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Department of
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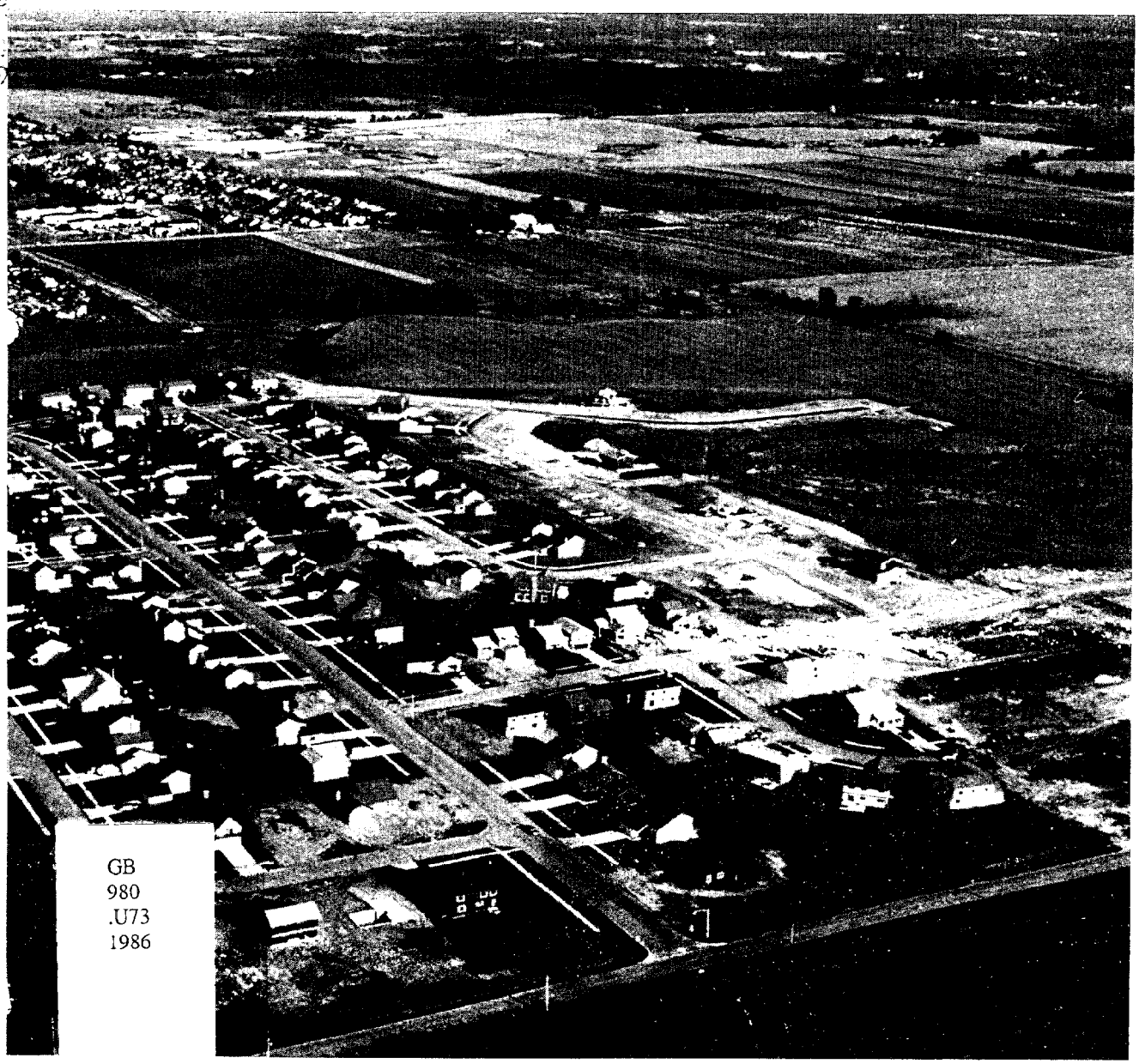
**Soil
Conservation
Service**

**Engineering
Division**

Technical
Release 55

June 1986

# Urban Hydrology for Small Watersheds



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# Preface

Technical Release 55 (TR-55) presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States. First issued by the Soil Conservation Service (SCS) in January 1975, TR-55 incorporates current SCS procedures. This revision includes results of recent research and other changes based on experience with use of the original edition.

The major revisions and additions are—

1. A flow chart for selecting the appropriate procedure;
2. Three additional rain distributions;
3. Expansion of the chapter on runoff curve numbers;
4. A procedure for calculating travel times of sheet flow;
5. Deletion of a chapter on peak discharges;
6. Modifications to the Graphical Peak Discharge method and Tabular Hydrograph method;
7. A new storage routing procedure;
8. Features of the TR-55 computer program; and
9. Worksheets.

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**Revised June 1986**

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## Metric conversions

The English system of units is used in this TR. To convert to the International System of units (metric), use the following factors:

| From English unit | To metric unit | Multiply by |
|---|---|---|
| Acre | Hectare | 0.405 |
| Square mile | Square kilometer | 2.59 |
| Cubic feet per second | Cubic meters per second | 0.0283 |
| Inch | Millimeter | 25.4 |
| Feet per second | Meters per second | 0.3048 |
| Acre-foot | Cubic meter | 1233.489 |
| Cubic foot | Cubic meter | 0.0283 |

Perform rounding operations as appropriate to indicate the same level of precision as that of the original measurement. For example:

1. A stream discharge is recorded in cubic feet per second with three significant digits.
2. Convert stream discharge to cubic meters per second by multiplying by 0.0283.
3. Round to enough significant digits so that, when converting back to cubic feet per second, you obtain the original value (step 1) with three significant digits.

## Definitions of symbols

| Symbol | Unit | Definition |
|---|---|---|
| $a$ | $ft^2$ | Cross sectional flow area |
| $A_m$ | $mi^2$ | Drainage area |
| CN | | Runoff curve number |
| $CN_c$ | | Composite runoff curve number |
| $CN_p$ | | Pervious runoff curve number |
| $E_{max}$ | | Maximum stage |
| $F_p$ | | Pond and swamp adjustment factor |
| $H_w$ | ft | Head over weir crest |
| $I_a$ | in | Initial abstraction |
| $L$ | ft | Flow length |
| $L_w$ | ft | Weir crest length |
| $m$ | | Number of flow segments |
| $n$ | | Manning's roughness coefficient |
| $P$ | in | Rainfall |
| $P_{imp}$ | | Percent imperviousness |
| $P_2$ | in | Two-year frequency, 24-hour rainfall |
| $p_w$ | ft | Wetted perimeter |
| $q$ | cfs | Hydrograph coordinate |
| $q_i$ | cfs | Peak inflow discharge |
| $q_o$ | cfs | Peak outflow discharge |
| $q_p$ | cfs | Peak discharge |
| $q_t$ | csm/in | Tabular hydrograph unit discharge |
| $q_u$ | csm/in | Unit peak discharge |
| $Q$ | in | Runoff |
| $r$ | ft | Hydraulic radius |
| $R$ | | Ratio of unconnected impervious area to total impervious area |
| $s$ | ft/ft | Slope of hydraulic grade line |
| $S$ | in | Potential maximum retention after runoff begins |
| $t$ | hr | Hydrograph time |
| $T_c$ | hr | Time of concentration |
| $T_p$ | hr | Time to peak |
| $T_t$ | hr | Travel time |
| $V$ | ft/s | Average velocity |
| $V_r$ | acre-ft, $ft^3$, or water-shed-inch | Runoff volume |
| $V_s$ | acre-ft, $ft^3$, or water-shed-inch | Storage volume |

# Chapter 1: Introduction

The conversion of rural land to urban land usually increases erosion and the discharge and volume of storm runoff in a watershed. It also causes other problems that affect soil and water. As part of programs established to alleviate these problems, engineers increasingly must assess the probable effects of urban development, as well as design and implement measures that will minimize its adverse effects.

Technical Release 55 (TR-55) presents simplified procedures for estimating runoff and peak discharges in small watersheds. In selecting the appropriate procedure, consider the scope and complexity of the problem, the available data, and the acceptable level of error. While this TR gives special emphasis to urban and urbanizing watersheds, the procedures apply to any small watershed in which certain limitations are met.

## Effects of urban development

An urban or urbanizing watershed is one in which impervious surfaces cover or will soon cover a considerable area. Impervious surfaces include roads, sidewalks, parking lots, and buildings. Natural flow paths in the watershed may be replaced or supplemented by paved gutters, storm sewers, or other elements of artificial drainage.

Hydrologic studies to determine runoff and peak discharge should ideally be based on long-term stationary streamflow records for the area. Such records are seldom available for small drainage areas. Even where they are available, accurate statistical analysis of them is usually impossible because of the conversion of land to urban uses during the period of record. It therefore is necessary to estimate peak discharges with hydrologic models based on measurable watershed characteristics. Only through an understanding of these characteristics and experience in using these models can we make sound judgments on how to alter model parameters to reflect changing watershed conditions.

Urbanization changes a watershed's response to precipitation. The most common effects are reduced infiltration and decreased travel time, which significantly increase peak discharges and runoff. Runoff is determined primarily by the amount of precipitation and by infiltration characteristics related to soil type, soil moisture, antecedent rainfall, cover type, impervious surfaces, and surface retention. Travel time is determined primarily by slope, length of flow path, depth of flow, and roughness of flow surfaces. Peak discharges are based on the relationship of these parameters and on the total drainage area of the watershed, the location of the development, the effect of any flood control works or other natural or manmade storage, and the time distribution of rainfall during a given storm event.

The model described in TR-55 begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). CN is based on soils, plant cover, amount of impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph by using unit hydrograph theory and routing procedures that depend on runoff travel time through segments of the watershed.

For a description of the hydrograph development method used by SCS, see chapter 16 of the SCS National Engineering Handbook, Section 4—Hydrology (NEH-4) (SCS 1985). The routing method (Modified Att-Kin) is explained in appendixes G and H of draft Technical Release 20 (TR-20) (SCS 1983).

## Rainfall

TR-55 includes four regional rainfall time distributions. See appendix B for a discussion of how these distributions were developed.

All four distributions are for a 24-hour period. This period was chosen because of the general availability of daily rainfall data that were used to estimate 24-hour rainfall amounts. The 24-hour duration spans most of the applications of TR-55.

One critical parameter in the model is time of concentration ($T_c$), which is the time it takes for runoff to travel to a point of interest from the hydraulically most distant point. Normally a rainfall duration equal to or greater than $T_c$ is used. Therefore, the rainfall distributions were designed to contain the intensity of any duration of rainfall for the frequency of the event chosen. That is, if the 10-year frequency, 24-hour rainfall is used, the most intense hour will approximate the 10-year, 1-hour rainfall volume.

## Runoff

To estimate runoff from storm rainfall, SCS uses the Runoff Curve Number (CN) method (see chapters 4 through 10 of NEH-4, SCS 1985). Determination of CN depends on the watershed's soil and cover conditions, which the model represents as hydrologic soil group, cover type, treatment, and hydrologic condition. Chapter 2 of this TR discusses the effect of urban development on CN and explains how to use CN to estimate runoff.

## Time parameters

Chapter 3 describes a method for estimating the parameters used to distribute the runoff into a hydrograph. The method is based on velocities of flow through segments of the watershed. Two major parameters are time of concentration ($T_c$) and travel time of flow through the segments ($T_t$). These and the other parameters used are the same as those used in accepted hydraulic analyses of open channels.

Many methods are empirically derived from actual runoff hydrographs and watershed characteristics. The method in chapter 3 was chosen because it is basic; however, other methods may be used.

## Peak discharge and hydrographs

Chapter 4 describes a method for approximating peak rates of discharge, and chapter 5 describes a method for obtaining or routing hydrographs. Both methods were derived from hydrographs prepared b procedures outlined in chapter 16 of NEH-4 (SCS 1985). The computations were made with a computerized SCS hydrologic model, TR-20 (SCS 1983).

The methods in chapters 4 and 5 should be used in accordance with specific guidelines. If basic data are improperly prepared or adjustments not properly used, errors will result.

## Storage effects

Chapter 6 outlines procedures to account for the effect of detention-type storage. It provides a shortcut method to estimate temporary flood storag based on hydrologic data developed from the Graphical Peak Discharge or Tabular Hydrograph methods.

By increasing runoff and decreasing travel times, urbanization can be expected to increase downstrea peak discharges. Chapter 6 discusses how flood detention can modify the hydrograph so that, ideally, downstream peak discharge is reduced approximate to the predevelopment condition. The shortcuts in chapter 6 are useful in sizing a basin even though the final design may require a more detailed analysi

## Selecting the appropriate procedures

Figure 1-1 is a flow chart that shows how to select the appropriate procedures to use in TR-55. In the figure, the diamond-shaped box labeled "Subareas required?" directs the user to the appropriate method based on whether the watershed needs to b divided into subareas. Watershed subdivision is required when significantly different conditions affecting runoff or timing are present in the watershed—for example, if the watershed has widel differing curve numbers or nonhomogeneous slope patterns.

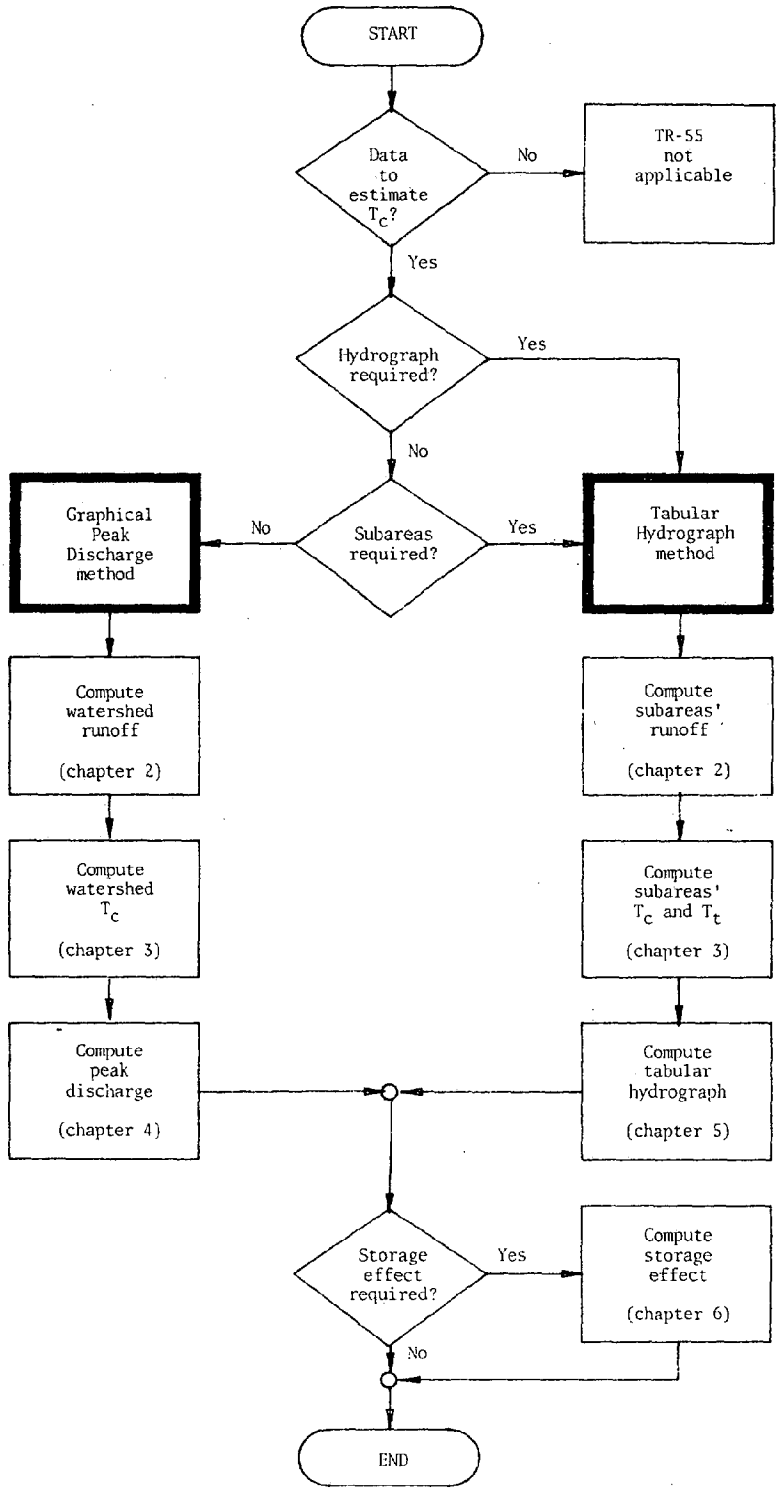



**Figure 1-1.—Flow chart for selecting the appropriate procedures in TR-55.**

## Limitations

To save time, the procedures in TR-55 are simplified by assumptions about some parameters. These simplifications, however, limit the use of the procedures and can provide results that are less accurate than more detailed methods. The user should examine the sensitivity of the analysis being conducted to a variation of the peak discharge or hydrograph. To ensure that the degree of error is tolerable, specific limitations are given in chapters 2 through 6. Additional general constraints to the use of TR-55 are as follows:

- The methods in this TR are based on open and unconfined flow over land or in channels. For large events during which flow is divided between sewer and overland flow, more information about hydraulics than is presented here is needed to determine $T_c$. After flow enters a closed system, the discharge can be assumed constant until another flow is encountered at a junction or another inlet.

- Both the Graphical Peak Discharge and Tabular Hydrograph methods are derived from TR-20 (SCS 1983) output. Their accuracy is comparable; they differ only in their products. The use of $T_c$ permits them to be used for any size watershed within the scope of the curves or tables. The Graphical method (chapter 4) is used only for hydrologically homogeneous watersheds because the procedure is limited to a single watershed subarea. The Tabular method (chapter 5) can be used for a heterogeneous watershed that is divided into a number of homogeneous subwatersheds. Hydrographs for the subwatersheds can be routed and added.

- The approximate storage-routing curves (chapter 6) should not be used if the adjustment for ponding (chapter 4) is used. These storage-routing curves, like the peak discharge and hydrograph procedures, are generalizations derived from TR-20 routings.

# Chapter 2: Estimating runoff

## SCS Runoff Curve Number method

The SCS Runoff Curve Number (CN) method is described in detail in NEH-4 (SCS 1985). The SCS runoff equation is

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad \text{[Eq. 2-1]}$$

where

$Q$ = runoff (in),
$P$ = rainfall (in),
$S$ = potential maximum retention after runoff begins (in), and
$I_a$ = initial abstraction (in).

Initial abstraction ($I_a$) is all losses before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation, evaporation, and infiltration. $I_a$ is highly variable but generally is correlated with soil and cover parameters. Through studies of many small agricultural watersheds, $I_a$ was found to be approximated by the following empirical equation:

$$I_a = 0.2S. \qquad \text{[Eq. 2-2]}$$

By removing $I_a$ as an independent parameter, this approximation allows use of a combination of S and P to produce a unique runoff amount. Substituting equation 2-2 into equation 2-1 gives

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}. \qquad \text{[Eq. 2-3]}$$

S is related to the soil and cover conditions of the watershed through the CN. CN has a range of 0 to 100, and S is related to CN by

$$S = \frac{1000}{CN} - 10. \qquad \text{[Eq. 2-4]}$$

Figure 2-1 and table 2-1 solve equations 2-3 and 2-4 for a range of CN's and rainfall.

## Factors considered in determining runoff curve numbers

The major factors that determine CN are the hydrologic soil group (HSG), cover type, treatment, hydrologic condition, and antecedent runoff conditic (ARC). Another factor considered is whether impervious areas outlet directly to the drainage system (connected) or whether the flow spreads ove pervious areas before entering the drainage system (unconnected). Figure 2-2 is provided to aid in selecting the appropriate figure or table for determining curve numbers.

CN's in table 2-2 (*a* to *d*) represent average antecedent runoff condition for urban, cultivated agricultural, other agricultural, and arid and semiari rangeland uses. Table 2-2 assumes impervious areas are directly connected. The following sections explai how to determine CN's and how to modify them for urban conditions.

### Hydrologic soil groups

Infiltration rates of soils vary widely and are affectec by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. Appendix A defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of interest may be identified from a soil survey report, which can be obtained from local SCS offices or soil and water conservation district offices.

Most urban areas are only partially covered by impervious surfaces: the soil remains an important factor in runoff estimates. Urbanization has a greater effect on runoff in watersheds with soils having high infiltration rates (sands and gravels) than in watersheds predominantly of silts and clays, which generally have low infiltration rates.

Any disturbance of a soil profile can significantly change its infiltration characteristics. With urbanization, native soil profiles may be mixed or removed or fill material from other areas may be introduced. Therefore, a method based on soil

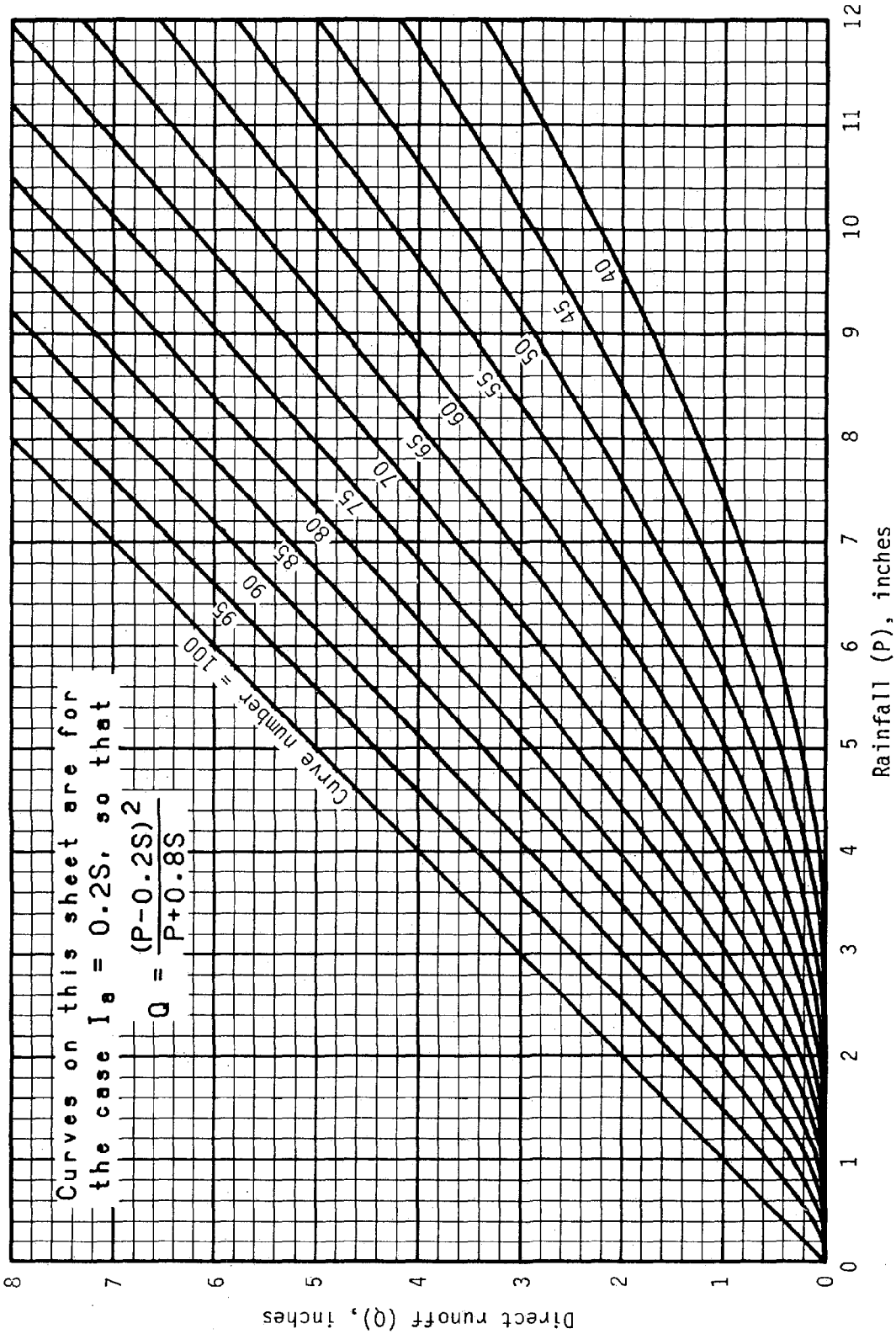



Figure 2-1.—Solution of runoff equation.

texture is given in appendix A for determining the HSG classification for disturbed soils.

### Cover type

Table 2-2 addresses most cover types, such as vegetation, bare soil, and impervious surfaces. There are a number of methods for determining cover type. The most common are field reconnaissance, aerial photographs, and land use maps.

### Treatment

*Treatment* is a cover type modifier (used only in table 2-2b) to describe the management of cultivated agricultural lands. It includes mechanical practices, such as contouring and terracing, and management practices, such as crop rotations and reduced or no tillage.

### Hydrologic condition

*Hydrologic condition* indicates the effects of cover type and treatment on infiltration and runoff and is generally estimated from density of plant and residue cover on sample areas. *Good* hydrologic condition indicates that the soil usually has a low runoff potential for that specific hydrologic soil group, cover type, and treatment. Some factors to consider in estimating the effect of cover on infiltration and runoff are (a) canopy or density of lawns, crops, or other vegetative areas; (b) amount of year-round cover; (c) amount of grass or close-seeded legumes in rotations; (d) percent of residue cover; and (e) degree of surface roughness.

**Table 2-1.—Runoff depth for selected CN's and rainfall amounts[1]**

| | Runoff depth for curve number of— | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 98 |
| | *inches* | | | | | | | | | | | | |
| 1.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.08 | 0.17 | 0.32 | 0.56 | 0.79 |
| 1.2 | .00 | .00 | .00 | .00 | .00 | .00 | .03 | .07 | .15 | .27 | .46 | .74 | .99 |
| 1.4 | .00 | .00 | .00 | .00 | .00 | .02 | .06 | .13 | .24 | .39 | .61 | .92 | 1.18 |
| 1.6 | .00 | .00 | .00 | .00 | .01 | .05 | .11 | .20 | .34 | .52 | .76 | 1.11 | 1.38 |
| 1.8 | .00 | .00 | .00 | .00 | .03 | .09 | .17 | .29 | .44 | .65 | .93 | 1.29 | 1.58 |
| 2.0 | .00 | .00 | .00 | .02 | .06 | .14 | .24 | .38 | .56 | .80 | 1.09 | 1.48 | 1.77 |
| 2.5 | .00 | .00 | .02 | .08 | .17 | .30 | .46 | .65 | .89 | 1.18 | 1.53 | 1.96 | 2.27 |
| 3.0 | .00 | .02 | .09 | .19 | .33 | .51 | .71 | .96 | 1.25 | 1.59 | 1.98 | 2.45 | 2.77 |
| 3.5 | .02 | .08 | .20 | .35 | .53 | .75 | 1.01 | 1.30 | 1.64 | 2.02 | 2.45 | 2.94 | 3.27 |
| 4.0 | .06 | .18 | .33 | .53 | .76 | 1.03 | 1.33 | 1.67 | 2.04 | 2.46 | 2.92 | 3.43 | 3.77 |
| 4.5 | .14 | .30 | .50 | .74 | 1.02 | 1.33 | 1.67 | 2.05 | 2.46 | 2.91 | 3.40 | 3.92 | 4.26 |
| 5.0 | .24 | .44 | .69 | .98 | 1.30 | 1.65 | 2.04 | 2.45 | 2.89 | 3.37 | 3.88 | 4.42 | 4.76 |
| 6.0 | .50 | .80 | 1.14 | 1.52 | 1.92 | 2.35 | 2.81 | 3.28 | 3.78 | 4.30 | 4.85 | 5.41 | 5.76 |
| 7.0 | .84 | 1.24 | 1.68 | 2.12 | 2.60 | 3.10 | 3.62 | 4.15 | 4.69 | 5.25 | 5.82 | 6.41 | 6.76 |
| 8.0 | 1.25 | 1.74 | 2.25 | 2.78 | 3.33 | 3.89 | 4.46 | 5.04 | 5.63 | 6.21 | 6.81 | 7.40 | 7.76 |
| 9.0 | 1.71 | 2.29 | 2.88 | 3.49 | 4.10 | 4.72 | 5.33 | 5.95 | 6.57 | 7.18 | 7.79 | 8.40 | 8.76 |
| 10.0 | 2.23 | 2.89 | 3.56 | 4.23 | 4.90 | 5.56 | 6.22 | 6.88 | 7.52 | 8.16 | 8.78 | 9.40 | 9.76 |
| 11.0 | 2.78 | 3.52 | 4.26 | 5.00 | 5.72 | 6.43 | 7.13 | 7.81 | 8.48 | 9.13 | 9.77 | 10.39 | 10.76 |
| 12.0 | 3.38 | 4.19 | 5.00 | 5.79 | 6.56 | 7.32 | 8.05 | 8.76 | 9.45 | 10.11 | 10.76 | 11.39 | 11.76 |
| 13.0 | 4.00 | 4.89 | 5.76 | 6.61 | 7.42 | 8.21 | 8.98 | 9.71 | 10.42 | 11.10 | 11.76 | 12.39 | 12.76 |
| 14.0 | 4.65 | 5.62 | 6.55 | 7.44 | 8.30 | 9.12 | 9.91 | 10.67 | 11.39 | 12.08 | 12.75 | 13.39 | 13.76 |
| 15.0 | 5.33 | 6.36 | 7.35 | 8.29 | 9.19 | 10.04 | 10.85 | 11.63 | 12.37 | 13.07 | 13.74 | 14.39 | 14.76 |

[1]Interpolate the values shown to obtain runoff depths for CN's or rainfall amounts not shown.

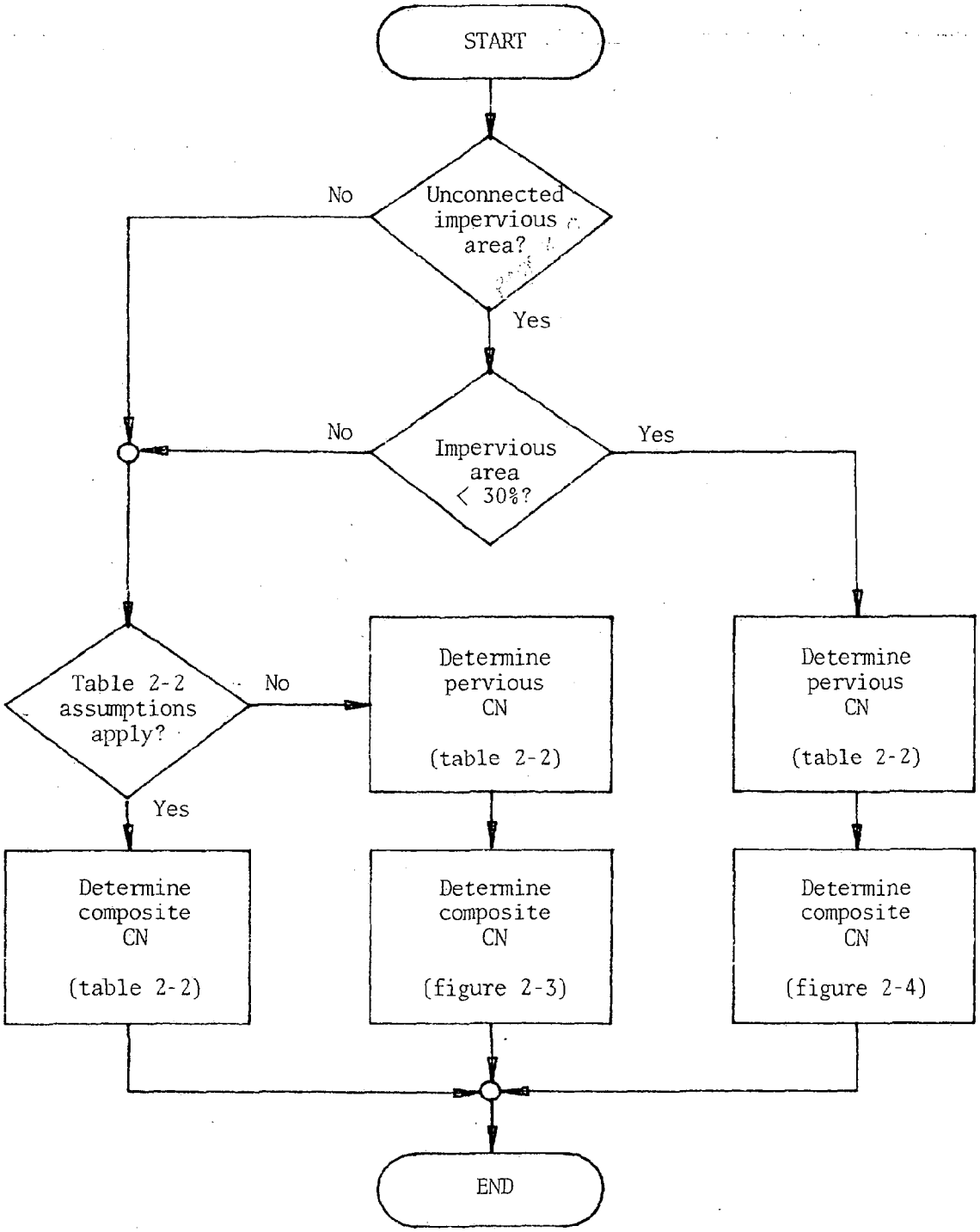



Figure 2-2.—Flow chart for selecting the appropriate figure or table for determining runoff curve numbers.

**Table 2-2a.—Runoff curve numbers for urban areas[1]**

| Cover description | | Curve numbers for hydrologic soil group— | | | |
|---|---|---|---|---|---|
| Cover type and hydrologic condition | Average percent impervious area[2] | A | B | C | D |
| *Fully developed urban areas (vegetation established)* | | | | | |
| Open space (lawns, parks, golf courses, cemeteries, etc.)[3]: | | | | | |
| Poor condition (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair condition (grass cover 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good condition (grass cover > 75%) | | 39 | 61 | 74 | 80 |
| Impervious areas: | | | | | |
| Paved parking lots, roofs, driveways, etc. (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; curbs and storm sewers (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved; open ditches (including right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (including right-of-way) | | 76 | 85 | 89 | 91 |
| Dirt (including right-of-way) | | 72 | 82 | 87 | 89 |
| Western desert urban areas: | | | | | |
| Natural desert landscaping (pervious areas only)[4] | | 63 | 77 | 85 | 88 |
| Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders) | | 96 | 96 | 96 | 96 |
| Urban districts: | | | | | |
| Commercial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| Residential districts by average lot size: | | | | | |
| 1/8 acre or less (town houses) | 65 | 77 | 85 | 90 | 92 |
| 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| 1/2 acre | 25 | 54 | 70 | 80 | 85 |
| 1 acre | 20 | 51 | 68 | 79 | 84 |
| 2 acres | 12 | 46 | 65 | 77 | 82 |
| *Developing urban areas* | | | | | |
| Newly graded areas (pervious areas only, no vegetation)[5] | | 77 | 86 | 91 | 94 |
| Idle lands (CN's are determined using cover types similar to those in table 2-2c). | | | | | |

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

**Table 2-2b.—Runoff curve numbers for cultivated agricultural lands[1]**

| Cover description | | | Curve numbers for hydrologic soil group— | | | |
|---|---|---|---|---|---|---|
| Cover type | Treatment[2] | Hydrologic condition[3] | A | B | C | D |
| Fallow | Bare soil | — | 77 | 86 | 91 | 94 |
| | Crop residue cover (CR) | Poor | 76 | 85 | 90 | 93 |
| | | Good | 74 | 83 | 88 | 90 |
| Row crops | Straight row (SR) | Poor | 72 | 81 | 88 | 91 |
| | | Good | 67 | 78 | 85 | 89 |
| | SR + CR | Poor | 71 | 80 | 87 | 90 |
| | | Good | 64 | 75 | 82 | 85 |
| | Contoured (C) | Poor | 70 | 79 | 84 | 88 |
| | | Good | 65 | 75 | 82 | 86 |
| | C + CR | Poor | 69 | 78 | 83 | 87 |
| | | Good | 64 | 74 | 81 | 85 |
| | Contoured & terraced (C&T) | Poor | 66 | 74 | 80 | 82 |
| | | Good | 62 | 71 | 78 | 81 |
| | C&T + CR | Poor | 65 | 73 | 79 | 81 |
| | | Good | 61 | 70 | 77 | 80 |
| Small grain | SR | Poor | 65 | 76 | 84 | 88 |
| | | Good | 63 | 75 | 83 | 87 |
| | SR + CR | Poor | 64 | 75 | 83 | 86 |
| | | Good | 60 | 72 | 80 | 84 |
| | C | Poor | 63 | 74 | 82 | 85 |
| | | Good | 61 | 73 | 81 | 84 |
| | C + CR | Poor | 62 | 73 | 81 | 84 |
| | | Good | 60 | 72 | 80 | 83 |
| | C&T | Poor | 61 | 72 | 79 | 82 |
| | | Good | 59 | 70 | 78 | 81 |
| | C&T + CR | Poor | 60 | 71 | 78 | 81 |
| | | Good | 58 | 69 | 77 | 80 |
| Close-seeded or broadcast legumes or rotation meadow | SR | Poor | 66 | 77 | 85 | 89 |
| | | Good | 58 | 72 | 81 | 85 |
| | C | Poor | 64 | 75 | 83 | 85 |
| | | Good | 55 | 69 | 78 | 83 |
| | C&T | Poor | 63 | 73 | 80 | 83 |
| | | Good | 51 | 67 | 76 | 80 |

[1]Average runoff condition, and $I_a = 0.2S$.
[2]*Crop residue cover* applies only if residue is on at least 5% of the surface throughout the year.
[3]Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.
*Poor*: Factors impair infiltration and tend to increase runoff.
*Good*: Factors encourage average and better than average infiltration and tend to decrease runoff.

**Table 2-2c.—Runoff curve numbers for other agricultural lands[1]**

| Cover description | | Curve numbers for hydrologic soil group— | | | |
|---|---|---|---|---|---|
| Cover type | Hydrologic condition | A | B | C | D |
| Pasture, grassland, or range—continuous forage for grazing.[2] | Poor | 68 | 79 | 86 | 89 |
| | Fair | 49 | 69 | 79 | 84 |
| | Good | 39 | 61 | 74 | 80 |
| Meadow—continuous grass, protected from grazing and generally mowed for hay. | — | 30 | 58 | 71 | 78 |
| Brush—brush-weed-grass mixture with brush the major element.[3] | Poor | 48 | 67 | 77 | 83 |
| | Fair | 35 | 56 | 70 | 77 |
| | Good | [4]30 | 48 | 65 | 73 |
| Woods—grass combination (orchard or tree farm).[5] | Poor | 57 | 73 | 82 | 86 |
| | Fair | 43 | 65 | 76 | 82 |
| | Good | 32 | 58 | 72 | 79 |
| Woods.[6] | Poor | 45 | 66 | 77 | 83 |
| | Fair | 36 | 60 | 73 | 79 |
| | Good | [4]30 | 55 | 70 | 77 |
| Farmsteads—buildings, lanes, driveways, and surrounding lots. | — | 59 | 74 | 82 | 86 |

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
*Fair:* 50 to 75% ground cover and not heavily grazed.
*Good:* >75% ground cover and lightly or only occasionally grazed.

[3]*Poor:* <50% ground cover.
*Fair:* 50 to 75% ground cover.
*Good:* >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
*Fair:* Woods are grazed but not burned, and some forest litter covers the soil.
*Good:* Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands[1]

| Cover description | | Curve numbers for hydrologic soil group— | | | |
|---|---|---|---|---|---|
| Cover type | Hydrologic condition[2] | A[3] | B | C | D |
| Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element. | Poor | | 80 | 87 | 93 |
| | Fair | | 71 | 81 | 89 |
| | Good | | 62 | 74 | 85 |
| Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush. | Poor | | 66 | 74 | 79 |
| | Fair | | 48 | 57 | 63 |
| | Good | | 30 | 41 | 48 |
| Pinyon-juniper—pinyon, juniper, or both; grass understory. | Poor | | 75 | 85 | 89 |
| | Fair | | 58 | 73 | 80 |
| | Good | | 41 | 61 | 71 |
| Sagebrush with grass understory. | Poor | | 67 | 80 | 85 |
| | Fair | | 51 | 63 | 70 |
| | Good | | 35 | 47 | 55 |
| Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus. | Poor | 63 | 77 | 85 | 88 |
| | Fair | 55 | 72 | 81 | 86 |
| | Good | 49 | 68 | 79 | 84 |

[1]Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
*Fair:* 30 to 70% ground cover.
*Good:* >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

### Antecedent runoff condition

The index of runoff potential before a storm event is the antecedent runoff condition (ARC). ARC is an attempt to account for the variation in CN at a site from storm to storm. CN for the average ARC at a site is the median value as taken from sample rainfall and runoff data. The CN's in table 2-2 are for the average ARC, which is used primarily for design applications. See NEH-4 (SCS 1985) and Rallison and Miller (1981) for more detailed discussion of storm-to-storm variation and a demonstration of upper and lower enveloping curves.

### Urban impervious area modifications

Several factors, such as the percentage of impervious area and the means of conveying runoff from impervious areas to the drainage system, should be considered in computing CN for urban areas (Rawls et al., 1981). For example, do the impervious areas connect directly to the drainage system, or do they outlet onto lawns or other pervious areas where infiltration can occur?

#### Connected impervious areas

An impervious area is considered connected if runoff from it flows directly into the drainage system. It is also considered connected if runoff from it occurs as concentrated shallow flow that runs over a pervious area and then into a drainage system.

Urban CN's (table 2-2a) were developed for typical land use relationships based on specific assumed percentages of impervious area. These CN values were developed on the assumptions that (a) pervious urban areas are equivalent to pasture in good hydrologic condition and (b) impervious areas have a CN of 98 and are directly connected to the drainage system. Some assumed percentages of impervious area are shown in table 2-2a.

If all of the impervious area is directly connected to the drainage system, but the impervious area percentages or the pervious land use assumptions in table 2-2a are not applicable, use figure 2-3 to compute a composite CN. For example, table 2-2a gives a CN of 70 for a ½-acre lot in HSG B, with an assumed impervious area of 25 percent. However, if the lot has 20 percent impervious area and a pervious area CN of 61, the composite CN obtained from figure 2-3 is 68. The CN difference between 70 and 68 reflects the difference in percent impervious area.

#### Unconnected impervious areas

Runoff from these areas is spread over a pervious area as sheet flow. To determine CN when all or part of the impervious area is not directly connected to the drainage system, (1) use figure 2-4 if total impervious area is less than 30 percent or (2) use figure 2-3 if the total impervious area is equal to or greater than 30 percent, because the absorptive capacity of the remaining pervious areas will not significantly affect runoff.

When impervious area is less than 30 percent, obtain the composite CN by entering the right half of figure 2-4 with the percentage of total impervious area and the ratio of total unconnected impervious area to total impervious area. Then move left to the appropriate pervious CN and read down to find the composite CN. For example, for a ½-acre lot with 20 percent total impervious area (75 percent of which is unconnected) and pervious CN of 61, the composite CN from figure 2-4 is 66. If all of the impervious area is connected, the resulting CN (from figure 2-3) would be 68.

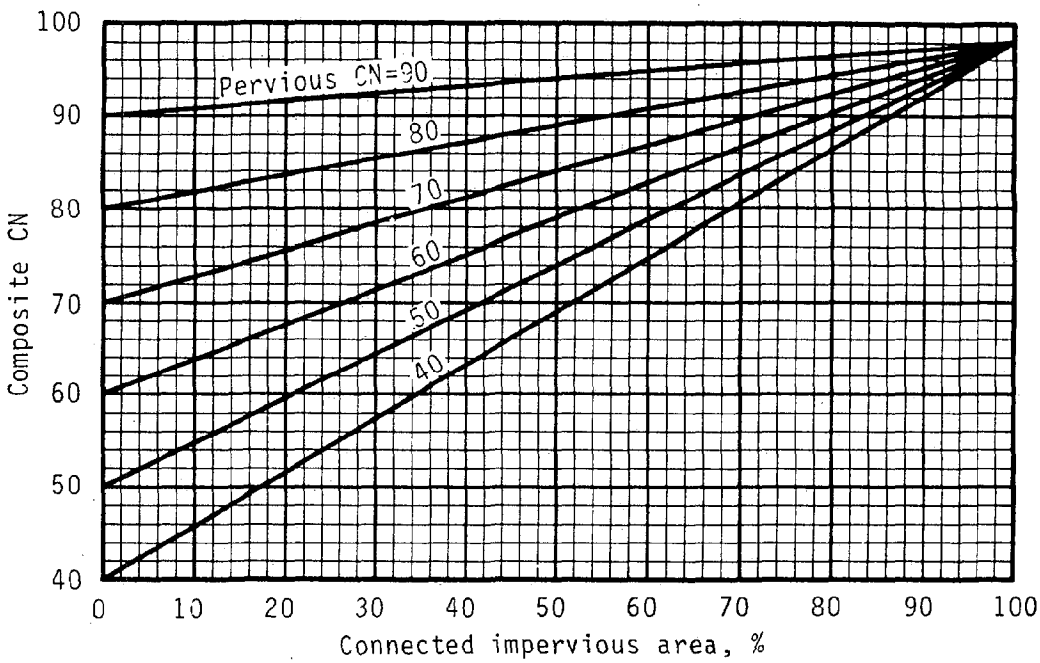



Figure 2-3.—Composite CN with connected impervious area.

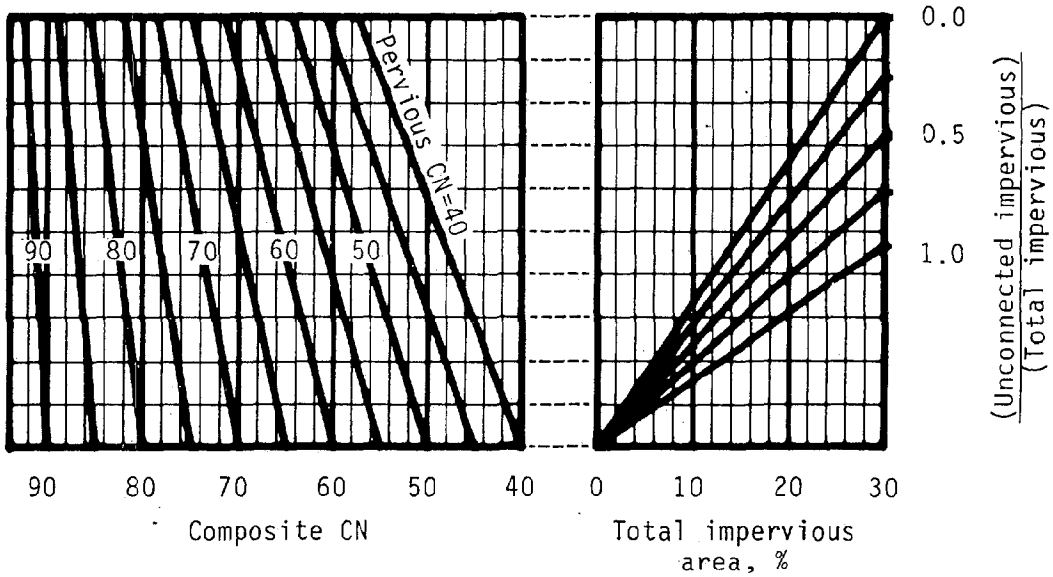



Figure 2-4.—Composite CN with unconnected impervious areas and total impervious area less than 30%.

## Runoff

When CN and the amount of rainfall have been determined for the watershed, determine runoff by using figure 2-1, table 2-1, or equations 2-3 and 2-4. The runoff is usually rounded to the nearest hundredth of an inch.

## Limitations

- Curve numbers describe average conditions that are useful for design purposes. If the rainfall event used is a historical storm, the modeling accuracy decreases.

- Use the runoff curve number equation with caution when recreating specific features of an actual storm. The equation does not contain an expression for time and, therefore, does not account for rainfall duration or intensity.

- The user should understand the assumption reflected in the initial abstraction term ($I_a$) and should ascertain that the assumption applies to the situation. $I_a$, which consists of interception, initial infiltration, surface depression storage, evapotranspiration, and other factors, was generalized as 0.2S based on data from agricultural watersheds (S is the potential maximum retention after runoff begins). This approximation can be especially important in an urban application because the combination of impervious areas with pervious areas can imply a significant initial loss that may not take place. The opposite effect, a greater initial loss, can occur if the impervious areas have surface depressions that store some runoff. To use a relationship other than $I_a = 0.2S$, one must redevelop equation 2-3, figure 2-1, table 2-1, and table 2-2 by using the original rainfall-runoff data to establish new S or CN relationships for each cover and hydrologic soil group.

- Runoff from snowmelt or rain on frozen ground cannot be estimated using these procedures.

- The CN procedure is less accurate when runoff is less than 0.5 inch. As a check, use another procedure to determine runoff.

- The SCS runoff procedures apply only to direct surface runoff: do not overlook large sources of subsurface flow or high ground water levels that contribute to runoff. These conditions are often related to HSG A soils and forest areas that have been assigned relatively low CN's in table 2-2. Good judgment and experience based on stream gage records are needed to adjust CN's as conditions warrant.

- When the weighted CN is less than 40, use another procedure to determine runoff.

## Examples

Four examples illustrate the procedure for computing runoff curve number (CN) and runoff (Q) in inches. Worksheet 2 in appendix D is provided to assist TR-55 users. Figures 2-5 to 2-8 represent the use of worksheet 2 for each example. All four examples are based on the same watershed and the same storm event.

The watershed covers 250 acres in Dyer County, northwestern Tennessee. Seventy percent (175 acres) is a Loring soil, which is in hydrologic soil group C. Thirty percent (75 acres) is a Memphis soil, which is in group B. The event is a 25-year frequency, 24-hour storm with total rainfall of 6 inches.

Cover type and conditions in the watershed are different for each example. The examples, therefore, illustrate how to compute CN and Q for various situations of proposed, planned, or present development.

### Example 2-1

The present cover type is pasture in good hydrologic condition. (See figure 2-5 for worksheet 2 information.)

### Example 2-2

Seventy percent (175 acres) of the watershed, consisting of all the Memphis soil and 100 acres of the Loring soil, is ½-acre residential lots with lawns in good hydrologic condition. The rest of the watershed is scattered open space in good hydrologic condition. (See figure 2-6.)

### Example 2-3

This example is the same as example 2-2, except that the ½-acre lots have a total impervious area of 35 percent. For these lots, the pervious area is lawns in good hydrologic condition. Since the impervious area percentage differs from the percentage assumed in table 2-2, use figure 2-3 to compute CN. (See figure 2-7.)

### Example 2-4

This example is also based on example 2-2, except that 50 percent of the impervious area associated with the ½-acre lots on the Loring soil is "unconnected," that is, it is not directly connected to the drainage system. For these lots, the pervious area CN (lawn, good condition) is 74 and the impervious area is 25 percent. Use figure 2-4 to compute the CN for these lots. CN's for the ½-acre lots on Memphis soil and the open space on Loring soil are the same as those in example 2-2. (See figure 2-8.)

## Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres By WJR Date 10/1/85

Location Dyer County, Tennessee Checked JLM Date 10/3/85

Circle one: (Present) Developed

1. Runoff curve number (CN)

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area ☐ acres ☐ mi² ☒ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Memphis, B | Pasture, good condition | 61 | | | 30 | 1830 |
| Loring, C | Pasture, good condition | 74 | | | 70 | 5180 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals = | 100 | 7010 |

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{7010}{100} = 70.1$; Use CN = 70

2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 25 | | |
| Rainfall, P (24-hour) | in | 6.0 | | |
| Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.) | in | 2.81 | | |

Figure 2-5.—Worksheet 2 for example 2-1.

## Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres By WJR Date 10/1/85

Location Dyer County, Tennessee Checked HM Date 10/3/85

Circle one: Present (Developed) 175 acres residential

1. Runoff curve number (CN)

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Memphis, B | 25% impervious ½ acre lots, good condition | 70 | | | 75 | 5250 |
| Loring, C | 25% impervious ½ acre lots, good condition | 80 | | | 100 | 8000 |
| Loring, C | Open space, good condition | 74 | | | 75 | 5550 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals = | 250 | 18,800 |

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{18,800}{250} = 75.2$; Use CN = 75

2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 25 | | |
| Rainfall, P (24-hour) | in | 6.0 | | |
| Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.) | in | 3.28 | | |

Figure 2-6.—Worksheet 2 for example 2-2.

## Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres By WJR Date 10/1/85

Location Dyer County, Tennessee Checked MM Date 10/3/85

Circle one: Present (Developed)

1. Runoff curve number (CN)

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Memphis, B | 35% impervious ½ acre lots, good condition | | 74 | | 75 | 5550 |
| Loring, C | 35% impervious ½ acre lots, good condition | | 82 | | 1000 | 8200 |
| Loring, C | Open space, good condition | 74 | | | 75 | 5550 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | Totals = 250 | 19,300 |

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{19,300}{250} = 77.2$; Use CN = 77

2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 25 | | |
| Rainfall, P (24-hour) | in | 6.0 | | |
| Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.) | in | 3.48 | | |

Figure 2-7.—Worksheet 2 for example 2-3.

## Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres By WJR Date 10/1/85

Location Dyer County, Tennessee Checked WM Date 10/3/85

Circle one: Present (Developed)

1. Runoff curve number (CN)

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Memphis, B | 25% connected impervious 1/2 acre lots, good condition | 70 | | | 75 | 5250 |
| Loring, C | 25% impervious with 50% unconnected 1/2 acre lots, good condition | | | 78 | 100 | 7800 |
| Loring, C | Open space, good condition | 74 | | | 75 | 5550 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals = | 250 | 18,600 |

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{18,600}{250} = 74.4$; Use CN = 74

2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 25 | | |
| Rainfall, P (24-hour) | in | 6.0 | | |
| Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.) | in | 3.19 | | |

Figure 2-8.—Worksheet 2 for example 2-4.

# Chapter 3: Time of concentration and travel time

Travel time ($T_t$) is the time it takes water to travel from one location to another in a watershed. $T_t$ is a component of time of concentration ($T_c$), which is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. $T_c$ is computed by summing all the travel times for consecutive components of the drainage conveyance system.

$T_c$ influences the shape and peak of the runoff hydrograph. Urbanization usually decreases $T_c$, thereby increasing the peak discharge. But $T_c$ can be increased as a result of (a) ponding behind small or inadequate drainage systems, including storm drain inlets and road culverts, or (b) reduction of land slope through grading.

## Factors affecting time of concentration and travel time

### Surface roughness

One of the most significant effects of urban development on flow velocity is less retardance to flow. That is, undeveloped areas with very slow and shallow overland flow through vegetation become modified by urban development: the flow is then delivered to streets, gutters, and storm sewers that transport runoff downstream more rapidly. Travel time through the watershed is generally decreased.

### Channel shape and flow patterns

In small non-urban watersheds, much of the travel time results from overland flow in upstream areas. Typically, urbanization reduces overland flow lengths by conveying storm runoff into a channel as soon as possible. Since channel designs have efficient hydraulic characteristics, runoff flow velocity increases and travel time decreases.

### Slope

Slopes may be increased or decreased by urbanization, depending on the extent of site grading or the extent to which storm sewers and street ditches are used in the design of the water management system. Slope will tend to increase when channels are straightened and decrease w overland flow is directed through storm sewers, street gutters, and diversions.

## Computation of travel time and time of concentration

Water moves through a watershed as sheet flow shallow concentrated flow, open channel flow, o some combination of these. The type that occur function of the conveyance system and is best determined by field inspection.

Travel time ($T_t$) is the ratio of flow length to fl velocity:

$$T_t = \frac{L}{3600\ V} \qquad \text{[E}$$

where

$T_t$ = travel time (hr),
$L$ = flow length (ft),
$V$ = average velocity (ft/s), and
3600 = conversion factor from seconds to hour

Time of concentration ($T_c$) is the sum of $T_t$ valu the various consecutive flow segments:

$$T_c = T_{t_1} + T_{t_2} + \ldots T_{t_m} \qquad \text{[E}$$

where

$T_c$ = time of concentration (hr) and
$m$ = number of flow segments.

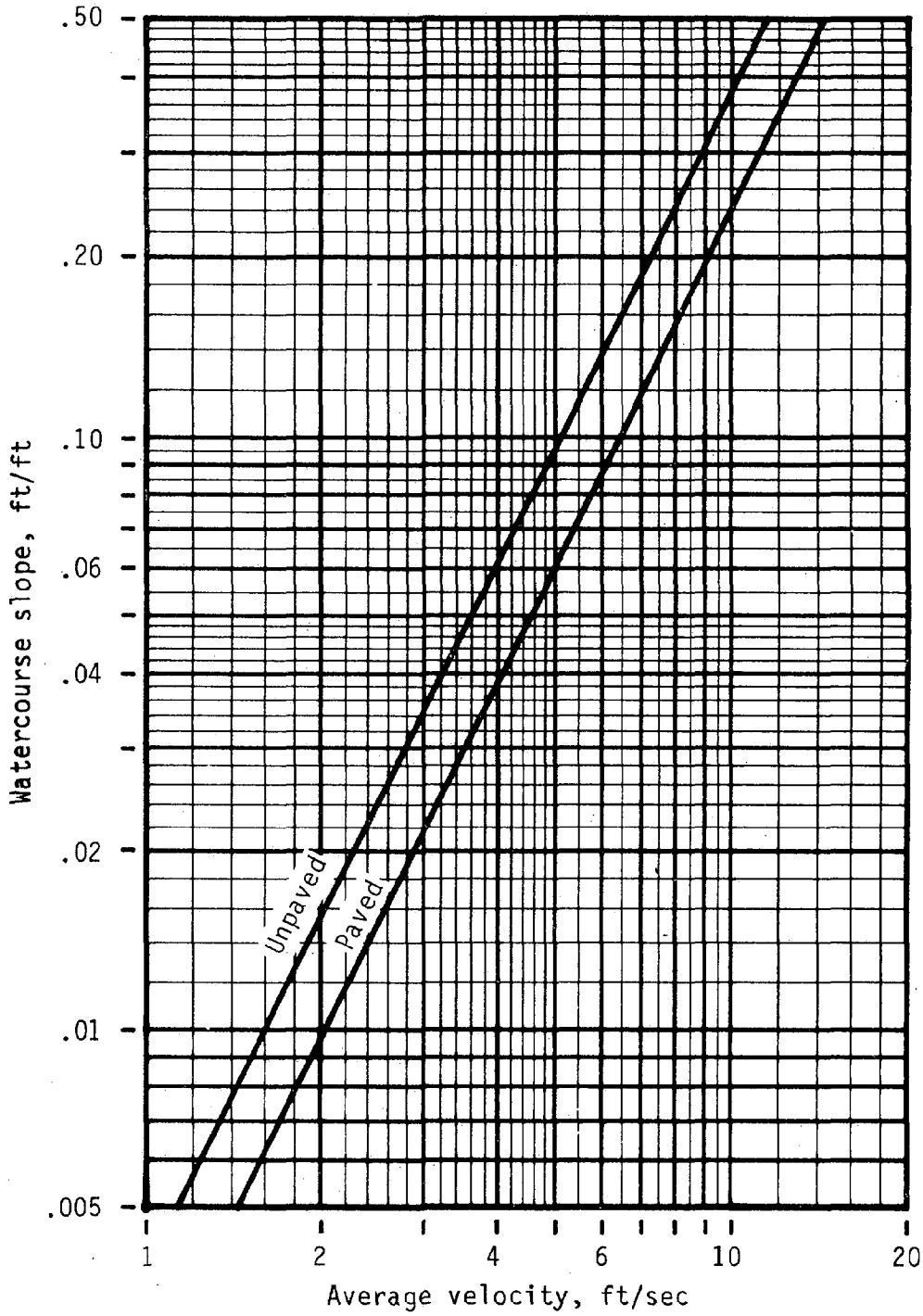



Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

### Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute $T_t$:

$$T_t = \frac{0.007\,(nL)^{0.8}}{(P_2)^{0.5}\,s^{0.4}} \qquad \text{[Eq. 3-3]}$$

**Table 3-1.—Roughness coefficients (Manning's n) for sheet flow**

| Surface description | n[1] |
|---|---|
| Smooth surfaces (concrete, asphalt, gravel, or bare soil) | 0.011 |
| Fallow (no residue) | 0.05 |
| Cultivated soils: | |
| Residue cover ≤20% | 0.06 |
| Residue cover >20% | 0.17 |
| Grass: | |
| Short grass prairie | 0.15 |
| Dense grasses[2] | 0.24 |
| Bermudagrass | 0.41 |
| Range (natural) | 0.13 |
| Woods:[3] | |
| Light underbrush | 0.40 |
| Dense underbrush | 0.80 |

[1]The n values are a composite of information compiled by Engman (1986).
[2]Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3]When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

where

$T_t$ = travel time (hr),
n = Manning's roughness coefficient (table 3-1),
L = flow length (ft),
$P_2$ = 2-year, 24-hour rainfall (in), and
s = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

### Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

### Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

Manning's equation is

$$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n} \qquad \text{[Eq. 3-4]}$$

where

- $V$ = average velocity (ft/s),
- $r$ = hydraulic radius (ft) and is equal to $a/p_w$,
- $a$ = cross sectional flow area ($ft^2$),
- $p_w$ = wetted perimeter (ft),
- $s$ = slope of the hydraulic grade line (channel slope, ft/ft), and
- $n$ = Manning's roughness coefficient for open channel flow.

Manning's n values for open channel flow can be obtained from standard textbooks such as Chow (1959) or Linsley et al. (1982). After average velocity is computed using equation 3-4, $T_t$ for the channel segment can be estimated using equation 3-1.

#### Reservoirs or lakes

Sometimes it is necessary to estimate the velocity of flow through a reservoir or lake at the outlet of a watershed. This travel time is normally very small and can be assumed as zero.

## Limitations

- Manning's kinematic solution should not be used for sheet flow longer than 300 feet. Equation 3-3 was developed for use with the four standard rainfall intensity-duration relationships.

- In watersheds with storm sewers, carefully identify the appropriate hydraulic flow path to estimate $T_c$. Storm sewers generally handle only a small portion of a large event. The rest of the peak flow travels by streets, lawns, and so on, to the outlet. Consult a standard hydraulics textbook to determine average velocity in pipes for either pressure or nonpressure flow.

- The minimum $T_c$ used in TR-55 is 0.1 hour.

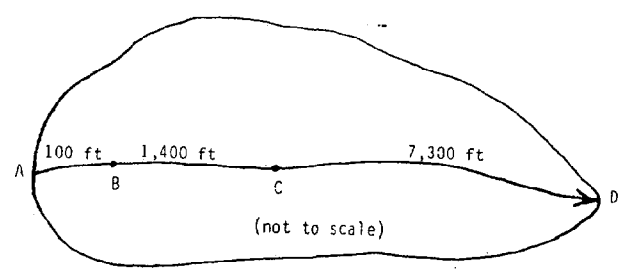
- A culvert or bridge can act as a reservoir outlet if there is significant storage behind it. The procedures in TR-55 can be used to determine the peak flow upstream of the culvert. Detailed storage routing procedures should be used to determine the outflow through the culvert.

## Example 3-1

The sketch below shows a watershed in Dyer County, northwestern Tennessee. The problem is to compute $T_c$ at the outlet of the watershed (point D). The 2-year 24-hour rainfall depth is 3.6 inches. All three types of flow occur from the hydraulically most distant point (A) to the point of interest (D). To compute $T_c$, first determine $T_t$ for each segment from the following information:

| | |
|---|---|
| Segment AB: | Sheet flow; dense grass; slope (s) = 0.01 ft/ft; and length (L) = 100 ft. |
| Segment BC: | Shallow concentrated flow; unpaved; s = 0.01 ft/ft; and L = 1400 ft. |
| Segment CD: | Channel flow; Manning's n = .05; flow area (a) = 27 $ft^2$; wetted perimeter ($p_w$) = 28.2 ft; s = 0.005 ft/ft; and L = 7300 ft. |

See figure 3-2 for the computations made on worksheet 3.



## Worksheet 3: Time of concentration ($T_c$) or travel time ($T_t$)

Project Heavenly Acres By DW Date 10/6/85

Location Dyer County, Tennessee Checked XW Date 10/8/85

Circle one: Present (Developed)

Circle one: ($T_c$) $T_t$ through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

| Sheet flow (Applicable to $T_c$ only) | | Segment ID | AB | | |
|---|---|---|---|---|---|
| 1. Surface description (table 3-1) ..... | | | DENSE GRASS | | |
| 2. Manning's roughness coeff., n (table 3-1) .. | | | 0.24 | | |
| 3. Flow length, L (total L $\leq$ 300 ft) ..... | ft | | 100 | | |
| 4. Two-yr 24-hr rainfall, $P_2$ ..... | in | | 3.6 | | |
| 5. Land slope, s ..... | ft/ft | | 0.01 | | |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ ..... | hr | | 0.30 | + | = 0.30 |

| Shallow concentrated flow | | Segment ID | BC | | |
|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) ..... | | | Unpaved | | |
| 8. Flow length, L ..... | ft | | 1400 | | |
| 9. Watercourse slope, s ..... | ft/ft | | 0.01 | | |
| 10. Average velocity, V (figure 3-1) ..... | ft/s | | 1.6 | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ ..... | hr | | 0.24 | + | = 0.24 |

| Channel flow | | Segment ID | CD | | |
|---|---|---|---|---|---|
| 12. Cross sectional flow area, a ..... | $ft^2$ | | 27 | | |
| 13. Wetted perimeter, $p_w$ ..... | ft | | 28.2 | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... | ft | | 0.957 | | |
| 15. Channel slope, s ..... | ft/ft | | 0.005 | | |
| 16. Manning's roughness coeff., n ..... | | | 0.05 | | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ..... | ft/s | | 2.05 | | |
| 18. Flow length, L ..... | ft | | 7300 | | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ ..... | hr | | 0.99 | + | = 0.99 |

20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) ..... hr 1.53

Figure 3-2.—Worksheet 3 for example 3-1.

# Chapter 4: Graphical Peak Discharge method

This chapter presents the Graphical Peak Discharge method for computing peak discharge from rural and urban areas. The Graphical method was developed from hydrograph analyses using TR-20, "Computer Program for Project Formulation–Hydrology" (SCS 1983). The peak discharge equation used is

$$q_p = q_u A_m Q F_p \qquad \text{[Eq. 4-1]}$$

where

$q_p$ = peak discharge (cfs);
$q_u$ = unit peak discharge (csm/in);
$A_m$ = drainage area (mi$^2$);
$Q$ = runoff (in); and
$F_p$ = pond and swamp adjustment factor.

The input requirements for the Graphical method are as follows: (1) $T_c$ (hr), (2) drainage area (mi$^2$), (3) appropriate rainfall distribution (I, IA, II, or III), (4) 24-hour rainfall (in), and (5) CN. If pond and swamp areas are spread throughout the watershed and are not considered in the $T_c$ computation, an adjustment for pond and swamp areas is also needed.

## Peak discharge computation

For a selected rainfall frequency, the 24-hour rainfall (P) is obtained from appendix B or more detailed local precipitation maps. CN and total runoff (Q) for the watershed are computed according to the methods outlined in chapter 2. The CN is used to determine the initial abstraction ($I_a$) from table 4-1. $I_a/P$ is then computed.

If the computed $I_a/P$ ratio is outside the range shown in exhibit 4 (4-I, 4-IA, 4-II, and 4-III) for the rainfall distribution of interest, then the limiting value should be used. If the ratio falls between the limiting values, use linear interpolation. Figure 4-1 illustrates the sensitivity of $I_a/P$ to CN and P.

Peak discharge per square mile per inch of runoff ($q_u$) is obtained from exhibit 4-I, 4-IA, 4-II, or 4-III by using $T_c$ (chapter 3), rainfall distribution type, and $I_a/P$ ratio. The pond and swamp adjustment factor is obtained from table 4-2 (rounded to the nearest table value). Use worksheet 4 in appendix D to aid in computing the peak discharge using the Graphical method.

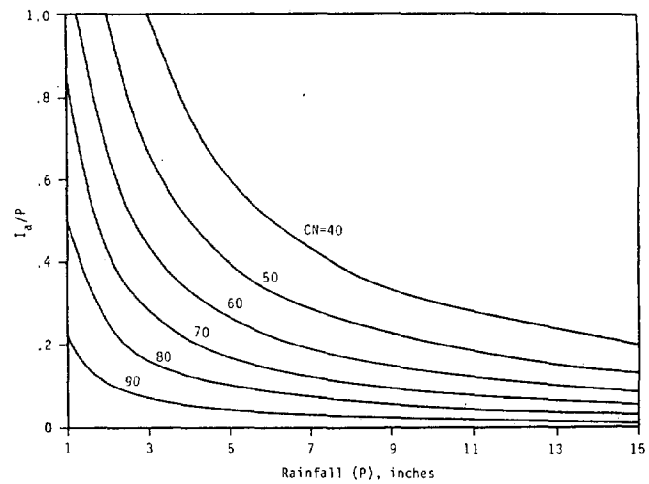



**Figure 4-1.—Variation of $I_a/P$ for P and CN.**

**Table 4-1.—$I_a$ values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|---|---|---|---|
| 40 | 3.000 | 70 | 0.857 |
| 41 | 2.878 | 71 | 0.817 |
| 42 | 2.762 | 72 | 0.778 |
| 43 | 2.651 | 73 | 0.740 |
| 44 | 2.545 | 74 | 0.703 |
| 45 | 2.444 | 75 | 0.667 |
| 46 | 2.348 | 76 | 0.632 |
| 47 | 2.255 | 77 | 0.597 |
| 48 | 2.167 | 78 | 0.564 |
| 49 | 2.082 | 79 | 0.532 |
| 50 | 2.000 | 80 | 0.500 |
| 51 | 1.922 | 81 | 0.469 |
| 52 | 1.846 | 82 | 0.439 |
| 53 | 1.774 | 83 | 0.410 |
| 54 | 1.704 | 84 | 0.381 |
| 55 | 1.636 | 85 | 0.353 |
| 56 | 1.571 | 86 | 0.326 |
| 57 | 1.509 | 87 | 0.299 |
| 58 | 1.448 | 88 | 0.273 |
| 59 | 1.390 | 89 | 0.247 |
| 60 | 1.333 | 90 | 0.222 |
| 61 | 1.279 | 91 | 0.198 |
| 62 | 1.226 | 92 | 0.174 |
| 63 | 1.175 | 93 | 0.151 |
| 64 | 1.125 | 94 | 0.128 |
| 65 | 1.077 | 95 | 0.105 |
| 66 | 1.030 | 96 | 0.083 |
| 67 | 0.985 | 97 | 0.062 |
| 68 | 0.941 | 98 | 0.041 |
| 69 | 0.899 | | |

Table 4-2.—Adjustment factor ($F_p$) for pond and swamp areas that are spread throughout the watershed

| Percentage of pond and swamp areas | $F_p$ |
|---|---|
| 0 | 1.00 |
| 0.2 | 0.97 |
| 1.0 | 0.87 |
| 3.0 | 0.75 |
| 5.0 | 0.72 |

## Limitations

The Graphical method provides a determination of peak discharge only. If a hydrograph is needed or watershed subdivision is required, use the Tabular Hydrograph method (chapter 5). Use TR-20 if the watershed is very complex or a higher degree of accuracy is required.

- The watershed must be hydrologically homogeneous, that is, describable by one CN. Land use, soils, and cover are distributed uniformly throughout the watershed.
- The watershed may have only one main stream or, if more than one, the branches must have nearly equal $T_c$'s.
- The method cannot perform valley or reservoir routing.
- The $F_p$ factor can be applied only for ponds or swamps that are not in the $T_c$ flow path.
- Accuracy of peak discharge estimated by this method will be reduced if $I_a/P$ values are used that are outside the range given in exhibit 4. The limiting $I_a/P$ values are recommended for use.
- This method should be used only if the weighted CN is greater than 40.
- When this method is used to develop estimates of peak discharge for both present and developed conditions of a watershed, use the same procedure for estimating $T_c$.
- $T_c$ values with this method may range from 0.1 to 10 hours.

## Example 4-1

Compute the 25-year peak discharge for the 250-acre watershed described in examples 2-2 and 3-1. Figure 4-2 shows how worksheet 4 is used to compute $q_p$ as 345 cfs.

## Worksheet 4: Graphical Peak Discharge method

Project Heavenly Acres By RHM Date 10/15/85

Location Dyer County, Tennessee Checked [illegible] Date 10/17/85

Circle one: Present (Developed)

1. Data:

Drainage area ..... $A_m$ = 0.39 $mi^2$ (acres/640) .006 [illegible]

Runoff curve number .... CN = 75 (From worksheet 2), Figure 2-6

Time of concentration .. $T_c$ = 1.53 hr (From worksheet 3), Figure 3-2

Rainfall distribution type = II (I, IA, II, III)

Pond and swamp areas spread throughout watershed ..... = -- percent of $A_m$ (-- acres or $mi^2$ covered)

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| 2. Frequency ..... | yr | 25 | .00078 | |
| 3. Rainfall, P (24-hour) ..... | in | 6.0 | 5.2 | |
| 4. Initial abstraction, $I_a$ ..... (Use CN with table 4-1.) | in | 0.667 | .703 | |
| 5. Compute $I_a/P$ ..... | | 0.11 | 0.135 | |
| 6. Unit peak discharge, $q_u$ ..... (Use $T_c$ and $I_a/P$ with exhibit 4-II) | csm/in | 270 | 1050 | |
| 7. Runoff, Q ..... (From worksheet 2). Figure 2-6 | in | 3.28 | 2.53 | |
| 8. Pond and swamp adjustment factor, $F_p$ .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.) | | 1.0 | 1.0 | |
| 9. Peak discharge, $q_p$ ..... (Where $q_p = q_u A_m Q F_p$) | cfs | 345 | [illegible] | |

Figure 4-2.—Worksheet 4 for example 4-1.

