UNITED STATES

Sec.

321.1 General.

321.2 Definitions.

321.3 Special policies and procedures.

Authority: 33 U.S.C. 401.

§ 321.1 General.

This regulation prescribes, in addition to the general policies of 33 CFR Part 320 and procedures of 33 CFR Part 325, those special policies, practices, and procedures to be followed by the Corps of Engineers in connection with the review of applications for Department of the Army (DA) permits to authorize the construction of a dike or dam in a navigable water of the United States pursuant to section 9 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401). See 33 CFR 320.2(a). Dams and dikes in navigable waters of the United States also require DA permits under section 404 of the Clean Water Act, as amended (33 U.S.C. 1344). Applicants for DA permits under this Part should also refer to 33 CFR Part 323 to satisfy the requirements of section 404.

§ 321.2 Definitions.

For the purpose of this regulation, the following terms are defined:

(a) The term "navigable waters of the United States" means those waters of the United States that are subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce. See 33 CFR Part 329 for a more complete definition of this term.

(b) The term "dike or dam" means, for the purposes of section 9, any impoundment structure that completely spans a navigable water of the United States and that may obstruct interstate waterborne commerce. The term does not include a weir. Weirs are regulated pursuant to section 10 of the Rivers and Harbors Act of 1899. (See 33 CFR Part 322.)

¹ This is a general statement of mitigation policy which applies to all Corps of Engineers regulatory authorities covered by these regulations (33 CFR Parts 320-330). It is not a substitute for the mitigation requirements necessary to ensure that a permit action under section 404 of the Clean Water Act complies with the section 404(b)(1) Guidelines. There is currently an interagency Working Group formed to develop guidance on implementing mitigation requirements of the Guidelines.

§ 321.3 Special policies and procedures.

The following additional special policies and procedures shall be applicable to the evaluation of permit applications under this regulation:

(a) The Assistant Secretary of the Army (Civil Works) will decide whether DA authorization for a dam or dike in an interstate navigable water of the United States will be issued, since this authority has not been delegated to the Chief of Engineers. The conditions to be imposed in any instrument of authorization will be recommended by the district engineer when forwarding the report to the Assistant Secretary of the Army (Civil Works), through the Chief of Engineers.

(b) District engineers are authorized to decide whether DA authorization for a dam or dike in an intrastate navigable water of the United States will be issued (see 33 CFR 325.8).

(c) Processing a DA application under section 9 will not be completed until the approval of the United States Congress has been obtained if the navigable water of the United States is an interstate waterbody, or until the approval of the appropriate state legislature has been obtained if the navigable water of the United States is an intrastate waterbody (i.e., the navigable portion of the navigable water of the United States is solely within the boundaries of one state). The district engineer, upon receipt of such an application, will notify the applicant that the consent of Congress or the state legislature must be obtained before a permit can be issued.

PART 322—PERMITS FOR STRUCTURES OR WORK IN OR AFFECTING NAVIGABLE WATERS OF THE UNITED STATES

Sec.

- 322.1 General.
- 322.2 Definitions.
- 322.3 Activities requiring permits.
- 322.4 Activities not requiring permits.
- 322.5 Special policies.

Authority: 33 U.S.C. 403.

§ 322.1 General.

This regulation prescribes, in addition to the general policies of 33 CFR Part 320 and procedures of 33 CFR Part 325, those special policies, practices, and procedures to be followed by the Corps of Engineers in connection with the review of applications for Department of the Army (DA) permits to authorize certain structures or work in or affecting navigable waters of the United States pursuant to section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) (hereinafter referred to as section 10). See 33 CFR 320.2(b). Certain structures

or work in or affecting navigable waters of the United States are also regulated under other authorities of the DA. These include discharges of dredged or fill material into waters of the United States, including the territorial seas, pursuant to section 404 of the Clean Water Act (33 U.S.C. 1344; see 33 CFR Part 323) and the transportation of dredged material by vessel for purposes of dumping in ocean waters, including the territorial seas, pursuant to section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (33 U.S.C. 1413; see 33 CFR Part 324). A DA permit will also be required under these additional authorities if they are applicable to structures or work in or affecting navigable waters of the United States. Applicants for DA permits under this part should refer to the other cited authorities and implementing regulations for these additional permit requirements to determine whether they also are applicable to their proposed activities.

§ 322.2 Definitions.

For the purpose of this regulation, the following terms are defined:

(a) The term "navigable waters of the United States" and all other terms relating to the geographic scope of jurisdiction are defined at 33 CFR Part 329. Generally, they are those waters of the United States that are subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce.

(b) The term "structure" shall include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other obstacle or obstruction.

(c) The term "work" shall include, without limitation, any dredging or disposal of dredged material, excavation, filling, or other modification of a navigable water of the United States.

(d) The term "letter of permission" means a type of individual permit issued in accordance with the abbreviated procedures of 33 CFR 325.2(e).

(e) The term "individual permit" means a DA authorization that is issued following a case-by-case evaluation of a specific structure or work in accordance with the procedures of this regulation and 33 CFR Part 325, and a

determination that the proposed structure or work is in the public interest pursuant to 33 CFR Part 320.

(f) The term "general permit" means a DA authorization that is issued on a nationwide or regional basis for a category or categories of activities when:

(1) Those activities are substantially similar in nature and cause only minimal individual and cumulative environmental impacts; or

(2) The general permit would result in avoiding unnecessary duplication of the regulatory control exercised by another Federal, state, or local agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal. (See 33 CFR 325.2(e) and 33 CFR Part 330.)

(g) The term "artificial reef" means a structure which is constructed or placed in the navigable waters of the United States or in the waters overlying the outer continental shelf for the purpose of enhancing fishery resources and commercial and recreational fishing opportunities. The term does not include activities or structures such as wing deflectors, bank stabilization, grade stabilization structures, or low flow key ways, all of which may be useful to enhance fisheries resources.

§ 322.3 Activities requiring permits.

(a) *General.* DA permits are required under section 10 for structures and/or work in or affecting navigable waters of the United States except as otherwise provided in § 322.4 below. Certain activities specified in 33 CFR Part 330 are permitted by that regulation ("nationwide general permits"). Other activities may be authorized by district or division engineers on a regional basis ("regional general permits"). If an activity is not exempted by section 322.4 of this part or authorized by a general permit, an individual section 10 permit will be required for the proposed activity. Structures or work are in navigable waters of the United States if they are within limits defined in 33 CFR Part 329. Structures or work outside these limits are subject to the provisions of law cited in paragraph (a) of this section, if these structures or work affect the course, location, or condition of the waterbody in such a manner as to impact on its navigable capacity. For purposes of a section 10 permit, a tunnel or other structure or work under or over a navigable water of the United States is considered to have an impact on the navigable capacity of the waterbody.

(b) *Outer continental shelf.* DA permits are required for the construction

of artificial islands, installations, and devices on the seabed, to the seaward limit of the outer continental shelf, pursuant to section 4(f) of the Outer Continental Shelf Lands Act as amended. (See 33 CFR 320.2(b).)

(c) *Activities of Federal agencies.* (1) Except as specifically provided in this paragraph, activities of the type described in paragraphs (a) and (b) of this section, done by or on behalf of any Federal agency are subject to the authorization procedures of these regulations. Work or structures in or affecting navigable waters of the United States that are part of the civil works activities of the Corps of Engineers, unless covered by a nationwide or regional general permit issued pursuant to these regulations, are subject to the procedures of separate regulations. Agreement for construction or engineering services performed for other agencies by the Corps of Engineers does not constitute authorization under this regulation. Division and district engineers will therefore advise Federal agencies accordingly, and cooperate to the fullest extent in expediting the processing of their applications.

(2) Congress has delegated to the Secretary of the Army in section 10 the duty to authorize or prohibit certain work or structures in navigable waters of the United States, upon recommendation of the Chief of Engineers. The general legislation by which Federal agencies are empowered to act generally is not considered to be sufficient authorization by Congress to satisfy the purposes of section 10. If an agency asserts that it has Congressional authorization meeting the test of section 10 or would otherwise be exempt from the provisions of section 10, the legislative history and/or provisions of the Act should clearly demonstrate that Congress was approving the exact location and plans from which Congress could have considered the effect on navigable waters of the United States or that Congress intended to exempt that agency from the requirements of section 10. Very often such legislation reserves final approval of plans or construction for the Chief of Engineers. In such cases evaluation and authorization under this regulation are limited by the intent of the statutory language involved.

(3) The policy provisions set out in 33 CFR 320.4(j) relating to state or local certifications and/or authorizations, do not apply to work or structures undertaken by Federal agencies, except where compliance with non-Federal authorization is required by Federal law or Executive policy, e.g., section 313 and section 401 of the Clean Water Act.

§ 322.4 Activities not requiring permits.

(a) Activities that were commenced or completed shoreward of established Federal harbor lines before May 27, 1970 (see 33 CFR 320.4(o)) do not require section 10 permits; however, if those activities involve the discharge of dredged or fill material into waters of the United States after October 18, 1972, a section 404 permit is required. (See 33 CFR Part 323.)

(b) Pursuant to section 154 of the Water Resource Development Act of 1976 (Pub. L. 94-587), Department of the Army permits are not required under section 10 to construct wharves and piers in any waterbody, located entirely within one state, that is a navigable water of the United States solely on the basis of its historical use to transport interstate commerce.

§ 322.5 Special policies.

The Secretary of the Army has delegated to the Chief of Engineers the authority to issue or deny section 10 permits. The following additional special policies and procedures shall also be applicable to the evaluation of permit applications under this regulation.

(a) *General.* DA permits are required for structures or work in or affecting navigable waters of the United States. However, certain structures or work specified in 33 CFR Part 330 are permitted by that regulation. If a structure or work is not permitted by that regulation, an individual or regional section 10 permit will be required.

(b) *Artificial Reefs.* (1) When considering an application for an artificial reef, as defined in 33 CFR 322.2(g), the district engineer will review the applicant's provisions for siting, constructing, monitoring, operating, maintaining, and managing the proposed artificial reef and shall determine if those provisions are consistent with the following standards:

(i) The enhancement of fishery resources to the maximum extent practicable;

(ii) The facilitation of access and utilization by United States recreational and commercial fishermen;

(iii) The minimization of conflicts among competing uses of the navigable waters or waters overlying the outer continental shelf and of the resources in such waters;

(iv) The minimization of environmental risks and risks to personal health and property;

(v) Generally accepted principles of international law; and

(vi) the prevention of any unreasonable obstructions to navigation. If the district engineer decides that the

applicant's provisions are not consistent with these standards, he shall deny the permit. If the district engineer decides that the provisions are consistent with these standards, and if he decides to issue the permit after the public interest review, he shall make the provisions part of the permit.

(2) In addition, the district engineer will consider the National Artificial Reef Plan developed pursuant to section 204 of the National Fishing Enhancement Act of 1964, and if he decides to issue the permit, will notify the Secretary of Commerce of any need to deviate from that plan.

(3) The district engineer will comply with all coordination provisions required by a written agreement between the DOD and the Federal agencies relative to artificial reefs. In addition, if the district engineer decides that further consultation beyond the normal public commenting process is required to evaluate fully the proposed artificial reef, he may initiate such consultation with any Federal agency, state or local government, or other interested party.

(4) The district engineer will issue a permit for the proposed artificial reef only if the applicant demonstrates, to the district engineer's satisfaction, that the title to the artificial reef construction material is unambiguous, that responsibility for maintenance of the reef is clearly established, and that he has the financial ability to assume liability for all damages that may arise with respect to the proposed artificial reef. A demonstration of financial responsibility might include evidence of insurance, sponsorship, or available assets.

(i) A person to whom a permit is issued in accordance with these regulations and any insurer of that person shall not be liable for damages caused by activities required to be undertaken under any terms and conditions of the permit, if the permittee is in compliance with such terms and conditions.

(ii) A person to whom a permit is issued in accordance with these regulations and any insurer of that person shall be liable, to the extent determined under applicable law, for damages to which paragraph (i) does not apply.

(iii) Any person who has transferred title to artificial reef construction materials to a person to whom a permit is issued in accordance with these regulations shall not be liable for damages arising from the use of such materials in an artificial reef, if such materials meet applicable requirements

of the plan published under section 204 of the National Artificial Reef Plan, and are not otherwise defective at the time title is transferred.

(c) *Non-Federal dredging for navigation.* (1) The benefits which an authorized Federal navigation project are intended to produce will often require similar and related operations by non-Federal agencies (e.g., dredging access channels to docks and berthing facilities or deepening such channels to correspond to the Federal project depth). These non-Federal activities will be considered by Corps of Engineers officials in planning the construction and maintenance of Federal navigation projects and, to the maximum practical extent, will be coordinated with interested Federal, state, regional and local agencies and the general public simultaneously with the associated Federal projects. Non-Federal activities which are not so coordinated will be individually evaluated in accordance with these regulations. In evaluating the public interest in connection with applications for permits for such coordinated operations, equal treatment will be accorded to the fullest extent possible to both Federal and non-Federal operations. Permits for non-Federal dredging operations will normally contain conditions requiring the permittee to comply with the same practices or requirements utilized in connection with related Federal dredging operations with respect to such matters as turbidity, water quality, containment of material, nature and location of approved spoil disposal areas (non-Federal use of Federal contained disposal areas will be in accordance with laws authorizing such areas and regulations governing their use), extent and period of dredging, and other factors relating to protection of environmental and ecological values.

(2) A permit for the dredging of a channel, slip, or other such project for navigation may also authorize the periodic maintenance dredging of the project. Authorization procedures and limitations for maintenance dredging shall be as prescribed in 33 CFR 325.6(e). The permit will require the permittee to give advance notice to the district engineer each time maintenance dredging is to be performed. Where the maintenance dredging involves the discharge of dredged material into waters of the United States or the transportation of dredged material for the purpose of dumping it in ocean waters, the procedures in 33 CFR Parts 323 and 324 respectively shall also be followed.

(d) *Structures for small boats.* (1) In the absence of overriding public interest, favorable consideration will generally be given to applications from riparian owners for permits for piers, boat docks, moorings, platforms and similar structures for small boats. Particular attention will be given to the location and general design of such structures to prevent possible obstructions to navigation with respect to both the public's use of the waterway and the neighboring proprietors' access to the waterway. Obstructions can result from both the existence of the structure, particularly in conjunction with other similar facilities in the immediate vicinity, and from its inability to withstand wave action or other forces which can be expected. District engineers will inform applicants of the hazards involved and encourage safety in location, design, and operation. District engineers will encourage cooperative or group use facilities in lieu of individual proprietary use facilities.

(2) Floating structures for small recreational boats or other recreational purposes in lakes controlled by the Corps of Engineers under a resource manager are normally subject to permit authorities cited in § 322.3, of this section, when those waters are regarded as navigable waters of the United States. However, such structures will not be authorized under this regulation but will be regulated under applicable regulations of the Chief of Engineers published in 36 CFR 327.19 if the land surrounding those lakes is under complete Federal ownership. District engineers will delineate those portions of the navigable waters of the United States where this provision is applicable and post notices of this designation in the vicinity of the lake resource manager's office.

(e) *Aids to navigation.* The placing of fixed and floating aids to navigation in a navigable water of the United States is within the purview of Section 10 of the Rivers and Harbors Act of 1899. Furthermore, these aids are of particular interest to the U.S. Coast Guard because of its control of marking, lighting and standardization of such navigation aids. A Section 10 nationwide permit has been issued for such aids provided they are approved by, and installed in accordance with the requirements of the U.S. Coast Guard (33 CFR 330.5(a)(1)). Electrical service cables to such aids are not included in the nationwide permit (an individual or regional Section 10 permit will be required).

(f) *Outer continental shelf.* Artificial islands, installations, and other devices located on the seabed, to the seaward

limit of the outer continental shelf, are subject to the standard permit procedures of this regulation. Where the islands, installations and other devices are to be constructed on lands which are under mineral lease from the Mineral Management Service, Department of the Interior, that agency, in cooperation with other federal agencies, fully evaluates the potential effect of the leasing program on the total environment. Accordingly, the decision whether to issue a permit on lands which are under mineral lease from the Department of the Interior will be limited to an evaluation of the impact of the proposed work on navigation and national security. The public notice will so identify the criteria.

(g) *Canals and other artificial waterways connected to navigable waters of the United States.* A canal or similar artificial waterway is subject to the regulatory authorities discussed in § 322.3, of this Part, if it constitutes a navigable water of the United States, or if it is connected to navigable waters of the United States in a manner which affects their course, location, condition, or capacity, or if at some point in its construction or operation it results in an effect on the course, location, condition, or capacity of navigable waters of the United States. In all cases the connection to navigable waters of the United States requires a permit. Where the canal itself constitutes a navigable water of the United States, evaluation of the permit application and further exercise of regulatory authority will be in accordance with the standard procedures of these regulations. For all other canals, the exercise of regulatory authority is restricted to those activities which affect the course, location, condition, or capacity of the navigable waters of the United States. The district engineer will consider, for applications for canal work, a proposed plan of the entire development and the location and description of anticipated docks, piers and other similar structures which will be placed in the canal.

(h) *Facilities at the borders of the United States.* (1) The construction, operation, maintenance, or connection of facilities at the borders of the United States are subject to Executive control and must be authorized by the President, Secretary of State, or other delegated official.

(2) Applications for permits for the construction, operation, maintenance, or connection at the borders of the United States of facilities for the transmission of electric energy between the United States and a foreign country, or for the exportation or importation of natural

gas to or from a foreign country, must be made to the Secretary of Energy. (Executive Order 10485, September 3, 1953, 18 U.S.C. 824(a)(e), 15 U.S.C. 717(b), as amended by Executive Order 12038, February 3, 1978, and 18 CFR Parts 32 and 153).

(3) Applications for the landing or operation of submarine cables must be made to the Federal Communications Commission. (Executive Order 10530, May 10, 1954, 47 U.S.C. 34 to 39, and 47 CFR 1.766).

(4) The Secretary of State is to receive applications for permits for the construction, connection, operation, or maintenance, at the borders of the United States, of pipelines, conveyor belts, and similar facilities for the exportation or importation of petroleum products, coals, minerals, or other products to or from a foreign country; facilities for the exportation or importation of water or sewage to or from a foreign country; and monorails, aerial cable cars, aerial tramways, and similar facilities for the transportation of persons and/or things, to or from a foreign country. (Executive Order 11423, August 18, 1968).

(5) A DA permit under section 10 of the Rivers and Harbors Act of 1899 is also required for all of the above facilities which affect the navigable waters of the United States, but in each case in which a permit has been issued as provided above, the district engineer, in evaluating the general public interest, may consider the basic existence and operation of the facility to have been primarily examined and permitted as provided by the Executive Orders. Furthermore, in those cases where the construction, maintenance, or operation at the above facilities involves the discharge of dredged or fill material in waters of the United States or the transportation of dredged material for the purpose of dumping it into ocean waters, appropriate DA authorizations under section 404 of the Clean Water Act or under section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, are also required. (See 33 CFR Parts 323 and 324.)

(i) *Power transmission lines.* (1) Permits under section 10 of the Rivers and Harbors Act of 1899 are required for power transmission lines crossing navigable waters of the United States unless those lines are part of a water power project subject to the regulatory authorities of the Department of Energy under the Federal Power Act of 1920. If an application is received for a permit for lines which are part of such a water power project, the applicant will be instructed to submit the application to the Department of Energy. If the lines

are not part of such a water power project, the application will be processed in accordance with the procedures of these regulations.

(2) The following minimum clearances are required for aerial electric power transmission lines crossing navigable waters of the United States. These clearances are related to the clearances over the navigable channel provided by existing fixed bridges, or the clearances which would be required by the U.S. Coast Guard for new fixed bridges, in the vicinity of the proposed power line crossing. The clearances are based on the low point of the line under conditions which produce the greatest sag, taking into consideration temperature, load, wind, length or span, and type of supports as outlined in the National Electrical Safety Code.

Nominal system voltage, kV	Minimum additional clearance (feet) above clearance required for bridges
115 and below	20
138	22
161	24
230	26
350	30
500	35
700	42
750-765	45

(3) Clearances for communication lines, stream gaging cables, ferry cables, and other aerial crossings are usually required to be a minimum of ten feet above clearances required for bridges. Greater clearances will be required if the public interest so indicates.

(4) Corps of Engineer regulation ER 1110-2-4401 prescribes minimum vertical clearances for power and communication lines over Corps lake projects. In instances where both this regulation and ER 1110-2-4401 apply, the greater minimum clearance is required.

(j) *Seaplane operations.* (1) Structures in navigable waters of the United States associated with seaplane operations require DA permits, but close coordination with the Federal Aviation Administration (FAA), Department of Transportation, is required on such applications.

(2) The FAA must be notified by an applicant whenever he proposes to establish or operate a seaplane base. The FAA will study the proposal and advise the applicant, district engineer, and other interested parties as to the effects of the proposal on the use of airspace. The district engineer will, therefore, refer any objections regarding the effect of the proposal on the use of airspace to the FAA, and give due

consideration to its recommendations when evaluating the general public interest.

(3) If the seaplane base would serve air carriers licensed by the Department of Transportation, the applicant must receive an airport operating certificate from the FAA. That certificate reflects a determination and conditions relating to the installation, operation, and maintenance of adequate air navigation facilities and safety equipment. Accordingly, the district engineer may, in evaluating the general public interest, consider such matters to have been primarily evaluated by the FAA.

(4) For regulations pertaining to seaplane landings at Corps of Engineers projects, see 36 CFR 327.4.

(k) *Foreign trade zones.* The Foreign Trade Zones Act (48 Stat. 998-1003, 19 U.S.C. 81a to 81u, as amended) authorizes the establishment of foreign-trade zones in or adjacent to United States ports of entry under terms of a grant and regulations prescribed by the Foreign-Trade Zones Board. Pertinent regulations are published at Title 15 of the Code of Federal Regulations, Part 400. The Secretary of the Army is a member of the Board, and construction of a zone is under the supervision of the district engineer. Laws governing the navigable waters of the United States remain applicable to foreign-trade zones, including the general requirements of these regulations. Evaluation by a district engineer of a permit application may give recognition to the consideration by the Board of the general economic effects of the zone on local and foreign commerce, general location of wharves and facilities, and other factors pertinent to construction, operation, and maintenance of the zone

(l) *Shipping safety fairways and anchorage areas.* DA permits are required for structures located within shipping safety fairways and anchorage areas established by the U.S. Coast Guard.

(1) The Department of the Army will grant no permits for the erection of structures in areas designated as fairways, except that district engineers may permit temporary anchors and attendant cables or chains for floating or semisubmersible drilling rigs to be placed within a fairway provided the following conditions are met:

(i) The installation of anchors to stabilize semisubmersible drilling rigs within fairways must be temporary and shall be allowed to remain only 120 days. This period may be extended by the district engineer provided reasonable cause for such extension can

be shown and the extension is otherwise justified.

(ii) Drilling rigs must be at least 500 feet from any fairway boundary or whatever distance necessary to insure that minimum clearance over an anchor line within a fairway will be 125 feet.

(iii) No anchor buoys or floats or related rigging will be allowed on the surface of the water or to a depth of 125 feet from the surface, within the fairway.

(iv) Drilling rigs may not be placed closer than 2 nautical miles of any other drilling rig situated along a fairway boundary, and not closer than 3 nautical miles to any drilling rig located on the opposite side of the fairway.

(v) The permittee must notify the district engineer, Bureau of Land Management, Mineral Management Service, U.S. Coast Guard, National Oceanic and Atmospheric Administration and the U.S. Navy Hydrographic Office of the approximate dates (commencement and completion) the anchors will be in place to insure maximum notification to mariners.