**Exhibit 4-I: Unit peak discharge ($q_u$) for SCS type I rainfall distribution**

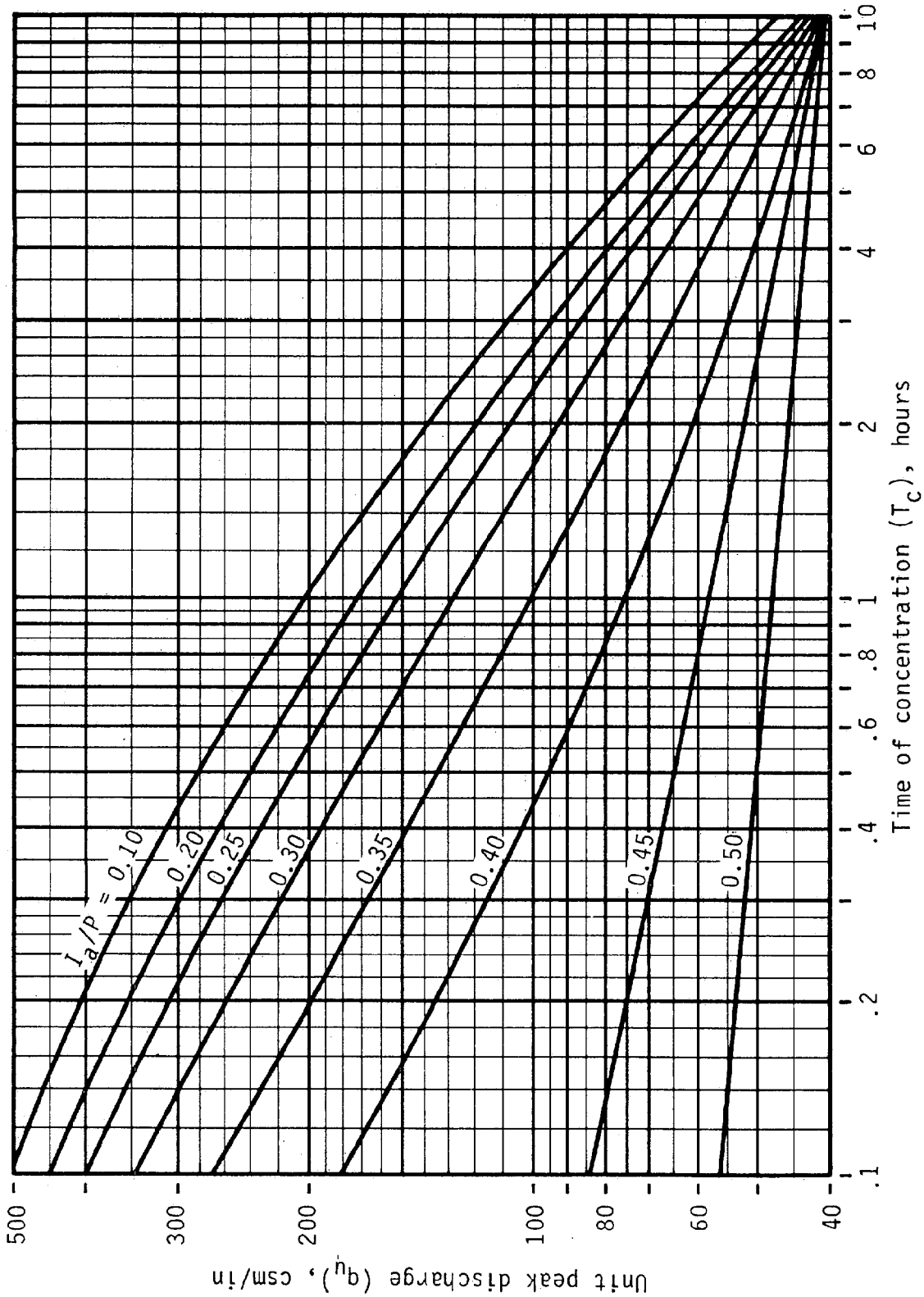


Exhibit 4-IA: Unit peak discharge ($q_u$) for SCS type IA rainfall distribution

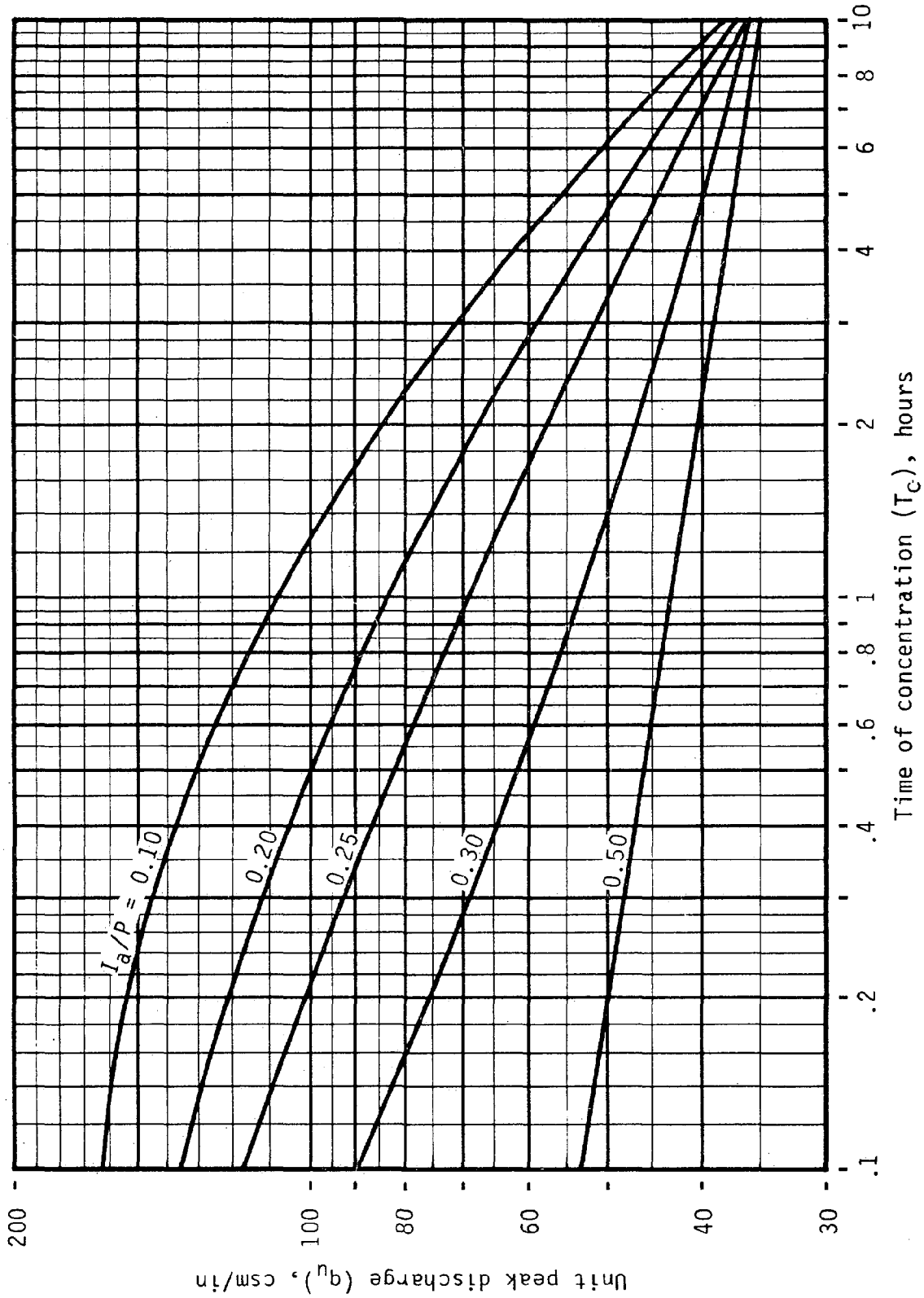


**Exhibit 4-II: Unit peak discharge ($q_u$) for SCS type II rainfall distribution**

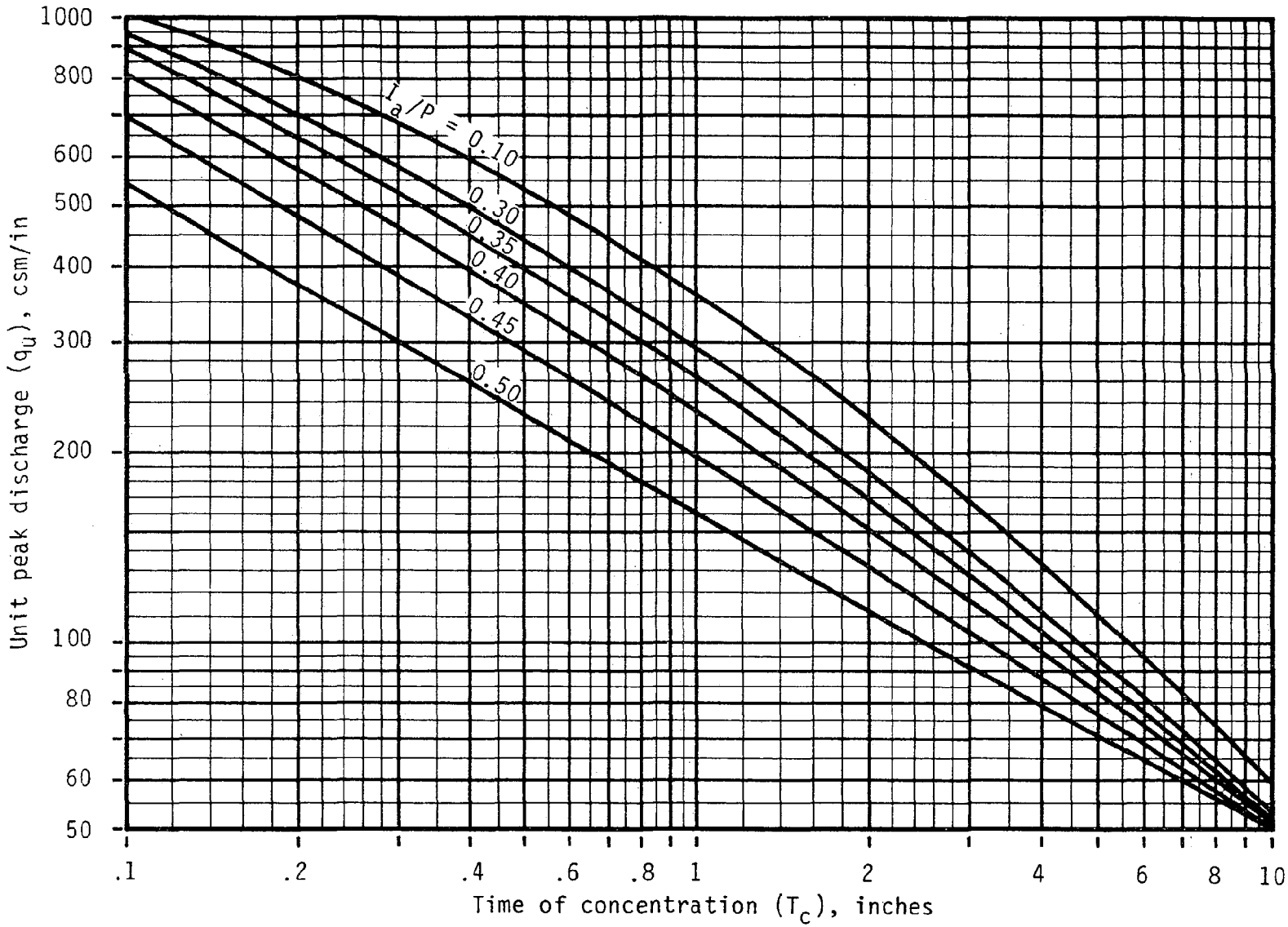
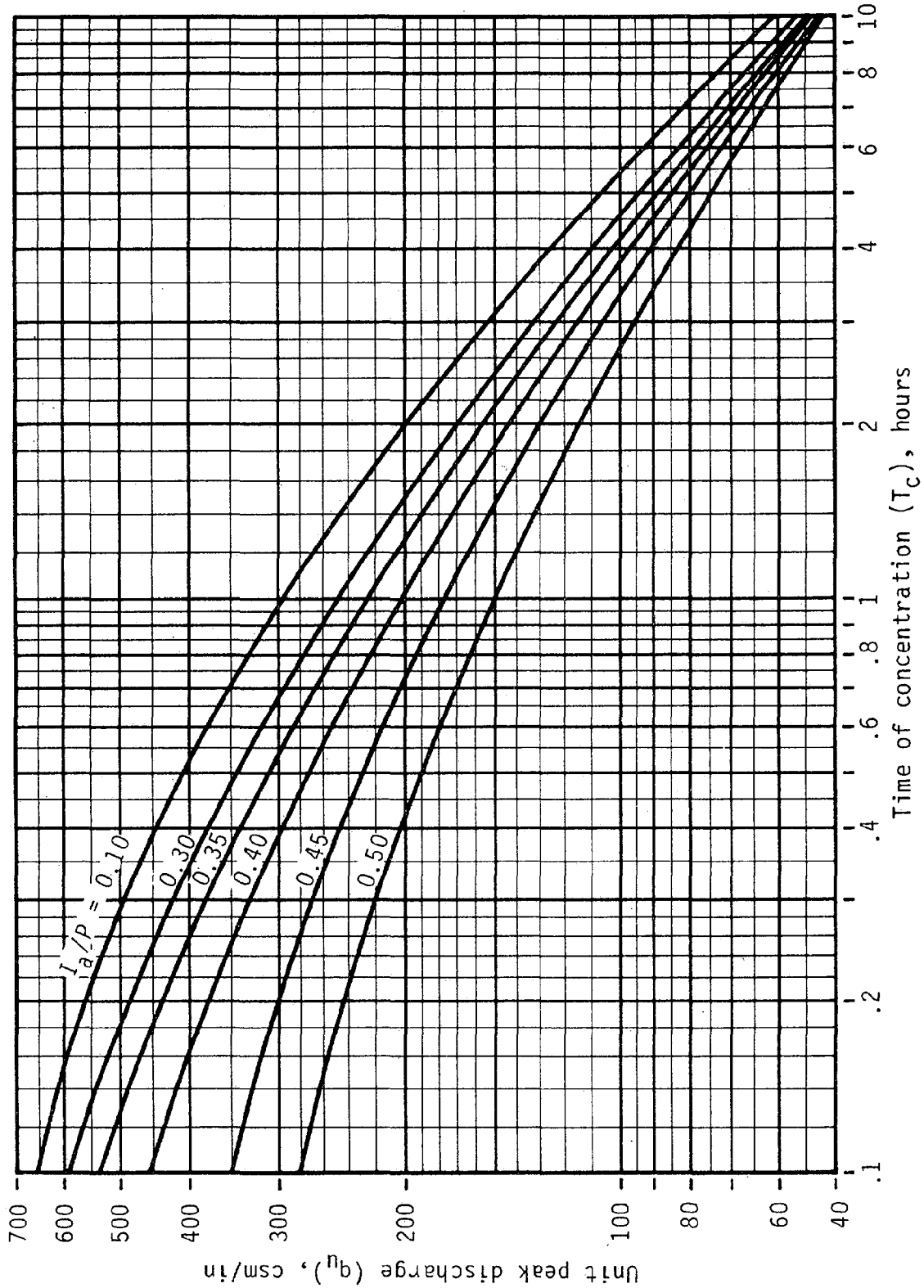


Exhibit 4-III: Unit peak discharge ($q_u$) for SCS type III rainfall distribution



# Chapter 5: Tabular Hydrograph method

This chapter presents the Tabular Hydrograph method of computing peak discharges from rural and urban areas, using time of concentration ($T_c$) and travel time ($T_t$) from a subarea as inputs. This method approximates TR-20, a more detailed hydrograph procedure (SCS 1983).

The Tabular method can develop partial composite flood hydrographs at any point in a watershed by dividing the watershed into homogeneous subareas. In this manner, the method can estimate runoff from nonhomogeneous watersheds. The method is especially applicable for estimating the effects of land use change in a portion of a watershed. It can also be used to estimate the effects of proposed structures.

Input data needed to develop a partial composite flood hydrograph include (1) 24-hour rainfall (in), (2) appropriate rainfall distribution (I, IA, II, or III), (3) CN, (4) $T_c$ (hr), (5) $T_t$ (hr), and (6) drainage area ($mi^2$).

## Tabular Hydrograph method exhibits

Exhibit 5 (5-I, 5-IA, 5-II, and 5-III) shows tabular discharge values for the various rainfall distributions. Tabular discharges expressed in csm/in (cubic feet of discharge per second per square mile of watershed per inch of runoff) are given for a range of subarea $T_c$'s from 0.1 to 2 hours and reach $T_t$'s from 0 to 3 hours.

The exhibit was developed by computing hydrographs for 1 square mile of drainage area for selected $T_c$'s and routing them through stream reaches with the range of $T_t$'s indicated. The Modified Att-Kin method for reach routing, formulated by SCS in the late 1970's, was used to compute the tabular hydrographs (Comer et al., 1981). A CN of 75 and rainfall amounts generating appropriate $I_a/P$ ratios were used. The resulting runoff estimate was used to convert the hydrographs in exhibits 5-I through 5-III to cubic feet per second per square mile per inch of runoff.

An assumption in development of the tabular hydrographs is that all discharges for a stream reach flow at the same velocity. By this assumption, the subarea flood hydrographs may be routed separately and added at the reference point. The tabular hydrographs in exhibit 5 are prerouted hydrographs. For $T_t$'s other than zero, the tabular discharge values represent the contribution from a single subarea to the composite hydrograph at $T_t$ downstream.

## Information required for Tabular Hydrograph method

The following information is required for the Tabular method:

1. Subdivision of the watershed into areas that are relatively homogeneous and have convenient routing reaches.
2. Drainage area of each subarea in square miles.
3. $T_c$ for each subarea in hours. The procedure for estimating $T_c$ is outlined in chapter 3. Worksheet 3 (appendix D) can be used to calculate $T_c$.
4. $T_t$ for each routing reach in hours. The procedure for estimating $T_t$ is outlined in chapter 3. Worksheet 3 can be used to calculate $T_t$ through a subarea for shallow concentrated and open channel flow.
5. Weighted CN for each subarea. Table 2-2 shows CN's for individual hydrologic soil cover combinations. Worksheet 2 can be used to calculate the weighted runoff curve number.
6. Appropriate rainfall distribution according to figure B-2 (appendix B).
7. The 24-hour rainfall for the selected frequency. Appendix B contains rainfall maps for various frequencies (figures B-3 to B-8).
8. Total runoff (Q) in inches computed from CN and rainfall.
9. $I_a$ for each subarea from table 5-1, which is the same as table 4-1.
10. Ratio of $I_a/P$ for each subarea. If the ratio for the rainfall distribution of interest is outside the range shown in exhibit 5, use the limiting value.

## Development of composite flood hydrograph

This section describes the procedure for developing the peak discharge and selected discharge values of a composite flood hydrograph.

### Selecting $T_c$ and $T_t$

First, use worksheet 5a to develop a summary of basic watershed data by subarea. Then use worksheet 5b to develop a tabular hydrograph discharge summary; this summary displays the effect of individual subarea hydrographs as routed to the watershed point of interest. Use $\Sigma T_t$ for each subarea as the total reach travel time from that subarea through the watershed to the point of interest. Compute the hydrograph coordinates for selected $\Sigma T_t$'s using the appropriate sheets in exhibit 5. The flow at any time is

$$q = q_t A_m Q \qquad \text{[Eq. 5-1]}$$

where

$q$ = hydrograph coordinate (cfs) at hydrograph time t;
$q_t$ = tabular hydrograph unit discharge from exhibit 5 (csm/in);
$A_m$ = drainage area of individual subarea (mi²); and
$Q$ = runoff (in).

Since the timing of peak discharge changes with $T_c$ and $T_t$, interpolation of peak discharge for $T_c$ and $T_t$ values for use in exhibit 5 is not recommended. Interpolation may result in an estimate of peak discharge that would be invalid because it would be lower than either of the hydrographs. Therefore, round the actual values of $T_c$ and $T_t$ to values presented in exhibit 5. Perform this rounding so that the sum of the selected table values is close to the sum of actual $T_c$ and $T_t$. An acceptable procedure is to select the results of one of three rounding operations:

1. Round $T_c$ and $T_t$ separately to the nearest table value and sum;
2. Round $T_c$ down and $T_t$ up to nearest table value and sum; and
3. Round $T_c$ up and $T_t$ down to nearest table value and sum.

From these three alternatives, choose the pair of rounded $T_c$ and $T_t$ values whose sum is closest to the sum of the actual $T_c$ and $T_t$. If two rounding methods produce sums equally close to the actual sum, use the combination in which rounded $T_c$ is closest to actual $T_c$. An illustration of the rounding procedure is as follows:

**Table 5-1.—$I_a$ values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|---|---|---|---|
| 40 | 3.000 | 70 | 0.857 |
| 41 | 2.878 | 71 | 0.817 |
| 42 | 2.762 | 72 | 0.778 |
| 43 | 2.651 | 73 | 0.740 |
| 44 | 2.545 | 74 | 0.703 |
| 45 | 2.444 | 75 | 0.667 |
| 46 | 2.348 | 76 | 0.632 |
| 47 | 2.255 | 77 | 0.597 |
| 48 | 2.167 | 78 | 0.564 |
| 49 | 2.082 | 79 | 0.532 |
| 50 | 2.000 | 80 | 0.500 |
| 51 | 1.922 | 81 | 0.469 |
| 52 | 1.846 | 82 | 0.439 |
| 53 | 1.774 | 83 | 0.410 |
| 54 | 1.704 | 84 | 0.381 |
| 55 | 1.636 | 85 | 0.353 |
| 56 | 1.571 | 86 | 0.326 |
| 57 | 1.509 | 87 | 0.299 |
| 58 | 1.448 | 88 | 0.273 |
| 59 | 1.390 | 89 | 0.247 |
| 60 | 1.333 | 90 | 0.222 |
| 61 | 1.279 | 91 | 0.198 |
| 62 | 1.226 | 92 | 0.174 |
| 63 | 1.175 | 93 | 0.151 |
| 64 | 1.125 | 94 | 0.128 |
| 65 | 1.077 | 95 | 0.105 |
| 66 | 1.030 | 96 | 0.083 |
| 67 | 0.985 | 97 | 0.062 |
| 68 | 0.941 | 98 | 0.041 |
| 69 | 0.899 | | |

| | Actual values | Table values by rounding method— | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| $T_c$ | 1.1 | 1.0 | 1.0 | 1.25 |
| $T_t$ | 1.7 | 1.5 | 2.0 | 1.5 |
| Sum | 2.8 | 2.5 | 3.0 | 2.75 |

In this instance, the results from method 3 would be selected because the sum 2.75 is closest to the actual sum of 2.8.

### Selecting $I_a/P$

The computed $I_a/P$ value can be rounded to the nearest $I_a/P$ value in exhibits 5-I through 5-III, or the hydrograph values (csm/in) can be linearly interpolated because $I_a/P$ interpolation generally involves peaks that occur at the same time.

### Summing for the composite hydrograph

The composite hydrograph is the summation of prerouted individual subarea hydrographs at each time shown on worksheet 5b. Only the times encompassing the expected maximum composite discharge are summed to define a portion of the composite hydrograph.

If desired, the entire composite hydrograph can be approximated by linear extrapolation as follows:

1. Set up a table similar to worksheet 5b. Include on this table the full range of hydrograph times displayed in exhibit 5.
2. Compute the subarea discharge values for those times and insert them in the table.
3. Sum the values to obtain the composite hydrograph.
4. Apply linear extrapolation to the first two points and the last two points of the composite hydrograph. The volume under this approximation of the entire composite hydrograph may differ from the computed runoff volume.

## Limitations

The Tabular method is used to determine peak flows and hydrographs within a watershed. However, its accuracy decreases as the complexity of the watershed increases. If you want to compare present and developed conditions of a watershed, use the same procedure for estimating $T_c$ for both conditions.

Use the TR-20 computer program (SCS-1983) instead of the Tabular method if any of the following conditions applies:

- $T_t$ is greater than 3 hours (largest $T_t$ in exhibit 5).
- $T_c$ is greater than 2 hours (largest $T_c$ in exhibit 5).
- Drainage areas of individual subareas differ by a factor of 5 or more.
- The entire composite flood hydrograph or entire runoff volume is required for detailed flood routings. The hydrograph based on extrapolation is only an approximation of the entire hydrograph.
- The time of peak discharge must be more accurate than that obtained through the Tabular method.

The composite flood hydrograph should be compared with actual stream gage data where possible. The instantaneous peak flow value from the composite flood hydrograph can be compared with data from USGS curves of peak flow versus drainage area.

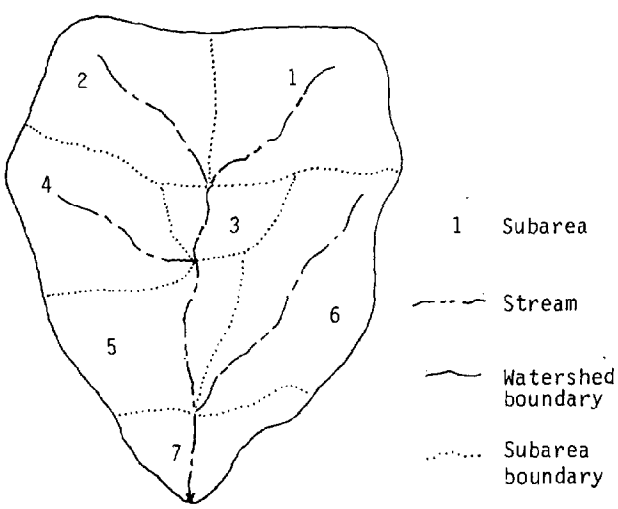
## Examples

A developer proposes to put a subdivision, Fallswood, in subareas 5, 6, and 7 of a watershed in Dyer County, northwestern Tennessee (see sketch below). Before approving the developer's proposal, the planning board wants to know how the development would affect the 25-year peak discharge at the downstream end of subarea 7. The rainfall distribution is type II (figure B-2), and the 24-hour rainfall (P) is 6.0 inches (figure B-6).

### Example 5-1

Compute the 25-year frequency peak discharge at the downstream end of subarea 7 for present conditions, using worksheets 5a and 5b. To do this, first calculate the present condition CN, $T_c$, and $T_t$ for each subarea, using the procedures in chapters 2 and 3. Enter the values on worksheet 5a (figure 5-1).

Next, compute the prerouted hydrograph points for each subarea hydrograph over a range of time near the peak discharge using worksheet 5b (figure 5-2) and the appropriate exhibit 5. For example, for subarea 4, in which $T_c = 0.75$ hr, refer to sheet 6 of exhibit 5-II. With $\Sigma T_t$ of 2.00 hr (the sum of downstream travel time through subareas 5 and 7 to the outlet) and $I_a/P$ of 0.1, the routed peak discharge of subarea 4 at the outlet of subarea 7 occurs at 14.6 hr and is 274 csm/in. Solving equation 5-1 with




appropriate values provides the peak discharge (q) for subarea 4 at 14.6 hr:

$$q = q_t(A_m Q) = (274)(0.70) = 192 \text{ cfs.}$$

Once all the prerouted subarea hydrographs have been tabulated on worksheet 5b, sum each of the time columns to obtain the composite hydrograph. The resulting 25-year frequency peak discharge is 720 cfs at 14.3 hr (figure 5-2).

### Example 5-2

Compute the 25-year frequency peak discharge at the downstream end of subarea 7 for the developed conditions, using worksheets 5a and 5b.

First, calculate the developed condition CN, $T_c$, and $T_t$ for each subarea, using the procedures in chapters 2 and 3. Enter the values on worksheet 5a (figure 5-3).

Next, compute the prerouted hydrograph points for each subarea hydrograph over a range of time near the peak discharge using worksheet 5b (figure 5-4) and the appropriate exhibit 5. For example, for subarea 6, in which $T_c = 1.0$ hr, refer to sheet 7 of exhibit 5-II. With $\Sigma T_t$ of 0.5 hr (downstream travel time through subarea 7 to the outlet) and $I_a/P$ of 0.1, the peak discharge of subarea 6 at the outlet of the watershed occurs at 13.2 hr and is 311 csm/in. Solving equation 5-1 provides the peak discharge (q):

$$q = q_t(A_m Q) = (311)(1.31) = 407 \text{ cfs.}$$

Once all the prerouted subarea hydrographs have been tabulated on worksheet 5b, sum each of the time columns to obtain the composite hydrograph. The resulting 25-year frequency peak discharge is 872 cfs at 13.6 hr (figure 5-4).

### Comparison

According to the results of the two examples, the proposed subdivision at the downstream end of subarea 7 is expected to increase peak discharge from 720 to 872 cfs and to decrease the time to peak from 14.3 to 13.6 hr.

## Worksheet 5a: Basic watershed data

Project Fallswood Location Dyer County, Tennessee By DW Date 10/1/85

Circle one: (Present) Developed _____ Frequency (yr) 25 Checked HH Date 10/3/85

| Subarea name | Drainage area $A_m$ ($mi^2$) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr Rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_m Q$ ($mi^2$-in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.30 | 1.50 | -- | 3, 5, 7 | 2.50 | 6.0 | 65 | 2.35 | 0.71 | 1.077 | 0.18 |
| 2 | 0.20 | 1.25 | -- | 3, 5, 7 | 2.50 | 6.0 | 70 | 2.80 | 0.56 | 0.857 | 0.14 |
| 3 | 0.10 | 0.50 | 0.50 | 5, 7 | 2.00 | 6.0 | 75 | 3.28 | 0.33 | 0.667 | 0.11 |
| 4 | 0.25 | 0.75 | -- | 5, 7 | 2.00 | 6.0 | 70 | 2.80 | 0.70 | 0.857 | 0.14 |
| 5 | 0.20 | 1.50 | 1.25 | 7 | 0.75 | 6.0 | 75 | 3.28 | 0.66 | 0.667 | 0.11 |
| 6 | 0.40 | 1.50 | -- | 7 | 0.75 | 6.0 | 70 | 2.80 | 1.12 | 0.857 | 0.14 |
| 7 | 0.20 | 1.25 | 0.75 | -- | 0 | 6.0 | 75 | 3.28 | 0.66 | 0.667 | 0.11 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | ↑ From worksheet 3 | | | | | ↑ From worksheet 2 | | | ↑ From table 5-1 | |

Figure 5-1.—Worksheet 5a for example 5-1.

## Worksheet 5b: Tabular hydrograph discharge summary

Project Fallswood Location Dyer County, Tennessee By DW Date 10/1/85

Circle one: (Present) Developed Frequency (yr) 25 Checked [illegible] Date 10/3/85

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sub-area $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ($mi^2$-in) | 12.7 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.3 | 14.6 | 15.0 | 15.5 |
| | | | | | Discharges at selected hydrograph times 3/ (cfs) | | | | | | | | | | | |
| 1 | 1.50 | 2.50 | 0.10 | 0.71 | 4 | 4 | 5 | 6 | 6 | 8 | 10 | 13 | 24 | 49 | 100 | 149 |
| 2 | 1.25 | 2.50 | 0.10 | 0.56 | 3 | 4 | 4 | 6 | 7 | 8 | 11 | 16 | 32 | 64 | 110 | 127 |
| 3 | 0.50 | 2.00 | 0.10 | 0.33 | 5 | 5 | 6 | 8 | 12 | 21 | 41 | 67 | 98 | 92 | 60 | 29 |
| 4 | 0.75 | 2.00 | 0.10 | 0.70 | 8 | 9 | 11 | 14 | 20 | 34 | 62 | 106 | 172 | 192 | 149 | 81 |
| 5 | 1.50 | 0.75 | 0.10 | 0.66 | 21 | 28 | 50 | 83 | 118 | 147 | 158 | 154 | 127 | 98 | 67 | 44 |
| 6 | 1.50 | 0.75 | 0.10 | 1.12 | 36 | 47 | 85 | 140 | 200 | 249 | 269 | 261 | 216 | 166 | 114 | 75 |
| 7 | 1.25 | 0 | 0.10 | 0.66 | 169 | 187 | 205 | 176 | 140 | 108 | 85 | 69 | 51 | 40 | 31 | 24 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | 246 | 284 | 366 | 433 | 503 | 575 | 636 | 686 | 720 | 701 | 631 | 529 |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

Figure 5-2.—Worksheet 5b for example 5-1.

## Worksheet 5a: Basic watershed data

Project Fallswood Location Dyer County, Tennessee By DW Date 10/1/85

Circle one: Present (Developed) Frequency (yr) 25 Checked XM Date 10/3/85

| Subarea name | Drainage area $A_m$ ($mi^2$) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr Rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_m Q$ ($mi^2$-in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.30 | 1.50 | -- | 3,5,7 | 2.00 | 6.0 | 65 | 2.35 | 0.71 | 1.077 | 0.18 |
| 2 | 0.20 | 1.25 | -- | 3,5,7 | 2.00 | 6.0 | 70 | 2.80 | 0.56 | 0.857 | 0.14 |
| 3 | 0.10 | 0.50 | 0.50 | 5,7 | 1.50 | 6.0 | 75 | 3.28 | 0.33 | 0.667 | 0.11 |
| 4 | 0.25 | 0.75 | -- | 5,7 | 1.50 | 6.0 | 70 | 2.80 | 0.70 | 0.857 | 0.14 |
| 5 | 0.20 | 1.50 | 1.00 | 7 | 0.50 | 6.0 | 85 | 4.31 | 0.86 | 0.353 | 0.06 |
| 6 | 0.40 | 1.00 | -- | 7 | 0.50 | 6.0 | 75 | 3.28 | 1.31 | 0.857 | 0.14 |
| 7 | 0.20 | 0.75 | 0.50 | -- | 0 | 6.0 | 90 | 4.85 | 0.97 | 0.222 | 0.04 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

↑ From worksheet 3 ↑ From worksheet 2 ↑ From table 5-1

Figure 5-3.—Worksheet 5a for example 5-2.

## Worksheet 5b: Tabular hydrograph discharge summary

Project Fallswood Location Dyer County, Tennessee By DW Date 10/1/85

Circle one: Present (Developed) Frequency (yr) 25 Checked XY Date 10/3/85

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sub-area $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ($mi^2$-in) | 12.7 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.3 | 14.6 | 15.0 | 15.5 |
| | | | | | Discharges at selected hydrograph times 3/ (cfs) | | | | | | | | | | | |
| 1 | 1.50 | 2.00 | 0.10 | 0.71 | 6 | 6 | 7 | 9 | 11 | 16 | 24 | 40 | 78 | 122 | 155 | 133 |
| 2 | 1.25 | 2.00 | 0.10 | 0.56 | 6 | 6 | 7 | 9 | 12 | 20 | 33 | 55 | 96 | 132 | 132 | 87 |
| 3 | 0.50 | 1.50 | 0.10 | 0.33 | 8 | 9 | 14 | 29 | 58 | 89 | 106 | 102 | 74 | 46 | 25 | 16 |
| 4 | 0.75 | 1.50 | 0.10 | 0.70 | 13 | 14 | 19 | 32 | 63 | 114 | 169 | 207 | 193 | 143 | 83 | 46 |
| 5 | 1.50 | 0.50 | 0.10 | 0.86 | 51 | 69 | 117 | 167 | 205 | 214 | 202 | 175 | 132 | 99 | 70 | 48 |
| 6 | 1.00 | 0.50 | 0.10 | 1.31 | 149 | 208 | 331 | 407 | 393 | 329 | 255 | 195 | 134 | 97 | 69 | 52 |
| 7 | 0.75 | 0 | 0.10 | 0.97 | 398 | 358 | 244 | 167 | 119 | 90 | 72 | 59 | 48 | 40 | 34 | 30 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | 631 | 670 | 739 | 820 | 861 | 872 | 861 | 833 | 755 | 679 | 568 | 412 |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

Figure 5-4.—Worksheet 5b for example 5-2.

## Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

TRVL ---------- HYDROGRAPH TIME (HOURS) ----------

| TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 30 | 40 | 56 | 183 | 337 | 304 | 326 | 155 | 122 | 107 | 93 | 81 | 73 | 66 | 60 | 56 | 54 | 52 | 49 | 46 | 44 | 40 | 36 | 32 | 30 | 29 | 28 | 27 | 26 | 24 | 20 | 13 |
| .10 | 26 | 35 | 48 | 93 | 153 | 276 | 428 | 360 | 223 | 156 | 123 | 103 | 83 | 72 | 65 | 59 | 56 | 54 | 51 | 47 | 45 | 42 | 37 | 33 | 30 | 29 | 28 | 28 | 26 | 24 | 21 | 13 |
| .20 | 23 | 30 | 41 | 60 | 82 | 129 | 227 | 361 | 360 | 269 | 194 | 147 | 118 | 85 | 71 | 63 | 58 | 55 | 53 | 49 | 46 | 43 | 39 | 35 | 31 | 29 | 29 | 28 | 26 | 24 | 21 | 14 |
| .30 | 22 | 29 | 39 | 56 | 73 | 111 | 188 | 303 | 341 | 293 | 227 | 173 | 136 | 94 | 75 | 65 | 60 | 56 | 54 | 50 | 47 | 43 | 39 | 35 | 31 | 29 | 29 | 28 | 26 | 25 | 21 | 14 |
| .40 | 18 | 25 | 34 | 46 | 53 | 66 | 96 | 157 | 255 | 312 | 300 | 251 | 199 | 126 | 90 | 73 | 64 | 59 | 56 | 52 | 48 | 44 | 40 | 36 | 32 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .50 | 15 | 24 | 32 | 44 | 50 | 61 | 84 | 133 | 214 | 280 | 293 | 265 | 221 | 144 | 99 | 77 | 66 | 60 | 56 | 52 | 49 | 45 | 41 | 37 | 32 | 30 | 29 | 28 | 27 | 25 | 21 | 14 |
| .75 | 14 | 19 | 25 | 34 | 38 | 43 | 49 | 62 | 88 | 134 | 190 | 234 | 252 | 221 | 162 | 115 | 87 | 71 | 63 | 56 | 52 | 47 | 43 | 39 | 35 | 31 | 29 | 29 | 27 | 25 | 22 | 15 |
| 1.0 | 11 | 14 | 19 | 26 | 28 | 31 | 34 | 38 | 44 | 52 | 68 | 98 | 141 | 222 | 238 | 191 | 139 | 101 | 79 | 63 | 56 | 51 | 45 | 41 | 37 | 33 | 30 | 29 | 27 | 26 | 22 | 15 |
| 1.5 | 9 | 10 | 13 | 17 | 18 | 20 | 22 | 25 | 27 | 30 | 34 | 38 | 44 | 74 | 132 | 191 | 211 | 190 | 151 | 101 | 73 | 58 | 50 | 45 | 41 | 37 | 33 | 30 | 28 | 27 | 23 | 16 |
| 2.0 | 6 | 7 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 20 | 22 | 24 | 29 | 38 | 58 | 97 | 148 | 193 | 193 | 141 | 89 | 61 | 51 | 46 | 41 | 37 | 33 | 29 | 27 | 24 | 17 |
| 2.5 | 4 | 5 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 16 | 19 | 23 | 29 | 39 | 58 | 93 | 154 | 181 | 147 | 87 | 61 | 51 | 45 | 41 | 37 | 30 | 28 | 25 | 18 |
| 3.0 | 2 | 3 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 13 | 15 | 19 | 23 | 28 | 39 | 72 | 124 | 170 | 138 | 86 | 61 | 50 | 45 | 40 | 33 | 29 | 26 | 19 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 61 | 195 | 343 | 232 | 129 | 113 | 103 | 91 | 81 | 76 | 71 | 66 | 64 | 62 | 61 | 59 | 56 | 54 | 51 | 47 | 43 | 40 | 40 | 39 | 39 | 37 | 36 | 31 | 21 |
| .10 | 0 | 0 | 0 | 12 | 45 | 145 | 277 | 247 | 169 | 131 | 112 | 98 | 87 | 76 | 70 | 65 | 64 | 62 | 60 | 57 | 55 | 53 | 49 | 44 | 40 | 40 | 39 | 39 | 38 | 36 | 32 | 21 |
| .20 | 0 | 0 | 0 | 9 | 33 | 107 | 220 | 238 | 192 | 151 | 125 | 107 | 94 | 79 | 71 | 66 | 64 | 62 | 61 | 58 | 56 | 53 | 49 | 45 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 21 |
| .30 | 0 | 0 | 0 | 1 | 6 | 24 | 79 | 173 | 216 | 200 | 168 | 139 | 118 | 90 | 77 | 70 | 66 | 64 | 62 | 59 | 57 | 54 | 50 | 46 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .40 | 0 | 0 | 0 | 1 | 4 | 17 | 59 | 135 | 189 | 196 | 177 | 152 | 129 | 97 | 81 | 72 | 67 | 64 | 63 | 60 | 57 | 54 | 51 | 46 | 42 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .50 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 43 | 104 | 161 | 185 | 180 | 161 | 121 | 93 | 79 | 71 | 66 | 64 | 61 | 58 | 55 | 52 | 48 | 43 | 40 | 40 | 39 | 38 | 37 | 33 | 22 |
| .75 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 18 | 49 | 92 | 130 | 153 | 159 | 142 | 114 | 92 | 79 | 71 | 66 | 63 | 60 | 56 | 53 | 49 | 44 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 27 | 56 | 92 | 144 | 152 | 128 | 103 | 86 | 75 | 67 | 63 | 59 | 55 | 51 | 47 | 43 | 40 | 40 | 39 | 37 | 34 | 24 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 32 | 79 | 121 | 136 | 127 | 109 | 85 | 72 | 64 | 58 | 55 | 51 | 47 | 43 | 40 | 39 | 38 | 34 | 25 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 33 | 70 | 105 | 126 | 118 | 97 | 75 | 63 | 58 | 54 | 50 | 46 | 42 | 40 | 39 | 35 | 26 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 32 | 63 | 105 | 118 | 100 | 75 | 63 | 58 | 54 | 50 | 46 | 40 | 39 | 36 | 27 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 12 | 43 | 84 | 112 | 96 | 74 | 63 | 58 | 54 | 50 | 42 | 40 | 37 | 28 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 3 | 13 | 28 | 39 | 44 | 45 | 46 | 46 | 48 | 49 | 51 | 53 | 54 | 54 | 55 | 56 | 55 | 53 | 50 | 50 | 49 | 49 | 49 | 49 | 48 | 45 | 32 |
| .10 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 22 | 33 | 41 | 44 | 45 | 46 | 48 | 49 | 50 | 52 | 54 | 54 | 54 | 56 | 55 | 53 | 50 | 50 | 49 | 49 | 49 | 49 | 48 | 45 | 32 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 17 | 28 | 36 | 41 | 44 | 46 | 48 | 49 | 51 | 53 | 54 | 54 | 56 | 56 | 54 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 45 | 32 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 23 | 32 | 38 | 44 | 47 | 48 | 50 | 51 | 53 | 54 | 54 | 55 | 54 | 52 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 18 | 27 | 34 | 43 | 46 | 48 | 49 | 51 | 53 | 54 | 54 | 55 | 54 | 52 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 15 | 23 | 36 | 43 | 46 | 48 | 50 | 51 | 53 | 54 | 55 | 55 | 53 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 34 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 27 | 37 | 43 | 46 | 48 | 50 | 52 | 54 | 55 | 55 | 54 | 51 | 50 | 50 | 49 | 49 | 48 | 46 | 34 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 20 | 32 | 40 | 45 | 47 | 50 | 52 | 54 | 55 | 54 | 52 | 50 | 50 | 49 | 49 | 49 | 47 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 23 | 33 | 42 | 47 | 51 | 54 | 55 | 54 | 53 | 50 | 50 | 49 | 49 | 48 | 37 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 12 | 25 | 37 | 46 | 51 | 54 | 53 | 54 | 52 | 50 | 49 | 49 | 48 | 39 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 31 | 45 | 51 | 53 | 55 | 54 | 52 | 50 | 49 | 48 | 41 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 32 | 45 | 51 | 53 | 54 | 54 | 51 | 49 | 48 | 42 |

RAINFALL TYPE = I  * * * TC = 0.1 HR * * *  SHEET 1 OF 10

## Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 28 | 37 | 52 | 126 | 220 | 379 | 405 | 267 | 168 | 129 | 108 | 92 | 80 | 69 | 62 | 58 | 55 | 53 | 50 | 47 | 44 | 41 | 37 | 33 | 30 | 29 | 28 | 27 | 26 | 24 | 21 | 13 |
| .10 | 24 | 32 | 44 | 71 | 108 | 182 | 313 | 375 | 303 | 213 | 157 | 124 | 103 | 78 | 68 | 61 | 57 | 55 | 52 | 49 | 46 | 42 | 38 | 34 | 30 | 29 | 29 | 28 | 26 | 24 | 21 | 14 |
| .20 | 21 | 28 | 38 | 53 | 65 | 94 | 153 | 260 | 336 | 314 | 247 | 187 | 145 | 97 | 77 | 67 | 60 | 57 | 54 | 50 | 47 | 44 | 39 | 35 | 31 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .30 | 20 | 27 | 36 | 50 | 60 | 82 | 129 | 216 | 296 | 308 | 267 | 214 | 168 | 110 | 82 | 69 | 62 | 58 | 55 | 51 | 47 | 44 | 40 | 36 | 32 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .40 | 17 | 23 | 31 | 42 | 47 | 56 | 74 | 111 | 181 | 258 | 291 | 275 | 234 | 152 | 103 | 79 | 68 | 61 | 57 | 53 | 49 | 45 | 41 | 37 | 33 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .50 | 16 | 22 | 30 | 40 | 45 | 52 | 66 | 96 | 153 | 223 | 269 | 273 | 247 | 171 | 115 | 86 | 71 | 63 | 58 | 54 | 50 | 46 | 42 | 37 | 33 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .75 | 13 | 17 | 24 | 32 | 35 | 39 | 44 | 52 | 68 | 99 | 145 | 194 | 229 | 240 | 183 | 132 | 97 | 77 | 66 | 58 | 53 | 48 | 44 | 39 | 35 | 31 | 30 | 29 | 27 | 26 | 22 | 15 |
| 1.0 | 11 | 13 | 17 | 24 | 26 | 29 | 32 | 35 | 39 | 45 | 56 | 75 | 107 | 189 | 229 | 206 | 158 | 115 | 88 | 67 | 58 | 52 | 46 | 42 | 38 | 34 | 31 | 29 | 28 | 26 | 23 | 15 |
| 1.5 | 8 | 10 | 12 | 15 | 17 | 19 | 21 | 23 | 25 | 28 | 31 | 35 | 39 | 60 | 106 | 166 | 204 | 197 | 165 | 112 | 79 | 60 | 51 | 46 | 42 | 37 | 33 | 30 | 28 | 27 | 23 | 16 |
| 2.0 | 5 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 20 | 22 | 27 | 34 | 49 | 79 | 126 | 169 | 188 | 152 | 97 | 64 | 52 | 46 | 42 | 38 | 34 | 29 | 28 | 24 | 17 |
| 2.5 | 3 | 5 | 6 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 18 | 22 | 26 | 34 | 49 | 77 | 136 | 176 | 155 | 95 | 64 | 52 | 46 | 42 | 37 | 31 | 28 | 25 | 18 |
| 3.0 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 13 | 16 | 19 | 23 | 29 | 49 | 91 | 154 | 167 | 102 | 67 | 53 | 47 | 42 | 34 | 29 | 26 | 19 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 22 | 76 | 206 | 258 | 207 | 144 | 119 | 104 | 92 | 82 | 74 | 68 | 65 | 63 | 62 | 60 | 57 | 55 | 52 | 48 | 44 | 40 | 40 | 39 | 39 | 38 | 36 | 32 | 21 |
| .10 | 0 | 0 | 0 | 3 | 16 | 56 | 156 | 224 | 213 | 167 | 135 | 114 | 99 | 81 | 73 | 67 | 65 | 63 | 61 | 58 | 56 | 53 | 50 | 45 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .20 | 0 | 0 | 0 | 2 | 11 | 41 | 118 | 189 | 205 | 179 | 150 | 126 | 108 | 85 | 75 | 69 | 65 | 63 | 62 | 59 | 56 | 54 | 50 | 46 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .30 | 0 | 0 | 0 | 0 | 2 | 8 | 30 | 88 | 155 | 188 | 182 | 161 | 138 | 103 | 83 | 74 | 68 | 65 | 63 | 60 | 57 | 55 | 51 | 47 | 42 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .40 | 0 | 0 | 0 | 0 | 1 | 6 | 22 | 66 | 126 | 167 | 177 | 166 | 147 | 111 | 88 | 76 | 69 | 66 | 63 | 61 | 58 | 55 | 51 | 47 | 43 | 40 | 40 | 39 | 38 | 37 | 33 | 22 |
| .50 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 16 | 50 | 100 | 145 | 167 | 166 | 136 | 105 | 85 | 75 | 69 | 65 | 62 | 59 | 56 | 53 | 49 | 44 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 22 | 50 | 87 | 119 | 140 | 148 | 124 | 101 | 85 | 74 | 69 | 64 | 61 | 57 | 54 | 50 | 45 | 42 | 40 | 40 | 38 | 37 | 33 | 23 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 11 | 28 | 55 | 114 | 142 | 135 | 113 | 93 | 80 | 69 | 64 | 60 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 37 | 34 | 24 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 17 | 52 | 97 | 124 | 129 | 115 | 91 | 75 | 65 | 59 | 55 | 52 | 48 | 43 | 41 | 39 | 38 | 35 | 25 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 19 | 49 | 84 | 111 | 120 | 102 | 79 | 65 | 59 | 55 | 51 | 47 | 43 | 40 | 39 | 36 | 26 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 20 | 45 | 89 | 113 | 104 | 78 | 65 | 59 | 55 | 51 | 47 | 41 | 39 | 36 | 28 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 30 | 68 | 108 | 99 | 77 | 65 | 58 | 54 | 50 | 43 | 40 | 37 | 29 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 15 | 28 | 38 | 43 | 45 | 45 | 48 | 49 | 50 | 52 | 53 | 53 | 53 | 53 | 53 | 53 | 50 | 50 | 50 | 49 | 49 | 49 | 48 | 45 | 32 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 22 | 32 | 40 | 43 | 45 | 47 | 48 | 50 | 52 | 53 | 53 | 53 | 53 | 53 | 53 | 50 | 50 | 50 | 49 | 49 | 49 | 48 | 45 | 32 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 17 | 27 | 36 | 41 | 43 | 46 | 48 | 49 | 51 | 53 | 53 | 53 | 53 | 53 | 53 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 45 | 33 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 13 | 23 | 31 | 38 | 41 | 45 | 48 | 49 | 51 | 52 | 53 | 53 | 53 | 53 | 53 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 19 | 27 | 34 | 39 | 44 | 47 | 49 | 50 | 52 | 53 | 53 | 53 | 53 | 53 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 23 | 30 | 36 | 43 | 46 | 48 | 50 | 51 | 53 | 53 | 53 | 53 | 53 | 52 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 14 | 20 | 27 | 37 | 43 | 46 | 48 | 50 | 52 | 53 | 53 | 53 | 53 | 52 | 50 | 50 | 50 | 49 | 49 | 48 | 46 | 34 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 14 | 26 | 36 | 42 | 46 | 48 | 51 | 52 | 53 | 53 | 53 | 52 | 50 | 50 | 49 | 49 | 49 | 47 | 35 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 23 | 33 | 40 | 46 | 49 | 52 | 53 | 53 | 53 | 51 | 50 | 50 | 49 | 49 | 48 | 37 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 26 | 37 | 44 | 50 | 52 | 53 | 53 | 53 | 51 | 50 | 49 | 49 | 48 | 38 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 19 | 31 | 43 | 50 | 52 | 53 | 53 | 52 | 51 | 50 | 49 | 48 | 39 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 25 | 41 | 49 | 52 | 53 | 53 | 52 | 50 | 49 | 48 | 41 |

RAINFALL TYPE = I  * * * TC = 0.2 HR * * *  SHEET 2 OF 10

## Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 25 | 34 | 46 | 87 | 138 | 242 | 349 | 346 | 256 | 182 | 141 | 115 | 97 | 76 | 66 | 60 | 57 | 54 | 52 | 48 | 45 | 42 | 38 | 34 | 30 | 29 | 28 | 28 | 26 | 24 | 21 | 13 |
| .10 | 24 | 32 | 44 | 77 | 118 | 200 | 299 | 330 | 281 | 215 | 166 | 132 | 109 | 82 | 69 | 62 | 58 | 55 | 52 | 49 | 46 | 42 | 38 | 34 | 30 | 29 | 29 | 28 | 26 | 24 | 21 | 14 |
| .20 | 21 | 28 | 38 | 54 | 69 | 102 | 167 | 255 | 305 | 289 | 240 | 190 | 152 | 103 | 79 | 67 | 61 | 57 | 54 | 50 | 47 | 44 | 40 | 35 | 31 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .30 | 20 | 27 | 36 | 51 | 63 | 89 | 141 | 217 | 276 | 285 | 255 | 212 | 172 | 115 | 85 | 71 | 63 | 58 | 55 | 51 | 48 | 44 | 40 | 36 | 32 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .40 | 17 | 23 | 31 | 42 | 48 | 58 | 79 | 120 | 185 | 246 | 272 | 260 | 228 | 156 | 108 | 82 | 69 | 62 | 57 | 53 | 49 | 45 | 41 | 37 | 33 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .50 | 16 | 22 | 30 | 40 | 45 | 54 | 70 | 104 | 158 | 216 | 253 | 258 | 238 | 173 | 120 | 89 | 72 | 63 | 58 | 54 | 50 | 46 | 42 | 37 | 33 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .75 | 13 | 17 | 24 | 32 | 35 | 39 | 45 | 54 | 72 | 104 | 147 | 189 | 219 | 231 | 182 | 135 | 100 | 79 | 67 | 58 | 53 | 48 | 44 | 40 | 35 | 32 | 30 | 29 | 27 | 26 | 22 | 15 |
| 1.0 | 11 | 13 | 17 | 24 | 26 | 29 | 32 | 35 | 40 | 46 | 58 | 79 | 110 | 184 | 221 | 202 | 158 | 118 | 90 | 68 | 58 | 52 | 46 | 42 | 38 | 34 | 31 | 29 | 28 | 26 | 23 | 15 |
| 1.5 | 8 | 10 | 12 | 15 | 17 | 19 | 21 | 23 | 25 | 28 | 31 | 35 | 40 | 62 | 107 | 163 | 199 | 193 | 165 | 114 | 81 | 61 | 52 | 46 | 42 | 37 | 33 | 31 | 28 | 27 | 23 | 16 |
| 2.0 | 5 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 20 | 22 | 27 | 35 | 50 | 80 | 125 | 165 | 184 | 152 | 99 | 64 | 53 | 47 | 42 | 38 | 34 | 29 | 28 | 24 | 17 |
| 2.5 | 3 | 5 | 6 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 18 | 22 | 27 | 35 | 50 | 78 | 134 | 173 | 154 | 96 | 64 | 52 | 46 | 42 | 37 | 31 | 28 | 25 | 18 |
| 3.0 | 2 | 3 | 4 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 12 | 14 | 17 | 21 | 26 | 34 | 61 | 107 | 164 | 145 | 94 | 64 | 52 | 46 | 41 | 33 | 29 | 26 | 19 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 8 | 32 | 98 | 198 | 217 | 192 | 148 | 125 | 108 | 95 | 79 | 72 | 67 | 64 | 63 | 61 | 58 | 56 | 53 | 49 | 45 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .10 | 0 | 0 | 0 | 1 | 6 | 23 | 73 | 156 | 197 | 194 | 164 | 138 | 118 | 91 | 77 | 70 | 66 | 64 | 62 | 59 | 57 | 54 | 50 | 46 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .20 | 0 | 0 | 0 | 1 | 4 | 17 | 54 | 122 | 172 | 187 | 171 | 149 | 128 | 98 | 81 | 72 | 67 | 64 | 63 | 60 | 57 | 54 | 51 | 46 | 42 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .30 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 40 | 95 | 146 | 173 | 172 | 157 | 120 | 94 | 79 | 71 | 67 | 64 | 61 | 58 | 55 | 52 | 48 | 43 | 40 | 40 | 39 | 38 | 37 | 33 | 23 |
| .40 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 30 | 73 | 122 | 156 | 167 | 160 | 128 | 100 | 83 | 73 | 68 | 65 | 62 | 59 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 38 | 37 | 33 | 23 |
| .50 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 22 | 56 | 100 | 137 | 157 | 159 | 135 | 107 | 87 | 76 | 69 | 65 | 62 | 59 | 56 | 53 | 49 | 44 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 26 | 53 | 86 | 115 | 143 | 134 | 113 | 93 | 80 | 72 | 65 | 62 | 58 | 54 | 51 | 46 | 42 | 40 | 40 | 39 | 37 | 33 | 23 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 32 | 57 | 111 | 138 | 132 | 113 | 94 | 81 | 69 | 64 | 60 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 37 | 34 | 24 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 34 | 74 | 111 | 126 | 121 | 99 | 80 | 67 | 61 | 56 | 53 | 49 | 44 | 41 | 39 | 38 | 35 | 26 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 33 | 66 | 97 | 118 | 108 | 84 | 67 | 60 | 56 | 52 | 48 | 44 | 40 | 39 | 36 | 27 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 32 | 74 | 106 | 112 | 83 | 67 | 60 | 56 | 52 | 48 | 41 | 39 | 37 | 28 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 21 | 54 | 98 | 107 | 81 | 67 | 60 | 55 | 51 | 43 | 40 | 37 | 29 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 16 | 27 | 36 | 41 | 44 | 46 | 48 | 49 | 51 | 52 | 52 | 52 | 52 | 52 | 52 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 22 | 31 | 38 | 42 | 45 | 48 | 49 | 51 | 52 | 52 | 52 | 52 | 52 | 52 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 18 | 27 | 34 | 39 | 44 | 47 | 49 | 50 | 51 | 52 | 52 | 52 | 52 | 52 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 14 | 23 | 30 | 36 | 43 | 46 | 48 | 50 | 51 | 52 | 52 | 52 | 52 | 52 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 11 | 19 | 26 | 33 | 41 | 46 | 48 | 49 | 51 | 52 | 52 | 52 | 52 | 52 | 52 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 15 | 23 | 30 | 39 | 44 | 47 | 49 | 50 | 51 | 52 | 52 | 52 | 52 | 52 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 8 | 14 | 20 | 31 | 40 | 44 | 47 | 49 | 51 | 52 | 52 | 52 | 52 | 52 | 50 | 50 | 50 | 49 | 49 | 48 | 46 | 34 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 9 | 20 | 31 | 39 | 44 | 47 | 50 | 51 | 52 | 52 | 52 | 52 | 50 | 50 | 50 | 49 | 49 | 47 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 18 | 28 | 36 | 44 | 48 | 51 | 52 | 52 | 52 | 51 | 50 | 50 | 49 | 49 | 48 | 37 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 12 | 21 | 33 | 42 | 48 | 51 | 52 | 52 | 52 | 51 | 50 | 49 | 49 | 48 | 38 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 15 | 27 | 40 | 48 | 51 | 52 | 52 | 52 | 51 | 50 | 49 | 48 | 40 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 11 | 25 | 41 | 48 | 51 | 52 | 52 | 51 | 50 | 49 | 48 | 41 |

RAINFALL TYPE = I  * * * TC = 0.3 HR * * *  SHEET 3 OF 10

# Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 23 | 31 | 42 | 66 | 96 | 157 | 250 | 310 | 304 | 244 | 186 | 149 | 122 | 89 | 73 | 64 | 59 | 56 | 53 | 49 | 46 | 43 | 39 | 35 | 31 | 29 | 29 | 28 | 26 | 25 | 21 | 14 |
| .10 | 22 | 29 | 40 | 61 | 84 | 133 | 211 | 277 | 295 | 261 | 211 | 170 | 138 | 98 | 78 | 66 | 60 | 56 | 54 | 50 | 47 | 43 | 39 | 35 | 31 | 29 | 29 | 28 | 26 | 25 | 21 | 14 |
| .20 | 19 | 26 | 34 | 47 | 56 | 75 | 114 | 178 | 244 | 278 | 267 | 230 | 190 | 128 | 93 | 75 | 65 | 59 | 56 | 52 | 48 | 44 | 40 | 36 | 32 | 30 | 29 | 28 | 27 | 25 | 21 | 14 |
| .30 | 18 | 24 | 33 | 45 | 53 | 67 | 98 | 152 | 213 | 257 | 263 | 241 | 207 | 143 | 102 | 80 | 68 | 61 | 57 | 52 | 49 | 45 | 41 | 37 | 32 | 30 | 29 | 28 | 27 | 25 | 21 | 14 |
| .40 | 15 | 21 | 28 | 38 | 43 | 49 | 61 | 86 | 130 | 185 | 233 | 253 | 245 | 188 | 132 | 97 | 77 | 66 | 60 | 55 | 51 | 46 | 42 | 38 | 34 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .50 | 15 | 20 | 27 | 36 | 41 | 46 | 56 | 76 | 112 | 161 | 209 | 238 | 243 | 201 | 146 | 106 | 82 | 69 | 61 | 55 | 51 | 47 | 42 | 38 | 34 | 31 | 29 | 29 | 27 | 25 | 22 | 14 |
| .75 | 12 | 16 | 21 | 29 | 32 | 35 | 39 | 46 | 57 | 77 | 108 | 147 | 184 | 220 | 200 | 157 | 118 | 91 | 74 | 61 | 55 | 50 | 45 | 40 | 36 | 32 | 30 | 29 | 27 | 26 | 22 | 15 |
| 1.0 | 10 | 12 | 16 | 21 | 24 | 26 | 29 | 32 | 36 | 40 | 48 | 61 | 83 | 147 | 202 | 212 | 178 | 138 | 105 | 75 | 62 | 54 | 47 | 43 | 39 | 35 | 31 | 29 | 28 | 26 | 23 | 16 |
| 1.5 | 8 | 9 | 11 | 14 | 16 | 17 | 19 | 21 | 23 | 25 | 28 | 31 | 35 | 50 | 83 | 134 | 179 | 193 | 177 | 131 | 92 | 65 | 53 | 47 | 42 | 38 | 34 | 31 | 29 | 27 | 24 | 16 |
| 2.0 | 5 | 6 | 8 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 20 | 25 | 31 | 42 | 64 | 102 | 144 | 179 | 163 | 111 | 70 | 55 | 48 | 43 | 39 | 35 | 30 | 28 | 25 | 17 |
| 2.5 | 3 | 4 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 20 | 24 | 30 | 42 | 63 | 114 | 160 | 170 | 107 | 70 | 54 | 47 | 43 | 38 | 31 | 29 | 25 | 18 |
| 3.0 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 13 | 16 | 19 | 23 | 30 | 51 | 90 | 148 | 161 | 104 | 69 | 54 | 47 | 42 | 34 | 29 | 26 | 19 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 3 | 14 | 48 | 115 | 184 | 192 | 178 | 148 | 127 | 111 | 88 | 77 | 70 | 66 | 64 | 62 | 59 | 56 | 54 | 50 | 46 | 41 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .10 | 0 | 0 | 0 | 0 | 2 | 10 | 35 | 89 | 152 | 179 | 178 | 158 | 137 | 105 | 85 | 75 | 69 | 65 | 63 | 60 | 58 | 55 | 51 | 47 | 42 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .20 | 0 | 0 | 0 | 0 | 2 | 7 | 26 | 68 | 124 | 161 | 172 | 163 | 146 | 113 | 90 | 78 | 70 | 66 | 64 | 61 | 58 | 55 | 52 | 47 | 43 | 40 | 40 | 39 | 38 | 37 | 33 | 22 |
| .30 | 0 | 0 | 0 | 0 | 1 | 5 | 19 | 52 | 100 | 140 | 162 | 162 | 151 | 120 | 96 | 81 | 72 | 67 | 64 | 61 | 59 | 55 | 52 | 48 | 43 | 41 | 40 | 39 | 38 | 37 | 33 | 23 |
| .40 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 39 | 80 | 120 | 148 | 158 | 142 | 114 | 92 | 79 | 71 | 67 | 63 | 60 | 57 | 53 | 49 | 45 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| .50 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 29 | 63 | 101 | 132 | 152 | 145 | 120 | 97 | 82 | 73 | 68 | 63 | 60 | 57 | 53 | 50 | 45 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 31 | 58 | 87 | 130 | 138 | 123 | 103 | 87 | 77 | 68 | 63 | 59 | 55 | 51 | 47 | 43 | 41 | 40 | 39 | 37 | 34 | 24 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 18 | 36 | 86 | 125 | 134 | 122 | 104 | 88 | 73 | 66 | 61 | 57 | 53 | 49 | 45 | 41 | 40 | 39 | 38 | 34 | 24 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 36 | 75 | 109 | 124 | 120 | 100 | 81 | 68 | 61 | 56 | 53 | 49 | 44 | 41 | 40 | 38 | 35 | 26 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 22 | 50 | 83 | 116 | 116 | 91 | 70 | 61 | 57 | 53 | 49 | 45 | 40 | 39 | 36 | 27 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 22 | 60 | 97 | 111 | 88 | 70 | 61 | 56 | 53 | 48 | 42 | 39 | 37 | 28 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 14 | 43 | 89 | 106 | 86 | 69 | 61 | 56 | 52 | 44 | 40 | 37 | 29 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 17 | 27 | 34 | 40 | 44 | 47 | 49 | 50 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 50 | 50 | 49 | 49 | 49 | 48 | 46 | 33 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 22 | 30 | 40 | 45 | 47 | 49 | 50 | 51 | 51 | 51 | 51 | 51 | 51 | 50 | 50 | 50 | 49 | 49 | 48 | 46 | 34 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 18 | 33 | 41 | 45 | 48 | 49 | 51 | 51 | 51 | 51 | 51 | 51 | 50 | 50 | 50 | 49 | 49 | 49 | 46 | 34 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 22 | 35 | 42 | 46 | 48 | 50 | 51 | 51 | 51 | 51 | 51 | 51 | 50 | 50 | 49 | 49 | 49 | 47 | 35 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 19 | 32 | 40 | 45 | 47 | 49 | 51 | 51 | 51 | 51 | 51 | 51 | 50 | 50 | 49 | 49 | 49 | 47 | 35 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 23 | 34 | 41 | 45 | 48 | 50 | 51 | 51 | 51 | 51 | 51 | 50 | 50 | 49 | 49 | 49 | 47 | 35 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 26 | 35 | 42 | 46 | 49 | 50 | 51 | 51 | 51 | 51 | 50 | 50 | 50 | 49 | 49 | 47 | 36 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 25 | 35 | 44 | 48 | 50 | 51 | 51 | 51 | 51 | 50 | 50 | 49 | 49 | 48 | 37 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 27 | 39 | 47 | 50 | 51 | 51 | 51 | 51 | 50 | 49 | 49 | 48 | 39 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 21 | 36 | 47 | 50 | 51 | 51 | 51 | 51 | 50 | 49 | 48 | 40 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 19 | 37 | 47 | 50 | 51 | 51 | 51 | 50 | 49 | 48 | 42 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 25 | 40 | 48 | 50 | 51 | 51 | 50 | 50 | 49 | 43 |

RAINFALL TYPE = I  * * * TC = 0.4 HR * * *  SHEET 4 OF 10

## Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 21 | 28 | 38 | 56 | 73 | 111 | 175 | 247 | 282 | 271 | 229 | 186 | 152 | 108 | 84 | 71 | 63 | 58 | 55 | 51 | 47 | 44 | 40 | 35 | 31 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .10 | 20 | 27 | 36 | 52 | 66 | 96 | 149 | 214 | 259 | 267 | 242 | 204 | 169 | 119 | 90 | 74 | 65 | 59 | 55 | 51 | 48 | 44 | 40 | 36 | 32 | 30 | 29 | 28 | 26 | 25 | 21 | 14 |
| .20 | 17 | 23 | 31 | 42 | 49 | 60 | 84 | 127 | 185 | 234 | 256 | 247 | 219 | 156 | 112 | 86 | 72 | 63 | 58 | 53 | 49 | 45 | 41 | 37 | 33 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .30 | 16 | 22 | 30 | 40 | 46 | 55 | 74 | 110 | 160 | 210 | 241 | 245 | 227 | 171 | 123 | 93 | 76 | 66 | 59 | 54 | 50 | 46 | 42 | 38 | 33 | 30 | 29 | 28 | 27 | 25 | 22 | 14 |
| .40 | 14 | 19 | 26 | 35 | 38 | 43 | 51 | 67 | 95 | 138 | 186 | 222 | 237 | 210 | 157 | 115 | 89 | 73 | 64 | 57 | 52 | 47 | 43 | 39 | 35 | 31 | 29 | 29 | 27 | 25 | 22 | 15 |
| .50 | 14 | 18 | 25 | 33 | 37 | 41 | 48 | 61 | 84 | 120 | 164 | 203 | 229 | 216 | 170 | 126 | 96 | 77 | 66 | 58 | 53 | 48 | 43 | 39 | 35 | 31 | 30 | 29 | 27 | 25 | 22 | 15 |
| .75 | 11 | 14 | 19 | 26 | 29 | 32 | 35 | 40 | 48 | 61 | 83 | 114 | 148 | 202 | 210 | 176 | 137 | 106 | 84 | 66 | 57 | 51 | 46 | 41 | 37 | 33 | 30 | 29 | 28 | 26 | 22 | 15 |
| 1.0 | 10 | 11 | 15 | 19 | 21 | 24 | 26 | 29 | 32 | 36 | 41 | 50 | 65 | 116 | 176 | 203 | 190 | 156 | 122 | 85 | 67 | 56 | 49 | 44 | 40 | 35 | 32 | 30 | 28 | 26 | 23 | 16 |
| 1.5 | 7 | 9 | 11 | 13 | 14 | 16 | 17 | 19 | 21 | 23 | 25 | 28 | 31 | 42 | 67 | 110 | 157 | 187 | 133 | 146 | 104 | 72 | 55 | 48 | 43 | 39 | 35 | 32 | 29 | 27 | 24 | 17 |
| 2.0 | 4 | 6 | 7 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 22 | 27 | 36 | 53 | 33 | 123 | 175 | 175 | 124 | 77 | 57 | 49 | 44 | 40 | 35 | 30 | 28 | 25 | 18 |
| 2.5 | 3 | 4 | 5 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 15 | 18 | 22 | 27 | 36 | 53 | 97 | 146 | 166 | 119 | 76 | 57 | 49 | 44 | 39 | 32 | 29 | 25 | 18 |
| 3.0 | 1 | 2 | 3 | 5 | 5 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 11 | 12 | 15 | 17 | 21 | 27 | 43 | 76 | 135 | 158 | 114 | 75 | 57 | 48 | 43 | 35 | 30 | 26 | 19 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 1 | 6 | 22 | 64 | 123 | 168 | 174 | 165 | 143 | 126 | 100 | 84 | 74 | 68 | 65 | 63 | 60 | 57 | 54 | 51 | 47 | 42 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .10 | 0 | 0 | 0 | 1 | 5 | 16 | 48 | 98 | 144 | 164 | 165 | 150 | 134 | 106 | 87 | 77 | 70 | 66 | 63 | 60 | 58 | 55 | 51 | 47 | 42 | 40 | 40 | 39 | 38 | 36 | 32 | 22 |
| .20 | 0 | 0 | 0 | 0 | 1 | 3 | 12 | 36 | 77 | 122 | 150 | 160 | 154 | 126 | 101 | 85 | 75 | 69 | 65 | 62 | 59 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 38 | 37 | 33 | 23 |
| .30 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 27 | 60 | 101 | 134 | 151 | 153 | 132 | 107 | 89 | 77 | 70 | 66 | 63 | 60 | 56 | 53 | 49 | 44 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 20 | 47 | 83 | 117 | 140 | 148 | 125 | 102 | 86 | 76 | 69 | 64 | 61 | 57 | 54 | 50 | 46 | 42 | 40 | 40 | 39 | 37 | 33 | 23 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 36 | 68 | 101 | 127 | 144 | 130 | 108 | 90 | 78 | 71 | 65 | 62 | 58 | 54 | 50 | 46 | 42 | 40 | 40 | 39 | 37 | 33 | 23 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 17 | 36 | 60 | 87 | 125 | 133 | 121 | 103 | 88 | 78 | 68 | 63 | 59 | 55 | 52 | 47 | 43 | 41 | 40 | 39 | 37 | 34 | 24 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 21 | 62 | 106 | 130 | 126 | 112 | 96 | 78 | 69 | 62 | 57 | 54 | 50 | 46 | 42 | 40 | 39 | 38 | 34 | 25 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 23 | 56 | 92 | 115 | 120 | 106 | 87 | 71 | 62 | 57 | 53 | 49 | 45 | 42 | 40 | 38 | 35 | 26 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 36 | 67 | 104 | 113 | 96 | 74 | 63 | 58 | 54 | 50 | 46 | 40 | 39 | 36 | 27 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 47 | 85 | 109 | 93 | 73 | 63 | 57 | 53 | 49 | 42 | 40 | 37 | 28 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 32 | 77 | 105 | 90 | 72 | 62 | 57 | 53 | 45 | 40 | 38 | 30 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 18 | 26 | 33 | 41 | 45 | 47 | 49 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 48 | 46 | 33 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 22 | 30 | 39 | 44 | 47 | 49 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 48 | 46 | 34 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 12 | 19 | 26 | 37 | 43 | 46 | 48 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 48 | 46 | 34 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 16 | 23 | 34 | 41 | 45 | 48 | 49 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 49 | 46 | 34 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 19 | 31 | 39 | 44 | 47 | 49 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 49 | 46 | 34 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 10 | 16 | 28 | 37 | 43 | 46 | 48 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 49 | 46 | 34 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 20 | 30 | 38 | 43 | 46 | 48 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 49 | 47 | 35 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 20 | 30 | 38 | 43 | 47 | 49 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 47 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 14 | 23 | 31 | 41 | 46 | 49 | 50 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 48 | 38 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 25 | 36 | 45 | 49 | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 48 | 39 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 23 | 37 | 46 | 49 | 50 | 50 | 50 | 50 | 50 | 49 | 48 | 40 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 21 | 37 | 46 | 49 | 50 | 50 | 50 | 50 | 50 | 49 | 48 | 42 |

RAINFALL TYPE = I  * * * TC = 0.5 HR * * *  SHEET 5 OF 10

# Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 16 | 22 | 30 | 41 | 47 | 59 | 82 | 119 | 167 | 209 | 229 | 233 | 212 | 161 | 122 | 97 | 80 | 69 | 62 | 56 | 51 | 46 | 42 | 38 | 33 | 31 | 29 | 28 | 27 | 25 | 22 | 14 |
| .10 | 14 | 19 | 26 | 35 | 39 | 44 | 54 | 72 | 104 | 146 | 188 | 215 | 227 | 197 | 150 | 116 | 93 | 77 | 68 | 59 | 53 | 48 | 43 | 39 | 35 | 31 | 30 | 29 | 27 | 25 | 22 | 15 |
| .20 | 13 | 16 | 22 | 30 | 33 | 37 | 42 | 50 | 65 | 91 | 128 | 168 | 200 | 218 | 183 | 142 | 110 | 89 | 75 | 63 | 56 | 49 | 44 | 40 | 36 | 32 | 30 | 29 | 27 | 26 | 22 | 15 |
| .30 | 12 | 16 | 21 | 28 | 31 | 35 | 39 | 46 | 59 | 80 | 112 | 149 | 183 | 214 | 191 | 151 | 118 | 94 | 79 | 65 | 57 | 50 | 45 | 41 | 36 | 32 | 30 | 29 | 27 | 26 | 22 | 15 |
| .40 | 12 | 15 | 20 | 27 | 30 | 33 | 37 | 43 | 54 | 71 | 98 | 132 | 166 | 207 | 197 | 161 | 126 | 100 | 83 | 67 | 58 | 51 | 45 | 41 | 37 | 33 | 30 | 29 | 27 | 26 | 22 | 15 |
| .50 | 11 | 13 | 18 | 24 | 26 | 29 | 32 | 36 | 41 | 49 | 64 | 87 | 117 | 178 | 204 | 186 | 152 | 120 | 96 | 74 | 62 | 53 | 47 | 42 | 38 | 34 | 31 | 29 | 28 | 26 | 23 | 15 |
| .75 | 10 | 12 | 15 | 21 | 23 | 25 | 28 | 31 | 35 | 40 | 49 | 63 | 83 | 136 | 180 | 190 | 171 | 142 | 115 | 85 | 69 | 57 | 49 | 44 | 39 | 35 | 32 | 30 | 28 | 26 | 23 | 16 |
| 1.0 | 8 | 10 | 12 | 16 | 17 | 19 | 21 | 23 | 25 | 28 | 31 | 35 | 42 | 66 | 110 | 158 | 186 | 180 | 157 | 116 | 86 | 65 | 53 | 46 | 42 | 38 | 34 | 31 | 28 | 27 | 23 | 16 |
| 1.5 | 5 | 7 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 20 | 22 | 27 | 35 | 52 | 83 | 124 | 159 | 174 | 147 | 102 | 69 | 54 | 47 | 42 | 38 | 34 | 30 | 28 | 24 | 17 |
| 2.0 | 3 | 5 | 6 | 8 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 18 | 22 | 27 | 36 | 52 | 80 | 131 | 165 | 148 | 99 | 68 | 54 | 47 | 42 | 38 | 31 | 28 | 25 | 18 |
| 2.5 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 14 | 17 | 21 | 26 | 35 | 63 | 107 | 157 | 141 | 96 | 67 | 54 | 46 | 42 | 34 | 29 | 26 | 19 |
| 3.0 | 1 | 1 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 10 | 11 | 13 | 15 | 19 | 26 | 42 | 36 | 151 | 141 | 101 | 71 | 55 | 47 | 38 | 31 | 27 | 20 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 35 | 69 | 105 | 131 | 143 | 146 | 124 | 104 | 89 | 79 | 72 | 68 | 64 | 60 | 56 | 53 | 49 | 44 | 41 | 40 | 40 | 38 | 37 | 33 | 23 |
| .10 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 27 | 55 | 88 | 117 | 134 | 142 | 118 | 100 | 87 | 77 | 71 | 66 | 62 | 58 | 54 | 50 | 46 | 42 | 40 | 40 | 39 | 37 | 33 | 23 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 20 | 43 | 73 | 102 | 123 | 137 | 123 | 105 | 90 | 80 | 73 | 66 | 62 | 58 | 54 | 50 | 46 | 42 | 40 | 40 | 39 | 37 | 33 | 23 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 34 | 60 | 88 | 128 | 134 | 118 | 101 | 88 | 78 | 69 | 64 | 60 | 55 | 52 | 48 | 43 | 41 | 40 | 39 | 37 | 34 | 24 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 27 | 49 | 75 | 118 | 131 | 121 | 105 | 91 | 80 | 71 | 65 | 60 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 37 | 34 | 24 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 21 | 39 | 87 | 122 | 128 | 116 | 101 | 88 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 42 | 40 | 39 | 38 | 34 | 24 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 21 | 56 | 95 | 118 | 121 | 110 | 98 | 82 | 72 | 64 | 58 | 54 | 50 | 46 | 42 | 41 | 39 | 38 | 34 | 25 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 12 | 39 | 76 | 106 | 119 | 115 | 98 | 82 | 69 | 61 | 57 | 53 | 49 | 44 | 42 | 40 | 38 | 35 | 26 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 37 | 67 | 95 | 112 | 105 | 85 | 69 | 61 | 56 | 52 | 48 | 44 | 40 | 39 | 36 | 27 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 15 | 35 | 74 | 102 | 107 | 84 | 69 | 61 | 56 | 52 | 48 | 41 | 39 | 37 | 28 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 23 | 55 | 94 | 103 | 82 | 68 | 60 | 56 | 52 | 44 | 40 | 37 | 29 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 50 | 93 | 100 | 81 | 68 | 60 | 55 | 47 | 41 | 38 | 30 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 29 | 37 | 42 | 45 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 34 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 8 | 14 | 26 | 35 | 41 | 45 | 47 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 35 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 11 | 23 | 33 | 39 | 44 | 47 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 35 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 20 | 30 | 38 | 43 | 46 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 35 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 17 | 28 | 36 | 41 | 45 | 47 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 35 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 15 | 25 | 34 | 40 | 44 | 47 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 35 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 9 | 16 | 27 | 35 | 40 | 44 | 47 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 47 | 36 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 18 | 27 | 35 | 40 | 45 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 48 | 37 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 21 | 29 | 38 | 44 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 48 | 38 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 15 | 26 | 36 | 44 | 48 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 48 | 39 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 21 | 34 | 44 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 40 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 19 | 35 | 44 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 42 |

RAINFALL TYPE = I  * * * TC = 0.75 HR * * *  SHEET [illegible] OF [illegible]

## Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 14 | 19 | 25 | 34 | 38 | 46 | 58 | 79 | 106 | 136 | 165 | 186 | 202 | 185 | 153 | 122 | 101 | 85 | 74 | 63 | 56 | 50 | 44 | 40 | 35 | 32 | 30 | 29 | 27 | 26 | 22 | 15 |
| .10 | 13 | 18 | 24 | 32 | 36 | 42 | 53 | 70 | 94 | 122 | 151 | 174 | 194 | 188 | 160 | 130 | 106 | 89 | 77 | 65 | 57 | 50 | 44 | 40 | 36 | 32 | 30 | 29 | 27 | 26 | 22 | 15 |
| .20 | 12 | 15 | 21 | 28 | 31 | 34 | 40 | 49 | 63 | 83 | 109 | 137 | 162 | 190 | 180 | 152 | 124 | 102 | 86 | 70 | 61 | 53 | 46 | 41 | 37 | 33 | 31 | 29 | 27 | 26 | 22 | 15 |
| .30 | 12 | 15 | 20 | 26 | 29 | 33 | 37 | 45 | 57 | 75 | 98 | 124 | 149 | 187 | 183 | 159 | 131 | 107 | 90 | 73 | 62 | 53 | 47 | 42 | 37 | 33 | 31 | 29 | 28 | 26 | 23 | 15 |
| .40 | 10 | 13 | 17 | 23 | 25 | 28 | 31 | 35 | 42 | 52 | 67 | 88 | 112 | 160 | 183 | 176 | 151 | 125 | 103 | 81 | 67 | 56 | 48 | 43 | 39 | 35 | 31 | 30 | 28 | 26 | 23 | 15 |
| .50 | 10 | 13 | 16 | 22 | 24 | 27 | 30 | 33 | 39 | 48 | 61 | 79 | 101 | 148 | 181 | 181 | 157 | 131 | 108 | 84 | 69 | 58 | 49 | 43 | 39 | 35 | 32 | 30 | 28 | 26 | 23 | 16 |
| .75 | 9 | 11 | 14 | 19 | 21 | 23 | 26 | 29 | 33 | 38 | 47 | 59 | 75 | 115 | 153 | 172 | 167 | 148 | 125 | 96 | 77 | 62 | 51 | 45 | 40 | 36 | 33 | 30 | 28 | 27 | 23 | 16 |
| 1.0 | 8 | 9 | 11 | 15 | 16 | 17 | 19 | 21 | 23 | 26 | 29 | 33 | 40 | 61 | 95 | 134 | 162 | 169 | 157 | 126 | 97 | 72 | 57 | 49 | 43 | 39 | 35 | 32 | 29 | 27 | 24 | 16 |
| 1.5 | 5 | 6 | 8 | 10 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 19 | 21 | 25 | 33 | 48 | 74 | 107 | 138 | 160 | 148 | 111 | 76 | 59 | 50 | 44 | 39 | 35 | 30 | 28 | 25 | 17 |
| 2.0 | 3 | 4 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 17 | 20 | 25 | 33 | 48 | 71 | 115 | 153 | 153 | 108 | 75 | 58 | 49 | 43 | 39 | 32 | 29 | 25 | 18 |
| 2.5 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 12 | 14 | 16 | 20 | 25 | 33 | 56 | 94 | 139 | 147 | 104 | 74 | 58 | 49 | 43 | 34 | 30 | 26 | 19 |
| 3.0 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 17 | 24 | 38 | 76 | 131 | 143 | 108 | 78 | 60 | 50 | 39 | 32 | 27 | 20 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 17 | 34 | 55 | 79 | 99 | 114 | 128 | 114 | 100 | 89 | 80 | 74 | 68 | 63 | 59 | 54 | 51 | 46 | 43 | 41 | 40 | 39 | 37 | 33 | 23 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 13 | 27 | 46 | 68 | 89 | 116 | 124 | 110 | 98 | 87 | 79 | 71 | 65 | 60 | 56 | 52 | 48 | 43 | 41 | 40 | 39 | 37 | 34 | 24 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 21 | 37 | 58 | 78 | 109 | 121 | 113 | 101 | 90 | 81 | 72 | 66 | 61 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 37 | 34 | 24 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 17 | 31 | 49 | 87 | 113 | 118 | 109 | 98 | 87 | 76 | 69 | 63 | 57 | 53 | 49 | 45 | 42 | 40 | 39 | 38 | 34 | 24 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 25 | 41 | 78 | 107 | 117 | 111 | 101 | 90 | 78 | 70 | 63 | 58 | 54 | 50 | 45 | 42 | 41 | 39 | 38 | 34 | 25 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 10 | 20 | 34 | 69 | 100 | 115 | 113 | 103 | 93 | 80 | 71 | 64 | 58 | 54 | 50 | 46 | 42 | 41 | 39 | 38 | 34 | 25 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 31 | 61 | 90 | 107 | 110 | 104 | 90 | 79 | 69 | 61 | 56 | 52 | 48 | 44 | 41 | 40 | 38 | 35 | 25 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 12 | 33 | 61 | 89 | 105 | 109 | 99 | 86 | 73 | 64 | 58 | 54 | 50 | 45 | 42 | 40 | 38 | 35 | 26 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 31 | 55 | 80 | 104 | 104 | 88 | 73 | 63 | 58 | 53 | 49 | 45 | 41 | 39 | 36 | 27 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 20 | 51 | 82 | 100 | 90 | 74 | 64 | 58 | 54 | 50 | 42 | 40 | 37 | 28 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 13 | 37 | 76 | 98 | 88 | 73 | 64 | 58 | 53 | 45 | 41 | 38 | 30 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 34 | 77 | 95 | 86 | 73 | 63 | 58 | 49 | 42 | 38 | 31 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 9 | 18 | 28 | 35 | 40 | 44 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 35 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 16 | 25 | 33 | 39 | 43 | 46 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 35 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 6 | 14 | 23 | 31 | 38 | 42 | 45 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 36 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 12 | 21 | 29 | 36 | 41 | 44 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 36 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 10 | 19 | 27 | 34 | 40 | 44 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 36 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 8 | 16 | 25 | 33 | 38 | 43 | 46 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 36 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 8 | 15 | 23 | 30 | 36 | 41 | 45 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 47 | 36 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 19 | 27 | 33 | 41 | 45 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 37 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 17 | 28 | 37 | 44 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 39 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 16 | 26 | 38 | 45 | 47 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 40 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 12 | 24 | 38 | 45 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 41 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 29 | 40 | 46 | 47 | 47 | 47 | 47 | 47 | 47 | 42 |

RAINFALL TYPE = I  * * * TC = 1.0 HR * * *  SHEET 7 OF 10

# Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 12 | 16 | 22 | 29 | 33 | 38 | 47 | 61 | 80 | 103 | 127 | 149 | 164 | 180 | 163 | 138 | 115 | 98 | 85 | 71 | 62 | 53 | 47 | 41 | 37 | 33 | 31 | 29 | 27 | 26 | 22 | 15 |
| .10 | 11 | 14 | 19 | 25 | 28 | 31 | 36 | 44 | 55 | 72 | 92 | 116 | 138 | 167 | 175 | 156 | 132 | 111 | 95 | 77 | 66 | 56 | 48 | 43 | 38 | 34 | 31 | 30 | 28 | 26 | 23 | 15 |
| .20 | 11 | 14 | 18 | 24 | 27 | 30 | 34 | 40 | 50 | 65 | 83 | 105 | 127 | 160 | 172 | 160 | 138 | 116 | 99 | 80 | 68 | 57 | 49 | 43 | 39 | 34 | 31 | 30 | 28 | 26 | 23 | 15 |
| .30 | 10 | 12 | 16 | 21 | 23 | 25 | 28 | 32 | 38 | 46 | 58 | 75 | 95 | 136 | 164 | 169 | 154 | 132 | 112 | 89 | 74 | 61 | 51 | 45 | 40 | 36 | 32 | 30 | 28 | 26 | 23 | 16 |
| .40 | 9 | 12 | 15 | 20 | 22 | 24 | 27 | 30 | 35 | 42 | 53 | 68 | 86 | 126 | 157 | 167 | 157 | 137 | 117 | 92 | 76 | 62 | 52 | 46 | 40 | 36 | 33 | 30 | 28 | 26 | 23 | 16 |
| .50 | 9 | 11 | 13 | 17 | 19 | 21 | 23 | 26 | 29 | 33 | 39 | 49 | 61 | 97 | 134 | 160 | 165 | 152 | 132 | 104 | 84 | 67 | 55 | 47 | 42 | 37 | 33 | 31 | 28 | 27 | 23 | 16 |
| .75 | 7 | 9 | 11 | 14 | 15 | 17 | 18 | 20 | 22 | 25 | 28 | 32 | 38 | 59 | 90 | 124 | 150 | 159 | 152 | 126 | 101 | 77 | 60 | 51 | 45 | 40 | 35 | 32 | 29 | 27 | 24 | 17 |
| 1.0 | 6 | 8 | 10 | 12 | 13 | 14 | 15 | 17 | 19 | 20 | 23 | 25 | 29 | 40 | 60 | 91 | 123 | 148 | 157 | 144 | 118 | 88 | 66 | 54 | 47 | 41 | 37 | 33 | 29 | 27 | 24 | 17 |
| 1.5 | 4 | 6 | 7 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 22 | 28 | 40 | 59 | 85 | 114 | 145 | 150 | 121 | 86 | 65 | 54 | 46 | 41 | 37 | 31 | 28 | 25 | 18 |
| 2.0 | 2 | 3 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 13 | 16 | 19 | 24 | 33 | 47 | 80 | 119 | 144 | 124 | 90 | 68 | 55 | 47 | 42 | 33 | 29 | 26 | 19 |
| 2.5 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 10 | 11 | 13 | 16 | 19 | 24 | 38 | 65 | 111 | 140 | 120 | 88 | 67 | 54 | 47 | 37 | 31 | 27 | 20 |
| 3.0 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 6 | 7 | 8 | 9 | 11 | 13 | 15 | 21 | 32 | 62 | 114 | 136 | 116 | 86 | 66 | 54 | 41 | 33 | 27 | 20 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 21 | 35 | 53 | 71 | 86 | 106 | 115 | 104 | 94 | 86 | 79 | 72 | 66 | 61 | 56 | 52 | 48 | 44 | 41 | 40 | 39 | 37 | 34 | 24 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 29 | 45 | 62 | 92 | 107 | 113 | 101 | 92 | 84 | 75 | 69 | 63 | 58 | 53 | 49 | 45 | 42 | 41 | 39 | 38 | 34 | 24 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 23 | 37 | 54 | 84 | 104 | 110 | 104 | 94 | 86 | 77 | 70 | 64 | 58 | 54 | 49 | 45 | 42 | 41 | 39 | 38 | 34 | 24 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 10 | 19 | 31 | 62 | 90 | 106 | 109 | 101 | 92 | 81 | 73 | 66 | 60 | 55 | 51 | 46 | 43 | 41 | 39 | 38 | 34 | 25 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 26 | 55 | 83 | 102 | 107 | 103 | 94 | 83 | 74 | 67 | 60 | 56 | 51 | 47 | 43 | 41 | 39 | 38 | 35 | 25 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 33 | 62 | 88 | 103 | 106 | 100 | 88 | 78 | 69 | 62 | 57 | 53 | 48 | 44 | 42 | 40 | 38 | 35 | 25 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 12 | 31 | 56 | 80 | 97 | 103 | 97 | 87 | 75 | 65 | 59 | 55 | 50 | 46 | 43 | 40 | 39 | 35 | 26 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 32 | 56 | 79 | 95 | 101 | 94 | 80 | 69 | 61 | 56 | 52 | 48 | 44 | 40 | 39 | 36 | 27 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 30 | 51 | 81 | 98 | 94 | 79 | 68 | 61 | 56 | 52 | 47 | 42 | 39 | 36 | 28 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 37 | 66 | 95 | 95 | 78 | 68 | 61 | 56 | 51 | 44 | 40 | 37 | 29 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 26 | 61 | 93 | 89 | 77 | 67 | 60 | 55 | 47 | 41 | 38 | 30 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 24 | 64 | 91 | 87 | 76 | 66 | 60 | 50 | 43 | 39 | 31 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 6 | 13 | 21 | 29 | 35 | 40 | 43 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 36 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 11 | 19 | 27 | 34 | 39 | 42 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 36 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 9 | 17 | 25 | 32 | 37 | 41 | 46 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 36 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 8 | 15 | 23 | 30 | 36 | 40 | 45 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 36 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 13 | 21 | 28 | 35 | 39 | 45 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 37 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 12 | 19 | 27 | 33 | 38 | 44 | 46 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 37 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 14 | 21 | 28 | 34 | 41 | 45 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 37 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 17 | 24 | 34 | 41 | 46 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 38 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 19 | 29 | 39 | 45 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 40 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 18 | 30 | 41 | 46 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 41 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 17 | 31 | 41 | 46 | 47 | 47 | 47 | 47 | 47 | 47 | 42 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 18 | 32 | 42 | 46 | 47 | 47 | 47 | 47 | 47 | 43 |

RAINFALL TYPE = I  * * * TC = 1.25 HR * * *  SHEET 8 OF 10

## Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

TRVL TIME (HR) — HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | IA/P = 0.10 | |
| 0.0 | 11 | 14 | 19 | 25 | 28 | 32 | 39 | 48 | 60 | 76 | 94 | 112 | 129 | 151 | 163 | 147 | 130 | 112 | 97 | 81 | 69 | 59 | 50 | 44 | 39 | 35 | 32 | 30 | 28 | 26 | 23 | 15 |
| .10 | 10 | 12 | 16 | 22 | 24 | 27 | 30 | 36 | 44 | 55 | 69 | 86 | 103 | 135 | 152 | 159 | 143 | 125 | 108 | 88 | 75 | 62 | 52 | 46 | 41 | 36 | 32 | 30 | 28 | 26 | 23 | 16 |
| .20 | 9 | 11 | 14 | 19 | 21 | 23 | 25 | 29 | 34 | 41 | 50 | 63 | 78 | 112 | 140 | 155 | 152 | 138 | 121 | 98 | 81 | 67 | 55 | 48 | 42 | 37 | 33 | 31 | 28 | 27 | 23 | 16 |
| .30 | 9 | 11 | 14 | 18 | 20 | 22 | 24 | 27 | 31 | 38 | 46 | 57 | 71 | 104 | 133 | 151 | 154 | 141 | 125 | 101 | 84 | 68 | 56 | 48 | 43 | 38 | 34 | 31 | 29 | 27 | 23 | 16 |
| .40 | 8 | 10 | 13 | 17 | 19 | 21 | 23 | 26 | 30 | 35 | 42 | 52 | 65 | 96 | 126 | 147 | 152 | 144 | 129 | 105 | 87 | 70 | 57 | 49 | 43 | 38 | 34 | 31 | 29 | 27 | 23 | 16 |
| .50 | 8 | 9 | 12 | 15 | 17 | 18 | 20 | 22 | 25 | 28 | 33 | 39 | 48 | 73 | 104 | 131 | 148 | 151 | 140 | 117 | 95 | 75 | 60 | 51 | 45 | 40 | 35 | 32 | 29 | 27 | 24 | 17 |
| .75 | 7 | 8 | 11 | 13 | 15 | 16 | 18 | 19 | 21 | 24 | 27 | 32 | 38 | 56 | 82 | 110 | 133 | 146 | 144 | 127 | 106 | 83 | 65 | 54 | 47 | 41 | 36 | 33 | 29 | 27 | 24 | 17 |
| 1.0 | 5 | 7 | 9 | 11 | 11 | 12 | 13 | 15 | 16 | 18 | 19 | 22 | 24 | 32 | 47 | 69 | 96 | 122 | 139 | 145 | 127 | 99 | 74 | 60 | 51 | 44 | 39 | 35 | 30 | 28 | 24 | 17 |
| 1.5 | 4 | 5 | 6 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 16 | 19 | 24 | 32 | 46 | 66 | 90 | 124 | 139 | 128 | 97 | 73 | 59 | 50 | 44 | 39 | 32 | 29 | 25 | 18 |
| 2.0 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 12 | 14 | 17 | 21 | 27 | 38 | 63 | 96 | 135 | 129 | 100 | 76 | 61 | 51 | 44 | 35 | 30 | 26 | 19 |
| 2.5 | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 10 | 11 | 14 | 16 | 20 | 31 | 51 | 91 | 132 | 124 | 98 | 75 | 60 | 51 | 39 | 32 | 27 | 20 |
| 3.0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 16 | 23 | 42 | 86 | 123 | 128 | 101 | 77 | 62 | 45 | 35 | 28 | 21 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | IA/P = 0.30 | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 21 | 33 | 46 | 60 | 83 | 97 | 106 | 97 | 90 | 84 | 76 | 70 | 64 | 59 | 54 | 50 | 45 | 43 | 41 | 39 | 38 | 34 | 25 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 18 | 28 | 40 | 66 | 86 | 98 | 103 | 95 | 88 | 80 | 73 | 66 | 60 | 55 | 51 | 47 | 43 | 41 | 39 | 38 | 35 | 25 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 14 | 23 | 34 | 60 | 81 | 95 | 101 | 97 | 90 | 81 | 74 | 67 | 61 | 56 | 52 | 47 | 44 | 41 | 40 | 38 | 35 | 25 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 19 | 41 | 65 | 85 | 98 | 100 | 95 | 85 | 77 | 69 | 62 | 57 | 53 | 48 | 44 | 42 | 40 | 38 | 35 | 25 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 16 | 36 | 59 | 80 | 94 | 99 | 96 | 87 | 79 | 70 | 63 | 58 | 53 | 49 | 45 | 42 | 40 | 38 | 35 | 26 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 13 | 31 | 54 | 75 | 91 | 98 | 97 | 88 | 80 | 71 | 64 | 58 | 54 | 49 | 45 | 42 | 40 | 38 | 35 | 26 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 13 | 28 | 49 | 69 | 85 | 95 | 95 | 87 | 76 | 67 | 61 | 56 | 51 | 47 | 44 | 40 | 39 | 36 | 26 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 29 | 49 | 69 | 84 | 95 | 92 | 81 | 71 | 63 | 58 | 53 | 49 | 45 | 41 | 39 | 36 | 27 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 20 | 35 | 63 | 84 | 92 | 83 | 72 | 64 | 58 | 54 | 49 | 43 | 40 | 37 | 28 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 25 | 50 | 79 | 90 | 81 | 71 | 63 | 58 | 53 | 45 | 41 | 38 | 29 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 18 | 46 | 79 | 88 | 80 | 70 | 63 | 57 | 49 | 42 | 38 | 31 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 17 | 50 | 79 | 87 | 79 | 70 | 62 | 52 | 45 | 39 | 32 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | IA/P = 0.50 | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 8 | 15 | 22 | 29 | 34 | 39 | 44 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 37 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 24 | 30 | 35 | 41 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 37 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 9 | 15 | 22 | 28 | 34 | 40 | 45 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 37 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 20 | 27 | 33 | 39 | 44 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 38 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 18 | 25 | 31 | 38 | 44 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 38 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 23 | 30 | 37 | 43 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 38 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 12 | 19 | 25 | 33 | 40 | 45 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 38 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 15 | 25 | 33 | 42 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 39 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 14 | 23 | 34 | 43 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 40 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 11 | 22 | 35 | 43 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 42 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 23 | 36 | 43 | 46 | 46 | 46 | 46 | 46 | 46 | 43 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 27 | 38 | 44 | 46 | 46 | 46 | 46 | 46 | 44 |

RAINFALL TYPE = I — * * * TC = 1.5 HR * * * — SHEET 9 OF 10

## Exhibit 5-I, continued: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 9.0 | 9.3 | 9.6 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.3 | 12.6 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 | 15.5 | 16.0 | 17.0 | 18.0 | 20.0 | 24.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 9 | 11 | 14 | 19 | 21 | 24 | 28 | 33 | 40 | 49 | 59 | 70 | 82 | 106 | 123 | 138 | 138 | 125 | 115 | 97 | 83 | 70 | 59 | 50 | 44 | 39 | 35 | 32 | 29 | 27 | 23 | 16 |
| .10 | 8 | 10 | 13 | 17 | 18 | 20 | 23 | 26 | 31 | 37 | 45 | 54 | 65 | 89 | 110 | 125 | 135 | 130 | 123 | 106 | 90 | 75 | 62 | 53 | 46 | 40 | 36 | 33 | 29 | 27 | 24 | 16 |
| .20 | 8 | 10 | 12 | 16 | 17 | 19 | 22 | 25 | 29 | 34 | 41 | 50 | 60 | 83 | 105 | 121 | 132 | 131 | 125 | 109 | 92 | 77 | 63 | 53 | 46 | 41 | 36 | 33 | 29 | 27 | 24 | 17 |
| .30 | 7 | 9 | 11 | 14 | 15 | 17 | 18 | 21 | 23 | 27 | 32 | 38 | 46 | 66 | 89 | 109 | 123 | 131 | 129 | 117 | 100 | 82 | 66 | 56 | 48 | 42 | 38 | 34 | 30 | 28 | 24 | 17 |
| .40 | 7 | 8 | 10 | 13 | 15 | 16 | 18 | 20 | 22 | 25 | 30 | 35 | 43 | 61 | 83 | 104 | 120 | 131 | 131 | 119 | 103 | 84 | 68 | 57 | 49 | 43 | 38 | 34 | 30 | 28 | 24 | 17 |
| .50 | 6 | 8 | 10 | 13 | 14 | 15 | 17 | 19 | 21 | 24 | 28 | 33 | 39 | 56 | 78 | 99 | 116 | 127 | 130 | 121 | 106 | 86 | 69 | 58 | 50 | 44 | 39 | 35 | 30 | 28 | 24 | 17 |
| .75 | 5 | 7 | 8 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 20 | 23 | 27 | 38 | 53 | 73 | 93 | 111 | 123 | 127 | 118 | 98 | 77 | 63 | 54 | 47 | 41 | 37 | 31 | 28 | 25 | 17 |
| 1.0 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 24 | 32 | 45 | 63 | 83 | 102 | 122 | 126 | 113 | 89 | 71 | 59 | 51 | 44 | 39 | 32 | 29 | 25 | 18 |
| 1.5 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 15 | 18 | 23 | 32 | 44 | 60 | 88 | 111 | 123 | 110 | 87 | 70 | 58 | 50 | 44 | 35 | 30 | 26 | 19 |
| 2.0 | 1 | 2 | 3 | 4 | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 10 | 12 | 14 | 18 | 23 | 31 | 49 | 74 | 106 | 121 | 107 | 86 | 69 | 58 | 49 | 38 | 32 | 27 | 20 |
| 2.5 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 11 | 13 | 16 | 22 | 35 | 62 | 101 | 118 | 108 | 88 | 71 | 59 | 44 | 35 | 28 | 21 |
| 3.0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 5 | 5 | 6 | 8 | 9 | 10 | 14 | 19 | 34 | 67 | 103 | 116 | 105 | 86 | 70 | 50 | 39 | 29 | 21 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 16 | 23 | 31 | 49 | 65 | 77 | 84 | 92 | 86 | 80 | 75 | 69 | 63 | 58 | 53 | 49 | 45 | 43 | 40 | 38 | 35 | 26 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 13 | 19 | 35 | 53 | 68 | 79 | 85 | 90 | 83 | 77 | 71 | 64 | 59 | 55 | 50 | 46 | 43 | 40 | 39 | 35 | 26 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 11 | 24 | 40 | 57 | 71 | 81 | 89 | 89 | 80 | 73 | 66 | 61 | 56 | 51 | 47 | 44 | 41 | 39 | 35 | 26 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 6 | 9 | 20 | 36 | 53 | 68 | 78 | 84 | 88 | 81 | 74 | 67 | 61 | 56 | 52 | 48 | 44 | 41 | 39 | 36 | 26 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 12 | 24 | 40 | 57 | 70 | 80 | 87 | 84 | 76 | 69 | 63 | 58 | 53 | 49 | 45 | 41 | 39 | 36 | 27 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 10 | 21 | 36 | 53 | 67 | 77 | 87 | 85 | 77 | 69 | 63 | 58 | 54 | 49 | 46 | 41 | 39 | 36 | 27 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 14 | 26 | 41 | 56 | 69 | 82 | 85 | 80 | 72 | 65 | 60 | 55 | 51 | 47 | 42 | 40 | 36 | 27 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 20 | 34 | 49 | 68 | 81 | 85 | 77 | 69 | 63 | 58 | 53 | 49 | 43 | 40 | 37 | 28 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 19 | 38 | 58 | 78 | 83 | 76 | 68 | 62 | 57 | 53 | 45 | 41 | 37 | 29 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 13 | 29 | 55 | 77 | 82 | 75 | 68 | 62 | 57 | 48 | 43 | 38 | 30 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 22 | 51 | 75 | 81 | 75 | 68 | 62 | 53 | 45 | 39 | 32 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 25 | 54 | 75 | 80 | 75 | 68 | 57 | 48 | 40 | 33 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 13 | 18 | 24 | 29 | 36 | 41 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 38 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 7 | 12 | 17 | 22 | 28 | 35 | 40 | 45 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 38 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 13 | 18 | 24 | 31 | 38 | 44 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 39 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 7 | 12 | 17 | 22 | 30 | 37 | 43 | 45 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 39 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 16 | 21 | 29 | 36 | 42 | 45 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 39 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 9 | 14 | 20 | 28 | 35 | 42 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 39 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 13 | 18 | 26 | 33 | 41 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 39 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 9 | 16 | 24 | 33 | 42 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 40 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 15 | 25 | 36 | 43 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 42 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 14 | 26 | 37 | 43 | 45 | 45 | 45 | 45 | 45 | 45 | 43 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 15 | 27 | 37 | 43 | 45 | 45 | 45 | 45 | 45 | 44 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 19 | 30 | 39 | 44 | 45 | 45 | 45 | 45 | 45 |

RAINFALL TYPE = I  * * * TC = 2.0 HR * * *  SHEET 10 OF 10

## Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | |
| | | IA/P = 0.10 | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | IA/P = 0.10 | | | |
| 0.0 | 28 | 36 | 50 | 143 | 154 | 163 | 140 | 103 | 87 | 76 | 68 | 67 | 65 | 61 | 54 | 49 | 45 | 44 | 44 | 41 | 40 | 39 | 36 | 33 | 32 | 32 | 31 | 30 | 30 | 29 | 26 | 21 |
| .10 | 27 | 32 | 43 | 104 | 130 | 146 | 157 | 145 | 117 | 97 | 83 | 73 | 69 | 65 | 59 | 53 | 48 | 45 | 45 | 42 | 40 | 39 | 37 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .20 | 26 | 29 | 37 | 59 | 89 | 116 | 136 | 150 | 147 | 127 | 107 | 91 | 79 | 68 | 63 | 57 | 52 | 47 | 45 | 44 | 41 | 39 | 37 | 35 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .30 | 25 | 28 | 35 | 53 | 77 | 103 | 125 | 142 | 145 | 133 | 116 | 99 | 86 | 71 | 65 | 59 | 53 | 48 | 46 | 44 | 41 | 39 | 38 | 35 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .40 | 24 | 26 | 31 | 41 | 49 | 68 | 91 | 114 | 132 | 141 | 136 | 122 | 107 | 82 | 70 | 63 | 57 | 52 | 48 | 45 | 43 | 40 | 38 | 36 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .50 | 24 | 26 | 30 | 39 | 46 | 60 | 81 | 103 | 123 | 135 | 135 | 127 | 114 | 88 | 73 | 65 | 59 | 53 | 49 | 45 | 43 | 40 | 39 | 36 | 33 | 33 | 32 | 31 | 30 | 29 | 27 | 22 |
| .75 | 20 | 24 | 27 | 32 | 35 | 39 | 47 | 60 | 76 | 94 | 111 | 122 | 125 | 114 | 94 | 79 | 68 | 61 | 55 | 48 | 45 | 42 | 39 | 37 | 35 | 33 | 32 | 32 | 30 | 30 | 27 | 22 |
| 1.0 | 16 | 20 | 24 | 27 | 28 | 30 | 32 | 36 | 41 | 49 | 62 | 77 | 94 | 118 | 122 | 104 | 86 | 74 | 65 | 55 | 49 | 44 | 41 | 39 | 36 | 34 | 33 | 32 | 31 | 30 | 28 | 23 |
| 1.5 | 12 | 15 | 18 | 22 | 23 | 24 | 25 | 27 | 28 | 30 | 32 | 36 | 42 | 61 | 86 | 107 | 112 | 104 | 91 | 73 | 60 | 50 | 44 | 41 | 38 | 36 | 34 | 33 | 31 | 30 | 28 | 23 |
| 2.0 | 7 | 10 | 12 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 30 | 36 | 50 | 69 | 90 | 106 | 103 | 87 | 67 | 52 | 45 | 41 | 39 | 36 | 34 | 32 | 31 | 29 | 24 |
| 2.5 | 4 | 6 | 8 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 21 | 23 | 26 | 30 | 36 | 49 | 66 | 91 | 101 | 89 | 66 | 51 | 44 | 41 | 38 | 36 | 33 | 31 | 29 | 25 |
| 3.0 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 16 | 18 | 20 | 23 | 25 | 29 | 36 | 55 | 79 | 98 | 86 | 65 | 51 | 44 | 41 | 38 | 34 | 32 | 30 | 25 |
| | | IA/P = 0.30 | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | IA/P = 0.30 | | | |
| 0.0 | 0 | 0 | 1 | 45 | 65 | 89 | 78 | 64 | 59 | 54 | 54 | 53 | 51 | 50 | 48 | 45 | 44 | 43 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 33 |
| .10 | 0 | 0 | 0 | 18 | 36 | 55 | 78 | 78 | 69 | 62 | 57 | 55 | 53 | 51 | 50 | 47 | 44 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .20 | 0 | 0 | 0 | 13 | 29 | 46 | 67 | 74 | 71 | 65 | 60 | 56 | 54 | 52 | 50 | 48 | 45 | 44 | 43 | 43 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .30 | 0 | 0 | 0 | 10 | 22 | 38 | 58 | 69 | 70 | 67 | 62 | 58 | 56 | 52 | 51 | 48 | 46 | 44 | 44 | 43 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .40 | 0 | 0 | 0 | 2 | 7 | 17 | 31 | 49 | 62 | 67 | 67 | 64 | 60 | 55 | 52 | 50 | 48 | 45 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .50 | 0 | 0 | 0 | 1 | 5 | 13 | 25 | 41 | 55 | 63 | 66 | 64 | 61 | 56 | 53 | 51 | 48 | 46 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .75 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 24 | 36 | 47 | 55 | 61 | 61 | 57 | 54 | 51 | 49 | 47 | 44 | 43 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 25 | 36 | 46 | 53 | 60 | 59 | 55 | 53 | 50 | 48 | 45 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 38 | 35 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 15 | 31 | 47 | 55 | 57 | 56 | 53 | 50 | 46 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 39 | 39 | 35 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 28 | 42 | 51 | 55 | 54 | 51 | 47 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 39 | 39 | 36 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 14 | 26 | 38 | 50 | 54 | 52 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 39 | 36 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 29 | 43 | 53 | 51 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 39 | 37 |
| | | IA/P = 0.50 | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | IA/P = 0.50 | | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 12 | 14 | 18 | 21 | 23 | 26 | 30 | 32 | 33 | 37 | 38 | 41 | 42 | 46 | 48 | 53 | 49 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 9 | 12 | 15 | 19 | 22 | 25 | 29 | 32 | 32 | 35 | 39 | 41 | 42 | 45 | 48 | 53 | 49 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 11 | 14 | 18 | 22 | 24 | 28 | 32 | 32 | 35 | 39 | 41 | 42 | 45 | 48 | 53 | 49 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 12 | 15 | 20 | 23 | 27 | 31 | 31 | 34 | 39 | 40 | 41 | 45 | 48 | 53 | 49 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 9 | 13 | 18 | 22 | 25 | 30 | 31 | 33 | 37 | 39 | 41 | 44 | 47 | 53 | 49 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 10 | 15 | 20 | 24 | 29 | 31 | 32 | 36 | 39 | 41 | 44 | 47 | 53 | 53 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 11 | 16 | 21 | 26 | 30 | 31 | 34 | 38 | 40 | 43 | 46 | 53 | 53 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 11 | 17 | 23 | 28 | 31 | 32 | 35 | 39 | 42 | 45 | 53 | 53 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 17 | 23 | 28 | 31 | 32 | 35 | 40 | 43 | 49 | 52 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 17 | 23 | 28 | 31 | 32 | 38 | 42 | 48 | 52 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 18 | 24 | 28 | 31 | 36 | 40 | 47 | 52 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 18 | 24 | 28 | 33 | 39 | 45 | 52 |
| | | RAINFALL TYPE = IA | | | | | | | | | | | | * * * TC = 0.1 HR * * * | | | | | | | | | | | | | | | SHEET 1 OF 10 | | | |

# Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 27 | 34 | 46 | 124 | 143 | 153 | 153 | 127 | 103 | 87 | 76 | 68 | 67 | 63 | 57 | 51 | 47 | 45 | 44 | 42 | 40 | 39 | 36 | 33 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 21 |
| .10 | 27 | 33 | 44 | 108 | 131 | 146 | 151 | 135 | 113 | 96 | 83 | 73 | 69 | 65 | 59 | 53 | 48 | 45 | 45 | 42 | 40 | 39 | 37 | 33 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .20 | 26 | 29 | 38 | 67 | 95 | 119 | 137 | 146 | 139 | 122 | 105 | 90 | 79 | 69 | 63 | 57 | 52 | 47 | 45 | 44 | 41 | 39 | 37 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .30 | 25 | 27 | 33 | 45 | 60 | 83 | 107 | 127 | 140 | 139 | 128 | 112 | 97 | 76 | 68 | 62 | 56 | 50 | 47 | 45 | 42 | 40 | 38 | 35 | 33 | 33 | 32 | 31 | 30 | 29 | 27 | 22 |
| .40 | 24 | 27 | 32 | 43 | 54 | 73 | 96 | 117 | 132 | 137 | 131 | 118 | 104 | 81 | 70 | 63 | 57 | 52 | 48 | 45 | 43 | 40 | 38 | 36 | 33 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .50 | 23 | 25 | 29 | 37 | 41 | 50 | 65 | 86 | 106 | 124 | 132 | 131 | 123 | 98 | 79 | 69 | 62 | 56 | 51 | 46 | 44 | 41 | 39 | 37 | 34 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .75 | 20 | 24 | 27 | 33 | 36 | 41 | 50 | 63 | 80 | 97 | 112 | 121 | 123 | 111 | 93 | 78 | 68 | 61 | 55 | 48 | 45 | 42 | 39 | 37 | 34 | 33 | 32 | 32 | 30 | 30 | 27 | 22 |
| 1.0 | 16 | 20 | 24 | 27 | 29 | 31 | 33 | 37 | 43 | 52 | 65 | 81 | 96 | 120 | 120 | 102 | 85 | 73 | 64 | 55 | 49 | 44 | 41 | 39 | 36 | 34 | 33 | 32 | 31 | 30 | 28 | 23 |
| 1.5 | 12 | 15 | 19 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 33 | 37 | 44 | 63 | 88 | 107 | 111 | 102 | 89 | 72 | 60 | 50 | 44 | 41 | 38 | 36 | 34 | 33 | 32 | 30 | 28 | 23 |
| 2.0 | 7 | 10 | 12 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 30 | 38 | 52 | 71 | 91 | 105 | 101 | 86 | 66 | 52 | 45 | 41 | 39 | 36 | 34 | 32 | 31 | 29 | 24 |
| 2.5 | 4 | 6 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 23 | 26 | 30 | 38 | 50 | 68 | 92 | 101 | 88 | 65 | 51 | 44 | 41 | 38 | 36 | 33 | 31 | 29 | 25 |
| 3.0 | 2 | 3 | 5 | 7 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 19 | 22 | 24 | 28 | 33 | 49 | 72 | 97 | 89 | 68 | 53 | 45 | 41 | 39 | 34 | 32 | 30 | 25 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 26 | 45 | 64 | 76 | 74 | 65 | 59 | 55 | 53 | 52 | 51 | 49 | 46 | 44 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 33 |
| .10 | 0 | 0 | 0 | 20 | 37 | 55 | 69 | 72 | 67 | 62 | 57 | 54 | 53 | 52 | 50 | 47 | 44 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .20 | 0 | 0 | 0 | 5 | 15 | 30 | 47 | 61 | 68 | 68 | 64 | 59 | 56 | 53 | 52 | 49 | 46 | 44 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .30 | 0 | 0 | 0 | 4 | 11 | 23 | 39 | 54 | 64 | 66 | 65 | 61 | 58 | 54 | 52 | 50 | 47 | 45 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .40 | 0 | 0 | 0 | 3 | 8 | 18 | 32 | 47 | 58 | 64 | 64 | 62 | 59 | 55 | 52 | 50 | 48 | 45 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .50 | 0 | 0 | 0 | 0 | 2 | 6 | 14 | 26 | 40 | 52 | 60 | 63 | 62 | 58 | 54 | 52 | 50 | 47 | 45 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .75 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 14 | 24 | 35 | 45 | 53 | 57 | 59 | 56 | 54 | 51 | 49 | 47 | 44 | 43 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 15 | 25 | 35 | 44 | 56 | 58 | 56 | 54 | 51 | 49 | 46 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 23 | 38 | 50 | 55 | 56 | 54 | 51 | 47 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 39 | 39 | 35 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 6 | 15 | 27 | 40 | 49 | 54 | 54 | 51 | 47 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 39 | 36 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 14 | 25 | 36 | 49 | 53 | 51 | 47 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 39 | 36 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 28 | 42 | 52 | 51 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 39 | 37 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 10 | 13 | 16 | 19 | 23 | 25 | 29 | 32 | 33 | 36 | 39 | 41 | 42 | 46 | 48 | 50 | 49 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 10 | 14 | 17 | 21 | 24 | 28 | 31 | 32 | 35 | 40 | 41 | 42 | 45 | 48 | 50 | 49 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 11 | 15 | 19 | 23 | 26 | 31 | 31 | 34 | 39 | 40 | 41 | 45 | 48 | 50 | 49 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 12 | 17 | 21 | 25 | 30 | 31 | 33 | 37 | 39 | 41 | 44 | 47 | 50 | 50 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 9 | 15 | 19 | 23 | 28 | 31 | 32 | 35 | 39 | 41 | 44 | 47 | 50 | 50 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 12 | 17 | 22 | 27 | 31 | 32 | 34 | 39 | 40 | 43 | 46 | 50 | 50 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 14 | 20 | 25 | 30 | 31 | 33 | 37 | 39 | 42 | 46 | 50 | 50 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 16 | 22 | 27 | 31 | 32 | 35 | 38 | 42 | 45 | 49 | 50 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 17 | 23 | 28 | 31 | 32 | 35 | 40 | 43 | 49 | 50 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 17 | 23 | 28 | 31 | 32 | 38 | 42 | 48 | 50 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 16 | 22 | 27 | 30 | 35 | 40 | 46 | 50 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 17 | 23 | 27 | 33 | 38 | 45 | 50 |

RAINFALL TYPE = IA  * * * TC = 0.2 HR * * *  SHEET 2 OF 10

## Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | IA/P = 0.10 | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 26 | 31 | 41 | 92 | 120 | 138 | 145 | 144 | 125 | 105 | 90 | 78 | 71 | 66 | 60 | 54 | 49 | 46 | 45 | 43 | 40 | 39 | 37 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .10 | 26 | 30 | 39 | 80 | 106 | 128 | 139 | 142 | 131 | 113 | 98 | 85 | 76 | 68 | 62 | 56 | 51 | 47 | 45 | 43 | 41 | 39 | 37 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 27 | 22 |
| .20 | 25 | 28 | 34 | 51 | 70 | 94 | 117 | 131 | 139 | 133 | 120 | 105 | 92 | 74 | 67 | 60 | 54 | 49 | 46 | 44 | 42 | 40 | 38 | 35 | 33 | 33 | 32 | 31 | 30 | 29 | 27 | 22 |
| .30 | 24 | 26 | 31 | 40 | 47 | 62 | 84 | 106 | 123 | 133 | 133 | 124 | 112 | 87 | 73 | 65 | 59 | 53 | 49 | 45 | 43 | 40 | 39 | 36 | 33 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .40 | 23 | 26 | 30 | 38 | 44 | 56 | 75 | 95 | 114 | 127 | 131 | 127 | 117 | 93 | 76 | 67 | 60 | 55 | 50 | 46 | 43 | 40 | 39 | 36 | 34 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .50 | 21 | 25 | 28 | 34 | 37 | 42 | 51 | 67 | 86 | 104 | 119 | 127 | 127 | 110 | 88 | 74 | 66 | 59 | 53 | 47 | 45 | 41 | 39 | 37 | 34 | 33 | 32 | 32 | 30 | 30 | 27 | 22 |
| .75 | 19 | 23 | 26 | 31 | 33 | 36 | 42 | 51 | 64 | 80 | 96 | 109 | 119 | 116 | 102 | 85 | 73 | 65 | 58 | 50 | 46 | 43 | 40 | 38 | 35 | 33 | 33 | 32 | 31 | 30 | 28 | 23 |
| 1.0 | 15 | 19 | 23 | 26 | 27 | 29 | 31 | 33 | 37 | 44 | 53 | 66 | 80 | 106 | 116 | 109 | 93 | 79 | 69 | 58 | 51 | 45 | 41 | 39 | 37 | 34 | 33 | 32 | 31 | 30 | 28 | 23 |
| 1.5 | 11 | 14 | 17 | 21 | 22 | 23 | 24 | 26 | 27 | 29 | 31 | 34 | 38 | 53 | 75 | 97 | 109 | 106 | 96 | 78 | 64 | 52 | 45 | 41 | 39 | 36 | 34 | 33 | 32 | 30 | 28 | 24 |
| 2.0 | 6 | 9 | 11 | 14 | 16 | 17 | 18 | 19 | 20 | 21 | 23 | 24 | 25 | 28 | 34 | 44 | 61 | 81 | 97 | 103 | 91 | 71 | 54 | 46 | 42 | 39 | 37 | 34 | 32 | 31 | 29 | 24 |
| 2.5 | 4 | 5 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 22 | 25 | 28 | 34 | 44 | 58 | 84 | 99 | 92 | 70 | 54 | 46 | 41 | 39 | 36 | 33 | 32 | 29 | 25 |
| 3.0 | 2 | 3 | 5 | 7 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 19 | 22 | 24 | 28 | 33 | 49 | 71 | 96 | 89 | 68 | 53 | 45 | 41 | 39 | 34 | 32 | 30 | 25 |
| | IA/P = 0.30 | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 13 | 28 | 45 | 63 | 69 | 69 | 65 | 60 | 55 | 53 | 53 | 51 | 48 | 45 | 44 | 43 | 43 | 42 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 38 | 34 |
| .10 | 0 | 0 | 0 | 9 | 21 | 37 | 54 | 64 | 67 | 65 | 62 | 57 | 54 | 53 | 51 | 49 | 46 | 44 | 43 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .20 | 0 | 0 | 0 | 7 | 17 | 30 | 46 | 58 | 64 | 65 | 63 | 59 | 56 | 53 | 52 | 49 | 46 | 44 | 44 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .30 | 0 | 0 | 0 | 1 | 5 | 13 | 25 | 39 | 52 | 60 | 63 | 63 | 60 | 55 | 53 | 51 | 49 | 46 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .40 | 0 | 0 | 0 | 1 | 4 | 10 | 20 | 33 | 45 | 55 | 61 | 62 | 61 | 56 | 54 | 52 | 49 | 46 | 45 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .50 | 0 | 0 | 0 | 1 | 3 | 7 | 15 | 27 | 39 | 50 | 57 | 60 | 61 | 57 | 54 | 52 | 50 | 47 | 45 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .75 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 24 | 34 | 43 | 51 | 55 | 58 | 56 | 54 | 52 | 49 | 47 | 44 | 43 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 9 | 16 | 25 | 34 | 49 | 56 | 57 | 55 | 53 | 50 | 47 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 10 | 23 | 37 | 49 | 54 | 55 | 54 | 51 | 47 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 39 | 39 | 35 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 21 | 33 | 44 | 51 | 54 | 52 | 48 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 39 | 36 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 19 | 30 | 45 | 53 | 53 | 48 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 39 | 37 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 23 | 37 | 50 | 52 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 39 | 37 |
| | IA/P = 0.50 | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 11 | 14 | 18 | 22 | 24 | 28 | 32 | 32 | 35 | 40 | 41 | 42 | 45 | 48 | 48 | 48 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 12 | 15 | 20 | 23 | 27 | 31 | 31 | 34 | 39 | 40 | 41 | 45 | 48 | 48 | 48 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 9 | 13 | 18 | 21 | 25 | 30 | 31 | 33 | 37 | 39 | 41 | 44 | 47 | 48 | 48 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 12 | 17 | 21 | 25 | 30 | 31 | 33 | 37 | 39 | 41 | 44 | 47 | 48 | 48 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 9 | 14 | 19 | 23 | 28 | 31 | 32 | 35 | 39 | 41 | 44 | 47 | 48 | 48 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 15 | 21 | 26 | 30 | 31 | 33 | 38 | 40 | 43 | 46 | 48 | 48 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 19 | 24 | 29 | 31 | 33 | 36 | 39 | 42 | 46 | 48 | 48 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 16 | 22 | 27 | 31 | 32 | 35 | 38 | 42 | 45 | 48 | 48 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 16 | 23 | 27 | 31 | 32 | 35 | 40 | 43 | 48 | 48 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 16 | 22 | 27 | 30 | 32 | 38 | 42 | 47 | 48 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 16 | 22 | 27 | 30 | 35 | 40 | 46 | 48 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 17 | 23 | 27 | 33 | 38 | 45 | 48 |
| | RAINFALL TYPE = IA | | | | | | | | | | | | | * * * TC = 0.3 HR * * * | | | | | | | | | | | | | | | | | | SHEET 3 OF 10 |

# Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 26 | 29 | 37 | 67 | 93 | 117 | 134 | 137 | 136 | 121 | 105 | 91 | 81 | 70 | 64 | 58 | 52 | 48 | 46 | 44 | 41 | 40 | 37 | 34 | 33 | 33 | 32 | 31 | 30 | 29 | 27 | 22 |
| .10 | 25 | 29 | 36 | 60 | 82 | 105 | 124 | 133 | 135 | 126 | 112 | 98 | 87 | 73 | 66 | 59 | 53 | 49 | 46 | 44 | 41 | 40 | 38 | 34 | 33 | 33 | 32 | 31 | 30 | 29 | 27 | 22 |
| .20 | 24 | 27 | 32 | 43 | 55 | 73 | 94 | 114 | 127 | 132 | 128 | 117 | 104 | 83 | 71 | 64 | 58 | 52 | 48 | 45 | 43 | 40 | 38 | 35 | 33 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .30 | 24 | 26 | 31 | 41 | 50 | 65 | 85 | 104 | 119 | 128 | 128 | 121 | 110 | 88 | 74 | 66 | 59 | 54 | 49 | 46 | 43 | 40 | 39 | 35 | 34 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .40 | 22 | 25 | 28 | 35 | 39 | 46 | 59 | 76 | 95 | 111 | 122 | 126 | 122 | 104 | 85 | 72 | 64 | 58 | 52 | 47 | 44 | 41 | 39 | 37 | 34 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .50 | 20 | 23 | 26 | 31 | 34 | 37 | 43 | 54 | 69 | 86 | 103 | 116 | 123 | 117 | 98 | 82 | 71 | 63 | 56 | 49 | 46 | 42 | 40 | 38 | 34 | 33 | 33 | 32 | 30 | 30 | 27 | 22 |
| .75 | 16 | 20 | 24 | 27 | 29 | 31 | 33 | 37 | 43 | 53 | 65 | 80 | 94 | 116 | 116 | 101 | 86 | 74 | 65 | 56 | 49 | 44 | 41 | 39 | 36 | 34 | 33 | 32 | 31 | 30 | 28 | 23 |
| 1.0 | 14 | 18 | 22 | 25 | 26 | 27 | 29 | 31 | 34 | 38 | 45 | 54 | 67 | 93 | 111 | 113 | 101 | 87 | 75 | 62 | 53 | 47 | 42 | 40 | 37 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| 1.5 | 10 | 13 | 16 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 29 | 31 | 34 | 45 | 64 | 86 | 102 | 107 | 101 | 84 | 69 | 55 | 46 | 42 | 39 | 37 | 34 | 33 | 32 | 30 | 28 | 24 |
| 2.0 | 6 | 8 | 11 | 13 | 14 | 16 | 17 | 18 | 19 | 20 | 21 | 23 | 24 | 27 | 31 | 39 | 52 | 71 | 88 | 102 | 96 | 76 | 57 | 47 | 42 | 40 | 37 | 35 | 33 | 31 | 29 | 24 |
| 2.5 | 3 | 5 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 21 | 23 | 26 | 31 | 38 | 51 | 75 | 94 | 98 | 74 | 57 | 47 | 42 | 39 | 37 | 33 | 32 | 30 | 25 |
| 3.0 | 1 | 2 | 4 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 18 | 20 | 23 | 26 | 30 | 43 | 64 | 89 | 95 | 72 | 56 | 47 | 42 | 39 | 34 | 33 | 30 | 25 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 6 | 15 | 29 | 46 | 60 | 65 | 65 | 63 | 59 | 56 | 53 | 52 | 49 | 47 | 44 | 44 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .10 | 0 | 0 | 0 | 4 | 12 | 23 | 38 | 53 | 61 | 63 | 63 | 60 | 57 | 54 | 53 | 50 | 47 | 45 | 44 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .20 | 0 | 0 | 0 | 3 | 9 | 19 | 32 | 46 | 56 | 61 | 62 | 61 | 59 | 55 | 53 | 51 | 48 | 45 | 44 | 43 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .30 | 0 | 0 | 0 | 2 | 7 | 15 | 26 | 39 | 50 | 57 | 61 | 61 | 59 | 56 | 53 | 51 | 49 | 46 | 44 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .40 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 21 | 33 | 44 | 53 | 58 | 60 | 58 | 55 | 53 | 51 | 48 | 45 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .50 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 17 | 28 | 39 | 48 | 55 | 59 | 59 | 56 | 53 | 51 | 49 | 46 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .75 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 9 | 16 | 25 | 34 | 43 | 49 | 57 | 57 | 55 | 53 | 50 | 48 | 45 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 25 | 34 | 48 | 55 | 56 | 55 | 53 | 50 | 47 | 45 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 16 | 30 | 43 | 51 | 55 | 55 | 52 | 49 | 45 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 36 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 15 | 27 | 39 | 47 | 53 | 53 | 49 | 45 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 39 | 36 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 14 | 25 | 40 | 50 | 52 | 49 | 45 | 43 | 42 | 41 | 41 | 40 | 40 | 39 | 37 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 18 | 32 | 47 | 52 | 48 | 45 | 43 | 42 | 41 | 40 | 40 | 39 | 37 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 9 | 13 | 16 | 20 | 23 | 27 | 31 | 32 | 34 | 39 | 40 | 42 | 45 | 47 | 47 | 47 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 10 | 13 | 18 | 22 | 26 | 30 | 31 | 33 | 38 | 39 | 41 | 45 | 47 | 47 | 47 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 11 | 16 | 20 | 24 | 29 | 31 | 33 | 36 | 39 | 41 | 44 | 47 | 47 | 47 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 13 | 18 | 23 | 28 | 31 | 32 | 35 | 39 | 41 | 43 | 47 | 47 | 47 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 16 | 21 | 26 | 30 | 32 | 34 | 38 | 40 | 43 | 46 | 47 | 47 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 13 | 19 | 25 | 29 | 31 | 33 | 37 | 39 | 42 | 46 | 47 | 47 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 11 | 17 | 23 | 28 | 31 | 32 | 35 | 39 | 42 | 45 | 47 | 47 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 12 | 20 | 25 | 29 | 31 | 33 | 37 | 41 | 44 | 47 | 47 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 20 | 26 | 30 | 31 | 34 | 40 | 43 | 47 | 47 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 14 | 21 | 26 | 30 | 32 | 37 | 41 | 47 | 47 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 15 | 21 | 26 | 30 | 34 | 40 | 46 | 47 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 15 | 22 | 27 | 32 | 38 | 45 | 47 |

RAINFALL TYPE = IA  * * * TC = 0.4 HR * * *  SHEET 4 OF 10

## Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IA/P = 0.10 * * * TC =0.5 HR * * * IA/P = 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 25 | 28 | 34 | 53 | 72 | 94 | 115 | 129 | 130 | 129 | 117 | 104 | 92 | 76 | 68 | 61 | 55 | 50 | 47 | 44 | 42 | 40 | 38 | 34 | 33 | 33 | 32 | 31 | 30 | 29 | 27 | 22 |
| .10 | 24 | 27 | 33 | 49 | 64 | 84 | 105 | 121 | 127 | 128 | 121 | 109 | 98 | 80 | 70 | 63 | 57 | 51 | 48 | 45 | 42 | 40 | 38 | 34 | 33 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .20 | 23 | 26 | 30 | 39 | 46 | 58 | 75 | 95 | 112 | 122 | 126 | 123 | 114 | 93 | 78 | 69 | 61 | 55 | 50 | 46 | 44 | 41 | 39 | 36 | 34 | 33 | 32 | 32 | 30 | 29 | 27 | 22 |
| .30 | 21 | 24 | 27 | 34 | 37 | 43 | 53 | 68 | 86 | 103 | 116 | 123 | 123 | 108 | 89 | 76 | 67 | 60 | 54 | 48 | 45 | 42 | 39 | 37 | 34 | 33 | 33 | 32 | 30 | 30 | 27 | 22 |
| .40 | 20 | 24 | 27 | 32 | 35 | 40 | 49 | 61 | 78 | 95 | 109 | 118 | 121 | 111 | 93 | 79 | 69 | 62 | 55 | 49 | 45 | 42 | 40 | 37 | 34 | 33 | 33 | 32 | 30 | 30 | 27 | 22 |
| .50 | 18 | 22 | 25 | 29 | 31 | 34 | 38 | 45 | 56 | 70 | 87 | 101 | 113 | 118 | 106 | 89 | 77 | 67 | 60 | 52 | 47 | 43 | 40 | 38 | 35 | 33 | 33 | 32 | 31 | 30 | 28 | 23 |
| .75 | 15 | 19 | 23 | 26 | 27 | 29 | 31 | 34 | 38 | 45 | 54 | 67 | 80 | 104 | 112 | 106 | 93 | 80 | 70 | 59 | 51 | 46 | 41 | 39 | 36 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| 1.0 | 13 | 16 | 20 | 24 | 25 | 26 | 27 | 29 | 31 | 34 | 39 | 46 | 56 | 80 | 102 | 110 | 105 | 93 | 81 | 66 | 56 | 48 | 43 | 40 | 38 | 35 | 33 | 33 | 31 | 30 | 28 | 23 |
| 1.5 | 9 | 12 | 15 | 18 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 29 | 31 | 39 | 55 | 75 | 94 | 104 | 103 | 89 | 74 | 58 | 48 | 43 | 40 | 37 | 35 | 33 | 32 | 31 | 29 | 24 |
| 2.0 | 5 | 7 | 10 | 12 | 13 | 14 | 15 | 17 | 18 | 19 | 20 | 21 | 23 | 25 | 29 | 35 | 45 | 62 | 79 | 100 | 100 | 81 | 61 | 49 | 43 | 40 | 38 | 35 | 33 | 31 | 29 | 25 |
| 2.5 | 3 | 4 | 6 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 20 | 22 | 25 | 28 | 34 | 45 | 67 | 88 | 96 | 79 | 60 | 49 | 43 | 40 | 37 | 33 | 32 | 30 | 25 |
| 3.0 | 1 | 2 | 3 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 15 | 17 | 19 | 21 | 24 | 28 | 38 | 56 | 83 | 93 | 77 | 59 | 48 | 43 | 40 | 35 | 33 | 30 | 26 |
| IA/P = 0.30 * * * TC =0.5 HR * * * IA/P = 0.30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 2 | 8 | 18 | 31 | 46 | 57 | 61 | 61 | 61 | 58 | 54 | 53 | 51 | 48 | 45 | 44 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .10 | 0 | 0 | 0 | 2 | 6 | 14 | 25 | 39 | 51 | 58 | 60 | 61 | 59 | 55 | 53 | 51 | 49 | 46 | 44 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .20 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 21 | 33 | 45 | 54 | 58 | 60 | 58 | 55 | 53 | 51 | 48 | 46 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 34 |
| .30 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 27 | 39 | 49 | 55 | 59 | 59 | 55 | 53 | 51 | 49 | 46 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 34 |
| .40 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 23 | 34 | 44 | 51 | 56 | 58 | 56 | 54 | 52 | 49 | 47 | 44 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 34 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 10 | 18 | 29 | 39 | 47 | 56 | 57 | 55 | 53 | 51 | 49 | 45 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 25 | 34 | 48 | 54 | 56 | 55 | 53 | 50 | 47 | 45 | 43 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 26 | 41 | 51 | 55 | 55 | 54 | 50 | 47 | 44 | 43 | 42 | 41 | 41 | 40 | 40 | 40 | 40 | 39 | 35 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 23 | 36 | 47 | 52 | 54 | 52 | 48 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 36 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 16 | 27 | 38 | 49 | 53 | 51 | 47 | 44 | 42 | 42 | 41 | 40 | 40 | 40 | 39 | 36 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 15 | 30 | 43 | 52 | 50 | 46 | 44 | 42 | 42 | 41 | 40 | 40 | 39 | 37 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 23 | 40 | 51 | 50 | 46 | 44 | 42 | 42 | 40 | 40 | 39 | 37 |
| IA/P = 0.50 * * * TC =0.5 HR * * * IA/P = 0.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 11 | 14 | 19 | 22 | 26 | 30 | 31 | 34 | 38 | 40 | 41 | 45 | 46 | 46 | 46 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 12 | 17 | 21 | 25 | 29 | 31 | 33 | 37 | 39 | 41 | 44 | 46 | 46 | 46 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 9 | 14 | 19 | 23 | 28 | 31 | 32 | 35 | 39 | 41 | 43 | 46 | 46 | 46 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 17 | 22 | 27 | 31 | 32 | 34 | 38 | 40 | 43 | 46 | 46 | 46 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 16 | 21 | 26 | 30 | 32 | 34 | 38 | 40 | 43 | 46 | 46 | 46 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 13 | 19 | 25 | 29 | 31 | 33 | 37 | 39 | 42 | 46 | 46 | 46 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 11 | 17 | 23 | 28 | 31 | 32 | 35 | 39 | 42 | 45 | 46 | 46 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 18 | 24 | 29 | 31 | 33 | 36 | 41 | 44 | 46 | 46 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 19 | 24 | 29 | 31 | 33 | 39 | 42 | 46 | 46 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 12 | 19 | 25 | 29 | 31 | 37 | 41 | 46 | 46 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 13 | 20 | 25 | 29 | 34 | 39 | 45 | 46 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 14 | 20 | 26 | 32 | 37 | 44 | 46 |

RAINFALL TYPE = IA * * * TC = 0.5 HR * * * SHEET 5 OF 10

# Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 22 | 25 | 29 | 38 | 45 | 56 | 71 | 87 | 103 | 114 | 117 | 117 | 111 | 95 | 81 | 72 | 65 | 58 | 53 | 48 | 45 | 41 | 39 | 36 | 33 | 33 | 33 | 32 | 30 | 29 | 27 | 22 |
| .10 | 21 | 25 | 28 | 36 | 42 | 51 | 64 | 79 | 95 | 108 | 114 | 116 | 113 | 99 | 85 | 74 | 66 | 60 | 54 | 48 | 45 | 42 | 39 | 37 | 34 | 33 | 33 | 32 | 30 | 30 | 27 | 22 |
| .20 | 19 | 23 | 26 | 32 | 35 | 39 | 47 | 58 | 72 | 87 | 101 | 110 | 114 | 109 | 95 | 82 | 72 | 65 | 58 | 51 | 47 | 43 | 40 | 38 | 34 | 33 | 33 | 32 | 31 | 30 | 27 | 23 |
| .30 | 19 | 22 | 26 | 31 | 33 | 37 | 44 | 54 | 66 | 80 | 94 | 104 | 112 | 110 | 98 | 85 | 75 | 67 | 60 | 52 | 47 | 43 | 40 | 38 | 34 | 33 | 33 | 32 | 31 | 30 | 28 | 23 |
| .40 | 17 | 21 | 24 | 28 | 30 | 32 | 36 | 41 | 49 | 61 | 74 | 87 | 99 | 111 | 106 | 94 | 82 | 73 | 65 | 56 | 49 | 45 | 41 | 39 | 35 | 33 | 33 | 33 | 31 | 30 | 28 | 23 |
| .50 | 16 | 20 | 23 | 27 | 29 | 31 | 34 | 39 | 46 | 56 | 68 | 81 | 93 | 109 | 107 | 97 | 85 | 75 | 67 | 57 | 50 | 45 | 41 | 39 | 36 | 33 | 33 | 33 | 31 | 30 | 28 | 23 |
| .75 | 15 | 18 | 22 | 25 | 27 | 28 | 31 | 34 | 38 | 45 | 54 | 64 | 75 | 95 | 104 | 102 | 93 | 83 | 74 | 62 | 54 | 47 | 42 | 40 | 37 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| 1.0 | 12 | 15 | 18 | 22 | 23 | 24 | 25 | 27 | 29 | 31 | 34 | 39 | 46 | 65 | 85 | 100 | 103 | 98 | 88 | 74 | 62 | 52 | 45 | 41 | 39 | 35 | 33 | 33 | 32 | 30 | 28 | 23 |
| 1.5 | 7 | 10 | 12 | 15 | 17 | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 31 | 39 | 53 | 71 | 87 | 99 | 99 | 85 | 68 | 53 | 46 | 41 | 39 | 36 | 34 | 33 | 31 | 29 | 24 |
| 2.0 | 4 | 6 | 8 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 21 | 23 | 26 | 31 | 39 | 51 | 67 | 88 | 95 | 86 | 67 | 53 | 45 | 41 | 38 | 36 | 33 | 32 | 29 | 25 |
| 2.5 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 16 | 18 | 20 | 23 | 26 | 30 | 38 | 56 | 77 | 93 | 84 | 66 | 52 | 45 | 41 | 38 | 34 | 33 | 30 | 25 |
| 3.0 | 0 | 1 | 2 | 4 | 4 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 12 | 14 | 16 | 18 | 21 | 24 | 30 | 42 | 67 | 90 | 84 | 68 | 54 | 46 | 42 | 36 | 33 | 30 | 26 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 2 | 4 | 10 | 19 | 29 | 39 | 48 | 53 | 56 | 56 | 54 | 53 | 51 | 49 | 46 | 44 | 44 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 34 |
| .10 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 24 | 34 | 43 | 50 | 54 | 56 | 54 | 53 | 52 | 49 | 47 | 45 | 44 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 34 |
| .20 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 12 | 20 | 30 | 39 | 46 | 54 | 55 | 54 | 53 | 51 | 49 | 46 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| .30 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 25 | 34 | 42 | 52 | 55 | 54 | 53 | 51 | 49 | 46 | 44 | 43 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 14 | 21 | 30 | 38 | 50 | 55 | 55 | 53 | 52 | 50 | 47 | 45 | 43 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 18 | 26 | 34 | 47 | 53 | 54 | 54 | 52 | 50 | 47 | 45 | 43 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 35 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 16 | 23 | 37 | 47 | 52 | 53 | 53 | 52 | 49 | 46 | 44 | 42 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 17 | 30 | 42 | 50 | 53 | 53 | 51 | 49 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 21 | 33 | 43 | 49 | 52 | 51 | 48 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 36 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 20 | 30 | 43 | 50 | 51 | 48 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 39 | 37 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 10 | 23 | 36 | 48 | 51 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 39 | 37 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 17 | 34 | 48 | 50 | 47 | 44 | 43 | 42 | 40 | 40 | 39 | 38 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 15 | 19 | 23 | 28 | 31 | 32 | 36 | 39 | 41 | 44 | 44 | 44 | 44 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 7 | 12 | 17 | 22 | 27 | 30 | 32 | 34 | 38 | 40 | 43 | 44 | 44 | 44 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 15 | 20 | 25 | 30 | 31 | 33 | 37 | 39 | 43 | 44 | 44 | 44 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 12 | 18 | 24 | 29 | 31 | 33 | 36 | 39 | 42 | 44 | 44 | 44 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 10 | 16 | 22 | 27 | 30 | 32 | 35 | 38 | 42 | 44 | 44 | 44 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 14 | 21 | 26 | 30 | 31 | 34 | 38 | 41 | 44 | 44 | 44 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 19 | 24 | 29 | 31 | 33 | 36 | 41 | 44 | 44 | 44 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 22 | 27 | 30 | 32 | 35 | 40 | 43 | 44 | 44 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 16 | 23 | 27 | 30 | 32 | 38 | 42 | 44 | 44 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 17 | 23 | 28 | 30 | 36 | 40 | 44 | 44 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 18 | 23 | 28 | 33 | 39 | 44 | 44 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 17 | 23 | 30 | 36 | 43 | 44 |