(vi) Navigation aids or danger markings must be installed as required by the U.S. Coast Guard.

(2) District engineers may grant permits for the erection of structures within an area designated as an anchorage area, but the number of structures will be limited by spacing, as follows: The center of a structure to be erected shall be not less than two (2) nautical miles from the center of any existing structure. In a drilling or production complex, associated structures shall be as close together as practicable having due consideration for the safety factors involved. A complex of associated structures, when connected by walkways, shall be considered one structure for the purpose of spacing. A vessel fixed in place by moorings and used in conjunction with the associated structures of a drilling or production complex, shall be considered an attendant vessel and its extent shall include its moorings. When a drilling or production complex includes an attendant vessel and the complex extends more than five hundred (500) yards from the center or the complex, a structure to be erected shall be not closer than two (2) nautical miles from the near outer limit of the complex. An underwater completion installation in and anchorage area shall be considered a structure and shall be marked with a lighted buoy as approved by the United States Coast Guard.

PART 323—PERMITS FOR DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES

Sec.

323.1 General.

323.2 Definitions.

323.3 Discharges requiring permits.

323.4 Discharges not requiring permits.

323.5 Program transfer to states.

323.6 Special policies and procedures.

Authority: 33 U.S.C. 1344.

§ 323.1 General.

This regulation prescribes, in addition to the general policies of 33 CFR Part 320 and procedures of 33 CFR Part 325, those special policies, practices, and procedures to be followed by the Corps of Engineers in connection with the review of applications for DA permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344) (hereinafter referred to as section 404). (See 33 CFR 320.2(g).) Certain discharges of dredged or fill material into waters of the United States are also regulated under other authorities of the Department of the Army. These include dams and dikes in navigable waters of the United States pursuant to section 9 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401; see 33 CFR Part 321) and certain structures or work in or affecting navigable waters of the United States pursuant to section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403; see 33 CFR Part 322). A DA permit will also be required under these additional authorities if they are applicable to activities involving discharges of dredged or fill material into waters of the United States. Applicants for DA permits under this part should refer to the other cited authorities and implementing regulations for these additional permit requirements to determine whether they also are applicable to their proposed activities.

§ 323.2 Definitions.

For the purpose of this part, the following terms are defined:

(a) The term "waters of the United States" and all other terms relating to the geographic scope of jurisdiction are defined at 33 CFR Part 328.

(b) The term "lake" means a standing body of open water that occurs in a natural depression fed by one or more streams from which a stream may flow, that occurs due to the widening or natural blockage or cutoff of a river or stream, or that occurs in an isolated natural depression that is not a part of a surface river or stream. The term also includes a standing body of open water created by artificially blocking or

restricting the flow of a river, stream, or tidal area. As used in this regulation, the term does not include artificial lakes or ponds created by excavating and/or diking dry land to collect and retain water for such purposes as stock watering, irrigation, settling basins, cooling, or rice growing.

(c) The term "dredged material" means material that is excavated or dredged from waters of the United States.

(d) The term "discharge of dredged material" means any addition of dredged material into the waters of the United States. The term includes, without limitation, the addition of dredged material to a specified discharge site located in waters of the United States and the runoff or overflow from a contained land or water disposal area. Discharges of pollutants into waters of the United States resulting from the onshore subsequent processing of dredged material that is extracted for any commercial use (other than fill) are not included within this term and are subject to section 402 of the Clean Water Act even though the extraction and deposit of such material may require a permit from the Corps of Engineers. The term does not include plowing, cultivating, seeding and harvesting for the production of food, fiber, and forest products (See § 323.4 for the definition of these terms). The term does not include *de minimis*, incidental soil movement occurring during normal dredging operations.

(e) The term "fill material" means any material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of an waterbody. The term does not include any pollutant discharged into the water primarily to dispose of waste, as that activity is regulated under section 402 of the Clean Water Act.

(f) The term "discharge of fill material" means the addition of fill material into waters of the United States. The term generally includes, without limitation, the following activities: Placement of fill that is necessary for the construction of any structure in a water of the United States; the building of any structure or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; causeways or road fills; dams and dikes; artificial islands; property protection and/or reclamation devices such as riprap, groins, seawalls, breakwaters, and revetments; beach nourishment; levees; fill for structures such as sewage treatment facilities.

intake and outfall pipes associated with power plants and subaqueous utility lines; and artificial reefs. The term does not include plowing, cultivating, seeding and harvesting for the production of food, fiber, and forest products (See § 323.4 for the definition of these terms).

(g) The term "individual permit" means a Department of the Army authorization that is issued following a case-by-case evaluation of a specific project involving the proposed discharge(s) in accordance with the procedures of this part and 33 CFR Part 325 and a determination that the proposed discharge is in the public interest pursuant to 33 CFR Part 320.

(h) The term "general permit" means a Department of the Army authorization that is issued on a nationwide or regional basis for a category or categories of activities when:

(1) Those activities are substantially similar in nature and cause only minimal individual and cumulative environmental impacts; or

(2) The general permit would result in avoiding unnecessary duplication of regulatory control exercised by another Federal, state, or local agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal. (See 33 CFR 325.2(e) and 33 CFR Part 330.)

§ 323.3 Discharges requiring permits.

(a) *General.* Except as provided in § 323.4 of this Part, DA permits will be required for the discharge of dredged or fill material into waters of the United States. Certain discharges specified in 33 CFR Part 330 are permitted by that regulation ("nationwide permits"). Other discharges may be authorized by district or division engineers on a regional basis ("regional permits"). If a discharge of dredged or fill material is not exempted by § 323.4 of this Part or permitted by 33 CFR Part 330, an individual or regional section 404 permit will be required for the discharge of dredged or fill material into waters of the United States.

(b) *Activities of Federal agencies.* Discharges of dredged or fill material into waters of the United States done by or on behalf of any Federal agency, other than the Corps of Engineers (see 33 CFR Part 209.145), are subject to the authorization procedures of these regulations. Agreement for construction or engineering services performed for other agencies by the Corps of Engineers does not constitute authorization under the regulations. Division and district engineers will therefore advise Federal agencies and instrumentalities accordingly and cooperate to the fullest

extent in expediting the processing of their applications.

§ 323.4 Discharges not requiring permits.

(a) *General.* Except as specified in paragraphs (b) and (c) of this section, any discharge of dredged or fill material that may result from any of the following activities is not prohibited by or otherwise subject to regulation under section 404:

(1)(i) Normal farming, silviculture and ranching activities such as plowing, seeding, cultivating, minor drainage, and harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices, as defined in paragraph (a)(1)(iii) of this section.

(ii) To fall under this exemption, the activities specified in paragraph (a)(1)(i) of this section must be part of an established (i.e., on-going) farming, silviculture, or ranching operation and must be in accordance with definitions in § 323.4(a)(1)(iii). Activities on areas lying fallow as part of a conventional rotational cycle are part of an established operation. Activities which bring an area into farming, silviculture, or ranching use are not part of an established operation. An operation ceases to be established when the area on which it was conducted has been covered to another use or has lain idle so long that modifications to the hydrological regime are necessary to resume operations. If an activity takes place outside the waters of the United States, or if it does not involve a discharge, it does not need a section 404 permit, whether or not it is part of an established farming, silviculture, or ranching operation.

(iii) (A) Cultivating means physical methods of soil treatment employed within established farming, ranching and silviculture lands on farm, ranch, or forest crops to aid and improve their growth, quality or yield.

(B) Harvesting means physical measures employed directly upon farm, forest, or ranch crops within established agricultural and silvicultural lands to bring about their removal from farm, forest, or ranch land, but does not include the construction of farm, forest, or ranch roads.

(C)(1) Minor Drainage means:

(i) The discharge of dredged or fill material incidental to connecting upland drainage facilities to waters of the United States, adequate to effect the removal of excess soil moisture from upland croplands. (Construction and maintenance of upland (dryland) facilities, such as ditching and tiling, incidental to the planting, cultivating, protecting, or harvesting of crops,

involve no discharge of dredged or fill material into waters of the United States, and as such never require a section 404 permit.);

(ii) The discharge of dredged or fill material for the purpose of installing ditching or other such water control facilities incidental to planting, cultivating, protecting, or harvesting of rice, cranberries or other wetland crop species, where these activities and the discharge occur in waters of the United States which are in established use for such agricultural and silvicultural wetland crop production;

(iii) The discharge of dredged or fill material for the purpose of manipulating the water levels of, or regulating the flow or distribution of water within, existing impoundments which have been constructed in accordance with applicable requirements of CWA, and which are in established use for the production of rice, cranberries, or other wetland crop species. (The provisions of paragraphs (a)(1)(iii)(C)(1) (ii) and (iii) of this section apply to areas that are in established use exclusively for wetland crop production as well as areas in established use for conventional wetland/non-wetland crop rotation (e.g., the rotations of rice and soybeans) where such rotation results in the cyclical or intermittent temporary dewatering of such areas.)

(iv) The discharges of dredged or fill material incidental to the emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainageways and, if not promptly removed, would result in damage to or loss of existing crops or would impair or prevent the plowing, seeding, harvesting or cultivating of crops on land in established use for crop production. Such removal does not include enlarging or extending the dimensions of, or changing the bottom elevations of, the affected drainageway as it existed prior to the formation of the blockage. Removal must be accomplished within one year of discovery of such blockages in order to be eligible for exemption.

(2) Minor drainage in waters of the U.S. is limited to drainage within areas that are part of an established farming or silviculture operation. It does not include drainage associated with the immediate or gradual conversion of a wetland to a non-wetland (e.g., wetland species to upland species not typically adapted to life in saturated soil conditions), or conversion from one wetland use to another (for example, silviculture to farming). In addition,

minor drainage does not include the construction of any canal, ditch, dike or other waterway or structure which drains or otherwise significantly modifies a stream, lake, swamp, bog or any other wetland or aquatic area constituting waters of the United States. Any discharge of dredged or fill material into the waters of the United States incidental to the construction of any such structure or waterway requires a permit.

(D) Plowing means all forms of primary tillage, including moldboard, chisel, or wide-blade plowing, disking, harrowing and similar physical means utilized on farm, forest or ranch land for the breaking up, cutting, turning over, or stirring of soil to prepare it for the planting of crops. The term does not include the redistribution of soil, rock, sand, or other surficial materials in a manner which changes any area of the waters of the United States to dry land. For example, the redistribution of surface materials by blading, grading, or other means to fill in wetland areas is not plowing. Rock crushing activities which result in the loss of natural drainage characteristics, the reduction of water storage and recharge capabilities, or the overburden of natural water filtration capacities do not constitute plowing. Plowing as described above will never involve a discharge of dredged or fill material.

(E) Seeding means the sowing of seed and placement of seedlings to produce farm, ranch, or forest crops and includes the placement of soil beds for seeds or seedlings on established farm and forest lands.

(2) Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption.

(3) Construction or maintenance of farm or stock ponds or irrigation ditches, or the maintenance (but not construction) of drainage ditches. Discharges associated with siphons, pumps, headgates, wingwalls, weirs, diversion structures, and such other facilities as are appurtenant and functionally related to irrigation ditches are included in this exemption.

(4) Construction of temporary sedimentation basins on a construction site which does not include placement of

fill material into waters of the U.S. The term "construction site" refers to any site involving the erection of buildings, roads, and other discrete structures and the installation of support facilities necessary for construction and utilization of such structures. The term also includes any other land areas which involve land-disturbing excavation activities, including quarrying or other mining activities, where an increase in the runoff of sediment is controlled through the use of temporary sedimentation basins.

(5) Any activity with respect to which a state has an approved program under section 208(b)(4) of the CWA which meets the requirements of sections 208(b)(4) (B) and (C).

(6) Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining equipment, where such roads are constructed and maintained in accordance with best management practices (BMPs) to assure that flow and circulation patterns and chemical and biological characteristics of waters of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized. These BMPs which must be applied to satisfy this provision shall include those detailed BMPs described in the state's approved program description pursuant to the requirements of 40 CFR Part 233.22(i), and shall also include the following baseline provisions:

(i) Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;

(ii) All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;

(iii) The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(iv) The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

(v) Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the

encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

(vi) In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum;

(vii) The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

(viii) Borrow material shall be taken from upland sources whenever feasible;

(ix) The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

(x) Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

(xi) The discharge shall not be located in the proximity of a public water supply intake;

(xii) The discharge shall not occur in areas of concentrated shellfish production;

(xiii) The discharge shall not occur in a component of the National Wild and Scenic River System;

(xiv) The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and

(xv) All temporary fills shall be removed in their entirety and the area restored to its original elevation.

(b) If any discharge of dredged or fill material resulting from the activities listed in paragraphs (a) (1)-(6) of this section contains any toxic pollutant listed under section 307 of the CWA such discharge shall be subject to any applicable toxic effluent standard or prohibition, and shall require a Section 404 permit.

(c) Any discharge of dredged or fill material into waters of the United States incidental to any of the activities identified in paragraphs (a) (1)-(6) of this section must have a permit if it is part of an activity whose purpose is to convert an area of the waters of the United States into a use to which it was not previously subject, where the flow or circulation of waters of the United States may be impaired or the reach of such waters reduced. Where the proposed discharge will result in significant discernible alterations to flow or circulation, the presumption is that flow or circulation may be impaired by such alteration. For example, a

permit will be required for the conversion of a cypress swamp to some other use or the conversion of a wetland from silvicultural to agricultural use when there is a discharge of dredged or fill material into waters of the United States in conjunction with construction of dikes, drainage ditches or other works or structures used to effect such conversion. A conversion of a Section 404 wetland to a non-wetland is a change in use of an area of waters of the United States. A discharge which elevates the bottom of waters of the United States without converting it to dry land does not thereby reduce the reach of, but may alter the flow or circulation of, waters of the United States.

(d) Federal projects which qualify under the criteria contained in section 404(r) of the CWA are exempt from section 404 permit requirements, but may be subject to other state or Federal requirements.

§ 323.5 Program transfer to states.

Section 404(h) of the CWA allows the Administrator of the Environmental Protection Agency (EPA) to transfer administration of the section 404 permit program for discharges into certain waters of the United States to qualified states. (The program cannot be transferred for those waters which are presently used, or are susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce shoreward to their ordinary high water mark, including all waters which are subject to the ebb and flow of the tide shoreward to the high tide line, including wetlands adjacent thereto). See 40 CFR Parts 233 and 124 for procedural regulations for transferring Section 404 programs to states. Once a state's 404 program is approved and in effect, the Corps of Engineers will suspend processing of section 404 applications in the applicable waters and will transfer pending applications to the state agency responsible for administering the program. District engineers will assist EPA and the states in any way practicable to effect transfer and will develop appropriate procedures to ensure orderly and expeditious transfer.

§ 323.6 Special policies and procedures.

(a) The Secretary of the Army has delegated to the Chief of Engineers the authority to issue or deny section 404 permits. The district engineer will review applications for permits for the discharge of dredged or fill material into waters of the United States in accordance with guidelines promulgated

by the Administrator, EPA, under authority of section 404(b)(1) of the CWA. (see 40 CFR Part 230.) Subject to consideration of any economic impact on navigation and anchorage pursuant to section 404(b)(2), a permit will be denied if the discharge that would be authorized by such a permit would not comply with the 404(b)(1) guidelines. If the district engineer determines that the proposed discharge would comply with the 404(b)(1) guidelines, he will grant the permit unless issuance would be contrary to the public interest.

(b) The Corps will not issue a permit where the regional administrator of EPA has notified the district engineer and applicant in writing pursuant to 40 CFR 231.3(a)(1) that he intends to issue a public notice of a proposed determination to prohibit or withdraw the specification, or to deny, restrict or withdraw the use for specification, of any defined area as a disposal site in accordance with section 404(c) of the Clean Water Act. However the Corps will continue to complete the administrative processing of the application while the section 404(c) procedures are underway including completion of final coordination with EPA under 33 CFR Part 325.

PART 324—PERMITS FOR OCEAN DUMPING OF DREDGED MATERIAL

Sec.

324.1 General.

324.2 Definitions.

324.3 Activities requiring permits.

324.4 Special procedures.

Authority: 33 U.S.C. 1413.

§ 324.1 General.

This regulation prescribes in addition to the general policies of 33 CFR Part 320 and procedures of 33 CFR Part 325, those special policies, practices and procedures to be followed by the Corps of Engineers in connection with the review of applications for Department of the Army (DA) permits to authorize the transportation of dredged material by vessel or other vehicle for the purpose of dumping it in ocean waters at dumping sites designated under 40 CFR Part 228 pursuant to section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (33 U.S.C. 1413) (hereinafter referred to as section 103). See 33 CFR 320.2(h). Activities involving the transportation of dredged material for the purpose of dumping in the ocean waters also require DA permits under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) for the dredging in navigable waters of the United States. Applicants for DA permits under this Part should also refer

to 33 CFR Part 322 to satisfy the requirements of Section 10.

§ 324.2 Definitions.

For the purpose of this regulation, the following terms are defined:

(a) The term "ocean waters" means those waters of the open seas lying seaward of the base line from which the territorial sea is measured, as provided for in the Convention on the Territorial Sea and the Contiguous Zone (15 UST 1606; TIAS 5639).

(b) The term "dredged material" means any material excavated or dredged from navigable waters of the United States.

(c) The term "transport" or "transportation" refers to the conveyance and related handling of dredged material by a vessel or other vehicle.

§ 324.3 Activities requiring permits.

(a) *General.* DA permits are required for the transportation of dredged material for the purpose of dumping it in ocean waters.

(b) *Activities of Federal agencies.* (1) The transportation of dredged material for the purpose of disposal in ocean waters done by or on behalf of any Federal agency other than the activities of the Corps of Engineers is subject to the procedures of this regulation. Agreement for construction or engineering services performed for other agencies by the Corps of Engineers does not constitute authorization under these regulations. Division and district engineers will therefore advise Federal agencies accordingly and cooperate to the fullest extent in the expeditious processing of their applications. The activities of the Corps of Engineers that involve the transportation of dredged material for disposal in ocean waters are regulated by 33 CFR 209.145.

(2) The policy provisions set out in 33 CFR 320.4(j) relating to state or local authorizations do not apply to work or structures undertaken by Federal agencies, except where compliance with non-Federal authorization is required by Federal law or Executive policy. Federal agencies are responsible for conformance with such laws and policies. (See EO 12088, October 18, 1978.) Federal agencies are not required to obtain and provide certification of compliance with effluent limitations and water quality standards from state or interstate water pollution control agencies in connection with activities involving the transport of dredged material for dumping into ocean waters beyond the territorial sea.

§ 324.4 Special procedures.

The Secretary of the Army has delegated to the Chief of Engineers the authority to issue or deny section 103 permits. The following additional procedures shall also be applicable under this regulation.

(a) *Public notice.* For all applications for section 103 permits, the district engineer will issue a public notice which shall contain the information specified in 33 CFR 325.3.

(b) *Evaluation.* Applications for permits for the transportation of dredged material for the purpose of dumping it in ocean waters will be evaluated to determine whether the proposed dumping will unreasonably degrade or endanger human health, welfare, amenities, or the marine environment, ecological systems or economic potentialities. District engineers will apply the criteria established by the Administrator of EPA pursuant to section 102 of the Marine Protection, Research and Sanctuaries Act of 1972 in making this evaluation. (See 40 CFR Parts 220-229) Where ocean dumping is determined to be necessary, the district engineer will, to the extent feasible, specify disposal sites using the recommendations of the Administrator pursuant to section 102(c) of the Act.

(c) *EPA review.* When the Regional Administrator, EPA, in accordance with CFR 225.2(b), advises the district engineer, in writing, that the proposed dumping will comply with the criteria, the district engineer will complete his evaluation of the application under this part and 33 CFR Parts 320 and 325. If, however, the Regional Administrator advises the district engineer, in writing, that the proposed dumping does not comply with the criteria, the district engineer will proceed as follows:

(1) The district engineer will determine whether there is an economically feasible alternative method or site available other than the proposed ocean disposal site. If there are other feasible alternative methods or sites available, the district engineer will evaluate them in accordance with 33 CFR Parts 320, 322, 323, and 325 and this Part, as appropriate.

(2) If the district engineer determines that there is no economically feasible alternative method or site available, and the proposed project is otherwise found to be not contrary to the public interest, he will so advise the Regional Administrator setting forth his reasons for such determination. If the Regional Administrator has not removed his objection within 15 days, the district engineer will submit a report of his determination to the Chief of Engineers

for further coordination with the Administrator, EPA, and decision. The report forwarding the case will contain the analysis of whether there are other economically feasible methods or sites available to dispose of the dredged material.

(d) *Chief of Engineers review.* The Chief of Engineers shall evaluate the permit application and make a decision to deny the permit or recommend its issuance. If the decision of the Chief of Engineers is that ocean dumping at the proposed disposal site is required because of the unavailability of economically feasible alternatives, he shall so certify and request that the Secretary of the Army seek a waiver from the Administrator, EPA, of the criteria or of the critical site designation in accordance with 40 CFR 225.4.

PART 325—PROCESSING OF DEPARTMENT OF THE ARMY PERMITS**Sec.**

- 325.1 Applications for permits.
 - 325.2 Processing of applications.
 - 325.3 Public notice.
 - 325.4 Conditioning of permits.
 - 325.5 Forms of permits.
 - 325.6 Duration of permits.
 - 325.7 Modification, suspension, or revocation of permits.
 - 325.8 Authority to issue or deny permits.
 - 325.9 Authority to determine jurisdiction.
 - 325.10 Publicity.
 - Appendix A—Permit Form and Special Conditions
 - Appendix B—Reserved (For Future NEPA Regulation)
 - Appendix C—Reserved (For Historic Properties Regulation)
- Authority: 33 U.S.C. 401 et seq.; 33 U.S.C. 1344; 33 USC 1413.

§ 325.1 Applications for permits.

(a) *General.* The processing procedures of this Part apply to any Department of the Army (DA) permit. Special procedures and additional information are contained in 33 CFR Parts 320 through 324, 327 and Part 330. This Part is arranged in the basic timing sequence used by the Corps of Engineers in processing applications for DA permits.

(b) *Pre-application consultation for major applications.* The district staff element having responsibility for administering, processing, and enforcing federal laws and regulations relating to the Corps of Engineers regulatory program shall be available to advise potential applicants of studies or other information foreseeably required for later federal action. The district engineer will establish local procedures and policies including appropriate publicity programs which will allow

potential applicants to contact the district engineer or the regulatory staff element to request pre-application consultation. Upon receipt of such request, the district engineer will assure the conduct of an orderly process which may involve other staff elements and affected agencies (Federal, state, or local) and the public. This early process should be brief but thorough so that the potential applicant may begin to assess the viability of some of the more obvious potential alternatives in the application. The district engineer will endeavor, at this stage, to provide the potential applicant with all helpful information necessary in pursuing the application, including factors which the Corps must consider in its permit decision making process. Whenever the district engineer becomes aware of planning for work which may require a DA permit and which may involve the preparation of an environmental document, he shall contact the principals involved to advise them of the requirement for the permit(s) and the attendant public interest review including the development of an environmental document. Whenever a potential applicant indicates the intent to submit an application for work which may require the preparation of an environmental document, a single point of contact shall be designated within the district's regulatory staff to effectively coordinate the regulatory process, including the National Environmental Policy Act (NEPA) procedures and all attendant reviews, meetings, hearings, and other actions, including the scoping process if appropriate, leading to a decision by the district engineer. Effort devoted to this process should be commensurate with the likelihood of a permit application actually being submitted to the Corps. The regulatory staff coordinator shall maintain an open relationship with each potential applicant or his consultants so as to assure that the potential applicant is fully aware of the substance (both quantitative and qualitative) of the data required by the district engineer for use in preparing an environmental assessment or an environmental impact statement (EIS) in accordance with 33 CFR Part 230, Appendix B.

(c) *Application form.* Applicants for all individual DA permits must use the standard application form (ENG Form 4345, OMB Approval No. OMB 49-R0420). Local variations of the application form for purposes of facilitating coordination with federal, state and local agencies may be used. The appropriate form may be obtained from the district office having

jurisdiction over the waters in which the activity is proposed to be located. Certain activities have been authorized by general permits and do not require submission of an application form but may require a separate notification.

(d) *Content of application.* (1) The application must include a complete description of the proposed activity including necessary drawings, sketches, or plans sufficient for public notice (detailed engineering plans and specifications are not required); the location, purpose and need for the proposed activity; scheduling of the activity; the names and addresses of adjoining property owners; the location and dimensions of adjacent structures; and a list of authorizations required by other federal, interstate, state, or local agencies for the work, including all approvals received or denials already made. See § 325.3 for information required to be in public notices. District and division engineers are not authorized to develop additional information forms but may request specific information on a case-by-case basis. (See § 325.1(e)).

(2) All activities which the applicant plans to undertake which are reasonably related to the same project and for which a DA permit would be required should be included in the same permit application. District engineers should reject, as incomplete, any permit application which fails to comply with this requirement. For example, a permit application for a marina will include dredging required for access as well as any fill associated with construction of the marina.

(3) If the activity would involve dredging in navigable waters of the United States, the application must include a description of the type, composition and quantity of the material to be dredged, the method of dredging, and the site and plans for disposal of the dredged material.

(4) If the activity would include the discharge of dredged or fill material into the waters of the United States or the transportation of dredged material for the purpose of disposing of it in ocean waters the application must include the source of the material; the purpose of the discharge, a description of the type, composition and quantity of the material; the method of transportation and disposal of the material; and the location of the disposal site. Certification under section 401 of the Clean Water Act is required for such discharges into waters of the United States.

(5) If the activity would include the construction of a filled area or pile or float-supported platform the project

description must include the use of, and specific structures to be erected on, the fill or platform.

(6) If the activity would involve the construction of an impoundment structure, the applicant may be required to demonstrate that the structure complies with established state dam safety criteria or that the structure has been designed by qualified persons and, in appropriate cases, independently reviewed (and modified as the review would indicate) by similarly qualified persons. No specific design criteria are to be prescribed nor is an independent detailed engineering review to be made by the district engineer.

(7) *Signature on application.* The application must be signed by the person who desires to undertake the proposed activity (i.e. the applicant) or by a duly authorized agent. When the applicant is represented by an agent, that information will be included in the space provided on the application or by a separate written statement. The signature of the applicant or the agent will be an affirmation that the applicant possesses or will possess the requisite property interest to undertake the activity proposed in the application, except where the lands are under the control of the Corps of Engineers, in which cases the district engineer will coordinate the transfer of the real estate and the permit action. An application may include the activity of more than one owner provided the character of the activity of each owner is similar and in the same general area and each owner submits a statement designating the same agent.

(8) If the activity would involve the construction or placement of an artificial reef, as defined in 33 CFR 322.2(g), in the navigable waters of the United States or in the waters overlying the outer continental shelf, the application must include provisions for siting, constructing, monitoring, and managing the artificial reef.

(9) *Complete application.* An application will be determined to be complete when sufficient information is received to issue a public notice (See 33 CFR 325.1(d) and 325.3(a)). The issuance of a public notice will not be delayed to obtain information necessary to evaluate an application.

(e) *Additional information.* In addition to the information indicated in paragraph (d) of this section, the applicant will be required to furnish only such additional information as the district engineer deems essential to make a public interest determination including, where applicable, a determination of compliance with the section 404(b)(1) guidelines or ocean

dumping criteria. Such additional information may include environmental data and information on alternate methods and sites as may be necessary for the preparation of the required environmental documentation.

(f) *Fees.* Fees are required for permits under section 404 of the Clean Water Act, section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, and sections 9 and 10 of the Rivers and Harbors Act of 1899. A fee of \$100.00 will be charged when the planned or ultimate purpose of the project is commercial or industrial in nature and is in support of operations that charge for the production, distribution or sale of goods or services. A \$10.00 fee will be charged for permit applications when the proposed work is non-commercial in nature and would provide personal benefits that have no connection with a commercial enterprise. The final decision as to the basis for a fee (commercial vs. non-commercial) shall be solely the responsibility of the district engineer. No fee will be charged if the applicant withdraws the application at any time prior to issuance of the permit or if the permit is denied. Collection of the fee will be deferred until the proposed activity has been determined to be not contrary to the public interest. Multiple fees are not to be charged if more than one law is applicable. Any modification significant enough to require publication of a public notice will also require a fee. No fee will be assessed when a permit is transferred from one property owner to another. No fees will be charged for time extensions, general permits or letters of permission. Agencies or instrumentalities of federal, state or local governments will not be required to pay any fee in connection with permits.

§ 325.2 Processing of applications.

(a) *Standard procedures.* (1) When an application for a permit is received the district engineer shall immediately assign it a number for identification, acknowledge receipt thereof, and advise the applicant of the number assigned to it. He shall review the application for completeness, and if the application is incomplete, request from the applicant within 15 days of receipt of the application any additional information necessary for further processing.

(2) Within 15 days of receipt of an application the district engineer will either determine that the application is complete (see 33 CFR 325.1(d)(9) and issue a public notice as described in § 325.3 of this Part, unless specifically exempted by other provisions of this

regulation or that it is incomplete and notify the applicant of the information necessary for a complete application. The district engineer will issue a supplemental, revised, or corrected public notice if in his view there is a change in the application data that would affect the public's review of the proposal.

(3) The district engineer will consider all comments received in response to the public notice in his subsequent actions on the permit application. Receipt of the comments will be acknowledged, if appropriate, and they will be made a part of the administrative record of the application. Comments received as form letters or petitions may be acknowledged as a group to the person or organization responsible for the form letter or petition. If comments relate to matters within the special expertise of another federal agency, the district engineer may seek the advice of that agency. If the district engineer determines, based on comments received, that he must have the views of the applicant on a particular issue to make a public interest determination, the applicant will be given the opportunity to furnish his views on such issue to the district engineer (see § 325.2(d)(5)). At the earliest practicable time other substantive comments will be furnished to the applicant for his information and any views he may wish to offer. A summary of the comments, the actual letters or portions thereof, or representative comment letters may be furnished to the applicant. The applicant may voluntarily elect to contact objectors in an attempt to resolve objections but will not be required to do so. District engineers will ensure that all parties are informed that the Corps alone is responsible for reaching a decision on the merits of any application. The district engineer may also offer Corps regulatory staff to be present at meetings between applicants and objectors, where appropriate, to provide information on the process, to mediate differences, or to gather information to aid in the decision process. The district engineer should not delay processing of the application unless the applicant requests a reasonable delay, normally not to exceed 30 days, to provide additional information or comments.

(4) The district engineer will follow Appendix B of 33 CFR Part 230 for environmental procedures and documentation required by the National Environmental Policy Act of 1969. A decision on a permit application will require either an environmental assessment or an environmental impact

statement unless it is included within a categorical exclusion.

(5) The district engineer will also evaluate the application to determine the need for a public hearing pursuant to 33 CFR Part 327.

(6) After all above actions have been completed, the district engineer will determine in accordance with the record and applicable regulations whether or not the permit should be issued. He shall prepare a statement of findings (SOF) or, where an EIS has been prepared, a record of decision (ROD), on all permit decisions. The SOF or ROD shall include the district engineer's views on the probable effect of the proposed work on the public interest including conformity with the guidelines published for the discharge of dredged or fill material into waters of the United States (40 CFR Part 230) or with the criteria for dumping of dredged material in ocean waters (40 CFR Parts 220 to 229), if applicable, and the conclusions of the district engineer. The SOF or ROD shall be dated, signed, and included in the record prior to final action on the application. Where the district engineer has delegated authority to sign permits for and in his behalf, he may similarly delegate the signing of the SOF or ROD. If a district engineer makes a decision on a permit application which is contrary to state or local decisions (33 CFR 320.4(j) (2) & (4)), the district engineer will include in the decision document the significant national issues and explain how they are overriding in importance. If a permit is warranted, the district engineer will determine the special conditions, if any, and duration which should be incorporated into the permit. In accordance with the authorities specified in Section 325.8 of this Part, the district engineer will take final action or forward the application with all pertinent comments, records, and studies, including the final EIS or environmental assessment, through channels to the official authorized to make the final decision. The report forwarding the application for decision will be in a format prescribed by the Chief of Engineers. District and division engineers will notify the applicant and interested federal and state agencies that the application has been forwarded to higher headquarters. The district or division engineer may, at his option, disclose his recommendation to the news media and other interested parties, with the caution that it is only a recommendation and not a final decision. Such disclosure is encouraged in permit cases which have become controversial and have been the subject of stories in the media or have generated

strong public interest. In those cases where the application is forwarded for decision in the format prescribed by the Chief of Engineers, the report will serve as the SOF or ROD. District engineers will generally combine the SOF, environmental assessment, and findings of no significant impact (FONSI), 404(b)(1) guideline analysis, and/or the criteria for dumping of dredged material in ocean waters into a single document.

(7) If the final decision is to deny the permit, the applicant will be advised in writing of the reason(s) for denial. If the final decision is to issue the permit and a standard individual permit form will be used, the issuing official will forward the permit to the applicant for signature accepting the conditions of the permit. The permit is not valid until signed by the issuing official. Letters of permission require only the signature of the issuing official. Final action on the permit application is the signature on the letter notifying the applicant of the denial of the permit or signature of the issuing official on the authorizing document.

(8) The district engineer will publish monthly a list of permits issued or denied during the previous month. The list will identify each action by public notice number, name of applicant, and brief description of activity involved. It will also note that relevant environmental documents and the SOF's or ROD's are available upon written request and, where applicable, upon the payment of administrative fees. This list will be distributed to all persons who may have an interest in any of the public notices listed.

(9) Copies of permits will be furnished to other agencies in appropriate cases as follows:

(i) If the activity involves the construction of artificial islands, installations or other devices on the outer continental shelf, to the Director, Defense Mapping Agency, Hydrographic Center, Washington, DC 20390 Attention, Code NS12, and to the Charting and Geodetic Services, N/CG222, National Ocean Service NOAA, Rockville, Maryland 20852.

(ii) If the activity involves the construction of structures to enhance fish propagation (e.g., fishing reefs) along the coasts of the United States, to the Defense Mapping Agency, Hydrographic Center and National Ocean Service as in paragraph (a)(9)(i) of this section and to the Director, Office of Marine Recreational Fisheries, National Marine Fisheries Service, Washington, DC 20235.

(iii) If the activity involves the erection of an aerial transmission line, submerged cable, or submerged pipeline

across a navigable water of the United States, to the Charting and Geodetic Services N/CG222, National Ocean Service NOAA, Rockville, Maryland 20852.

(iv) If the activity is listed in paragraphs (a)(9) (i), (ii), or (iii) of this section, or involves the transportation of dredged material for the purpose of dumping it in ocean waters, to the appropriate District Commander, U.S. Coast Guard.

(b) *Procedures for particular types of permit situations.*—(1) *Section 401 Water Quality Certification.* If the district engineer determines that water quality certification for the proposed activity is necessary under the provisions of section 401 of the Clean Water Act, he shall so notify the applicant and obtain from him or the certifying agency a copy of such certification.

(i) The public notice for such activity, which will contain a statement on certification requirements (see § 325.3(a)(8)), will serve as the notification to the Administrator of the Environmental Protection Agency (EPA) pursuant to section 401(a)(2) of the Clean Water Act. If EPA determines that the proposed discharge may affect the quality of the waters of any state other than the state in which the discharge will originate, it will so notify such other state, the district engineer, and the applicant. If such notice or a request for supplemental information is not received within 30 days of issuance of the public notice, the district engineer will assume EPA has made a negative determination with respect to section 401(a)(2). If EPA determines another state's waters may be affected, such state has 60 days from receipt of EPA's notice to determine if the proposed discharge will affect the quality of its waters so as to violate any water quality requirement in such state, to notify EPA and the district engineer in writing of its objection to permit issuance, and to request a public hearing. If such occurs, the district engineer will hold a public hearing in the objecting state. Except as stated below, the hearing will be conducted in accordance with 33 CFR Part 327. The issues to be considered at the public hearing will be limited to water quality impacts. EPA will submit its evaluation and recommendations at the hearing with respect to the state's objection to permit issuance. Based upon the recommendations of the objecting state, EPA, and any additional evidence presented at the hearing, the district engineer will condition the permit, if issued, in such a manner as may be

necessary to insure compliance with applicable water quality requirements. If the imposition of conditions cannot, in the district engineer's opinion, insure such compliance, he will deny the permit.

(ii) No permit will be granted until required certification has been obtained or has been waived. A waiver may be explicit, or will be deemed to occur if the certifying agency fails or refuses to act on a request for certification within sixty days after receipt of such a request unless the district engineer determines a shorter or longer period is reasonable for the state to act. In determining whether or not a waiver period has commenced or waiver has occurred, the district engineer will verify that the certifying agency has received a valid request for certification. If, however, special circumstances identified by the district engineer require that action on an application be taken within a more limited period of time, the district engineer shall determine a reasonable lesser period of time, advise the certifying agency of the need for action by a particular date, and that, if certification is not received by that date, it will be considered that the requirement for certification has been waived. Similarly, if it appears that circumstances may reasonably require a period of time longer than sixty days, the district engineer, based on information provided by the certifying agency, will determine a longer reasonable period of time, not to exceed one year, at which time a waiver will be deemed to occur.

(2) *Coastal Zone Management Consistency.* If the proposed activity is to be undertaken in a state operating under a coastal zone management program approved by the Secretary of Commerce pursuant to the Coastal Zone Management (CZM) Act (see 33 CFR 320.3(b)), the district engineer shall proceed as follows:

(i) If the applicant is a federal agency, and the application involves a federal activity in or affecting the coastal zone, the district engineer shall forward a copy of the public notice to the agency of the state responsible for reviewing the consistency of federal activities. The federal agency applicant shall be responsible for complying with the CZM Act's directive for ensuring that federal agency activities are undertaken in a manner which is consistent, to the maximum extent practicable, with approved CZM Programs. (See 15 CFR Part 930.) If the state coastal zone agency objects to the proposed federal activity on the basis of its inconsistency with the state's approved CZM Program,

the district engineer shall not make a final decision on the application until the disagreeing parties have had an opportunity to utilize the procedures specified by the CZM Act for resolving such disagreements.

(ii) If the applicant is not a federal agency and the application involves an activity affecting the coastal zone, the district engineer shall obtain from the applicant a certification that his proposed activity complies with and will be conducted in a manner that is consistent with the approved state CZM Program. Upon receipt of the certification, the district engineer will forward a copy of the public notice (which will include the applicant's certification statement) to the state coastal zone agency and request its concurrence or objection. If the state agency objects to the certification or issues a decision indicating that the proposed activity requires further review, the district engineer shall not issue the permit until the state concurs with the certification statement or the Secretary of Commerce determines that the proposed activity is consistent with the purposes of the CZM Act or is necessary in the interest of national security. If the state agency fails to concur or object to a certification statement within six months of the state agency's receipt of the certification statement, state agency concurrence with the certification statement shall be conclusively presumed. District engineers will seek agreements with state CZM agencies that the agency's failure to provide comments during the public notice comment period will be considered as a concurrence with the certification or waiver of the right to concur or non-concur.

(iii) If the applicant is requesting a permit for work on Indian reservation lands which are in the coastal zone, the district engineer shall treat the application in the same manner as prescribed for a Federal applicant in paragraph (b)(2)(i) of this section. However, if the applicant is requesting a permit on non-trust Indian lands, and the state CZM agency has decided to assert jurisdiction over such lands, the district engineer shall treat the application in the same manner as prescribed for a non-Federal applicant in paragraph (b)(2)(ii) of this section.

(3) *Historic Properties.* If the proposed activity would involve any property listed or eligible for listing in the National Register of Historic Places, the district engineer will proceed in accordance with Corps National Historic Preservation Act implementing regulations.

(4) *Activities Associated with Federal Projects.* If the proposed activity would consist of the dredging of an access channel and/or berthing facility associated with an authorized federal navigation project, the activity will be included in the planning and coordination of the construction or maintenance of the federal project to the maximum extent feasible. Separate notice, hearing, and environmental documentation will not be required for activities so included and coordinated, and the public notice issued by the district engineer for these federal and associated non-federal activities will be the notice of intent to issue permits for those included non-federal dredging activities. The decision whether to issue or deny such a permit will be consistent with the decision on the federal project unless special considerations applicable to the proposed activity are identified. (See § 322.5(c).)

(5) *Endangered Species.* Applications will be reviewed for the potential impact on threatened or endangered species pursuant to section 7 of the Endangered Species Act as amended. The district engineer will include a statement in the public notice of his current knowledge of endangered species based on his initial review of the application (see 33 CFR 325.2(a)(2)). If the district engineer determines that the proposed activity would not affect listed species or their critical habitat, he will include a statement to this effect in the public notice. If he finds the proposed activity may affect an endangered or threatened species or their critical habitat, he will initiate formal consultation procedures with the U.S. Fish and Wildlife Service or National Marine Fisheries Service. Public notices forwarded to the U.S. Fish and Wildlife Service or National Marine Fisheries Service will serve as the request for information on whether any listed or proposed to be listed endangered or threatened species may be present in the area which would be affected by the proposed activity, pursuant to section 7(c) of the Act. References, definitions, and consultation procedures are found in 50 CFR Part 402.

(c) [Reserved]

(d) *Timing of processing of applications.* The district engineer will be guided by the following time limits for the indicated steps in the evaluation process:

(1) The public notice will be issued within 15 days of receipt of all information required to be submitted by the applicant in accordance with paragraph 325.1(d) of this Part.

(2) The comment period on the public notice should be for a reasonable period of time within which interested parties

may express their views concerning the permit. The comment period should not be more than 30 days nor less than 15 days from the date of the notice. Before designating comment periods less than 30 days, the district engineer will consider: (i) Whether the proposal is routine or noncontroversial, (ii) mail time and need for comments from remote areas, (iii) comments from similar proposals, and (iv) the need for a site visit. After considering the length of the original comment period, paragraphs (a)(2) (i) through (iv) of this section, and other pertinent factors, the district engineer may extend the comment period up to an additional 30 days if warranted.

(3) District engineers will decide on all applications not later than 60 days after receipt of a complete application, unless (i) precluded as a matter of law or procedures required by law (see below), (ii) the case must be referred to higher authority (see § 325.8 of this Part), (iii) the comment period is extended, (iv) a timely submittal of information or comments is not received from the applicant, (v) the processing is suspended at the request of the applicant, or (vi) information needed by the district engineer for a decision on the application cannot reasonably be obtained within the 60-day period. Once the cause for preventing the decision from being made within the normal 60-day period has been satisfied or eliminated, the 60-day clock will start running again from where it was suspended. For example, if the comment period is extended by 30 days, the district engineer will, absent other restraints, decide on the application within 90 days of receipt of a complete application. Certain laws (e.g., the Clean Water Act, the CZM Act, the National Environmental Policy Act, the National Historic Preservation Act, the Preservation of Historical and Archeological Data Act, the Endangered Species Act, the Wild and Scenic Rivers Act, and the Marine Protection, Research and Sanctuaries Act) require procedures such as state or other federal agency certifications, public hearings, environmental impact statements, consultation, special studies, and testing which may prevent district engineers from being able to decide certain applications within 60 days.

(4) Once the district engineer has sufficient information to make his public interest determination, he should decide the permit application even though other agencies which may have regulatory jurisdiction have not yet granted their authorizations, except where such authorizations are, by federal law, a prerequisite to making a decision on the

DA permit application. Permits granted prior to other (non-prerequisite) authorizations by other agencies should, where appropriate, be conditioned in such manner as to give those other authorities an opportunity to undertake their review without the applicant biasing such review by making substantial resource commitments on the basis of the DA permit. In unusual cases the district engineer may decide that due to the nature or scope of a specific proposal, it would be prudent to defer taking final action until another agency has acted on its authorization. In such cases, he may advise the other agency of his position on the DA permit while deferring his final decision.

(5) The applicant will be given a reasonable time, not to exceed 30 days, to respond to requests of the district engineer. The district engineer may make such requests by certified letter and clearly inform the applicant that if he does not respond with the requested information or a justification why additional time is necessary, then his application will be considered withdrawn or a final decision will be made, whichever is appropriate. If additional time is requested, the district engineer will either grant the time, make a final decision, or consider the application as withdrawn.

(6) The time requirements in these regulations are in terms of calendar days rather than in terms of working days.

(e) *Alternative procedures.* Division and district engineers are authorized to use alternative procedures as follows:

(1) *Letters of permission.* Letters of permission are a type of permit issued through an abbreviated processing procedure which includes coordination with Federal and state fish and wildlife agencies, as required by the Fish and Wildlife Coordination Act, and a public interest evaluation, but without the publishing of an individual public notice. The letter of permission will not be used to authorize the transportation of dredged material for the purpose of dumping it in ocean waters. Letters of permission may be used:

(i) In those cases subject to section 10 of the Rivers and Harbors Act of 1899 when, in the opinion of the district engineer, the proposed work would be minor, would not have significant individual or cumulative impacts on environmental values, and should encounter no appreciable opposition.

(ii) In those cases subject to section 404 of the Clean Water Act after:

(A) The district engineer, through consultation with Federal and state fish and wildlife agencies, the Regional

Administrator, Environmental Protection Agency, the state water quality certifying agency, and, if appropriate, the state Coastal Zone Management Agency, develops a list of categories of activities proposed for authorization under LOP procedures;

(B) The district engineer issues a public notice advertising the proposed list and the LOP procedures, requesting comments and offering an opportunity for public hearing; and

(C) A 401 certification has been issued or waived and, if appropriate, CZM consistency concurrence obtained or presumed either on a generic or individual basis.

(2) *Regional permits.* Regional permits are a type of general permit as defined in 33 CFR 322.2(f) and 33 CFR 323.2(n). They may be issued by a division or district engineer after compliance with the other procedures of this regulation. After a regional permit has been issued, individual activities falling within those categories that are authorized by such regional permits do not have to be further authorized by the procedures of this regulation. The issuing authority will determine and add appropriate conditions to protect the public interest. When the issuing authority determines on a case-by-case basis that the concerns for the aquatic environment so indicate, he may exercise discretionary authority to override the regional permit and require an individual application and review. A regional permit may be revoked by the issuing authority if it is determined that it is contrary to the public interest provided the procedures of § 325.7 of this Part are followed. Following revocation, applications for future activities in areas covered by the regional permit shall be processed as applications for individual permits. No regional permit shall be issued for a period of more than five years.

(3) *Joint procedures.* Division and district engineers are authorized and encouraged to develop joint procedures with states and other Federal agencies with ongoing permit programs for activities also regulated by the Department of the Army. Such procedures may be substituted for the procedures in paragraphs (a)(1) through (a)(5) of this section provided that the substantive requirements of those sections are maintained. Division and district engineers are also encouraged to develop management techniques such as joint agency review meetings to expedite the decision-making process. However, in doing so, the applicant's rights to a full public interest review and independent decision by the district or division engineer must be strictly observed.

(4) *Emergency procedures.* Division engineers are authorized to approve special processing procedures in emergency situations. An "emergency" is a situation which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process the application under standard procedures. In emergency situations, the district engineer will explain the circumstances and recommend special procedures to the division engineer who will instruct the district engineer as to further processing of the application. Even in an emergency situation, reasonable efforts will be made to receive comments from interested Federal, state, and local agencies and the affected public. Also, notice of any special procedures authorized and their rationale is to be appropriately published as soon as practicable.