RAINFALL TYPE = IA  * * * TC = 0.75 HR * * *  SHEET 6 OF 10

## Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | IA/P = 0.10 | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | IA/P = 0.10 | | |
| 0.0 | 19 | 23 | 26 | 33 | 37 | 43 | 52 | 63 | 76 | 88 | 97 | 104 | 108 | 102 | 91 | 81 | 72 | 65 | 59 | 52 | 48 | 43 | 40 | 38 | 34 | 33 | 33 | 32 | 31 | 30 | 28 | 23 |
| .10 | 19 | 22 | 26 | 32 | 35 | 41 | 48 | 58 | 70 | 82 | 92 | 100 | 105 | 103 | 94 | 83 | 75 | 67 | 61 | 53 | 48 | 44 | 40 | 38 | 35 | 33 | 33 | 32 | 31 | 30 | 28 | 23 |
| .20 | 17 | 21 | 24 | 28 | 30 | 34 | 38 | 45 | 54 | 65 | 76 | 87 | 96 | 104 | 100 | 91 | 81 | 73 | 66 | 57 | 51 | 45 | 41 | 39 | 36 | 33 | 33 | 33 | 31 | 30 | 28 | 23 |
| .30 | 16 | 20 | 23 | 27 | 29 | 32 | 36 | 42 | 50 | 60 | 71 | 81 | 91 | 103 | 101 | 93 | 84 | 75 | 67 | 58 | 52 | 46 | 42 | 39 | 36 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| .40 | 15 | 18 | 22 | 25 | 27 | 29 | 31 | 35 | 40 | 46 | 55 | 65 | 76 | 94 | 102 | 99 | 91 | 81 | 73 | 63 | 55 | 48 | 43 | 40 | 37 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| .50 | 14 | 18 | 21 | 25 | 26 | 28 | 30 | 33 | 37 | 43 | 51 | 61 | 71 | 90 | 101 | 101 | 93 | 84 | 75 | 64 | 56 | 49 | 43 | 40 | 37 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| .75 | 13 | 16 | 19 | 23 | 24 | 25 | 27 | 29 | 32 | 37 | 42 | 49 | 58 | 76 | 91 | 98 | 96 | 89 | 81 | 70 | 60 | 51 | 45 | 41 | 38 | 35 | 34 | 33 | 32 | 30 | 28 | 23 |
| 1.0 | 10 | 13 | 16 | 19 | 20 | 22 | 23 | 24 | 26 | 27 | 30 | 33 | 37 | 50 | 67 | 83 | 94 | 97 | 93 | 81 | 70 | 58 | 48 | 43 | 40 | 37 | 34 | 33 | 32 | 31 | 29 | 24 |
| 1.5 | 6 | 8 | 10 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 24 | 27 | 33 | 42 | 56 | 71 | 84 | 93 | 89 | 75 | 59 | 49 | 44 | 40 | 37 | 35 | 33 | 31 | 29 | 24 |
| 2.0 | 3 | 5 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 21 | 23 | 27 | 32 | 41 | 53 | 74 | 88 | 91 | 74 | 59 | 49 | 43 | 40 | 37 | 34 | 32 | 30 | 25 |
| 2.5 | 1 | 2 | 4 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 16 | 18 | 20 | 23 | 26 | 32 | 45 | 64 | 84 | 89 | 72 | 58 | 48 | 43 | 40 | 34 | 33 | 30 | 26 |
| 3.0 | 0 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 18 | 21 | 26 | 35 | 55 | 81 | 87 | 73 | 59 | 50 | 44 | 37 | 34 | 31 | 26 |
| | IA/P = 0.30 | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | IA/P = 0.30 | | |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 16 | 23 | 31 | 38 | 44 | 51 | 53 | 52 | 52 | 50 | 48 | 46 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .10 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 13 | 20 | 27 | 35 | 46 | 51 | 53 | 52 | 51 | 50 | 47 | 45 | 44 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 17 | 24 | 31 | 43 | 50 | 52 | 52 | 51 | 50 | 47 | 45 | 44 | 42 | 42 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 14 | 21 | 28 | 40 | 48 | 52 | 52 | 52 | 50 | 48 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 12 | 18 | 31 | 42 | 49 | 52 | 52 | 51 | 49 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 6 | 10 | 15 | 28 | 39 | 47 | 51 | 52 | 51 | 49 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 6 | 9 | 19 | 31 | 41 | 47 | 50 | 51 | 50 | 48 | 46 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 14 | 25 | 36 | 44 | 49 | 51 | 50 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 23 | 33 | 44 | 49 | 50 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 39 | 37 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 25 | 38 | 48 | 50 | 47 | 44 | 43 | 42 | 41 | 40 | 40 | 39 | 37 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 19 | 36 | 48 | 49 | 47 | 44 | 43 | 42 | 40 | 40 | 39 | 38 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 18 | 37 | 47 | 49 | 46 | 44 | 43 | 41 | 40 | 40 | 38 |
| | IA/P = 0.50 | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | IA/P = 0.50 | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 7 | 11 | 16 | 21 | 26 | 30 | 32 | 34 | 38 | 40 | 43 | 43 | 43 | 43 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 14 | 19 | 25 | 29 | 31 | 33 | 37 | 39 | 42 | 43 | 43 | 43 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 11 | 17 | 23 | 28 | 30 | 32 | 36 | 39 | 42 | 43 | 43 | 43 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 9 | 15 | 21 | 27 | 30 | 32 | 35 | 38 | 41 | 43 | 43 | 43 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 20 | 25 | 29 | 31 | 34 | 37 | 41 | 43 | 43 | 43 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 18 | 24 | 28 | 31 | 33 | 36 | 41 | 43 | 43 | 43 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 22 | 27 | 30 | 32 | 35 | 40 | 43 | 43 | 43 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 20 | 25 | 29 | 31 | 34 | 39 | 42 | 43 | 43 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 14 | 20 | 25 | 29 | 31 | 37 | 41 | 43 | 43 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 14 | 20 | 26 | 29 | 34 | 39 | 43 | 43 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 15 | 21 | 26 | 32 | 37 | 43 | 43 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 14 | 20 | 29 | 34 | 42 | 43 |
| | RAINFALL TYPE = IA | | | | | | | | | | | | | * * * TC = 1.0 HR * * * | | | | | | | | | | | | | | | | SHEET 7 OF 10 | | |

# Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 17 | 21 | 24 | 29 | 33 | 37 | 43 | 52 | 61 | 71 | 81 | 89 | 95 | 100 | 94 | 86 | 78 | 71 | 64 | 57 | 51 | 46 | 42 | 39 | 35 | 34 | 33 | 33 | 31 | 30 | 28 | 23 |
| .10 | 16 | 19 | 23 | 27 | 29 | 31 | 35 | 41 | 48 | 57 | 66 | 76 | 85 | 96 | 99 | 92 | 84 | 76 | 69 | 60 | 54 | 47 | 43 | 40 | 36 | 34 | 34 | 33 | 31 | 30 | 28 | 23 |
| .20 | 15 | 19 | 22 | 26 | 28 | 30 | 33 | 38 | 45 | 53 | 62 | 71 | 80 | 93 | 97 | 93 | 86 | 78 | 71 | 62 | 55 | 48 | 43 | 40 | 37 | 34 | 34 | 33 | 31 | 30 | 28 | 23 |
| .30 | 14 | 17 | 20 | 24 | 25 | 27 | 29 | 32 | 36 | 42 | 49 | 58 | 67 | 84 | 95 | 96 | 91 | 84 | 76 | 66 | 58 | 50 | 44 | 41 | 38 | 35 | 34 | 33 | 31 | 30 | 28 | 23 |
| .40 | 13 | 16 | 20 | 23 | 25 | 26 | 28 | 31 | 34 | 39 | 46 | 54 | 62 | 80 | 92 | 96 | 93 | 86 | 78 | 68 | 59 | 51 | 45 | 41 | 38 | 35 | 34 | 33 | 31 | 30 | 28 | 23 |
| .50 | 12 | 15 | 18 | 21 | 23 | 24 | 25 | 27 | 29 | 33 | 37 | 43 | 50 | 67 | 83 | 93 | 95 | 91 | 84 | 73 | 63 | 54 | 46 | 42 | 39 | 36 | 34 | 33 | 32 | 30 | 28 | 23 |
| .75 | 10 | 13 | 16 | 20 | 21 | 22 | 23 | 25 | 27 | 29 | 32 | 36 | 42 | 55 | 71 | 84 | 93 | 93 | 88 | 78 | 68 | 57 | 49 | 43 | 40 | 37 | 34 | 34 | 32 | 31 | 28 | 24 |
| 1.0 | 8 | 10 | 13 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 25 | 27 | 29 | 37 | 49 | 63 | 78 | 88 | 92 | 88 | 78 | 65 | 53 | 46 | 42 | 39 | 36 | 34 | 33 | 31 | 29 | 24 |
| 1.5 | 5 | 7 | 9 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 25 | 29 | 36 | 47 | 60 | 73 | 87 | 89 | 79 | 64 | 53 | 46 | 42 | 38 | 36 | 33 | 32 | 29 | 25 |
| 2.0 | 2 | 4 | 6 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 19 | 21 | 24 | 29 | 36 | 45 | 64 | 80 | 87 | 77 | 63 | 52 | 46 | 41 | 38 | 34 | 32 | 30 | 25 |
| 2.5 | 1 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 13 | 15 | 17 | 19 | 22 | 26 | 35 | 49 | 72 | 85 | 78 | 65 | 53 | 46 | 42 | 36 | 33 | 30 | 26 |
| 3.0 | 0 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 7 | 9 | 11 | 12 | 14 | 17 | 19 | 23 | 31 | 47 | 73 | 84 | 76 | 63 | 53 | 46 | 38 | 34 | 31 | 26 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 15 | 22 | 28 | 34 | 43 | 48 | 51 | 51 | 51 | 49 | 47 | 45 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 8 | 13 | 19 | 25 | 36 | 45 | 49 | 51 | 50 | 50 | 48 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 11 | 16 | 22 | 34 | 43 | 48 | 50 | 50 | 50 | 48 | 46 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 5 | 9 | 14 | 19 | 31 | 40 | 46 | 49 | 50 | 50 | 48 | 46 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 12 | 17 | 28 | 38 | 45 | 49 | 50 | 50 | 49 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 6 | 10 | 14 | 25 | 36 | 43 | 48 | 50 | 50 | 49 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 6 | 13 | 23 | 33 | 41 | 46 | 49 | 50 | 48 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 14 | 23 | 32 | 40 | 46 | 49 | 49 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 21 | 30 | 41 | 47 | 49 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 39 | 37 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 23 | 35 | 45 | 48 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 37 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 18 | 33 | 45 | 48 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 38 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 17 | 34 | 45 | 48 | 46 | 44 | 43 | 41 | 40 | 40 | 38 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 9 | 14 | 19 | 24 | 28 | 31 | 33 | 37 | 39 | 42 | 42 | 42 | 42 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 11 | 17 | 23 | 27 | 30 | 32 | 36 | 38 | 42 | 42 | 42 | 42 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 15 | 21 | 26 | 29 | 32 | 35 | 38 | 41 | 42 | 42 | 42 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 19 | 25 | 29 | 31 | 34 | 37 | 41 | 42 | 42 | 42 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 17 | 23 | 28 | 30 | 33 | 36 | 40 | 42 | 42 | 42 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 22 | 26 | 30 | 32 | 35 | 40 | 42 | 42 | 42 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 13 | 20 | 25 | 29 | 31 | 34 | 39 | 42 | 42 | 42 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 17 | 23 | 27 | 30 | 33 | 38 | 42 | 42 | 42 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 11 | 18 | 23 | 28 | 30 | 36 | 40 | 42 | 42 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 12 | 18 | 24 | 28 | 33 | 39 | 42 | 42 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 19 | 24 | 31 | 37 | 42 | 42 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 12 | 18 | 28 | 33 | 42 | 42 |

RAINFALL TYPE = IA * * * TC = 1.25 HR * * * SHEET 8 OF 12

## Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

| TRVL TIME (HR) | 7.0 | 7.3 | 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 15 | 19 | 22 | 27 | 29 | 32 | 37 | 42 | 49 | 57 | 65 | 73 | 80 | 89 | 94 | 89 | 83 | 76 | 70 | 62 | 55 | 49 | 44 | 40 | 37 | 35 | 34 | 33 | 31 | 30 | 28 | 23 |
| .10 | 14 | 17 | 20 | 24 | 26 | 28 | 31 | 35 | 40 | 46 | 53 | 61 | 69 | 82 | 90 | 92 | 87 | 81 | 74 | 65 | 58 | 51 | 45 | 41 | 38 | 35 | 34 | 33 | 31 | 30 | 28 | 23 |
| .20 | 13 | 16 | 20 | 23 | 25 | 27 | 29 | 33 | 37 | 43 | 50 | 57 | 65 | 79 | 88 | 91 | 88 | 82 | 76 | 67 | 59 | 52 | 46 | 42 | 38 | 35 | 34 | 33 | 32 | 30 | 28 | 23 |
| .30 | 12 | 15 | 18 | 22 | 23 | 24 | 26 | 28 | 31 | 35 | 41 | 47 | 54 | 69 | 81 | 89 | 90 | 86 | 81 | 71 | 63 | 54 | 47 | 43 | 39 | 36 | 34 | 34 | 32 | 30 | 28 | 24 |
| .40 | 11 | 14 | 18 | 21 | 22 | 24 | 25 | 27 | 30 | 34 | 38 | 44 | 51 | 65 | 78 | 87 | 90 | 87 | 82 | 73 | 64 | 55 | 48 | 43 | 40 | 36 | 34 | 34 | 32 | 30 | 28 | 24 |
| .50 | 10 | 13 | 16 | 19 | 20 | 22 | 23 | 24 | 26 | 29 | 32 | 36 | 41 | 54 | 69 | 81 | 88 | 89 | 86 | 77 | 68 | 58 | 50 | 44 | 41 | 37 | 35 | 34 | 32 | 31 | 29 | 24 |
| .75 | 9 | 11 | 14 | 18 | 19 | 20 | 21 | 22 | 24 | 26 | 28 | 31 | 35 | 46 | 58 | 71 | 82 | 88 | 88 | 81 | 73 | 62 | 52 | 46 | 42 | 38 | 35 | 34 | 32 | 31 | 29 | 24 |
| 1.0 | 7 | 9 | 11 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 24 | 26 | 32 | 40 | 52 | 65 | 76 | 84 | 87 | 81 | 70 | 58 | 49 | 44 | 40 | 37 | 35 | 33 | 31 | 29 | 24 |
| 1.5 | 4 | 6 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 22 | 26 | 31 | 39 | 50 | 62 | 77 | 85 | 81 | 69 | 57 | 49 | 44 | 40 | 37 | 34 | 32 | 30 | 25 |
| 2.0 | 2 | 3 | 5 | 7 | 7 | 8 | 9 | 10 | 11 | 12 | 12 | 13 | 14 | 17 | 19 | 22 | 25 | 31 | 38 | 53 | 69 | 83 | 80 | 68 | 56 | 48 | 43 | 40 | 35 | 33 | 30 | 25 |
| 2.5 | 1 | 1 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 9 | 11 | 13 | 15 | 17 | 20 | 23 | 30 | 41 | 61 | 82 | 82 | 69 | 58 | 49 | 44 | 37 | 34 | 31 | 26 |
| 3.0 | 0 | 0 | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 8 | 9 | 11 | 13 | 15 | 17 | 21 | 27 | 40 | 63 | 80 | 78 | 68 | 57 | 49 | 40 | 35 | 31 | 27 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 6 | 10 | 14 | 19 | 24 | 34 | 41 | 46 | 48 | 49 | 48 | 47 | 46 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 35 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 5 | 8 | 12 | 17 | 27 | 36 | 42 | 46 | 48 | 49 | 48 | 46 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 10 | 15 | 24 | 33 | 41 | 45 | 48 | 49 | 48 | 47 | 45 | 43 | 43 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 6 | 9 | 13 | 22 | 31 | 39 | 44 | 47 | 48 | 48 | 47 | 45 | 44 | 43 | 41 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 5 | 7 | 15 | 24 | 33 | 40 | 45 | 47 | 48 | 47 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 6 | 13 | 22 | 31 | 38 | 44 | 47 | 48 | 48 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 4 | 9 | 16 | 24 | 33 | 39 | 44 | 47 | 48 | 47 | 45 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 39 | 36 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 12 | 20 | 29 | 36 | 44 | 47 | 48 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 36 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 19 | 30 | 39 | 46 | 47 | 46 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 37 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 17 | 28 | 40 | 46 | 47 | 45 | 44 | 42 | 41 | 40 | 40 | 40 | 37 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 26 | 40 | 47 | 47 | 45 | 43 | 42 | 40 | 40 | 40 | 38 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 28 | 41 | 46 | 46 | 45 | 43 | 41 | 40 | 40 | 38 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 7 | 11 | 16 | 22 | 27 | 30 | 32 | 35 | 38 | 42 | 42 | 42 | 42 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 7 | 13 | 19 | 24 | 28 | 31 | 34 | 37 | 41 | 42 | 42 | 42 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 12 | 19 | 24 | 28 | 31 | 33 | 36 | 41 | 42 | 42 | 42 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 18 | 23 | 28 | 30 | 33 | 36 | 40 | 42 | 42 | 42 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 17 | 23 | 27 | 30 | 33 | 36 | 40 | 42 | 42 | 42 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 17 | 22 | 27 | 30 | 32 | 36 | 40 | 41 | 41 | 41 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 10 | 16 | 22 | 26 | 29 | 32 | 35 | 40 | 41 | 41 | 41 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 17 | 23 | 27 | 30 | 33 | 38 | 41 | 41 | 41 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 12 | 18 | 23 | 27 | 30 | 36 | 40 | 41 | 41 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 12 | 18 | 24 | 28 | 33 | 39 | 41 | 41 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 13 | 19 | 24 | 31 | 36 | 41 | 41 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 19 | 28 | 34 | 41 | 41 |
| RAINFALL TYPE = IA | | | | | | | | | | | | | | * * * TC = 1.5 HR * * * | | | | | | | | | | | | | | | | | | SHEET 9 OF 10 |

## Exhibit 5-IA, continued: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

| TRVL TIME (HR) | 7.0 | 7.3/ 7.6 | 7.9 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.3 | 10.6 | 11.0 | 11.5 | 12.0 | 12.5 | 13.0 | 13.5 | 14.0 | 15.0 | 16.0 | 18.0 | 22.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | IA/P = 0.10 | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 12 | 15 | 18 | 22 | 24 | 26 | 28 | 32 | 36 | 41 | 46 | 52 | 58 | 68 | 76 | 80 | 84 | 79 | 76 | 68 | 62 | 55 | 48 | 44 | 40 | 37 | 35 | 34 | 32 | 31 | 28 | 24 |
| .10 | 11 | 13 | 16 | 20 | 21 | 23 | 25 | 27 | 30 | 34 | 38 | 43 | 49 | 60 | 70 | 77 | 83 | 83 | 78 | 72 | 65 | 57 | 50 | 45 | 41 | 38 | 36 | 34 | 32 | 31 | 29 | 24 |
| .20 | 9 | 12 | 15 | 18 | 19 | 21 | 22 | 24 | 26 | 29 | 32 | 36 | 41 | 52 | 63 | 72 | 78 | 82 | 81 | 75 | 68 | 60 | 52 | 46 | 42 | 39 | 36 | 35 | 32 | 31 | 29 | 24 |
| .30 | 9 | 12 | 14 | 18 | 19 | 20 | 21 | 23 | 25 | 28 | 31 | 34 | 39 | 49 | 60 | 70 | 77 | 81 | 81 | 76 | 70 | 61 | 53 | 47 | 43 | 39 | 36 | 35 | 33 | 31 | 29 | 24 |
| .40 | 9 | 11 | 14 | 17 | 18 | 19 | 21 | 22 | 24 | 26 | 29 | 33 | 37 | 47 | 57 | 67 | 75 | 80 | 81 | 77 | 71 | 62 | 53 | 47 | 43 | 39 | 37 | 35 | 33 | 31 | 29 | 24 |
| .50 | 7 | 10 | 12 | 15 | 17 | 18 | 19 | 20 | 21 | 23 | 25 | 28 | 31 | 39 | 49 | 60 | 69 | 76 | 81 | 79 | 74 | 65 | 56 | 49 | 44 | 40 | 37 | 35 | 33 | 31 | 29 | 24 |
| .75 | 6 | 9 | 11 | 14 | 15 | 16 | 17 | 18 | 20 | 21 | 23 | 25 | 27 | 34 | 42 | 52 | 62 | 70 | 76 | 79 | 76 | 68 | 59 | 51 | 46 | 41 | 38 | 36 | 33 | 31 | 29 | 24 |
| 1.0 | 5 | 6 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 21 | 25 | 30 | 38 | 47 | 57 | 66 | 76 | 79 | 75 | 64 | 55 | 49 | 44 | 40 | 37 | 34 | 32 | 29 | 25 |
| 1.5 | 3 | 4 | 6 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 21 | 24 | 30 | 37 | 45 | 59 | 71 | 78 | 73 | 63 | 55 | 48 | 43 | 40 | 35 | 33 | 30 | 25 |
| 2.0 | 1 | 2 | 3 | 4 | 5 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 10 | 12 | 14 | 16 | 19 | 22 | 26 | 36 | 48 | 65 | 77 | 73 | 64 | 56 | 49 | 44 | 37 | 34 | 31 | 26 |
| 2.5 | 0 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 10 | 12 | 14 | 16 | 18 | 23 | 31 | 46 | 66 | 76 | 72 | 63 | 55 | 48 | 40 | 35 | 31 | 27 |
| 3.0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 7 | 8 | 10 | 11 | 13 | 17 | 21 | 30 | 49 | 67 | 75 | 71 | 63 | 54 | 43 | 37 | 32 | 27 |
| | IA/P = 0.30 | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 5 | 7 | 10 | 13 | 20 | 27 | 34 | 39 | 42 | 44 | 47 | 45 | 45 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 39 | 36 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 4 | 6 | 8 | 15 | 22 | 29 | 35 | 40 | 43 | 45 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 36 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 5 | 10 | 17 | 24 | 31 | 36 | 41 | 44 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 36 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 9 | 15 | 22 | 29 | 35 | 39 | 44 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 36 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 4 | 8 | 14 | 20 | 27 | 33 | 38 | 43 | 46 | 46 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 40 | 36 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 5 | 9 | 15 | 22 | 29 | 35 | 41 | 44 | 45 | 45 | 44 | 43 | 42 | 40 | 40 | 40 | 40 | 40 | 36 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 6 | 11 | 17 | 24 | 30 | 38 | 42 | 45 | 45 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 40 | 37 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 14 | 21 | 30 | 38 | 43 | 45 | 44 | 44 | 43 | 41 | 40 | 40 | 40 | 40 | 37 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 16 | 25 | 36 | 43 | 45 | 44 | 43 | 42 | 41 | 40 | 40 | 40 | 38 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 12 | 24 | 36 | 43 | 45 | 44 | 43 | 42 | 40 | 40 | 40 | 38 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 25 | 37 | 43 | 45 | 44 | 43 | 41 | 40 | 40 | 38 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 26 | 37 | 43 | 44 | 44 | 42 | 40 | 40 | 39 |
| | IA/P = 0.50 | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 12 | 18 | 23 | 27 | 30 | 33 | 36 | 40 | 40 | 40 | 40 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 10 | 16 | 21 | 26 | 29 | 32 | 35 | 40 | 40 | 40 | 40 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 14 | 20 | 25 | 28 | 31 | 34 | 39 | 40 | 40 | 40 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 12 | 18 | 23 | 27 | 30 | 33 | 38 | 40 | 40 | 40 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 16 | 22 | 26 | 29 | 32 | 38 | 40 | 40 | 40 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 15 | 20 | 25 | 28 | 31 | 37 | 40 | 40 | 40 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 13 | 19 | 24 | 27 | 30 | 36 | 40 | 40 | 40 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 14 | 20 | 24 | 28 | 34 | 39 | 40 | 40 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 10 | 16 | 21 | 25 | 32 | 37 | 40 | 40 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 11 | 16 | 21 | 29 | 35 | 40 | 40 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 11 | 17 | 26 | 32 | 40 | 40 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 11 | 21 | 29 | 39 | 40 |

RAINFALL TYPE = IA * * * TC = 2.0 HR * * * SHEET 10 OF 10

## Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR) — HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 24 | 34 | 53 | 334 | 647 | 1010 | 623 | 217 | 147 | 123 | 104 | 86 | 76 | 66 | 57 | 51 | 46 | 42 | 38 | 34 | 32 | 29 | 26 | 23 | 21 | 20 | 19 | 18 | 15 | 13 | 12 | 0 |
| .10 | 21 | 29 | 43 | 134 | 267 | 520 | 847 | 701 | 378 | 224 | 157 | 122 | 98 | 75 | 64 | 56 | 50 | 45 | 41 | 36 | 33 | 30 | 27 | 24 | 21 | 20 | 19 | 18 | 16 | 13 | 12 | 0 |
| .20 | 18 | 25 | 35 | 61 | 110 | 215 | 418 | 704 | 702 | 486 | 312 | 209 | 151 | 94 | 73 | 62 | 54 | 49 | 44 | 38 | 34 | 31 | 28 | 25 | 22 | 21 | 19 | 18 | 16 | 14 | 12 | 0 |
| .30 | 17 | 23 | 33 | 56 | 92 | 174 | 337 | 582 | 662 | 545 | 359 | 269 | 190 | 109 | 79 | 65 | 56 | 50 | 45 | 39 | 35 | 32 | 29 | 25 | 22 | 21 | 20 | 18 | 16 | 14 | 12 | 0 |
| .40 | 15 | 20 | 28 | 41 | 51 | 78 | 142 | 272 | 478 | 601 | 563 | 447 | 328 | 172 | 104 | 76 | 63 | 55 | 49 | 42 | 37 | 33 | 29 | 26 | 23 | 21 | 20 | 19 | 17 | 14 | 12 | 0 |
| .50 | 14 | 19 | 26 | 39 | 47 | 68 | 117 | 220 | 392 | 531 | 553 | 482 | 380 | 209 | 121 | 84 | 67 | 57 | 51 | 43 | 38 | 33 | 30 | 27 | 23 | 21 | 20 | 19 | 17 | 14 | 12 | 0 |
| .75 | 12 | 15 | 21 | 29 | 33 | 38 | 49 | 73 | 126 | 224 | 343 | 432 | 464 | 385 | 252 | 156 | 103 | 76 | 62 | 50 | 43 | 36 | 31 | 28 | 25 | 22 | 21 | 19 | 17 | 15 | 12 | 0 |
| 1.0 | 9 | 12 | 15 | 21 | 23 | 26 | 29 | 33 | 40 | 55 | 86 | 148 | 238 | 406 | 434 | 317 | 205 | 130 | 89 | 62 | 50 | 41 | 34 | 30 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 0 |
| 1.5 | 7 | 8 | 10 | 14 | 15 | 16 | 18 | 20 | 22 | 25 | 29 | 34 | 45 | 101 | 220 | 339 | 373 | 320 | 234 | 131 | 80 | 53 | 40 | 34 | 30 | 27 | 24 | 21 | 19 | 17 | 12 | 2 |
| 2.0 | 4 | 6 | 7 | 9 | 9 | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 25 | 37 | 72 | 150 | 252 | 336 | 312 | 216 | 109 | 58 | 42 | 34 | 30 | 27 | 24 | 20 | 18 | 13 | 8 |
| 2.5 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 16 | 19 | 25 | 39 | 75 | 142 | 262 | 303 | 229 | 108 | 58 | 41 | 34 | 30 | 27 | 22 | 19 | 14 | 11 |
| 3.0 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 10 | 12 | 14 | 17 | 22 | 31 | 76 | 169 | 288 | 236 | 122 | 64 | 43 | 35 | 30 | 24 | 20 | 16 | 11 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 154 | 568 | 936 | 524 | 217 | 172 | 149 | 126 | 107 | 97 | 86 | 76 | 69 | 63 | 58 | 53 | 48 | 46 | 42 | 38 | 34 | 31 | 30 | 28 | 27 | 24 | 20 | 19 | 0 |
| .10 | 0 | 0 | 0 | 19 | 109 | 415 | 762 | 603 | 346 | 230 | 176 | 143 | 119 | 96 | 84 | 74 | 68 | 62 | 57 | 50 | 47 | 44 | 40 | 35 | 32 | 30 | 29 | 27 | 24 | 21 | 19 | 0 |
| .20 | 0 | 0 | 0 | 0 | 13 | 77 | 302 | 609 | 605 | 432 | 297 | 217 | 167 | 115 | 94 | 81 | 73 | 66 | 60 | 53 | 48 | 45 | 41 | 37 | 33 | 31 | 29 | 28 | 25 | 21 | 19 | 0 |
| .30 | 0 | 0 | 0 | 0 | 9 | 54 | 219 | 479 | 563 | 476 | 357 | 263 | 199 | 129 | 99 | 85 | 75 | 68 | 62 | 54 | 49 | 45 | 41 | 37 | 33 | 31 | 29 | 23 | 25 | 21 | 19 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 6 | 38 | 159 | 372 | 500 | 484 | 399 | 309 | 183 | 123 | 96 | 82 | 73 | 66 | 58 | 51 | 46 | 42 | 38 | 34 | 31 | 30 | 28 | 25 | 22 | 19 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 4 | 27 | 115 | 287 | 429 | 465 | 421 | 346 | 213 | 138 | 103 | 86 | 76 | 68 | 59 | 52 | 47 | 43 | 39 | 34 | 32 | 30 | 29 | 25 | 22 | 19 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 46 | 132 | 246 | 338 | 381 | 341 | 243 | 165 | 119 | 94 | 80 | 67 | 58 | 50 | 45 | 41 | 37 | 33 | 31 | 29 | 26 | 23 | 19 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 22 | 69 | 149 | 241 | 357 | 331 | 246 | 170 | 122 | 96 | 76 | 64 | 54 | 47 | 42 | 38 | 34 | 32 | 30 | 27 | 24 | 19 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 41 | 142 | 258 | 310 | 285 | 224 | 142 | 97 | 71 | 55 | 47 | 43 | 39 | 35 | 32 | 29 | 25 | 20 | 4 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 49 | 130 | 221 | 279 | 255 | 182 | 108 | 70 | 55 | 47 | 42 | 38 | 34 | 30 | 27 | 20 | 11 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 14 | 52 | 119 | 224 | 256 | 193 | 107 | 70 | 55 | 47 | 42 | 38 | 32 | 28 | 22 | 17 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 52 | 141 | 240 | 199 | 117 | 74 | 56 | 48 | 43 | 35 | 30 | 24 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 70 | 539 | 377 | 196 | 171 | 154 | 134 | 117 | 108 | 99 | 89 | 83 | 77 | 72 | 67 | 61 | 59 | 56 | 51 | 46 | 43 | 42 | 40 | 38 | 34 | 30 | 28 | 0 |
| .10 | 0 | 0 | 0 | 0 | 47 | 375 | 376 | 256 | 199 | 169 | 146 | 126 | 114 | 102 | 92 | 85 | 79 | 73 | 68 | 62 | 59 | 56 | 52 | 47 | 43 | 42 | 40 | 38 | 34 | 30 | 28 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 31 | 260 | 338 | 283 | 227 | 189 | 160 | 138 | 112 | 99 | 90 | 83 | 77 | 72 | 64 | 60 | 57 | 53 | 48 | 44 | 42 | 41 | 39 | 35 | 30 | 28 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 180 | 285 | 284 | 246 | 208 | 176 | 131 | 110 | 97 | 88 | 82 | 76 | 68 | 62 | 59 | 54 | 50 | 45 | 43 | 41 | 39 | 36 | 31 | 28 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 125 | 232 | 266 | 253 | 223 | 192 | 142 | 115 | 100 | 91 | 83 | 77 | 69 | 63 | 59 | 55 | 50 | 45 | 43 | 41 | 40 | 36 | 31 | 28 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 86 | 183 | 239 | 248 | 231 | 205 | 154 | 122 | 104 | 93 | 85 | 79 | 71 | 64 | 59 | 55 | 51 | 46 | 43 | 41 | 40 | 36 | 32 | 28 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 31 | 87 | 147 | 190 | 211 | 213 | 184 | 147 | 121 | 103 | 92 | 84 | 75 | 67 | 61 | 57 | 52 | 47 | 44 | 42 | 40 | 37 | 32 | 28 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 45 | 92 | 141 | 205 | 197 | 165 | 134 | 112 | 98 | 84 | 75 | 65 | 59 | 55 | 50 | 46 | 43 | 41 | 38 | 34 | 28 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 51 | 118 | 170 | 183 | 167 | 143 | 111 | 92 | 77 | 65 | 59 | 54 | 50 | 45 | 43 | 39 | 35 | 28 | 2 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 15 | 51 | 103 | 148 | 168 | 156 | 127 | 96 | 76 | 65 | 58 | 54 | 49 | 45 | 41 | 37 | 29 | 12 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 31 | 69 | 131 | 159 | 140 | 101 | 78 | 66 | 59 | 54 | 50 | 43 | 39 | 31 | 24 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 46 | 101 | 151 | 134 | 99 | 77 | 65 | 59 | 54 | 45 | 41 | 33 | 26 |

RAINFALL TYPE = II — * * * TC = 0.1 HR * * * — SHEET 1 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 23 | 31 | 47 | 209 | 403 | 739 | 800 | 481 | 250 | 166 | 128 | 102 | 86 | 70 | 61 | 54 | 49 | 44 | 40 | 35 | 33 | 30 | 27 | 24 | 21 | 20 | 19 | 18 | 16 | 13 | 12 | 0 |
| .10 | 19 | 26 | 39 | 86 | 168 | 325 | 601 | 733 | 565 | 355 | 229 | 161 | 122 | 83 | 69 | 59 | 53 | 47 | 43 | 37 | 34 | 31 | 28 | 25 | 22 | 21 | 19 | 18 | 16 | 14 | 12 | 0 |
| .20 | 17 | 23 | 32 | 49 | 74 | 136 | 262 | 488 | 652 | 594 | 435 | 298 | 207 | 115 | 81 | 67 | 58 | 51 | 46 | 40 | 35 | 32 | 29 | 26 | 23 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .30 | 16 | 22 | 30 | 46 | 64 | 112 | 212 | 396 | 566 | 585 | 485 | 360 | 258 | 139 | 90 | 71 | 60 | 53 | 48 | 41 | 36 | 32 | 29 | 26 | 23 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .40 | 14 | 19 | 25 | 37 | 43 | 57 | 94 | 173 | 322 | 485 | 551 | 507 | 409 | 227 | 129 | 87 | 68 | 58 | 52 | 44 | 38 | 33 | 30 | 27 | 24 | 21 | 20 | 19 | 17 | 14 | 12 | 0 |
| .50 | 13 | 18 | 24 | 35 | 40 | 52 | 80 | 142 | 262 | 410 | 504 | 506 | 441 | 269 | 153 | 98 | 73 | 61 | 53 | 45 | 39 | 34 | 30 | 27 | 24 | 22 | 20 | 19 | 17 | 15 | 12 | 0 |
| .75 | 10 | 13 | 17 | 23 | 26 | 30 | 34 | 40 | 55 | 86 | 150 | 247 | 349 | 438 | 360 | 240 | 151 | 101 | 75 | 57 | 47 | 39 | 33 | 29 | 26 | 23 | 21 | 20 | 18 | 15 | 12 | 0 |
| 1.0 | 9 | 11 | 14 | 19 | 21 | 24 | 26 | 30 | 35 | 44 | 62 | 101 | 167 | 337 | 413 | 353 | 245 | 157 | 104 | 68 | 53 | 42 | 35 | 31 | 28 | 24 | 22 | 20 | 18 | 16 | 12 | 0 |
| 1.5 | 6 | 8 | 10 | 13 | 14 | 15 | 17 | 19 | 21 | 23 | 26 | 30 | 37 | 73 | 166 | 288 | 356 | 337 | 264 | 154 | 91 | 57 | 42 | 35 | 30 | 27 | 24 | 22 | 19 | 17 | 13 | 3 |
| 2.0 | 4 | 5 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 14 | 15 | 16 | 18 | 23 | 31 | 55 | 114 | 206 | 291 | 324 | 239 | 125 | 63 | 44 | 35 | 31 | 28 | 24 | 20 | 18 | 14 | 9 |
| 2.5 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 15 | 18 | 22 | 32 | 58 | 111 | 227 | 298 | 246 | 122 | 63 | 43 | 35 | 31 | 27 | 22 | 19 | 15 | 11 |
| 3.0 | 1 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 11 | 13 | 16 | 19 | 27 | 59 | 138 | 280 | 248 | 137 | 70 | 46 | 36 | 31 | 25 | 21 | 16 | 11 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 39 | 180 | 545 | 697 | 497 | 276 | 198 | 158 | 130 | 110 | 93 | 81 | 73 | 67 | 61 | 56 | 49 | 46 | 43 | 39 | 35 | 32 | 30 | 29 | 27 | 24 | 21 | 19 | 0 |
| .10 | 0 | 0 | 0 | 2 | 27 | 129 | 407 | 600 | 532 | 361 | 252 | 190 | 150 | 108 | 90 | 79 | 71 | 65 | 59 | 52 | 48 | 44 | 41 | 36 | 32 | 31 | 29 | 28 | 25 | 21 | 19 | 0 |
| .20 | 0 | 0 | 0 | 2 | 19 | 92 | 302 | 501 | 521 | 415 | 306 | 228 | 176 | 119 | 95 | 82 | 73 | 67 | 61 | 53 | 48 | 45 | 41 | 37 | 33 | 31 | 29 | 28 | 25 | 21 | 19 | 0 |
| .30 | 0 | 0 | 0 | 0 | 1 | 13 | 66 | 223 | 408 | 484 | 438 | 350 | 269 | 163 | 114 | 93 | 80 | 72 | 65 | 57 | 51 | 46 | 42 | 38 | 34 | 31 | 30 | 28 | 25 | 22 | 19 | 0 |
| .40 | 0 | 0 | 0 | 0 | 1 | 9 | 47 | 164 | 327 | 431 | 436 | 379 | 306 | 189 | 127 | 98 | 83 | 74 | 67 | 58 | 52 | 47 | 43 | 38 | 34 | 31 | 30 | 28 | 25 | 22 | 19 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 33 | 120 | 258 | 374 | 415 | 391 | 271 | 173 | 121 | 95 | 81 | 72 | 62 | 55 | 48 | 44 | 40 | 35 | 32 | 30 | 29 | 26 | 22 | 19 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 50 | 126 | 221 | 302 | 348 | 323 | 240 | 167 | 121 | 96 | 81 | 68 | 59 | 50 | 45 | 41 | 37 | 33 | 31 | 29 | 26 | 23 | 19 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 24 | 69 | 139 | 285 | 331 | 280 | 204 | 145 | 109 | 82 | 68 | 56 | 48 | 43 | 39 | 35 | 32 | 30 | 27 | 24 | 19 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 16 | 79 | 186 | 271 | 288 | 247 | 165 | 110 | 76 | 58 | 49 | 44 | 40 | 35 | 32 | 29 | 26 | 20 | 5 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 24 | 80 | 163 | 235 | 262 | 202 | 123 | 76 | 58 | 49 | 43 | 39 | 35 | 30 | 27 | 21 | 13 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 28 | 77 | 179 | 242 | 207 | 120 | 75 | 57 | 48 | 43 | 39 | 32 | 29 | 22 | 17 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 30 | 101 | 207 | 227 | 130 | 80 | 59 | 49 | 44 | 35 | 30 | 24 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.2 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 7 | 98 | 371 | 322 | 221 | 182 | 158 | 137 | 120 | 104 | 94 | 86 | 80 | 74 | 69 | 62 | 60 | 57 | 52 | 47 | 44 | 42 | 40 | 39 | 35 | 30 | 28 | 0 |
| .10 | 0 | 0 | 0 | 0 | 4 | 67 | 270 | 305 | 249 | 204 | 174 | 149 | 130 | 108 | 97 | 88 | 82 | 76 | 71 | 64 | 60 | 57 | 53 | 48 | 44 | 42 | 41 | 39 | 35 | 30 | 28 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 3 | 45 | 195 | 268 | 255 | 221 | 189 | 163 | 125 | 106 | 95 | 87 | 80 | 75 | 67 | 62 | 58 | 54 | 49 | 45 | 43 | 41 | 39 | 35 | 31 | 28 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 2 | 31 | 140 | 226 | 245 | 229 | 203 | 176 | 134 | 111 | 98 | 89 | 82 | 76 | 68 | 62 | 59 | 55 | 50 | 45 | 43 | 41 | 39 | 36 | 31 | 28 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 1 | 21 | 101 | 184 | 225 | 228 | 211 | 188 | 144 | 117 | 101 | 91 | 84 | 78 | 69 | 63 | 59 | 55 | 50 | 45 | 43 | 41 | 40 | 36 | 31 | 28 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 14 | 72 | 146 | 199 | 218 | 213 | 175 | 137 | 113 | 99 | 89 | 82 | 73 | 66 | 60 | 56 | 52 | 47 | 43 | 42 | 40 | 36 | 32 | 28 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 28 | 71 | 121 | 162 | 186 | 193 | 161 | 133 | 112 | 98 | 88 | 78 | 70 | 62 | 57 | 53 | 48 | 44 | 42 | 41 | 37 | 33 | 28 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 38 | 77 | 154 | 186 | 174 | 147 | 122 | 105 | 89 | 78 | 68 | 60 | 56 | 51 | 46 | 43 | 42 | 38 | 34 | 28 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 22 | 71 | 129 | 163 | 168 | 150 | 120 | 98 | 80 | 67 | 60 | 55 | 51 | 46 | 43 | 40 | 36 | 28 | 4 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 25 | 65 | 112 | 146 | 157 | 134 | 103 | 79 | 67 | 60 | 55 | 50 | 46 | 41 | 38 | 29 | 14 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 26 | 60 | 117 | 148 | 136 | 101 | 79 | 66 | 59 | 54 | 50 | 43 | 39 | 31 | 24 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 40 | 90 | 142 | 130 | 99 | 78 | 66 | 59 | 54 | 45 | 41 | 33 | 26 |

[redacted] INF[redacted] TYPE[redacted] I [redacted] * *[redacted] = C.[redacted] R * [redacted] SHE[redacted] OF[redacted]

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 * * * TC =0.3 HR * * * IA/P = 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 20 | 28 | 41 | 118 | 235 | 447 | 676 | 676 | 459 | 283 | 196 | 146 | 114 | 80 | 66 | 57 | 51 | 46 | 42 | 37 | 33 | 31 | 28 | 24 | 22 | 20 | 19 | 18 | 16 | 13 | 12 | 0 |
| .10 | 19 | 26 | 39 | 99 | 189 | 361 | 571 | 641 | 520 | 362 | 251 | 181 | 136 | 89 | 70 | 60 | 53 | 48 | 43 | 37 | 34 | 31 | 28 | 25 | 22 | 21 | 19 | 18 | 16 | 14 | 12 | 0 |
| .20 | 17 | 23 | 32 | 53 | 83 | 154 | 292 | 478 | 587 | 542 | 422 | 308 | 223 | 127 | 86 | 68 | 58 | 52 | 46 | 40 | 35 | 32 | 29 | 26 | 23 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .30 | 16 | 22 | 30 | 49 | 72 | 127 | 237 | 398 | 524 | 536 | 460 | 359 | 268 | 151 | 97 | 73 | 61 | 53 | 48 | 41 | 36 | 32 | 29 | 26 | 23 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .40 | 14 | 19 | 25 | 37 | 45 | 63 | 105 | 193 | 330 | 459 | 510 | 477 | 398 | 237 | 139 | 92 | 70 | 59 | 52 | 44 | 38 | 34 | 30 | 27 | 24 | 21 | 20 | 19 | 17 | 14 | 12 | 0 |
| .50 | 13 | 18 | 24 | 35 | 42 | 56 | 89 | 158 | 272 | 397 | 472 | 475 | 424 | 274 | 163 | 104 | 76 | 62 | 54 | 46 | 39 | 34 | 30 | 27 | 24 | 22 | 20 | 19 | 17 | 15 | 12 | 0 |
| .75 | 11 | 14 | 19 | 26 | 30 | 34 | 42 | 59 | 95 | 160 | 250 | 339 | 417 | 398 | 299 | 196 | 128 | 89 | 69 | 54 | 45 | 37 | 32 | 29 | 26 | 23 | 21 | 20 | 17 | 15 | 12 | 0 |
| 1.0 | 9 | 11 | 14 | 19 | 21 | 24 | 27 | 30 | 36 | 46 | 68 | 109 | 174 | 328 | 396 | 346 | 248 | 163 | 109 | 70 | 54 | 43 | 35 | 31 | 28 | 24 | 22 | 20 | 18 | 16 | 12 | 0 |
| 1.5 | 6 | 8 | 10 | 13 | 14 | 15 | 17 | 19 | 21 | 23 | 26 | 31 | 38 | 77 | 169 | 282 | 347 | 330 | 264 | 158 | 94 | 58 | 42 | 35 | 31 | 27 | 24 | 22 | 19 | 17 | 13 | 3 |
| 2.0 | 4 | 5 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 14 | 15 | 16 | 18 | 23 | 32 | 57 | 116 | 205 | 285 | 317 | 239 | 128 | 64 | 44 | 36 | 31 | 28 | 25 | 20 | 18 | 14 | 9 |
| 2.5 | 2 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 15 | 18 | 23 | 33 | 60 | 113 | 223 | 293 | 245 | 125 | 65 | 44 | 35 | 31 | 27 | 22 | 19 | 15 | 11 |
| 3.0 | 1 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 11 | 13 | 16 | 20 | 27 | 61 | 138 | 275 | 246 | 139 | 72 | 46 | 36 | 31 | 25 | 21 | 16 | 11 |
| IA/P = 0.30 * * * TC =0.3 HR * * * IA/P = 0.30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 11 | 64 | 251 | 525 | 574 | 454 | 303 | 221 | 173 | 140 | 104 | 88 | 77 | 70 | 64 | 58 | 51 | 47 | 44 | 40 | 36 | 32 | 31 | 29 | 28 | 24 | 21 | 19 | 0 |
| .10 | 0 | 0 | 0 | 0 | 7 | 45 | 183 | 411 | 520 | 476 | 360 | 268 | 205 | 133 | 101 | 85 | 76 | 69 | 62 | 55 | 49 | 45 | 41 | 37 | 33 | 31 | 30 | 28 | 25 | 21 | 19 | 0 |
| .20 | 0 | 0 | 0 | 0 | 5 | 32 | 132 | 318 | 452 | 468 | 396 | 310 | 240 | 151 | 109 | 90 | 78 | 70 | 64 | 56 | 50 | 46 | 42 | 38 | 33 | 31 | 30 | 28 | 25 | 22 | 19 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 3 | 22 | 96 | 244 | 383 | 440 | 411 | 344 | 217 | 142 | 105 | 87 | 76 | 69 | 60 | 53 | 47 | 43 | 39 | 35 | 32 | 30 | 29 | 26 | 22 | 19 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 2 | 16 | 69 | 186 | 317 | 399 | 407 | 365 | 246 | 160 | 115 | 92 | 79 | 71 | 61 | 54 | 48 | 43 | 39 | 35 | 32 | 30 | 29 | 26 | 22 | 19 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 50 | 140 | 258 | 352 | 389 | 327 | 223 | 149 | 110 | 89 | 77 | 66 | 57 | 50 | 45 | 41 | 36 | 33 | 31 | 29 | 26 | 23 | 19 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 20 | 63 | 135 | 219 | 290 | 335 | 281 | 205 | 146 | 110 | 89 | 72 | 62 | 52 | 46 | 42 | 38 | 34 | 31 | 30 | 27 | 23 | 19 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 32 | 78 | 216 | 320 | 306 | 243 | 176 | 128 | 90 | 72 | 59 | 49 | 44 | 40 | 36 | 33 | 31 | 28 | 24 | 19 | 1 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 84 | 185 | 264 | 281 | 246 | 168 | 112 | 77 | 58 | 49 | 44 | 40 | 36 | 32 | 29 | 26 | 20 | 5 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 50 | 121 | 200 | 257 | 224 | 141 | 83 | 61 | 50 | 44 | 40 | 36 | 31 | 28 | 21 | 14 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 16 | 51 | 145 | 239 | 223 | 137 | 82 | 60 | 50 | 44 | 40 | 33 | 29 | 22 | 17 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 19 | 74 | 184 | 224 | 146 | 89 | 63 | 51 | 45 | 36 | 31 | 24 | 18 |
| IA/P = 0.50 * * * TC =0.3 HR * * * IA/P = 0.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 25 | 151 | 299 | 277 | 219 | 187 | 162 | 141 | 113 | 100 | 90 | 84 | 78 | 72 | 65 | 61 | 58 | 53 | 48 | 44 | 42 | 41 | 39 | 35 | 31 | 28 | 0 |
| .10 | 0 | 0 | 0 | 0 | 1 | 17 | 106 | 235 | 263 | 234 | 202 | 175 | 152 | 120 | 104 | 93 | 85 | 79 | 73 | 66 | 61 | 58 | 54 | 49 | 44 | 42 | 41 | 39 | 35 | 31 | 28 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 75 | 182 | 236 | 234 | 213 | 188 | 144 | 116 | 101 | 91 | 84 | 78 | 70 | 63 | 59 | 55 | 50 | 45 | 43 | 41 | 40 | 36 | 31 | 28 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 52 | 138 | 203 | 224 | 217 | 197 | 154 | 123 | 105 | 94 | 86 | 79 | 71 | 64 | 59 | 55 | 51 | 46 | 43 | 42 | 40 | 36 | 32 | 28 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 37 | 105 | 170 | 206 | 213 | 203 | 164 | 131 | 110 | 97 | 88 | 81 | 72 | 65 | 60 | 56 | 51 | 46 | 43 | 42 | 40 | 36 | 32 | 28 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 26 | 78 | 140 | 184 | 203 | 191 | 155 | 126 | 107 | 95 | 86 | 76 | 69 | 62 | 57 | 53 | 48 | 44 | 42 | 41 | 37 | 33 | 28 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 34 | 73 | 117 | 153 | 184 | 173 | 146 | 122 | 105 | 94 | 82 | 73 | 64 | 58 | 54 | 49 | 45 | 43 | 41 | 37 | 33 | 28 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 17 | 42 | 114 | 168 | 178 | 159 | 134 | 114 | 94 | 82 | 70 | 61 | 57 | 52 | 47 | 44 | 42 | 39 | 35 | 28 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 44 | 98 | 144 | 163 | 157 | 130 | 105 | 84 | 69 | 61 | 56 | 52 | 47 | 44 | 40 | 36 | 29 | 6 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 14 | 44 | 87 | 127 | 153 | 141 | 110 | 83 | 69 | 61 | 56 | 51 | 47 | 42 | 38 | 30 | 17 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 16 | 42 | 97 | 138 | 145 | 107 | 82 | 68 | 60 | 55 | 51 | 43 | 40 | 32 | 25 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 27 | 71 | 127 | 139 | 105 | 81 | 68 | 60 | 55 | 46 | 41 | 33 | 27 |

RAINFALL TYPE = II * * * TC = 0.3 HR * * * SHEET 3 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 18 | 25 | 36 | 77 | 141 | 271 | 468 | 592 | 574 | 431 | 298 | 216 | 163 | 104 | 77 | 63 | 55 | 49 | 44 | 38 | 34 | 31 | 28 | 25 | 22 | 21 | 20 | 18 | 16 | 14 | 12 | 0 |
| .10 | 18 | 24 | 34 | 67 | 116 | 219 | 385 | 523 | 557 | 473 | 357 | 263 | 196 | 119 | 84 | 67 | 57 | 51 | 46 | 39 | 35 | 32 | 29 | 25 | 22 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .20 | 15 | 20 | 28 | 44 | 59 | 97 | 179 | 316 | 454 | 523 | 489 | 401 | 309 | 178 | 112 | 81 | 65 | 56 | 49 | 42 | 37 | 33 | 30 | 26 | 23 | 21 | 20 | 19 | 17 | 14 | 12 | 0 |
| .30 | 15 | 20 | 27 | 41 | 53 | 82 | 147 | 260 | 389 | 478 | 486 | 429 | 349 | 210 | 129 | 89 | 69 | 58 | 51 | 43 | 38 | 33 | 30 | 27 | 24 | 21 | 20 | 19 | 17 | 14 | 12 | 0 |
| .40 | 13 | 17 | 23 | 33 | 38 | 48 | 71 | 121 | 214 | 331 | 429 | 467 | 442 | 308 | 189 | 120 | 85 | 66 | 56 | 47 | 41 | 35 | 31 | 28 | 24 | 22 | 20 | 19 | 17 | 15 | 12 | 0 |
| .50 | 12 | 16 | 22 | 31 | 36 | 44 | 62 | 102 | 176 | 279 | 379 | 438 | 440 | 339 | 218 | 137 | 94 | 71 | 59 | 49 | 42 | 35 | 31 | 28 | 25 | 22 | 21 | 19 | 17 | 15 | 12 | 0 |
| .75 | 10 | 13 | 17 | 24 | 26 | 30 | 35 | 45 | 65 | 106 | 170 | 251 | 326 | 393 | 341 | 245 | 164 | 112 | 81 | 59 | 48 | 39 | 33 | 30 | 26 | 23 | 21 | 20 | 18 | 15 | 12 | 0 |
| 1.0 | 8 | 10 | 13 | 17 | 19 | 21 | 24 | 27 | 31 | 37 | 50 | 75 | 118 | 251 | 360 | 376 | 292 | 205 | 138 | 83 | 60 | 45 | 36 | 32 | 28 | 25 | 22 | 21 | 18 | 16 | 12 | 1 |
| 1.5 | 6 | 7 | 9 | 12 | 13 | 14 | 15 | 17 | 19 | 21 | 23 | 26 | 31 | 56 | 121 | 224 | 311 | 333 | 293 | 192 | 115 | 66 | 45 | 36 | 31 | 28 | 25 | 22 | 19 | 17 | 13 | 4 |
| 2.0 | 4 | 5 | 6 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 14 | 15 | 16 | 20 | 27 | 43 | 85 | 159 | 243 | 306 | 264 | 154 | 74 | 47 | 37 | 32 | 28 | 25 | 21 | 18 | 14 | 9 |
| 2.5 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 13 | 16 | 20 | 27 | 46 | 85 | 184 | 285 | 262 | 147 | 74 | 47 | 37 | 32 | 28 | 22 | 19 | 15 | 11 |
| 3.0 | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 10 | 12 | 14 | 17 | 23 | 47 | 109 | 227 | 268 | 160 | 83 | 50 | 38 | 32 | 25 | 21 | 16 | 11 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 4 | 26 | 113 | 296 | 480 | 495 | 413 | 306 | 234 | 186 | 127 | 100 | 84 | 74 | 67 | 61 | 54 | 49 | 45 | 41 | 37 | 33 | 31 | 29 | 28 | 25 | 21 | 19 | 0 |
| .10 | 0 | 0 | 0 | 0 | 2 | 18 | 81 | 224 | 395 | 462 | 430 | 347 | 272 | 172 | 121 | 96 | 82 | 73 | 66 | 57 | 51 | 46 | 42 | 38 | 34 | 31 | 30 | 28 | 25 | 22 | 19 | 0 |
| .20 | 0 | 0 | 0 | 0 | 2 | 13 | 59 | 169 | 320 | 414 | 424 | 373 | 305 | 196 | 134 | 103 | 85 | 75 | 67 | 59 | 52 | 47 | 43 | 39 | 34 | 32 | 30 | 29 | 25 | 22 | 19 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 42 | 127 | 255 | 361 | 403 | 383 | 274 | 181 | 127 | 99 | 83 | 73 | 63 | 55 | 48 | 44 | 40 | 36 | 32 | 30 | 29 | 26 | 23 | 19 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 30 | 94 | 202 | 308 | 372 | 379 | 298 | 203 | 141 | 106 | 87 | 76 | 65 | 56 | 49 | 44 | 40 | 36 | 32 | 31 | 29 | 26 | 23 | 19 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 21 | 70 | 158 | 258 | 334 | 364 | 270 | 187 | 133 | 102 | 85 | 70 | 60 | 51 | 46 | 41 | 37 | 33 | 31 | 30 | 26 | 23 | 19 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 30 | 76 | 145 | 219 | 321 | 305 | 241 | 177 | 130 | 102 | 78 | 65 | 55 | 47 | 43 | 38 | 34 | 32 | 30 | 27 | 24 | 19 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 15 | 42 | 150 | 267 | 308 | 272 | 209 | 154 | 103 | 79 | 62 | 51 | 45 | 41 | 37 | 33 | 31 | 28 | 25 | 19 | 1 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 51 | 136 | 226 | 274 | 263 | 195 | 131 | 85 | 62 | 51 | 45 | 41 | 36 | 33 | 29 | 26 | 20 | 6 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 31 | 86 | 162 | 252 | 239 | 162 | 93 | 64 | 52 | 45 | 41 | 37 | 31 | 28 | 21 | 15 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 33 | 112 | 202 | 235 | 155 | 92 | 64 | 52 | 45 | 41 | 33 | 29 | 23 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 21 | 76 | 182 | 221 | 148 | 90 | 63 | 51 | 45 | 36 | 31 | 24 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 7 | 59 | 168 | 245 | 257 | 213 | 186 | 163 | 128 | 109 | 96 | 88 | 81 | 75 | 67 | 62 | 58 | 54 | 50 | 45 | 43 | 41 | 39 | 35 | 31 | 28 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 41 | 125 | 205 | 240 | 222 | 198 | 154 | 123 | 106 | 94 | 86 | 79 | 71 | 64 | 60 | 56 | 51 | 46 | 43 | 42 | 40 | 36 | 32 | 28 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 28 | 93 | 168 | 216 | 220 | 205 | 164 | 131 | 110 | 97 | 88 | 81 | 72 | 65 | 60 | 56 | 51 | 46 | 43 | 42 | 40 | 36 | 32 | 28 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 69 | 135 | 189 | 209 | 192 | 155 | 126 | 107 | 95 | 86 | 77 | 69 | 62 | 57 | 53 | 48 | 44 | 42 | 41 | 37 | 33 | 28 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 14 | 50 | 106 | 161 | 193 | 202 | 163 | 133 | 112 | 98 | 89 | 78 | 70 | 62 | 58 | 53 | 48 | 44 | 42 | 41 | 37 | 33 | 28 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 37 | 83 | 135 | 174 | 194 | 171 | 140 | 117 | 102 | 91 | 80 | 71 | 63 | 58 | 54 | 49 | 45 | 43 | 41 | 37 | 33 | 28 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 40 | 76 | 147 | 177 | 169 | 146 | 124 | 107 | 90 | 79 | 68 | 60 | 56 | 51 | 47 | 43 | 42 | 38 | 34 | 28 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 21 | 78 | 141 | 173 | 167 | 146 | 125 | 101 | 86 | 73 | 63 | 58 | 53 | 48 | 45 | 42 | 39 | 35 | 28 | 1 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 26 | 71 | 121 | 153 | 159 | 139 | 113 | 89 | 72 | 63 | 57 | 53 | 48 | 44 | 40 | 37 | 29 | 7 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 16 | 45 | 86 | 138 | 150 | 125 | 93 | 74 | 64 | 58 | 53 | 48 | 42 | 39 | 31 | 20 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 17 | 59 | 112 | 143 | 121 | 91 | 73 | 63 | 57 | 53 | 45 | 40 | 32 | 26 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 11 | 40 | 101 | 138 | 117 | 90 | 73 | 63 | 57 | 48 | 42 | 34 | 27 |

RAINFALL TYPE = II  * * * TC = 0.4 HR * * *  SHEET 4 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 * * * TC =0.5 HR * * * IA/P = 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 17 | 23 | 32 | 57 | 94 | 170 | 308 | 467 | 529 | 507 | 402 | 297 | 226 | 140 | 96 | 74 | 61 | 53 | 47 | 41 | 36 | 32 | 29 | 26 | 23 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .10 | 16 | 22 | 30 | 51 | 80 | 140 | 252 | 395 | 484 | 499 | 434 | 343 | 265 | 162 | 108 | 80 | 65 | 55 | 49 | 42 | 36 | 33 | 29 | 26 | 23 | 21 | 20 | 19 | 16 | 14 | 12 | 0 |
| .20 | 14 | 19 | 25 | 38 | 47 | 69 | 116 | 207 | 332 | 434 | 477 | 449 | 378 | 238 | 149 | 101 | 77 | 62 | 53 | 45 | 39 | 34 | 30 | 27 | 24 | 22 | 20 | 19 | 17 | 14 | 12 | 0 |
| .30 | 13 | 18 | 24 | 35 | 43 | 60 | 97 | 170 | 278 | 382 | 446 | 448 | 401 | 270 | 171 | 114 | 83 | 66 | 56 | 46 | 40 | 34 | 31 | 27 | 24 | 22 | 20 | 19 | 17 | 15 | 12 | 0 |
| .40 | 12 | 15 | 21 | 29 | 33 | 40 | 53 | 83 | 141 | 233 | 332 | 408 | 434 | 361 | 243 | 157 | 107 | 79 | 64 | 51 | 43 | 36 | 32 | 28 | 25 | 22 | 21 | 20 | 17 | 15 | 12 | 0 |
| .50 | 11 | 15 | 20 | 28 | 31 | 37 | 48 | 71 | 118 | 194 | 286 | 367 | 412 | 378 | 271 | 178 | 119 | 86 | 68 | 53 | 44 | 37 | 32 | 29 | 25 | 23 | 21 | 20 | 17 | 15 | 12 | 0 |
| .75 | 9 | 11 | 14 | 19 | 21 | 24 | 27 | 31 | 37 | 49 | 74 | 118 | 182 | 319 | 374 | 328 | 244 | 169 | 117 | 76 | 56 | 43 | 35 | 31 | 28 | 25 | 22 | 21 | 18 | 16 | 12 | 1 |
| 1.0 | 7 | 9 | 12 | 16 | 17 | 19 | 21 | 24 | 27 | 32 | 40 | 55 | 83 | 188 | 309 | 359 | 322 | 245 | 172 | 102 | 68 | 49 | 38 | 32 | 29 | 26 | 23 | 21 | 19 | 16 | 12 | 1 |
| 1.5 | 5 | 7 | 8 | 11 | 12 | 13 | 14 | 15 | 17 | 19 | 21 | 23 | 27 | 43 | 89 | 175 | 269 | 322 | 309 | 225 | 140 | 77 | 49 | 38 | 32 | 29 | 25 | 23 | 20 | 17 | 13 | 5 |
| 2.0 | 3 | 4 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 14 | 15 | 18 | 23 | 35 | 65 | 123 | 202 | 297 | 280 | 181 | 88 | 52 | 39 | 33 | 29 | 26 | 21 | 19 | 14 | 10 |
| 2.5 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 12 | 15 | 18 | 24 | 36 | 66 | 150 | 244 | 278 | 171 | 87 | 52 | 39 | 33 | 29 | 23 | 20 | 15 | 11 |
| 3.0 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 11 | 13 | 16 | 20 | 37 | 86 | 198 | 263 | 182 | 96 | 56 | 40 | 33 | 26 | 21 | 16 | 11 |
| IA/P = 0.30 * * * TC =0.5 HR * * * IA/P = 0.30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 1 | 9 | 53 | 157 | 314 | 433 | 439 | 379 | 299 | 237 | 159 | 118 | 95 | 81 | 71 | 65 | 56 | 50 | 46 | 42 | 38 | 34 | 31 | 30 | 28 | 25 | 22 | 19 | 0 |
| .10 | 0 | 0 | 0 | 0 | 1 | 6 | 37 | 117 | 248 | 372 | 416 | 391 | 330 | 218 | 150 | 113 | 92 | 79 | 70 | 60 | 53 | 47 | 43 | 39 | 35 | 32 | 30 | 29 | 26 | 22 | 19 | 0 |
| .20 | 0 | 0 | 0 | 0 | 1 | 4 | 26 | 87 | 194 | 313 | 382 | 388 | 349 | 244 | 167 | 122 | 97 | 82 | 72 | 62 | 54 | 48 | 43 | 39 | 35 | 32 | 30 | 29 | 26 | 22 | 19 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 19 | 64 | 151 | 259 | 341 | 372 | 316 | 223 | 156 | 117 | 94 | 80 | 67 | 58 | 50 | 45 | 41 | 36 | 33 | 31 | 29 | 26 | 23 | 19 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 47 | 116 | 211 | 298 | 354 | 328 | 245 | 172 | 127 | 100 | 83 | 69 | 59 | 51 | 45 | 41 | 37 | 33 | 31 | 29 | 26 | 23 | 19 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 34 | 89 | 170 | 255 | 341 | 303 | 225 | 161 | 120 | 96 | 76 | 64 | 54 | 47 | 42 | 38 | 34 | 31 | 30 | 27 | 24 | 19 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 41 | 89 | 152 | 270 | 305 | 268 | 207 | 155 | 118 | 87 | 70 | 57 | 48 | 44 | 39 | 35 | 32 | 30 | 27 | 24 | 19 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 22 | 98 | 212 | 295 | 285 | 237 | 181 | 120 | 88 | 67 | 53 | 46 | 42 | 38 | 34 | 31 | 28 | 25 | 19 | 2 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 30 | 95 | 183 | 249 | 265 | 217 | 152 | 96 | 66 | 53 | 46 | 41 | 37 | 34 | 30 | 26 | 20 | 8 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 18 | 59 | 125 | 221 | 245 | 182 | 105 | 69 | 54 | 47 | 42 | 38 | 32 | 28 | 22 | 16 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 21 | 84 | 174 | 230 | 172 | 103 | 69 | 54 | 46 | 42 | 34 | 30 | 23 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 56 | 157 | 217 | 163 | 101 | 68 | 53 | 46 | 37 | 31 | 25 | 18 |
| IA/P = 0.50 * * * TC =0.5 HR * * * IA/P = 0.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 2 | 26 | 89 | 170 | 217 | 229 | 200 | 179 | 144 | 119 | 104 | 93 | 85 | 78 | 70 | 64 | 59 | 55 | 51 | 46 | 43 | 41 | 40 | 36 | 32 | 28 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 18 | 65 | 135 | 190 | 216 | 205 | 170 | 137 | 115 | 101 | 91 | 83 | 74 | 67 | 61 | 56 | 52 | 47 | 44 | 42 | 40 | 36 | 32 | 28 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 47 | 106 | 162 | 198 | 203 | 178 | 145 | 121 | 105 | 94 | 85 | 76 | 68 | 61 | 57 | 52 | 48 | 44 | 42 | 40 | 37 | 32 | 28 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 34 | 82 | 135 | 177 | 194 | 168 | 139 | 117 | 102 | 92 | 80 | 71 | 63 | 58 | 54 | 49 | 45 | 43 | 41 | 37 | 33 | 28 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 25 | 63 | 111 | 155 | 189 | 174 | 146 | 122 | 106 | 94 | 82 | 73 | 64 | 58 | 54 | 50 | 45 | 43 | 41 | 37 | 33 | 28 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 18 | 48 | 90 | 133 | 184 | 177 | 152 | 128 | 110 | 97 | 84 | 74 | 65 | 59 | 55 | 50 | 45 | 43 | 41 | 38 | 33 | 28 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 22 | 47 | 80 | 142 | 169 | 164 | 144 | 124 | 108 | 91 | 79 | 68 | 61 | 56 | 51 | 47 | 44 | 42 | 38 | 34 | 28 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 11 | 51 | 112 | 155 | 166 | 154 | 134 | 109 | 91 | 76 | 65 | 59 | 54 | 49 | 45 | 43 | 39 | 35 | 28 | 2 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 16 | 50 | 97 | 136 | 154 | 145 | 121 | 95 | 75 | 64 | 58 | 54 | 49 | 45 | 41 | 37 | 29 | 10 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 18 | 47 | 86 | 134 | 146 | 125 | 94 | 75 | 64 | 58 | 53 | 49 | 42 | 39 | 31 | 21 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 44 | 95 | 140 | 127 | 97 | 77 | 65 | 58 | 54 | 45 | 41 | 33 | 26 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 29 | 86 | 135 | 122 | 95 | 76 | 65 | 58 | 49 | 43 | 35 | 27 |

RAINFALL TYPE = II * * * TC = 0.5 HR * * * SHEET 5 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | IA/P = 0.10 | | | |
| 0.0 | 13 | 18 | 24 | 36 | 46 | 68 | 115 | 194 | 294 | 380 | 424 | 410 | 369 | 252 | 172 | 123 | 93 | 74 | 61 | 49 | 41 | 35 | 31 | 27 | 24 | 22 | 20 | 19 | 17 | 15 | 12 | 0 |
| .10 | 13 | 17 | 23 | 34 | 42 | 59 | 97 | 162 | 250 | 337 | 395 | 405 | 381 | 279 | 191 | 135 | 100 | 79 | 65 | 51 | 42 | 36 | 31 | 28 | 25 | 22 | 21 | 19 | 17 | 15 | 12 | 0 |
| .20 | 11 | 15 | 20 | 28 | 32 | 39 | 52 | 82 | 135 | 211 | 295 | 362 | 391 | 351 | 255 | 178 | 127 | 95 | 75 | 57 | 46 | 38 | 32 | 29 | 26 | 23 | 21 | 20 | 17 | 15 | 12 | 0 |
| .30 | 11 | 14 | 19 | 26 | 30 | 36 | 47 | 70 | 113 | 179 | 256 | 326 | 379 | 360 | 277 | 196 | 140 | 103 | 80 | 60 | 48 | 38 | 33 | 29 | 26 | 23 | 21 | 20 | 18 | 15 | 12 | 0 |
| .40 | 10 | 12 | 16 | 22 | 25 | 28 | 33 | 42 | 61 | 96 | 151 | 221 | 291 | 367 | 336 | 255 | 182 | 131 | 98 | 69 | 54 | 42 | 34 | 30 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 0 |
| .50 | 9 | 12 | 16 | 21 | 24 | 27 | 31 | 39 | 53 | 82 | 128 | 190 | 258 | 358 | 343 | 274 | 200 | 144 | 106 | 74 | 56 | 43 | 35 | 30 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 0 |
| .75 | 8 | 10 | 13 | 17 | 18 | 21 | 23 | 26 | 31 | 39 | 55 | 82 | 122 | 230 | 314 | 329 | 281 | 217 | 161 | 104 | 72 | 51 | 38 | 33 | 29 | 26 | 23 | 21 | 19 | 16 | 12 | 1 |
| 1.0 | 6 | 8 | 10 | 13 | 14 | 15 | 17 | 19 | 21 | 23 | 27 | 32 | 42 | 89 | 177 | 272 | 319 | 303 | 249 | 163 | 105 | 66 | 45 | 36 | 31 | 27 | 24 | 22 | 19 | 17 | 13 | 3 |
| 1.5 | 4 | 6 | 7 | 9 | 10 | 10 | 11 | 12 | 14 | 15 | 16 | 18 | 20 | 27 | 46 | 90 | 163 | 241 | 295 | 275 | 204 | 119 | 66 | 45 | 35 | 31 | 27 | 24 | 20 | 18 | 13 | 7 |
| 2.0 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 16 | 20 | 28 | 48 | 89 | 151 | 245 | 274 | 213 | 115 | 65 | 44 | 35 | 30 | 27 | 22 | 19 | 14 | 10 |
| 2.5 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 10 | 12 | 14 | 17 | 24 | 37 | 86 | 170 | 260 | 219 | 127 | 71 | 47 | 36 | 31 | 24 | 20 | 16 | 11 |
| 3.0 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 7 | 8 | 10 | 11 | 14 | 17 | 30 | 64 | 157 | 247 | 205 | 122 | 70 | 46 | 36 | 27 | 22 | 17 | 12 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | IA/P = 0.30 | | | |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 6 | 30 | 86 | 174 | 266 | 326 | 348 | 328 | 246 | 181 | 138 | 110 | 92 | 79 | 66 | 57 | 49 | 44 | 40 | 36 | 32 | 31 | 29 | 26 | 23 | 19 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 22 | 65 | 137 | 223 | 292 | 329 | 303 | 228 | 170 | 131 | 106 | 89 | 73 | 61 | 52 | 46 | 41 | 37 | 33 | 31 | 29 | 26 | 23 | 19 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 48 | 108 | 185 | 256 | 305 | 321 | 245 | 184 | 141 | 112 | 93 | 75 | 63 | 53 | 46 | 42 | 37 | 34 | 31 | 30 | 27 | 23 | 19 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 36 | 84 | 151 | 221 | 277 | 308 | 260 | 199 | 152 | 120 | 98 | 78 | 65 | 54 | 47 | 42 | 38 | 34 | 31 | 30 | 27 | 23 | 19 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 27 | 65 | 122 | 188 | 286 | 301 | 243 | 187 | 144 | 114 | 87 | 71 | 57 | 48 | 43 | 39 | 35 | 32 | 30 | 27 | 24 | 19 | 1 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 20 | 50 | 98 | 158 | 263 | 292 | 254 | 200 | 155 | 122 | 91 | 74 | 59 | 49 | 44 | 40 | 35 | 32 | 30 | 27 | 24 | 19 | 1 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 23 | 51 | 140 | 231 | 269 | 253 | 211 | 167 | 119 | 90 | 68 | 53 | 46 | 42 | 37 | 34 | 31 | 28 | 25 | 19 | 2 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 29 | 96 | 186 | 249 | 261 | 231 | 169 | 120 | 84 | 61 | 50 | 44 | 40 | 36 | 33 | 29 | 26 | 20 | 5 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 34 | 91 | 163 | 220 | 241 | 197 | 131 | 83 | 61 | 50 | 44 | 40 | 35 | 31 | 27 | 21 | 12 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 36 | 85 | 174 | 226 | 200 | 127 | 82 | 60 | 49 | 44 | 39 | 32 | 29 | 22 | 17 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 37 | 105 | 196 | 214 | 135 | 87 | 62 | 51 | 44 | 36 | 31 | 24 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 24 | 96 | 205 | 189 | 130 | 85 | 62 | 50 | 39 | 32 | 26 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | IA/P = 0.50 | | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 16 | 45 | 92 | 137 | 166 | 185 | 170 | 146 | 125 | 110 | 98 | 89 | 79 | 70 | 63 | 58 | 53 | 48 | 44 | 42 | 41 | 37 | 33 | 28 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 11 | 34 | 73 | 115 | 149 | 180 | 163 | 141 | 122 | 107 | 96 | 84 | 74 | 65 | 59 | 54 | 50 | 45 | 43 | 41 | 38 | 33 | 28 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 25 | 57 | 96 | 131 | 173 | 166 | 146 | 126 | 111 | 99 | 86 | 76 | 66 | 59 | 55 | 50 | 46 | 43 | 41 | 38 | 34 | 28 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 18 | 44 | 79 | 143 | 170 | 160 | 141 | 122 | 108 | 92 | 81 | 69 | 61 | 56 | 52 | 47 | 44 | 42 | 38 | 34 | 28 | 1 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 14 | 34 | 64 | 127 | 166 | 162 | 145 | 127 | 111 | 95 | 82 | 70 | 62 | 57 | 52 | 47 | 44 | 42 | 38 | 34 | 28 | 1 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 26 | 82 | 138 | 162 | 157 | 140 | 123 | 103 | 88 | 75 | 64 | 58 | 53 | 49 | 45 | 43 | 39 | 35 | 28 | 2 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 47 | 98 | 139 | 154 | 148 | 135 | 113 | 96 | 80 | 67 | 60 | 55 | 50 | 46 | 43 | 39 | 36 | 29 | 3 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 30 | 73 | 119 | 146 | 151 | 134 | 113 | 91 | 74 | 63 | 58 | 53 | 48 | 45 | 41 | 37 | 29 | 7 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 30 | 66 | 105 | 143 | 143 | 117 | 90 | 73 | 63 | 57 | 52 | 48 | 42 | 39 | 30 | 18 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 30 | 77 | 121 | 137 | 114 | 88 | 72 | 63 | 57 | 52 | 44 | 40 | 32 | 25 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 19 | 55 | 111 | 132 | 111 | 87 | 71 | 62 | 56 | 47 | 42 | 34 | 27 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 12 | 51 | 112 | 128 | 108 | 86 | 71 | 62 | 51 | 44 | 36 | 27 |
| RAINFALL TYPE = II | | | | | | | | | | | | | | * * * TC = 0.75 HR * * * | | | | | | | | | | | | | | | SHEET 6 OF 10 | | | |

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 11 | 15 | 20 | 29 | 35 | 47 | 72 | 112 | 168 | 231 | 289 | 329 | 357 | 313 | 239 | 175 | 133 | 103 | 83 | 63 | 50 | 40 | 33 | 29 | 26 | 23 | 21 | 20 | 17 | 15 | 12 | 0 |
| .10 | 10 | 13 | 17 | 24 | 27 | 33 | 42 | 62 | 95 | 144 | 202 | 260 | 306 | 340 | 293 | 222 | 165 | 126 | 98 | 72 | 56 | 43 | 35 | 30 | 27 | 24 | 22 | 20 | 18 | 15 | 12 | 0 |
| .20 | 10 | 13 | 17 | 23 | 26 | 30 | 38 | 54 | 82 | 123 | 176 | 232 | 281 | 332 | 303 | 238 | 179 | 136 | 105 | 76 | 59 | 45 | 35 | 30 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 1 |
| .30 | 9 | 12 | 16 | 22 | 24 | 28 | 35 | 48 | 70 | 105 | 152 | 205 | 256 | 323 | 310 | 254 | 193 | 146 | 113 | 81 | 61 | 46 | 36 | 31 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 1 |
| .40 | 8 | 11 | 14 | 19 | 21 | 23 | 27 | 32 | 42 | 61 | 91 | 132 | 181 | 276 | 318 | 294 | 237 | 181 | 138 | 95 | 70 | 51 | 39 | 32 | 28 | 25 | 23 | 21 | 18 | 16 | 12 | 1 |
| .50 | 8 | 10 | 13 | 18 | 20 | 22 | 25 | 30 | 38 | 53 | 78 | 114 | 159 | 253 | 311 | 300 | 251 | 195 | 149 | 102 | 74 | 53 | 40 | 33 | 29 | 25 | 23 | 21 | 18 | 16 | 12 | 1 |
| .75 | 7 | 8 | 11 | 14 | 16 | 17 | 19 | 21 | 25 | 30 | 38 | 53 | 76 | 146 | 228 | 284 | 293 | 256 | 208 | 143 | 99 | 66 | 46 | 36 | 31 | 27 | 24 | 22 | 19 | 17 | 13 | 2 |
| 1.0 | 5 | 7 | 8 | 11 | 12 | 13 | 14 | 16 | 17 | 19 | 22 | 25 | 31 | 57 | 111 | 188 | 256 | 286 | 272 | 208 | 144 | 90 | 56 | 41 | 33 | 29 | 26 | 23 | 20 | 17 | 13 | 4 |
| 1.5 | 4 | 5 | 6 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 22 | 33 | 59 | 107 | 171 | 231 | 268 | 235 | 157 | 88 | 56 | 41 | 33 | 29 | 25 | 21 | 18 | 14 | 8 |
| 2.0 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 12 | 15 | 19 | 27 | 44 | 78 | 157 | 231 | 252 | 167 | 96 | 59 | 42 | 34 | 29 | 23 | 20 | 15 | 11 |
| 2.5 | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 10 | 12 | 15 | 19 | 27 | 58 | 120 | 214 | 241 | 159 | 94 | 59 | 42 | 34 | 26 | 21 | 16 | 11 |
| 3.0 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 10 | 12 | 14 | 22 | 44 | 113 | 214 | 231 | 152 | 91 | 58 | 42 | 29 | 23 | 17 | 12 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 4 | 16 | 42 | 83 | 137 | 195 | 243 | 271 | 292 | 227 | 178 | 143 | 117 | 98 | 79 | 66 | 55 | 47 | 42 | 38 | 34 | 31 | 30 | 27 | 23 | 19 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 32 | 66 | 113 | 168 | 218 | 279 | 260 | 213 | 169 | 136 | 113 | 88 | 72 | 59 | 49 | 43 | 39 | 35 | 32 | 30 | 27 | 24 | 19 | 1 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 24 | 52 | 93 | 143 | 193 | 271 | 271 | 225 | 180 | 145 | 119 | 92 | 75 | 60 | 50 | 44 | 39 | 35 | 32 | 30 | 27 | 24 | 19 | 1 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 18 | 41 | 75 | 120 | 169 | 246 | 264 | 234 | 191 | 153 | 125 | 96 | 78 | 62 | 51 | 44 | 40 | 36 | 33 | 31 | 27 | 24 | 19 | 1 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 32 | 61 | 100 | 190 | 251 | 259 | 222 | 181 | 146 | 109 | 86 | 67 | 53 | 46 | 41 | 37 | 33 | 31 | 28 | 25 | 19 | 2 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 24 | 49 | 83 | 168 | 237 | 254 | 230 | 191 | 155 | 115 | 90 | 69 | 54 | 47 | 42 | 37 | 34 | 31 | 28 | 25 | 19 | 2 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 25 | 76 | 150 | 213 | 239 | 228 | 198 | 149 | 112 | 82 | 61 | 50 | 44 | 39 | 35 | 32 | 29 | 26 | 20 | 4 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 15 | 51 | 113 | 182 | 226 | 234 | 197 | 150 | 104 | 72 | 56 | 47 | 42 | 38 | 34 | 30 | 27 | 20 | 7 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 18 | 51 | 104 | 162 | 220 | 210 | 158 | 102 | 71 | 56 | 47 | 42 | 37 | 31 | 28 | 22 | 13 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 20 | 49 | 121 | 187 | 209 | 152 | 100 | 70 | 55 | 47 | 41 | 34 | 29 | 23 | 17 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 32 | 87 | 171 | 199 | 146 | 98 | 69 | 54 | 46 | 37 | 31 | 24 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 62 | 158 | 192 | 151 | 103 | 73 | 56 | 41 | 34 | 26 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 21 | 42 | 71 | 101 | 126 | 160 | 154 | 138 | 123 | 110 | 100 | 87 | 77 | 67 | 60 | 55 | 50 | 46 | 43 | 41 | 38 | 34 | 28 | 1 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 33 | 58 | 87 | 134 | 156 | 149 | 134 | 120 | 108 | 93 | 82 | 71 | 62 | 57 | 52 | 47 | 44 | 42 | 38 | 34 | 28 | 1 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 26 | 48 | 74 | 123 | 153 | 153 | 137 | 123 | 111 | 95 | 84 | 72 | 63 | 57 | 52 | 47 | 44 | 42 | 38 | 34 | 28 | 1 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 20 | 38 | 62 | 111 | 143 | 150 | 140 | 127 | 114 | 98 | 86 | 73 | 63 | 58 | 53 | 48 | 45 | 42 | 39 | 35 | 28 | 1 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 16 | 31 | 75 | 120 | 145 | 148 | 137 | 123 | 106 | 91 | 77 | 66 | 59 | 54 | 49 | 45 | 43 | 39 | 35 | 29 | 2 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 12 | 25 | 64 | 109 | 139 | 146 | 139 | 127 | 108 | 94 | 79 | 67 | 60 | 55 | 50 | 46 | 43 | 39 | 36 | 29 | 3 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 12 | 39 | 78 | 115 | 136 | 140 | 134 | 117 | 101 | 84 | 70 | 62 | 56 | 51 | 47 | 44 | 40 | 36 | 29 | 4 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 26 | 59 | 96 | 125 | 139 | 133 | 117 | 97 | 78 | 66 | 59 | 54 | 49 | 46 | 41 | 37 | 29 | 8 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 26 | 54 | 86 | 123 | 133 | 119 | 95 | 77 | 66 | 59 | 54 | 49 | 43 | 39 | 31 | 17 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 25 | 64 | 104 | 129 | 116 | 93 | 76 | 65 | 58 | 53 | 45 | 41 | 33 | 24 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 34 | 84 | 125 | 117 | 96 | 78 | 66 | 59 | 49 | 43 | 35 | 27 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 32 | 89 | 122 | 114 | 94 | 77 | 66 | 53 | 45 | 37 | 27 |

RAINFALL TYPE = II  * * * TC = 1.0 HR * * *  SHEET 7 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 10 | 13 | 18 | 25 | 29 | 38 | 54 | 81 | 118 | 163 | 213 | 256 | 284 | 311 | 266 | 212 | 163 | 129 | 104 | 78 | 61 | 47 | 37 | 31 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 1 |
| .10 | 10 | 13 | 17 | 23 | 27 | 34 | 47 | 69 | 102 | 143 | 189 | 234 | 267 | 297 | 274 | 226 | 175 | 138 | 111 | 82 | 64 | 48 | 38 | 31 | 27 | 24 | 22 | 20 | 18 | 16 | 12 | 1 |
| .20 | 9 | 11 | 15 | 20 | 22 | 26 | 31 | 42 | 60 | 88 | 124 | 168 | 212 | 280 | 292 | 261 | 212 | 166 | 131 | 95 | 72 | 53 | 40 | 33 | 28 | 25 | 23 | 21 | 18 | 16 | 12 | 1 |
| .30 | 8 | 11 | 14 | 19 | 21 | 24 | 29 | 38 | 53 | 76 | 108 | 148 | 190 | 263 | 288 | 268 | 224 | 177 | 140 | 101 | 76 | 55 | 41 | 34 | 29 | 25 | 23 | 21 | 18 | 16 | 12 | 2 |
| .40 | 8 | 10 | 13 | 18 | 20 | 23 | 27 | 34 | 46 | 66 | 94 | 130 | 170 | 245 | 282 | 273 | 235 | 188 | 149 | 107 | 80 | 58 | 42 | 34 | 29 | 26 | 23 | 21 | 19 | 16 | 12 | 2 |
| .50 | 7 | 9 | 12 | 16 | 17 | 19 | 22 | 25 | 31 | 41 | 58 | 82 | 114 | 190 | 256 | 279 | 262 | 222 | 178 | 127 | 93 | 65 | 46 | 36 | 31 | 27 | 24 | 22 | 19 | 17 | 13 | 2 |
| .75 | 6 | 8 | 10 | 14 | 15 | 17 | 19 | 21 | 25 | 31 | 41 | 56 | 78 | 139 | 207 | 254 | 265 | 245 | 208 | 152 | 110 | 75 | 51 | 39 | 32 | 28 | 25 | 22 | 19 | 17 | 13 | 3 |
| 1.0 | 5 | 6 | 8 | 10 | 11 | 13 | 14 | 15 | 17 | 19 | 22 | 26 | 33 | 60 | 109 | 173 | 230 | 261 | 255 | 208 | 153 | 100 | 64 | 46 | 36 | 30 | 26 | 24 | 20 | 18 | 13 | 5 |
| 1.5 | 3 | 4 | 5 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 15 | 19 | 27 | 45 | 79 | 130 | 186 | 247 | 239 | 180 | 108 | 68 | 48 | 37 | 31 | 27 | 22 | 19 | 14 | 10 |
| 2.0 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 11 | 13 | 16 | 22 | 35 | 59 | 98 | 171 | 236 | 236 | 156 | 95 | 62 | 44 | 35 | 30 | 23 | 20 | 15 | 11 |
| 2.5 | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 7 | 8 | 10 | 12 | 14 | 19 | 28 | 58 | 114 | 197 | 226 | 163 | 102 | 65 | 46 | 36 | 26 | 21 | 16 | 11 |
| 3.0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 9 | 10 | 13 | 19 | 35 | 88 | 184 | 218 | 169 | 109 | 70 | 49 | 31 | 24 | 18 | 12 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 25 | 50 | 86 | 130 | 174 | 208 | 253 | 235 | 201 | 164 | 136 | 115 | 92 | 76 | 61 | 51 | 44 | 39 | 35 | 32 | 30 | 27 | 24 | 19 | 1 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 19 | 40 | 71 | 110 | 153 | 217 | 247 | 227 | 191 | 157 | 131 | 103 | 84 | 66 | 53 | 46 | 41 | 36 | 33 | 31 | 28 | 24 | 19 | 2 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 31 | 58 | 93 | 133 | 202 | 239 | 231 | 199 | 165 | 138 | 108 | 87 | 68 | 55 | 47 | 41 | 37 | 33 | 31 | 28 | 25 | 19 | 2 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 24 | 46 | 77 | 152 | 210 | 236 | 222 | 190 | 158 | 122 | 97 | 74 | 58 | 49 | 43 | 38 | 34 | 32 | 28 | 25 | 20 | 3 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 19 | 37 | 64 | 134 | 196 | 232 | 225 | 198 | 166 | 127 | 101 | 77 | 59 | 50 | 43 | 38 | 35 | 32 | 28 | 25 | 20 | 3 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 14 | 30 | 82 | 151 | 206 | 228 | 217 | 189 | 146 | 113 | 85 | 64 | 52 | 45 | 40 | 36 | 33 | 29 | 26 | 20 | 5 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 15 | 49 | 105 | 164 | 205 | 218 | 205 | 166 | 129 | 95 | 69 | 55 | 47 | 41 | 37 | 33 | 29 | 26 | 20 | 6 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 32 | 77 | 134 | 185 | 214 | 203 | 166 | 120 | 83 | 63 | 52 | 45 | 39 | 35 | 30 | 27 | 21 | 10 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 33 | 72 | 121 | 184 | 203 | 171 | 117 | 82 | 62 | 51 | 44 | 39 | 32 | 29 | 22 | 15 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 21 | 67 | 132 | 194 | 174 | 123 | 86 | 64 | 52 | 45 | 35 | 31 | 24 | 18 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 46 | 121 | 187 | 166 | 119 | 84 | 63 | 52 | 39 | 32 | 25 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 44 | 129 | 180 | 160 | 116 | 83 | 63 | 44 | 35 | 27 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 26 | 44 | 68 | 91 | 125 | 142 | 142 | 128 | 117 | 107 | 94 | 83 | 72 | 63 | 57 | 52 | 47 | 44 | 42 | 38 | 34 | 28 | 2 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 20 | 36 | 57 | 100 | 129 | 140 | 136 | 125 | 114 | 100 | 88 | 76 | 65 | 59 | 54 | 49 | 45 | 43 | 39 | 35 | 29 | 3 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 16 | 30 | 48 | 90 | 122 | 139 | 139 | 127 | 117 | 102 | 90 | 77 | 66 | 60 | 54 | 49 | 45 | 43 | 39 | 35 | 29 | 3 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 12 | 24 | 59 | 98 | 126 | 137 | 134 | 125 | 109 | 96 | 82 | 69 | 61 | 56 | 51 | 46 | 44 | 40 | 36 | 29 | 4 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 19 | 51 | 89 | 119 | 134 | 136 | 127 | 112 | 98 | 83 | 70 | 62 | 56 | 51 | 47 | 44 | 40 | 36 | 29 | 5 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 15 | 43 | 79 | 112 | 131 | 135 | 129 | 114 | 100 | 85 | 71 | 63 | 57 | 52 | 47 | 44 | 40 | 36 | 29 | 6 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 15 | 39 | 71 | 102 | 123 | 130 | 125 | 112 | 94 | 78 | 67 | 60 | 54 | 49 | 46 | 41 | 37 | 29 | 9 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 17 | 40 | 71 | 101 | 121 | 129 | 121 | 103 | 84 | 71 | 62 | 56 | 51 | 47 | 42 | 38 | 30 | 13 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 26 | 51 | 92 | 119 | 125 | 105 | 86 | 72 | 63 | 57 | 52 | 44 | 40 | 32 | 23 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 11 | 35 | 72 | 112 | 122 | 103 | 85 | 71 | 63 | 56 | 47 | 42 | 34 | 26 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 24 | 66 | 111 | 119 | 101 | 83 | 71 | 62 | 51 | 44 | 36 | 27 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 23 | 71 | 110 | 116 | 99 | 82 | 70 | 55 | 46 | 37 | 27 |

RAINFALL TYPE = II  * * * TC = 1.25 HR * * *  SHEET 8 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 9 | 11 | 15 | 21 | 25 | 31 | 41 | 58 | 82 | 112 | 147 | 184 | 216 | 255 | 275 | 236 | 198 | 159 | 129 | 98 | 76 | 57 | 43 | 35 | 30 | 25 | 23 | 21 | 18 | 16 | 12 | 1 |
| .10 | 8 | 10 | 13 | 18 | 20 | 23 | 28 | 37 | 51 | 72 | 98 | 131 | 166 | 226 | 265 | 254 | 226 | 187 | 151 | 113 | 86 | 63 | 46 | 37 | 31 | 26 | 23 | 21 | 19 | 16 | 13 | 2 |
| .20 | 8 | 10 | 13 | 17 | 19 | 22 | 26 | 33 | 45 | 63 | 87 | 116 | 149 | 212 | 259 | 259 | 233 | 197 | 160 | 119 | 90 | 66 | 48 | 38 | 32 | 27 | 24 | 22 | 19 | 16 | 13 | 2 |
| .30 | 7 | 9 | 12 | 16 | 18 | 21 | 24 | 30 | 40 | 55 | 76 | 103 | 134 | 197 | 244 | 255 | 238 | 206 | 169 | 125 | 95 | 68 | 49 | 38 | 32 | 27 | 24 | 22 | 19 | 17 | 13 | 2 |
| .40 | 7 | 8 | 11 | 14 | 15 | 17 | 19 | 23 | 28 | 36 | 49 | 67 | 91 | 151 | 208 | 247 | 252 | 230 | 196 | 146 | 109 | 77 | 54 | 41 | 34 | 29 | 25 | 22 | 19 | 17 | 13 | 3 |
| .50 | 6 | 8 | 10 | 13 | 15 | 16 | 18 | 21 | 26 | 33 | 43 | 59 | 80 | 136 | 194 | 238 | 249 | 235 | 204 | 154 | 115 | 81 | 56 | 42 | 34 | 29 | 25 | 23 | 20 | 17 | 13 | 3 |
| .75 | 5 | 7 | 8 | 11 | 12 | 13 | 14 | 16 | 18 | 21 | 25 | 32 | 42 | 76 | 125 | 179 | 222 | 240 | 233 | 193 | 148 | 102 | 67 | 48 | 38 | 32 | 27 | 24 | 20 | 18 | 13 | 5 |
| 1.0 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 18 | 22 | 34 | 59 | 101 | 152 | 201 | 236 | 230 | 193 | 135 | 86 | 59 | 44 | 35 | 30 | 26 | 21 | 18 | 14 | 7 |
| 1.5 | 3 | 4 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 16 | 22 | 34 | 58 | 95 | 141 | 203 | 226 | 197 | 131 | 84 | 58 | 43 | 35 | 29 | 23 | 20 | 15 | 10 |
| 2.0 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 10 | 12 | 16 | 22 | 34 | 56 | 110 | 172 | 218 | 187 | 126 | 82 | 57 | 43 | 34 | 25 | 21 | 16 | 11 |
| 2.5 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 11 | 14 | 18 | 34 | 69 | 141 | 210 | 190 | 133 | 87 | 60 | 44 | 30 | 23 | 17 | 12 |
| 3.0 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 5 | 5 | 6 | 8 | 9 | 11 | 16 | 27 | 66 | 149 | 204 | 181 | 128 | 85 | 58 | 35 | 25 | 18 | 12 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 15 | 31 | 53 | 80 | 112 | 144 | 193 | 225 | 208 | 186 | 157 | 134 | 108 | 89 | 70 | 56 | 48 | 42 | 37 | 34 | 31 | 28 | 25 | 20 | 2 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 25 | 43 | 68 | 97 | 157 | 198 | 219 | 203 | 178 | 151 | 120 | 98 | 77 | 60 | 50 | 44 | 38 | 35 | 32 | 28 | 25 | 20 | 3 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 19 | 35 | 57 | 114 | 168 | 201 | 213 | 196 | 171 | 135 | 108 | 84 | 64 | 53 | 46 | 40 | 36 | 33 | 29 | 26 | 20 | 4 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 15 | 29 | 48 | 100 | 155 | 193 | 210 | 200 | 177 | 140 | 113 | 87 | 66 | 54 | 46 | 41 | 36 | 33 | 29 | 26 | 20 | 5 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 12 | 23 | 39 | 87 | 141 | 184 | 207 | 202 | 182 | 146 | 117 | 89 | 68 | 55 | 47 | 41 | 36 | 33 | 29 | 26 | 20 | 5 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 18 | 51 | 101 | 153 | 190 | 205 | 197 | 164 | 131 | 99 | 73 | 58 | 49 | 43 | 38 | 34 | 30 | 26 | 20 | 7 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 9 | 30 | 68 | 116 | 160 | 189 | 197 | 179 | 147 | 110 | 80 | 62 | 52 | 45 | 39 | 35 | 30 | 27 | 21 | 8 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 20 | 49 | 92 | 138 | 175 | 195 | 178 | 137 | 97 | 72 | 57 | 48 | 42 | 37 | 31 | 28 | 21 | 12 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 21 | 47 | 85 | 145 | 187 | 178 | 133 | 95 | 71 | 57 | 48 | 42 | 34 | 29 | 23 | 16 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 45 | 97 | 162 | 180 | 138 | 99 | 74 | 58 | 49 | 38 | 32 | 25 | 18 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 31 | 89 | 161 | 174 | 133 | 97 | 72 | 58 | 42 | 34 | 26 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 29 | 98 | 160 | 169 | 129 | 95 | 71 | 48 | 37 | 28 | 19 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 16 | 27 | 42 | 59 | 92 | 116 | 128 | 130 | 121 | 112 | 100 | 90 | 78 | 67 | 60 | 55 | 50 | 46 | 43 | 39 | 35 | 29 | 4 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 12 | 22 | 35 | 51 | 84 | 110 | 125 | 128 | 123 | 114 | 102 | 91 | 79 | 68 | 61 | 55 | 50 | 46 | 43 | 39 | 35 | 29 | 4 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 18 | 29 | 60 | 91 | 114 | 126 | 128 | 120 | 108 | 97 | 83 | 71 | 63 | 57 | 52 | 47 | 44 | 40 | 36 | 29 | 5 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 14 | 24 | 52 | 83 | 108 | 123 | 126 | 122 | 110 | 98 | 85 | 72 | 63 | 57 | 52 | 48 | 44 | 40 | 36 | 29 | 6 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 12 | 31 | 60 | 90 | 112 | 124 | 126 | 116 | 104 | 90 | 75 | 66 | 59 | 54 | 49 | 45 | 41 | 37 | 29 | 8 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 9 | 26 | 53 | 83 | 106 | 121 | 125 | 118 | 106 | 91 | 77 | 67 | 60 | 54 | 49 | 46 | 41 | 37 | 29 | 8 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 16 | 36 | 62 | 88 | 108 | 119 | 122 | 112 | 97 | 81 | 69 | 62 | 56 | 51 | 47 | 42 | 38 | 30 | 11 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 26 | 49 | 75 | 98 | 118 | 121 | 108 | 90 | 76 | 66 | 59 | 54 | 49 | 43 | 39 | 31 | 16 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 11 | 25 | 45 | 80 | 107 | 118 | 106 | 89 | 75 | 65 | 59 | 53 | 45 | 41 | 32 | 23 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 32 | 63 | 100 | 115 | 104 | 87 | 74 | 65 | 58 | 48 | 42 | 34 | 26 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 16 | 48 | 94 | 113 | 105 | 89 | 76 | 66 | 53 | 45 | 36 | 27 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 54 | 96 | 111 | 103 | 88 | 75 | 58 | 48 | 38 | 28 |

RAINFALL TYPE = II  * * * TC = 1.5 HR * * *  SHEET 9 OF 10

## Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 7 | 9 | 12 | 16 | 18 | 21 | 27 | 36 | 49 | 64 | 82 | 104 | 127 | 171 | 201 | 226 | 208 | 193 | 171 | 132 | 105 | 79 | 58 | 45 | 36 | 30 | 26 | 23 | 20 | 17 | 13 | 3 |
| .10 | 6 | 8 | 10 | 14 | 15 | 17 | 20 | 25 | 33 | 43 | 57 | 74 | 94 | 139 | 179 | 204 | 218 | 205 | 188 | 150 | 118 | 88 | 63 | 48 | 38 | 32 | 27 | 24 | 20 | 17 | 13 | 4 |
| .20 | 6 | 8 | 10 | 13 | 14 | 16 | 19 | 23 | 29 | 39 | 51 | 66 | 84 | 128 | 169 | 198 | 213 | 207 | 192 | 157 | 123 | 91 | 65 | 49 | 39 | 33 | 28 | 24 | 20 | 17 | 13 | 4 |
| .30 | 6 | 7 | 9 | 12 | 14 | 15 | 18 | 21 | 27 | 35 | 45 | 59 | 76 | 117 | 159 | 191 | 211 | 208 | 196 | 163 | 128 | 95 | 68 | 51 | 40 | 33 | 28 | 25 | 20 | 18 | 13 | 4 |
| .40 | 5 | 6 | 8 | 11 | 12 | 13 | 15 | 17 | 20 | 24 | 31 | 41 | 53 | 87 | 128 | 167 | 197 | 209 | 205 | 180 | 145 | 106 | 75 | 55 | 43 | 35 | 30 | 26 | 21 | 18 | 14 | 5 |
| .50 | 5 | 6 | 8 | 10 | 11 | 13 | 14 | 16 | 18 | 22 | 28 | 37 | 48 | 78 | 118 | 158 | 190 | 208 | 208 | 185 | 151 | 111 | 77 | 57 | 44 | 36 | 30 | 26 | 21 | 18 | 14 | 5 |
| .75 | 4 | 6 | 7 | 9 | 10 | 11 | 12 | 13 | 15 | 18 | 22 | 27 | 35 | 58 | 91 | 129 | 164 | 191 | 202 | 194 | 167 | 125 | 87 | 63 | 48 | 38 | 32 | 27 | 22 | 18 | 14 | 6 |
| 1.0 | 3 | 4 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 28 | 46 | 74 | 110 | 147 | 178 | 201 | 193 | 156 | 108 | 76 | 56 | 43 | 35 | 30 | 23 | 19 | 14 | 8 |
| 1.5 | 2 | 3 | 3 | 5 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 12 | 16 | 23 | 36 | 57 | 86 | 137 | 178 | 195 | 160 | 113 | 79 | 58 | 45 | 36 | 26 | 21 | 16 | 11 |
| 2.0 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 10 | 12 | 16 | 23 | 35 | 67 | 112 | 169 | 190 | 154 | 110 | 78 | 57 | 44 | 30 | 23 | 17 | 11 |
| 2.5 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 9 | 12 | 16 | 28 | 52 | 105 | 170 | 185 | 149 | 107 | 76 | 56 | 35 | 26 | 18 | 12 |
| 3.0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 8 | 12 | 18 | 41 | 99 | 161 | 180 | 152 | 112 | 80 | 45 | 30 | 19 | 12 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 15 | 25 | 38 | 54 | 74 | 115 | 148 | 168 | 185 | 170 | 159 | 131 | 110 | 89 | 70 | 57 | 49 | 42 | 38 | 34 | 29 | 26 | 20 | 5 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 12 | 21 | 32 | 47 | 85 | 124 | 153 | 169 | 180 | 168 | 145 | 120 | 96 | 75 | 60 | 51 | 44 | 39 | 35 | 30 | 26 | 20 | 6 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 10 | 17 | 27 | 41 | 75 | 114 | 146 | 165 | 175 | 170 | 149 | 124 | 99 | 76 | 62 | 52 | 45 | 39 | 35 | 30 | 27 | 21 | 6 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 14 | 23 | 49 | 86 | 122 | 151 | 170 | 174 | 160 | 136 | 107 | 82 | 66 | 54 | 47 | 41 | 37 | 31 | 27 | 21 | 8 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 11 | 19 | 43 | 77 | 113 | 144 | 165 | 173 | 163 | 140 | 111 | 85 | 67 | 55 | 47 | 41 | 37 | 31 | 27 | 21 | 8 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 9 | 16 | 37 | 68 | 104 | 136 | 160 | 171 | 165 | 144 | 114 | 87 | 69 | 56 | 48 | 42 | 37 | 31 | 27 | 21 | 9 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 15 | 34 | 62 | 96 | 127 | 152 | 167 | 160 | 132 | 100 | 77 | 62 | 52 | 45 | 40 | 32 | 28 | 22 | 11 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 24 | 48 | 79 | 111 | 150 | 166 | 153 | 118 | 90 | 71 | 58 | 49 | 43 | 34 | 29 | 23 | 14 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 24 | 45 | 88 | 130 | 161 | 148 | 115 | 88 | 70 | 57 | 48 | 37 | 31 | 24 | 17 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 32 | 68 | 122 | 157 | 143 | 113 | 87 | 68 | 56 | 42 | 34 | 26 | 18 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 16 | 51 | 114 | 153 | 144 | 116 | 89 | 70 | 49 | 38 | 27 | 19 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 59 | 118 | 150 | 140 | 113 | 88 | 57 | 42 | 29 | 19 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 13 | 20 | 28 | 51 | 73 | 92 | 104 | 111 | 112 | 106 | 97 | 86 | 75 | 66 | 60 | 54 | 49 | 46 | 41 | 37 | 30 | 7 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 17 | 24 | 45 | 68 | 87 | 101 | 109 | 112 | 107 | 98 | 88 | 76 | 67 | 60 | 55 | 50 | 46 | 41 | 37 | 30 | 8 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 14 | 21 | 40 | 62 | 82 | 98 | 107 | 111 | 108 | 100 | 89 | 77 | 68 | 61 | 55 | 50 | 47 | 41 | 37 | 30 | 8 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 7 | 12 | 26 | 46 | 67 | 86 | 100 | 108 | 111 | 104 | 93 | 80 | 70 | 63 | 57 | 52 | 48 | 42 | 38 | 30 | 10 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 22 | 41 | 62 | 81 | 96 | 106 | 110 | 105 | 94 | 81 | 71 | 63 | 57 | 52 | 48 | 42 | 38 | 30 | 11 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 13 | 27 | 46 | 67 | 85 | 99 | 110 | 108 | 98 | 85 | 74 | 66 | 59 | 54 | 49 | 43 | 39 | 31 | 13 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 18 | 33 | 52 | 71 | 88 | 104 | 108 | 102 | 89 | 77 | 68 | 61 | 55 | 50 | 44 | 39 | 31 | 15 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 25 | 43 | 62 | 87 | 103 | 108 | 97 | 84 | 73 | 65 | 59 | 53 | 45 | 41 | 32 | 20 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 12 | 24 | 48 | 74 | 99 | 106 | 95 | 83 | 72 | 64 | 58 | 48 | 43 | 34 | 25 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 17 | 37 | 69 | 99 | 104 | 94 | 82 | 72 | 64 | 52 | 45 | 36 | 27 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 27 | 65 | 95 | 102 | 95 | 83 | 73 | 58 | 49 | 38 | 28 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 32 | 68 | 95 | 101 | 93 | 82 | 64 | 52 | 40 | 28 |

RAINFALL TYPE = II  * * * TC = 2.0 HR * * *  SHEET 10 OF 10

## Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

TRVL ---------- HYDROGRAPH TIME (HOURS) ----------

| TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 29 | 38 | 57 | 172 | 241 | 425 | 662 | 531 | 345 | 265 | 191 | 130 | 101 | 83 | 68 | 62 | 58 | 54 | 50 | 44 | 41 | 37 | 32 | 27 | 23 | 21 | 19 | 16 | 14 | 13 | 11 | 0 |
| .10 | 26 | 32 | 47 | 98 | 147 | 210 | 353 | 559 | 540 | 410 | 313 | 231 | 164 | 101 | 80 | 67 | 61 | 57 | 53 | 47 | 43 | 39 | 34 | 28 | 24 | 22 | 19 | 17 | 14 | 13 | 11 | 0 |
| .20 | 25 | 31 | 44 | 86 | 127 | 182 | 296 | 471 | 517 | 446 | 357 | 273 | 200 | 117 | 86 | 70 | 63 | 58 | 54 | 48 | 44 | 39 | 34 | 29 | 24 | 22 | 20 | 17 | 14 | 13 | 11 | 0 |
| .30 | 22 | 28 | 37 | 57 | 76 | 110 | 158 | 250 | 398 | 477 | 457 | 390 | 312 | 178 | 111 | 83 | 69 | 62 | 57 | 51 | 45 | 41 | 36 | 31 | 25 | 23 | 20 | 18 | 15 | 13 | 11 | 0 |
| .40 | 21 | 27 | 35 | 53 | 68 | 96 | 137 | 213 | 336 | 430 | 448 | 410 | 345 | 210 | 128 | 90 | 72 | 64 | 58 | 52 | 46 | 41 | 36 | 31 | 26 | 23 | 20 | 18 | 15 | 13 | 11 | 0 |
| .50 | 19 | 24 | 30 | 43 | 49 | 62 | 85 | 120 | 182 | 284 | 382 | 426 | 415 | 305 | 188 | 120 | 86 | 71 | 63 | 55 | 49 | 43 | 38 | 33 | 27 | 24 | 21 | 19 | 15 | 14 | 11 | 0 |
| .75 | 17 | 22 | 27 | 37 | 41 | 49 | 62 | 84 | 120 | 181 | 258 | 327 | 375 | 353 | 264 | 177 | 120 | 88 | 72 | 59 | 52 | 45 | 39 | 34 | 29 | 25 | 22 | 20 | 15 | 14 | 11 | 0 |
| 1.0 | 13 | 17 | 22 | 27 | 30 | 33 | 37 | 43 | 52 | 66 | 91 | 131 | 190 | 315 | 358 | 307 | 220 | 149 | 104 | 72 | 60 | 50 | 43 | 37 | 32 | 27 | 23 | 21 | 16 | 14 | 12 | 0 |
| 1.5 | 9 | 11 | 14 | 18 | 19 | 21 | 23 | 25 | 27 | 29 | 33 | 37 | 44 | 70 | 134 | 229 | 304 | 318 | 269 | 172 | 106 | 68 | 52 | 44 | 38 | 33 | 28 | 24 | 19 | 15 | 12 | 2 |
| 2.0 | 6 | 8 | 10 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 22 | 24 | 26 | 32 | 45 | 73 | 130 | 207 | 271 | 292 | 216 | 121 | 68 | 51 | 43 | 37 | 32 | 27 | 21 | 16 | 13 | 6 |
| 2.5 | 3 | 4 | 6 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 20 | 23 | 29 | 38 | 57 | 97 | 189 | 271 | 244 | 136 | 75 | 53 | 44 | 38 | 33 | 24 | 19 | 14 | 9 |
| 3.0 | 1 | 2 | 4 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 19 | 23 | 28 | 38 | 74 | 146 | 256 | 226 | 131 | 74 | 53 | 44 | 37 | 27 | 21 | 14 | 10 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 48 | 106 | 296 | 597 | 496 | 368 | 300 | 221 | 155 | 125 | 106 | 89 | 83 | 79 | 74 | 69 | 62 | 59 | 54 | 47 | 40 | 35 | 32 | 28 | 25 | 22 | 20 | 17 | 0 |
| .10 | 0 | 0 | 0 | 35 | 82 | 225 | 473 | 488 | 408 | 336 | 260 | 190 | 147 | 113 | 94 | 85 | 80 | 75 | 70 | 63 | 59 | 54 | 48 | 40 | 35 | 32 | 29 | 25 | 22 | 20 | 17 | 0 |
| .20 | 0 | 0 | 0 | 7 | 26 | 64 | 171 | 372 | 449 | 422 | 365 | 295 | 225 | 142 | 109 | 92 | 84 | 79 | 74 | 66 | 61 | 56 | 50 | 43 | 36 | 33 | 30 | 26 | 22 | 20 | 17 | 0 |
| .30 | 0 | 0 | 0 | 5 | 19 | 49 | 130 | 291 | 397 | 414 | 381 | 323 | 258 | 161 | 118 | 96 | 86 | 80 | 75 | 68 | 62 | 57 | 50 | 43 | 37 | 33 | 30 | 27 | 22 | 20 | 17 | 0 |
| .40 | 0 | 0 | 0 | 0 | 3 | 14 | 37 | 99 | 227 | 340 | 389 | 384 | 343 | 229 | 152 | 113 | 94 | 85 | 79 | 71 | 65 | 59 | 52 | 46 | 38 | 34 | 31 | 28 | 23 | 21 | 17 | 0 |
| .50 | 0 | 0 | 0 | 0 | 2 | 10 | 28 | 75 | 177 | 286 | 355 | 374 | 354 | 256 | 170 | 123 | 99 | 87 | 80 | 73 | 66 | 60 | 53 | 46 | 39 | 35 | 31 | 28 | 23 | 21 | 18 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 35 | 86 | 161 | 238 | 296 | 325 | 266 | 194 | 141 | 110 | 93 | 80 | 71 | 63 | 56 | 50 | 43 | 37 | 33 | 30 | 24 | 21 | 18 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 19 | 48 | 99 | 165 | 282 | 311 | 264 | 197 | 144 | 112 | 88 | 77 | 67 | 59 | 52 | 45 | 39 | 34 | 31 | 24 | 22 | 18 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 29 | 99 | 197 | 265 | 277 | 236 | 162 | 113 | 84 | 69 | 60 | 53 | 46 | 39 | 35 | 28 | 23 | 19 | 2 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 35 | 94 | 172 | 233 | 253 | 196 | 124 | 83 | 68 | 59 | 52 | 45 | 39 | 31 | 25 | 20 | 8 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 37 | 88 | 184 | 235 | 201 | 122 | 83 | 67 | 59 | 52 | 45 | 34 | 27 | 21 | 13 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 38 | 110 | 222 | 202 | 131 | 88 | 69 | 60 | 52 | 39 | 31 | 22 | 15 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.1 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 107 | 226 | 282 | 258 | 209 | 155 | 130 | 123 | 107 | 97 | 95 | 91 | 87 | 82 | 78 | 74 | 69 | 61 | 52 | 47 | 43 | 39 | 35 | 32 | 29 | 25 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 71 | 174 | 246 | 254 | 224 | 178 | 146 | 130 | 112 | 100 | 96 | 92 | 88 | 83 | 78 | 75 | 70 | 62 | 53 | 48 | 44 | 40 | 35 | 32 | 29 | 25 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 132 | 208 | 239 | 229 | 195 | 162 | 127 | 109 | 99 | 95 | 91 | 87 | 80 | 77 | 72 | 65 | 56 | 49 | 45 | 41 | 36 | 32 | 30 | 25 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 99 | 172 | 216 | 225 | 205 | 176 | 136 | 113 | 101 | 96 | 92 | 88 | 81 | 77 | 72 | 65 | 57 | 50 | 45 | 41 | 37 | 32 | 30 | 26 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 73 | 139 | 191 | 213 | 208 | 164 | 131 | 111 | 100 | 95 | 91 | 85 | 79 | 74 | 68 | 60 | 51 | 47 | 43 | 38 | 33 | 30 | 26 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 53 | 110 | 164 | 197 | 204 | 174 | 139 | 116 | 103 | 97 | 92 | 86 | 80 | 75 | 68 | 60 | 52 | 47 | 43 | 39 | 33 | 30 | 26 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 22 | 54 | 96 | 137 | 166 | 180 | 159 | 134 | 115 | 103 | 96 | 89 | 83 | 77 | 70 | 63 | 54 | 48 | 44 | 40 | 33 | 31 | 26 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 29 | 60 | 132 | 175 | 169 | 146 | 124 | 109 | 97 | 89 | 81 | 74 | 67 | 59 | 52 | 47 | 43 | 34 | 31 | 27 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 17 | 58 | 112 | 150 | 159 | 148 | 122 | 104 | 91 | 81 | 74 | 67 | 59 | 51 | 46 | 38 | 32 | 28 | 1 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 20 | 54 | 98 | 133 | 149 | 133 | 108 | 90 | 80 | 73 | 66 | 58 | 51 | 42 | 34 | 29 | 7 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 12 | 35 | 87 | 131 | 141 | 111 | 92 | 81 | 74 | 66 | 59 | 46 | 38 | 30 | 18 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 22 | 63 | 120 | 136 | 110 | 91 | 81 | 73 | 66 | 51 | 42 | 31 | 22 |

RAINFALL TYPE = III  * * * TC = 0.1 HR * * *  SHEET 1 OF 10

## Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 11.3 | 11.9 | 12.1 | 12.3 | 12.5 | 12.7 | 13.0 | 13.4 | 13.8 | 14.3 | 15.0 | 16.0 | 17.0 | 18.0 | 20.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11.0 | 11.6 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.2 | 13.6 | 14.0 | 14.6 | 15.5 | 16.5 | 17.5 | 19.0 | 22.0 |

IA/P = 0.10 * * * TC =0.2 HR * * * IA/P = 0.10

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 27 | 34 | 50 | 119 | 176 | 258 | 448 | 565 | 483 | 358 | 270 | 194 | 137 | 93 | 75 | 65 | 60 | 56 | 52 | 46 | 42 | 38 | 33 | 28 | 24 | 21 | 19 | 17 | 14 | 13 | 11 | 0 |
| .10 | 24 | 30 | 42 | 70 | 103 | 151 | 222 | 372 | 501 | 489 | 402 | 314 | 234 | 128 | 91 | 73 | 64 | 59 | 55 | 49 | 44 | 40 | 35 | 30 | 25 | 22 | 20 | 17 | 15 | 13 | 11 | 0 |
| .20 | 23 | 29 | 39 | 64 | 90 | 131 | 192 | 312 | 438 | 472 | 425 | 351 | 273 | 153 | 101 | 78 | 66 | 61 | 56 | 50 | 45 | 40 | 35 | 30 | 25 | 22 | 20 | 18 | 15 | 13 | 11 | 0 |
| .30 | 21 | 26 | 33 | 48 | 59 | 79 | 114 | 166 | 263 | 380 | 441 | 431 | 378 | 238 | 141 | 96 | 75 | 65 | 60 | 53 | 47 | 42 | 37 | 32 | 26 | 23 | 21 | 18 | 15 | 13 | 11 | 0 |
| .40 | 20 | 25 | 32 | 45 | 54 | 71 | 99 | 144 | 224 | 328 | 404 | 422 | 392 | 271 | 165 | 108 | 81 | 68 | 61 | 54 | 48 | 43 | 37 | 32 | 27 | 23 | 21 | 19 | 15 | 14 | 11 | 0 |
| .50 | 18 | 22 | 28 | 38 | 43 | 51 | 64 | 88 | 125 | 191 | 282 | 363 | 402 | 356 | 241 | 151 | 102 | 78 | 66 | 57 | 51 | 44 | 39 | 34 | 28 | 24 | 22 | 19 | 15 | 14 | 11 | 0 |
| .75 | 15 | 18 | 23 | 30 | 33 | 37 | 42 | 50 | 64 | 87 | 125 | 184 | 253 | 359 | 341 | 260 | 177 | 121 | 89 | 67 | 57 | 48 | 42 | 36 | 31 | 26 | 23 | 21 | 16 | 14 | 12 | 0 |
| 1.0 | 12 | 16 | 20 | 25 | 28 | 30 | 33 | 37 | 43 | 53 | 68 | 94 | 135 | 251 | 345 | 330 | 260 | 181 | 125 | 81 | 63 | 52 | 44 | 38 | 33 | 28 | 24 | 21 | 17 | 14 | 12 | 0 |
| 1.5 | 8 | 10 | 13 | 17 | 18 | 19 | 21 | 23 | 25 | 27 | 30 | 33 | 38 | 55 | 99 | 179 | 266 | 308 | 289 | 201 | 124 | 74 | 54 | 45 | 39 | 34 | 29 | 24 | 19 | 15 | 12 | 2 |
| 2.0 | 5 | 7 | 9 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 22 | 24 | 29 | 38 | 57 | 99 | 166 | 238 | 284 | 239 | 141 | 75 | 54 | 44 | 38 | 33 | 28 | 21 | 17 | 13 | 6 |
| 2.5 | 2 | 4 | 5 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 16 | 18 | 22 | 26 | 33 | 46 | 75 | 155 | 240 | 264 | 154 | 83 | 56 | 46 | 39 | 34 | 25 | 19 | 14 | 9 |
| 3.0 | 1 | 2 | 3 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 13 | 15 | 18 | 21 | 25 | 33 | 59 | 118 | 220 | 250 | 147 | 82 | 56 | 45 | 39 | 28 | 22 | 14 | 10 |

IA/P = 0.30 * * * TC =0.2 HR * * * IA/P = 0.30

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0 | 0 | 0 | 17 | 49 | 115 | 297 | 489 | 462 | 379 | 307 | 230 | 167 | 119 | 98 | 86 | 81 | 76 | 72 | 64 | 60 | 55 | 48 | 41 | 36 | 32 | 29 | 26 | 22 | 20 | 17 | 0 |
| .10 | 0 | 0 | 0 | 12 | 37 | 89 | 228 | 402 | 442 | 400 | 338 | 266 | 200 | 131 | 104 | 89 | 82 | 78 | 73 | 65 | 61 | 56 | 49 | 42 | 36 | 33 | 29 | 26 | 22 | 20 | 17 | 0 |
| .20 | 0 | 0 | 0 | 1 | 8 | 27 | 69 | 175 | 326 | 403 | 401 | 359 | 297 | 182 | 126 | 100 | 88 | 81 | 76 | 69 | 63 | 58 | 51 | 44 | 37 | 34 | 30 | 27 | 23 | 21 | 17 | 0 |
| .30 | 0 | 0 | 0 | 1 | 6 | 20 | 52 | 134 | 262 | 356 | 386 | 368 | 321 | 208 | 140 | 107 | 91 | 83 | 78 | 70 | 64 | 58 | 52 | 45 | 38 | 34 | 31 | 27 | 23 | 21 | 17 | 0 |
| .40 | 0 | 0 | 0 | 1 | 4 | 15 | 40 | 103 | 209 | 307 | 360 | 365 | 336 | 234 | 157 | 116 | 95 | 85 | 79 | 72 | 65 | 59 | 53 | 46 | 39 | 34 | 31 | 28 | 23 | 21 | 17 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 30 | 78 | 165 | 260 | 327 | 352 | 305 | 213 | 147 | 111 | 93 | 84 | 75 | 68 | 61 | 55 | 48 | 41 | 35 | 32 | 29 | 23 | 21 | 18 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 37 | 83 | 150 | 220 | 276 | 311 | 264 | 196 | 144 | 112 | 94 | 80 | 72 | 64 | 56 | 50 | 43 | 37 | 33 | 30 | 24 | 21 | 18 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 20 | 48 | 94 | 215 | 299 | 286 | 230 | 171 | 128 | 95 | 81 | 69 | 61 | 54 | 47 | 40 | 35 | 32 | 25 | 22 | 18 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 56 | 139 | 224 | 266 | 253 | 186 | 128 | 89 | 71 | 61 | 54 | 48 | 41 | 36 | 29 | 23 | 19 | 3 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 17 | 58 | 126 | 196 | 245 | 214 | 140 | 89 | 71 | 61 | 54 | 47 | 40 | 32 | 25 | 20 | 9 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 21 | 57 | 145 | 228 | 213 | 136 | 89 | 70 | 60 | 53 | 46 | 35 | 28 | 21 | 13 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 23 | 78 | 180 | 215 | 145 | 94 | 72 | 61 | 54 | 41 | 32 | 22 | 15 |

IA/P = 0.50 * * * TC =0.2 HR * * * IA/P = 0.50

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0 | 0 | 0 | 0 | 0 | 10 | 110 | 206 | 245 | 245 | 208 | 162 | 137 | 117 | 102 | 96 | 93 | 90 | 85 | 79 | 76 | 71 | 63 | 54 | 48 | 44 | 40 | 36 | 32 | 29 | 25 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 7 | 76 | 163 | 217 | 235 | 217 | 181 | 152 | 122 | 106 | 98 | 94 | 90 | 86 | 80 | 76 | 71 | 64 | 55 | 49 | 45 | 41 | 36 | 32 | 29 | 25 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 52 | 126 | 187 | 219 | 218 | 193 | 145 | 119 | 104 | 97 | 93 | 89 | 83 | 78 | 73 | 66 | 58 | 50 | 46 | 42 | 37 | 32 | 30 | 26 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 36 | 96 | 156 | 198 | 211 | 199 | 155 | 125 | 108 | 99 | 94 | 90 | 84 | 79 | 74 | 67 | 59 | 51 | 46 | 42 | 38 | 32 | 30 | 26 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 24 | 72 | 128 | 175 | 199 | 184 | 147 | 121 | 106 | 98 | 93 | 87 | 81 | 76 | 69 | 61 | 53 | 48 | 44 | 39 | 33 | 30 | 26 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 17 | 54 | 103 | 151 | 183 | 194 | 156 | 127 | 109 | 100 | 95 | 88 | 82 | 76 | 70 | 62 | 54 | 48 | 44 | 40 | 33 | 30 | 26 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 23 | 52 | 90 | 127 | 174 | 168 | 146 | 124 | 109 | 100 | 92 | 85 | 78 | 72 | 65 | 56 | 49 | 45 | 41 | 34 | 31 | 26 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 29 | 91 | 149 | 169 | 157 | 135 | 117 | 100 | 92 | 83 | 76 | 69 | 61 | 53 | 48 | 43 | 35 | 32 | 27 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 33 | 81 | 128 | 155 | 155 | 130 | 109 | 94 | 83 | 75 | 68 | 60 | 53 | 47 | 39 | 33 | 28 | 2 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 34 | 72 | 112 | 145 | 139 | 114 | 93 | 82 | 74 | 67 | 60 | 52 | 43 | 35 | 29 | 9 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 33 | 83 | 126 | 139 | 112 | 92 | 81 | 74 | 67 | 59 | 47 | 38 | 30 | 13 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 21 | 60 | 116 | 133 | 110 | 92 | 81 | 73 | 66 | 51 | 42 | 31 | 22 |

RAINFALL TYPE = III * * * TC = 0.2 HR * * * SHEET 2 OF 10

## Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 25 | 31 | 44 | 84 | 124 | 181 | 287 | 441 | 498 | 451 | 358 | 276 | 204 | 118 | 87 | 70 | 63 | 58 | 54 | 48 | 44 | 39 | 34 | 29 | 24 | 22 | 20 | 17 | 14 | 13 | 11 | 0 |
| .10 | 22 | 28 | 37 | 56 | 74 | 108 | 156 | 244 | 375 | 457 | 453 | 389 | 314 | 180 | 113 | 83 | 69 | 62 | 57 | 51 | 46 | 41 | 36 | 31 | 26 | 23 | 20 | 18 | 15 | 13 | 11 | 0 |
| .20 | 21 | 27 | 35 | 53 | 67 | 94 | 136 | 208 | 319 | 411 | 439 | 406 | 345 | 212 | 130 | 91 | 73 | 64 | 59 | 52 | 46 | 42 | 36 | 31 | 26 | 23 | 21 | 18 | 15 | 13 | 11 | 0 |
| .30 | 19 | 24 | 30 | 42 | 49 | 61 | 83 | 118 | 178 | 272 | 365 | 414 | 409 | 305 | 190 | 121 | 87 | 71 | 63 | 55 | 49 | 43 | 38 | 33 | 27 | 24 | 21 | 19 | 15 | 14 | 11 | 0 |
| .40 | 18 | 23 | 29 | 40 | 46 | 56 | 74 | 103 | 153 | 232 | 321 | 383 | 400 | 329 | 217 | 138 | 96 | 75 | 65 | 57 | 50 | 44 | 38 | 33 | 28 | 24 | 21 | 19 | 15 | 14 | 11 | 0 |
| .50 | 16 | 21 | 26 | 34 | 38 | 43 | 52 | 67 | 91 | 132 | 199 | 280 | 349 | 383 | 297 | 196 | 128 | 91 | 73 | 60 | 53 | 46 | 40 | 35 | 30 | 25 | 22 | 20 | 16 | 14 | 11 | 0 |
| .75 | 14 | 18 | 23 | 30 | 33 | 37 | 43 | 52 | 66 | 91 | 131 | 187 | 251 | 347 | 331 | 260 | 182 | 126 | 92 | 68 | 57 | 49 | 42 | 36 | 31 | 26 | 23 | 21 | 16 | 14 | 12 | 0 |
| 1.0 | 11 | 15 | 18 | 23 | 25 | 28 | 30 | 33 | 38 | 44 | 54 | 71 | 98 | 192 | 296 | 334 | 294 | 221 | 154 | 94 | 69 | 55 | 45 | 40 | 34 | 29 | 25 | 22 | 17 | 15 | 12 | 0 |
| 1.5 | 7 | 9 | 12 | 15 | 17 | 18 | 19 | 21 | 23 | 25 | 27 | 30 | 33 | 45 | 75 | 137 | 222 | 287 | 300 | 233 | 149 | 84 | 57 | 47 | 40 | 35 | 30 | 25 | 20 | 16 | 13 | 3 |
| 2.0 | 4 | 6 | 8 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 22 | 26 | 33 | 46 | 76 | 131 | 201 | 278 | 258 | 165 | 85 | 57 | 46 | 40 | 34 | 29 | 22 | 17 | 13 | 7 |
| 2.5 | 2 | 3 | 5 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 17 | 20 | 24 | 29 | 39 | 60 | 125 | 213 | 260 | 177 | 94 | 60 | 47 | 40 | 35 | 25 | 20 | 14 | 9 |
| 3.0 | 1 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 12 | 14 | 16 | 19 | 23 | 29 | 48 | 95 | 195 | 247 | 167 | 93 | 60 | 47 | 40 | 29 | 22 | 15 | 10 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 6 | 22 | 58 | 146 | 308 | 424 | 422 | 367 | 303 | 234 | 145 | 111 | 92 | 84 | 79 | 74 | 67 | 62 | 57 | 50 | 43 | 36 | 33 | 30 | 26 | 22 | 20 | 17 | 0 |
| .10 | 0 | 0 | 0 | 4 | 16 | 44 | 112 | 243 | 364 | 402 | 379 | 328 | 266 | 166 | 120 | 97 | 86 | 80 | 75 | 68 | 62 | 57 | 51 | 44 | 37 | 33 | 30 | 27 | 22 | 21 | 17 | 0 |
| .20 | 0 | 0 | 0 | 3 | 12 | 33 | 86 | 190 | 306 | 370 | 376 | 344 | 292 | 189 | 132 | 103 | 89 | 82 | 77 | 69 | 63 | 58 | 51 | 44 | 37 | 34 | 30 | 27 | 23 | 21 | 17 | 0 |
| .30 | 0 | 0 | 0 | 0 | 2 | 8 | 25 | 65 | 149 | 254 | 331 | 361 | 350 | 261 | 175 | 126 | 100 | 88 | 81 | 73 | 66 | 60 | 53 | 46 | 39 | 35 | 31 | 28 | 23 | 21 | 18 | 0 |
| .40 | 0 | 0 | 0 | 0 | 1 | 6 | 19 | 50 | 116 | 208 | 290 | 338 | 346 | 282 | 195 | 138 | 107 | 91 | 83 | 74 | 67 | 60 | 54 | 47 | 40 | 35 | 32 | 28 | 23 | 21 | 18 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 38 | 90 | 168 | 250 | 308 | 333 | 256 | 180 | 131 | 103 | 89 | 78 | 71 | 63 | 56 | 49 | 42 | 36 | 33 | 29 | 23 | 21 | 18 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 17 | 43 | 89 | 150 | 213 | 299 | 286 | 229 | 171 | 129 | 104 | 85 | 75 | 65 | 58 | 51 | 44 | 38 | 34 | 30 | 24 | 22 | 18 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 24 | 53 | 153 | 253 | 288 | 257 | 200 | 150 | 105 | 85 | 72 | 62 | 55 | 48 | 41 | 36 | 32 | 26 | 22 | 19 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 15 | 59 | 138 | 217 | 258 | 248 | 187 | 130 | 91 | 71 | 62 | 55 | 48 | 41 | 36 | 29 | 23 | 19 | 3 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 36 | 90 | 159 | 239 | 227 | 158 | 97 | 74 | 63 | 55 | 48 | 42 | 32 | 26 | 20 | 10 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 12 | 37 | 113 | 194 | 224 | 151 | 96 | 73 | 62 | 55 | 48 | 36 | 29 | 21 | 14 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 24 | 78 | 176 | 211 | 145 | 95 | 73 | 62 | 54 | 41 | 32 | 22 | 15 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.3 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 2 | 33 | 116 | 193 | 221 | 221 | 200 | 165 | 129 | 110 | 99 | 95 | 92 | 87 | 81 | 77 | 72 | 65 | 56 | 49 | 45 | 41 | 37 | 32 | 30 | 25 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 1 | 23 | 85 | 157 | 200 | 214 | 205 | 178 | 138 | 115 | 102 | 96 | 92 | 88 | 82 | 77 | 73 | 66 | 57 | 50 | 46 | 42 | 37 | 32 | 30 | 26 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 1 | 15 | 62 | 125 | 175 | 201 | 203 | 187 | 147 | 121 | 105 | 98 | 94 | 89 | 83 | 78 | 73 | 66 | 58 | 50 | 46 | 42 | 38 | 32 | 30 | 26 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 45 | 99 | 149 | 184 | 197 | 174 | 140 | 117 | 104 | 97 | 93 | 86 | 80 | 75 | 69 | 61 | 52 | 47 | 43 | 39 | 33 | 30 | 26 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 32 | 76 | 125 | 164 | 189 | 179 | 148 | 123 | 107 | 99 | 94 | 87 | 81 | 76 | 69 | 62 | 53 | 48 | 44 | 39 | 33 | 30 | 26 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 23 | 59 | 103 | 144 | 183 | 169 | 141 | 119 | 105 | 98 | 90 | 84 | 78 | 71 | 64 | 55 | 49 | 45 | 41 | 33 | 31 | 26 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 27 | 55 | 89 | 148 | 168 | 156 | 135 | 117 | 105 | 94 | 87 | 80 | 73 | 66 | 58 | 51 | 46 | 42 | 34 | 31 | 27 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 59 | 119 | 157 | 163 | 145 | 126 | 105 | 95 | 85 | 77 | 71 | 63 | 55 | 49 | 44 | 36 | 32 | 27 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 19 | 56 | 103 | 139 | 151 | 138 | 116 | 97 | 85 | 77 | 70 | 62 | 54 | 48 | 40 | 33 | 28 | 3 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 21 | 52 | 91 | 135 | 143 | 120 | 96 | 84 | 76 | 69 | 61 | 54 | 44 | 35 | 29 | 11 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 22 | 65 | 112 | 136 | 117 | 96 | 83 | 75 | 68 | 60 | 48 | 39 | 30 | 19 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 45 | 102 | 131 | 114 | 95 | 83 | 75 | 67 | 53 | 43 | 31 | 22 |

RAINFALL TYPE = III  * * * TC = 0.3 HR * * *  SHEET 3 OF 10

# Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 23 | 29 | 39 | 65 | 91 | 132 | 198 | 308 | 422 | 449 | 417 | 345 | 274 | 162 | 108 | 82 | 68 | 61 | 57 | 50 | 45 | 41 | 35 | 30 | 25 | 22 | 20 | 18 | 15 | 13 | 11 | 0 |
| .10 | 20 | 26 | 33 | 48 | 60 | 80 | 114 | 170 | 262 | 368 | 422 | 418 | 370 | 242 | 149 | 102 | 79 | 67 | 60 | 53 | 47 | 42 | 37 | 32 | 27 | 23 | 21 | 18 | 15 | 13 | 11 | C |
| .20 | 20 | 25 | 32 | 45 | 55 | 72 | 100 | 147 | 224 | 320 | 388 | 408 | 383 | 272 | 171 | 114 | 85 | 70 | 62 | 54 | 48 | 43 | 37 | 32 | 27 | 23 | 21 | 19 | 15 | 14 | 11 | 0 |
| .30 | 17 | 22 | 28 | 38 | 43 | 51 | 65 | 88 | 127 | 191 | 277 | 351 | 389 | 349 | 244 | 157 | 108 | 81 | 68 | 58 | 51 | 45 | 39 | 34 | 29 | 24 | 22 | 19 | 15 | 14 | 11 | 0 |
| .40 | 17 | 21 | 27 | 36 | 41 | 47 | 59 | 79 | 111 | 165 | 240 | 314 | 378 | 359 | 268 | 178 | 120 | 88 | 72 | 60 | 52 | 45 | 40 | 34 | 29 | 25 | 22 | 20 | 15 | 14 | 11 | 0 |
| .50 | 15 | 19 | 24 | 31 | 34 | 38 | 44 | 54 | 71 | 98 | 142 | 207 | 278 | 364 | 332 | 243 | 163 | 113 | 84 | 65 | 56 | 48 | 41 | 36 | 31 | 26 | 23 | 20 | 16 | 14 | 12 | 0 |
| .75 | 12 | 16 | 20 | 25 | 27 | 30 | 33 | 38 | 44 | 54 | 70 | 97 | 138 | 249 | 333 | 320 | 257 | 185 | 131 | 85 | 65 | 53 | 44 | 39 | 33 | 28 | 24 | 22 | 17 | 14 | 12 | 0 |
| 1.0 | 11 | 13 | 17 | 22 | 23 | 25 | 28 | 30 | 34 | 38 | 46 | 57 | 75 | 145 | 245 | 322 | 311 | 255 | 188 | 114 | 77 | 58 | 47 | 41 | 35 | 30 | 26 | 23 | 18 | 15 | 12 | 1 |
| 1.5 | 6 | 9 | 11 | 14 | 15 | 17 | 18 | 19 | 21 | 23 | 25 | 27 | 30 | 39 | 59 | 105 | 180 | 255 | 292 | 257 | 176 | 98 | 61 | 48 | 41 | 36 | 31 | 26 | 20 | 16 | 13 | 4 |
| 2.0 | 4 | 6 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 24 | 30 | 39 | 61 | 103 | 166 | 253 | 272 | 189 | 98 | 61 | 48 | 41 | 35 | 30 | 23 | 18 | 13 | 8 |
| 2.5 | 2 | 3 | 4 | 6 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 16 | 18 | 22 | 26 | 34 | 49 | 100 | 183 | 255 | 198 | 108 | 66 | 50 | 42 | 36 | 26 | 20 | 14 | 9 |
| 3.0 | 1 | 1 | 2 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 11 | 13 | 15 | 18 | 21 | 26 | 40 | 77 | 169 | 243 | 185 | 106 | 65 | 49 | 41 | 30 | 23 | 15 | 10 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 2 | 10 | 30 | 78 | 177 | 306 | 379 | 379 | 347 | 293 | 187 | 133 | 105 | 90 | 82 | 77 | 69 | 63 | 58 | 51 | 44 | 38 | 34 | 30 | 27 | 23 | 21 | 17 | 0 |
| .10 | 0 | 0 | 0 | 2 | 7 | 22 | 59 | 138 | 250 | 336 | 365 | 353 | 313 | 212 | 146 | 112 | 94 | 84 | 78 | 71 | 64 | 59 | 52 | 45 | 38 | 34 | 31 | 27 | 23 | 21 | 17 | 0 |
| .20 | 0 | 0 | 0 | 1 | 5 | 17 | 45 | 107 | 202 | 292 | 341 | 349 | 325 | 235 | 162 | 121 | 98 | 87 | 80 | 72 | 65 | 59 | 53 | 46 | 39 | 34 | 31 | 28 | 23 | 21 | 17 | 0 |
| .30 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 34 | 83 | 162 | 249 | 310 | 336 | 298 | 215 | 152 | 116 | 96 | 85 | 76 | 68 | 61 | 55 | 48 | 41 | 36 | 32 | 29 | 23 | 21 | 18 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 26 | 64 | 130 | 209 | 276 | 324 | 307 | 234 | 168 | 125 | 101 | 88 | 77 | 70 | 62 | 55 | 49 | 41 | 36 | 32 | 29 | 23 | 21 | 18 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 19 | 49 | 103 | 173 | 242 | 313 | 285 | 216 | 157 | 119 | 98 | 82 | 73 | 65 | 57 | 51 | 44 | 37 | 33 | 30 | 24 | 22 | 18 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 23 | 52 | 97 | 153 | 253 | 285 | 253 | 199 | 151 | 118 | 91 | 78 | 68 | 59 | 53 | 46 | 39 | 35 | 31 | 25 | 22 | 18 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 30 | 104 | 204 | 276 | 276 | 226 | 175 | 120 | 92 | 75 | 64 | 57 | 50 | 43 | 37 | 33 | 26 | 22 | 19 | 1 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 36 | 98 | 177 | 236 | 250 | 207 | 148 | 99 | 75 | 63 | 56 | 49 | 42 | 37 | 29 | 24 | 19 | 4 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 22 | 62 | 124 | 210 | 232 | 176 | 107 | 78 | 65 | 57 | 50 | 43 | 33 | 27 | 20 | 11 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 24 | 95 | 167 | 219 | 167 | 106 | 77 | 64 | 56 | 49 | 37 | 29 | 21 | 14 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 15 | 58 | 152 | 207 | 159 | 104 | 76 | 64 | 55 | 42 | 33 | 22 | 15 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.4 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 54 | 121 | 182 | 204 | 204 | 191 | 146 | 121 | 106 | 98 | 94 | 90 | 83 | 78 | 73 | 66 | 58 | 50 | 46 | 42 | 38 | 32 | 30 | 26 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 38 | 94 | 153 | 187 | 198 | 193 | 155 | 128 | 110 | 100 | 95 | 91 | 84 | 79 | 74 | 67 | 59 | 51 | 46 | 42 | 38 | 32 | 30 | 26 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 27 | 71 | 126 | 166 | 187 | 191 | 164 | 134 | 114 | 103 | 96 | 92 | 85 | 80 | 75 | 68 | 60 | 52 | 47 | 43 | 38 | 33 | 30 | 26 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 19 | 54 | 102 | 145 | 173 | 185 | 155 | 129 | 111 | 101 | 95 | 88 | 82 | 76 | 70 | 62 | 54 | 48 | 44 | 40 | 33 | 31 | 26 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 40 | 81 | 124 | 157 | 180 | 161 | 135 | 116 | 104 | 97 | 90 | 83 | 77 | 71 | 63 | 55 | 49 | 44 | 40 | 33 | 31 | 26 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 30 | 64 | 104 | 163 | 174 | 154 | 130 | 113 | 102 | 93 | 86 | 79 | 73 | 66 | 57 | 50 | 46 | 42 | 34 | 31 | 27 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 13 | 32 | 59 | 120 | 157 | 162 | 145 | 126 | 111 | 98 | 90 | 82 | 75 | 68 | 60 | 52 | 47 | 43 | 35 | 31 | 27 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 36 | 90 | 138 | 158 | 152 | 135 | 112 | 98 | 88 | 79 | 72 | 65 | 56 | 50 | 45 | 37 | 32 | 27 | 0 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 37 | 80 | 121 | 148 | 143 | 123 | 102 | 87 | 78 | 71 | 64 | 56 | 49 | 41 | 34 | 28 | 4 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 36 | 71 | 121 | 140 | 126 | 101 | 86 | 78 | 70 | 63 | 55 | 44 | 36 | 29 | 13 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 49 | 97 | 135 | 122 | 100 | 86 | 77 | 70 | 62 | 49 | 40 | 30 | 20 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 33 | 88 | 130 | 119 | 98 | 85 | 76 | 69 | 54 | 44 | 32 | 22 |

RAINFALL TYPE = III  * * * TC = 0.4 HR * * *  SHEET 4 OF 10

## Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HYDROGRAPH TIME (HOURS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 21 | 27 | 35 | 54 | 70 | 97 | 144 | 217 | 316 | 397 | 411 | 388 | 330 | 214 | 139 | 99 | 78 | 67 | 60 | 52 | 47 | 42 | 36 | 31 | 26 | 23 | 21 | 18 | 15 | 13 | 11 | 0 |
| .10 | 19 | 24 | 30 | 43 | 50 | 64 | 86 | 125 | 186 | 273 | 355 | 392 | 390 | 296 | 194 | 129 | 94 | 75 | 65 | 56 | 49 | 43 | 38 | 33 | 28 | 24 | 21 | 19 | 15 | 14 | 11 | 0 |
| .20 | 18 | 23 | 29 | 40 | 47 | 58 | 77 | 109 | 161 | 235 | 315 | 367 | 382 | 318 | 218 | 145 | 103 | 80 | 68 | 57 | 50 | 44 | 39 | 33 | 28 | 24 | 22 | 19 | 15 | 14 | 11 | 0 |
| .30 | 16 | 21 | 26 | 34 | 38 | 44 | 53 | 69 | 95 | 139 | 203 | 278 | 337 | 367 | 289 | 199 | 135 | 98 | 77 | 62 | 54 | 46 | 40 | 35 | 30 | 25 | 22 | 20 | 16 | 14 | 11 | 0 |
| .40 | 16 | 20 | 25 | 33 | 36 | 41 | 49 | 62 | 84 | 121 | 176 | 244 | 306 | 358 | 306 | 220 | 151 | 107 | 83 | 64 | 55 | 47 | 41 | 35 | 30 | 25 | 23 | 20 | 16 | 14 | 12 | 0 |
| .50 | 14 | 18 | 22 | 28 | 31 | 35 | 39 | 46 | 57 | 75 | 106 | 152 | 213 | 323 | 346 | 282 | 202 | 140 | 102 | 73 | 59 | 50 | 42 | 37 | 32 | 27 | 23 | 21 | 16 | 14 | 12 | 0 |
| .75 | 12 | 16 | 20 | 25 | 28 | 30 | 34 | 38 | 45 | 56 | 75 | 104 | 145 | 246 | 319 | 308 | 252 | 187 | 135 | 89 | 67 | 53 | 44 | 39 | 33 | 28 | 24 | 22 | 17 | 14 | 12 | 0 |
| 1.0 | 10 | 12 | 16 | 20 | 22 | 23 | 25 | 28 | 31 | 34 | 39 | 47 | 60 | 110 | 197 | 280 | 309 | 279 | 220 | 138 | 90 | 63 | 49 | 42 | 37 | 31 | 26 | 23 | 18 | 15 | 12 | 1 |
| 1.5 | 6 | 8 | 10 | 13 | 14 | 15 | 17 | 18 | 19 | 21 | 23 | 25 | 27 | 34 | 49 | 82 | 143 | 218 | 283 | 271 | 203 | 116 | 68 | 51 | 43 | 37 | 32 | 27 | 21 | 16 | 13 | 4 |
| 2.0 | 3 | 5 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 22 | 27 | 34 | 50 | 82 | 135 | 226 | 265 | 211 | 114 | 67 | 50 | 42 | 37 | 31 | 23 | 18 | 13 | 8 |
| 2.5 | 2 | 3 | 4 | 6 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 16 | 18 | 22 | 26 | 34 | 50 | 102 | 182 | 249 | 197 | 111 | 67 | 50 | 42 | 36 | 26 | 20 | 14 | 9 |
| 3.0 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 10 | 12 | 14 | 16 | 19 | 23 | 34 | 63 | 144 | 238 | 201 | 121 | 72 | 52 | 43 | 31 | 23 | 15 | 10 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 1 | 4 | 15 | 40 | 101 | 198 | 295 | 345 | 345 | 325 | 232 | 161 | 122 | 100 | 88 | 80 | 72 | 65 | 59 | 53 | 46 | 39 | 34 | 31 | 28 | 23 | 21 | 18 | 0 |
| .10 | 0 | 0 | 0 | 1 | 3 | 11 | 30 | 77 | 158 | 249 | 313 | 335 | 329 | 253 | 178 | 132 | 106 | 91 | 82 | 73 | 66 | 60 | 53 | 47 | 40 | 35 | 31 | 28 | 23 | 21 | 18 | 0 |
| .20 | 0 | 0 | 0 | 0 | 2 | 8 | 23 | 59 | 125 | 208 | 278 | 316 | 324 | 271 | 196 | 144 | 112 | 95 | 85 | 75 | 67 | 61 | 54 | 47 | 40 | 35 | 32 | 28 | 23 | 21 | 18 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 17 | 45 | 98 | 171 | 242 | 291 | 313 | 249 | 182 | 136 | 108 | 92 | 80 | 71 | 63 | 56 | 49 | 42 | 36 | 33 | 29 | 24 | 21 | 18 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 34 | 77 | 140 | 208 | 264 | 304 | 263 | 198 | 148 | 115 | 97 | 81 | 72 | 64 | 57 | 50 | 43 | 37 | 33 | 30 | 24 | 21 | 18 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 26 | 60 | 113 | 177 | 276 | 295 | 244 | 185 | 140 | 111 | 88 | 77 | 67 | 59 | 52 | 45 | 39 | 34 | 31 | 24 | 22 | 18 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 29 | 60 | 104 | 204 | 271 | 263 | 222 | 174 | 136 | 101 | 83 | 70 | 61 | 54 | 47 | 40 | 35 | 32 | 25 | 22 | 18 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 16 | 67 | 155 | 235 | 263 | 242 | 198 | 138 | 102 | 80 | 66 | 58 | 51 | 44 | 38 | 34 | 27 | 23 | 19 | 1 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 22 | 67 | 138 | 205 | 241 | 221 | 167 | 110 | 79 | 66 | 58 | 51 | 44 | 38 | 30 | 24 | 20 | 5 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 13 | 42 | 93 | 182 | 225 | 191 | 119 | 83 | 67 | 58 | 51 | 44 | 34 | 27 | 21 | 12 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 15 | 62 | 139 | 213 | 180 | 117 | 82 | 67 | 58 | 51 | 38 | 30 | 22 | 15 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 41 | 127 | 203 | 171 | 114 | 81 | 66 | 57 | 43 | 33 | 23 | 16 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 24 | 68 | 124 | 174 | 190 | 190 | 162 | 133 | 114 | 103 | 97 | 92 | 85 | 80 | 75 | 68 | 60 | 52 | 47 | 43 | 39 | 33 | 30 | 26 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 17 | 51 | 100 | 149 | 177 | 186 | 169 | 140 | 119 | 106 | 99 | 93 | 86 | 81 | 75 | 69 | 61 | 52 | 47 | 43 | 39 | 33 | 30 | 26 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 38 | 79 | 126 | 160 | 181 | 173 | 147 | 124 | 109 | 101 | 95 | 88 | 81 | 76 | 69 | 62 | 53 | 48 | 44 | 39 | 33 | 30 | 26 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 28 | 62 | 105 | 141 | 176 | 165 | 141 | 120 | 107 | 99 | 91 | 84 | 78 | 71 | 64 | 56 | 49 | 45 | 41 | 33 | 31 | 26 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 20 | 48 | 86 | 123 | 172 | 172 | 146 | 125 | 111 | 101 | 92 | 85 | 79 | 72 | 65 | 56 | 50 | 45 | 41 | 34 | 31 | 26 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 15 | 37 | 70 | 105 | 157 | 167 | 151 | 130 | 114 | 104 | 94 | 87 | 79 | 73 | 66 | 57 | 50 | 46 | 42 | 34 | 31 | 27 | 0 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 17 | 37 | 91 | 139 | 157 | 150 | 134 | 119 | 103 | 93 | 84 | 76 | 69 | 62 | 54 | 48 | 44 | 35 | 32 | 27 | 0 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 40 | 91 | 135 | 153 | 149 | 135 | 113 | 99 | 88 | 79 | 72 | 65 | 57 | 50 | 45 | 37 | 32 | 27 | 1 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 24 | 59 | 101 | 132 | 144 | 130 | 107 | 90 | 80 | 73 | 65 | 57 | 51 | 41 | 34 | 29 | 6 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 25 | 55 | 106 | 138 | 130 | 105 | 89 | 79 | 72 | 65 | 57 | 45 | 37 | 30 | 15 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 36 | 81 | 133 | 133 | 104 | 88 | 79 | 71 | 64 | 50 | 41 | 31 | 21 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 24 | 74 | 128 | 122 | 103 | 88 | 78 | 70 | 55 | 45 | 32 | 23 |
| RAINFALL TYPE = III | | | | | | | | | | | | | | * * * TC = 0.5 HR * * * | | | | | | | | | | | | | | | | | | SHEET 5 OF 10 |

# Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 17 | 22 | 28 | 39 | 45 | 56 | 73 | 104 | 151 | 215 | 281 | 328 | 343 | 310 | 228 | 163 | 121 | 94 | 77 | 63 | 53 | 45 | 39 | 34 | 29 | 25 | 22 | 20 | 15 | 14 | 11 | 0 |
| .10 | 17 | 21 | 27 | 37 | 42 | 51 | 66 | 91 | 131 | 187 | 250 | 302 | 336 | 319 | 247 | 179 | 131 | 101 | 82 | 65 | 55 | 46 | 40 | 35 | 29 | 25 | 22 | 20 | 16 | 14 | 11 | 0 |
| .20 | 15 | 19 | 24 | 31 | 35 | 40 | 48 | 60 | 81 | 114 | 163 | 221 | 275 | 328 | 298 | 229 | 167 | 124 | 96 | 73 | 60 | 49 | 42 | 36 | 31 | 26 | 23 | 20 | 16 | 14 | 12 | 0 |
| .30 | 14 | 18 | 23 | 30 | 33 | 38 | 44 | 55 | 72 | 100 | 142 | 194 | 248 | 320 | 305 | 245 | 182 | 135 | 103 | 76 | 62 | 50 | 42 | 37 | 31 | 27 | 23 | 21 | 16 | 14 | 12 | 0 |
| .40 | 13 | 16 | 21 | 26 | 29 | 32 | 36 | 41 | 50 | 65 | 88 | 124 | 171 | 268 | 313 | 288 | 228 | 170 | 127 | 88 | 68 | 54 | 44 | 38 | 33 | 28 | 24 | 21 | 17 | 14 | 12 | 0 |
| .50 | 12 | 16 | 20 | 25 | 28 | 30 | 34 | 39 | 46 | 59 | 78 | 109 | 150 | 244 | 306 | 294 | 242 | 184 | 138 | 94 | 71 | 56 | 45 | 39 | 34 | 28 | 24 | 22 | 17 | 14 | 12 | 0 |
| .75 | 10 | 13 | 16 | 21 | 23 | 25 | 27 | 30 | 33 | 38 | 46 | 58 | 77 | 140 | 221 | 277 | 287 | 248 | 197 | 133 | 92 | 66 | 50 | 42 | 36 | 31 | 26 | 23 | 18 | 15 | 12 | 1 |
| 1.0 | 8 | 10 | 13 | 16 | 18 | 19 | 21 | 23 | 25 | 27 | 30 | 34 | 39 | 61 | 109 | 181 | 249 | 280 | 265 | 198 | 134 | 85 | 58 | 46 | 40 | 34 | 29 | 25 | 20 | 16 | 12 | 2 |
| 1.5 | 5 | 7 | 9 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 22 | 24 | 30 | 40 | 63 | 106 | 167 | 225 | 261 | 226 | 147 | 84 | 58 | 46 | 39 | 34 | 29 | 22 | 17 | 13 | 5 |
| 2.0 | 2 | 4 | 5 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 18 | 22 | 26 | 34 | 50 | 80 | 155 | 226 | 246 | 158 | 91 | 61 | 47 | 40 | 34 | 25 | 20 | 14 | 9 |
| 2.5 | 1 | 2 | 3 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 13 | 15 | 18 | 21 | 26 | 34 | 62 | 120 | 209 | 234 | 151 | 90 | 60 | 47 | 39 | 29 | 22 | 15 | 10 |
| 3.0 | 0 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 7 | 9 | 10 | 12 | 15 | 17 | 21 | 29 | 50 | 113 | 209 | 224 | 144 | 88 | 59 | 46 | 33 | 25 | 16 | 10 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 24 | 58 | 113 | 182 | 243 | 283 | 287 | 233 | 178 | 139 | 114 | 98 | 83 | 73 | 64 | 56 | 50 | 43 | 37 | 33 | 30 | 24 | 21 | 18 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 18 | 45 | 91 | 151 | 212 | 259 | 284 | 245 | 191 | 149 | 120 | 102 | 85 | 75 | 65 | 57 | 50 | 43 | 37 | 33 | 30 | 24 | 21 | 18 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 35 | 72 | 125 | 183 | 263 | 277 | 230 | 180 | 142 | 116 | 93 | 80 | 68 | 59 | 52 | 45 | 39 | 34 | 31 | 25 | 22 | 18 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 26 | 57 | 102 | 156 | 245 | 270 | 240 | 192 | 151 | 122 | 96 | 82 | 69 | 60 | 53 | 46 | 39 | 35 | 31 | 25 | 22 | 18 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 8 | 20 | 45 | 83 | 182 | 252 | 264 | 226 | 181 | 144 | 108 | 89 | 73 | 62 | 55 | 48 | 41 | 36 | 32 | 26 | 22 | 19 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 15 | 35 | 67 | 158 | 235 | 259 | 235 | 192 | 153 | 113 | 92 | 75 | 63 | 56 | 49 | 42 | 36 | 33 | 26 | 22 | 19 | 1 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 35 | 100 | 178 | 232 | 242 | 217 | 163 | 121 | 90 | 71 | 61 | 54 | 47 | 40 | 35 | 28 | 23 | 19 | 2 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 21 | 68 | 140 | 205 | 236 | 229 | 181 | 135 | 97 | 74 | 63 | 55 | 48 | 41 | 36 | 29 | 24 | 19 | 3 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 42 | 94 | 155 | 221 | 212 | 158 | 103 | 77 | 64 | 56 | 49 | 42 | 33 | 26 | 20 | 10 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 15 | 42 | 113 | 184 | 209 | 151 | 101 | 76 | 63 | 55 | 48 | 36 | 29 | 21 | 14 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 27 | 80 | 168 | 199 | 146 | 100 | 75 | 63 | 55 | 41 | 32 | 22 | 15 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 56 | 154 | 191 | 151 | 105 | 78 | 64 | 48 | 37 | 24 | 16 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =0.75 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 13 | 37 | 71 | 108 | 140 | 167 | 156 | 136 | 120 | 108 | 101 | 92 | 85 | 78 | 72 | 64 | 56 | 50 | 45 | 41 | 34 | 31 | 26 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 28 | 57 | 91 | 124 | 163 | 158 | 140 | 124 | 111 | 103 | 94 | 86 | 79 | 72 | 65 | 57 | 50 | 46 | 41 | 34 | 31 | 27 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 21 | 45 | 76 | 135 | 159 | 153 | 136 | 120 | 109 | 98 | 90 | 82 | 74 | 67 | 59 | 52 | 47 | 43 | 35 | 31 | 27 | 0 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 15 | 35 | 62 | 121 | 157 | 157 | 140 | 124 | 112 | 100 | 91 | 83 | 75 | 68 | 60 | 52 | 47 | 43 | 35 | 31 | 27 | 0 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 11 | 27 | 50 | 107 | 146 | 154 | 143 | 128 | 115 | 102 | 93 | 84 | 76 | 69 | 61 | 53 | 48 | 43 | 35 | 32 | 27 | 0 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 21 | 66 | 118 | 148 | 152 | 139 | 125 | 108 | 97 | 87 | 78 | 71 | 63 | 55 | 49 | 45 | 36 | 32 | 27 | 1 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 38 | 82 | 122 | 142 | 144 | 133 | 116 | 103 | 91 | 80 | 73 | 66 | 58 | 51 | 46 | 37 | 32 | 28 | 1 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 24 | 60 | 102 | 132 | 142 | 133 | 116 | 99 | 86 | 77 | 70 | 62 | 55 | 49 | 40 | 33 | 28 | 3 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 25 | 55 | 91 | 128 | 136 | 119 | 98 | 85 | 77 | 69 | 62 | 54 | 44 | 36 | 29 | 11 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 25 | 66 | 109 | 131 | 116 | 97 | 85 | 76 | 69 | 61 | 48 | 39 | 30 | 18 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 16 | 47 | 100 | 127 | 114 | 96 | 84 | 75 | 68 | 53 | 43 | 31 | 22 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 44 | 102 | 124 | 112 | 95 | 83 | 75 | 59 | 47 | 33 | 23 |

RAINFALL TYPE = III  * * * TC = 0.75 HR * * *  SHEET 6 OF 10

## Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

TRVL TIME (HR) — HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 * * * TC =1.0 HR * * * IA/P = 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 15 | 19 | 24 | 32 | 37 | 44 | 54 | 71 | 98 | 136 | 181 | 227 | 264 | 297 | 270 | 215 | 164 | 128 | 103 | 78 | 64 | 52 | 43 | 36 | 31 | 26 | 23 | 21 | 16 | 14 | 12 | 0 |
| .10 | 13 | 17 | 22 | 28 | 31 | 35 | 41 | 49 | 64 | 87 | 120 | 161 | 205 | 273 | 289 | 254 | 201 | 155 | 122 | 90 | 71 | 56 | 45 | 38 | 33 | 28 | 24 | 21 | 17 | 14 | 12 | 0 |
| .20 | 13 | 16 | 21 | 27 | 29 | 33 | 38 | 46 | 58 | 77 | 105 | 142 | 184 | 257 | 285 | 263 | 214 | 167 | 130 | 95 | 74 | 57 | 46 | 39 | 33 | 28 | 24 | 22 | 17 | 14 | 12 | 0 |
| .30 | 12 | 16 | 20 | 26 | 28 | 31 | 36 | 42 | 53 | 69 | 93 | 126 | 165 | 240 | 279 | 268 | 225 | 178 | 139 | 100 | 77 | 59 | 47 | 39 | 34 | 29 | 25 | 22 | 17 | 15 | 12 | 1 |
| .40 | 11 | 14 | 18 | 23 | 25 | 27 | 30 | 34 | 40 | 48 | 62 | 83 | 112 | 185 | 251 | 276 | 256 | 213 | 163 | 118 | 87 | 65 | 50 | 41 | 35 | 30 | 26 | 23 | 18 | 15 | 12 | 1 |
| .50 | 11 | 13 | 17 | 22 | 24 | 26 | 29 | 32 | 37 | 45 | 56 | 74 | 99 | 167 | 235 | 270 | 261 | 223 | 179 | 126 | 92 | 67 | 51 | 42 | 36 | 31 | 26 | 23 | 18 | 15 | 12 | 1 |
| .75 | 8 | 10 | 13 | 17 | 18 | 19 | 21 | 23 | 25 | 28 | 31 | 36 | 44 | 72 | 122 | 186 | 239 | 258 | 243 | 189 | 136 | 90 | 62 | 48 | 40 | 34 | 29 | 25 | 20 | 16 | 12 | 2 |
| 1.0 | 6 | 9 | 11 | 14 | 15 | 17 | 18 | 20 | 21 | 23 | 25 | 28 | 32 | 46 | 75 | 124 | 185 | 234 | 253 | 226 | 170 | 110 | 71 | 53 | 43 | 37 | 31 | 27 | 21 | 16 | 13 | 4 |
| 1.5 | 4 | 6 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 21 | 25 | 32 | 46 | 74 | 118 | 170 | 230 | 239 | 179 | 108 | 70 | 52 | 43 | 36 | 31 | 23 | 18 | 13 | 7 |
| 2.0 | 2 | 3 | 4 | 6 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 16 | 18 | 22 | 28 | 38 | 58 | 111 | 179 | 228 | 185 | 116 | 75 | 54 | 44 | 37 | 27 | 21 | 14 | 9 |
| 2.5 | 1 | 1 | 2 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 11 | 13 | 15 | 18 | 22 | 28 | 46 | 87 | 167 | 219 | 176 | 113 | 73 | 54 | 43 | 31 | 23 | 15 | 10 |
| 3.0 | 0 | 0 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 7 | 8 | 10 | 12 | 14 | 16 | 21 | 32 | 68 | 156 | 210 | 179 | 120 | 78 | 56 | 37 | 27 | 16 | 11 |
| IA/P = 0.30 * * * TC =1.0 HR * * * IA/P = 0.30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 30 | 57 | 95 | 141 | 186 | 243 | 249 | 213 | 174 | 142 | 119 | 97 | 83 | 70 | 60 | 53 | 46 | 39 | 35 | 31 | 25 | 22 | 18 | 0 |
| .10 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 23 | 46 | 79 | 120 | 164 | 230 | 245 | 221 | 183 | 150 | 125 | 101 | 85 | 72 | 61 | 53 | 46 | 40 | 35 | 31 | 25 | 22 | 18 | 0 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 18 | 36 | 65 | 102 | 183 | 233 | 241 | 210 | 174 | 144 | 112 | 92 | 76 | 64 | 56 | 48 | 42 | 36 | 33 | 26 | 22 | 19 | 1 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 14 | 29 | 53 | 86 | 163 | 221 | 237 | 217 | 183 | 151 | 117 | 95 | 78 | 65 | 56 | 49 | 42 | 37 | 33 | 26 | 22 | 19 | 1 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 11 | 23 | 43 | 107 | 180 | 225 | 233 | 207 | 175 | 133 | 105 | 84 | 68 | 59 | 51 | 44 | 38 | 34 | 27 | 23 | 19 | 1 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 18 | 34 | 91 | 162 | 214 | 230 | 213 | 183 | 139 | 109 | 86 | 70 | 60 | 52 | 45 | 39 | 34 | 27 | 23 | 19 | 1 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 33 | 82 | 145 | 196 | 218 | 211 | 174 | 135 | 101 | 77 | 64 | 56 | 48 | 42 | 37 | 29 | 24 | 19 | 3 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 11 | 37 | 85 | 144 | 192 | 214 | 199 | 160 | 116 | 85 | 69 | 59 | 51 | 44 | 38 | 30 | 25 | 20 | 5 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 23 | 56 | 104 | 174 | 203 | 177 | 123 | 89 | 71 | 60 | 52 | 45 | 35 | 27 | 21 | 11 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 24 | 73 | 139 | 194 | 169 | 120 | 87 | 70 | 59 | 51 | 39 | 30 | 22 | 14 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 15 | 51 | 127 | 186 | 162 | 117 | 86 | 69 | 59 | 44 | 34 | 23 | 16 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 35 | 117 | 180 | 164 | 122 | 90 | 71 | 51 | 39 | 25 | 16 |
| IA/P = 0.50 * * * TC =1.0 HR * * * IA/P = 0.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 17 | 34 | 57 | 83 | 127 | 151 | 142 | 130 | 118 | 109 | 99 | 91 | 83 | 75 | 68 | 59 | 52 | 47 | 43 | 35 | 31 | 27 | 1 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 13 | 27 | 47 | 71 | 117 | 146 | 144 | 133 | 121 | 112 | 101 | 92 | 84 | 76 | 68 | 60 | 53 | 48 | 43 | 35 | 32 | 27 | 1 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 21 | 38 | 60 | 106 | 138 | 143 | 135 | 124 | 114 | 102 | 94 | 85 | 76 | 69 | 61 | 54 | 48 | 44 | 35 | 32 | 27 | 1 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 16 | 31 | 73 | 114 | 139 | 142 | 132 | 121 | 108 | 98 | 88 | 79 | 71 | 64 | 56 | 50 | 45 | 36 | 32 | 27 | 1 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 13 | 25 | 62 | 104 | 133 | 140 | 134 | 124 | 110 | 99 | 89 | 80 | 72 | 64 | 56 | 50 | 45 | 37 | 32 | 27 | 1 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 35 | 74 | 112 | 134 | 138 | 131 | 117 | 104 | 93 | 82 | 74 | 67 | 59 | 52 | 47 | 38 | 33 | 28 | 2 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 19 | 42 | [illegible] | 115 | 131 | 134 | 123 | 110 | 97 | 85 | 77 | 69 | 61 | 54 | 48 | 39 | 33 | 28 | 3 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 21 | 49 | 84 | 113 | 129 | 132 | 119 | 103 | 89 | 80 | 72 | 64 | 56 | 50 | 41 | 34 | 28 | 5 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 21 | 46 | 75 | 113 | 128 | 120 | 102 | 88 | 79 | 71 | 63 | 56 | 45 | 37 | 29 | 12 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 42 | 82 | 119 | 124 | 104 | 90 | 80 | 72 | 64 | 50 | 41 | 31 | 20 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 29 | 75 | 117 | 121 | 102 | 89 | 79 | 71 | 56 | 45 | 32 | 23 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 28 | 80 | 113 | 118 | 101 | 88 | 79 | 63 | 49 | 34 | 24 |

RAINFALL TYPE = III * * * TC = 1.0 HR * * * SHEET 7 OF 10

## Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

TRVL ---------- HYDROGRAPH TIME (HOURS) ----------

| TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 13 | 17 | 22 | 28 | 32 | 37 | 44 | 56 | 75 | 100 | 133 | 170 | 206 | 255 | 264 | 236 | 194 | 155 | 125 | 95 | 75 | 59 | 47 | 39 | 33 | 28 | 24 | 22 | 17 | 14 | 12 | 1 |
| .10 | 13 | 16 | 21 | 27 | 30 | 34 | 41 | 51 | 67 | 89 | 118 | 152 | 188 | 243 | 261 | 243 | 204 | 164 | 133 | 100 | 79 | 61 | 48 | 40 | 34 | 29 | 25 | 22 | 17 | 15 | 12 | 1 |
| .20 | 11 | 15 | 18 | 24 | 26 | 29 | 33 | 38 | 47 | 60 | 79 | 105 | 137 | 203 | 248 | 256 | 232 | 193 | 156 | 115 | 88 | 67 | 51 | 42 | 35 | 30 | 26 | 23 | 18 | 15 | 12 | 1 |
| .30 | 11 | 14 | 18 | 23 | 25 | 27 | 31 | 36 | 43 | 54 | 71 | 94 | 122 | 187 | 237 | 254 | 238 | 203 | 165 | 121 | 92 | 69 | 53 | 43 | 36 | 30 | 26 | 23 | 18 | 15 | 12 | 1 |
| .40 | 10 | 12 | 16 | 20 | 22 | 24 | 26 | 29 | 34 | 40 | 49 | 64 | 84 | 140 | 201 | 242 | 250 | 228 | 193 | 142 | 106 | 77 | 57 | 46 | 38 | 32 | 27 | 24 | 19 | 15 | 12 | 1 |
| .50 | 9 | 12 | 15 | 19 | 21 | 23 | 25 | 28 | 32 | 37 | 45 | 58 | 75 | 126 | 186 | 232 | 248 | 233 | 201 | 150 | 111 | 80 | 58 | 47 | 39 | 33 | 28 | 24 | 19 | 15 | 12 | 2 |
| .75 | 8 | 11 | 14 | 17 | 19 | 20 | 22 | 24 | 27 | 31 | 36 | 44 | 56 | 93 | 144 | 196 | 230 | 237 | 220 | 174 | 131 | 91 | 64 | 50 | 41 | 34 | 29 | 25 | 20 | 16 | 12 | 2 |
| 1.0 | 6 | 8 | 11 | 14 | 15 | 16 | 17 | 19 | 20 | 22 | 25 | 28 | 32 | 46 | 74 | 119 | 170 | 213 | 234 | 218 | 174 | 120 | 79 | 58 | 46 | 38 | 32 | 27 | 21 | 17 | 13 | 4 |
| 1.5 | 3 | 5 | 7 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 18 | 22 | 27 | 38 | 58 | 91 | 134 | 197 | 223 | 194 | 128 | 83 | 60 | 47 | 39 | 33 | 24 | 19 | 14 | 7 |
| 2.0 | 2 | 3 | 4 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 15 | 18 | 22 | 27 | 38 | 57 | 106 | 166 | 214 | 184 | 124 | 82 | 59 | 47 | 39 | 28 | 21 | 14 | 9 |
| 2.5 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 7 | 8 | 10 | 11 | 13 | 16 | 19 | 24 | 38 | 68 | 137 | 206 | 186 | 130 | 87 | 62 | 48 | 33 | 24 | 15 | 10 |
| 3.0 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 8 | 9 | 11 | 13 | 16 | 21 | 31 | 66 | 145 | 200 | 178 | 126 | 85 | 61 | 39 | 28 | 17 | 11 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 18 | 35 | 61 | 94 | 130 | 192 | 222 | 218 | 191 | 161 | 136 | 110 | 93 | 77 | 65 | 56 | 48 | 41 | 36 | 32 | 26 | 22 | 19 | 1 |
| .10 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 14 | 28 | 50 | 79 | 113 | 177 | 214 | 219 | 197 | 168 | 142 | 115 | 96 | 79 | 66 | 57 | 49 | 42 | 37 | 33 | 26 | 22 | 19 | 1 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 22 | 41 | 66 | 97 | 162 | 205 | 217 | 202 | 175 | 149 | 119 | 99 | 81 | 67 | 58 | 50 | 43 | 37 | 33 | 26 | 23 | 19 | 1 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 17 | 33 | 55 | 115 | 174 | 208 | 214 | 195 | 168 | 133 | 108 | 87 | 70 | 60 | 52 | 45 | 39 | 34 | 27 | 23 | 19 | 2 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 14 | 26 | 45 | 100 | 159 | 200 | 212 | 199 | 174 | 138 | 112 | 89 | 72 | 61 | 53 | 45 | 39 | 35 | 28 | 23 | 19 | 2 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 21 | 60 | 116 | 170 | 203 | 209 | 192 | 156 | 124 | 97 | 76 | 64 | 55 | 47 | 41 | 36 | 29 | 24 | 19 | 3 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 35 | 79 | 131 | 175 | 201 | 201 | 172 | 140 | 107 | 82 | 67 | 58 | 50 | 43 | 37 | 30 | 24 | 20 | 4 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 23 | 57 | 105 | 153 | 186 | 198 | 172 | 131 | 95 | 75 | 63 | 54 | 47 | 41 | 32 | 25 | 20 | 7 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 24 | 54 | 96 | 157 | 189 | 174 | 127 | 94 | 74 | 63 | 54 | 46 | 35 | 28 | 21 | 12 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 24 | 69 | 127 | 182 | 167 | 124 | 93 | 74 | 62 | 53 | 40 | 31 | 22 | 15 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 35 | 99 | 176 | 167 | 129 | 96 | 76 | 63 | 46 | 35 | 23 | 16 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 34 | 107 | 171 | 161 | 125 | 94 | 75 | 53 | 40 | 25 | 17 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.25 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 21 | 36 | 55 | 95 | 123 | 138 | 131 | 122 | 114 | 104 | 95 | 86 | 78 | 70 | 62 | 55 | 49 | 44 | 36 | 32 | 27 | 1 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 30 | 66 | 102 | 125 | 134 | 128 | 120 | 108 | 99 | 89 | 80 | 73 | 65 | 57 | 51 | 46 | 37 | 32 | 28 | 2 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 13 | 24 | 57 | 94 | 120 | 132 | 130 | 122 | 110 | 101 | 91 | 81 | 73 | 66 | 58 | 51 | 46 | 37 | 33 | 28 | 2 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 19 | 49 | 85 | 113 | 131 | 131 | 124 | 112 | 102 | 92 | 82 | 74 | 66 | 58 | 52 | 47 | 38 | 33 | 28 | 2 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 42 | 76 | 106 | 126 | 130 | 125 | 114 | 104 | 93 | 83 | 75 | 67 | 59 | 52 | 47 | 38 | 33 | 28 | 3 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 22 | 51 | 84 | 112 | 127 | 129 | 120 | 109 | 97 | 86 | 77 | 70 | 61 | 54 | 49 | 40 | 33 | 28 | 4 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 12 | 32 | 61 | 91 | 113 | 125 | 123 | 114 | 101 | 89 | 80 | 72 | 64 | 56 | 50 | 41 | 34 | 28 | 5 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 22 | 47 | 76 | 102 | 122 | 124 | 111 | 96 | 85 | 76 | 69 | 61 | 54 | 43 | 36 | 29 | 9 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 22 | 43 | 82 | 111 | 121 | 109 | 95 | 84 | 76 | 68 | 60 | 48 | 39 | 30 | 16 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 9 | 30 | 63 | 104 | 118 | 107 | 94 | 83 | 75 | 67 | 53 | 43 | 31 | 21 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 20 | 58 | 104 | 116 | 106 | 93 | 83 | 74 | 59 | 47 | 33 | 23 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 19 | 64 | 104 | 114 | 104 | 92 | 82 | 65 | 52 | 35 | 24 |

RAINFALL TYPE = III * * * TC = 1.25 HR * * * SHEET 8 OF 10

## Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 12 | 15 | 19 | 25 | 27 | 31 | 37 | 45 | 57 | 75 | 97 | 122 | 151 | 203 | 231 | 238 | 213 | 182 | 150 | 115 | 91 | 70 | 54 | 44 | 37 | 30 | 26 | 23 | 18 | 15 | 12 | 1 |
| .10 | 10 | 13 | 17 | 21 | 23 | 26 | 29 | 34 | 41 | 52 | 67 | 87 | 111 | 165 | 210 | 233 | 227 | 205 | 173 | 131 | 102 | 77 | 58 | 46 | 39 | 32 | 27 | 24 | 19 | 15 | 12 | 1 |
| .20 | 10 | 13 | 16 | 21 | 23 | 25 | 28 | 32 | 38 | 47 | 61 | 78 | 100 | 152 | 199 | 228 | 231 | 210 | 181 | 138 | 107 | 80 | 59 | 47 | 39 | 33 | 28 | 24 | 19 | 15 | 12 | 2 |
| .30 | 9 | 12 | 15 | 20 | 22 | 24 | 27 | 30 | 36 | 44 | 55 | 70 | 90 | 139 | 188 | 221 | 228 | 215 | 188 | 145 | 112 | 83 | 61 | 48 | 40 | 33 | 28 | 24 | 19 | 15 | 12 | 2 |
| .40 | 8 | 11 | 14 | 18 | 19 | 21 | 23 | 25 | 29 | 33 | 40 | 50 | 64 | 103 | 152 | 196 | 223 | 226 | 208 | 166 | 127 | 92 | 66 | 52 | 42 | 35 | 30 | 25 | 20 | 16 | 13 | 2 |
| .50 | 8 | 10 | 13 | 17 | 18 | 20 | 22 | 24 | 27 | 31 | 37 | 46 | 58 | 93 | 140 | 186 | 216 | 224 | 212 | 173 | 133 | 96 | 69 | 53 | 43 | 36 | 30 | 26 | 20 | 16 | 13 | 3 |
| .75 | 6 | 8 | 11 | 14 | 15 | 16 | 18 | 19 | 21 | 23 | 26 | 31 | 36 | 55 | 87 | 130 | 173 | 205 | 217 | 202 | 165 | 119 | 81 | 60 | 48 | 39 | 33 | 28 | 21 | 17 | 13 | 4 |
| 1.0 | 5 | 6 | 8 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 19 | 21 | 24 | 31 | 46 | 71 | 109 | 151 | 189 | 214 | 200 | 153 | 102 | 72 | 55 | 44 | 37 | 31 | 23 | 18 | 13 | 6 |
| 1.5 | 3 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 14 | 15 | 16 | 19 | 24 | 31 | 45 | 69 | 103 | 159 | 207 | 207 | 147 | 99 | 71 | 54 | 44 | 36 | 26 | 20 | 14 | 8 |
| 2.0 | 1 | 2 | 3 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 13 | 16 | 19 | 23 | 31 | 45 | 81 | 132 | 189 | 199 | 142 | 97 | 69 | 53 | 43 | 30 | 22 | 15 | 10 |
| 2.5 | 0 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 6 | 6 | 7 | 8 | 10 | 12 | 14 | 17 | 20 | 31 | 53 | 107 | 179 | 194 | 147 | 102 | 73 | 55 | 36 | 26 | 16 | 10 |
| 3.0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 7 | 8 | 10 | 11 | 13 | 18 | 26 | 51 | 116 | 178 | 188 | 142 | 100 | 71 | 43 | 30 | 18 | 11 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 22 | 38 | 59 | 84 | 138 | 180 | 200 | 195 | 176 | 154 | 125 | 105 | 86 | 71 | 60 | 52 | 44 | 39 | 34 | 27 | 23 | 19 | 2 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 18 | 31 | 50 | 99 | 149 | 184 | 198 | 190 | 170 | 139 | 115 | 93 | 75 | 63 | 55 | 47 | 40 | 35 | 28 | 23 | 19 | 3 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 14 | 25 | 41 | 86 | 137 | 176 | 195 | 192 | 175 | 144 | 119 | 95 | 76 | 64 | 55 | 47 | 41 | 36 | 28 | 24 | 19 | 3 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 11 | 21 | 53 | 100 | 147 | 181 | 194 | 187 | 159 | 130 | 103 | 81 | 68 | 58 | 50 | 43 | 37 | 29 | 24 | 19 | 4 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 9 | 17 | 45 | 88 | 136 | 172 | 192 | 189 | 164 | 135 | 106 | 83 | 69 | 59 | 51 | 43 | 38 | 30 | 24 | 20 | 4 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 23 | 56 | 101 | 145 | 177 | 190 | 177 | 149 | 116 | 89 | 73 | 62 | 53 | 45 | 39 | 31 | 25 | 20 | 6 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 13 | 35 | 71 | 113 | 151 | 176 | 184 | 162 | 128 | 97 | 77 | 65 | 55 | 48 | 41 | 32 | 26 | 20 | 7 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 24 | 53 | 92 | 132 | 174 | 182 | 153 | 114 | 88 | 72 | 61 | 52 | 45 | 34 | 27 | 21 | 10 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 24 | 50 | 103 | 152 | 175 | 148 | 112 | 87 | 71 | 60 | 51 | 38 | 30 | 22 | 14 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 24 | 62 | 127 | 170 | 151 | 116 | 89 | 73 | 61 | 45 | 34 | 23 | 16 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 16 | 58 | 131 | 165 | 146 | 113 | 88 | 72 | 52 | 39 | 25 | 16 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 16 | 67 | 134 | 161 | 142 | 111 | 87 | 60 | 44 | 27 | 17 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =1.5 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 13 | 22 | 34 | 65 | 94 | 114 | 129 | 122 | 117 | 108 | 100 | 91 | 81 | 74 | 66 | 58 | 52 | 46 | 38 | 33 | 28 | 2 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 10 | 18 | 42 | 73 | 99 | 116 | 126 | 121 | 112 | 104 | 94 | 84 | 76 | 68 | 60 | 53 | 48 | 39 | 33 | 28 | 3 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 8 | 15 | 36 | 65 | 93 | 112 | 123 | 122 | 113 | 105 | 95 | 85 | 77 | 69 | 61 | 54 | 48 | 39 | 34 | 28 | 4 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 20 | 44 | 72 | 97 | 114 | 122 | 118 | 109 | 99 | 88 | 79 | 71 | 63 | 56 | 50 | 41 | 34 | 28 | 5 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 16 | 38 | 65 | 91 | 110 | 121 | 119 | 110 | 100 | 89 | 80 | 72 | 64 | 57 | 51 | 41 | 34 | 29 | 5 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 13 | 33 | 59 | 85 | 105 | 118 | 120 | 112 | 101 | 90 | 81 | 73 | 65 | 57 | 51 | 41 | 35 | 29 | 6 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 20 | 41 | 66 | 89 | 107 | 118 | 115 | 105 | 93 | 83 | 75 | 67 | 60 | 53 | 43 | 35 | 29 | 8 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 | 31 | 53 | 78 | 106 | 117 | 113 | 100 | 89 | 80 | 72 | 64 | 57 | 46 | 37 | 30 | 12 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 14 | 29 | 60 | 91 | 115 | 111 | 99 | 88 | 79 | 71 | 63 | 50 | 41 | 31 | 18 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 20 | 45 | 85 | 113 | 109 | 98 | 87 | 78 | 70 | 56 | 45 | 32 | 22 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 13 | 42 | 87 | 111 | 107 | 97 | 86 | 78 | 62 | 49 | 34 | 24 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 39 | 82 | 109 | 109 | 98 | 87 | 70 | 56 | 37 | 25 |

RAINFALL TYPE = III  * * * TC = 1.5 HR * * *  SHEET 9 OF 10

# Exhibit 5-III, continued: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution

HYDROGRAPH TIME (HOURS)

| TRVL TIME (HR) | 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 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 19.0 | 20.0 | 22.0 | 26.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA/P = 0.10 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.10 |
| 0.0 | 9 | 11 | 15 | 19 | 21 | 23 | 27 | 31 | 39 | 48 | 60 | 75 | 91 | 129 | 164 | 187 | 200 | 191 | 178 | 147 | 119 | 92 | 69 | 55 | 45 | 37 | 31 | 26 | 20 | 16 | 13 | 3 |
| .10 | 8 | 10 | 13 | 17 | 18 | 20 | 22 | 25 | 29 | 36 | 44 | 55 | 68 | 101 | 139 | 170 | 189 | 197 | 188 | 163 | 132 | 101 | 75 | 59 | 47 | 39 | 33 | 28 | 21 | 17 | 13 | 3 |
| .20 | 7 | 10 | 13 | 16 | 18 | 19 | 21 | 24 | 28 | 33 | 40 | 50 | 62 | 93 | 129 | 162 | 185 | 195 | 190 | 168 | 137 | 104 | 77 | 60 | 48 | 40 | 33 | 28 | 21 | 17 | 13 | 4 |
| .30 | 7 | 9 | 12 | 15 | 17 | 18 | 20 | 23 | 26 | 31 | 37 | 46 | 56 | 85 | 120 | 154 | 179 | 193 | 191 | 172 | 142 | 108 | 80 | 62 | 49 | 41 | 34 | 29 | 21 | 17 | 13 | 4 |
| .40 | 6 | 8 | 11 | 14 | 15 | 16 | 18 | 19 | 22 | 25 | 29 | 34 | 42 | 64 | 94 | 129 | 161 | 183 | 192 | 183 | 157 | 120 | 87 | 66 | 53 | 43 | 36 | 30 | 22 | 17 | 13 | 5 |
| .50 | 6 | 8 | 10 | 13 | 14 | 16 | 17 | 19 | 21 | 23 | 27 | 32 | 38 | 58 | 87 | 121 | 153 | 177 | 191 | 185 | 162 | 124 | 90 | 68 | 54 | 44 | 36 | 31 | 22 | 18 | 13 | 5 |
| .75 | 5 | 6 | 8 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 20 | 23 | 26 | 37 | 55 | 81 | 113 | 144 | 169 | 186 | 179 | 147 | 106 | 78 | 61 | 49 | 40 | 33 | 24 | 19 | 14 | 6 |
| 1.0 | 4 | 5 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 20 | 27 | 38 | 56 | 82 | 113 | 143 | 176 | 185 | 164 | 121 | 88 | 67 | 53 | 43 | 36 | 26 | 20 | 14 | 7 |
| 1.5 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 15 | 18 | 23 | 31 | 45 | 65 | 106 | 148 | 180 | 166 | 126 | 92 | 69 | 55 | 44 | 31 | 23 | 15 | 9 |
| 2.0 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 10 | 12 | 14 | 18 | 23 | 31 | 52 | 87 | 139 | 176 | 160 | 122 | 90 | 68 | 54 | 36 | 26 | 16 | 10 |
| 2.5 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 9 | 11 | 13 | 16 | 22 | 36 | 71 | 132 | 172 | 161 | 126 | 94 | 71 | 45 | 31 | 18 | 11 |
| 3.0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 14 | 19 | 35 | 78 | 136 | 168 | 156 | 123 | 92 | 54 | 36 | 20 | 11 |
| IA/P = 0.30 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.30 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 11 | 18 | 29 | 41 | 75 | 111 | 140 | 159 | 170 | 163 | 145 | 124 | 103 | 84 | 70 | 60 | 51 | 44 | 39 | 30 | 25 | 20 | 4 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 9 | 15 | 24 | 50 | 84 | 118 | 145 | 160 | 167 | 155 | 134 | 110 | 89 | 74 | 63 | 54 | 46 | 40 | 31 | 25 | 20 | 5 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 12 | 20 | 43 | 76 | 110 | 138 | 157 | 165 | 157 | 138 | 113 | 91 | 75 | 64 | 55 | 47 | 41 | 32 | 26 | 20 | 5 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 10 | 17 | 38 | 68 | 101 | 131 | 152 | 164 | 159 | 141 | 116 | 93 | 77 | 65 | 56 | 48 | 41 | 32 | 26 | 20 | 6 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 8 | 22 | 45 | 76 | 109 | 137 | 155 | 163 | 151 | 125 | 99 | 81 | 68 | 58 | 50 | 43 | 33 | 26 | 20 | 7 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 7 | 18 | 39 | 69 | 101 | 130 | 151 | 162 | 153 | 128 | 101 | 83 | 69 | 59 | 51 | 44 | 34 | 27 | 20 | 7 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 17 | 36 | 63 | 93 | 122 | 151 | 158 | 143 | 114 | 92 | 76 | 64 | 55 | 47 | 36 | 28 | 21 | 9 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 18 | 37 | 63 | 93 | 132 | 157 | 153 | 125 | 100 | 82 | 68 | 58 | 50 | 38 | 29 | 21 | 11 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 26 | 59 | 100 | 142 | 154 | 128 | 102 | 83 | 70 | 59 | 44 | 34 | 23 | 15 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 18 | 43 | 93 | 142 | 150 | 125 | 101 | 82 | 69 | 50 | 38 | 24 | 16 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 41 | 98 | 141 | 147 | 122 | 99 | 81 | 58 | 43 | 26 | 17 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 38 | 92 | 135 | 144 | 124 | 102 | 69 | 50 | 30 | 18 |
| IA/P = 0.50 | | | | | | | | | | | | | | * * * TC =2.0 HR * * * | | | | | | | | | | | | | | | | | | IA/P = 0.50 |
| 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 11 | 16 | 33 | 54 | 75 | 91 | 102 | 114 | 114 | 103 | 96 | 87 | 79 | 72 | 64 | 57 | 51 | 41 | 35 | 29 | 6 |
| .10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 14 | 29 | 49 | 70 | 87 | 99 | 106 | 113 | 104 | 97 | 88 | 80 | 72 | 65 | 58 | 52 | 42 | 35 | 29 | 6 |
| .20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 7 | 18 | 34 | 54 | 74 | 90 | 101 | 112 | 107 | 99 | 90 | 82 | 75 | 67 | 60 | 53 | 43 | 36 | 29 | 8 |
| .30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 15 | 30 | 49 | 69 | 86 | 98 | 111 | 108 | 100 | 91 | 83 | 75 | 68 | 60 | 54 | 43 | 36 | 29 | 8 |
| .40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 8 | 19 | 35 | 55 | 73 | 89 | 105 | 110 | 103 | 94 | 86 | 78 | 70 | 62 | 56 | 45 | 37 | 30 | 10 |
| .50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 16 | 31 | 50 | 69 | 85 | 102 | 109 | 104 | 95 | 86 | 78 | 71 | 63 | 56 | 45 | 37 | 30 | 11 |
| .75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 10 | 21 | 37 | 55 | 73 | 93 | 107 | 107 | 97 | 89 | 81 | 73 | 65 | 58 | 47 | 38 | 30 | 13 |
| 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 15 | 29 | 46 | 72 | 93 | 107 | 103 | 94 | 86 | 78 | 70 | 62 | 50 | 40 | 31 | 16 |
| 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 15 | 34 | 59 | 89 | 105 | 101 | 93 | 85 | 77 | 69 | 55 | 44 | 32 | 21 |
| 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 25 | 55 | 90 | 104 | 100 | 92 | 84 | 76 | 61 | 49 | 34 | 23 |
| 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 24 | 59 | 91 | 103 | 99 | 91 | 83 | 68 | 54 | 36 | 25 |
| 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 28 | 62 | 91 | 101 | 98 | 90 | 75 | 60 | 39 | 26 |

RAINFALL TYPE = III  * * * TC = 2.0 HR * * *  SHEET 10 OF 10

# Chapter 6: Storage volume for detention basins

As rural areas become urbanized, the resulting increases in peak discharges can adversely affect downstream flood plains. Increasingly, planners, developers, and the public want these downstream areas to be protected. Many local governments are adopting ordinances to control the type of development and its allowable impacts on the watershed. One of the most common controls requires that postdevelopment discharges do not exceed present-condition discharges for one or more storm frequencies at specified points along a channel.

This chapter discusses ways to manage peak discharges by delaying runoff. It also presents a procedure for estimating the storage capacity required to maintain the peaks within a specified level.

Efforts to reduce the effects of increased runoff from urban areas have been innovative and diverse. Many methods have been used effectively, such as infiltration trenches, porous pavement, rooftop storage, and cisterns. But these solutions can be expensive or require site conditions that cannot be provided.

The detention basin is the most widely used measure for controlling peak discharge. It is generally the least expensive and most reliable of the measures that have been considered. It can be designed to fit a wide variety of sites and can accommodate multiple-outlet spillways to meet requirements for multifrequency control of outflow. Measures other than a detention basin may be preferred in some locations; their omission here is not intended to discourage their use. Any device selected, however, should be assessed as to its function, maintenance needs, and impact.

## Estimating the effect of storage

When a detention basin is installed, hydraulic routing procedures can be used to estimate the effect on hydrographs. Both the TR-20 (SCS 1983) and DAMS2 (SCS 1982) computer programs provide accurate methods of analysis. Programmable calculator and computer programs are available for routing hydrographs through dams.

This chapter contains a manual method for quick estimates of the effects of temporary detention on peak discharges. The method is based on average storage and routing effects for many structures.

Figure 6-1 relates two ratios: peak outflow to peak inflow discharge ($q_o/q_i$) and storage volume to runoff volume ($V_s/V_r$) for all four rainfall distributions.

The relationships in figure 6-1 were determined on the basis of single stage outflow devices. Some were controlled by pipe flow, others by weir flow. Verification runs were made using multiple stage outflow devices, and the variance was similar to that in the base data. The method can therefore be used for both single- and multiple-stage outflow devices. The only constraints are that (1) each stage requires a design storm and a computation of the storage required for it and (2) the discharge of the upper stage(s) includes the discharge of the lower stage(s).

The brevity of the procedure allows the planner to examine many combinations of detention basins. When combined with the Tabular Hydrograph method, the procedure's usefulness is increased. Its principal use is to develop preliminary indications of storage adequacy and to allocate control to a group of detention basins. It is also adequate, however, for final design of small detention basins.

## Input requirements and procedures

Use figure 6-1 to estimate storage volume ($V_s$) required or peak outflow discharge ($q_o$). The most frequent application is to estimate $V_s$, for which the required inputs are runoff volume ($V_r$), $q_o$, and peak inflow discharge ($q_i$). To estimate $q_o$, the required inputs are $V_r$, $V_s$, and $q_i$.

### Estimating $V_s$

Use worksheet 6a to estimate $V_s$, storage volume required, by the following procedure.

1. Determine $q_o$. Many factors may dictate the selection of peak outflow discharge. The most common is to limit downstream discharges to a desired level, such as predevelopment discharge. Another factor may be that the outflow device has already been selected.
2. Estimate $q_i$ by procedures in chapters 4 or 5. Do not use peak discharges developed by any other procedure. When using the Tabular Hydrograph method to estimate $q_i$ for a subarea, only use

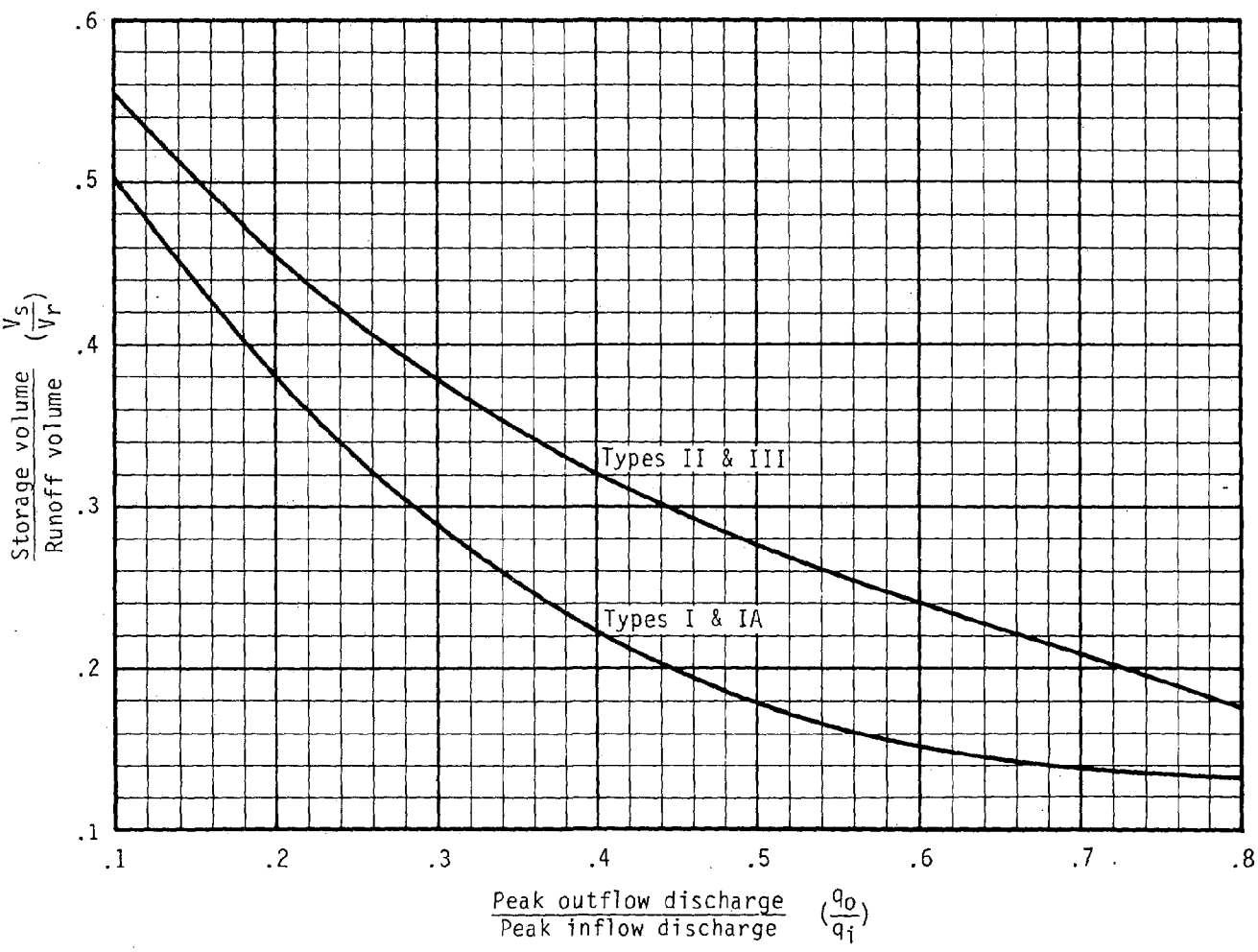



Figure 6-1.—Approximate detention basin routing for rainfall types I, IA, II, and III.

peak discharge associated with $T_t = 0$.

3. Compute $q_o/q_i$ and determine $V_s/V_r$ from figure 6-1.
4. Q (in inches) was determined when computing $q_i$ in step 2, but now it must be converted to the units in which $V_s$ is to be expressed—most likely, acre-feet or cubic feet. The most common conversion of Q to $V_r$ is expressed in acre-feet:

$$V_r = 53.33Q(A_m) \qquad \text{[Eq. 6-1]}$$

where

$V_r$ = runoff volume (acre-ft),
Q = runoff (in),
$A_m$ = drainage area ($mi_2$), and
53.33 = conversion factor from in-mi$^2$ to acre-ft.

5. Use the results of steps 3 and 4 to compute $V_s$:

$$V_s = V_r\left(\frac{V_s}{V_r}\right) \qquad \text{[Eq. 6-2]}$$

where $V_s$ = storage volume required (acre-ft).

6. The stage in the detention basin corresponding to $V_s$ must be equal to the stage used to generate $q_o$. In most situations a minor modification of the outflow device can be made. If the outflow device has been preselected, repeat the calculations with a modified $q_o$ value.

### Estimating $q_o$

Use worksheet 6b to estimate $q_o$, required peak outflow discharge, by the following procedure.

1. Determine $V_s$. If the maximum stage in the detention basin is constrained, set $V_s$ by the maximum permissible stage.
2. Compute Q (in inches) by the procedures in chapter 2, and convert it to the same units as $V_s$ (see step 4 in "Estimating $V_s$").
3. Compute $V_s/V_r$ and determine $q_o/q_i$ from figure 6-1.
4. Estimate $q_i$ by the procedures in chapters 4 or 5. Do not use peak discharges developed by any other method. When using the Tabular method to estimate $q_i$ for a subarea, use only the peak discharge associated with $T_t = 0$.
5. From steps 3 and 4, compute $q_o$:

$$q_o = q_i\left(\frac{q_o}{q_i}\right) \qquad \text{[Eq. 6-3]}$$

6. Proportion the outflow device so that the stage at $q_o$ is equal to the stage corresponding to $V_s$. If $q_o$ cannot be calibrated except in discrete steps (i.e., pipe sizes), repeat the procedure until the stages for $q_o$ and $V_s$ are approximately equal.

## Limitations

- This routing method is less accurate as the $q_o/q_i$ ratio approaches the limits shown in figure 6-1. The curves in figure 6-1 depend on the relationship between available storage, outflow device, inflow volume, and shape of the inflow hydrograph. When storage volume ($V_s$) required is small, the shape of the outflow hydrograph is sensitive to the rate of rise of the inflow hydrograph. Conversely, when $V_s$ is large, the inflow hydrograph shape has little effect on the outflow hydrograph. In such instances, the outflow hydrograph is controlled by the hydraulics of the outflow device and the procedure therefore yields consistent results. When the peak outflow discharge ($q_o$) approaches the peak inflow discharge ($q_i$), parameters that affect the rate of rise of a hydrograph, such as rainfall volume, curve number, and time of concentration, become especially significant.

- The procedure should not be used to perform final design if an error in storage of 25 percent cannot be tolerated. Figure 6-1 is biased to prevent undersizing of outflow devices, but it may significantly overestimate the required storage capacity. More detailed hydrograph development and routing will often pay for itself through reduced construction costs.

## Examples

Four examples illustrate the use of figure 6-1. Examples 6-1 through 6-4, respectively, show estimation of $V_s$, use of a two-stage structure, estimation of $q_o$, and use with the Tabular Hydrograph method.

### Example 6-1: Estimating $V_s$, single-stage structure

A development is being planned in a 75-acre (0.117-mi$^2$) watershed that outlets into an existing concrete-lined channel designed for present conditions. If the channel capacity is exceeded, damages will be substantial. The watershed is in the type II storm distribution region. The present channel capacity, 180 cfs, was established by computing discharge for the 25-year-frequency storm by the Graphical Peak Discharge method (chapter 4).

The developed-condition peak discharge ($q_i$) computed by the same method is 360 cfs, and runoff (Q) is 3.4 inches. Since outflow must be held to 180 cfs, a detention basin having that maximum outflow discharge ($q_o$) will be built at the watershed outlet.

How much storage ($V_s$) will be required to meet the maximum outflow discharge ($q_o$) of 180 cfs, and what will be the approximate dimensions of a rectangular weir outflow structure? Figure 6-2 shows how worksheet 6a is used to estimate required storage ($V_s$ = 5.9 acre-ft) and maximum stage ($E_{max}$ = 105.7 ft).

The rectangular weir was chosen for its simplicity; however, several types of outlets can meet the outflow device proportion requirement. Most hydraulic references, along with considerable research data that are available, provide more guidance on variations of outlet devices than can be summarized here.

An outlet device should be proportioned to meet specific objectives. A single-stage device was specified in this example because only one storm was considered. A weir is suitable here because of the low head. The weir crest elevation is 100.0 ft.

Using $V_s$ = 5.9 acre-ft (figure 6-2, step 9) and the elevation-storage curve, the maximum stage ($E_{max}$) is 105.7 ft.

The rectangular weir equation is

$$q_o = 3.2\ L_w H_w^{1.5} \qquad \text{[Eq. 6-}$$

where

$q_o$ = peak outflow discharge (cfs),
$L_w$ = weir crest length (ft), and
$H_w$ = head over weir crest (ft).

$H_w$ and $q_o$ are computed as follows:

$$H_w = E_{max} - \text{weir crest elevation}$$
$$= 105.7 - 100.0 = 5.7 \text{ ft.}$$

Since $q_o$ is known to be 180 cfs, solving equation 6-4 for $L_w$ yields

$$L_w = \frac{q_o}{3.2\ H_w^{1.5}} \qquad \text{[Eq. 6-}$$

$$= \frac{180}{3.2\ (5.7)^{1.5}} = 4.1 \text{ ft.}$$

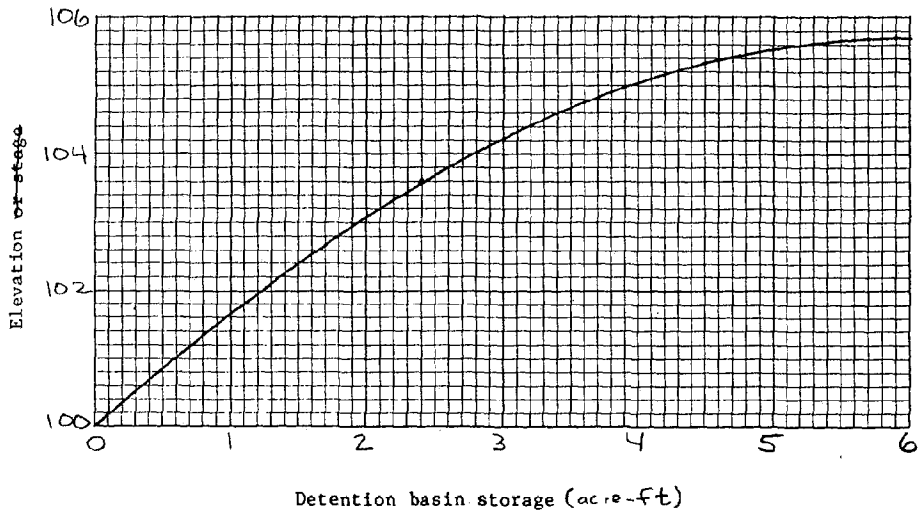
In summary, the outlet structure is a rectangular weir with crest length of 4.1 ft, $H_w$ = 5.7 ft, and $q_o$ 180 cfs corresponding to a $V_s$ = 5.9 acre-ft.

## Worksheet 6a: Detention basin storage, peak outflow discharge ($q_0$) known

Project Robbinsville By SWR Date 11/5/85

Location Dyer County, Tennessee Checked RGC Date 11/8/85

Circle one: Present (Developed) Single-stage-structure




1. Data:
   Drainage area ..... $A_m$ = 0.117 $mi^2$
   Rainfall distribution type (I, IA, II, III) = II

| | 1st stage | 2nd stage |
|---|---|---|
| 2. Frequency ..... yr | 25 | |
| 3. Peak inflow discharge, $q_i$ .... cfs (From worksheet 4 or 5b) | 360 | |
| 4. Peak outflow discharge, $q_o$ .... cfs 1/ | 180 | |
| 5. Compute $\frac{q_o}{q_i}$ ..... | 0.50 | |
| 6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1) | 0.28 | |
| 7. Runoff, Q ..... in (From worksheet 2) | 3.4 | |
| 8. Runoff volume, $V_r$ ..... ac-ft ($V_r = QA_m 53.33$) | 21.2 | |
| 9. Storage volume, $V_s$ ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$) | 5.9 | |
| 10. Maximum stage, $E_{max}$ (From plot) | 105.7 | |

1/ 2nd stage $q_o$ includes 1st stage $q_o$.

Figure 6-2.—Worksheet 6a for example 6-1.

**Example 6-2: Estimating $V_s$, two-stage structure**

In addition to the requirements for a 25-year peak outflow discharge of 180 cfs stated in example 6-1, a decision was made to limit the 2-year outflow discharge to 50 cfs because of potential damages to agricultural property below the lined channel. By the method in chapter 4, the estimated 2-year peak discharge for developed conditions will be 91 cfs and runoff (Q) will be 1.5 inches.

Again, a rectangular concrete weir outflow device was selected; the device could have been another type, but it is important to remember that the flows through the first stage are part of the total discharge of the higher stage.

Figure 6-3 shows how worksheet 6a is used to compute the $V_s$ of 2.4 acre-ft and $E_{max}$ of 103.6 for the first stage. $E_{max}$ of 103.6 is the weir crest elevation for the second stage.

Equation 6-5 is again used to compute $L_w$ for the first stage. The weir crest elevation for the first stage is 100.00 ft and $q_o$ = 50 cfs. The first-stage computations for $H_w$ and $L_w$ are

$$H_w = E_{max} - \text{weir crest elevation}$$
$$= 103.6 - 100.0 = 3.6 \text{ ft};$$

and, from equation 6-5,

$$L_w = \frac{50}{3.2(3.6)^{1.5}} = 2.3 \text{ ft.}$$

The second stage is then proportioned to discharge the correct amount at 105.7 ft (figure 6-2, step 10). Compute the discharge through the first stage for elevation 105.7 ft using

$$L_w = 2.3 \text{ ft (first stage)}$$

and

$$H_w = 105.7 - 100.0 = 5.7 \text{ ft.}$$

By substituting these values in equation 6-4, discharge ($q_o$) through the first stage at 105.7 ft is calculated:

$$q_o = 3.2(2.3)(5.7)^{1.5} = 100 \text{ cfs.}$$

Now compute the required weir crest length ($L_w$) the second stage, using equation 6-5. Since the second stage crest elevation is 103.6 ft,

$$H_w = 105.7 - 103.6 = 2.1 \text{ ft};$$

and, since $q_o$ for the second stage equals the total discharge from example 6-1 minus discharge throug the first stage,

$$q_o = 180 - 100 = 80 \text{ cfs.}$$

Finally, substituting these $H_w$ and $q_o$ values in equation 6-5 results in

$$L_w = \frac{80}{3.2(2.1)^{1.5}} = 8.2 \text{ ft.}$$

In summary, the outlet structure is a 2-stage rectangular weir with first stage crest length of 2.3 ft at elevation 100.0, and second stage crest length 8.2 ft at elevation 103.6 ft.

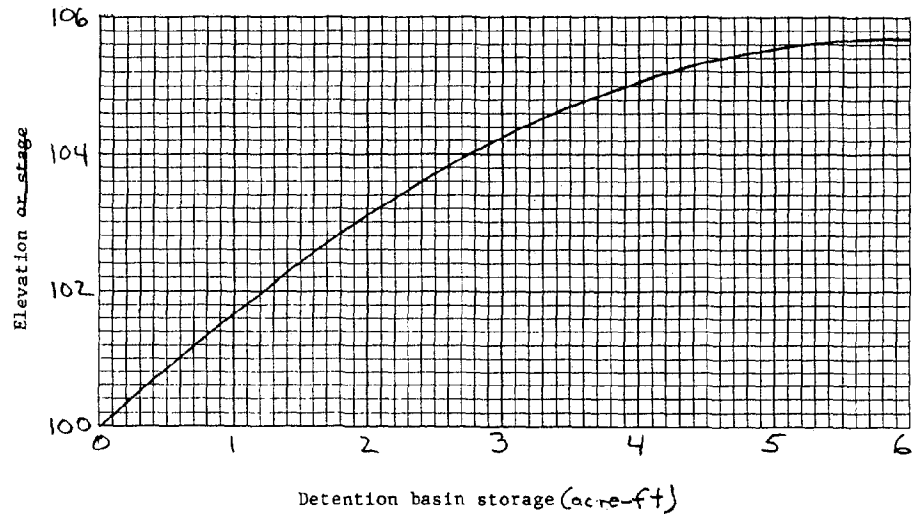
The weir equation used is probably less accurate fo the two-stage example than for the single-stage example. The actual second-stage discharge will be slightly more than the one computed, but a discussion of hydraulics of outflow devices is outside the scope of this technical release. Example 6-2 is presented only to illustrate the interrelationship of outflow discharges and storage volume and to show how to develop preliminary estimates of storage requirements for two-stage outlet structures.

## Worksheet 6a: Detention basin storage, peak outflow discharge ($q_o$) known

Project Robbinsville By SWR Date 11/6/85

Location Dyer County, Tennessee Checked RGC Date 11/9/85

Circle one: Present (Developed) 2- stage structure




1. Data:
   Drainage area ..... $A_m$ = 0.117 $mi^2$
   Rainfall distribution type (I, IA, II, III) = II

| | 1st stage | 2nd stage |
|---|---|---|
| 2. Frequency ..... yr | 2 | 25 |
| 3. Peak inflow discharge, $q_i$ .... cfs (From worksheet 4 or 5b) | 91 | 360 |
| 4. Peak outflow discharge, $q_o$ .... cfs 1/ | 50 | 180 |
| 5. Compute $\frac{q_o}{q_i}$ ..... | 0.55 | 0.50 |
| 6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1) | 0.26 | 0.28 |
| 7. Runoff, Q ..... in (From worksheet 2) | 1.5 | 3.4 |
| 8. Runoff volume, $V_r$ ..... ac-ft ($V_r = QA_m 53.33$) | 9.4 | 21.2 |
| 9. Storage volume, $V_s$ ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$) | 2.4 | 5.9 |
| 10. Maximum stage, $E_{max}$ (From plot) | 103.6 | 105.7 |

1/ 2nd stage $q_o$ includes 1st stage $q_o$.

Figure 6-3.—Worksheet 6a for example 6-2.

**Example 6-3: Estimating $q_o$**

A development is being planned for a 10-acre watershed (0.0156 $mi^2$). A county ordinance requires that the developed-condition outflow from the watershed for a 24-hr, 100-year frequency storm does not exceed the outflow for present conditions. The peak discharge from the watershed for present conditions, 35 cfs, is calculated from procedures in chapter 4. For developed conditions, runoff (Q) is 5.4 inches, peak discharge from the watershed is 42 cfs from procedures in chapter 4, and rainfall distribution is type II.

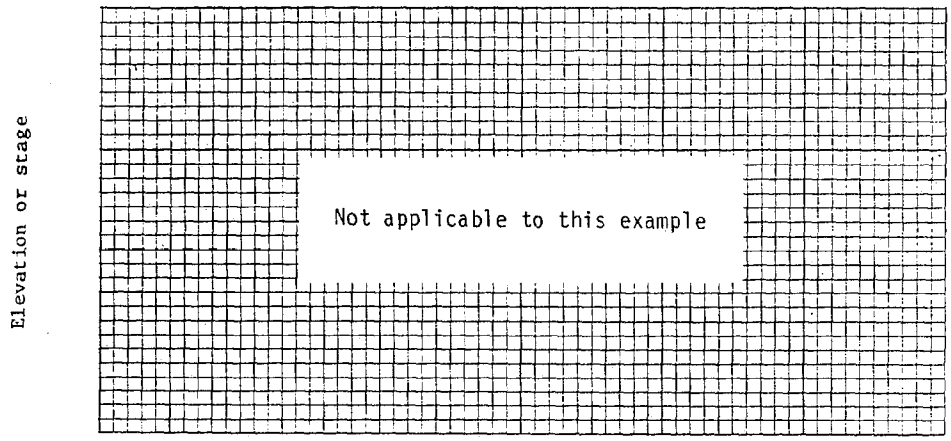
What will be the peak outflow discharge ($q_o$) from a detention basin that is located at the outlet and has maximum allowable storage volume ($V_s$) of 35,000 $ft^3$ and peak inflow discharge ($q_i$) of 42 cfs? Figure 6-4 shows how worksheet 6b is used to estimate $q_o$ as 33 cfs, which is within the 35-cfs limit. An outflow device will be selected to discharge 33 cfs at a stage corresponding to a $V_s$ of 35,000 $ft^3$.

## Worksheet 6b: Detention basin peak outflow, storage volume ($V_s$) known

Project Woods Acres By SWR Date 11/8/85

Location Dyer County, Tennessee Checked RGC Date 11/11/85

Circle one: Present (Developed)




Detention basin storage

1. Data:
   Drainage area ..... $A_m$ = 0.0156 $mi^2$
   Rainfall distribution type (I, IA, II, III) = II

| | 1st stage | 2nd stage |
|---|---|---|
| 2. Frequency ..... yr | 100 | |
| 3. Storage volume, $V_s$ ..... ac ft | 0.8 | |
| 4. Runoff, Q ..... in (From worksheet 2) | 5.4 | |
| 5. Runoff volume, $V_r$ ..... ac-ft ($V_r = QA_m 53.33$) | 4.5 | |
| 6. Compute $\frac{V_s}{V_r}$ ..... | 0.18 | |
| 7. $\frac{q_o}{q_i}$ ..... in (Use $\frac{V_s}{V_r}$ and figure 6-1) | 0.78 | |
| 8. Peak inflow discharge, $q_i$ .... cfs (From worksheet 4 or 5b) | 42 | |
| 9. Peak outflow discharge, $q_o$ .... cfs ($q_o = q_i(\frac{q_o}{q_i})$) 1/ | 33 | |
| 10. Maximum stage, $E_{max}$ (From plot) | N/A | |

1/ 2nd stage $q_o$ includes 1st stage $q_o$.

Figure 6-4.—Worksheet 6b for example 6-3.

**Example 6-4: Estimating $V_s$, Tabular Hydrograph method**

This example builds on examples 5-1 and 5-2 (pages 5-4 to 5-8). If peak outflow discharge from subarea 7 must not exceed the discharge for present conditions, what will be the storage volume ($V_s$) required in a detention basin at the outlet of subarea 6?

First, compute the outflow hydrograph without subarea 6 as shown in the table below, which presents developed-condition discharges for example 5-2. (The information in the table is from figure 5-4.)

| | Discharge (cfs) at time (hr)— | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Subarea | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.3 | 14.6 | 15.0 |
| | cfs | | | | | | | | |
| 1 | 7 | 9 | 11 | 16 | 24 | 40 | 78 | 122 | 155 |
| 2 | 7 | 9 | 12 | 20 | 33 | 55 | 96 | 132 | 132 |
| 3 | 14 | 29 | 58 | 89 | 106 | 102 | 74 | 46 | 25 |
| 4 | 19 | 32 | 63 | 114 | 169 | 207 | 193 | 143 | 83 |
| 5 | 117 | 167 | 205 | 214 | 202 | 175 | 132 | 99 | 70 |
| 6 omitted | — | — | — | — | — | — | — | — | — |
| 7 | 244 | 167 | 119 | 90 | 72 | 59 | 48 | 40 | 34 |
| Total without subarea 6 | 408 | 413 | 468 | 543 | 606 | 638 | 621 | 582 | 499 |

After computing the outflow hydrograph, determine the maximum permissible outflow discharge from subarea 6. The present condition peak discharge at the outlet of subarea 7 is 720 cfs at 14.3 hr (figure 5-2), and the developed condition peak discharge at the outlet of subarea 7 minus subarea 6 is 638 cfs (table above). The difference between these two discharges, 82 cfs, is the maximum outflow discharge ($q_o$) for the detention basin.

Next, determine the peak discharge for subarea 6 for developed conditions by substituting values in equation 5-1:

$$q = q_t A_m Q. \qquad \text{[Eq. 5-1]}$$

From exhibit 5-II, the largest $q_t$ value is 357 csm/in (exhibit 5-II, sheet 7: $T_c$ = 1.0 hr, $T_t$ = 0, and $I_a/P$ = 0.10 at 12.8 hr). From figure 5-4, $A_mQ$ for subarea 6 is 1.31. Therefore,

$$q = (357)(1.31) = 468 \text{ cfs.}$$

This q value is, of course, the same as the peak inflow discharge ($q_i$) into the detention basin.

Finally, use worksheet 6a (figure 6-5) to compute $V_s$ as 33.2 acre-ft.

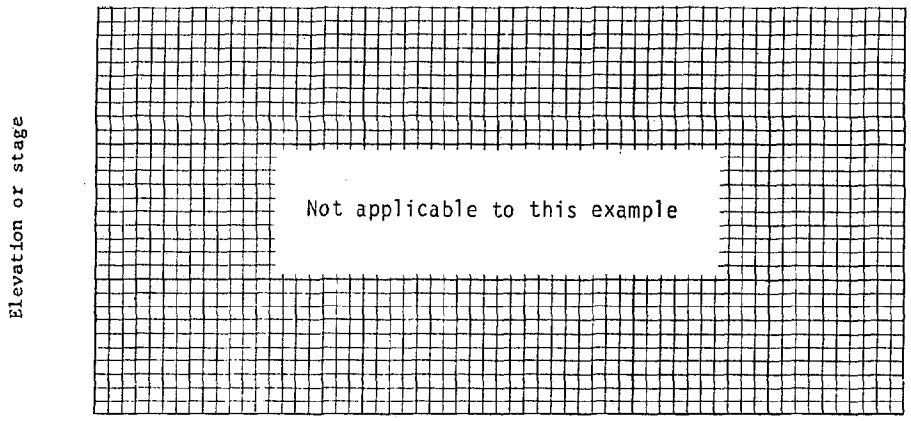
The required storage volume of 33.2 acre-ft is the basis for determining the required stage in the detention basin. This stage is a guide in proportioning a spillway that will discharge 82 cfs or less at that storage. The timing or routing effect is not considered because the outflow hydrograph will discharge at near $q_o$ for a significant period.

## Worksheet 6a: Detention basin storage, peak outflow discharge ($q_o$) known

Project Fallswood By SWR Date 10/8/85

Location Dyer County, Tennessee Checked RGC Date 10/10/85

Circle one: Present Developed




1. Data:
   Drainage area ..... $A_m$ = 0.40 $mi^2$
   Rainfall distribution type (I, IA, II, III) = II

| | 1st stage | 2nd stage |
|---|---|---|
| 2. Frequency ..... yr | 25 | |
| 3. Peak inflow discharge, $q_i$ .... cfs (From worksheet 4 or 5b) | 468 | |
| 4. Peak outflow discharge, $q_o$ .... cfs 1/ | 82 | |
| 5. Compute $\frac{q_o}{q_i}$ ..... | 0.175 | |
| 6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1) | 0.475 | |
| 7. Runoff, Q ..... in (From worksheet 2) | 3.28 | |
| 8. Runoff volume, $V_r$ ..... ac-ft ($V_r = QA_m 53.33$) | 69.9 | |
| 9. Storage volume, $V_s$ ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$) | 33.2 | |
| 10. Maximum stage, $E_{max}$ (From plot) | N/A | |

1/ 2nd stage $q_o$ includes 1st stage $q_o$.

Figure 6-5.—Worksheet 6a for example 6-4.

# Appendix A: Hydrologic soil groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate—the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist 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. These soils have a very low rate of water transmission (0-0.05 in/hr).

In exhibit A-1, some of the listed soils have an added modifier; for example, "Abrazo, gravelly." This refers to a gravelly phase of the Abrazo series that is found in SCS soil map legends.

## Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred (Brakensiek and Rawls 1983):

| *HSG* | *Soil textures* |
|---|---|
| A | Sand, loamy sand, or sandy loam |
| B | Silt loam or loam |
| C | Sandy clay loam |
| D | Clay loam, silty clay loam, sandy clay, silty clay, or clay |

## Drainage and group D soils

Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D.