§ 325.3 Public notice.

(a) *General.* The public notice is the primary method of advising all interested parties of the proposed activity for which a permit is sought and of soliciting comments and information necessary to evaluate the probable impact on the public interest. The notice must, therefore, include sufficient information to give a clear understanding of the nature and magnitude of the activity to generate meaningful comment. The notice should include the following items of information:

(1) Applicable statutory authority or authorities;

(2) The name and address of the applicant;

(3) The name or title, address and telephone number of the Corps employee from whom additional information concerning the application may be obtained;

(4) The location of the proposed activity;

(5) A brief description of the proposed activity, its purpose and intended use, so as to provide sufficient information concerning the nature of the activity to generate meaningful comments, including a description of the type of structures, if any, to be erected on fills or pile or float-supported platforms, and a description of the type, composition, and quantity of materials to be discharged or disposed of in the ocean;

(6) A plan and elevation drawing showing the general and specific site location and character of all proposed activities, including the size relationship

of the proposed structures to the size of the impacted waterway and depth of water in the area;

(7) If the proposed activity would occur in the territorial seas or ocean waters, a description of the activity's relationship to the baseline from which the territorial sea is measured;

(8) A list of other government authorizations obtained or requested by the applicant, including required certifications relative to water quality, coastal zone management, or marine sanctuaries;

(9) If appropriate, a statement that the activity is a categorical exclusion for purposes of NEPA (see paragraph 7 of Appendix B to 33 CFR Part 230);

(10) A statement of the district engineer's current knowledge on historic properties;

(11) A statement of the district engineer's current knowledge on endangered species (see § 325.2(b)(5));

(12) A statement(s) on evaluation factors (see § 325.3(c));

(13) Any other available information which may assist interested parties in evaluating the likely impact of the proposed activity, if any, on factors affecting the public interest;

(14) The comment period based on § 325.2(d)(2);

(15) A statement that any person may request, in writing, within the comment period specified in the notice, that a public hearing be held to consider the application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing;

(16) For non-federal applications in states with an approved CZM Plan, a statement on compliance with the approved Plan; and

(17) In addition, for section 103 (ocean dumping) activities:

(i) The specific location of the proposed disposal site and its physical boundaries;

(ii) A statement as to whether the proposed disposal site has been designated for use by the Administrator, EPA, pursuant to section 102(c) of the Act;

(iii) If the proposed disposal site has not been designated by the Administrator, EPA, a description of the characteristics of the proposed disposal site and an explanation as to why no previously designated disposal site is feasible;

(iv) A brief description of known dredged material discharges at the proposed disposal site;

(v) Existence and documented effects of other authorized disposals that have been made in the disposal area (e.g.,

heavy metal background reading and organic carbon content);

(vi) An estimate of the length of time during which disposal would continue at the proposed site; and

(vii) Information on the characteristics and composition of the dredged material.

(b) *Public notice for general permits.* District engineers will publish a public notice for all proposed regional general permits and for significant modifications to, or reissuance of, existing regional permits within their area of jurisdiction. Public notices for statewide regional permits may be issued jointly by the affected Corps districts. The notice will include all applicable information necessary to provide a clear understanding of the proposal. In addition, the notice will state the availability of information at the district office which reveals the Corps' provisional determination that the proposed activities comply with the requirements for issuance of general permits. District engineers will publish a public notice for nationwide permits in accordance with 33 CFR 330.4.

(c) *Evaluation factors.* A paragraph describing the various evaluation factors on which decisions are based shall be included in every public notice.

(1) Except as provided in paragraph (c)(3) of this section, the following will be included:

"The decision whether to issue a permit will be based on an evaluation of the probable impact including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people."

(2) If the activity would involve the discharge of dredged or fill material into the waters of the United States or the transportation of dredged material for the purpose of disposing of it in ocean waters, the public notice shall also indicate that the evaluation of the impact of the activity on the public interest will include application of the guidelines promulgated by the Administrator, EPA, (40 CFR Part 230) or of the criteria

established under authority of section 102(a) of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (40 CFR Parts 220 to 229), as appropriate. (See 33 CFR Parts 323 and 324).

(3) In cases involving construction of artificial islands, installations and other devices on outer continental shelf lands which are under mineral lease from the Department of the Interior, the notice will contain the following statement: "The decision as to whether a permit will be issued will be based on an evaluation of the impact of the proposed work on navigation and national security."

(d) *Distribution of public notices.* (1) Public notices will be distributed for posting in post offices or other appropriate public places in the vicinity of the site of the proposed work and will be sent to the applicant, to appropriate city and county officials, to adjoining property owners, to appropriate state agencies, to appropriate Indian Tribes or tribal representatives, to concerned Federal agencies, to local, regional and national shipping and other concerned business and conservation organizations, to appropriate River Basin Commissions, to appropriate state and areawide clearing houses as prescribed by OMB Circular A-95, to local news media and to any other interested party. Copies of public notices will be sent to all parties who have specifically requested copies of public notices, to the U.S. Senators and Representatives for the area where the work is to be performed, the field representative of the Secretary of the Interior, the Regional Director of the Fish and Wildlife Service, the Regional Director of the National Park Service, the Regional Administrator of the Environmental Protection Agency (EPA), the Regional Director of the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA), the head of the state agency responsible for fish and wildlife resources, the State Historic Preservation Officer, and the District Commander, U.S. Coast Guard.

(2) In addition to the general distribution of public notices cited above, notices will be sent to other addressees in appropriate cases as follows:

(i) If the activity would involve structures or dredging along the shores of the seas or Great Lakes, to the Coastal Engineering Research Center, Washington, DC 20018.

(ii) If the activity would involve construction of fixed structures or artificial islands on the outer continental shelf or in the territorial seas, to the

Assistant Secretary of Defense (Manpower, Installations, and Logistics (ASD(MI&L))), Washington, DC 20310; the Director, Defense Mapping Agency (Hydrographic Center) Washington, DC 20390, Attention, Code NS12; and the Charting and Geodetic Services, N/CG222, National Ocean Service NOAA, Rockville, Maryland 20852, and to affected military installations and activities.

(iii) If the activity involves the construction of structures to enhance fish propagation (e.g., fishing reefs) along the coasts of the United States, to the Director, Office of Marine Recreational Fisheries, National Marine Fisheries Service, Washington, DC 20235.

(iv) If the activity involves the construction of structures which may affect aircraft operations or for purposes associated with seaplane operations, to the Regional Director of the Federal Aviation Administration.

(v) If the activity would be in connection with a foreign-trade zone, to the Executive Secretary, Foreign-Trade Zones Board, Department of Commerce, Washington, DC 20230 and to the appropriate District Director of Customs as Resident Representative, Foreign-Trade Zones Board.

(3) It is presumed that all interested parties and agencies will wish to respond to public notices; therefore, a lack of response will be interpreted as meaning that there is no objection to the proposed project. A copy of the public notice with the list of the addressees to whom the notice was sent will be included in the record. If a question develops with respect to an activity for which another agency has responsibility and that other agency has not responded to the public notice, the district engineer may request its comments. Whenever a response to a public notice has been received from a member of Congress, either in behalf of a constituent or himself, the district engineer will inform the member of Congress of the final decision.

(4) District engineers will update public notice mailing lists at least once every two years.

§ 325.4. Conditioning of permits.

(a) District engineers will add special conditions to Department of the Army permits when such conditions are necessary to satisfy legal requirements or to otherwise satisfy the public interest requirement. Permit conditions will be directly related to the impacts of the proposal, appropriate to the scope and degree of those impacts, and reasonably enforceable.

(1) Legal requirements which may be satisfied by means of Corps permit conditions include compliance with the 404(b)(1) guidelines, the EPA ocean dumping criteria, the Endangered Species Act, and requirements imposed by conditions on state section 401 water quality certifications.

(2) Where appropriate, the district engineer may take into account the existence of controls imposed under other federal, state, or local programs which would achieve the objective of the desired condition, or the existence of an enforceable agreement between the applicant and another party concerned with the resource in question, in determining whether a proposal complies with the 404(b)(1) guidelines, ocean dumping criteria, and other applicable statutes, and is not contrary to the public interest. In such cases, the Department of the Army permit will be conditioned to state that material changes in, or a failure to implement and enforce such program or agreement, will be grounds for modifying, suspending, or revoking the permit.

(3) Such conditions may be accomplished on-site, or may be accomplished off-site for mitigation of significant losses which are specifically identifiable, reasonably likely to occur, and of importance to the human or aquatic environment.

(b) District engineers are authorized to add special conditions, exclusive of paragraph (a) of this section, at the applicant's request or to clarify the permit application.

(c) If the district engineer determines that special conditions are necessary to insure the proposal will not be contrary to the public interest, but those conditions would not be reasonably implementable or enforceable, he will deny the permit.

(d) *Bonds.* If the district engineer has reason to consider that the permittee might be prevented from completing work which is necessary to protect the public interest, he may require the permittee to post a bond of sufficient amount to indemnify the government against any loss as a result of corrective action it might take.

§ 325.5 Forms of permits.

(a) *General discussion.* (1) DA permits under this regulation will be in the form of individual permits or general permits. The basic format shall be ENG Form 1721, DA Permit (Appendix A).

(2) The general conditions included in ENG Form 1721 are normally applicable to all permits; however, some conditions may not apply to certain permits and may be deleted by the issuing officer. Special conditions applicable to the

specific activity will be included in the permit as necessary to protect the public interest in accordance with Section 325.4 of this Part.

(b) *Individual permits.*—(1) *Standard permits.* A standard permit is one which has been processed through the public interest review procedures, including public notice and receipt of comments, described throughout this Part. The standard individual permit shall be issued using ENG Form 1721.

(2) *Letters of permission.* A letter of permission will be issued where procedures of paragraph 325.2(e)(1) have been followed. It will be in letter form and will identify the permittee, the authorized work and location of the work, the statutory authority, any limitations on the work, a construction time limit and a requirement for a report of completed work. A copy of the relevant general conditions from ENG Form 1721 will be attached and will be incorporated by reference into the letter of permission.

(c) *General permits.*—(1) *Regional permits.* Regional permits are a type of general permit. They may be issued by a division or district engineer after compliance with the other procedures of this regulation. If the public interest so requires, the issuing authority may condition the regional permit to require a case-by-case reporting and acknowledgment system. However, no separate applications or other authorization documents will be required.

(2) *Nationwide permits.* Nationwide permits are a type of general permit and represent DA authorizations that have been issued by the regulation (33 CFR Part 330) for certain specified activities nationwide. If certain conditions are met, the specified activities can take place without the need for an individual or regional permit.

(3) *Programmatic permits.* Programmatic permits are a type of general permit founded on an existing state, local or other Federal agency program and designed to avoid duplication with that program.

(d) *Section 9 permits.* Permits for structures in interstate navigable waters of the United States under section 9 of the Rivers and Harbors Act of 1899 will be drafted at DA level.

§ 325.6 Duration of permits.

(a) *General.* DA permits may authorize both the work and the resulting use. Permits continue in effect until they automatically expire or are modified, suspended, or revoked.

(b) *Structures.* Permits for the existence of a structure or other activity of a permanent nature are usually for an

indefinite duration with no expiration date cited. However, where a temporary structure is authorized, or where restoration of a waterway is contemplated, the permit will be of limited duration with a definite expiration date.

(c) *Works.* Permits for construction work, discharge of dredged or fill material, or other activity and any construction period for a structure with a permit of indefinite duration under paragraph (b) of this section will specify time limits for completing the work or activity. The permit may also specify a date by which the work must be started, normally within one year from the date of issuance. The date will be established by the issuing official and will provide reasonable times based on the scope and nature of the work involved. Permits issued for the transport of dredged material for the purpose of disposing of it in ocean waters will specify a completion date for the disposal not to exceed three years from the date of permit issuance.

(d) *Extensions of time.* An authorization or construction period will automatically expire if the permittee fails to request and receive an extension of time. Extensions of time may be granted by the district engineer. The permittee must request the extension and explain the basis of the request, which will be granted unless the district engineer determines that an extension would be contrary to the public interest. Requests for extensions will be processed in accordance with the regular procedures of § 325.2 of this Part, including issuance of a public notice, except that such processing is not required where the district engineer determines that there have been no significant changes in the attendant circumstances since the authorization was issued.

(e) *Maintenance dredging.* If the authorized work includes periodic maintenance dredging, an expiration date for the authorization of that maintenance dredging will be included in the permit. The expiration date, which in no event is to exceed ten years from the date of issuance of the permit, will be established by the issuing official after evaluation of the proposed method of dredging and disposal of the dredged material in accordance with the requirements of 33 CFR Parts 320 to 325. In such cases, the district engineer shall require notification of the maintenance dredging prior to actual performance to insure continued compliance with the requirements of this regulation and 33 CFR Parts 320 to 324. If the permittee desires to continue maintenance

dredging beyond the expiration date, he must request a new permit. The permittee should be advised to apply for the new permit six months prior to the time he wishes to do the maintenance work.

§ 325.7 Modification, suspension, or revocation of permits.

(a) *General.* The district engineer may reevaluate the circumstances and conditions of any permit, including regional permits, either on his own motion, at the request of the permittee, or a third party, or as the result of periodic progress inspections, and initiate action to modify, suspend, or revoke a permit as may be made necessary by considerations of the public interest. In the case of regional permits, this reevaluation may cover individual activities, categories of activities, or geographic areas. Among the factors to be considered are the extent of the permittee's compliance with the terms and conditions of the permit; whether or not circumstances relating to the authorized activity have changed since the permit was issued or extended, and the continuing adequacy of or need for the permit conditions; any significant objections to the authorized activity which were not earlier considered; revisions to applicable statutory and/or regulatory authorities; and the extent to which modification, suspension, or other action would adversely affect plans, investments and actions the permittee has reasonably made or taken in reliance on the permit. Significant increases in scope of a permitted activity will be processed as new applications for permits in accordance with § 325.2 of this Part, and not as modifications under this section.

(b) *Modification.* Upon request by the permittee or, as a result of reevaluation of the circumstances and conditions of a permit, the district engineer may determine that the public interest requires a modification of the terms or conditions of the permit. In such cases, the district engineer will hold informal consultations with the permittee to ascertain whether the terms and conditions can be modified by mutual agreement. If a mutual agreement is reached on modification of the terms and conditions of the permit, the district engineer will give the permittee written notice of the modification, which will then become effective on such date as the district engineer may establish. In the event a mutual agreement cannot be reached by the district engineer and the permittee, the district engineer will proceed in accordance with paragraph (c) of this section if immediate suspension is warranted. In cases where

immediate suspension is not warranted but the district engineer determines that the permit should be modified, he will notify the permittee of the proposed modification and reasons therefor, and that he may request a meeting with the district engineer and/or a public hearing. The modification will become effective on the date set by the district engineer which shall be at least ten days after receipt of the notice by the permittee unless a hearing or meeting is requested within that period. If the permittee fails or refuses to comply with the modification, the district engineer will proceed in accordance with 33 CFR Part 326. The district engineer shall consult with resource agencies before modifying any permit terms or conditions, that would result in greater impacts, for a project about which that agency expressed a significant interest in the term, condition, or feature being modified prior to permit issuance.

(c) *Suspension.* The district engineer may suspend a permit after preparing a written determination and finding that immediate suspension would be in the public interest. The district engineer will notify the permittee in writing by the most expeditious means available that the permit has been suspended with the reasons therefor, and order the permittee to stop those activities previously authorized by the suspended permit. The permittee will also be advised that following this suspension a decision will be made to either reinstate, modify, or revoke the permit, and that he may within 10 days of receipt of notice of the suspension, request a meeting with the district engineer and/or a public hearing to present information in this matter. If a hearing is requested, the procedures prescribed in 33 CFR Part 327 will be followed. After the completion of the meeting or hearing (or within a reasonable period of time after issuance of the notice to the permittee that the permit has been suspended if no hearing or meeting is requested), the district engineer will take action to reinstate, modify, or revoke the permit.

(d) *Revocation.* Following completion of the suspension procedures in paragraph (c) of this section, if revocation of the permit is found to be in the public interest, the authority who made the decision on the original permit may revoke it. The permittee will be advised in writing of the final decision.

(e) *Regional permits.* The issuing official may, by following the procedures of this section, revoke regional permits for individual activities, categories of activities, or geographic areas. Where groups of permittees are

involved, such as for categories of activities or geographic areas, the informal discussions provided in paragraph (b) of this section may be waived and any written notification may be made through the general public notice procedures of this regulation. If a regional permit is revoked, any permittee may then apply for an individual permit which shall be processed in accordance with these regulations.

§ 325.8 Authority to issue or deny permits

(a) *General.* Except as otherwise provided in this regulation, the Secretary of the Army, subject to such conditions as he or his authorized representative may from time to time impose, has authorized the Chief of Engineers and his authorized representatives to issue or deny permits for dams or dikes in intrastate waters of the United States pursuant to section 9 of the Rivers and Harbors Act of 1899; for construction or other work in or affecting navigable waters of the United States pursuant to section 10 of the Rivers and Harbors Act of 1899; for the discharge of dredged or fill material into waters of the United States pursuant to section 404 of the Clean Water Act; or for the transportation of dredged material for the purpose of disposing of it into ocean waters pursuant to section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended. The authority to issue or deny permits in interstate navigable waters of the United States pursuant to section 9 of the Rivers and Harbors Act of March 3, 1899 has not been delegated to the Chief of Engineers or his authorized representatives.

(b) *District engineer's authority.* District engineers are authorized to issue or deny permits in accordance with these regulations pursuant to sections 9 and 10 of the Rivers and Harbors Act of 1899; section 404 of the Clean Water Act; and section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, in all cases not required to be referred to higher authority (see below). It is essential to the legality of a permit that it contain the name of the district engineer as the issuing officer. However, the permit need not be signed by the district engineer in person but may be signed for and in behalf of him by whomever he designates. In cases where permits are denied for reasons other than navigation or failure to obtain required local, state, or other federal approvals or certifications, the Statement of Findings must conclusively justify a denial decision. District

engineers are authorized to deny permits without issuing a public notice or taking other procedural steps where required local, state, or other federal permits for the proposed activity have been denied or where he determines that the activity will clearly interfere with navigation except in all cases required to be referred to higher authority (see below). District engineers are also authorized to add, modify, or delete special conditions in permits in accordance with § 325.4 of this Part, except for those conditions which may have been imposed by higher authority, and to modify, suspend and revoke permits according to the procedures of § 325.7 of this Part. District engineers will refer the following applications to the division engineer for resolution:

(1) When a referral is required by a written agreement between the head of a Federal agency and the Secretary of the Army;

(2) When the recommended decision is contrary to the written position of the Governor of the state in which the work would be performed;

(3) When there is substantial doubt as to authority, law, regulations, or policies applicable to the proposed activity;

(4) When higher authority requests the application be forwarded for decision; or

(5) When the district engineer is precluded by law or procedures required by law from taking final action on the application (e.g. section 9 of the Rivers and Harbors Act of 1899, or territorial sea baseline changes).

(c) *Division engineer's authority.* Division engineers will review and evaluate all permit applications referred by district engineers. Division engineers may authorize the issuance or denial of permits pursuant to section 10 of the Rivers and Harbors Act of 1899; section 404 of the Clean Water Act; and section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended; and the inclusion of conditions in accordance with § 325.4 of this Part in all cases not required to be referred to the Chief of Engineers. Division engineers will refer the following applications to the Chief of Engineers for resolution:

(1) When a referral is required by a written agreement between the head of a Federal agency and the Secretary of the Army;

(2) When there is substantial doubt as to authority, law, regulations, or policies applicable to the proposed activity;

(3) When higher authority requests the application be forwarded for decision; or

(4) When the division engineer is precluded by law or procedures required

by law from taking final action on the application.

§ 325.9 Authority to determine jurisdiction.

District engineers are authorized to determine the area defined by the terms "navigable waters of the United States" and "waters of the United States" except:

(a) When a determination of navigability is made pursuant to 33 CFR 329.14 (division engineers have this authority); or

(b) When EPA makes a section 404 jurisdiction determination under its authority.

§ 325.10 Publicity.

The district engineer will establish and maintain a program to assure that potential applicants for permits are informed of the requirements of this regulation and of the steps required to obtain permits for activities in waters of the United States or ocean waters. Whenever the district engineer becomes aware of plans being developed by either private or public entities which might require permits for implementation, he should advise the potential applicant in writing of the statutory requirements and the provisions of this regulation. Whenever the district engineer is aware of changes in Corps of Engineers regulatory jurisdiction, he will issue appropriate public notices.

Appendix A—Permit Form and Special Conditions

A. Permit Form

Department of the Army Permit

Permittee _____
Permit No. _____
Issuing Office _____

Note.—The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: (Describe the permitted activity and its intended use with references to any attached plans or drawings that are considered to be a part of the project description. Include a description of the types and quantities of dredged or fill materials to be discharged in jurisdictional waters.)

Project Location: (Where appropriate, provide the names of and the locations on the waters where the permitted activity and any off-site disposals will take place. Also, using name, distance, and direction, locate the permitted activity in reference to a nearby landmark such as a town or city.)

Permit Conditions: General Conditions:

1. The time limit for completing the work authorized ends on _____. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions: (Add special conditions as required in this space with reference to a continuation sheet if necessary.)

Further Information:

1. **Congressional Authorities:** You have been authorized to undertake the activity described above pursuant to:

() Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

() Section 404 of the Clean Water Act (33 U.S.C. 1344).

() Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(Permittee)

(Date)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

(District Engineer)

(Date)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(Transferee)

(Date)

B. Special Conditions. No special conditions will be preprinted on the permit form. The following and other special conditions should be added, as appropriate, in the space provided after the general conditions or on a referenced continuation sheet:

1. Your use of the permitted activity must not interfere with the public's right to free navigation on all navigable waters of the United States.

2. You must have a copy of this permit available on the vessel used for the authorized transportation and disposal of dredged material.

3. You must advise this office in writing, at least two weeks before you start maintenance dredging activities under the authority of this permit.

4. You must install and maintain, at your expense, any safety lights and signals prescribed by the United States Coast Guard (USCG), through regulations or otherwise, on your authorized facilities. The USCG may be reached at the following address and telephone number:

5. The condition below will be used when a Corps permit authorizes an artificial reef, an aerial transmission line, a submerged cable or pipeline, or a structure on the outer continental shelf.

National Ocean Service (NOS) has been notified of this authorization. You must notify NOS and this office in writing, at least two weeks before you begin work and upon completion of the activity authorized by this permit. Your notification of completion must include a drawing which certifies the location and configuration of the completed activity (a certified permit drawing may be used). Notifications to NOS will be sent to the following address: The Director, National Ocean Service (N/CG 222), Rockville, Maryland 20852.

6. The following condition should be used for every permit where legal recordation of the permit would be reasonably practicable and recordation could put a subsequent purchaser or owner of property on notice of permit conditions.

You must take the actions required to record this permit with the Registrar of Deeds or other appropriate official charged with the responsibility for maintaining records of title to or interest in real property.

Appendix B—[Reserved] (For Future NEPA Regulation)

Appendix C—[Reserved] (For Historic Properties Regulation)

PART 326—ENFORCEMENT

Sec.

326.1 Purpose.

326.2 Policy.

326.3 Unauthorized activities.

326.4 Supervision of authorized activities.

326.5 Legal action.

Authority: 33 U.S.C. 401 et seq.; 33 U.S.C. 1344; 33 U.S.C. 1413.

§ 326.1 Purpose.

This Part prescribes enforcement policies (§ 326.2) and procedures applicable to activities performed without required Department of the Army permits (§ 326.3) and to activities not in compliance with the terms and conditions of issued Department of the Army permits (§ 326.4). Procedures for initiating legal actions are prescribed in § 326.5. Nothing contained in this Part shall establish a non-discretionary duty on the part of district engineers nor shall deviation from these procedures give rise to a private right of action against a district engineer.

§ 326.2 Policy.

Enforcement, as part of the overall regulatory program of the Corps, is based on a policy of regulating the waters of the United States by discouraging activities that have not been properly authorized and by requiring corrective measures, where appropriate, to ensure those waters are not misused and to maintain the integrity of the program. There are several methods discussed in the remainder of this part which can be used either singly or in combination to implement this policy, while making the most effective use of the enforcement resources available. As EPA has independent enforcement authority under the Clean Water Act for unauthorized discharges, the district engineer should normally coordinate with EPA to determine the most effective and efficient manner by which resolution of a section 404 violation can be achieved.

§ 326.3 Unauthorized activities.

(a) *Surveillance.* To detect unauthorized activities requiring permits, district engineers should make the best use of all available resources.

Corps employees; members of the public; and representatives of state, local, and other Federal agencies should be encouraged to report suspected violations. Additionally, district engineers should consider developing joint surveillance procedures with Federal, state, or local agencies having similar regulatory responsibilities, special expertise, or interest.

(b) *Initial investigation.* District engineers should take steps to investigate suspected violations in a timely manner. The scheduling of investigations will reflect the nature and location of the suspected violations, the anticipated impacts, and the most effective use of inspection resources available to the district engineer. These investigations should confirm whether a violation exists, and if so, will identify the extent of the violation and the parties responsible.

(c) *Formal notifications to parties responsible for violations.* Once the district engineer has determined that a violation exists, he should take appropriate steps to notify the responsible parties.

(1) If the violation involves a project that is not complete, the district engineer's notification should be in the form of a cease and desist order prohibiting any further work pending resolution of the violation in accordance with the procedures contained in this part. See paragraph (c)(4) of this section for exception to this procedure.

(2) If the violation involves a completed project, a cease and desist order should not be necessary. However, the district engineer should still notify the responsible parties of the violation.

(3) All notifications, pursuant to paragraphs (c) (1) and (2) of this section, should identify the relevant statutory authorities, indicate potential enforcement consequences, and direct the responsible parties to submit any additional information that the district engineer may need at that time to determine what course of action he should pursue in resolving the violation; further information may be requested, as needed, in the future.

(4) In situations which would, if a violation were not involved, qualify for emergency procedures pursuant to 33 CFR Part 325.2(e)(4), the district engineer may decide it would not be appropriate to direct that the unauthorized work be stopped. Therefore, in such situations, the district engineer may, at his discretion, allow the work to continue, subject to appropriate limitations and conditions as he may prescribe, while the violation is being resolved in

accordance with the procedures contained in this part.

(5) When an unauthorized activity requiring a permit has been undertaken by American Indians (including Alaskan natives, Eskimos, and Aleuts, but not including Native Hawaiians) on reservation lands or in pursuit of specific treaty rights, the district engineer should use appropriate means to coordinate proposed directives and orders with the Assistant Chief Counsel for Indian Affairs (DAEN-CCI).

(6) When an unauthorized activity requiring a permit has been undertaken by an official acting on behalf of a foreign government, the district engineer should use appropriate means to coordinate proposed directives and orders with the Office, Chief of Engineers, ATTN: DAEN-CCK.

(d) *Initial corrective measures.* (1) The district engineer should, in appropriate cases, depending upon the nature of the impacts associated with the unauthorized, completed work, solicit the views of the Environmental Protection Agency; the U.S. Fish and Wildlife Service; the National Marine Fisheries Service, and other Federal, state, and local agencies to facilitate his decision on what initial corrective measures are required. If the district engineer determines as a result of his investigation, coordination, and preliminary evaluation that initial corrective measures are required, he should issue an appropriate order to the parties responsible for the violation. In determining what initial corrective measures are required, the district engineer should consider whether serious jeopardy to life, property, or important public resources (see 33 CFR Part 320.4) may be reasonably anticipated to occur during the period required for the ultimate resolution of the violation. In his order, the district engineer will specify the initial corrective measures required and the time limits for completing this work. In unusual cases where initial corrective measures substantially eliminate all current and future detrimental impacts resulting from the unauthorized work, further enforcement actions should normally be unnecessary. For all other cases, the district engineer's order should normally specify that compliance with the order will not foreclose the Government's options to initiate appropriate legal action or to later require the submission of a permit application.

(2) An order requiring initial corrective measures that resolve the violation may also be issued by the district engineer in situations where the acceptance or processing of an after-the-

fact permit application is prohibited or considered not appropriate pursuant to § 326.3(e)(1) (iii)-(iv) below. However, such orders will be issued only when the district engineer has reached an independent determination that such measures are necessary and appropriate.

(3) It will not be necessary to issue a Corps permit in connection with initial corrective measures undertaken at the direction of the district engineer.

(e) *After-the-fact permit applications.*

(1) Following the completion of any required initial corrective measures, the district engineer will accept an after-the-fact permit application unless he determines that one of the exceptions listed in subparagraphs i-iv below is applicable. Applications for after-the-fact permits will be processed in accordance with the applicable procedures in 33 CFR Parts 320-325. Situations where no permit application will be processed or where the acceptance of a permit application must be deferred are as follows:

(i) No permit application will be processed when restoration of the waters of the United States has been completed that eliminates current and future detrimental impacts to the satisfaction of the district engineer.

(ii) No permit application will be accepted in connection with a violation where the district engineer determines that legal action is appropriate (§ 326.5(a)) until such legal action has been completed.

(iii) No permit application will be accepted where a Federal, state, or local authorization or certification, required by Federal law, has already been denied.

(iv) No permit application will be accepted nor will the processing of an application be continued when the district engineer is aware of enforcement litigation that has been initiated by other Federal, state, or local regulatory agencies, unless he determines that concurrent processing of an after-the-fact permit application is clearly appropriate.

(2) Upon completion of his review in accordance with 33 CFR Parts 320-325, the district engineer will determine if a permit should be issued, with special conditions if appropriate, or denied. In reaching a decision to issue, he must determine that the work involved is not contrary to the public interest, and if section 404 is applicable, that the work also complies with the Environmental Protection Agency's section 404(b)(1) guidelines. If he determines that a denial is warranted, his notification of denial should prescribe any final corrective

actions required. His notification should also establish a reasonable period of time for the applicant to complete such actions unless he determines that further information is required before the corrective measures can be specified. If further information is required, the final corrective measures may be specified at a later date. If an applicant refuses to undertake prescribed corrective actions ordered subsequent to permit denial or refuses to accept a conditioned permit, the district engineer may initiate legal action in accordance with § 326.5.

(f) *Combining steps.* The procedural steps in this section are in the normal sequence. However, these regulations do not prohibit the streamlining of the enforcement process through the combining of steps.

(g) *Coordination with EPA.* In all cases where the district engineer is aware that EPA is considering enforcement action, he should coordinate with EPA to attempt to avoid conflict or duplication. Such coordination applies to interim protective measures and after-the-fact permitting, as well as to appropriate legal enforcement actions.

§ 326.4 Supervision of authorized activities.

(a) *Inspections.* District engineers will, at their discretion, take reasonable measures to inspect permitted activities, as required, to ensure that these activities comply with specified terms and conditions. To supplement inspections by their enforcement personnel, district engineers should encourage their other personnel; members of the public; and interested state, local, and other Federal agency representatives to report suspected violations of Corps permits. To facilitate inspections, district engineers will, in appropriate cases, require that copies of ENG Form 4336 be posted conspicuously at the sites of authorized activities and will make available to all interested persons information on the terms and conditions of issued permits. The U.S. Coast Guard will inspect permitted ocean dumping activities pursuant to section 107(c) of the Marine Protection, Research and Sanctuaries Act of 1972, as amended.

(b) *Inspection limitations.* Section 326.4 does not establish a non-discretionary duty to inspect permitted activities for safety, sound engineering practices, or interference with other permitted or unpermitted structures or uses in the area. Further, the regulations implementing the Corps regulatory program do not establish a non-discretionary duty to inspect permitted activities for any other purpose.

(c) *Inspection expenses.* The expenses incurred in connection with the inspection of permitted activities will normally be paid by the Federal Government unless daily supervision or other unusual expenses are involved. In such unusual cases, the district engineer may condition permits to require permittees to pay inspection expenses pursuant to the authority contained in Section 9701 of Pub L. 97-258 (33 U.S.C. 9701). The collection and disposition of inspection expense funds obtained from applicants will be administered in accordance with the relevant Corps regulations governing such funds.

(d) *Non-compliance.* If a district engineer determines that a permittee has violated the terms or conditions of the permit and that the violation is sufficiently serious to require an enforcement action, then he should, unless at his discretion he deems it inappropriate: (1) First contact the permittee; (2) request corrected plans reflecting actual work, if needed; and (3) attempt to resolve the violation. Resolution of the violation may take the form of the permitted project being voluntarily brought into compliance or of a permit modification (33 CFR 325.7(b)). If a mutually agreeable solution cannot be reached, a written order requiring compliance should normally be issued and delivered by personal service. Issuance of an order is not, however, a prerequisite to legal action. If an order is issued, it will specify a time period of not more than 30 days for bringing the permitted project into compliance, and a copy will be sent to the appropriate state official pursuant to section 404(s)(2) of the Clean Water Act. If the permittee fails to comply with the order within the specified period of time, the district engineer may consider using the suspension/revocation procedures in 33 CFR 325.7(c) and/or he may recommend legal action in accordance with § 326.5.

§ 326.5 Legal action.

(a) *General.* For cases the district engineer determines to be appropriate, he will recommend criminal or civil actions to obtain penalties for violations, compliance with the orders and directives he has issued pursuant to §§ 326.3 and 326.4, or other relief as appropriate. Appropriate cases for criminal or civil action include, but are not limited to, violations which, in the district engineer's opinion, are willful, repeated, flagrant, or of substantial impact.

(b) *Preparation of case.* If the district engineer determines that legal action is appropriate, he will prepare a litigation report or such other documentation that

he and the local U.S. Attorney have mutually agreed to, which contains an analysis of the information obtained during his investigation of the violation or during the processing of a permit application and a recommendation of appropriate legal action. The litigation report or alternative documentation will also recommend what, if any, restoration or mitigative measures are required and will provide the rationale for any such recommendation.

(c) *Referral to the local U.S. Attorney.* Except as provided in paragraph (d) of this section, district engineers are authorized to refer cases directly to the U.S. Attorney. Because of the unique legal system in the Trust Territories, all cases over which the Department of Justice has no authority will be referred to the Attorney General for the trust Territories. Information copies of all letters of referral shall be forwarded to the appropriate division counsel, the Office, Chief of Engineers, ATTN: DAEN-CCK, the Office of the Assistant Secretary of the Army (Civil Works), and the Chief of the Environmental Defense Section, Lands and Natural Resources Division, U.S. Department of Justice.

(d) *Referral to the Office, Chief of Engineers.* District engineers will forward litigation reports with recommendations through division offices to the Office, Chief of Engineers, ATTN: DAEN-CCK, for all cases that qualify under the following criteria:

- (1) Significant precedential or controversial questions of law or fact;
- (2) Requests for elevation to the Washington level by the Department of Justice;
- (3) Violations of section 9 of the Rivers and Harbors Act of 1899;
- (4) Violations of section 103 of the Marine Protection, Research and Sanctuaries Act of 1972;
- (5) All cases involving violations by American Indians (original of litigation report to DAEN-CCI with copy to DAEN-CCK) on reservation lands or in pursuit of specific treaty rights;
- (6) All cases involving violations by officials acting on behalf of foreign governments; and
- (7) Cases requiring action pursuant to paragraph (e) of this section.

(e) *Legal option not available.* In cases where the local U.S. Attorney declines to take legal action, it would be appropriate for the district engineer to close the enforcement case record unless he believes that the case warrants special attention. In that situation, he is encouraged to forward a litigation report to the Office, Chief of Engineers, ATTN: DAEN-CCK, for

direct coordination through the Office of the Assistant Secretary of the Army (Civil Works) with the Department of Justice. Further, the case record should not be closed if the district engineer anticipates that further administrative enforcement actions, taken in accordance with the procedures prescribed in this part, will identify remedial measures which, if not complied with by the parties responsible for the violation, will result in appropriate legal action at a later date.

PART 327—PUBLIC HEARINGS

Sec.

- 327.1 Purpose.
- 327.2 Applicability.
- 327.3 Definitions.
- 327.4 General policies.
- 327.5 Presiding officer.
- 327.6 Legal adviser.
- 327.7 Representation.
- 327.8 Conduct of hearings.
- 327.9 Filing of transcript of the public hearing.
- 327.10 Authority of the presiding officer.
- 327.11 Public notice.

Authority: 33 U.S.C. 1344; 33 U.S.C. 1413.

§ 327.1 Purpose.

This regulation prescribes the policy, practice and procedures to be followed by the U.S. Army Corps of Engineers in the conduct of public hearings conducted in the evaluation of a proposed DA permit action or Federal project as defined in § 327.3 of this Part including those held pursuant to section 404 of the Clean Water Act (33 U.S.C. 1344) and section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA), as amended (33 U.S.C. 1413).

§ 327.2 Applicability.

This regulation is applicable to all divisions and districts responsible for the conduct of public hearings.

§ 327.3 Definitions.

(a) Public hearing means a public proceeding conducted for the purpose of acquiring information or evidence which will be considered in evaluating a proposed DA permit action, or Federal project, and which affords the public an opportunity to present their views, opinions, and information on such permit actions or Federal projects.

(b) Permit action, as used herein means the evaluation of and decision on an application for a DA permit pursuant to sections 9 or 10 of the Rivers and Harbors Act of 1899, section 404 of the Clean Water Act, or section 103 of the MPRSA, as amended, or the modification, suspension or revocation of any DA permit (see 33 CFR 325.7).

(c) Federal project means a Corps of Engineers project (work or activity of any nature for any purpose which is to be performed by the Chief of Engineers pursuant to Congressional authorizations) involving the discharge of dredged or fill material into waters of the United States or the transportation of dredged material for the purpose of dumping it in ocean waters subject to section 404 of the Clean Water Act, or section 103 of the MPRSA.

§ 327.4 General policies.

(a) A public hearing will be held in connection with the consideration of a DA permit application or a Federal project whenever a public hearing is needed for making a decision on such permit application or Federal project. In addition, a public hearing may be held when it is proposed to modify or revoke a permit. (See 33 CFR 325.7).

(b) Unless the public notice specifies that a public hearing will be held, any person may request, in writing, within the comment period specified in the public notice on a DA permit application or on a Federal project, that a public hearing be held to consider the material matters at issue in the permit application or with respect to Federal project. Upon receipt of any such request, stating with particularity the reasons for holding a public hearing, the district engineer may expeditiously attempt to resolve the issues informally. Otherwise, he shall promptly set a time and place for the public hearing, and give due notice thereof, as prescribed in § 327.11 of this Part. Requests for a public hearing under this paragraph shall be granted, unless the district engineer determines that the issues raised are insubstantial or there is otherwise no valid interest to be served by a hearing. The district engineer will make such a determination in writing, and communicate his reasons therefor to all requesting parties. Comments received as form letters or petitions may be acknowledged as a group to the person or organization responsible for the form letter or petition.

(c) In case of doubt, a public hearing shall be held. HQDA has the discretionary power to require hearings in any case.

(d) In fixing the time and place for a hearing, the convenience and necessity of the interested public will be duly considered.

§ 327.5 Presiding officer.

(a) The district engineer, in whose district a matter arises, shall normally serve as the presiding officer. When the district engineer is unable to serve, he may designate the deputy district

engineer or other qualified person as presiding officer. In cases of unusual interest, the Chief of Engineers or the division engineer may appoint such person as he deems appropriate to serve as the presiding officer.

(b) The presiding officer shall include in the administrative record of the permit action the request or requests for the hearing and any data or material submitted in justification thereof, materials submitted in opposition to or in support of the proposed action, the hearing transcript, and such other material as may be relevant or pertinent to the subject matter of the hearing. The administrative record shall be available for public inspection with the exception of material exempt from disclosure under the Freedom of Information Act.

§ 327.6 Legal adviser.

At each public hearing, the district counsel or his designee may serve as legal advisor to the presiding officer. In appropriate circumstances, the district engineer may waive the requirement for a legal advisor to be present.

§ 327.7 Representation.

At the public hearing, any person may appear on his own behalf, or may be represented by counsel, or by other representatives.

§ 327.8 Conduct of hearings.

(a) The presiding officer shall make an opening statement outlining the purpose of the hearing and prescribing the general procedures to be followed.

(b) Hearings shall be conducted by the presiding officer in an orderly but expeditious manner. Any person shall be permitted to submit oral or written statements concerning the subject matter of the hearing, to call witnesses who may present oral or written statements, and to present recommendations as to an appropriate decision. Any person may present written statements for the hearing record prior to the time the hearing record is closed to public submissions, and may present proposed findings and recommendations. The presiding officer shall afford participants a reasonable opportunity for rebuttal.

(c) The presiding officer shall have discretion to establish reasonable limits upon the time allowed for statements of witnesses, for arguments of parties or their counsel or representatives, and upon the number of rebuttals.

(d) Cross-examination of witnesses shall not be permitted.

(e) All public hearings shall be reported verbatim. Copies of the transcripts of proceedings may be

purchased by any person from the Corps Engineers or the reporter of such hearing. A copy will be available for public inspection at the office of the appropriate district engineer.

(f) All written statements, charts, tabulations, and similar data offered in evidence at the hearing shall, subject to exclusion by the presiding officer for reasons of redundancy, be received in evidence and shall constitute a part of the record.

(g) The presiding officer shall allow a period of not less than 10 days after the close of the public hearing for submission of written comments.

(h) In appropriate cases, the district engineer may participate in joint public hearings with other Federal or state agencies, provided the procedures of those hearings meet the requirements of this regulation. In those cases in which the other Federal or state agency allows a cross-examination in its public hearing, the district engineer may still participate in the joint public hearing but shall not require cross examination as a part of his participation.

§ 327.9 Filing of the transcript of the public hearing.

Where the presiding officer is the initial action authority, the transcript of the public hearing, together with all evidence introduced at the public hearing, shall be made a part of the administrative record of the permit action or Federal project. The initial action authority shall fully consider the matters discussed at the public hearing in arriving at his initial decision or recommendation and shall address, in his decision or recommendation, all substantial and valid issues presented at the hearing. Where a person other than the initial action authority serves as presiding officer, such person shall forward the transcript of the public hearing and all evidence received in connection therewith to the initial action authority together with a report summarizing the issues covered at the hearing. The report of the presiding officer and the transcript of the public hearing and evidence submitted thereat shall in such cases be fully considered by the initial action authority in making his decision or recommendation to higher authority as to such permit action or Federal project.

§ 327.10 Authority of the presiding officer.

Presiding officers shall have the following authority:

(a) To regulate the course of the hearing including the order of all sessions and the scheduling thereof, after any initial session, and the

recessing, reconvening, and adjournment thereof; and

(b) To take any other action necessary or appropriate to the discharge of the duties vested in them, consistent with the statutory or other authority under which the Chief of Engineers functions, and with the policies and directives of the Chief of Engineers and the Secretary of the Army.

§ 327.11 Public notice.

(a) Public notice shall be given of any public hearing to be held pursuant to this regulation. Such notice should normally provide for a period of not less than 30 days following the date of public notice during which time interested parties may prepare themselves for the hearing. Notice shall also be given to all Federal agencies affected by the proposed action, and to state and local agencies and other parties having an interest in the subject matter of the hearing. Notice shall be sent to all persons requesting a hearing and shall be posted in appropriate government buildings and provided to newspapers of general circulation for publication. Comments received as form letters or petitions may be acknowledged as a group to the person or organization responsible for the form letter or petition.

(b) The notice shall contain time, place, and nature of hearing; the legal authority and jurisdiction under which the hearing is held; and location of and availability of the draft environmental impact statement or environmental assessment.

PART 328—DEFINITION OF WATERS OF THE UNITED STATES

Sec.

328.1 Purpose.

328.2 General scope.

328.3 Definitions.

328.4 Limits of jurisdiction.

328.5 Changes in limits of waters of the United States.

Authority: 33 U.S.C. 1344.

§ 328.1 Purpose.

This section defines the term "waters of the United States" as it applies to the jurisdictional limits of the authority of the Corps of Engineers under the Clean Water Act. It prescribes the policy, practice, and procedures to be used in determining the extent of jurisdiction of the Corps of Engineers concerning "waters of the United States." The terminology used by section 404 of the Clean Water Act includes "navigable waters" which is defined at section 502(7) of the Act as "waters of the United States including the territorial seas." To provide clarity and to avoid

confusion with other Corps of Engineer regulatory programs, the term "waters of the United States" is used throughout 33 CFR Parts 320-330. This section does not apply to authorities under the Rivers and Harbors Act of 1899 except that some of the same waters may be regulated under both statutes (see 33 CFR Parts 322 and 329).

§ 328.2 General scope.

Waters of the United States include those waters listed in § 328.3(a). The lateral limits of jurisdiction in those waters may be divided into three categories. The categories include the territorial seas, tidal waters, and non-tidal waters (see 33 CFR 328.4 (a), (b), and (c), respectively).

§ 328.3 Definitions.

For the purpose of this regulation these terms are defined as follows:

(a) The term "waters of the United States" means

(1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(2) All interstate waters including interstate wetlands;

(3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

(i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or

(ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(iii) Which are used or could be used for industrial purpose by industries in interstate commerce;

(4) All impoundments of waters otherwise defined as waters of the United States under the definition;

(5) Tributaries of waters identified in paragraphs (a) (1)-(4) of this section;

(6) The territorial seas;

(7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) (1)-(6) of this section.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 123.11(m) which also meet the criteria of this definition) are not waters of the United States.

(b) The term "wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

(c) The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are "adjacent wetlands."

(d) The term "high tide line" means the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

(e) The term "ordinary high water mark" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

(f) The term "tidal waters" means those waters that rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by hydrologic, wind, or other effects.

§ 329.4 Limits of jurisdiction.

(a) *Territorial Seas.* The limit of jurisdiction in the territorial seas is measured from the baseline in a seaward direction a distance of three nautical miles. (See 33 CFR 329.12)

(b) *Tidal Waters of the United States.* The landward limits of jurisdiction in tidal waters:

- (1) Extends to the high tide line, or
- (2) When adjacent non-tidal waters of the United States are present, the jurisdiction extends to the limits identified in paragraph (c) of this section.

(c) *Non-Tidal Waters of the United States.* The limits of jurisdiction in non-tidal waters:

- (1) In the absence of adjacent wetlands, the jurisdiction extends to the ordinary high water mark, or
- (2) When adjacent wetlands are present, the jurisdiction extends beyond the ordinary high water mark to the limit of the adjacent wetlands.
- (3) When the water of the United States consists only of wetlands the jurisdiction extends to the limit of the wetland.

§ 329.5 Changes in limits of waters of the United States.

Permanent changes of the shoreline configuration result in similar alterations of the boundaries of waters of the United States. Gradual changes which are due to natural causes and are perceptible only over some period of time constitute changes in the bed of a waterway which also change the boundaries of the waters of the United States. For example, changing sea levels or subsidence of land may cause some areas to become waters of the United States while siltation or a change in drainage may remove an area from waters of the United States. Man-made changes may affect the limits of waters of the United States; however, permanent changes should not be presumed until the particular circumstances have been examined and verified by the district engineer. Verification of changes to the lateral limits of jurisdiction may be obtained from the district engineer.