# Exhibit A-1: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AABAB | D | ADAVEN | C | AHREN | B | ALDING | D | ALSEA | B |
| AABERG | D | ADDICKS | D | AHRNKLIN | C | ALDINO | C | ALSPAUGH | C |
| AARON | C | ADDIELOU | B | AHRS | B | ALEDO | C | ALSTAD | C |
| AASTAD | B | ADE | A | AHTANUM | D | ALEGROS | C | ALSTONY | B |
| AAZDAHL | B | ADEK | B | AHTANUM, DRAINED | C | ALEKNAGIK | C | ALSUP | C |
| ABAC | D | ADEL | B | AHWAHNEE | B | ALEMEDA | C | ALTAMONT | D |
| ABAJO | C | ADEL, WET | D | AIBONITO | C | ALEX | B | ALTAPEAK | B |
| ABALOBADIAH | B | ADELAIDE | D | AIDO | D | ALEXANDER | C | ALTAR | B |
| ABARCA | B | ADELANTO | B | AIKEN | B | ALEXANDRIA | C | ALTAVISTA | C |
| ABBAYE | B | ADELINO | B | AIKMAN | D | ALFIR | B | ALTDORF | D |
| ABBIE | B | ADELINO, | C | AIKMAN, STONY | C | ALFLACK | C | ALTHOUSE | B |
| ABBOTT | D | SALINE-ALKALI | | AILEY | B | ALFORD | B | ALTICREST | B |
| ABBOTTSTOWN | C | ADELPHIA | B/C | AIMELIIK | B | ALGANSEE | B | ALTITA | C |
| ABCAL | D | ADEN | C | AINAKEA | B | ALGARROBO | A | ALTMAR | B |
| ABEGG | B | ADENA | C | AINSLEY | B | ALGERITA | B | ALTO | C |
| ABELA | B | ADGER | D | AINSWORTH | E | ALGIERS | C/D | ALTOGA | C |
| ABELL | B | ADIEUX | B | AIRMONT | C | ALGOA | C | ALTON | A |
| ABERDEEN | C | ADILIS | B | AIRPORT | D | ALGOMA | B/D | ALTOONA | C |
| ABERONE | B | ADIN | D | AITS | B | ALHAMBRA | B | ALTUDA | D |
| ABERSITO | C | ADIOS | D | AJO | C | ALHARK | B | ALTURAS | C |
| ABERT | B | ADJUNTAS | C | AJOLITO | D | ALICE | B | ALTUS | B |
| ABES | D | ADKINS | B | AKAD | C | ALICEL | B | ALTVAN | B |
| ABGESE | B | ADKINS, ALKALI | C | AKAKA | A | ALICIA | B | ALUF | A |
| ABILENE | C | ADKINS, WET | C | AKAN | B/D | ALIDA | B | ALUM | B |
| ABIQUA | B | ADLER | C | AKASKA | B | ALIKCHI | B | ALUSA | D |
| ABIQUA, FLOODED | C | ADMAN | D | AKELA | D | ALINE | A | ALVARADO | B |
| ABITA | C | ADOBE | C | AKERCAN | B | ALKIRIDGE | C | ALVIN | B |
| ABO | C | ADOLPH | B/D | AKERUE | D | ALKO | D | ALVIRA | C |
| ABOR | D | ADOS | C | AKINA | B | ALLAGASH | B | ALVISO | D |
| ABORIGINE | D | ADRIAN | A/D | AKLEF | D | ALLAMORE | D | ALVODEST | D |
| ABOTEN | D | ADVOKAY | D | ALADDIN | B | ALLANTON | B/D | ALVOR | D |
| ABRA | B | AECET | C | ALADSHI | B | ALLANTON, | D | ALVOR, DRAINED | C |
| ABRAHAM | B | AENEAS | B | ALAE | A | DEPRESSIONAL | | ALVOR, PROTECTED | C |
| ABRAZO | D | AFFEY | C | ALAELOA | B | ALLARD | B | ALWILDA | B |
| ABRAZO, GRAVELLY | C | AFLEY | B | ALAGA | A | ALLDOWN | B | ALYAN | C |
| ABREU | B | AFTADEN | D | ALAKAI | C | ALLEGHENY | B | ALZADA | D |
| ABRIGO | B | AFTON | C/D | ALAMA | B | ALLEMANDS | D | ALZOLA | C |
| ABSAROKEE | C | AGA | B | ALAMADITAS | C | ALLEN | B | AMADOR | D |
| ABSCOTA | A | AGAIPAH | D | ALAMANCE | B | ALLENDALE | B | AMAGON | D |
| ABSHER | D | AGAN | D | ALAMBIQUE | B | ALLENDORF | B | AMALIA | B |
| ABSTED | C | AGAR | B | ALAMO | D | ALLENS PARK | B | AMALU | D |
| ABSTED, FLOODED | D | AGASSIZ | D | ALAMOGORDO | B | ALLENS PARK, STONY | C | AMANA | B |
| ABSTON | C | AGATE | D | ALAMOSA | D | ALLENTINE | D | AMANDA | C |
| ACACIO | B | AGATHA | B | ALAMOSA, DRAINED | B | ALLENWOOD | B | AMARILLO | B |
| ACADEMY | C | AGAWAM | B | ALAMUCHEE | B | ALLEY | B | AMASA | B |
| ACADIA | D | AGENCY | C | ALANGS | B | ALLHANDS | D | AMASA, MODERATELY | C |
| ACANA | D | AGER | D | ALAPAHA | D | ALLIANCE | B | WET, SANDY | |
| ACANOD | C | AGFAYAN | D | ALAPAI | A | ALLIGATOR | D | SUBSTRATUM | |
| ACASCO | D | AGNAL | D | ALAZAN | B | ALLIS | D | AMBER | B |
| ACCELERATOR | B | AGNESTON | B | ALBAN | B | ALLISON | B | AMBIA | D |
| ACEITUNAS | B | AGNESTON, COBBLY | C | ALBANO | D | ALLKER | B | AMBOAT | C |
| ACEL | C | SUBSTRATUM | | ALBANY | C | ALLOR | B | AMBOY | C |
| ACHIMIN | C | AGNESTON, COBBLY | C | ALBATON | D | ALLOUEZ | B | AMBRANT | B |
| ACKER | B | AGNESTON, | C | ALBEE | C | ALMAC | B | AMBRAW | B/D |
| ACKERMAN | A/D | NONGRAVELLY | | ALBEMARLE | B | ALMANOR | B | AMELIA | C |
| ACKERVILLE | C | AGNEW | C | ALBERTON | B | ALMAVILLE | D | AMENE | D |
| ACKETT | D | AGNOS | D | ALBERTVILLE | C | ALMENA | C | AMENIA | B |
| ACKLEY | B | AGON | C | ALBINAS | B | ALMERIA | D | AMENSON | D |
| ACKMEN | B | AGORT | C | ALBION | B | ALMIRANTE | B | AMERICANOS | B |
| ACKMORE | B | AGRA | D | ALBRIGHTS | C | ALMO | D | AMERICUS | A |
| ACKWATER | D | AGUA | B | ALBURZ | C | ALMONT | D | AMERY | B |
| ACME | C | AGUA DULCE | B | ALBURZ, DRAINED | B | ALMOTA | C | AMES | C/D |
| ACO | B | AGUA FRIA | C | ALBUS | B | ALMY | B | AMESHA | B |
| ACOMA | C | AGUA FRIA, HIGH | B | ALCAN | D | ALNITE | D | AMESMONT | C |
| ACORD | C | RAINFALL | | ALCESTER | B | ALO | D | AMHERST | D |
| ACOVE | C | AGUA FRIA, STONY | B | ALCOA | B | ALOHA | C | AMISTAD | D |
| ACREDALE | D | AGUADILLA | A | ALCONA | B | ALOMAX | D | AMITY | D |
| ACREE | C | AGUALT | B | ALCOT | A | ALONA | B | AMMON | B |
| ACRELANE | C | AGUEDA | B | ALCOVA | B | ALONSO | B | AMODAC | C |
| ACTON | B | AGUILARES | B | ALDA | C | ALOVAR | C | AMOLE | A |
| ACUFF | B | AGUILITA | B | ALDA, SALINE | B/D | ALPENA | A | AMOR | B |
| ACUNA | C | AGUIRRE | D | ALDAX | D | ALPHA | B | AMORUS | D |
| ACY | C | AGUSTIN | B | ALDEN | D | ALPIN | A | AMOS | C |
| ADA | C | AHART | C | ALDER | C | ALPON | B | AMOSTOWN | C |
| ADAIR | C | AHL | C | ALDERDALE | C | ALPOWA | B | AMPAD | C |
| ADAMS | A | AHLSTROM | D | ALDERMAND | B | ALRED | B | AMPHION | C |
| ADAMSON | B | AHMEEK | C | ALDERWOOD | C | ALROS | C | AMSDEN | B |
| ADAMSVILLE | C | AHOLT | D | ALDI | D | ALS | A | AMSTERDAM | B |
| ADATON | D | AHPAH | B | ALDINE | D | ALSCO | B | AMTOFT | D |

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AMWELL | C | ANSELMO, BEDROCK | A | ARCH | B | ARMYDRAIN | C | ASSUMPTION | B |
| AMY | D | SUBSTRATUM | | ARCHABAL | B | ARNEGARD | B | ASTA | B |
| ANACAPA | B | ANSGAR | B/D | ARCHBOLD | A | ARNESS | D | ASTATULA | A |
| ANACOCO | D | ANSPING | B | ARCHER | C | ARNHEIM | D | ASTOR | B/D |
| ANACONDA | B | ANT FLAT | C | ARCHERDALE | C | ARNO | D | ASTOR, FLOODED | D |
| ANAHEIM | C | ANTEL | B | ARCHES | D | ARNOLD | A | ASTORIA | B |
| ANAHUAC | D | ANTELOPE SPRINGS | C | ARCHIN | D | ARNOT | C/D | ATARQUE | D |
| ANAMITE | D | ANTERO | D | ARCHIN, COOL | C | ARNTZ | C | ATASCO | C |
| ANAPRA | B | ANTHO | B | ARCHULETA | D | AROL | D | ATASCOSA | D |
| ANASAZI | C | ANTHOLOP | D | ARCIA | C | AROSA | C | ATATE | B |
| ANATONE | D | ANTHONY | B | ARCLAY | D | ARP | C | ATCHEE | D |
| ANAUD | D | ANTIGO | B | ARCO | C | ARRADA | D | ATCO | B |
| ANAVERDE | B | ANTILON | C | ARCO, DRAINED | B | ARRASTRE | B | ATENCIO | B |
| ANAWALT | D | ANTIOCH | D | ARCOLA | C | ARREDONDO | A | ATEPIC | D |
| ANCHO | B | ANTLER | C | ARD | C | ARRIBA | C | ATHELWOLD | B |
| ANCHO, SALINE | C | ANTOINE | B | ARDENMONT | B | ARRINGTON | B | ATHENA | B |
| ANCHOR POINT | D | ANTONITO | C | ARDENVOIR | B | ARRIOLA | D | ATHERTON | B/D |
| ANCHORAGE | A | ANTOSA | D | ARDEP | B | ARRITOLA | D | ATHOL | B |
| ANCLOTE | B/D | ANTROBUS | B | ARDEP, WET | C | ARROLIME | C | ATKINS | D |
| ANCLOTE, | D | ANTWERP | C | ARDILLA | C | ARRON | D | ATKINSON | B |
| DEPRESSIONAL | | ANTY | B | ARDIVEY | B | ARROWHEAD | C | ATLAS | D |
| ANCLOTE, | D | ANUNDE | B | ARDNAS | B | ARROYADA | D | ATLEE | C |
| FREQUENTLY | | ANVIK | B | ARDTOO | B | ARROYO SECO | B | ATLOW | D |
| FLOODED | | ANWAY | B | ARECIBO | A | ARSITE | D | ATMORE | B/D |
| ANCO | C | AOWA | B | AREDALE | B | ARTA | C | ATOKA | C |
| ANDERGEORGE | B | APACHE | D | ARENA | D | ARTESIA | D | ATOMIC | B |
| ANDERLY | C | APAKUIE | A | ARENA, DRAINED | C | ARTESIAN | D | ATRAC | B |
| ANDERS | C | APALACHEE | D | ARENALES | A | ARTNOC | B | ATRAVESADA | D |
| ANDERSON | B | APALO | B | ARENDTSVILLE | B | ARTOIS | C | ATRING | B |
| ANDOK | B | APAREJO | B | ARENOSA | A | ARUJO | B | ATRYPA | D |
| ANDOVER | D | APELDORN | D | ARENZVILLE | B | ARUNDEL | C | ATSION | C/D |
| ANDRADA | D | APEX | B | ARGALT | D | ARVA | D | ATSION, TIDE | D |
| ANDREESON | C | APISHAPA | D | ARGENT | D | ARVADA | D | FLOODED | |
| ANDREGG | B | APISON | B | ARGENTA | C | ARVANA | C | ATTELLA | D |
| ANDRES | B | APMAT | B | ARGONAUT | D | ARVESON | B/D | ATTER | A |
| ANDREWS | C | APMAY | D | ARGORA | B | ARVILLA | A | ATTERBERRY | B |
| ANDRUSIA | A | APOLLO | B | ARGYLE | B | ARVIN | B | ATTEWAN | B |
| ANDRY | D | APOPKA | A | ARIEL | C | ARZO | D | ATTEWAN, WET | D |
| ANDYS | B | APPANOOSE | D | ARIKARA | B | ASA | B | ATTICA | B |
| ANED | D | APPERSON | C | ARIMO | B | ASABEAN | B | ATTOYAC | B |
| ANELA | B | APPIAN | B | ARIPEKA | C | ASBILL | D | ATWATER | B |
| ANETH | B | APPIAN, | C | ARIPINE | A | ASCALON | B | ATWELL | D |
| ANETH, DRY | A | SALINE-ALKALI | | ARIS | D | ASCAR | C | ATWOOD | B |
| ANGELICA | B/D | APPIAN, WET | C | ARISPE | C | ASCHOFF | B | AU GRES | B |
| ANGELINA | D | APPIAN, RECLAIMED | C | ARIZO | A | ASH SPRINGS | C | AUA | B |
| ANGELO | C | APPLEBUSH | B | ARKABUTLA | C | ASHART | D | AUBARQUE | D |
| ANGELUS | B | APPLEDELLIA | C | ARKANA | C | ASHBON | D | AUBBEENAUBBEE | B |
| ANGIE | D | APPLEGATE | C | ARKAQUA | C | ASHCROFT | B | AUBERRY | B |
| ANGLE | A | APPLETON | C | ARKONA | B | ASHDALE | B | AUBREY | C |
| ANGLEN | C | APPLING | B | ARKPORT | B | ASHDOWN | B | AUBURN | D |
| ANGOLA | C | APRON | B | ARKSON | B | ASHE | B | AUBURNDALE | B/D |
| ANGORA | B | APT | B | ARKTON | C | ASHER | C | AUFCO | D |
| ANGOSTURA | B | APTAKISIC | B | ARLAND | B | ASHFORD | D | AUGGIE | B |
| ANHALT | D | APTOS | C | ARLE | C | ASHFORK | D | AUGSBURG | B/D |
| ANIAK | D | AQUILLA | A | ARLINGTON | C | ASHGROVE | D | AUGUSTA | C |
| ANIMAS | C | AQUINAS | C | ARLINGTON, THICK | B | ASHHURST | C | AUGUSTINE | B |
| ANINTO | D | ARABRAB | D | SOLUM | | ASHIPPUN | C | AULD | D |
| ANITA | D | ARADA | B | ARLO | B | ASHKUM | B/D | AURA | B |
| ANKENY | B | ARAGON | C | ARLOYAL | A | ASHLAR | B | AURELIE | D |
| ANKLAM | D | ARAMBURU | C | ARMAGH | D | ASHLEY | B | AURELIUS | B/D |
| ANKONA | D | ARANSAS | D | ARMCO | C | ASHLO | B | AURORA | C |
| ANNABELLA | B | ARAPAHOE | B/D | ARMELLS | B | ASHMED | B | AUSMUS | D |
| ANNANDALE | C | ARAPIEN | C | ARMENDARIS | C | ASHMUN | D | AUSTIN | C |
| ANNAW | B | ARARAT | B | ARMENIA | D | ASHOLLER | D | AUSTINVILLE | B |
| ANNEMAINE | C | ARAT | D | ARMESA | B | ASHPORT | B | AUSTWELL | D |
| ANNIS | C | ARAVAIPA | C | ARMESPAN | B | ASHTON | B | AUT | C |
| ANNIS, SALINE | B | ARAVE | D | ARMIESBURG | B | ASHUE | B | AUTOMBA | B |
| ANNIS, DRAINED | B | ARAVETON | B | ARMIJO | D | ASHUELOT | D | AUTRYVILLE | A |
| ANNISQUAM | C | ARBELA | C | ARMINGTON | D | ASHWOOD | C | AUXVASSE | D |
| ANNISTON | B | ARBIDGE | C | ARMISTEAD | C | ASKEW | C | AUZOUI | B |
| ANNONA | D | ARBOLES | C | ARMITAGE | C | ASOLT | D | AVA | C |
| ANOCON | C | ARBONE | B | ARMO | B | ASOTIN | C | AVALON | B |
| ANOKA | B | ARBOR | B | ARMOINE | D | ASPARAS | B | AVANT | B |
| ANONES | C | ARBUCKLE | B | ARMONA | C | ASPEN | B | AVAR | D |
| ANOWELL | D | ARBUCKLE, WET | C | ARMOUR | B | ASPERMONT | B | AVAWATZ | A |
| ANSARI | D | ARBURUA | C | ARMPUP | C | ASPERSON | C | AVENAL | B |
| ANSEL | B | ARBUS | B | ARMSTER | C | ASSATEAGUE | A | AVILLA | B |
| ANSELMO | B | ARCATA | B | ARMSTRONG | C | ASSININS | B | AVIS | A |
| | | ARCETTE | B | ARMUCHEE | C | ASSINNIBOINE | B | AVOCA | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AVON | C | BALDFIELD | C | BARDLEY | C | BATESON | B | BEAVERTON | B |
| AVONBURG | D | BALDHILL | B | BARELA | C | BATESVILLE | C | BECKER | B |
| AVONDA | B | BALDMOUNTAIN | B | BARFIELD | D | BATH | C | BECKET | C |
| AVONDALE | B | BALDOCK | D | BARFUSS | B | BATTERSON | D | BECKLEY | B |
| AVONVILLE | B | BALDOCK, GRAVELLY | C | BARGE | C | BATTLE CREEK | C | BECKMAN | D |
| AVTABLE | D | SUBSTRATUM, | | BARGER | C | BATTLEMENT | B | BECKS | C |
| AWBRIG | D | DRAINED | | BARIO | B | BATZA | D | BECKTON | D |
| AXIS | D | BALDOCK, SALINE | C | BARISHMAN | C | BAUDETTE | B | BECKTON, WELL | C |
| AXTELL | D | BALDOCK, SALINE | C | BARKCAMP | B | BAUER | C | DRAINED | |
| AYAR | D | BALDOCK, DRAINED | C | BARKELEW | B | BAUMAN | C | BECKVILLE | B |
| AYCOCK | B | BALDWIN | D | BARKERVILLE | C | BAUMGARD | B | BECKWITH | D |
| AYDELOTTE | D | BALDY | B | BARKLEY | C | BAUSCHER | B | BECKWOURTH | C |
| AYERSVILLE | B | BALE | B | BARKOF | D | BAUX | B | BECRAFT | B |
| AYLMER | A | BALE, WET | D | BARLEYFIELD | B | BAUXSON | B | BECREEK | B |
| AYNOR | B/D | BALLAHACK | D | BARLING | C | BAXENDALE | B | BEDELL | B |
| AYON | B | BALLARD | B | BARLOW | B | BAXTER | B | BEDEN | D |
| AYOUB | C | BALLER | D | BARNABE | D | BAXTERVILLE | B | BEDFORD | C |
| AYR | B | BALLINGER | D | BARNARD | C | BAYAMON | B | BEDINGTON | B |
| AYRES | D | BALLTOWN | D | BARNELLCREEK | B | BAYARD | B | BEDKE | B |
| AYRSHIRE | C | BALLVAR | B | BARNES | B | BAYBORO | D | BEDNER | C |
| AYSEES | B | BALLY | C | BARNESTON | B | BAYERTON | C | BEDSTEAD | C |
| AZAAR | C | BALM | D | BARNESTON, | A | BAYFIELD | C | BEDWYR | D |
| AZELTINE | B | BALMAN | B | NONGRAVELLY | | BAYFIELD, WET | D | BEE | B |
| AZTALAN | C | BALMAN, SALINE, | C | BARNEY | D | BAYHORSE | D | BEEBE | A |
| AZTEC | B | FLOODED | | BARNHARDT | B | BAYLIS | B | BEECHER | C |
| AZTEC, HIGH | C | BALMLAKE | B | BARNHOT | D | BAYMEADE | A | BEECHGROVE | B |
| RAINFALL | | BALMORHEA | C | BARNSDALL | B | BAYOU | D | BEECHWOOD | C |
| AZULE | C | BALON | B | BARNSTABLE | B | BAYOUDAN | D | BEEK | C |
| AZWELL | C | BALSORA | B | BARNUM | B | BAYSHORE | D | BEEKMAN | C |
| BAAHISH | B | BALTIC | D | BARODA | D | BAYSHORE, | B | BEELEM | D |
| BABB | B | BALTIMORE | B | BAROID | A | MODERATELY WET | | BEELINE | D |
| BABBINGTON | B | BAMA | B | BAROID, WET | D | BAYSIDE | D | BEEMONT | C |
| BABELTHUAP | B | BAMAC | A | BARRADA | D | BAYTOWN | B | BEENOM | D |
| BACA | B | BAMBER | B | BARRE | D | BAYUCOS | D | BEESKOVE | B |
| BACA, FLOODED | C | BAMOS | C | BARRETT | D | BAYVI | D | BEETVILLE | B |
| BACH | B/D | BAMTUSH | B | BARRIER | D | BAYVIEW | D | BEEZEE | B |
| BACHELOR | B | BANADERU | D | BARRINGTON | B | BAYWOOD | A | BEFAR | D |
| BACHO | D | BANAT | B | BARRON | B | BAZETTE | C | BEGAY | B |
| BACHUS | C | BANBURY | D | BARRONETT | B/D | BAZILE | B | BEHANIN | B |
| BACKBAY | D | BANCAS | C | BARRY | B/D | BEACH | D | BEHEMOTOSH | C |
| BACKBONE | B | BANCKER | D | BARSAC | C | BEAD | C | BEHRING | D |
| BACLIFF | D | BANCROFT | B | BARSHAAD | D | BEADLE | C | BEIGLE | B |
| BACOBI | C | BANCY | D | BART | B | BEALAND | B | BEIRMAN | D |
| BACONA | B | BANDAG | B | BARTINE | C | BEALES | B | BEISIGL | A |
| BADAXE | B | BANDERA | B | BARTLE | D | BEAM | D | BEJE | D |
| BADENA | B | BANDID | B | BARTLEY | C | BEAMTON | C | BEJUCOS | B |
| BADENAUGH | B | BANDON | C | BARTO | D | BEANBLOSSOM | B | BELAIN | C |
| BADGE | B | BANE | A | BARTOME | D | BEANFLAT | C | BELATE | B |
| BADGERTON | B | BANGO | B | BARTON | B | BEANLAKE | B | BELCHER | D |
| BADIN | C | BANGOR | B | BARTONFLAT | B | BEANO | D | BELDEN | C |
| BADITO | C | BANGSTON | A | BARYON | B | BEAR BASIN | B | BELDING | B |
| BADO | D | BANIDA | D | BARX | B | BEAR CREEK | B | BELEN | D |
| BADUS | C/D | BANKARD | A | BASCAL | B | BEAR LAKE | D | BELFAST | B |
| BADWATER | B | BANKHEAD | B | BASCO | C | BEAR PRAIRIE | B | BELFIELD | C |
| BAGARD | B | BANKS | A | BASCOM | B | BEARDALL | C | BELFORE | B |
| BAGDAD | B | BANLIC | C | BASCOVY | D | BEARDEN | C | BELGARRA | C |
| BAGGOTT | D | BANNEL | B | BASEHOR | D | BEARDSLEY | C | BELGRADE | B |
| BAGLEY | B | BANNER | C | BASH | C | BEARDSTOWN | C | BELHAVEN | D |
| BAHEM | B | BANNING | C | BASHAW | D | BEARGULCH | B | BELINDA | D |
| BAHIA | A | BANNION | C | BASHER | B | BEARMOUTH | B | BELJICA | B |
| BAHL | C | BANNOCK | B | BASILE | D | BEARPAW | C | BELK | D |
| BAILE | D | BANTRY | A/D | BASIN | C | BEARSKIN | D | BELKNAP | C |
| BAILEGAP | B | BAPOS | D | BASINGER | B/D | BEARSPRING | B | BELLAVISTA | C |
| BAILEYCREEK | C | BARABOO | B | BASINGER, | D | BEARTRAP | B | BELLE | B |
| BAILING | C | BARAGA | C | DEPRESSIONAL | | BEAPVILLE | C | BELLECHESTER | A |
| BAINVILLE | C | BARANA | B | BASINGER, FLOODED | D | BEARWALLOW | C | BELLEHELEN | D |
| BAIRD HOLLOW | C | BARATARI | A/D | BASKET | B | BEASLEY | C | BELLENMINE | D |
| BAIRD HOLLOW, | D | BARBAROSA | D | BASSEL | B | BEASON | C | BELLEVILLE | B/D |
| EXTREMELY COBBLY | | BARBARY | D | BASSETT | B | BEATRICE | D | BELLEVILLE, PONDED | D |
| BAIRD HOLLOW, | B | BARBERT | D | BASSFIELD | B | BEAUCOUP | B/D | BELLEVUE | B |
| GRAVELLY | | BARBOUR | B | BASTIAN | C | BEAUFORD | D | BELLICUM | B |
| BAJURA | D | BARBOURVILLE | B | BASTON | C | BEAUGHTON | D | BELLINGHAM | D |
| BAKEOVEN | D | BARCAVE | B | BASTROP | B | BEAUMONT | D | BELLINGHAM, | C |
| BAKER | C | BARCE | B | BASTSIL | B | BEAUREGARD | C | DRAINED | |
| BAKERSVILLE | D | BARCLAY | C | BATA | B | BEAUSITE | C | BELLPASS | D |
| BALAAM | B | BARCO | B | BATAN | B | BEAUVAIS | B | BELLPINE | C |
| BALCOM | B | BARCUS | A | BATAVIA | B | BEAVERCREEK | B | BELLWOOD | D |
| BALD | C | BARD | D | BATEMAN | B | BEAVERDAM | C | BELMEAR | D |
| BALDER | D | BARDEN | C | BATES | B | BEAVERELL | B | BELMILL | B |

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## Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BELMONT | B | BERTRAM | B | BILLINGS, | B | BLACKNOLL | C | BLUE LAKE | A |
| BELMORE | B | BERTRAND | B | MODERATELY SLOW | | BLACKOAR | B/D | BLUE STAR | B |
| BELPRE | C | BERVILLE | B/D | PERM | | BLACKPIPE | C | BLUEBELL | C |
| BELSAC | B | BERWOLF | B | BILLYCREEK | C | BLACKPRINCE | B | BLUECHIEF | C |
| BELTED | D | BERYL | B | BILLYHAW | D | BLACKROCK | B | BLUECREEK | D |
| BELTON | C | BERZATIC | D | BILTMORE | A | BLACKSAN | B | BLUEDOME | C |
| BELTRAMI | B | BESEMAN | A/D | BIMMER | D | BLACKSPAR | D | BLUEFLAT | C |
| BELTSVILLE | C | BESHERM | C | BINCO | D | BLACKSPOT | D | BLUEGROVE | C |
| BELUGA | D | BESNER | B | BINDLE | B | BLACKSTON | B | BLUEGULCH | B |
| BELUGA, DRAINED, | C | BESSEMER | C | BINFORD | B | BLACKTHORN | B | BLUEHILL | C |
| SLOPING | | BESSIE | D | BINGER | B | BLACKTOP | D | BLUEHON | C |
| BELVOIR | C | BESTROM | C | BINGHAM | B | BLACKWATER | D | BLUEJOINT | B |
| BELZAR | C | BETHANY | C | BINGHAMPTON | B | BLACKWELL | D | BLUENOSE | B |
| BEMIDJI | A | BETHEL | B | BINGHAMVILLE | D | BLADEN | D | BLUEPOINT | A |
| BEN LOMOND | B | BETHERA | D | BINNA | B | BLAG | D | BLUERIM | C |
| BENCHLEY | C | BETHESDA | C | BINNSVILLE | D | BLAGO | D | BLUESLIDE | D |
| BENCLARE | C | BETHLEHEM | B | BINS | B | BLAINE | C | BLUESPRIN | C |
| BENCO | B | BETIS | A | BINTON | C | BLAIR | C | BLUESTONE | D |
| BENDER | B | BETONNIE | B | BINTON, RECLAIMED | B | BLAIRTON | C | BLUEWING | A |
| BENDIRE | C | BETRA | C | BIOYA | B | BLAKABIN | C | BLUFF | D |
| BENEVOLA | C | BETTERAVIA | C | BIPPUS | B | BLAKE | B | BLUFFDALE | C |
| BENEWAH | D | BETTS | B | BIRCHBAY | C | BLAKELAND | A | BLUFFTON | C/D |
| BENFIELD | C | BEULAH | B | BIRCHFIELD | D | BLAKENEY | C | BLUFORD | C |
| BENGAL | C | BEVENT | A | BIRCHWOOD | C | BLAKEWELL | C | BLUM | C |
| BENGE | B | BEVERIDGE | D | BIRDOW | B | BLALOCK | D | BLY | B |
| BENHAM | B | BEVERLY | B | BIRDS | C/D | BLAMER | C | BLYBURG | B |
| BENIN | D | BEVERLY, GRAVELLY | A | BIRDSALL | D | BLANCA | B | BLYTHE | D |
| BENITO | D | BEW | C | BIRDSBORO | B | BLANCHARD | A | BOARDMAN | D |
| BENJAMIN | D | BEWLEYVILLE | B | BIRDSLEY | D | BLANCHE | B | BOARDTREE | C |
| BENKLIN | C | BEXAR | D | BIRDSVIEW | A | BLANCHESTER | B/D | BOASH | D |
| BENMAN | C | BEZO | D | BIRKBECK | B | BLANCOT | B | BOAZ | C |
| BENNDALE | B | BEZZANT | B | BIRMINGHAM | B | BLAND | C | BOBBITT | C |
| BENNINGTON | C | BIBB | C | BIRNEY | B | BLANDING | B | BOBILLO | A |
| BENRIDGE | B | BIBLESPRINGS | B | BIROME | C | BLANEY | B | BOBNBOB | C |
| BENSLEY | B | BICE | B | BISBEE | A | BLANKET | C | BOBS | D |
| BENSON | D | BICKERDYKE | D | BISCARO | D | BLANTON | A | BOBTAIL | C |
| BENTEEN | C | BICKETT | D | BISCAY | B/D | BLANTON, | B | BOBTOWN | B |
| BENWY | B | BICKLETON | B | BISGANI, | B | MODERATELY WET | | BOCA | B/D |
| BENZ | D | BICKMORE | C | MODERATELY WET | | BLANYON | C | BOCA, DEPRESSIONAL | D |
| BEOR | D | BICONDOA | D | BISGANI, FLOODED | C | BLAPPERT | D | BOCA, TIDAL | D |
| BEOSKA | B | BICONDOA, DRAINED | C | BISHOP | D | BLAQUIERE | C | BOCK | B |
| BEOTIA | B | BIDDEFORD | D | BISMARCK | D | BLASDELL | A | BOCKER | D |
| BEOWAWE | B | BIDDLEMAN | B | BISOODI | D | BLASE | C | BOCKSTON | B |
| BEQUINN | B | BIDMAN | C | BISPING | B | BLASINGAME | C | BODE | B |
| BERCUMB | B | BIDWELL | B | BISSELL | B | BLAYDEN | D | BODECKER | A |
| BERDA | B | BIEBER | D | BISSONNET | D | BLAZBIRD | D | BODELL | D |
| BEREA | C | BIEDELL | D | BIT | C | BLAZON | D | BODEN | C |
| BERENICETON | B | BIEDSAW | C | BITTER | B | BLEAKWOOD | C | BODENBURG | B |
| BERGHOLZ | C | BIENVILLE | A | BITTER SPRING | B | BLEDSOE | C | BODINE | B |
| BERGLAND | D | BIG BLUE | D | BITTERROOT | C | BLEIBLERVILLE | D | BODORUMPE | C |
| BERGQUIST | B | BIG HORN | B | BITTERWATER | B | BLENCOE | D | BODOT | C |
| BERGSTROM | B | BIG TIMBER | D | BITTON | B | BLEND | D | BOEL | A |
| BERGSVIK | D | BIGARM | B | BIVANS | D | BLENDON | B | BOEL, OVERWASH | C |
| BERINO | B | BIGBEE | A | BIXBY | B | BLETHEN | B | BOELUS | A |
| BERIT | D | BIGBEND | B | BIXLER | C | BLEVINS | B | BOERNE | B |
| BERKS | C | BIGBROWN | C | BJORK | C | BLEVINTON | B | BOESEL | C |
| BERKSHIRE | B | BIGELOW | B | BLACHLY | B | BLEWETT | D | BOESEL, PROTECTED | B |
| BERLAKE | B | BIGETTY | B | BLACK BUTTE | B | BLICHTON | D | BOETTCHER | C |
| BERLIN | C | BIGFLAT | D | BLACK CANYON | D | BLICKENSTAFF | B | BOGAN | C |
| BERMESA | C | BIGFOOT | C | BLACK CANYON, | C | BLIHO | B | BOGART | B |
| BERMUDIAN | B | BIGFORK | C | DRAINED | | BLIMSTER | C | BOGGS | C |
| BERNAL | D | BIGHAMS | B | BLACK RIDGE | D | BLINN | C | BOGGY | C |
| BERNALDO | B | BIGHILL | B | BLACKA | C | BLISS | C | BOGRAP | B |
| BERNARD | D | BIGLAKE | A | BLACKBURN | B | BLITZEN | C | BOGUE | D |
| BERNARDINO | C | BIGMEADOW | C | BLACKDRAW | D | BLOCKHOUSE | D | BOGUS | C |
| BERNARDSTON | C | BIGNELL | C | BLACKETT | B | BLOMFORD | B/D | BOHANNON | C |
| BERNHILL | B | BIGRIVER | B | BLACKFOOT | C | BLOOM | D | BOHEMIAN | B |
| BERNICE | A | BIGSHEEP | B | BLACKFOOT, DRAINED | B | BLOOMFIELD | A | BOHICKET | D |
| BERNING | C | BIGSPRING | D | BLACKHALL | D | BLOOMING | B | BOHNA | B |
| BERNOW | B | BIGWIN | C | BLACKHALL, WARM | C | BLOOMSDALE | B | BOHNLY | D |
| BERRYLAND | B/D | BIGWINDER | D | BLACKHAMMER | B | BLOOR | C | BOHNSACK | B |
| BERRYMAN | C | BIJORJA | C | BLACKHAWK | D | BLOOR, GRAVELLY | D | BOISTFORT | B |
| BERSON | B | BIJOU | B | BLACKHOOF | D | SUBSTRATUM | | BOJAC | B |
| BERTAG | C | BILBO | C | BLACKHORSE | C | BLOUNT | C | BOJO | D |
| BERTELSON | B | BILGER | D | BLACKLEED | B | BLOWERS | B | BOLAN | B |
| BERTHOUD | B | BILLETT | B | BLACKLEG | C | BLUCHER | C | BOLAR | C |
| BERTIE | B | BILLINGS | C | BLACKLOCK | D | BLUE EARTH | B/D | BOLD | B |
| BERTO | D | | | BLACKMAN | C | BLUE EARTH, | D | BOLENT | A |
| BERTOLDTTI | B | | | BLACKMOUNT | B | SLOPING | | BOLES | C |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BOLFAR | C | BORGEAU | B | BRACEVILLE | C | BREW | C | BROKENHORN | D |
| BOLICKER | B | BORGES | D | BRACKEN | B | BREWER | C | BROLLIAR | D |
| BOLIO | D | BORIANA | D | BRACKETT | C | BREWLESS | C | BROMER | C |
| BOLIVAR | B | BORKY | C | BRAD | D | BREWSTER | D | BROMIDE | B |
| BOLLING | C | BORNSTEDT | C | BRADDOCK | B | BREWTON | C | BROMO | B |
| BOLSA | C | BORO | D | BRADEN | B | BRIBUTTE | D | BRONAUGH | B |
| BOLTON | B | BOROBEY | C | BRADENTON | B/D | BRICKEL | C | BRONCHO | B |
| BOLTUS | D | BORREGO | D | BRADENTON, FLOODED | D | BRICKMILL | C | BRONCHO, LOAMY | A |
| BOMAR | C | BORREGUERO | C | BRADER | D | BRICKTON | C | SUBSTRATUM | |
| BOMBADIL | D | BORSKI | B | BRADSHAW | B | BRICO | C | BRONELL | B |
| BOMBAY | B | BORTH | C | BRADSON | B | BRIDGE | C | BRONSON | B |
| BOMOSEEN | C | BORUP | B/D | BRADWAY | D | BRIDGECREEK | C | BRONTE | C |
| BON | B | BORVANT | D | BRADY | B | BRIDGEHAMPTON | B | BROOKE | D |
| BONAIR | D | BOSANKO | D | BRADYVILLE | C | BRIDGEPORT | B | BROOKFIELD | B |
| BONANZA | B | BOSCO | B | BRAFFITS | B | BRIDGER | B | BROOKINGS | B |
| BONAPARTE | A | BOSKET | B | BRAGG | C | BRIDGESON | D | BROOKLYN | C/D |
| BONCLAIR | B | BOSLER | B | BRAHAM | B | BRIDGESON, DRAINED | C | BROOKMAN | D |
| BOND | D | BOSO | D | BRAILSFORD | C | BRIDGET | B | BROOKSHIRE | C |
| BONDFARM | D | BOSQUE | B | BRAINERD | C | BRIDGEWATER | B | BROOKSIDE | C |
| BONDMAN | D | BOSSBURG | D | BRALLIER | D | BRIEDWELL | B | BROOKSTON | B/D |
| BONDRANCH | D | BOSSBURG, DRAINED | C | BRAM | C | BRIEF | B | BROOKSTON, STONY | D |
| BONDUEL | C | BOSTON | C | BRAMARD | B | BRIER | D | BROOKSVILLE | D |
| BONE | D | BOSTRUM | D | BRAMLETT | C | BRIGGS | A | BROOME | B |
| BONEEK | B | BOSTWICK | B | BRAMWELL | C | BRIGGSDALE | C | BROPHY | A/D |
| BONEYARD | C | BOSVILLE | C | BRANCH | B | BRIGGSVILLE | C | BROSE | D |
| BONFIELD | B | BOSWELL | D | BRANCROFT | C | BRIGHTON | B/D | BROSELEY | B |
| BONFRI | C | BOSWORTH | D | BRAND | D | BRIGHTWOOD | B | BROSS | B |
| BONG | A | BOTELLA | B | BRANDENBURG | A | BRILEY | B | BROUGHTON | D |
| BONHAM | C | BOTHWELL | B | BRANDON | B | BRILL | B | BROWARD | C |
| BONIFAY | A | BOTHWI | C | BRANDYWINE | C | BRILLIANT | B | BROWER | B |
| BONILLA | B | BOTON | B | BRANFORD | B | BRIMFIELD | C/D | BROWNBEAR | C |
| BONITA | D | BOTTINEAU | C | BRANHAM | C | BRIMLEY | B | BROWNDELL | D |
| BONJEA | D | BOTTLE | C | BRANSCOMB | B | BRIMSTONE | D | BROWNELL | B |
| BONN | D | BOTTLEROCK | C | BRANTFORD | B | BRINEGAR | B | BROWNFIELD | A |
| BONNEAU | A | BOULDER | B | BRANTLEY | C | BRINGMEE | B | BROWNLEE | B |
| BONNELL | C | BOULDER LAKE | D | BRANYON | D | BRINKER | C | BROWNRIGG | D |
| BONNER | B | BOULDER POINT | B | BRASHEAR | C | BRINKERT | C | BROWNSCOMBE | C |
| BONNERDALE | B | BOULDERCREEK | B | BRASSFIELD | B | BRINKERTON | D | BROWNSCREEK | B |
| BONNET | B | BOULDIN | B | BRATTON | B | BRINNUM | D | BROWNSDALE | C |
| BONNEVILLE | A | BOULFLAT | C | BRAUN | C | BRINNUM, DRAINED | C | BROWNSTO | B |
| BONNICK | A | BOUNCER | D | BRAVANE | D | BRIONES | B | BROWNSVILLE | C |
| BONNIE | C/D | BOUNDARY | B | BRAWLEY | D | BRIOS | A | BROWNTON | C/D |
| BONNIE, PONDED | C | BOURBON | B | BRAXTON | C | BRISBANE | B | BROXON | B |
| BONNYDOON | D | BOURNE | C | BRAY | D | BRISCO | B | BROYLES | B |
| BONO | D | BOUSIC | D | BRAYTON | C | BRISCOT | D | BRUBECK | D |
| BONSALL | D | BOW | D | BRAZILTON | D | BRISCOT, DRAINED | C | BRUCE | B/D |
| BONTA | B | BOWBAC | C | BRAZITO | A | BRISKY | D | BRUELLA | B |
| BONTI | C | BOWBELLS | B | BRAZITO, THICK | B | BRISTOW | D | BRUELLA, HARD | C |
| BONWIER | C | BOWDISH | C | SURFACE | | BRITTO | D | SUBSTRATUM | |
| BONWIER, GRADED | D | BOWDLE | B | BRAZITO, THICK | C | BRITTON | D | BRUFFY | B |
| BONZ | C | BOWDOIN | D | SURFACE, | | BRITWATER | B | BRUHEL | B |
| BOOFORD | C | BOWDRE | C | SALINE-ALKALI | | BROAD | C | BRUIN | B |
| BOOFUSS | D | BOWEN | C | BRAZON | C | BROAD CANYON | B | BRUMAN | B |
| BOOKCLIFF | B | BOWERS | C | BRAZORIA | D | BROADALBIN | C | BRUMBAUGH | C |
| BOOKER | D | BOWES | B | BRECKENRIDGE | B/D | BROADAX | B | BRUNCAN | D |
| BOOKOUT | C | BOWIE | B | BRECKNOCK | B | BROADBROOK | C | BRUNDAGE | D |
| BOOKWOOD | B | BOWLAKE | C | BRECKSVILLE | C | BROADHEAD | C | BRUNEEL | D |
| BOOMER | B | BOWLUS | B | BREECE | B | BROADHURST | D | BRUNELDA | D |
| BOOMSTICK | D | BOWMAN | C | BREGAR | D | BROADMOOR | C | BRUNO | A |
| BOOMTOWN | D | BOWMANSVILLE | B/D | BREIEN | B | BROADUS | B | BRUNSWICK | B |
| BOONE | A | BOWNS | C | BREKO | B | BROADWELL | B | BRUNZELL | B |
| BOONESBORO | B | BOWSTRING | A/D | BREMER | C | BROBETT | C | BRUSHCREEK | C |
| BOONEVILLE | B | BOXELDER | C | BREMER, SANDY | B | BROCK | D | BRUSHCREEK | B |
| BOONTON | C | BOXFORD | C | SUBSTRATUM | | BROCKET | C | BRUSSELS | C |
| BOONVILLE | C | BOXVILLE | C | BREMO | C | BROCKGULCH | C | BRUSSETT | B |
| BOONVILLE | D | BOXWELL | C | BREMS | A | BROCKLISS | B | BRYAN | A |
| BOOTH | C | BOY | B | BRENDA | C | BROCKMAN | C | BRYANT | B |
| BOOTHBAY | C | BOYCE | D | BRENHAM | C | BROCKO | B | BRYARLY | D |
| BOOTJACK | D | BOYD | D | BRENNAN | B | BROCKPORT | D | BRYCAN | B |
| BOOTS | A/D | BOYER | B | BRENNER | D | BROCKROAD | C | BRYCE | D |
| BOQUILLAS | C | BOYETT | B | BRENT | D | BROCKSBURG | B | BRYMAN | B |
| BORACHO | C | BOYKIN | B | BRENTON | B | BROCKTON | D | BRYSTAL | B |
| BORAH | C | BOYLE | D | BRENTSVILLE | C | BROCKWAY | B | BUB | C |
| BORAVALL | D | BOYSAG | D | BRENTWOOD | B | BROCKWELL | B | BUBUS | B |
| BORDA | D | BOYSEN | D | BRESSA | C | BRODALE | C | BUCAN | C |
| BORDEAUX | B | BOZE | B | BRESSER | B | BRODY | C | BUCAN, GRAVELLY | D |
| BORDEN | B | BOZEMAN | B | BREVARD | B | BROE | B | BUCHANAN | C |
| BORDER | B | BRABAS | D | BREVATOR | C | BROGAN | B | BUCHEL | D |
| BOREALIS | D | BRACE | C | BREVORT | B/D | BROGDON | B | BUCHENAU | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BUCHENAU, THICK SOLUM | B | BURCHELL | C | CABO ROJO | C | CALODO | C | CANTEEN | B |
| | | BURDETT | C | CABOOSE | B | CALOOSA | C | CANTEY | D |
| BUCKAROO | C | BUREN | C | CABOT | D | CALOUSE | B | CANTINA | C |
| BUCKBAY | C | BURGESS | C | CABRILLO | C | CALPAC | B | CANTON | B |
| BUCKCREEK | C | BURGI | B | CABSTON | B | CALPEAK | D | CANTON BEND | C |
| BUCKEYE | C | BURIBURI | C | CACHE | D | CALPINE | B | CANTRIL | B |
| BUCKHALL | B | BURKE | C | CACIGUE | C | CALROY | B | CANTUA | B |
| BUCKHOUSE | B | BURKETOWN | C | CACTUSFLAT | C | CALUME | B | CANTUCHE | D |
| BUCKING | A | BURKEVILLE | D | CADDO | D | CALVERTON | C | CANUTIO | B |
| BUCKLAKE | C | BURKHARDT | B | CADEVILLE | D | CALVIN | C | CANWALL | C |
| BUCKLAND | C | BURLEIGH | A/D | CADILLAC | A | CALVISTA | D | CANYON | D |
| BUCKLE | B | BURLESON | D | CADIZ | B | CALWOODS | D | CAPAC | C |
| BUCKLEBAR | B | BURLEWASH | D | CADMUS | B | CALZACORTA | D | CAPAY | D |
| BUCKLEY | D | BURLINGTON | A | CADOMA | D | CAMAGUEY | D | CAPE | D |
| BUCKLICK | C | BURMAH | D | CAESAR | A | CAMARGO | B | CAPE FEAR | D |
| BUCKLICK, THICK SOLUM | B | BURNAC | D | CAGEY | C | CAMARILLO | C | CAPEHORN | D |
| | | BURNBOROUGH | B | CAGLE | C | CAMARILLO, DRAINED | B | CAPERS | D |
| BUCKLON | D | BURNEL | C | CAGUABO | D | CAMAS | A | CAPERTON | D |
| BUCKNELL | D | BURNETTE | C | CAGWIN | B | CAMAS, STONY | B | CAPHOR | B |
| BUCKNEY | B | BURNHAM | D | CAHABA | B | CAMATTA | D | CAPILLO | C |
| BUCKPEAK | B | BURNSIDE | B | CAHONA | B | CAMBARGE | B | CAPISTRANO | B |
| BUCKS | B | BURNSVILLE | B | CAID | B | CAMBERN | C | CAPITAN | D |
| BUCKSHOT | B | BURNSWICK | B | CAINHOY | A | CAMBERT | C | CAPJAC | C |
| BUCKSKIN | C | BURNT LAKE | A | CAIRO | D | CAMBETH | C | CAPLEN | D |
| BUCKTON | B | BURNTRIVER | B | CAJALCO | C | CAMBRIA | B | CAPLES | D |
| BUDE | C | BURR | D | CAJETE | B | CAMBRIDGE | C | CAPLES, DRAINED | C |
| BUDIHOL | D | BURRITA | D | CAJON, OVERWASH | A | CAMDEN | B | CAPONA | C |
| BUDLEWIS | C | BURROWSVILLE | C | CAJON, LOAMY | A | CAMEEK | D | CAPOOSE | C |
| BUELL | B | BURSLEY | D | SUBSTRATUM | | CAMELBACK | B | CAPPS | B |
| BUENA VISTA | B | BURSON | C | CAJON, SILTY | A | CAMEO | B | CAPSHAW | C |
| BUFFARAN | D | BURT | D | SUBSTRATUM | | CAMERON | D | CAPTINA | C |
| BUFFCREEK | B | BURTON | B | CAJON, ALKALI, | A | CAMILLUS | B | CAPTIVA | B/D |
| BUFFINGTON | B | BURWELL | C | OVERWASH | | CAMINO | C | CAPULIN | B |
| BUFFMEYER | B | BUSBY | B | CAJON, | B | CAMPANA | B | CARACOLES | D |
| BUFFORK | C | BUSE | B | SALINE-ALKALI | | CAMPBELL, MUCK | C | CARADAN | D |
| BUFTON | C | BUSHER | B | CAJON, COOL, | A | SUBSTRATUM | | CARALAMPI | B |
| BUHRIG | C | BUSHMAN | B | OVERWASH | | CAMPBELL, DRAINED | B | CARBENGLE | B |
| BUICK | C | BUSHNELL | C | CAJON, GRAVELLY | A | CAMPBELLTON | C | CARBO | C |
| BUIST | B | BUSHVALLEY | D | CAJON, COOL | A | CAMPCREEK | C | CARBOL | D |
| BUKO | B | BUSKA | B | CAJON, WARM | A | CAMPIA | B | CARBONA | D |
| BUKO, WET | C | BUSSY | C | CALABAR | D | CAMPO | C | CARBONDALE | A/D |
| BUKREEK | B | BUSTER | B | CALABASAS | B | CAMPONE | C | CARCITY | D |
| BULAKE | D | BUSTI | C | CALAMINE | D | CAMPSPASS | B | CARDENAS | D |
| BULKLEY | C | BUSYWILD | B | CALAMITY | D | CAMPUS | B | CARDIFF | B |
| BULL RUN | B | BUTANO | C | CALAMUS | A | CAMRODEN | C | CARDIGAN | B |
| BULL RUN, HARDPAN SUBSTRATUM | C | BUTCHE | D | CALAVERAS | B | CANA | C | CARDINGTON | C |
| | | BUTLER | D | CALAWAH | B | CANAAN | C | CARDON | D |
| BULL TRAIL | B | BUTLERTOWN | C | CALCO | B/D | CANADIAN | B | CAREFREE | D |
| BULLARDS | B | BUTTERFIELD | C | CALCOUSTA | B/D | CANADICE | D | CAREY | B |
| BULLCREEK | D | BUTTERMILK | B | CALCROSS | B | CANALOU | B | CAREY LAKE | B |
| BULLFLAT | B | BUTTERS | B | CALD | C | CANANDAIGUA | D | CARGENT | B |
| BULLFOR | C | BUTTON | D | CALDER | D | CANASERAGA | C | CARGILL | C |
| BULLION | D | BUTTONHOOK | B | CALDERWOOD | D | CANAVERAL | C | CARIBEL | B |
| BULLNEL | C | BUTTONWILLOW | C | CALDWELL | C | CANBURN | D | CARIBOU | B |
| BULLOCK | D | BUXIN | D | CALDWELL, DRAINED | B | CANDELARIA | B | CARIOCA | B |
| BULLREY | B | BUXTON, SOMEWHAT POORLY DRAINED | D | CALE | B | CANDELERO | C | CARIS | C |
| BULLUMP | B | | | CALEAST | C | CANDERLY | B | CARJO | C |
| BULLYARD | B | BUXTON, STONY | C | CALEB | B | CANDLER | A | CARLIN | D |
| BULLWINKLE | D | BUXTON, MODERATELY WELL DRAINED | C | CALEDONIA | B | CANDLESTICK | C | CARLINTON | C |
| BULLY | B | | | CALENDAR | C | CANDOR | A | CARLISLE | A/D |
| BULOW | A | BUZZN | A | CALERA | C | CANE | C | CARLITO | D |
| BUNCOMBE | A | BYARS | D | CALHI | A | CANEADEA | D | CARLOS | A/D |
| BUNDO | B | BYBEE | D | CALHOUN | D | CANEEK | B | CARLOTTA | B |
| BUNDORF | D | BYINGTON | C | CALICO | C | CANELO | D | CARLOW | D |
| BUNDY | C | BYLER | C | CALICOTT | A | CANEST | D | CARLSBAD | C |
| BUNDYMAN | C | BYLO | B | CALIFON | C | CANEYVILLE | C | CARLSBORG | A |
| BUNEJUG | C | BYNUM | C | CALIMUS | B | CANEZ | B | CARLSON | B |
| BUNKER | B | BYRAM | C | CALITA | B | CANFIELD | C | CARLSTROM | C |
| BUNKERHILL | D | BYRNIE | D | CALIZA | B | CANISTEO | B/D | CARLTON | C |
| BUNKWATER | C | CABALLO | B | CALKINS | C | CANISTEO, STONY | D | CARMACK | B |
| BUNKY | C | CABARTON | D | CALLABO | C | CANIWE | B | CARMEL | C |
| BUNNELL | B | CABBA | D | CALLAHAN | D | CANLON | D | CARMI | B |
| BUNSELMEIER | B | CABBART | C | CALLAN | C | CANNELL | B | CARMICHAEL | C |
| BUNTINGVILLE | C | CABBART, STONY | D | CALLEGUAS | D | CANNING | B | CARMODY | C |
| BUNYAN | B | CABBART, WARM | D | CALLINGS | C | CANNON | B | CARNASAW | C |
| BURBANK | A | CABEZON | D | CALLISBURG | C | CANNONVILLE | D | CARNEGIE | C |
| BURCH | B | CABIN | B | CALLOWAY | C | CANOE | B | CARNERO | C |
| BURCHAM | B | CABINET | C | CALMAR | B | CANOVA | B/D | CARNEY | D |
| BURCHARD | B | CABLE | B/D | CALNEVA | C | CANTALA | B | CAROLINE | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CAROLLO | D | CATALPA | C | CENCOVE | B | CHARLOTTE | B/D | CHEWACLA | C |
| CARON | A/D | CATAMOUNT | D | CENIZA | B | CHARLTON | B | CHEWELAH | C |
| CARON, MARSHY | D | CATANO | A | CENTENARY | A | CHARNOCK | C | CHEYENNE | B |
| CARPENTER | B | CATARACT | B | CENTER | C | CHARNOCK, | B | CHIA | D |
| CARR | B | CATAPINA | D | CENTER CREEK | C | MODERATELY WET | | CHIARA | D |
| CARRACAS | D | CATASKA | D | CENTERBURG | C | CHARO | C | CHICANE | C |
| CARRANZA | B | CATAULA | B | CENTERFIELD | B | CHASE | C | CHICHANTNA | D |
| CARRCREEK | B | CATCHELL | C | CENTERVILLE | D | CHASEBURG | B | CHICKAHOMINY | D |
| CARRIZALES | A | CATELLI | B | CENTISSIMA | B | CHASEVILLE | A | CHICKAMAN | B |
| CARRIZO | A | CATERL | B | CENTRAL POINT | B | CHASKA | B/D | CHICKASAW | C |
| CARROLLS | D | CATH | C | CENTRALIA | B | CHASTAIN | D | CHICKASHA | B |
| CARRYBACK | C | CATHARPIN | C | CENTRALPEAK | C | CHATBURN | B | CHICKREEK | D |
| CARSITAS | A | CATHAY | C | CEPBAT | D | CHATCOLET | B | CHICOLETE | C |
| CARSITAS, WET | B | CATHCART | B | CERESCO | B | CHATEAU | D | CHICOTE | D |
| CARSON | D | CATHEDRAL | D | CERINI | B | CHATFIELD | B | CHIEFLAND | B |
| CARSTAIRS | A | CATHEEN | B | CERINI, ALKALI | C | CHATHAM | B | CHIGLEY | C |
| CARSTUMP | C | CATHERINE | C | CERLIN | C | CHATSWORTH | D | CHIKAMIN | C |
| CART | B | CATHLAMET | B | CERRILLOS | B | CHATT | C | CHILAO | C |
| CARTAGENA | D | CATHRO | A/D | CERRO | C | CHATUGE | D | CHILCOTT | C |
| CARTECAY | C | CATILLA | B | CESTNIK | C | CHAUMONT | D | CHILCOTT, GRAVELLY | D |
| CARTER | D | CATLA | D | CETRACK | B | CHAUNCEY | C | CHILCOTT, COOL | D |
| CARTERET | D | CATLETT | C/D | CHACHA | C | CHAUTAUQUA | C | CHILDS | B |
| CARTHAGE | B | CATLIN | B | CHACON | D | CHAVIES | B | CHILGREN | C |
| CARUSO | C | CATMAN | D | CHAD | C | CHAWANAKEE | C | CHILHOWIE | C |
| CARUTHERSVILLE | B | CATNIP | D | CHAFFEE | D | CHAYSON | C | CHILI | B |
| CARVER | A | CATOCTIN | C | CHAGRIN | B | CHAZOS | C | CHILICOTAL | B |
| CARWILE | D | CATOOSA | B | CHAIN | C | CHEADLE | D | CHILKOOT | D |
| CARYTOWN | D | CATPOINT | A | CHAIRES | B/D | CHEAHA | D | CHILL | D |
| CARYVILLE | B | CATTCREEK | B | CHAIRES, | D | CHEBOYGAN | B | CHILLUM | B |
| CASA GRANDE | C | CATTCREEK, | A | DEPRESSIONAL | | CHECHI | D | CHILMARK | C |
| CASABONNE | B | GRAVELLY | | CHAIX | B | CHECKER | C | CHILOQUIN | D |
| CASAGA | C | SUBSTRATUM | | CHALCO | D | CHECKETT | D | CHILPEP | D |
| CASCADE | C | CATTO | D | CHALFONT | C | CHEDATNA | B | CHILSON | D |
| CASCAJO | A | CAUDLE | C | CHALKCREEK | B | CHEDEHAP | B | CHILTON | B |
| CASCAJO, COBBLY | B | CAUSEWA | C | CHALMERS | B/D | CHEDESKI | B | CHIMAYO | D |
| CASCILLA | B | CAUSEY | B | CHAMA, MODERATELY | B | CHEDSEY | C | CHIME | C |
| CASCO | B | CAVAL | B | SLOW PERM | | CHEEBE | D | CHIMENEA | D |
| CASE | B | CAVANAUGH | C | CHAMA, MODERATE | B | CHEEKTOWAGA | D | CHIMNEY | A |
| CASEY | D | CAVE | D | PERMEABILITY | | CHEESEMAN | B | CHINAPOINT | D |
| CASHEL | C | CAVEGULCH | B | CHAMA, COOL | C | CHEHALEM | C | CHINCAP | B |
| CASHIERS | B | CAVEHILL | C | CHAMATE | B | CHEHALIS | B | CHINCHALLO | D |
| CASHION | D | CAVELT | D | CHAMBEAM | B | CHEHULPUM | D | CHINCOTEAGUE | D |
| CASHMERE | B | CAVENDISH | B | CHAMBERINO | C | CHELAN | B | CHINEN | D |
| CASHMONT | B | CAVO | D | CHAMBERLAIN | B | CHELSEA | A | CHINIAK | A |
| CASITO | D | CAYODE | C | CHAMISE | D | CHEMAWA | B | CHINO | C |
| CASLO | D | CAYOUR | D | CHAMOKANE | C | CHEN | D | CHINO, DRAINED | B |
| CASLO, MODERATELY | C | CAYA | D | CHAMPAGNE | B | CHENA | A | CHINOOK | B |
| WET | | CAYAGUA | C | CHAMPION | B | CHENANGO | A | CHINVAR | C |
| CASMOS | D | CAYTON | C | CHANAC | B | CHENAULT | B | CHIPENDALE | D |
| CASPAR | B | CAYUGA | C | CHANCE | D | CHENEGA | A | CHIPENHILL | D |
| CASPIANA | B | CAYUSE | B | CHANCELLOR | C | CHENEY | B | CHIPETA | D |
| CASS | B | CAZADERO | C | CHANDLER | B | CHENNEBY | C | CHIPLEY | C |
| CASSIA | C | CAZADOR | B | CHANEY | C | CHENOWETH | B | CHIPMAN, | D |
| CASSIA, MODERATELY | B | CAZENOVIA | B | CHANNAHON | D | CHEOAH | B | SALINE-ALKALI | |
| WELL DRAINED | | CEBOLIA | C | CHANNING | B | CHEQUEST | C | CHIPMAN, | C |
| CASSIRO | B | CEBOLLETA | C | CHANTA | B | CHERIONI | D | MODERATELY WET | |
| CASSIRO, STONY | C | CEBONE | C | CHANTIER | D | CHERCKEE | D | CHIPMAN, DRAINED | D |
| CASSOLAPY | C | CEBOYA | C | CHAPANOKE | C | CHERRY | C | CHIPOLA | A |
| CASTAIC | C | CECIL | B | CHAPERTON | C | CHERRY, CALCAREOUS | B | CHIPPENY | D |
| CASTALIA | C | CEDA | B | CHAPIN | C | CHERRY, COOL | B | CHIPPEWA | D |
| CASTANA | B | CEDAR BUTTE | D | CHAPMAN | B | CHERRY SPRING | C | CHIRENO | D |
| CASTELL | C | CEDAR MOUNTAIN | D | CHAPOT | B | CHERRYHILL | B | CHIRICAHUA | D |
| CASTELLEJA | B | CEDARAN | D | CHAPPELL | A | CHERUM | B | CHIPPCHATTER | B |
| CASTELLO | B | CEDARBLUFF | C | CHAPPUIS | C | CHESAW | A | CHISCA | D |
| CASTEPHEN | C | CEDARCREEK | C | CHAQUA | B | CHESHIRE | B | CHISMORE | D |
| CASTILE | B | CEDARFALLS | A | CHARCO | C | CHESHNINA | C | CHISOLM | A |
| CASTINO | C | CEDARGAP | B | CHARCOL | B | CHESNIMNUS | B | CHISPA | B |
| CASTINO, NONSTONY | D | CEDARHILL | B | CHARD | B | CHESTATEE | B | CHISTOCHINA | B |
| CASTLE | D | CEDARPASS | B | CHARDOTON | C | CHESTER | B | CHITINA | C |
| CASTLEVALE | D | CEDONIA | B | CHARETTE | C | CHESTERTON | D | CHITTUM | D |
| CASTNER | D | CEEK | B | CHARGO | C | CHESTNUT | B | CHITWOOD | D |
| CASTO | C | CELACY | C | CHARITON | C | CHESTONIA | D | CHIVATO | C |
| CASTON | B | CELESTE | D | CHARLEBOIS | B | CHESUNCOOK | C | CHIWAUKUM | B |
| CASTRO | D | CELETON | D | CHARLEBOIS, WET | C | CHETCO | D | CHIWAWA | B |
| CASTROVILLE | B | CELINA | C | CHARLES | C | CHETEK | B | CHO | C |
| CASUSE | D | CELIO | C | CHARLESTON | C | CHETWYND | B | CHOATES | C |
| CASVARE | D | CELLAR | D | CHARLEVOIX | B | CHEVAL | C | CHOBEE | B/D |
| CASWELL | B | CELSOSPRINGS | C | CHARLOS | B | CHEVELON | C | CHOBEE, | D |
| CATALINA | B | CEMBER | C | CHARLOS, WET | D | CHEVIOT | B | DEPRESSIONAL | |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CHOBEE, LIMESTONE SUBSTRATUM | D | CLALLAM | C | CLIPPER | D | COKEL | B | COLVIN, OVERBLOWN, SALINE | C |
| CHOCCOLOCCO | B | CLAM GULCH | D | CLIPPER, DRAINED | C | COKER | D | COLWOOD | B/D |
| CHOCK | D | CLAMO | C/D | CLODINE | D | COKESBURY | D | COLY | B |
| CHOCORUA | D | CLAMP | D | CLONTARF | B | COKEVILLE | B | COLYER | D |
| CHOICE | D | CLANA | A | CLOQUALLUM | C | COLAND | B/D | COMAD | A |
| CHOOP | D | CLANALPINE | C | CLOQUATO | B | COLBAR | C | COMAR | C |
| CHOPTIE | D | CLANTON | C | CLOQUET | B | COLBERT | D | COMBE | B |
| CHORALMONT | B | CLAPPER | B | CLOSKEY | C | COLBURN | C | COMBS | B |
| CHOSKA | B | CLAREMORE | D | CLOTHO | C/D | COLBY | B | COMER | B |
| CHOTEAU | C | CLARENCE | D | CLOUD PEAK | C | COLDCREEK | B | COMETA | D |
| CHOWAN | D | CLARENDON | C | CLOUD RIM | B | COLDENT | C | COMFORT | D |
| CHRIS | C | CLARESON | C | CLOUDCROFT | D | COLE | C | COMFREY | B/D |
| CHRISMAN | D | CLAREVILLE | C | CLOUDLAND | C | COLEMAN | C | COMFREY, PONDED | D |
| CHRISTIAN | C | CLARINDA | D | CLOUGH | D | COLEMANTOWN | C/D | COMITAS | A |
| CHRISTIANA | C | CLARION | B | CLOVELLY | D | COLESTINE | C | COMLY | C |
| CHRISTIANBURG | C | CLARITA | D | CLOVER SPRINGS | B | COLFAX | C | COMMERCE | C |
| CHRISTINE | D | CLARK | B | CLOVERDALE | D | COLHILL | B | COMMSKI | B |
| CHRISTOFF | C | CLARK FORK | A | CLOVERLAND | C | COLIBRO | B | COMO | A |
| CHRISTY | C | CLARKELEN | B | CLOVIS | B | COLINAS | B | COMORABI | D |
| CHRODER | B | CLARKRANGE | C | CLOWERS | B | COLITA | D | COMODORE | D |
| CHROME | C | CLARKSBURG | C | CLOWERS, WET | C | COLLAMER | C | COMORO | B |
| CHRYSLER | C | CLARKSDALE | C | CLOWFIN | B | COLLARD | B | COMPASS | B |
| CHUALAR | B | CLARKSVILLE | B | CLUFF | C | COLLAYOMI | B | COMPTCHE | B |
| CHUBBS | C | CLARNO | B | CLUNIE | D | COLLBRAN | D | COMSTOCK | C |
| CHUCKANUT | B | CLATO | B | CLURDE | B | COLLBRAN, COBBLY | C | COMUS | B |
| CHUCKAWALLA | B | CLATSOP | D | CLURO | B | COLLEGEDALE | C | CONA | C |
| CHUCKLES | B | CLAUNCH | B | CLYDE | B/D | COLLEGIATE | D | CONABY | B/D |
| CHUCKRIDGE | D | CLAVERACK | C | CLYMER | B | COLLETT | | CONALB | B |
| CHUGCREEK | C | CLAVICON | C | COACHELLA | B | COLLETT, DRAINED | C | CONANT | C |
| CHUGTER | B | CLAWSON | C | COACHELLA, WET | C | COLLIER | A | CONASAUGA | C |
| CHUIT | B | CLAYBURN | B | COAHUILA | B | COLLINGTON | B | CONATA | D |
| CHULITNA | B | CLAYSPRINGS | D | COAL CREEK | D | COLLINS | C | CONBOY | D |
| CHUMALL | B | CLAYTON | B | COALBANK | B | COLLINSTON | B | CONCEPCION | D |
| CHUMMY | D | CLE ELUM | C | COALDALE | D | COLLINSVILLE | D | CONCHAS | C |
| CHUMSTICK | D | CLEAR LAKE | D | COALDRAW | D | COLLINWOOD | C | CONCHO | C |
| CHUPADERA | C | CLEAR LAKE, STRATIFIED | C | COALMONT | C | COLMA | B | CONCONULLY | B |
| CHURCH | D | CLEAR LAKE, SUBSTRATUM | | COAMO | C | COLMOR | B | CONCORD | D |
| CHURCHILL | D | CLEAR LAKE, MODERATELY WET | C | COARSEGOLD | C | COLNEVEE | B | CONDA | D |
| CHURCHVILLE | D | CLEARBROOK | D | COATSBURG | D | COLO | B/D | CONDIE | B |
| CHURN | B | CLEARFIELD | C | COBAT | B | COLO, DRAINED | B | CONDIT | D |
| CHUSKA | D | CLEARFORK | D | COBATUS | C | COLO, NONFLOODED | B | CONDON | C |
| CHUTE | A | CLEARWATER | D | COBB | B | COLOCKUM | B | CONE | A |
| CIALES | D | CLEAVAGE | D | COBBSFORK | D | COLOMA | A | CONECUH | D |
| CIBEQUE | B | CLEAVER | D | COBEN | D | COLOMBO | B | CONEJO | B |
| CIBO | D | CLEAVMOR | D | COBEY | B | COLONA | C | CONEJO, WET | C |
| CIBOLA | B | CLEBIT | D | COBLE | D | COLONIE | A | CONEJO, GRAVELLY SUBSTRATUM | C |
| CID | C | CLEGG | B | COBOC | C | COLONVILLE | C | CONESTOGA | B |
| CIDRAL | C | CLEGHORN | C | COBRE | C | COLORADO | B | CONESUS | B |
| CIENEBA | C | CLEMAN | B | COBURG | C | COLOROCK | D | CONETOE | A |
| CIENO | D | CLEMENTINE | C | COCHETOPA | C | COLOROW | B | CONGAREE | B |
| CIERVO, ALKALI | D | CLEMENTINE, DRAINED | B | COCHINA | D | COLOSO | D | CONGER | C |
| CIERVO, ALKALI, WET | D | CLEMS | B | COCHITI | C | COLOSSE | A | CONGER, COBBLY SUBSTRATUM | D |
| CIERVO, RECLAIMED | C | CLEMVILLE | B | COCHRAN | C | COLP | C | CONGLE | B |
| CIFIC | C | CLENDENEN | D | COCOA | A | COLRAIN | B | CONI | D |
| CIMARRON | C | CLEONE | B | COCODRIE | C | COLSAVAGE | C | CONIC | C |
| CINCINNATI | C | CLEORA | B | COCOLALLA | D | COLTER | B | CONLEN | B |
| CINCO | A | CLERF | C | COCOLALLA, DRAINED | C | COLTHORP | D | CONLEY | C |
| CINDERHURST | D | CLERGERN | B | CODLEY | B | COLTON | A | CONNEAUT | C |
| CINEBAR | B | CLERMONT | D | CODORUS | C | COLTROOP | D | CONNEL | B |
| CINNADALE | D | CLEVELAND | C | CODOUIN | D | COLTS NECK | B | CONNERTON | B |
| CINNAMON | B | CLEVERLY | B | CODYLAKE | B | COLUMBIA, MUCK SUBSTRATUM | B | CONOSTA | C |
| CINTRONA | D | CLICK | A | COE | A | COLUMBIA, DRAINED, CLAY SUBSTRATUM | B | CONOTTON | B |
| CIPRIANO | D | CLIFFDELL | B | COERCK | D | COLUMBIA, MODERATELY WET | C | CONOVER | C |
| CIRAC | B | CLIFFDOWN | B | COESSE | C/D | COLUMBIA, DRAINED | B | CONOWINGO | C |
| CIRCLEBACK | A | CLIFFHOUSE | C | COFFEEN | B | COLUMBIA, FLOODED | C | CONPEAK | D |
| CIRCLEBAR | C | CLIFFORD | C | COGGON | B | COLUMBIA, CLAY SUBSTRATUM | C | CONRAD | A/D |
| CIRCLEVILLE | C | CLIFSAND | B | COGNA | B | COLUMBIA, SLOPING | B | CONROE | B |
| CISCO | B | CLIFTERSON | B | COGSWELL | C | COLUMBINE | A | CONSEJO | C |
| CISNE | D | CLIFTON | B | COHAGEN | D | COLUMBUS | C | CONSER | D |
| CISPUS | B | CLIFTY | B | COHASSET | B | COLUSA | C | CONSTABLE | A |
| CITADEL | C | CLIMARA | D | COHOCTAH | B/D | COLVARD | B | CONSTANCIA | D |
| CITICO | B | CLIMAX | D | COHOCTAH, SANDY SUBSTRATUM | D | COLVILLE | D | CONSUMO | B |
| CITRONELLE | D | CLIME | C | COHOE | B | COLVILLE, DRAINED | C | CONTACT | A |
| CLACKAMAS | D | CLINETOP | D | COILS | C | COLVIN | C/D | CONTEE | D |
| CLAIBORNE | B | CLINT | C | COIT | D | COLVIN, SALINE | C | CONTIDE | B |
| CLAIRE | A | CLINTON | B | COKEDALE | D | | | CONTINE | C |
| CLAIREMONT | B | | | COKEDALE, DRAINED | C | | | | |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CONTINENTAL | C | CORRALITOS, SILTY | B | COWERS | B | CREVA | D | CUBCREEK | B |
| CONTO | B | SUBSTRATUM | | COWESTGLEN | B | CREVASSE | A | CUBERANT | B |
| CONTRA COSTA | C | CORRECO | C | COWETA | C | CREVISCREEK | C | CUCAMUNGO | D |
| CONTRARY | B | CORRIGAN | D | COWGIL | B | CREWS | D | CUCHILLAS | C |
| CONVENT | C | CORSON | C | COWHORN | B | CRIDER | B | CUCHO | C |
| COOERS | B | CORTA | D | COWICHE | B | CRIHS | D | CUDAHY | D |
| COOK | D | CORTADA | B | COWLAKE | B | CRINKER | C | CUDAHY, DRAINED | C |
| COOKPORT | C | CORTEZ | D | COWLITZ | A | CRIPPIN | B | CUDDEBACK | C |
| COOLBRITH | C | CORTINA | B | COWOOD | D | CRISFIELD | B | CUERDA | C |
| COOLIDGE | B | CORTINA, THIN | A | COWSLY | C | CRISTO | C | CUERO | B |
| COOLVILLE | C | SURFACE | | COWTON | C | CRISTO, LOAMY | | CUERVO | C |
| COOMBS | B | CORUNNA | B/D | COX | D | CRISTOBAL | B | CUESTA | C |
| COONSKIN | C | CORWIN | B | COXLAKE | D | CRITCHELL | B | CUEVA | D |
| COOPER | B | CORWITH | B | COXVILLE | D | CRITTENDEN | B | CUEVITAS | D |
| COOSAW | B | CORY | C | COXWELL | C | CROATAN | D | CUEVOLAND | B |
| COOTER | C | CORYDON | D | COY | D | CROCKER | A | CULBERTSON | B |
| COPAKE | B | COSAD | C | COYANOSA | D | CROCKETT | D | CULDESAC | B |
| COPALIS | C | COSER | D | COYATA | C | CROESUS | C | CULLEN | C |
| COPANO | D | COSEY | B | COYET | A | CROFTON | B | CULLEOKA | B |
| COPASTON | D | COSH | C | COYLE | B | CROGHAN | B | CULP | C |
| COPELAND | B/D | COSHOCTON | C | COYNE | B | CROKE | B | CULPEPER | C |
| COPELAND, | D | COSKI | B | COYOTECREEK | B | CROMWELL | A | CULTUS | B |
| DEPRESSIONAL | | COSTILLA | A | COZAD | B | CRONKHITE | C | CULVING | C |
| COPEMAN | B | COSUMNES | C | COZBERG | B | CRONKS | C | CUMBERLAND | B |
| COPENHAGEN | D | COTACO | C | COZTUR | D | CROOKED | D | CUMBRES | C |
| COPITA | B | COTAIL | B | CRABTREE | C | CROOKED CREEK | D | CUMLEY | C |
| COPPER RIVER | D | COTANT | D | CRACKERCREEK | B | CROOKED CREEK, | C | CUMMINGS | D |
| COPPER RIVER, | B | COTATI | C | CRACKLER | B | DRAINED | | CUMMISKEY | B |
| LACUSTRINE | | COTEAU | C | CRADDOCK | B | CROOKED CREEK, | C | CUNARD | B |
| SUBSTRATUM | | COTHA | C | CRADLEBAUGH | D | FLOODED | | CUNDICK | D |
| COPPER RIVER, TILL | B | COTITO | B | CRADLEBAUGH, | C | CROOKSTON | B | CUNDIYO | B |
| SUBSTRATUM | | COTO | B | SALINE-ALKALI | | CROOM | C | CUNNINGHAM | C |
| COPPER RIVER, | B | COTOPAXI | A | CRADLEBAUGH, | C | CROPLEY | D | CUPCO | C |
| SILTY SUBSTRATUM | | COTT | B | DRAINED | | CROPPER | D | CUPOLA | B |
| COPPER RIVER, | B | COTTER | B | CRAFT | B | CROQUIB | D | CUPPER | B |
| GRAVELLY | | COTTERAL | B | CRAFTON | C | CROSBY | C | CUPPLES | C |
| SUBSTRATUM | | COTTLE | D | CRAGGEY | D | CROSIER | C | CUPPY | D |
| COPPERCREEK | B | COTTONEVA | C | CRAGO | B | CROSS | D | CURABITH | A |
| COPPEREID | D | COTTONTHOMAS | B | CRAGOLA | D | CROSSPLAIN | C | CURANT | B |
| COPPERTON | B | COTTONWOOD | C | CRAGOSEN | D | CROSSTELL | D | CURDLI | C |
| COPPOCK | B | COTTRELL | C | CRAIG | B | CROSSVILLE | B | CURECANTI | B |
| COPSEY | D | COTULLA | D | CRAIGMILE | B/D | CROSWELL | A | CURHOLLOW | D |
| COQUAT | D | COUCH | D | CRAIGSVILLE | B | CROT | D | CUROB | D |
| COQUILLE | D | COUGARBAY | D | CRAMER | D | CROTON | D | CURRAN | C |
| CORA | D | COUGHANOUR | C | CRAMONT | C | CROUCH | B | CURRIER | A |
| CORAL | C | COULEEDAM | D | CRANE | B | CROW | C | CURRITUCK | D |
| CORALLAKE | B | COULSTONE | B | CRANECREEK | C | CROW CREEK | B | CURTIN | D |
| CORBETT | B | COULTERG | B | CRANFILL | B | CROW HILL | C | CURTIS CREEK | D |
| CORBILT | B | COULTERVILLE | D | CRANNLER | B | CROWCAMP | D | CURTIS SIDING | A |
| CORBIN | B | COUNCELOR | B | CRANSTON | B | CROWFLATS | B | CURTISTOWN | B |
| CORCEGA | C | COUNCIL | B | CRARY | C | CROWFOOT | B | CUSHENBURY | B |
| CORDELL | D | COUNTRYMAN | C | CRASH | B | CROWHEART | C | CUSHING | B |
| CORDES | B | COUNTS | D | CRATER LAKE | B | CROWLEY | D | CUSHMAN | C |
| CORDESTON | B | COUPEE | B | CRATERMO | C | CROWNEST | D | CUSHOOL | C |
| CORDOVA | C/D | COUPEVILLE | C | CRAVEN | C | CROWSHAW | B | CUSICK | D |
| CORDY | B | COURT | B | CRAWFORD | D | CROWTHER | D | CUSTCO | B |
| CORIFF | B/D | COURTHOUSE | D | CRAWLEYVILLE | B | CROYDON | B | CUSTER | D |
| CORINTH | C | COURTLAND | B | CREAL | C | CROZIER | C | CUSTER, DRAINED | C |
| CORKSTONE | D | COURTNEY | D | CREASEY | C/D | CRUCES | D | CUTAWAY | B |
| CORLENA | A | COURTROCK | B | CREDO | B | CRUCKTON | B | CUTHAND | B |
| CORLETT | A | COURVILLE | B | CREED | C | CRUICKSHANK | C | CUTHBERT | C |
| CORLEY | B/D | COUSE | C | CREEDMOOR | C | CRUISER | B | CUTHBERT, GRADED | D |
| CORMANT | A/D | COUSHATTA | B | CREEL | C | CRUMARINE | B | CUTOFF | C |
| CORNELIA | A | COUTIS | B | CREEMON | B | CRUME | B | CUTSHIN | B |
| CORNELIUS | C | COVE | D | CREFORK | C | CRUMP | D | CUTZ | D |
| CORNHILL | B | COVELAND | D | CREIGHTON | B | CRUMP, DRAINED | C | CUYAMA | B |
| CORNICK | D | COVELAND, DRAINED | C | CRELDON | C | CRUNKER | B | CUYON | A |
| CORNING | C | COVELLO | C | CREN | B | CRUNKVAR | A | CYAN | B |
| CORNISH | C | COVERT | A | CREOLE | D | CRUST | D | CYCLONE | B/D |
| CORNUTT | C | COVEYTOWN | C | CRESAL | B | CRUTCH | C | CYLINDER | B |
| CORNVILLE | B | COVILLE | B | CRESBARD | C | CRUTCHER | C | CYMRIC | D |
| COROLLA | D | COVING | C | CRESCO | C | CRUZE | C | CYNTHIANA | D |
| CORONA | B | COVINGTON | D | CRESKEN | B | CRYLUHA | C | CYNTHIANIA | D |
| CORONACA | B | COWAN | B | CRESPIN | C | CRYSTAL LAKE | B | CYPHER | D |
| COROZAL | C | COWARTS | C | CREST | C | CRYSTAL SPRINGS | D | CYRIL | B |
| COROZO | A | COWCO | B | CRESTLINE | B | CRYSTALBUTTE | B | CZAR | B |
| CORPENING | D | COWDEN | D | CRESTMAN | D | CRYSTALCREEK | B | DABNEY | A |
| CORRAL | C | COWDREY | C | CRESTVALE | C | CUATE | C | DABOB | C |
| CORRALITOS | A | COWEEMAN | D | CRETE | C | CUBA | B | DACKER | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DACONO | B | DARLAND | B | DECKERVILLE, | C | DELLO, CLAY | B | DESCHELL | B |
| DACONO, COBBLY | C | DARLEY | C | DRAINED | | SUBSTRATUM | | DESCHUTES | C |
| SUBSTRATUM | | DARLING | B | DECLO | B | DELLROSE | B | DESCOT | B |
| DACORE | B | DARMSTADT | D | DECOLNEY | B | DELLS | C | DESEED | C |
| DACOSTA | D | DARNELL | C | DECORDOVA | B | DELLWOOD | A | DESERET | C |
| DADE | A | DARNEN | B | DECRAM | C | DELMA | C | DESHA | D |
| DADINA | D | DAROW | C | DECROSS | B | DELMITA | C | DESHLER | C |
| DAGAN | B | DARR | B | DECY | E | DELMONT | B | DESKAMP | C |
| DAGFLAT | C | DARRET | C | DEDAS | D | DELNORTE | C | DESMET | B |
| DAGLUM | D | DARROCH | B | DEDMOUNT | C | DELORO | D | DESOLATION | B |
| DAGOR | B | DARROCH, BEDROCK | C | DEDRICK | D | DELOSS | B/D | DESPAIN | B |
| DAGUAO | C | SUBSTRATUM | | DEE | C | DELP | A | DESTAZO | B |
| DAGUEY | C | DARROUZETT | C | DEECREE | B | DELPHI | B | DESTER | C |
| DAHAR | C | DARSIL | C | DEEFAN | D | DELPHILL | C | DETER | C |
| DAHLQUIST | B | DARST | C | DEEMER | B | DELPIEDRA | D | DETOUR | B |
| DAICK | D | DART | A | DEEPCUT | D | DELPLAIN | D | DETRA | B |
| DAIGLE | C | DARTMOUTH | B | DEEPEEK | D | DELPOINT | C | DETROIT | C |
| DAILEY | A | DARVEY | B | DEEPWATER | B | DELRAY | B/D | DEUNAH | D |
| DAILEY, LOAMY | B | DARWIN | D | DEER CREEK | C | DELRAY, | D | DEV | A |
| SUBSTRATUM | | DASHER | D | DEER PARK | A | DEPRESSIONAL | | DEVADA | D |
| DAINT | B | DASSEL | B/D | DEERFIELD | B | DELRIDGE | B | DEVEN | D |
| DAKENT | B | DAST | B | DEERFORD | D | DELSON | C | DEVILS | D |
| DAKOTA | B | DATELAND | B | DEERHORN | C | DELTAJO | C | DEVILSCREEK | C |
| DALBO | B | DATEMAN | C | DEERLODGE | C | DELTON | B | DEVILSGAIT | D |
| DALBY | D | DATIL | B | DEERTON | A | DELWIN | A | DEVILSGAIT, | B |
| DALCAN | C | DATINO | D | DEERTRAIL | C | DELYNDIA | A | DRAINED, | |
| DALCO | D | DATINO, STONY | B | DEERWOOD | B/D | DEMAR | D | OCCASIONALLY | |
| DALE | B | DATWYLER | C | DEETZ | A | DEMAST | B | DEVILSGAIT, | B |
| DALECREEK | C | DAULTON | D | DEFENBAUGH | B | DEMENT | B | DRAINED | |
| DALEVILLE | D | DAVEY | B | DEFIANCE | D | DEMING | B | DEVINE | C |
| DALHART | B | DAVEY, WARM | A | DEFLER | B | DEMKY | D | DEVISADERO | C |
| DALIAN | B | DAVIDELL | B | DEFORD | A/D | DEMNER | B | DEVOE | D |
| DALIG | B | DAVIDSON | B | DEGARMO | D | DEMOGUL | B | DEVOIGNES | D |
| DALKENA | C | DAVIS | B | DEGNER | B | DEMONA | C | DEVOIGNES, DRAINED | C |
| DALLAM | B | DAVISON | B | DEGOLA | B | DEMONTREVILLE | B | DEVOIGNES, | C |
| DALLARDSVILLE | C | DAVTONE | B | DEGRAND | B | DEMOPOLIS | C | PROTECTED | |
| DALLESPORT | B | DAWES | C | DEGREY | D | DEMOPOLIS, COBBLY | D | DEVOL | B |
| DALTON | C | DAWHOO | B/D | DEHANA | E | DEMOSS | D | DEVORE | B |
| DALUPE | B | DAWSON | A/D | DEHART | B | DEMOX | B | DEVOY | C |
| DALZELL | C | DAWTONIA | B | DEHAVEN | B | DEMPSEY | B | DEVRIES | C |
| DAMASCUS | B/D | DAXTY | C | DEHILL | B | DEMPSTER | B | DEWAR | D |
| DAMERON | B | DAY | D | DEHLINGER | B | DENAUD | B/D | DEWEY | B |
| DAMEWOOD | C | DAYBELL | A | DEJARNET | B | DENAY | B | DEWEYVILLE | D |
| DAMLUIS | C | DAYSCHOOL | B | DEKALB | C | DENBAR | C | DEWMINE | D |
| DAMON | D | DAYTON | D | DEKOOM | B | DENBY | C | DEWVILLE | B |
| DANA | B | DAYTONA | B | DEKOVEN | D | DENCO | D | DEXTER | B |
| DANAHER | C | DAYVILLE | C | DEL REY | C | DENHAWKEN | D | DIA | C |
| DANAVORE | B | DAZE | D | DELA | B | DENISON | C | DIA, WET, SALINE | D |
| DANCY | B/D | DE MASTERS | B | DELAMETER | A | DENMAN | C | DIA, WET | D |
| DANDAN | C | DEACON | B | DELANCO | C | DENMARK | D | DIABLO | D |
| DANDREA | C | DEADFALL | C | DELAND | A | DENNIS | C | DIAGULCH | B |
| DANDRIDGE | D | DEADHORSE | C | DELANEY | A | DENNOT | B | DIAMANTE | B |
| DANFORTH | B | DEADMAN | B | DELANO | B | DENNY | D | DIAMOND | D |
| DANGBERG | D | DEADWOOD | D | DELASSUS | C | DENROCK | D | DIAMOND SPRINGS | C |
| DANIA | B/D | DEADYON | B | DELCOMB | D | DENTON | D | DIAMONDVILLE | C |
| DANJER | D | DEAMA | D | DELDOTA | D | DENURE | B | DIANEY | C |
| DANKO | D | DEAN | B | DELECO | D | DENVER | C | DIANOLA | D |
| DANLEY | C | DEANDALE | D | DELENA | D | DEPALT | D | DIASPAR | B |
| DANN | C | DEARBORN | B | DELECN | C | DEPCOR | B | DIATEE | B |
| DANNEMORA | D | DEARYTON | C | DELEPLAIN | D | DEPOE | D | DIAZ | C |
| DANSKIN | B | DEATMAN | C | DELETTE | C | DEPORT | D | DIBBLE | C |
| DANT | D | DEAVER | C | DELFINA | B | DEPPY | D | DIBOLL | D |
| DANVERS | C | DEBAB | C | DELFT | B/D | DEPUTY | C | DICK | A |
| DANVILLE | C | DEBENGER | C | DELGADO | D | DERA | B | DICKERSON | D |
| DAPHNEDALE | C | DEBEQUE | B | DELHI | A | DERALLO | B | DICKEY | B |
| DAPOIN | C | DEBONE | D | DELICIAS | B | DERB | C | DICKINSON, MAP<25 | B |
| DARBONNE | B | DEBORAH | D | DELKS | C/D | DERBY | A | DICKINSON, TILL | A |
| DARBY | C | DEBS | B | DELL | C | DERECHO | B | SUBSTRATUM | |
| DARCO | A | DEBUTE | C | DELLEKER | B | DERINDA | C | DICKINSON, MAAT>50 | B |
| DARDANELLE | B | DECAN | C | DELLO, OVERWASH | A | DERLY | D | DICKINSON, MAAT<50 | B |
| DARDEN | A | DECANTEL | D | DELLO, SALINE | C | DEROUX | C | DICKMAN | A |
| DARDOOW | B | DECATHON | C | DELLO, GRAVELLY | D | DERR | C | DICKSON | C |
| DARE | D | DECATUR | B | SUBSTRATUM, WET | | DERRICK | B | DIDDY | D |
| DARFUR | B/D | DECCA | B | DELLO, | A | DES MOINES, DRY | B | DIEHLSTADT | C |
| DARGOL | D | DECCA, NONGRAVELLY | C | SALINE-ALKALI | | DES MOINES, COBBLY | C | DIERSSEN | D |
| DARIEN | C | DECHEL | D | DELLO, MODERATELY | C | DESAN | A | DIETRICH | C |
| DARKBULL | B | DECKER | C | WET | | DESART | C | DIGBY | B |
| DARKCANYON | C | DECKERVILLE | D | DELLO, DRAINED | A | DESATOYA | C | DIGGER | C |
| DARL | C | | | | | DESCALABRADO | D | DIGHTON | B |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIGIORGIO | B | DOLAND | B | DOUGAN | C | DUCHESNE | B | DURFEE | C |
| DILANSON | D | DOLBEE | C | DOUGCITY | B | DUCKHILL | D | DURHAM | B |
| DILL | B | DOLBEE, SANDY | B | DOUGCLIFF | D | DUCKREE | B | DURKEE | C |
| DILLARD | C | SUBSTRATUM | | DOUGH | D | DUCKSTON | A/D | DUROC | B |
| DILLEY | B | DOLEKEI | B | DOUGHERTY | A | DUCO | D | DURRSTEIN | D |
| DILLWYN | A | DOLEN | B | DOUGHTY | B | DUDA | A | DURST | C |
| DILMAN | C | DOLES | C | DOUGLAS | B | DUDGEN | D | DUSLER | C |
| DILTON | D | DOLLAR | C | DOUGVILLE | B | DUDLEY | D | DUSTON | A |
| DILTS | D | DOLLARD | C | DOUHIDE | D | DUEL | A | DUTCHESS | B |
| DIMAL | C | DOLLARHIDE | D | DOURO | B | DUELM | A | DUTEK | A |
| DIMEBOX | D | DOLLYCLARK | C | DOVER | B | DUETTE | A | DUTTON | C |
| DIMMICK | D | DOLMAN | C | DOVRAY | C/D | DUFF | B | DUVAL | B |
| DIMO | B | DOLPH | C | DOW | B | DUFFAU | B | DUXBURY | A |
| DIMYAW | C | DOLUS | C | DOWAGIAC | B | DUFFER | C | DUZEL | C |
| DINA | C | DOME | B | DOWDE | B | DUFFERN | A | DWIGHT | D |
| DINCO | B | DOMELL | B | DOWELLTON | D | DUFFIELD | B | DWORSHAK | B |
| DINES | B | DOMENGINE | C | DOWNATA | D | DUFFSON | B | DWYER | A |
| DINEVO | B | DOMERIE | B | DOWNER | B | DUFFYMONT | C | DYE | D |
| DINGLE | C | DOMEZ | B | DOWNEY | B | DUFORT | B | DYKE | B |
| DINGLISHNA | D | DOMINGUEZ | C | DOWNEYVILLE | D | DUFUR | B | DYLAN | D |
| DINGMAN | C | DOMINIC | B | DOWNS | B | DUGGINS | C | DYRENG | D |
| DINKELMAN | B | DOMINO | C | DOYCE | B | DUGOUT | D | EACHUS | B |
| DINKELS | B | DOMINSON | A | DOYCE, LOAMY | C | DUGWAY | C | EACHUSTON | D |
| DINNEN | B | DOMO | B | SUBSTRATUM | | DUKES | A | EAD | C |
| DINSDALE | B | DONA ANA | B | DOYCE, MODERATELY | C | DULAC | C | EAGAR | B |
| DINUBA | C | DONAHUE | C | WET | | DULCE | D | EAGLECONE | B |
| DINWOODY | B | DONALD | C | DOYCE, SANDY | C | DULEYLAKE | C | EAGLEPASS | D |
| DINZER | B | DONALDSON | B | SUBSTRATUM | | DULLES | D | EAGLEROCK | B |
| DIOBSUD | C | DONAVAN | B | DOYLESTOWN | D | DULUTH | B | EAGLEVILLE | D |
| DIOXICE | B | DONERAIL | C | DOYN | D | DUMAS | B | EAGLEWING | B |
| DIPMAN | D | DONEY | C | DRA | C | DUMFRIES | B | EAKIN | B |
| DIPSEA | B | DONICA | A | DRAGE | B | DUMMERSTON | B | EALY | B |
| DIQUE | B | DONICA, LOAMY | B | DRAGOON | C | DUMONT | B | EAPA | B |
| DIREGO | D | SURFACE | | DRAGSTON | C | DUN GLEN | B | EARCREE | B |
| DISABEL | C | DONIPHAN | B | DRAKE | B | DUNBAR | D | EARLE | D |
| DISAUTEL | B | DONKEHILL | D | DRAKNAB | A | DUNBARTON | D | EARLMONT | D |
| DISCO | B | DONLONTON | C | DRALL | B | DUNBRIDGE | B | EARLMONT, DRAINED | C |
| DISHNER | D | DONNA | D | DRANYON | B | DUNC | C | EARP | B |
| DISHPAN | C | DONNAN | C | DRAPER | C | DUNCAN | D | EARSMAN | D |
| DISTELL | C | DONNARDO | B | DRAX | B | DUNCANNON | B | EASBY | D |
| DISTERHEFF | C | DONNEL | B | DRAX, WET | C | DUNCKLEY | B | EASLEY | C |
| DISTON | C | DONNELLY | A | DREDGE | B | DUNCOM | D | EASPUR | B |
| DISWOOD | D | DONNER | C | DRESDEN | B | DUNDAS | B/D | EAST FORK | C |
| DITCHCAMP | C | DONNING | D | DRESSLER | C | DUNDAY | A | EAST LAKE | A |
| DITHOD | C | DONNYBROOK | D | DREWING | D | DUNDEE | C | EASTABLE | B |
| DITNEY | C | DOODLELINK | B | DREWS | B | DUNELLEN | B | EASTCAN | B |
| DIVERS | B | DOOLEY | C | DREXEL | B | DUNFORD | C | EASTCHOP | A |
| DIVIDE | B | DOOLIN | D | DRIFTWOOD | C/D | DUNGENESS | B | EASTGATE | B |
| DIVOT | C | DOONE | B | DRIGGS | B | DUNKIRK | B | EASTLAND | B |
| DIX | A | DOOR | B | DRISCOLL | C | DUNLAP | C | EASTON | D |
| DIXALETA | D | DOOWAK | A | DRIT | B | DUNLATOP | B | EASTPORT | A |
| DIXBORO | B | DORA | B/D | DRIVER | C | DUNMORE | B | EASTWELL | D |
| DIXIE | C | DORAN | C | DROEM | C | DUNN | A | EASTWOOD | D |
| DIXMONT | C | DORB | C | DROVAL | C | DUNNING | D | EATON | D |
| DIXON | B | DORCHESTER | B | DRUM | C | DUNNLAKE | D | EAUGALLIE | B/D |
| DIXONVILLE | C | DORERTON | B | DRUMMER | B/D | DUNNVILLE | B | EAUGALLIE, | D |
| DIYOU | C | DORMONT | C | DRUMMOND | D | DUNOIR | B | DEPRESSIONAL | |
| DOAK | B | DORNA | B | DRURY | B | DUNPHY | C | EAUPLEINE | B |
| DOAKUM | B | DOROSHIN | D | DRY CREEK | C | DUNPHY, DRAINED | B | EBA | C |
| DOBBINS | C | DOROTHEA | C | DRY LAKE | C | DUNPHY, HARDPAN | B | EBAL | B |
| DOBBS | C | DOROVAN | D | DRYADINE | C | SUBSTRATUM | | EBBERT | C/D |
| DOBEL | D | DORPER | D | DRYBURG | B | DUNSMUIR | B | EBBS | B |
| DOBENT | C | DORRANCE | A | DRYDEN | B | DUNSMUIR, | C | EBIC | D |
| DOBROW | D | DORS | B | DRYN | C | NONGRAVELLY | | EBODA | B |
| DOBY | D | DORSET | B | DRYVALLEY | C | DUNTON | C | EBODA, STONY | C |
| DOCAS | B | DOSAMIGOS | D | DU PAGE | B | DUNUL | A | EBON | C |
| DOCDEE | D | DOSPALOS | D | DUANE | B | DUPEE | C | EBRO | D |
| DOCENA | C | DOSS | C | DUART | C | DUPLIN | C | ECCLES | B |
| DOCKERY | C | DOSSMAN | B | DUBAKELLA | C | DUPO | C | ECHARD | D |
| DOCPAR | B | DOTEN | D | DUBAKELLA, | C | DUPONT | D | ECHAW | A |
| DOCT | C | DOTHAN | B | GRAVELLY | | DUPREE | D | ECHEMOOR | C |
| DODES | B | DOTLAKE | D | DUBAKELLA, COBBLY | C | DURADOS | A | ECKERT | D |
| DODGE | B | DOTSERO | B | DUBAY | B | DURALDE | C | ECKLEY | B |
| DODGEVILLE | B | DOTTA | B | DUBBS | B | DURAND | B | ECKMAN | B |
| DODSON | C | DOTY | B | DUBBS, FLOODED | C | DURANGO | B | ECKRANT | D |
| DOEL | C | DOUCETTE | B | DUBINA | C | DURANT | D | ECKVOLL | B |
| DOGER | A | DOUDLE | B | DUBLON | B | DURAZO | A | ECLIPSE | B |
| DOGIECREEK | B | DOUDS | B | DUBOIS | C | DURBIN | D | ECOLA | C |
| DOGUE | C | DOUGAL | D | DUBUQUE | B | DURELLE | B | ECON | B |