PART 329—DEFINITION OF NAVIGABLE WATERS OF THE UNITED STATES

Sec.

- 329.1 Purpose.
- 329.2 Applicability.
- 329.3 General policies.
- 329.4 General definitions.
- 329.5 General scope of determination.
- 329.6 Interstate or foreign commerce.
- 329.7 Intrastate or interstate nature of waterway.
- 329.8 Improved or natural conditions of the waterbody.
- 329.9 Time at which commerce exists or determination is made.
- 329.10 Existence of obstructions.

Sec.

- 329.11 Geographic and jurisdictional limits of rivers and lakes.
- 329.12 Geographic and jurisdictional limits of oceanic and tidal waters.
- 329.13 Geographic limits: shifting boundaries.
- 329.14 Determination of navigability.
- 329.15 Inquiries regarding determinations.
- 329.16 Use and maintenance of lists of determinations.

Authority: 33 U.S.C. 401 *et seq.*

§ 329.1 Purpose.

This regulation defines the term "navigable waters of the United States" as it is used to define authorities of the Corps of Engineers. It also prescribes the policy, practice and procedure to be used in determining the extent of the jurisdiction of the Corps of Engineers and in answering inquiries concerning "navigable waters of the United States." This definition does not apply to authorities under the Clean Water Act which definitions are described under 33 CFR Parts 323 and 328.

§ 329.2 Applicability.

This regulation is applicable to all Corps of Engineers districts and divisions having civil works responsibilities.

§ 329.3 General policies.

Precise definitions of "navigable waters of the United States" or "navigability" are ultimately dependent on judicial interpretation and cannot be made conclusively by administrative agencies. However, the policies and criteria contained in this regulation are in close conformance with the tests used by Federal courts and determinations made under this regulation are considered binding in regard to the activities of the Corps of Engineers.

§ 329.4 General definition.

Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity.

§ 329.5 General scope of determination.

The several factors which must be examined when making a determination whether a waterbody is a navigable water of the United States are discussed in detail below. Generally, the following conditions must be satisfied:

(a) Past, present, or potential presence of interstate or foreign commerce;

(b) Physical capabilities for use by commerce as in paragraph (a) of this section; and

(c) Defined geographic limits of the waterbody.

§ 329.6 Interstate or foreign commerce.

(a) *Nature of commerce: type, means, and extent of use.* The types of commercial use of a waterway are extremely varied and will depend on the character of the region, its products, and the difficulties or dangers of navigation. It is the waterbody's capability of use by the public for purposes of transportation of commerce which is the determinative factor, and not the time, extent or manner of that use. As discussed in § 329.9 of this Part, it is sufficient to establish the potential for commercial use at any past, present, or future time. Thus, sufficient commerce may be shown by historical use of canoes, bateaux, or other frontier craft, as long as that type of boat was common or well-suited to the place and period. Similarly, the particular items of commerce may vary widely, depending again on the region and period. The goods involved might be grain, furs, or other commerce of the time. Logs are a common example; transportation of logs has been a substantial and well-recognized commercial use of many navigable waters of the United States. Note, however, that the mere presence of floating logs will not of itself make the river "navigable"; the logs must have been related to a commercial venture. Similarly, the presence of recreational craft may indicate that a waterbody is capable of bearing some forms of commerce, either presently, in the future, or at a past point in time.

(b) *Nature of commerce: interstate and intrastate.* Interstate commerce may of course be existent on an intrastate voyage which occurs only between places within the same state. It is only necessary that goods may be brought from, or eventually be destined to go to, another state. (For purposes of this regulation, the term "interstate commerce" hereinafter includes "foreign commerce" as well.)

§ 329.7 Intrastate or interstate nature of waterway.

A waterbody may be entirely within a state, yet still be capable of carrying interstate commerce. This is especially clear when it physically connects with a generally acknowledged avenue of interstate commerce, such as the ocean or one of the Great Lakes, and is yet wholly within one state. Nor is it necessary that there be a physically

navigable connection across a state boundary. Where a waterbody extends through one or more states, but substantial portions, which are capable of bearing interstate commerce, are located in only one of the states, the entirety of the waterway up to the head (upper limit) of navigation is subject to Federal jurisdiction.

§ 329.8 Improved or natural conditions of the waterbody.

Determinations are not limited to the natural or original condition of the waterbody. Navigability may also be found where artificial aids have been or may be used to make the waterbody suitable for use in navigation.

(a) *Existing improvements: artificial waterbodies.* (1) An artificial channel may often constitute a navigable water of the United States, even though it has been privately developed and maintained, or passes through private property. The test is generally as developed above, that is, whether the waterbody is capable of use to transport interstate commerce. Canals which connect two navigable waters of the United States and which are used for commerce clearly fall within the test, and themselves become navigable. A canal open to navigable waters of the United States on only one end is itself navigable where it in fact supports interstate commerce. A canal or other artificial waterbody that is subject to ebb and flow of the tide is also a navigable water of the United States.

(2) The artificial waterbody may be a major portion of a river or harbor area or merely a minor backwash, slip, or turning area (see paragraph 329.12(b) of this Part).

(3) Private ownership of the lands underlying the waterbody, or of the lands through which it runs, does not preclude a finding of navigability. Ownership does become a controlling factor if a privately constructed and operated canal is not used to transport interstate commerce nor used by the public; it is then not considered to be a navigable water of the United States. However, a private waterbody, even though not itself navigable, may so affect the navigable capacity of nearby waters as to nevertheless be subject to certain regulatory authorities.

(b) *Non-existing improvements, past or potential.* A waterbody may also be considered navigable depending on the feasibility of use to transport interstate commerce after the construction of whatever "reasonable" improvements may potentially be made. The improvement need not exist, be planned, nor even authorized; it is enough that potentially they could be made. What is

a "reasonable" improvement is always a matter of degree; there must be a balance between cost and need at a time when the improvement would be (or would have been) useful. Thus, if an improvement were "reasonable" at a time of past use, the water was therefore navigable in law from that time forward. The changes in engineering practices or the coming of new industries with varying classes of freight may affect the type of the improvement; those which may be entirely reasonable in a thickly populated, highly developed industrial region may have been entirely too costly for the same region in the days of the pioneers. The determination of reasonable improvement is often similar to the cost analyses presently made in Corps of Engineers studies.

§ 329.9 Time at which commerce exists or determination is made.

(a) *Past use.* A waterbody which was navigable in its natural or improved state, or which was susceptible of reasonable improvement (as discussed in paragraph 329.8(b) of this Part) retains its character as "navigable in law" even though it is not presently used for commerce, or is presently incapable of such use because of changed conditions or the presence of obstructions. Nor does absence of use because of changed economic conditions affect the legal character of the waterbody. Once having attained the character of "navigable in law," the Federal authority remains in existence, and cannot be abandoned by administrative officers or court action. Nor is mere inattention or ambiguous action by Congress an abandonment of Federal control. However, express statutory declarations by Congress that described portions of a waterbody are non-navigable, or have been abandoned, are binding upon the Department of the Army. Each statute must be carefully examined, since Congress often reserves the power to amend the Act, or assigns special duties of supervision and control to the Secretary of the Army or Chief of Engineers.

(b) *Future or potential use.* Navigability may also be found in a waterbody's susceptibility for use in its ordinary condition or by reasonable improvement to transport interstate commerce. This may be either in its natural or improved condition, and may thus be existent although there has been no actual use to date. Non-use in the past therefore does not prevent recognition of the potential for future use.

navigable waters of the United States (i.e., isolated waters).

(b) *Conditions.* The following special conditions must be followed in order for the nationwide permits identified in paragraph (a) of this section to be valid:

(1) That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake.

(2) That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production unless the discharge is directly related to a shellfish harvesting activity authorized by paragraph (a)(4) of this section.

(3) That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act (ESA), or destroy or adversely modify the critical habitat of such species. In the case of federal agencies, it is the agencies' responsibility to comply with the requirements of the ESA. If the activity may adversely affect any listed species or critical habitat, the district engineer must initiate Section 7 consultation in accordance with the ESA. In such cases, the district engineer may:

(i) Initiate section 7 consultation and then, upon completion, authorize the activity under the nationwide permit by adding, if appropriate, activity specific conditions, or

(ii) Prior to or concurrent with section 7 consultation he may recommend discretionary authority (See section 330.8) or use modification, suspension, or revocation procedures (See 33 CFR 325.7).

(4) That the activity shall not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody (unless the primary purpose of the fill is to impound water);

(5) That any discharge of dredged or fill material shall consist of suitable material free from toxic pollutants (see section 307 of the Clean Water Act) in toxic amounts;

(6) That any structure or fill authorized shall be properly maintained.

(7) That the activity will not occur in a component of the National Wild and Scenic River System; nor in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status;

(8) That the activity shall not cause an unacceptable interference with navigation;

(9) That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register of Historic Places, the permittee will notify the district

engineer. If the district engineer determines that such historic properties may be adversely affected, he will provide the Advisory Council on Historic Preservation an opportunity to comment on the effects on such historic properties or he will consider modification, suspension, or revocation in accordance with 33 CFR 325.7.

Furthermore, that, if the permittee before or during prosecution of the work authorized, encounters a historic property that has not been listed or determined eligible for listing on the National Register, but which may be eligible for listing in the National Register, he shall immediately notify the district engineer;

(10) That the construction or operation of the activity will not impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights;

(11) That in certain states, an individual state water quality certification must be obtained or waived (See § 330.9);

(12) That in certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (See § 330.10);

(13) That the activity will comply with regional conditions which may have been added by the division engineer (See § 330.8(a)); and

(14) That the management practices listed in § 330.6 of this part shall be followed to the maximum extent practicable.

(c) *Further information.* (1) District engineers are authorized to determine if an activity complies with the terms and conditions of a nationwide permit unless that decision must be made by the division engineer in accordance with § 330.7.

(2) Nationwide permits do not obviate the need to obtain other Federal, state or local authorizations required by law.

(3) Nationwide permits do not grant any property rights or exclusive privileges.

(4) Nationwide permits do not authorize any injury to the property or rights of others.

(5) Nationwide permits do not authorize interference with any existing or proposed Federal project.

(d) *Modification, Suspension or Revocation of Nationwide Permits.* The Chief of Engineers may modify, suspend, or revoke nationwide permits in accordance with the relevant procedures of 33 CFR 325.7. Such authority includes, but is not limited to: adding individual, regional, or nationwide conditions; revoking authorization for a category of activities

or a category of waters by requiring individual or regional permits; or revoking an authorization on a case-by-case basis. This authority is not limited to concerns for the aquatic environment as is the discretionary authority in § 330.8.

§ 330.6 Management practices.

(a) In addition to the conditions specified in § 330.5 of this Part, the following management practices shall be followed, to the maximum extent practicable, in order to minimize the adverse effects of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the district engineer to recommend, or the division engineer to take, discretionary authority to regulate the activity on an individual or regional basis pursuant to § 330.8 of this Part.

(1) Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

(2) Discharges in spawning areas during spawning seasons shall be avoided.

(3) Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

(4) If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

(5) Discharge in wetlands areas shall be avoided.

(6) Heavy equipment working in wetlands shall be placed on mats.

(7) Discharges into breeding areas for migratory waterfowl shall be avoided.

(8) All temporary fills shall be removed in their entirety.

§ 330.7 Notification procedures.

(a) The general permittee shall not begin discharges requiring pre-discharge notification pursuant to the nationwide permit at § 330.5(a)(26):

(1) Until notified by the district engineer that the work may proceed under the nationwide permit with any special conditions imposed by the district or division engineer; or

(2) If notified by the district or division engineer that an individual permit may be required; or

(3) Unless 20 days have passed from receipt of the notification by the district engineer and no notice has been

received from the district or division engineer.

(b) Notification pursuant to the nationwide permit at § 330.5(a)(26) must be in writing and include the information listed below. Notification is not an admission that the proposed work would result in more than minimal impacts to waters of the United States; it simply allows the district or division engineer to evaluate specific activities for compliance with general permit criteria.

(1) Name, address, and phone number of the general permittee;

(2) Location of the planned work;

(3) Brief description of the proposed work, its purpose, and the approximate size of the waters, including wetlands, which would be lost or substantially adversely modified as a result of the work; and

(4) Any specific information required by the nationwide permit and any other information that the permittee believes is appropriate.

(c) *District engineer review of notification.* Upon receipt of notification, the district engineer will promptly review the general permittee's notification to determine which of the following procedures should be followed:

(1) If the nationwide permit at § 330.5(a)(26) is involved and the district engineer determines either, (i) the proposed activity falls within a class of discharges or will occur in a category of waters which has been previously identified by the Regional Administrator, Environmental Protection Agency; the Regional Director, Fish and Wildlife Service; the Regional Director, National Marine Fisheries Service; or the heads of the appropriate state natural resource agencies as being of particular interest to those agencies; or (ii) the particular discharge has not been previously identified but he believes it may be of importance to those agencies, he will promptly forward the notification to the division engineer and the head and appropriate staff officials of those agencies to afford those agencies an adequate opportunity before such discharge occurs to consider such notification and express their views, if any, to the district engineer concerning whether individual permits should be required.

(2) If the nationwide permits at § 330.5(a) (7), (17), or (21) are involved and the Environmental Protection Agency, the Fish and Wildlife Service, the National Marine Fisheries Service or the appropriate state natural resource or water quality agencies forward concerns to the district engineer, he will forward those concerns to the division engineer

together with a statement of the factors pertinent to a determination of the environmental effects of the proposed discharges, including those set forth in the 404(b)(1) guidelines, and his views on the specific points raised by those agencies.

(3) If the nationwide permit at § 330.5(a)(21) is involved the district engineer will give notice to the Environmental Protection Agency and the appropriate state water quality agency. This notice will include as a minimum the information required by paragraph (b) of this section.

(d) *Division engineer review of notification.* The division engineer will review all notifications referred to him in accordance with paragraph (c)(1) or (c)(2) of this section. The division engineer will require an individual permit when he determines that an activity does not comply with the terms or conditions of a nationwide permit or does not meet the definition of a general permit (see 33 CFR 322.2(f) and 323.2(n)) including discharges under the nationwide permit at § 330.5(a)(26) which have more than minimal adverse environmental effects on the aquatic environment when viewed either cumulatively or separately. In reaching his decision, he will review factors pertinent to a determination of the environmental effects of the proposed discharge, including those set forth in the 404(b)(1) guidelines, and will give full consideration to the views, if any, of the federal and state natural resource agencies identified in paragraph (c) of this section. If the division engineer decides that an individual permit is not required, and a federal or appropriate state natural resource agency has indicated in writing that an activity may result in more than minimal adverse environmental impacts, he will prepare a written statement, available to the public on request, which sets forth his response to the specific points raised by the commenting agency. When the division engineer reaches his decision he will notify the district engineer, who will immediately notify the general permittee of the division engineer's decision.

§ 330.8 Discretionary authority.

Except as provided in paragraphs (c) (2) and (d) of this section, division engineers on their own initiative or upon recommendation of a district engineer are authorized to modify nationwide permits by adding regional conditions or to override nationwide permits by requiring individual permit applications on a case-by-case basis, for a category of activities, or in specific geographic areas. Discretionary authority will be

based on concerns for the aquatic environment as expressed in the guidelines published by EPA pursuant to section 404(b)(1). (40 CFR Part 230)

(a) *Activity Specific conditions.* Division engineers are authorized to modify nationwide permits by adding individual conditions on a case-by-case basis applicable to certain activities within their division. Activity specific conditions may be added by the District Engineer in instances where there is mutual agreement between the district engineer and the permittee. Furthermore, district engineers will condition NWP's with conditions which have been imposed on a state section 401 water quality certification issued pursuant to § 330.9 of this Part.

(b) *Regional conditions.* Division engineers are authorized to modify nationwide permits by adding conditions on a generic basis applicable to certain activities or specific geographic areas within their divisions. In developing regional conditions, division and district engineers will follow standard permit processing procedures as prescribed in 33 CFR Part 325 applying the evaluation criteria of 33 CFR Part 320 and appropriate parts of 33 CFR Parts 321, 322, 323, and 324. Division and district engineers will take appropriate measures to inform the public of the additional conditions.

(c) *Individual permits—(1) Case-by-Case.* In nationwide permit cases where additional individual or regional conditioning may not be sufficient to address concerns for the aquatic environment or where there is not sufficient time to develop such conditions under paragraphs (a) or (b) of this section, the division engineer may suspend use of the nationwide permit and require an individual permit application on a case-by-case basis. The district engineer will evaluate the application and will either issue or deny a permit. However, if at any time the reason for taking discretionary authority is satisfied, then the division engineer may remove the suspension, reactivating authority under the nationwide permit. Where time is of the essence, the district engineer may telephonically recommend that the division engineer assert discretionary authority to require an individual permit application for a specific activity. If the division engineer concurs, he may orally authorize the district engineer to implement that authority. Oral authorization should be followed by written confirmation.

(2) *Category.* Additionally, after notice and opportunity for public hearing, division engineers may decide that individual permit applications

should be required for categories of activities, or in specific geographic areas. However, only the Chief of Engineers may modify, suspend, or revoke nationwide permits on a statewide or nationwide basis. The division engineer will announce the decision to persons affected by the action. The district engineer will then regulate the activity or activities by processing an application(s) for an individual permit(s) pursuant to 33 CFR Part 325.

(d) For the nationwide permit found at § 330.5(a)(26), after the applicable provisions of § 330.7(a) (1) and (3) have been satisfied, the permittee's right to proceed under the general permit may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 325.7.

(e) A copy of all modifications or revocations of activities covered by nationwide permits will be forwarded to the Office of the Chief of Engineers, ATTN: DAEN-CWO-N.

§ 330.9 State water quality certification.

(a) State water quality certification is required for nationwide permits which may result in any discharge into waters of the United States. If a state issues a water quality certification which includes special conditions, the district engineer will add these conditions as conditions of the nationwide permit in the state. However, if such conditions do not comply with the provisions of 33 CFR 325.4 or if a state denies a required 401 certification for a particular nationwide permit, authorization for all discharges covered by the nationwide permit within the state is denied without prejudice until the state issues an individual or generic water quality certification or waives its right to do so. A district engineer will not process an individual permit application for an activity for which authorization has been denied without prejudice under the nationwide permit program. However, if the division engineer determines that it would otherwise be appropriate to exercise his discretionary authority, pursuant to § 330.8, to override the nationwide permit or permits in question, he may do so, and the district engineer may proceed with the processing of individual permit applications. In instances where a state has denied the 401 water quality certification for discharges under a particular nationwide permit, applicants must furnish the district engineer with an individual or generic 401 certification or a copy of the application to the state for the certification. If a state fails to act within a reasonable period of time (see § 330.2(b)(1)(ii)), a waiver will be

presumed. Upon receipt of an individual or generic certification or a waiver of certification, the proposed work is authorized under the nationwide permit. If a state issues a conditioned individual certification, the district engineer will include those conditions that comply with 33 CFR 325.4 as special conditions of the nationwide permit (see 33 CFR Part 330.8(a)) and notify the applicant that the work is authorized under the nationwide permit provided all conditions are met.

(b) Certification requirements for nationwide permits fall into the following general categories:

(1) *No certification required.* Nationwide permits numbered 1, 2, 4, 5, 8, 9, 10, 11, and 19 do not involve activities which may result in a discharge and therefore 401 certification is not applicable.

(2) *Certification sometimes required.* Nationwide permits numbered 3, 6, 7, 13, 20, 21, 22, and 23 each involve various activities, some of which may result in a discharge and require certification, and others of which do not. State denial of certification for any specific nationwide permit in this category affects only those activities involving discharges. Those not involving discharges remain in effect.

(3) *Certification required.* Nationwide permits numbered 12, 14, 15, 16, 17, 18, 24, 25, and 26 involve activities which would result in discharges and therefore 401 certification is required.

(c) District engineers will take appropriate measures to inform the public of which waterbodies or regions within the state, and for which nationwide permits, an individual 401 water quality certification is required.

§ 330.10 Coastal zone management consistency determination.

In instances where a state has not concurred that a particular nationwide permit is consistent with an approved coastal zone management plan, authorization for all activities subject to such nationwide permit within or affecting the state coastal zone agency's area of authority is denied without prejudice until the applicant has furnished to the district engineer a coastal zone management consistency determination pursuant to section 307 of the Coastal Zone Management Act and the state has concurred in it. If a state does not act on an applicant's consistency statement within six months after receipt by the state, consistency shall be presumed. District engineers will take appropriate measures to inform the public of which waterbodies or regions within the state, and for which nationwide permits, such individual

consistency determination is required. District engineers will not process any permit application for an activity which has been denied without prejudice under the nationwide permit program. However, if the division engineer determines that it would otherwise be appropriate to exercise his discretionary authority, pursuant to § 330.8, to override the nationwide permit or permits in question, he may do so, and the district engineer may proceed with the processing of individual permit applications.

§ 330.11 Nationwide permit verification.

(a) General permittees may, and in some cases must, request from a district engineer confirmation that an activity complies with the terms and conditions of a nationwide permit. District engineers will respond promptly to such requests. The response will state that the verification is valid for a period of no more than two years or a lesser period of time if deemed appropriate. Section 330.12 takes precedence over this section, therefore, it is incumbent upon the permittee to remain informed of changes to nationwide permits.

(b) If the district engineer decides that an activity does not comply with the terms or conditions of a nationwide permit, he will so notify the person desiring to do the work and indicate that an individual permit is required (unless covered by a regional permit).

(c) If the district engineer decides that an activity does comply with the terms and conditions of a nationwide permit he will so notify the general permittee. In such cases, as with any activity which qualifies under a nationwide permit, the general permittee's right to proceed with the activities under the nationwide permit may be modified, suspended, or revoked only in accordance with the procedures of 33 CFR 325.7.

§ 330.12 Expiration of nationwide permits.

The Chief of Engineers will review nationwide permits on a continual basis, and will decide to either modify, reissue (extend) or revoke the permits at least every five years. If a nationwide permit is not modified or reissued within five years of publication in the Federal Register, it automatically expires and becomes null and void. Authorization of activities which have commenced or are under contract to commence in reliance upon a nationwide permit will remain in effect provided the activity is completed within twelve months of the date a nationwide permit has expired or was revoked unless discretionary permit authority has been exercised in

accordance with § 330.8 of this Part or modification, suspension, or revocation procedures are initiated in accordance with the relevant provisions of 33 CFR 325.7. Activities completed under the authorization of a nationwide permit which was in effect at the time the activity was completed continue to be authorized by that nationwide permit.

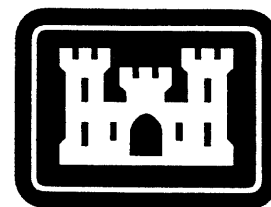
[FR Doc. 86-25301 Filed 11-12-86; 8:45 am]

BILLING CODE 5710-02-M

United States Army Corps of Engineers

Regulatory Program

Applicant Information

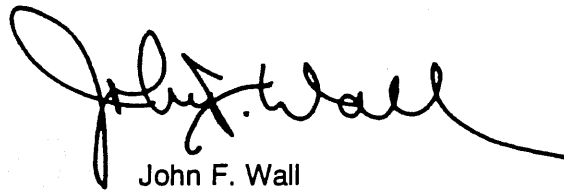


This Pamphlet Supersedes EP 1145-2-1, November 1977

INTRODUCTION

This pamphlet is designed to assist you in applying for a Department of the Army permit from the Corps of Engineers. The pamphlet is not intended to be a complete description of all aspects of the permit program, but will provide general information of a non-technical nature and specific guidance on how to complete a permit application. Full explanation of the program may be found in Title 33 Code of Federal Regula-

tions, Parts 320 through 330. These regulations are available for review at the Corps of Engineers District offices listed at the back of this pamphlet. Answers to technical questions and detailed information about special aspects of the program that pertain to your geographical area and your proposed activity may also be obtained from Corps of Engineers District offices.

A handwritten signature in black ink, appearing to read "John F. Wall". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

John F. Wall
Major General, USA
Director of Civil Works

CONTENTS

	Page
General Information	2
Authority for the Regulatory Program	2
Explanation of Some Commonly Used Terms	3
Questions That Are Frequently Asked	4
The Permit Application	6
General	6
Typical Processing Procedure for a Standard Individual Permit	7
Evaluation Factors	8
Forms and Permits	9
Instructions for Preparing an Application	10
Sample Application	12
Drawings	14
General Information	14
Vicinity Map	14
Plan View	14
Elevation and/or Cross Section View	15
Notes on Drawings	15
Sample Drawings	16
Divisions and Districts for Regulatory Activities (Map)	18
Locations of Regulatory Offices	20

2

Authority for the Regulatory Program

The U.S. Army Corps of Engineers has been regulating activities in the nation's waters since 1890. Until the 1960's the primary purpose of the regulatory program was to protect navigation. Since then, as a result of laws and court decisions, the program has been broadened so that it now considers the full public interest for both the protection and utilization of water resources.

The regulatory authorities and responsibilities of the Corps of Engineers are based on the following laws:

- ☐ **Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403)** prohibits the obstruction or alteration of navigable waters of the United States without a permit from the Corps of Engineers.
- ☐ **Section 404 of the Clean Water Act (33 U.S.C. 1344).** Section 301 of this Act prohibits the discharge of dredged or fill material into waters of the United States without a permit from the Corps of Engineers.

- ☐ **Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 U.S.C. 1413)** authorizes the Corps of Engineers to issue permits for the transportation of dredged material for the purpose of dumping it into ocean waters.

Other laws may also affect the processing of applications for Corps of Engineers permits. Among these are the National Environmental Policy Act, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act, the Endangered Species Act, the National Historic Preservation Act, the Deepwater Port Act, the Federal Power Act, the Marine Mammal Protection Act, the Wild and Scenic Rivers Act, and the National Fishing Enhancement Act of 1984.

Explanation of Some Commonly Used Terms

Certain terms which are closely associated with the regulatory program are explained briefly in this section. If you need more detailed definitions, refer to the Code of Federal Regulations (33 CFR Parts 320 through 330) or contact a Corps district regulatory office.

Activity(ies) as used in this pamphlet includes structures (for example a pier, wharf, bulkhead, or jetty) and work (which includes dredging, disposal of dredged material, filling, excavation or other modification of a navigable water of the United States).

Navigable Waters of the United States are those waters of the United States that are subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past or may be susceptible to use to transport interstate or foreign commerce. These are waters that are navigable in the traditional sense where permits are required for certain activities pursuant to Section 10 of the Rivers and Harbors Act. This term should not be confused with the term *waters of the United States* below.

Waters of the United States is a broader term than navigable waters of the United States defined above. Included are adjacent wetlands and tributaries to navigable waters of the United States and other waters where the degradation or destruction of which could affect interstate or foreign commerce. These are the waters where permits are required for the discharge of dredged or fill material pursuant to Section 404 of the Clean Water Act.

Pre-application Consultation is one or more meetings between members of the district engineer's staff and an applicant and his agent or his consultant. A pre-application consultation is usually related to applications

for major activities and may involve discussion of alternatives, environmental documents, National Environmental Policy Act procedures, and development of the scope of the data required when an environmental impact statement is required.

Public Hearings may be held to acquire information and give the public the opportunity to present views and opinions. The Corps may hold a hearing or participate in joint public hearings with other Federal or state agencies. The district engineer may specify in the public notice that a hearing will be held. In addition, any person may request in writing during the comment period that a hearing be held. Specific reasons must be given as to the need for a hearing. The district engineer may attempt to resolve the issue informally or he may set the date for a public hearing. Hearings are held at times and places that are convenient for the interested public. Very few applications involve a public hearing.

The Public Interest Review is the term which refers to the evaluation of a proposed activity to determine probable impacts. Expected benefits are balanced against reasonably foreseeable detriments. All relevant factors are weighed. Corps policy is to provide applicants with a timely and carefully weighed decision which reflects the public interest.

Public Notice is the primary method of advising interested public agencies and private parties of the proposed activity and of soliciting comments and information necessary to evaluate the probable impact on the public interest. Upon request, anyone's name will be added to the distribution list to receive public notices.

Waterbody is a river, creek, stream, lake, pool, bay, wetland, marsh, swamp, tidal flat, ocean, or other water area.

Questions That Are Frequently Asked

Various questions are often asked about the regulatory program. It is hoped that these answers will help you to understand the program better.

Q. When should I apply for a Corps permit?

A. Since two to three months is normally required to process a routine application involving a public notice, you should apply as early as possible to be sure you have all required approvals before your planned commencement date. For a large or complex activity that may take longer, it is often helpful to have a "pre-application consultation" or informal meeting with the Corps during the early planning phase of your project. You may receive helpful information at this point which could prevent delays later. When in doubt as to whether a permit may be required or what you need to do, don't hesitate to call a district regulatory office.

Q. I have obtained permits from local and state governments. Why do I have to get a permit from the Corps of Engineers?

A. It is possible you may not have to obtain an individual permit, depending on the type or location of work. The Corps has many general permits which authorize minor activities without the need for individual processing. Check with your Corps district regulatory office for information on general permits. When a general permit does not apply, you may still be required to obtain an individual permit.

Q. What will happen if I do work without getting a permit from the Corps?

A. Performing unauthorized work in waters of the United States or failure to comply with terms of a valid permit can have

serious consequences. You would be in violation of Federal law and could face stiff penalties, including fines and /or requirements to restore the area.

Enforcement is an important part of the Corps regulatory program. Corps surveillance and monitoring activities are often aided by various agencies, groups, and individuals, who report suspected violations. When in doubt as to whether a planned activity needs a permit, contact the nearest district regulatory office. It could save a lot of unnecessary trouble later.

Q. How can I obtain further information about permit requirements?

A. Information about the regulatory program is available from any Corps district regulatory office. Addresses and telephone numbers of offices are listed at the back of this pamphlet. Information may also be obtained from the water resource agency in your state.

Q. Why should I waste my time and yours by applying for a permit when you probably won't let me do the work anyway?

A. Nationwide, only three percent of all requests for permits are denied. Those few applicants who have been denied permits usually have refused to change the design, timing, or location of the proposed activity. When a permit is denied, an applicant may redesign the project and submit a new application. To avoid unnecessary delays pre-application conferences, particularly for applications for major activities, are recommended. The Corps will endeavor to give you helpful information, including factors which will be considered during the public interest review, and alternatives to consider that may prove to be useful in designing a project.

Q. What is a wetland and what is its value?

A. Wetlands are areas that are periodically or permanently inundated by surface or ground water and support vegetation adapted for life in saturated soil. Wetlands include swamps, marshes, bogs and similar areas. A significant natural resource, wetlands serve important functions relating to fish and wildlife; food chain production; habitat; nesting; spawning; rearing and resting sites for aquatic and land species; protection of other areas from wave action and erosion; storage areas for storm and flood waters; natural recharge areas where ground and surface water are interconnected; and natural water filtration and purification functions.

Although individual alterations of wetlands may constitute a minor change, the cumulative effect of numerous changes often results in major damage to wetland resources. The review of applications for alteration of wetlands will include consideration of whether the proposed activity is dependent upon being located in an aquatic environment.

Q. How can I design my project to eliminate the need for a Corps permit?

A. If your activity is located in an area of tidal waters, the best way to avoid the need for a permit is to select a site that is above the high tide line and avoids wetlands or other waterbodies. In the vicinity of fresh water, stay above ordinary high water and avoid wetlands adjacent to the stream or lake. Also, it is possible that your activity is exempt and does not need a Corps permit or that it has been authorized by a nationwide or regional general permit. So, before you build, dredge or fill, contact the Corps district regulatory office in your area for specific information about location, exemptions, and regional and nationwide general permits.

6

General

The application form used to apply for a permit is Engineer Form 4345, *Application for a Department of the Army Permit*. You can obtain the application from one of the Corps of Engineers district regulatory offices listed in the back of this pamphlet. Some offices may use a slightly modified form for joint processing with a state agency; however, the required information is basically the same. It is important that you provide complete information in the requested format. If incomplete information is provided, processing of your application will be delayed. This information will be used to determine the appropriate form of authorization, and to evaluate your proposal. Some categories of activities have been previously authorized by nationwide or regional permits, and no further Corps approvals are required. Others may qualify for abbreviated permit processing, with authorizations in the form of letters of permission, in which a permit decision can usually be reached in less than 30 days. For other activities, a Public Notice may be required to notify Federal, state, and local agencies, adjacent property owners, and the general public of the proposal to allow an opportunity for review and comment or to request a public hearing. Most applications involving Public Notices are completed within four months and many are completed within 60 days.

The district engineer will begin to process your application immediately upon receipt of all required information. You will be sent an acknowledgement of its receipt and the application number assigned to your file. You should refer to this number when inquiring about your application. Your proposal will be reviewed, balancing the need and expected benefits against the probable impacts of the work, taking into consideration all comments received and other relevant factors. This process is called the *public interest review*. The Corps goal is to reach a decision regarding permit issuance or denial within 60 days of receipt of a complete application. However, some complex activities, issues, or requirements of law may prevent the district engineer from meeting this goal.

For any specific information on the evaluation process, filling out the application forms, or the status of your application, you should contact the regulatory branch of the Corps of Engineers district office which has jurisdiction over the area where you plan to do the work.

7

Typical Processing Procedure for a Standard Individual Permit

1. Preapplication consultation (optional)
2. Applicant submits ENG Form 4345 to district regulatory office*
3. Application received and assigned identification number
4. Public notice issued (within 15 days of receiving all information)
5. 15 to 30 day comment period depending upon nature of activity
6. Proposal is reviewed** by Corps and:
 - Public
 - Special interest groups
 - Local agencies
 - State agencies
 - Federal agencies
7. Corps considers all comments
8. Other federal agencies consulted, if appropriate
9. District engineer may ask applicant to provide additional information
10. Public hearing held, if needed
11. District engineer makes decision
12. Permit issued
 - or
 - Permit denied and applicant advised of reason

*A local variation, often a joint federal-state application form may be submitted.

**Review period may be extended if applicant fails to submit information or due to requirements of certain laws.

Evaluation Factors

The decision whether to grant or deny a permit is based on a public interest review of the probable impact of the proposed activity and its intended use. Benefits and detriments are balanced by considering effects on items such as:

- conservation
- economics
- aesthetics
- general environmental concerns
- wetlands
- cultural values
- fish and wildlife values
- flood hazards
- floodplain values
- food and fiber production
- navigation
- shore erosion and accretion
- recreation
- water supply and conservation
- water quality
- energy needs
- safety
- needs and welfare of the people
- considerations of private ownership

The following general criteria will be considered in the evaluation of every application:

- ☐ the relative extent of the public and private need for the proposed activity;
- ☐ the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed activity; and
- ☐ the extent and permanence of the beneficial and/or detrimental effects which the proposed activity is likely to have on the public and private uses to which the area is suited.

Section 404(b) (1) of the Clean Water Act

If your project involves the discharge of dredged or fill material, it will be necessary for the Corps to evaluate your proposed activity under the Section 404(b)(1) guidelines prepared by the Environmental Protection Agency. The guidelines restrict discharges into aquatic areas where less environmentally damaging, practicable alternatives exist.

Forms and Permits

The following forms apply to the permit process:

Application

The form that you will need to initiate the review process is ENG Form 4345 or a joint Federal-state application that may be available in your state. The appropriate form may be obtained from the district regulatory office which has jurisdiction in the area where your proposed project is located.

Individual Permits

An individual permit may be issued as either ENG Form 1721, the standard permit, or as a Letter of Permission.

- ☐ A standard permit is one processed through the typical review procedures, (see page 7) which include public notice, opportunity for a public hearing, and receipt of comments. It is issued following a case-by-case evaluation of a specific activity.
- ☐ If work is minor or routine with minimum impacts and objections are unlikely, then it may qualify for a Letter of Permission (LOP). An LOP can be issued much more quickly than a standard permit since an individual public notice is not required. The District Engineer will notify you if your proposed activity qualifies for an LOP.

General Permits

In many cases the formal processing of a permit application is not required because of general permits already issued to the public at large by the Corps of Engineers. These are issued on a regional and nationwide basis.

Separate applications may not be required for activities authorized by a general permit; nevertheless, reporting may be required. For specific information on general permits, contact a district regulatory office.

ENG Form 4336

The third form, ENG Form 4336, is used to assist with surveillance for unauthorized activities. The form, which contains a description of authorized work, should be posted at the site of an authorized activity. If the Corps decides it is appropriate for you to post this form, it will be furnished to you when you receive your permit.

Fees. Fees are required for most permits. \$10.00 will be charged for a permit for a non-commercial activity; \$100.00 will be charged for a permit for a commercial or industrial activity. The district engineer will make the final decision as to the amount of the fee. Do not send a fee when you submit an application. When the Corps issues a permit, you will be notified and asked to submit the required fee payable to the Treasurer of the United States. No fees are charged for transferring a permit from one property owner to another, for Letters of Permission, or for any activities authorized by a general permit or for permits to governmental agencies.

Instructions for Preparing an Application

The instructions given below, together with the sample application and drawings, should help in completing the required application form. If you have additional questions, do not hesitate to contact the district regulatory office.

Block Number 1. Application Number.

Leave this block blank. When your completed application is received, it will be assigned a number for identification. You will be notified of the number in an acknowledgement letter. Please refer to this number in any correspondence or inquiry concerning your application.

Block 2. Name and address of

applicant(s). Fill in name, mailing address, and telephone number(s) for all applicants. The telephone number(s) should be a number where you can be reached during business hours. If space is needed for additional names, attach a sheet of white, 8½ × 11 inch paper labeled "Block 2 Continued."

Block 3. Name, address and title of authorized agent. It is not necessary to have an agent represent you; however, if you do, fill in the agent's name, address, title and telephone number(s). If your agent is submitting and signing the application, you must fill out and sign the Statement of Authorization in Block 3.

Block 4. Detailed description of proposed activity. The written description and the drawings are the most important parts of the application. If there is not enough space in Block 4, (a), (b) or (c) attach additional sheet(s) of white, 8½ × 11 inch paper labeled "Block 4 Continued."

- a. **Activity.** Describe the overall activity. Give the approximate dimensions of structures, fills, excavations (lengths, widths, heights or depths).

- b. **Purpose.** Describe the purpose, need and intended use (public, private, commercial, or other use) of the proposed activity. Include a description of related facilities, if any, to be constructed on adjacent land. Give the date you plan to begin work on the activity and the date work is expected to be completed.

- c. **Discharge of Dredged or Fill Material.** If the activity will involve the discharge of dredged or fill material, describe the type (rock, sand, dirt, rubble, etc.), quantity (in cubic yards), and mode of transportation to the discharge site.

Block 5. Names and addresses of adjoining property owners, lessees, etc. whose property adjoins the waterbody. List complete names, addresses and zip codes of adjacent property owners (both public and private), lessee, etc., whose property also adjoins the waterbody or wetland, in order that they may be notified of the proposed activity. This information is usually available at the local tax assessor office. If more space is needed attach a sheet of white, 8½ × 11 inch paper labeled "Block 5 Continued."

Block 6. Waterbody and location on waterbody where activity exists or is proposed. Fill in the name of the waterbody and the river mile (if known) at the location of the activity. Include easily recognizable landmarks on the shore of the waterbody to aid in locating the site of the activity.

Block 7. Location and land where activity exists or is proposed. This information is used to locate the site. Give the street address of the property where the proposed activity will take place. If the site does not have a street address, give the best descriptive location (name or waterbody), names and/or numbers of roads or highways, name of nearest community or town, name of county and state, and directions, such as 2 miles east of Brown's Store on Route 105.

Do not use your home address unless that is the location of the proposed activity. Do not use a post office box number.

Block 8. Information about completed activity. Provide information about parts of the activity which may be complete. An activity may have been authorized by a previously issued permit, may exist from a time before a Corps permit was required or may be constructed on adjacent upland.

Block 9. Information about approvals or denials by other government agencies. You may need approval or certification from other Federal, interstate, state, or local government agencies for the activity described

in your application. Applications you have submitted, and approvals, certifications, or disapprovals that you have received should be recorded in Block 9. It is not necessary to obtain other Federal, state, and local permits before applying for a Corps of Engineers permit.

Block 10. Signature of applicant or agent. The application must be signed in Block 10 by the owner, lessee, or a duly authorized agent. The person named in Block 3 will be accepted as the officially designated agent of the applicant. The signature will be understood to be affirmation that the applicant possesses the requisite property interest to undertake the proposed activity.

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

(33 CFR 325)

OMB APPROVAL NO. 0702-0036
Expires 30 June 1986

The Department of the Army permit program is authorized by Section 10 of the River and Harbor Act of 1899, Section 404 of the Clean Water Act and Section 103 of the Marine, Protection, Research and Sanctuaries Act. These laws require permits authorizing activities in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Information provided on this form will be used in evaluating the application for a permit. Information in this application is made a matter of public record through issuance of a public notice. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the permit application. If necessary information is not provided, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (*see sample drawings and instructions*) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

1. APPLICATION NUMBER (To be assigned by Corps)

3. NAME, ADDRESS, AND TITLE OF AUTHORIZED AGENT

None

2. NAME AND ADDRESS OF APPLICANT

Fred R. Harris
852 West Branch Road
Blue Harbor, Maryland 21705

Telephone no. during business hours

A/C () (Residence)

A/C () (Office)

Telephone no. during business hours

A/C (301) 585-2779 (Residence)

A/C () (Office)

Statement of Authorization: I hereby designate and authorize

to act in my behalf as my

agent in the processing of this permit application and to furnish, upon request, supplemental information in support of the application.

SIGNATURE OF APPLICANT

DATE

4. DETAILED DESCRIPTION OF PROPOSED ACTIVITY

4a. ACTIVITY

Build timber bulkhead and pier and fill.

4b. PURPOSE

To provide boat access and prevent erosion of shoreline at my place of residence.

4c. DISCHARGE OF DREDGED OR FILL MATERIAL

Approximately 200 cubic yards of upland fill will be placed between new bulkhead and existing shoreline.

5. NAMES AND ADDRESSES OF ADJOINING PROPERTY OWNERS, LESSEES, ETC., WHOSE PROPERTY ALSO ADJOINS THE WATERWAY

Mary L. Clark
850 West Branch Road
Blue Harbor, Maryland 21703
(301) 585-8830

Harry N. Hampton
854 West Branch Road
Blue Harbor, Maryland 21703
(301) 585-3676

6. WATERBODY AND LOCATION ON WATERBODY WHERE ACTIVITY EXISTS OR IS PROPOSED

West Branch of the Haven River on Blue Harbor.

7. LOCATION ON LAND WHERE ACTIVITY EXISTS OR IS PROPOSED

ADDRESS:

852 West Branch Road

STREET, ROAD, ROUTE OR OTHER DESCRIPTIVE LOCATION

King Edward, Maryland 21703
COUNTY STATE ZIP CODE

Town of Blue Harbor

LOCAL GOVERNING BODY WITH JURISDICTION OVER SITE

8. Is any portion of the activity for which authorization is sought now complete? ☐ YES ☒ NO
If answer is "Yes" give reasons, month and year the activity was completed. Indicate the existing work on the drawings.

9. List all approvals or certifications and denials received from other federal, interstate, state or local agencies for any structures, construction, discharges or other activities described in this application.

ISSUING AGENCY	TYPE APPROVAL	IDENTIFICATION NO.	DATE OF APPLICATION	DATE OF APPROVAL	DATE OF DENIAL
Town of Blue Harbor	Zoning	BH25172	6/20/82	6/30/82	
Md DNR	Certification	DNR258WQ	6/11/82	8/12/82	

10. Application is hereby made for a permit or permits to authorize the activities described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities or I am acting as the duly authorized agent of the applicant.

[Signature]
SIGNATURE OF APPLICANT

Oct. 15, 1982
DATE

SIGNATURE OF AGENT

DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in Block 3 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of The United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.

Do not send a permit processing fee with this application. The appropriate fee will be assessed when a permit is issued.

General Information

Three types of drawings—Vicinity, Plan, and Elevation—are required to accurately depict activities (See sample drawings on pages 16 and 17).

Submit one original, or good quality copy, of all drawings on 8½ × 11 inch white paper (tracing cloth or film may be used). Submit the fewest number of sheets necessary to adequately show the proposed activity. Drawings should be prepared in accordance with the general format of the samples, using block style lettering. Each page should have a title block. See check list below. Drawings do not have to be prepared by an engineer, but professional assistance may become necessary if the project is large or complex.

Leave a 1-inch margin at the top edge of each sheet for purposes of reproduction and binding.

In the title block of each sheet of drawings identify the proposed activity and include the name of the body of water; river mile (if applicable); name of county and state; name of applicant; number of the sheet and total number of sheets in set; and date the drawing was prepared.

Since drawings must be reproduced, use heavy dark lines. Color shading cannot be used; however, dot shading, hatching, or similar graphic symbols may be used to clarify line drawings.

Vicinity Map

The vicinity map you provide will be printed in any public notice that is issued and used by the Corps of Engineers and other reviewing agencies to locate the site of the proposed activity. You may use an existing road map or U.S. Geological Survey topographic map (scale 1:24,000) as the vicinity map. Please include sufficient details

to simplify locating the site from both the waterbody and from land. Identify the source of the map or chart from which the vicinity map was taken and, if not already shown, add the following:

- ☐ location of activity site (draw an arrow showing the exact location of the site on the map).
- ☐ latitude, longitude, river mile, if known, and/or other information that coincides with Block 6 on the application form.
- ☐ name of waterbody and the name of the larger creek, river, bay, etc., that the waterbody is immediately tributary to.
- ☐ names, descriptions and location of landmarks.
- ☐ name of all applicable political (county, parish, borough, town, city, etc.) jurisdictions.
- ☐ name of and distance to nearest town, community, or other identifying locations.
- ☐ names or numbers of all roads in the vicinity of the site.
- ☐ north arrow.
- ☐ scale.

Plan View

The plan view shows the proposed activity as if you were looking straight down on it from above. Your plan view should clearly show the following:

- ☐ Name of waterbody (river, creek, lake, wetland, etc.) and river mile (if known) at location of activity.
- ☐ Existing shorelines.
- ☐ Mean high and mean low water lines and maximum (spring) high tide line in tidal areas.
- ☐ Ordinary high water line and ordinary low water line if the proposed activity is located on a non-tidal waterbody.

- ☐ Average water depths around the activity.
- ☐ Dimensions of the activity and distance it extends from the high water line into the water.
- ☐ Distances to nearby Federal projects, if applicable.
- ☐ Distance between proposed activity and navigation channel, where applicable.
- ☐ Location of structures, if any, in navigable waters immediately adjacent to the proposed activity.
- ☐ Location of any wetlands (marshes, swamps, tidal flats, etc.)
- ☐ North arrow.
- ☐ Scale.
- ☐ If dredged material is involved, you must describe the type of material, number of cubic yards, method of handling, and the location of fill and spoil disposal area. The drawing should show proposed retention levees, weirs, and/or other means for retaining hydraulically placed materials.
- ☐ Mark the drawing to indicate previously completed portions of the activity.
- ☐ Water depth at waterward face of proposed activity or, if dredging is proposed, dredging and estimated disposal grades.
- ☐ Dimensions from mean high water line (in tidal waters) for proposed fill or float, or high tide line for pile supported platform. Describe any structures to be built on the platform.
- ☐ Cross section of excavation or fill, including approximate side slopes.
- ☐ Graphic or numerical scale.
- ☐ Principal dimensions of the activity.

Notes on Drawings*

- ☐ Names of adjacent property owners who may be affected. Complete names and addresses should be shown in Block 5 on ENG Form 4345.
- ☐ Legal property description: Number, name of subdivision, block and lot number. Section, Township and Range (if applicable) from plot, deed or tax assessment.
- ☐ Photographs of the site of the proposed activity are not required; however, pictures are helpful and may be submitted as part of any application.

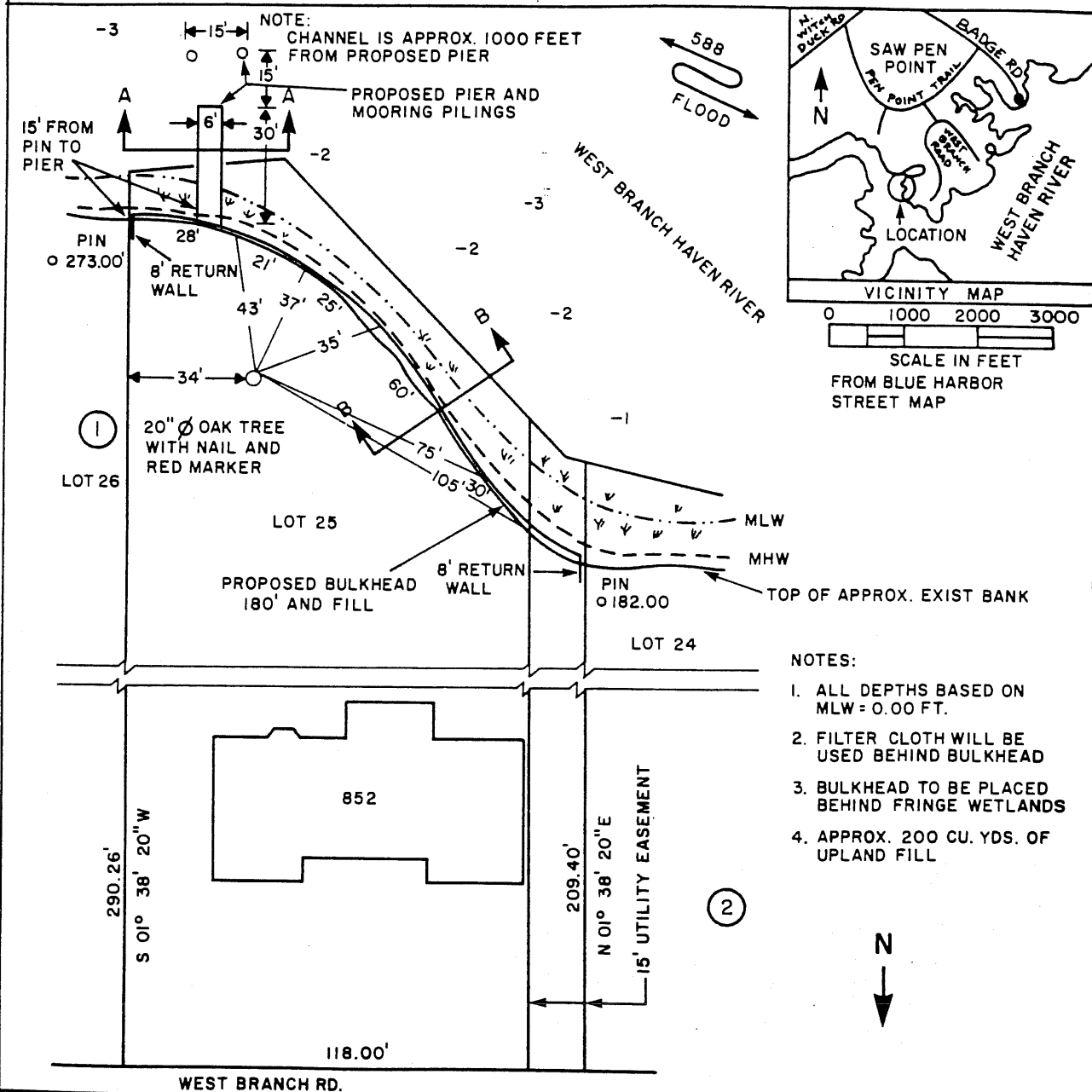
Elevation and/or Cross Section View

The elevation and/or cross section view is a scale drawing that shows the side, front, or rear of the proposed activity. If a section view is shown, it represents the proposed structure as it would appear if cut internally for display. Your elevation should clearly show the following:

- ☐ Water elevations as shown in the plan view.

*Drawings should be as clear and simple as possible (i.e., not too "busy").

NOTE: THE DRAWINGS SUBMITTED NEED NOT BE PREPARED BY A PROFESSIONAL DRAFTSMAN AS IN THESE SAMPLES.



- NOTES:**
- 1. ALL DEPTHS BASED ON
MLW = 0.00 FT.**
 - 2. FILTER CLOTH WILL BE
USED BEHIND BULKHEAD**
 - 3. BULKHEAD TO BE PLACED
BEHIND FRINGE WETLANDS**
 - 4. APPROX. 200 CU. YDS. OF
UPLAND FILL**

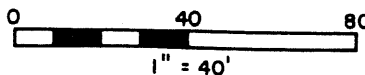
**PURPOSE: PREVENT EROSION AND
PROVIDE BOATING
ACCESS**

DATUM: MLW

ADJACENT PROPERTY OWNERS:

1. MARY L. CLARK
2. HARRY N. HAMPTON
- 3.

PLAN VIEW

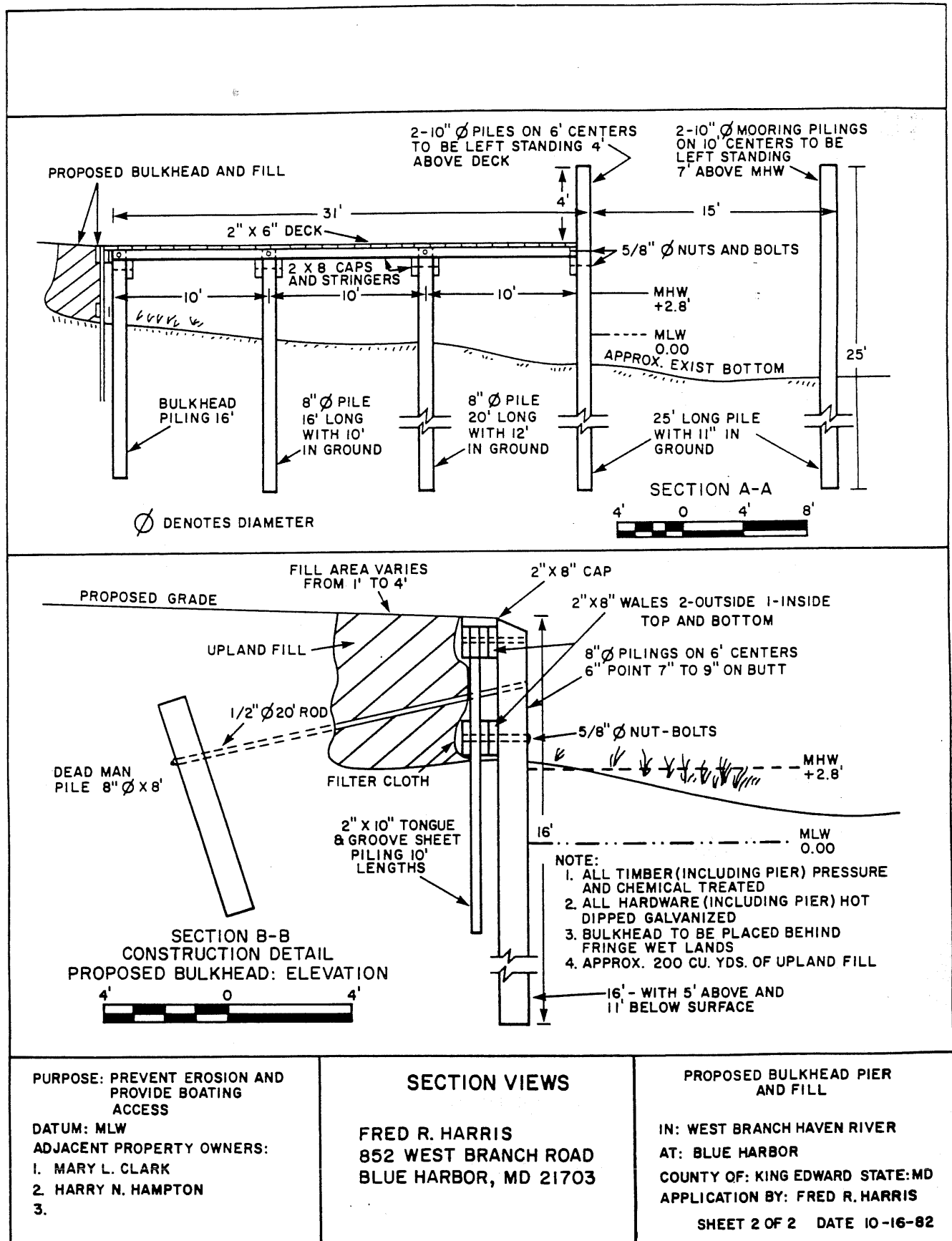


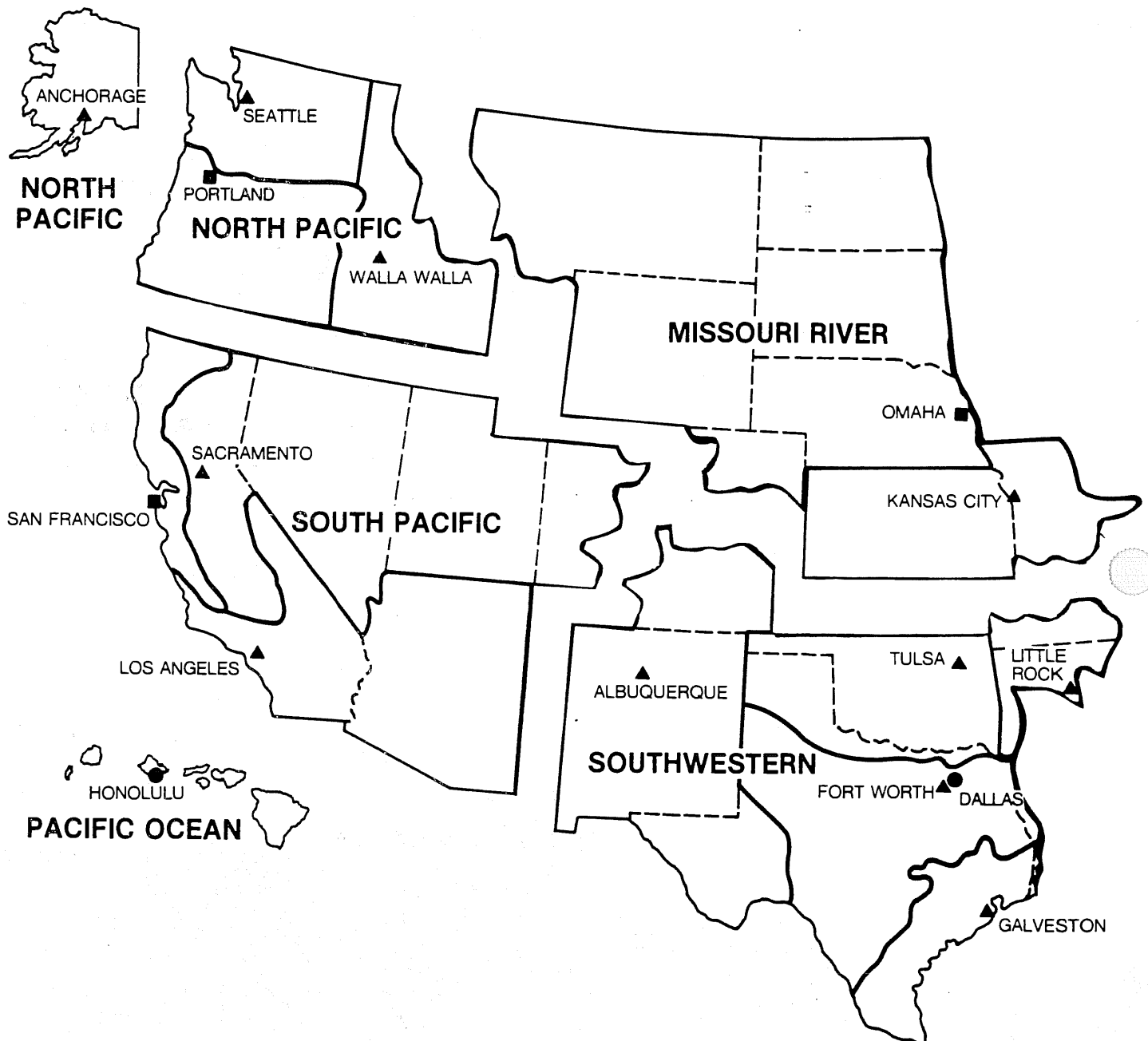
FRED R. HARRIS
852 WEST BRANCH ROAD
BLUE HARBOR, MD 21703

PROPOSED BULKHEAD PIER AND FILL

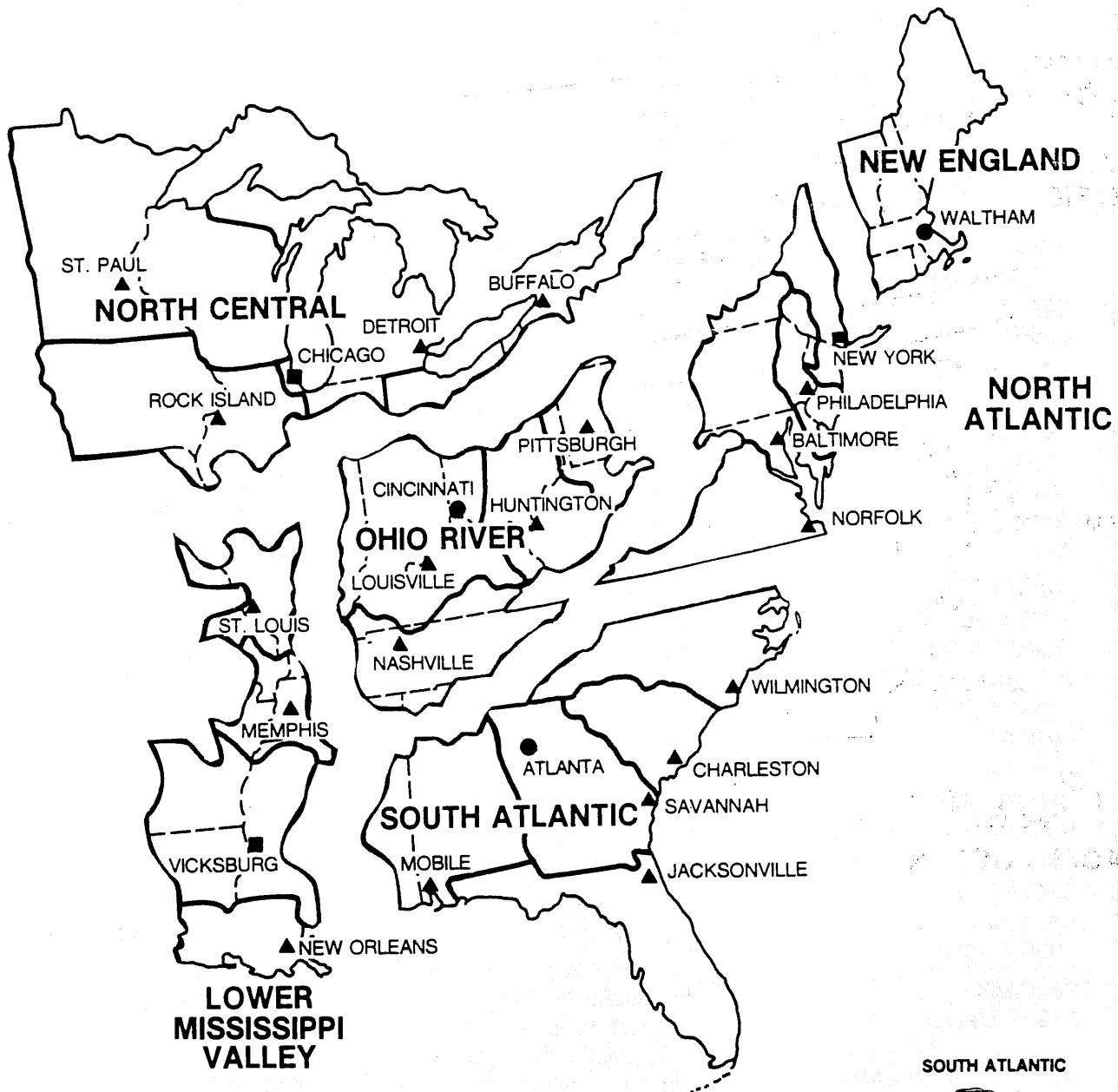
IN: WEST BRANCH HAVEN RIVER
AT: BLUE HARBOR
COUNTY OF: KING EDWARD STATE: MD
APPLICATION BY: FRED R. HARRIS

SHEET 1 OF 2 DATE 10-16-82





- DIVISION AND DISTRICT HEADQUARTERS
- DIVISION HEADQUARTERS
- ▲ DISTRICT HEADQUARTERS
- STATE BOUNDARIES
- DISTRICT BOUNDARIES



Note: In Iowa the eastern bank of the Missouri River is regulated by the Omaha office.

LOCATIONS OF REGULATORY OFFICES

20

Address correspondence to:

**The District Engineer
U.S. Army Engineer
District**

Please include attention
line in address.

ALASKA

P.O. Box 898
Anchorage, AK
99506-0898
Attention: NPACO-RF
907/753-2712

ALBUQUERQUE

P.O. Box 1580
Albuquerque, NM
87103-1580
Attention: SWACO-OR
505/766-2776

BALTIMORE

P.O. Box 1715
Baltimore, MD 21203-1715
Attention: NABOP-R
301/962-3670

*Joint application with
New York, Maryland*

BUFFALO

1776 Niagara Street
Buffalo, NY 14207-3199
Attention: NCBCO-S
716/876-5454 x2313

*Joint application with
New York*

CHARLESTON

P.O. Box 919
Charleston, SC
29402-0919
Attention: SACCO-P
803/724-4330

CHICAGO

219 S. Dearborn Street
Chicago, IL 60604-1797
Attention: NCCCO-R
312/353-6428

*Joint application with
Illinois*

DETROIT

P.O. Box 1027
Detroit, MI 48231-1027
Attention: NCECO-L
313/226-2218

*Joint application with
Michigan*

FT. WORTH

P.O. Box 17300
Ft. Worth, TX 76102-0300
Attention: SWFOD-O
817/334-2681

GALVESTON

P.O. Box 1229
Galveston, TX 77553-1229
Attention: SWGCO-R
409/766-3925

HUNTINGTON

502 8th Street
Huntington, WV 25701-2070
Attention: ORHOP-F
304/529-5487

*Joint application with
West Virginia*

HONOLULU

Building 230, Fort Shafter
Honolulu, HI 96858-5440
Attention: PODCO-O
808/438-9258

JACKSONVILLE

P.O. Box 4970
Jacksonville, FL 32232-0019
Attention: SAJRD
904/791-1659

*Joint application with
Florida, Virgin Islands*

KANSAS CITY

700 Federal Building
601 E. 12th Street
Kansas City, MO 64106-2896
Attention: MRKOD-P
816/374-3645

LITTLE ROCK

P.O. Box 867
Little Rock, AR
72203-0867
Attention: SWLCO-P
501/378-5295

LOS ANGELES

P.O. Box 2711
Los Angeles, CA 90053-2325
Attention: SPLCO-R
213/688-5606

LOUISVILLE

P.O. Box 59
Louisville, KY 40201-0059
Attention: ORLOP-F
502/582-5452

*Joint application with
Illinois*

MEMPHIS

Clifford Davis Federal
Building
Room B-202
Memphis, TN 38103-1894
Attention: LMMCO-G
901/521-3471

*Joint application with
Missouri, Tennessee,
Kentucky*

MOBILE

P.O. Box 2288
Mobile, AL 36628-00001
Attention: SAMOP-S
205/690-2658

*Joint application with
Mississippi*

NASHVILLE

P.O. Box 1070
Nashville, TN 37202-1070
Attention: ORNOR-F
615/251-5181

*Joint application with TVA,
Tennessee, Alabama*

NEW ORLEANS

P.O. Box 60267
New Orleans, LA
70160-0267
Attention: LMNOD-S
504/838-2255

NEW YORK

26 Federal Plaza
New York, NY 10278-0090
Attention: NANOP-R
212/264-3996

NORFOLK

803 Front Street
Norfolk, VA 23510-1096
Attention: NAOOP-P
804/446-3652
*Joint application with
Virginia*

OMAHA

P.O. Box 5
Omaha, NE 68101-0005
Attention: MROOP-N
402/221-4133

PHILADELPHIA

U.S. Custom House
2nd and Chestnut Street
Philadelphia, PA
19106-2991
Attention: NAPOP-R
215/597-2812

PITTSBURGH

Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222-4186
Attention: ORPOP-F
412/644-4204
*Joint application with
New York*

PORTLAND

P.O. Box 2946
Portland, OR 97208-2946
Attention: NPPND-RF
503/221-6995
*Joint application with
Oregon*

ROCK ISLAND

Clock Tower Building
Rock Island, IL 61201-2004
Attention: NCROD-S
309/788-6361 x6370
*Joint application with
Illinois*

SACRAMENTO

650 Capitol Mall
Sacramento, CA 95814-4794
Attention: SPKCO-O
916/440-2842

ST. LOUIS

210 Tucker Blvd., N
St. Louis, MO 63101-1986
Attention: LMSOD-F
314/263-5703
*Joint application with
Illinois, Missouri*

ST. PAUL

1135 USPO & Custom
House
St. Paul, MN 55101-1479
Attention: NCSCO-RF
612/725-5819

SAN FRANCISCO

211 Main Street
San Francisco, CA 94105-1905
Attention: SPNCO-R
415/974-0416

SAVANNAH

P.O. Box 889
Savannah, GA 31402-0889
Attention: SASOP-F
912/944-5347
*Joint application with
Georgia*

SEATTLE

P.O. Box C-3755
Seattle, WA 98124-2255
Attention: NPSOP-RF
206/764-3495
Joint application with Idaho

TULSA

P.O. Box 61
Tulsa, OK 74121-0061
Attention: SWTOD-RF
918/581-7261

VICKSBURG

P.O. Box 60
Vicksburg, MS 39180-0060
Attention: LMKOD-F
601/634-5276
*Joint application with
Mississippi*

WALLA WALLA

Building 602
City-County Airport
Walla Walla, WA
99362-9265
Attention: NPWOP-RF
509/522-6718
*Joint application with
Idaho*

WILMINGTON

P.O. Box 1890
Wilmington, NC
28402-1890
Attention: SAWCO-E
919/343-4511
*Joint application with North
Carolina*

**The Division Engineer
U.S. Army Engineer
Division**

NEW ENGLAND

424 Trapelo Road
Waltham, MA 02254-9149
Attention: NEDOD-R
617/647-8338
*Joint application with
Massachusetts, Maine*