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ECONFINA | A | ELBOWLAKE | B | ELRICK | B | ENDCHVILLE, | C | ESTER | D |
| ECTOR | D | ELBURN | B | ELRIN | B | DRAINED | | ESTER, THAWED | C |
| EDALGO | C | ELBUTTE | D | ELROSE | B | ENOLA | B | ESTERO | D |
| EDDINGS | B | ELCO | B | ELS | A | ENON | C | ESTES | D |
| EDDS | B | ELD | B | ELSAH | B | ENOREE | D | ESTESLAKE | C |
| EDDY | C | ELDEAN | B | ELSIE | B | ENOS | C | ESTHERVILLE | B |
| EDEN | C | ELDER | B | ELSINBORO | B | ENOSBURG | C | ESTO | B |
| EDENBOWER | D | ELDER HOLLOW | D | ELSMERE | A | ENSENADA | B | ESTRELLA | B |
| EDENTON | C | ELDERON | B | ELSTON | B | ENSIGN | D | ETACH | C |
| EDFRO | D | ELDERON, STONY | A | ELTREE | B | ENSLEY | B/D | ETCHEN | C |
| EDGAR | B | ELDGIN | B | ELTSAC | D | ENSTROM | B | ETELKA | C |
| EDGE | D | ELDON | B | ELVE | B | ENTENTE | B | ETHAN | B |
| EDGEHILL | C | ELDORADO | B | ELVEDERE | C | ENTERO | D | ETHANIA | B |
| EDGELEY | C | ELDRIDGE | C | ELVERS | B/D | ENTERPRISE | B | ETHELMAN | B |
| EDGEMONT | B | ELECTRA | C | ELVIRA | B/D | ENTIAT | D | ETHETE | B |
| EDGEWATER | C | ELEROY | B | ELWELL | C | ENTMOOT | C | ETHETE, SALINE | C |
| EDGEWICK | C | ELEVA | B | ELWHA | C | ENVILLE | C | ETHRIDGE | C |
| EDGINGTON | C/D | ELFCREEK | C | ELWOOD | C | ENVOL | D | ETIL | A |
| EDINA | D | ELFRIDA | B | ELY | B | ENZIAN | D | ETOE | B |
| EDINBURG | C | ELGEE | A | ELYSIAN | B | EOJ | C | ETOILE | D |
| EDISTO | C | ELHINA | C | ELZINGA | B | EOLA | D | ETOWAH | B |
| EDLIN | B | ELIJAH | C | EMBAL | B | EPHRAIM | C | ETOWN | B |
| EDLOE | B | ELINDIO | C | EMBARGO | C | EPHRATA | B | ETSEL | D |
| EDMINSTER | D | ELIOAK | C | EMBDEN | B | EPIKOM | D | ETTA | B |
| EDMONDS | D | ELIZA | D | EMBERTON | C | EPLEY | C | ETTER | B |
| EDMORE | D | ELK | B | EMBLEM | B | EPOKE | B | ETTERSBURG | B |
| EDMUND | D | ELK HOLLOW | B | EMBRY | B | EPOT | B | ETTRICK | B/D |
| EDMUNDSTON | B | ELK MOUNTAIN | B | EMBUDO | B | EPOUFETTE | B/D | EUBANKS | B |
| EDNA | D | ELKA | C | EMDENT | D | EPPING | D | EUCLID | C |
| EDNEYTOWN | B | ELKADER | B | EMDENT, BEDROCK | C | EPSIE | D | EUDORA | B |
| EDNEYVILLE | B | ELKCREEK | C | SUBSTRATUM, | | EPVIP | D | EUER | B |
| EDOM | C | ELKHART | B | DRAINED | | ECUIS | D | EUFAULA | A |
| EDROY | D | ELKHILLS | B | EMDENT, DRAINED | C | ERA | B | EUHARLEE | C |
| EDSON | C | ELKHORN | B | EMERALD | B | EPAKATAK | C | EULONIA | C |
| EDWARDS | B/D | ELKINS | D | EMERALDA | D | ERAM | C | EUNOLA | C |
| EEL | B | ELKINSVILLE | B | EMERSON | B | ERAMOSH | D | EUREKA | D |
| EELCOVE | D | ELKMOUND | D | EMIGRANT | C | ERBER | C | EUSBIO | C |
| EELPOINT | D | ELKNER | B | EMIGRATION | D | ERCAN | B | EUSTIS | A |
| EEP | C | ELKOL | D | EMILY | B | ERD | D | EUTAW | D |
| EFFIE | C | ELKRIDGE | B | EMLIN | C | ERICSON | B | EVADALE | D |
| EFFINGTON | D | ELKSEL | C | EMMA | C | ERIE | C | EVANGELINE | C |
| EGAM | C | ELKTON | C/D | EMMERT | A | ERIN | B | EVANS | B |
| EGAN | B | ELLABELLE | D | EMMET | B | ERNEM | D | EVANSHAM | D |
| EGAS | D | ELLEDGE | C | EMMONS | B | ERNEST | C | EVANSTON | B |
| EGBERT | D | ELLEN | B | EMORY | B | ERNO | B | EVANSVILLE | B/D |
| EGBERT, STRATIFIED | C | ELLETT | D | EMOT | B | ERRAMOUSPE | C | EVANT | D |
| SUBSTRATUM | | ELLIBER | A | EMPEDRADO | B | ERVIDE | C | EVARD | B |
| EGBERT, MODERATELY | C | ELLICOTT | A | EMPEYVILLE | C | ESCABOSA | C | EVARO | B |
| WET | | ELLINGTON | B | EMPIRE | B | ESCALANTE | B | EVART | D |
| EGBERT, DRAINED | C | ELLINOR | C | EMPORIA | C | ESCAMBIA | C | EVENDALE | C |
| EGBERT, SANDY | C | ELLIOTT | C | EMRICK | B | ESCANABA | A | EVERETT | A |
| SUBSTRATUM | | ELLIOTTSVILLE | B | EMRO | C | ESCANO | C | EVERETT, HARD | B |
| EGBERT, SLOPING | C | ELLIS | D | ENBAR | B | ESCARLO | B | SUBSTRATUM | |
| EGELAND | B | ELLISFORDE | B | ENBAR, WET | D | ESCONDIDO | C | EVERGLADES | B/D |
| EGINBENCH | C | ELLISVILLE | B | ENCAMPMENT | B | ESHAMY | B | EVERLY | B |
| EGLIN | A | ELLOAM | D | ENCHANTED | B | ESLENDO | D | EVERMAN | C |
| EGYPT | D | ELLOREE | D | ENCIERRO | D | ESMERALDA | B | EVERSON | D |
| EICKS | C | ELLSWORTH | C | ENCINA | B | ESMOND | B | EVERWHITE | C |
| EIGHTLAR | D | ELLUM | C | ENDCAV | C | ESPARTO | B | EVESBORO | A |
| EIGHTMILE | D | ELLZEY | B/D | ENDERS | C | ESPELIE | B/D | EVRIDGE | B |
| EILERTSEN | B | ELM LAKE | A/D | ENDERSBY | B | ESPIL | D | EWA | B |
| EITZEN | B | ELMDALE | B | ENDICOTT | C | ESPINAL | A | EWA, BEDROCK | C |
| EKAH | C | ELMENDORF | D | ENDLICH | B | ESPINOSA | B | SUBSTRATUM | |
| EKALAKA | B | ELMINA | C | ENDSAW | C | ESPINT | D | EWALL | A |
| EKIM | C | ELMIRA | A | ENERGY | B | ESPLIN | D | EXCELSIOR | B |
| EKRUB | D | ELMONT | B | ENET | B | ESPY | C | EXCHEQUER | D |
| EL DARA | B | ELMORE | B | ENFIELD | B | ESQUATZEL | B | EXCLOSE | B |
| EL PECO | C | ELMRIDGE | C | ENGELHARD | B/D | ESRO | D | EXEL | C |
| EL RANCHO | B | ELMVILLE | B | ENGETT | A | ESRO, MODERATELY | C | EXETER | C |
| EL SOLYO | C | ELMWOOD | C | ENGLE | B | WET | | EXETER, THICK | B |
| ELAM | A | ELNIDO | C | ENGLEWOOD | C | ESS | B | SOLUM | |
| ELAM, HARDPAN | B | ELNORA | B | ENKO | C | ESSAL | B | EXETTE | B |
| SUBSTRATUM | | ELOCHOMAN | B | ENKO, OVERBLOWN | B | ESSEN | C | EXIRA | B |
| ELANDCO | B | ELOCIN | D | ENLOE | D | ESSEX | C | EXLINE | D |
| ELBA | C | ELOIKA | B | ENNING | D | ESSEXVILLE | A/D | EXRAY | D |
| ELBAVILLE | B | ELOMA | C | ENNIS | B | ESTACADO | B | EXUM | C |
| ELBERT | D | ELPAM | D | ENOCH | C | ESTACION | B | EYAK | C |
| ELBETH | B | ELPEDRO | B | ENOCHVILLE | D | ESTATE | C | EYERBOW | C |
| ELBON | B | ELRED | B/D | | | ESTELLINE | B | EYLAU | C |

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MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EYOTA | A | FARRAGUT | C | FETTIC | D | FLATRON | D | FORKWOOD | B |
| EYRE | D | FARRAR | B | FETZER | C | FLATTOP | D | FORMADER | C |
| EZBIN | B | FARRELL | B | FEZ | C | FLAXTON | B | FORMAN | B |
| FABIUS | B | FARRENBURG | B | FIANDER | D | FLEAK | D | FORMDALE | B |
| FACEVILLE | B | FARROT | C | FIANDER, DRAINED | C | FLEER | A/D | FORNEY | D |
| FACEY | B | FARSON | B | FIAT | C | FLEISCHMANN | D | FORNOR | B |
| FACTORY | C | FARSON, WET | C | FIDALGO | C | FLEMING | C | FORREST | C |
| FACTORY, MOIST | B | FARVA | C | FIDDLER | C | FLEMINGTON | D | FORSEER | C |
| FADDIN | D | FARVANT | D | FIDDLETOWN | B | FLETCHER | B | FORSEY | B |
| FADOLL | B | FASHING | D | FIDDYMENT | D | FLEWSIE | B | FORSGREN | C |
| FAGAN | C | FASKIN | B | FIELD | C | FLEX | D | FORSYTH | A |
| FAGASA | C | FATHOM | A | FIELDCREEK | B | FLO | A | FORT COLLINS | B |
| FAHEY | B | FATIMA | B | FIELDING | B | FLOER | D | FORT MEADE | A |
| FAIM | C | FATTIG | C | FIELDON | B/D | FLOKE | D | FORT MOTT | A |
| FAIM, MOIST | B | FAUNCE | A | FIFER | D | FLOM | B/D | FORT ROCK | C |
| FAIRBANKS | B | FAUNSDALE | D | FIFIELD | C | FLOMATON | A | FORTANK | C |
| FAIRBURN | D | FAUQUIER | C | FILION | D | FLOMOT | B | FORTESCUE | C/D |
| FAIRCHILD | C | FAUSSE | D | FILIRAN | D | FLOODWOOD | B | FORTUNA | D |
| FAIRDALE | B | FAVRET | C | FILLMORE | D | FLORAHOME | A | FORTWINGATE | C |
| FAIRFAX | B | FAWIN | B | FINCASTLE | C | FLORALA | C | FORTYFOUR | C |
| FAIRFIELD | B | FAX | C | FINCH | C | FLORENCE | C | FORVIC | C |
| FAIRHAVEN | B | FAXON | B/D | FINCHFORD | A | FLORESVILLE | C | FORWARD | B |
| FAIRLIE | D | FAYETTE | B | FINDOUT | D | FLORIDANA | B/D | FOSS | B |
| FAIRLO | B | FAYETTEVILLE | B | FINGAL | C | FLORIDANA, | D | FOSSILON | D |
| FAIRMOUNT | D | FAYWOOD | C | FINGEROCK | D | DEPRESSIONAL | | FOSSUM | A/D |
| FAIRPLAY | B | FE | D | FINLAND | C | FLORIDANA, FLOODED | D | FOSTER | C |
| FAIRPOINT | C | FEARS | B | FINLEY | B | FLORIN | C | FOSTORIA | B |
| FAIRPORT | C | FEATHERLEGS | B | FINLEYPOINT | B | FLORISSANT | C | FOUNTAIN | D |
| FAIRWAY | C | FEATHERSTONE | D | FINNERTY | D | FLORITA | B | FOUR STAR | C |
| FAIRYDELL | C | FEDJI | A | FINO | B | FLOTAG | B | FOUR STAR, DRAINED | B |
| FAIRYLAWN | D | FEDORA | B/D | FINOL | C | FLOWELL | C | FOURCHE | B |
| FAJARDO | C | FEDSCREEK | B | FIONE | B | FLOWEREE | B | FOURLOG | D |
| FALAYA | D | FELAN | B | FIPADA | C | FLOYD | B | FOURME | B |
| FALBA | D | FELCHER | B | FIREBALL | B | FLUETSCH | B | FOURMILE | B |
| FALCON | D | FELDA | B/D | FIREBOX | B | FLUGLE | B | FOX | B |
| FALFA | C | FELDA, | D | FIRESTEEL | B | FLUKER | C | FOXCREEK | D |
| FALFURRIAS | A | DEPRESSIONAL | | FIRESTONE | C | FLUVANNA | C | FOXCREEK, DRAINED | C |
| FALK | C | FELICITY | A | FIRMAGE | B | FLYBOW | D | FOXHOME | B |
| FALKIRK | B | FELIPE | D | FIRO | D | FLYGARE | B | FOXMOUNT | C |
| FALKNER | C | FELIZ | B | FIROKE | B | FLYNN | B | FOXOL | D |
| FALLBROOK | B | FELKER | B | FIRSTVIEW | C | FLYNNCOVE | B | FOXTON | C |
| FALLCREEK | C | FELLOWSHIP | D | FIRTH | C | FOAD | C | FOXWORTH | A |
| FALLERT | B | FELOR | B | FIRTH, DRAINED | B | FOARD | D | FRADDLE | B |
| FALLON | C | FELT | B | FISHERMAN | D | FOEHLIN | B | FRAILEY | B |
| FALLON, NONFLOODED | B | FELTA | C | FISHERS | B | FOIDEL | B | FRAILTON | D |
| FALLSAM | D | FELTHAM | B | FISHFIN | D | FOLA | B | FRAM | B |
| FALLSINGTON | B/D | FELTNER | D | FISHHOOK | D | FOLDAHL | B | FRANCIS | A |
| FALOMA | D | FELTON | B | FISHLAKE | D | FOLEY | D | FRANCISCAN | C |
| FALSEN | A | FELTONIA | B | FISHPOT | C | FOLLET | D | FRANCISQUITO | C |
| FALULA | D | FENCE | B | FISHROCK | D | FOMSENG | C | FRANCITAS | D |
| FANAL | C | FENDALL | C | FISHTRAP | D | FONDA | D | FRANDSEN | B |
| FANCHER | C | FENELON | C | FISK | B | FONDIS | C | FRANKFORT | C |
| FANDANGLE | C | FENN | D | FITCHVILLE | C | FONNER | B | FRANKIRK | C |
| FANDOW | D | FENSTER | B | FITZGERALD | B | FONS | B | FRANKLIN | B |
| FANG | B | FENWICK | C | FITZHUGH | B | FONTANA | B | FRANKSTOWN | B |
| FANNIN | B | FENWOOD | B | FIVEBLOCK | C | FONTREEN | B | FRANKTOWN | D |
| FANNO | C | FERA | C | FIVEMILE | B | FOPIANO | D | FRANKVILLE | B |
| FANSHAW | B | FERDELFORD | C | FIVEMILE, SALINE | C | FORADA | B/D | FRATERNIDAD | D |
| FANTZ | C | FERDINAND | C | FIVEOH | B | FORAKER | D | FRAVAL | C |
| FANU | B | FEREBEE | D | FIVEPINE | D | FORBAR | D | FRAVAL, GRAVELLY | B |
| FAPS | C | FERGUS | B | FIVES | B | FORBES | C | FRAZER | C |
| FARAWAY | D | FERN CLIFF | B | FIVESPRINGS | C | FORBESVILLE | C | FRAZERTON | B |
| FARB | D | FERNANDO | B | FLACO | C | FORBING | D | FRED | C |
| FARBER | B | FERNCREEK | D | FLAGG | B | FORD | D | FREDENSBORG | C |
| FARGO | D | FERNDALE | B | FLAGLER | B | FORDICE | B | FREDERICK | B |
| FARISITA | D | FERNEY | D | FLAGSTAFF | D | FORDNEY | A | FREDON | C |
| FARLAND | B | FERNHAVEN | B | FLAK | C | FORDNEY, WET | C | FREDONIA | C |
| FARLOW | B | FERNLEY | C | FLAMBEAU | B | FORDTRAN | C | FREDONYER | C |
| FARLOW, HIGH | C | FERNOW | B | FLAMING | A | FORDUM | D | FREE | B/D |
| RAINFALL | | FERNPOINT | B | FLANAGAN | B | FORDVILLE | B | FREEBURG | C |
| FARMELL | B | FERNWOOD | B | FLANDREAU | B | FORELAND | D | FREECE | D |
| FARMINGTON | C | FERRELO | B | FLANE | C | FORELLE | B | FREEDOM | C |
| FARMSWORTH | D | FERRIS | D | FLANLY | B | FORESMAN | B | FREEDOM, SALINE | B |
| FARMTON | D | FERROBURRO | D | FLASHER | D | FORESTBURG | A | FREEHOLD | B |
| FARNHAM | B | FERRON | D | FLAT HORN | B | FORESTDALE | D | FREELAND | C |
| FARNHAMTON | C | FERTALINE | D | FLATHEAD | B | FORESTER | C | FREEMAN | C |
| FARNUF | B | FERTEG | C | FLATIRONS | C | FORESTON | C | FREEMANVILLE | B |
| FARNUF, WET | C | FESTINA | B | FLATNOSE | B | FORGAY | B | FREEON | B |
| FARNUM | B | FETT | D | FLATONIA | D | FORK | C | FREER | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FREEST | C | FULSHEAR | C | GAPCOT | D | GED | D | GILISPIE | D |
| FREESTONE | C | FULSTONE | D | GAPO | D | GEE | C | GILLAND | C |
| FREETOWN | D | FULTON | D | GAPO, DRAINED | C | GEEBURG | C | GILLENDER | D |
| FREEWATER | B | FULTS | D | GAPPMAYER | B | GEEMORE | C | GILLIAM | C |
| FREEZENER | B | FULWIDER | D | GARA | C | GEER | B | GILLIGAN | B |
| FREEZEOUT | B | FUNTER | D | GARBER | B | GEERTSEN | B | GILLS | C |
| FRELSBURG | D | FUQUAY | B | GARBO | B | GEFO | A | GILLSBURG | C |
| FREMONT | C | FURNISS | D | GARBUTT | B | GEISEL | B | GILMAN | B |
| FREN | B | FURSHUR | D | GARCENO | C | GEKE | C | GILMORE | C |
| FRENCH | C | FURY | D | GARCES | D | GELKIE | B | GILPAR | B |
| FRENCHCREEK | B | FURY, DRAINED | C | GARCIA | C | GEM | C | GILPIN | C |
| FRENCHJOHN | C | FUSULINA | D | GARCITAS | C | GEM, STONY | D | GILROY | C |
| FRENCHMAN | B | FUSUVAR | D | GARCON | C | GEMID | C | GILSTON | B |
| FRENCHTOWN | D | GAASTRA | C | GARDELLA | D | GENSON | B | GILT EDGE | D |
| FRESHWATER | D | GABALDON | B | GARDENA | B | GENAW | D | GIMLETT | B |
| FRESNO, | D | GABBS | C | GARDINER | A | GENEGRAF | B | GINAT | D |
| SALINE-ALKALI | | GABBVALLY | D | GARDNER'S FORK | B | GENESEE | B | GINEX | D |
| FRESNO, THICK | C | GABEL | C | GARDNERVILLE | C | GENEVA | B | GINGER | D |
| SOLUM | | GABICA | D | GARDONE | A | GENOA | D | GINI | B |
| FRENA | B | GABINO | D | GAREY | B | GENOLA | B | GINLAND | D |
| FREZNIK | D | GACEY | D | GARFAN | B | GENTILLY | D | GINNIS | C |
| FRIANA | D | GACHADO | D | GARFIELD | C | GENTRY | D | GINSER | C |
| FRIANT | D | GACIBA | D | GARHILL | D | GEOCONDA | C | GIRARD | D |
| FRIDLO | C | GADDES | C | GARIPER | C | GEOHROCK | B | GIRARDOT | D |
| FRIEDLANDER | C | GADDY | A | GARITA | B | GEORGECREEK | B | GIRD | B |
| FRIEDMAN | C | GADSDEN | D | GARLAND | B | GEORGETOWN | D | GIST | D |
| FRIENDS | C | GADSDEN, WET | C | GARLET | B | GEORGEVILLE | B | GITAKUP | C |
| FRIENDSHIP | A | SUBSTRATUM | | GARLOCK | B | GEORGIA | C | GITAM | D |
| FRIES | D | GADWELL | C | GARMON | C | GEPFORD | D | GIVIN | C |
| FRIESLAND | B | GAGEBY | B | GARMORE | B | GEPP | B | GLACIERCREEK | A |
| FRIJOLES | B | GAGETOWN | B | GARNEL | D | GEPPERT | C | GLADDEN | B |
| FRINDLE | C | GAGIL | B | GARNER | D | GERALD | D | GLADEL | D |
| FRINES | C | GAHEE | B | GARNES | B | GERBER | D | GLADEVILLE | D |
| FRIO | B | GAIB | D | GARO | D | GERDRUH | D | GLADEWATER | D |
| FRIONA | C | GAILA | B | GARR | D | GERING | B | GLADSTONE | B |
| FRIOTON | C | GAINES | C | GARRETSON | B | GERLACH | D | GLADWIN | A |
| FRIPP | A | GAINESBORO | C | GARRETT | B | GERLANE | B | GLASGOW | C |
| FRISCO | B | GAINESVILLE | A | GARRISON | B | GERLE | B | GLASSNER | D |
| FRISITE | B | GALATA | D | GARROCHALES | D | GERMANTOWN | B | GLEAN | B |
| FRITZ | B | GALBRETH | D | GARSID | C | GERMANY | B | GLEASON | B |
| FRIZZELL | C | GALCHUIT | C | GARTON | C | GERMER | C | GLEBE | C |
| FROBERG | D | GALE | B | GARVESON | D | GERONI | B | GLEN | B |
| FRODO | D | GALEN | B | GARVIN | D | GERRARD | C | GLENBAR | B |
| FROHMAN | C | GALEPPI | B | GARWIN | B/D | GERRARD, DRAINED | B | GLENBAR, WET | C |
| FROLIC | B | GALESTINA | C | GARZA | B | GERST | D | GLENBERG | B |
| FROLIC, | C | GALESTOWN | A | GARZONA | D | GESSIE | B | GLENBLAIR | C |
| ELEVATION<8000 | | GALEY | B | GAS CREEK | D | GESSNER | B/D | GLENBROOK | D |
| FROLIC, FLOODED | C | GALILEE | C | GASCONADE | D | GESTRIN | B | GLENCARB | B |
| FRONDORF | B | GALISTEO | C | GASIL | B | GETAWAY | B | GLENCARB, WET, | C |
| FRONTENAC | B | GALISTEO, | D | GASQUET | B | GETCHELL | C | SALINE | |
| FRONTIER | C | SALINE-ALKALI | | GASSAWAY | D | GETRAIL | D | GLENCOE | B/D |
| FRONTON | D | GALLAND | D | GASSVILLE | C | GETTYS | C | GLENCOE, PONDED | D |
| FROST | D | GALLATIN | C | GASTON | C | GETZVILLE | D | GLENDALE | B |
| FROZARD | C | GALLEGOS | B | GAT | B | GEWTER | C | GLENDALE, WET | C |
| FRUITA | B | GALLEN | B | GATES | B | GEYSEN | C | GLENDALE, RARELY | C |
| FRUITFIELD | A | GALLIA | B | GATESON | C | GIBBLER | C | FLOODED | |
| FRUITHURST | C | GALLIME | B | GATEVIEW | B | GIBBON | B | GLENDERSON | B |
| FRUITLAND | B | GALLION | B | GATEWAY | C | GIBBONSCREEK | C | GLENDIVE | B |
| FRUITLAND, | C | GALLMAN | B | GATEWOOD | C | GIBBS | D | GLENDORA | A/D |
| MODERATELY WET | | GALLUP | B | GATLIN | B | GIBNEY | C | GLENEDEN | D |
| FRUITLAND, WET | C | GALOO | C/D | GATOR | D | GIBSONVILLE | D | GLENELG | B |
| FRYE | C | GALT | D | GATTON | D | GIBWELL | C | GLENFORD | C |
| FRYEBURG | B | GALVA | B | GAULDY | B | GIDEON | C | GLENHALL | B |
| FT. DRUM | C | GALVESTON | A | GAULEY | C | GIELOW | C | GLENHAM | B |
| FT. GREEN | D | GALVEZ | C | GAVEL | C | GIFFORD | D | GLENMEN | B |
| FUBAR | C | GALVIN | D | GAVILAN | C | GIGGER | C | GLENMORA | C |
| FUBBLE | D | GALWAY | B | GAVINS | D | GILA | B | GLENNALLEN | C |
| FUEGO | C | GAMBLER | B | GAVIOTA | D | GILBERT | D | GLENOMA | B |
| FUEGOSTA | D | GAMBOA | B | GAY | B/D | GILBOA | B | GLENPOOL | A |
| FUERA | C | GAMGEE | C | GAYLESVILLE | D | GILBY | B | GLENRIO | D |
| FUGAWEE | B | GANADO | D | GAYLORD | C | GILCHRIST | A | GLENROSE | B |
| FUGHES | C | GANCE | C | GAYNOR | C | GILCO | B | GLENROSS | D |
| FULCHER | C | GANDO | D | GAYVILLE | D | GILCREST | B | GLENSTED | D |
| FULDA | C/D | GANIS | D | GAZELLE | D | GILEAD | C | GLENTON | B |
| FULLAM | C | GANNETT | D | GAZOS | C | GILES | B | GLENTON, WET | C |
| FULLER | D | GANSNER | C | GAZWELL | C | GILFORD | B/D | GLENTOSH | A |
| FULLERTON | B | GANSNER, PONDED | D | GEARHART | A | GILFORD, | D | GLENVIEW | B |
| FULMER | D | GANY | B | GEARY | B | STRATIFIED | | GLENVILLE | C |
| FULMER, DRAINED | C | GAPBUTTE | B | GEBSON | B | SUBSTRATUM | | GLENYON | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| GLOHM | C | GODSEFLATS | D | GRANGEVILLE, | B | GRELLTON | B | GUAYABOTA | D |
| GLORIA | D | GOOSMUS | B | DRAINED | | GRENADA | C | GUAYAMA | D |
| GLOUCESTER | A | GORDO | B | GRANGEVILLE, | B | GRENADIER | B | GUBE | C |
| GLOVER | C/D | GORE | D | OCCASIONALLY | | GRENVILLE | B | GUBEN | B |
| GLYNDON | B | GOREEN | D | FLOODED | | GRESHAM | C | GUCKEEN | C |
| GLYNN | C | GORGAS | D | GRANILE | B | GRETDIVID | B | GUDGEL | C |
| GLYNWOOD | C | GORGONIO | A | GRANMOUNT | C | GREWINGK | C | GUDGREY | B |
| GLYPHS | B | GORHAM | B/D | GRANO | D | GREYBACK | B | GUELPH | B |
| GOBAR | B | GORIN | C | GRANSHAW | B | GREYBO | B | GUEMES | B |
| GOBERNADOR | D | GORING | C | GRANT | B | GREYBULL | C | GUENOC | C |
| GOBINE | B | GORMAN | C | GRANTFORK | D | GREYEAGLE | D | GUENTHER | B |
| GOBLE | C | GORSKEL | D | GRANTHAM | D | GREYS | B | GUERNSEY | C |
| GOBLIN | D | GORST | D | GRANTSBURG | C | GRIBBLE | D | GUERO | C |
| GOCHEA | B | GORUS | B | GRANTSDALE | B | GRIDELL | D | GUERRERO | A |
| GODDARD | B | GORZELL | B | GRANVILLE | B | GRIDGE | D | GUEST | D |
| GODDE | D | GOSA | B | GRANYON | B | GRIDLEY | C | GUFFEY | C |
| GODDING | C | GOSHEN | B | GRANZAN | B | GRIETA | B | GUFFIN | D |
| GODECKE | D | GOSHUTE | D | GRAPEVINE | B | GRIEVES | B | GUGUAK | D |
| GODFREY | D | GOSINTA | C | GRAPIT | B | GRIFFITH | D | GUILDER | C |
| GODWIN | D | GOSLIN | B | GRASHUL | C | GRIFFY | B | GUISER | B |
| GOEMMER | C | GOSNEY | D | GRASMERE | B | GRIFTON | D | GULER | B |
| GOESLING | B | GOSPER | B | GRASSNA | B | GRIGSBY | B | GULF | B/D |
| GOESSEL | D | GOSPORT | C | GRASSVAL | D | GRIGSTON | B | GULKANA | B |
| GOFFPEAK | B | GOSS | B | GRASSVALLEY | D | GRIMM | A | GULNARE | D |
| GOGEBIC | B | GOSUMI | D | GRASSY BUTTE | A | GRIMM, STONY | B | GUMBLE | D |
| GOL | D | GOTEBO | B | GRASSYCONE | A | GRIMSLEY | B | GUMBOOT | D |
| GOL | C | GOTHAM | A | GRAT | D | GRIMSTAD | B | GUMBOOT, DRAINED | C |
| GOL, NONSTONY | C | GOTHARD | C | GRATTAN | A | GRIMSTONE | B | GUNBARREL, SALINE | D |
| GOL, GRAVELLY | C | GOTHENBURG | D | GRAUFELS | C | GRINA | D | GUNBARREL, DRAINED | A |
| GOLCONDA | C | GOTHIC | C | GRAYDEN | D | GRINDALL | D | GUND | C |
| GOLD CREEK | D | GOTHO | C | GRAVELTON | B/D | GRINDBROOK | C | GUNDY | C |
| GOLDBERG | D | GOTHO, MODERATELY | B | GRAVIER | B | GRINDSTONE | C | GUNLOCK | C |
| GOLDENDALE | B | WET | | GRAYBERT | B | GRINK | C | GUNN | B |
| GOLDFINCH | D | GOTHO, COOL | B | GRAYCALM | A | GRINROD | C | GUNNEL | D |
| GOLDHEAD | B/D | GOULDING | D | GRAYFORD | B | GRISDALE | B | GUNSIGHT | B |
| GOLDHILL | D | GOULDSBORO | D | GRAYLAND | D | GRISWOLD | B | GUNSONE | D |
| GOLDHILL, LOAMY | C | GOURDIN | C | GRAYLAND, DRAINED | C | GRITNEY | C | GUNSTOCK | C |
| SUBSTRATUM | | GOURLEY | C | GRAYLING | A | GRIVER | C | GUNTER | B |
| GOLDLAKE | B | GOVE | B | GRAYLOCK | A | GRIVER, WET | D | GUP | C |
| GOLDMAN | C | GOWEN | B | GRAYLOCK, STONY | B | GRIVER, DRAINED | B | GURDANE | C |
| GOLDMIRE | C | GOWKER | C | GRAYPOINT | B | GRIZZLY | B | GURDON | C |
| GOLDRIDGE | B | GOWTON | B | GRAYPOINT, WET | C | GROBUTTE | B | GURLEY | C |
| GOLDRUN | A | GOZEM | D | GRAYROCK | C | GRODGAN | B | GURNEY | B |
| GOLDSBORO | B | GRABE | B | GRAYS | B | GROOM | C | GUSTIN | D |
| GOLDSTON | C | GRABLE | B | GRAYSILL | C | GROSECLOSE | C | GUSTSPRING | B |
| GOLDSTREAM | D | GRACEMONT | C | GRAZER | C | GROSS | C | GUTHRIE | D |
| GOLDSTREAM, THAWED | B | GRACEMORE | C | GREAT BEND | B | GROSSWELL | C | GUY | B |
| GOLDUST | C | GRACEVILLE | B | GREDGE | D | GROTON | A | GUYAN | C |
| GOLDVALE | B | GRADCO | C | GREEN BLUFF | B | GROTTE | B | GUYANDOTTE | B |
| GOLDVALE, NONSTONY | C | GRADON | C | GREEN CANYON | B | GROTTO | A | GUYTON | D |
| GOLDVEIN | C | GRADY | D | GREEN RIVER | C | GROUSECREEK | B | GWENA | D |
| GOLDYKE | D | GRAFEN | B | GREEN RIVER, | B | GROUSEVILLE | C | GWIN | D |
| GOLETA | B | GRAFF | D | STRONGLY SALINE | | GROVE | A | GWIN, GRAVELLY | C |
| GOLIAD | C | GRAHAM | D | GREEN RIVER, | B | GROVECITY | B | GWINLY | D |
| GOLLAHER | D | GRAIL | C | FLOODED | | GROVENA | B | GWINNETT | B |
| GOLSUM | C | GRAINOLA | D | GREENBRAE | C | GROVER | B | GYMER | C |
| GOLTRY | A | GRALEY | D | GREENBRIAR | B | GROVETON | B | GYNELLE | A |
| GOLVA | B | GRALIC | B | GREENCREEK | B | GROWDEN | C | GYPNEVEE | B |
| GOMERY | B | GRAN | D | GREENDALE | B | GROWLER | B | GYSTRUM | C |
| GOMEZ | B | GRANATH | B | GREENE | B | GROWTON | B | HAAR | D |
| GONVICK | B | GRANBY | A/D | GREENFIELD | B | GRUBBS | D | HAARVAR | D |
| GONZAGA | C | GRANDE RONDE | D | GREENFIELD, | C | GRUBSTAKE | B | HACCKE | C |
| GOOCH | D | GRANDFIELD | B | HARDPAN | | GRUENE | D | HACK | B |
| GOODING | D | GRANDMORE | B | SUBSTRATUM | | GRULLA | D | HACKBERRY | B |
| GOODINGTON | D | GRANDPON | B | GREENHALGH | B | GRUMMIT | D | HACKERS | B |
| GOODLAND | B | GRANDVIEW | C | GREENHORN | D | GRUNDY | C | HACKROY | D |
| GOODLOW | B | GRANDVIEW, DRAINED | B | GREENLEAF | B | GRUVER | C | HACKWOOD | B |
| GOODMAN | B | GRANER | B | GREENLEE | B | GRYGLA | B/D | HADAR | B |
| GOODNIGHT | A | GRANGE | C | GREENMAN | C | GSCHWEND | B | HADENCREEK | C |
| GOODPASTER | D | GRANGEMONT | C | GREENOUGH | B | GUADALUPE | B | HADES | B |
| GOODRICH | B | GRANGEVILLE, | B | GREENSON | C | GUAJE | D | HADLEY | B |
| GOODSPRINGS | D | DRAINED, SLOPING | | GREENTON | C | GUAM | D | HADSELVILLE | D |
| GOODWILL | B | GRANGEVILLE, | C | GREENVILLE | B | GUAMANI | B | HAFLINGER | A |
| GOODWIN | B | SALINE-ALKALI, | | GREENVINE | D | GUANABANO | C | HAGEN | B |
| GOOLAWAY | C | WET | | GREENWATER | A | GUANAJIBO | C | HAGENBARTH | B |
| GOOSE CREEK | B | GRANGEVILLE, | B | GREENWAY | B | GUANICA | D | HAGER | D |
| GOOSE CREEK, WET | C | SALINE-ALKALI | | GREENWOOD | A/D | GUARD | C | HAGERMAN | C |
| GOOSE LAKE | D | GRANGEVILLE, | B | GREHALEM | B | GUARDLAKE | A | HAGERSTOWN | C |
| GOOSEBURY | B | MODERATELY WET | | GRELL | D | GUAYABO | A | HAGGA | D |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| HAGGA, SALINE-ALKALI | C | HANIPOE, BEDROCK SUBSTRATUM | C | HARSHA | B | HAWI | B | HEIMDAL | B |
| HAGGERTY | B | HANIS | C | HARSLOW | C | HAWICK | A | HEINSAW | C |
| HAGSTADT | C | HANKINS | C | HARSTINE | C | HAWKEYE | A | HEISETON | B |
| HAGUE | A | HANKS | B | HARSTON | B | HAWKINS | C | HEISETON, STONY | C |
| HAIG | C/D | HANKSVILLE | D | HART | D | HAWKSBILL | B | HEISETON, SALINE-ALKALI | C |
| HAIGHTS | B | HANKSVILLE, NONFLOODED | C | HART CAMP | D | HAWKSNEST | C/D | | |
| HAIKU | B | HANLON | B | HARTER | C | HAWKSPRINGS | B | HEISLER | B |
| HAILMAN | B | HANLY | A | HARTFORD | A | HAWKSTONE | B | HEIST | B |
| HAIRE | C | HANNA | B | HARTIG | B | HAWLEY | B | HEITT | C |
| HAIRE, BEDROCK SUBSTRATUM | D | HANNAHATCHEE | B | HARTILL | C | HAWSLEY | A | HEIZER | D |
| HAKKER | C | HANNING | B | HARTLAND | B | HAXTUN | B | HELDT | C |
| HALACAN | D | HANO | C | HARTLESS | B | HAYBOURNE | B | HELEMAND | B |
| HALAWA | B | HANOVER | C | HARTLETON | B | HAYCRIK | C | HELENA | C |
| HALBERT | D | HANS | C | HARTSBURG | B/D | HAYESTON | B | HELENDALE | B |
| HALCOTT | C/D | HANSEL | C | HARTSELLS | B | HAYESVILLE | B | HELLGATE | B |
| HALDER | C | HANSKA | B/D | HARTSHORN | B | HAYESVILLE, STONY | C | HELLMAN | C |
| HALE | D | HANSON | B | HARTVILLE | C | HAYFIELD | B | HELM | D |
| HALE, DRAINED | C | HANTHO | B | HARTWELL | D | HAYFORD | C | HELMER | C |
| HALEDON | C | HANTZ | D | HARVARD | B | HAYHOOK | B | HELMER, GRAVELLY SUBSOIL | D |
| HALEIWA | B | HANTZ, DRY | C | HARVESTER | B | HAYMARKET | D | HELMER, THIN SURFACE | D |
| HALEY | B | HAP | B | HARVEY | B | HAYMOND | B | HELMER, SEVERELY ERODED | D |
| HALF MOON | B | HAPGOOD | B | HARVEY, BEDROCK SUBSTRATUM, DRY | | HAYMONT | B | HELMICK | D |
| HALFADAY | A | HAPJACK | D | HARWOOD | C | HAYNESS | B | HELTER | B |
| HALFWAY | D | HAPNEY | C | HASKILL | B | HAYNIE | B | HELVETIA | C |
| HALII | B | HAPPLE | B | HASKINS | C | HAYPRESS | A | HELY | C |
| HALIIMAILE | B | HAPUR | D | HASSEE | D | HAYRACK | C | HEMBRE | B |
| HALL | B | HARAHAN | D | HASSELL | C | HAYSPUR | D | HEMCROSS | B |
| HALL RANCH | C | HARAHILL | C | HASTINGS | B | HAYSUM | B | HEMINGFORD | B |
| HALLANDALE | B/D | HARANA | B | HAT | C | HAYTER | B | HEMPSTEAD | B |
| HALLANDALE, TIDAL | D | HARBORD | B | HATBORO | D | HAYTI | D | HENCO | B/D |
| HALLCREEK | A | HARCANY | B | HATCH | C | HAYWIRE | C | HENDERSON | B |
| HALLECK | C | HARCO | B | HATCH, GRAVELLY | D | HAYWOOD | B | HENDON | C |
| HALLECK, GRAVELLY SUBSTRATUM | B | HARCOT | B/D | HATCHERY | C | HAZEL | C | HENDRICKS | B |
| HALLETTSVILLE | D | HARDEMAN | B | HATCHET, OVERBLOWN, THICK SOLUM | B | HAZELAIR | D | HENDY | C |
| HALLISON | C | HARDESTY | B | HATCHET, GRAVELLY | C | HAZEN | B | HENEFER | C |
| HALLORAN | C | HARDHAT | B | HATCHET, OVERBLOWN | C | HAZELHURST | C | HENHOIT | B |
| HALSEY | C/D | HARDING | D | HATCHET, COBBLY | C | HAZLETON | B | HENKIN | B |
| HALSO | D | HARDISTER | B | HATCHIE | C | HAZTON | D | HENLEY | C |
| HAMACER | A | HARDOOL | B | HATERMUS | D | HEADLEY | B | HENLINE | C |
| HAMAKUAPOKO | B | HARDSCRABBLE | D | HATERTON | D | HEADQUARTERS | B | HENMEL | C |
| HAMAR | A/D | HARDTRIGGER | B | HATHAWAY | B | HEALDTON | C | HENNEKE | D |
| HAMBLEN | C | HARDY | C | HATLEY | C | HEALING | B | HENNEPIN | B |
| HAMBONE | B | HARGILL | B | HATLIFF | C | HEARNE | C | HENNESSY | B |
| HAMBRIGHT | D | HARGREAVE | C | HATMAKER | C | HEARNE, GRADED | D | HENNEWAY | B |
| HAMBURG | B | HARJO | D | HATPEAK | C | HEATH | C | HENNEY | B |
| HAMBY | C | HARKERS | C | HATTIE | C | HEATHCOAT | C | HENNINGS | B |
| HAMDEN | B | HARKEY | B | HATTON | C | HEATLY | A | HENNINGSEN | C |
| HAMEL | C | HARKNESS | C | HATUR | C | HEATON | A | HENRIETTA | B/D |
| HAMERLY | C | HARLAN | B | HATWAI | D | HEBBRONVILLE | B | HENRIEVILLE | B |
| HAMILTON | B | HARLEM | C | HAUBSTADT | C | HEBER | A | HENRY | D |
| HAMLET | B | HARLEM, CHANNELED | D | HAUG | B/D | HEBO | D | HENSHAW | C |
| HAMLIN | B | HARLESTON | C | HAUGAN | B | HEERON | B | HENSLEY | D |
| HAMMACK | B | HARLINGEN | D | HAULINGS | D | HECETA | D | HENSON | B |
| HAMMONTON | B | HARLOW | D | HAUNCHEE | D | HECHTMAN | D | HEPLER | C |
| HAMPSHIRE | C | HARMEHL | C | HAUZ | C | HECKER | B | HEPPSIE | D |
| HAMPSON | C | HARMONY | C | HAVALA | B | HECKISON | D | HERAKLE | D |
| HAMRE | C/D | HARNEY | B | HAVANA | B | HECLA | A | HERBERT | B |
| HAMRUB | B | HAROL | B | HAVELOCK | B/D | HECTOR | D | HERBMAN | D |
| HAMTAH | C | HARPER | D | HAVEN | B | HEDGE | D | HERD | C |
| HANA | A | HARPERSVILLE | D | HAVERDAD | B | HEDDES | C | HEREFORD | B |
| HANAGITA | D | HARPETH | B | HAVERDAD, MODERATELY SALINE | B/D | HEDOX | C | HERITO | C |
| HANAKER | C | HARPOLE | B | | | HEDRICK | B | HERKIMER | B |
| HANALEI | C | HARPS | B/D | HAVERHILL | D | HEDSTROM | B | HERLONG | D |
| HANAMAULU | B | HARPSTER | B/D | HAVERLY | C | HEDVILLE | D | HERM | C |
| HANCEVILLE | B | HARPT | B | HAVERMOM | B | HEECHEE | B | HERMANTOWN | C |
| HAND | B | HARQUA | C | HAVERSON | B | HEELY | B | HERMERING | B |
| HANDPAH | D | HARRAH | B | HAVILAND | B | HEESER | B | HERMISTON | B |
| HANDRAN | A | HARRIET | D | HAVILLAH | B | HEFED | B | HERMON | A |
| HANDSBORO | D | HARRIMAN | B | HAVINGDON | C | HEFLIN | B | HERNANDEZ | B |
| HANDY | C | HARRIMAN, WET | C | HAVRE | B | HEGLAR | B | HERNDON | B |
| HANEY | B | HARRINGTON | C | HAVRE, SALINE | C | HEGNE | D | HERO | B |
| HANFORD | B | HARRIS | D | HAVRE, MODERATELY WET | C | HEIDEL | B | HERDD | D |
| HANGAARD | D | HARRISBURG | C | HAVRELON | B | HEIDEN | D | HERRICK | B |
| HANGDO | B | HARRISON | B | HAW | B | HEIDTMAN | C | HERSH | B |
| HANGTOWN | B | HARRISVILLE | C | HAWI | B | HEIGHTS | B/D | HERSHAL | D |
| HANIPOE | B | HARROUN | D | HAWICK | A | HEIL | D | HERTY | D |
| | | HARSAN | B | HAWKEYE | A | | | | |
| | | | | HAWKINS | C | | | | |
| | | | | HAWKSBILL | B | | | | |
| | | | | HAWKSNEST | C/D | | | | |
| | | | | HAWKSPRINGS | B | | | | |
| | | | | HAWKSTONE | B | | | | |
| | | | | HAWLEY | B | | | | |
| | | | | HAWSLEY | A | | | | |
| | | | | HAXTUN | B | | | | |
| | | | | HAYBOURNE | B | | | | |
| | | | | HAYCRIK | C | | | | |
| | | | | HAYDEN | B | | | | |
| | | | | HAYESTON | B | | | | |
| | | | | HAYESVILLE | B | | | | |
| | | | | HAYESVILLE, STONY | C | | | | |
| | | | | HAYFIELD | B | | | | |
| | | | | HAYFORD | C | | | | |
| | | | | HAYHOOK | B | | | | |
| | | | | HAYMARKET | D | | | | |
| | | | | HAYMOND | B | | | | |
| | | | | HAYMONT | B | | | | |
| | | | | HAYNESS | B | | | | |
| | | | | HAYNIE | B | | | | |
| | | | | HAYPRESS | A | | | | |
| | | | | HAYRACK | C | | | | |
| | | | | HAYSPUR | D | | | | |
| | | | | HAYSUM | B | | | | |
| | | | | HAYTER | B | | | | |
| | | | | HAYTI | D | | | | |
| | | | | HAYWIRE | C | | | | |
| | | | | HAYWOOD | B | | | | |
| | | | | HAZEL | C | | | | |
| | | | | HAZELAIR | D | | | | |
| | | | | HAZEN | B | | | | |
| | | | | HAZELHURST | C | | | | |
| | | | | HAZLETON | B | | | | |
| | | | | HAZTON | D | | | | |
| | | | | HEADLEY | B | | | | |
| | | | | HEADQUARTERS | B | | | | |
| | | | | HEAKE | D | | | | |
| | | | | HEALDTON | C | | | | |
| | | | | HEALING | B | | | | |
| | | | | HEARNE | C | | | | |
| | | | | HEARNE, GRADED | D | | | | |
| | | | | HEATH | C | | | | |
| | | | | HEATHCOAT | C | | | | |
| | | | | HEATLY | A | | | | |
| | | | | HEATON | A | | | | |
| | | | | HEBBRONVILLE | B | | | | |
| | | | | HEBER | A | | | | |
| | | | | HEBERT | C | | | | |
| | | | | HEBO | D | | | | |
| | | | | HEERON | B | | | | |
| | | | | HECETA | D | | | | |
| | | | | HECHTMAN | D | | | | |
| | | | | HECKER | B | | | | |
| | | | | HECKISON | D | | | | |
| | | | | HECLA | A | | | | |
| | | | | HECTOR | D | | | | |
| | | | | HEDGE | D | | | | |
| | | | | HEDDES | C | | | | |
| | | | | HEDOX | C | | | | |
| | | | | HEDRICK | B | | | | |
| | | | | HEDSTROM | B | | | | |
| | | | | HEDVILLE | D | | | | |
| | | | | HEECHEE | B | | | | |
| | | | | HEELY | B | | | | |
| | | | | HEESER | B | | | | |
| | | | | HEFED | B | | | | |
| | | | | HEFLIN | B | | | | |
| | | | | HEGLAR | B | | | | |
| | | | | HEGNE | D | | | | |
| | | | | HEIDEL | B | | | | |
| | | | | HEIDEN | D | | | | |
| | | | | HEIDTMAN | C | | | | |
| | | | | HEIGHTS | B/D | | | | |
| | | | | HEIL | D | | | | |

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| HESCH | B | HILLSBORO | B | HOLDERMAN | C | HOODVIEW | B | HOWELL | C |
| HESPER | B | HILLSDALE | B | HOLDERNESS | C | HOODGDAL | C | HOWLAND | C |
| HESPERIA | B | HILLTO | B | HOLDINGFORD | C | HOOKS | B | HOWSON | C |
| HESPERUS | B | HILLWOOD | B | HOLDREGE | B | HOOKSAN | A | HOYE | B |
| HESSEL | B/D | HILMAR | D | HOLILLIPAH | A | HOOKTON | C | HOYLETON | C |
| HESSELBERG | D | HILMAR, DRAINED | B | HOLLAND | B | HOOLEHUA | B | HOYPUS | A |
| HESSELTINE | B | HILMOE | C | HOLLANDLAKE | B | HOOLY | C | HOYTVILLE | C/D |
| HESSING | B | HILO | A | HOLLINGER | B | HOOPAL | D | HUACHUCA | D |
| HESSLAN | C | HILOLD | D | HOLLIS | C/D | HOOPER | D | HUALAPAI | C |
| HESSON | C | HILT | B | HOLLISTER | D | HOOPESTON | B | HUB | B |
| HETERWA | C | HILTON | B | HOLLOMAN | D | HOOPLITE | D | HUBBARD | A |
| HETTINGER | C/D | HINCKLEY | A | HOLLOMEX | B | HOOSAN | B | HUBBARDTON | D |
| HEUSSER | C | HINDES | C | HOLLOW | C | HOOSEGOW | B | HUBBELL | B |
| HEUVELTON | C | HINESBURG | C | HOLLOWAY | B | HOOSIC | A | HUBERLY | D |
| HEWITT | D | HINKER | C | HOLLOWTREE | C | HOOSIERVILLE | C | HUBERT | B |
| HEXT | B | HINKLE | D | HOLLY | B/D | HOOSIMBIM | B | HUBLERSBURG | B |
| HEYDER | B | HINMAN | C | HOLLY, PONDED | D | HOOT | D | HUCKLEBERRY | C |
| HEYDLAUFF | B | HINSDALE | D | HOLLY SPRINGS | D | HOOTEN | D | HUCKLEBERRY, HIGH RAINFALL | B |
| HEYTOU | B | HIRAMSBURG | C | HOLLYWELL | B | HOPCO | C | | |
| HEZEL | B | HIRIDGE | D | HOLLYWOOD | D | HOPDRAW | A | HUDNUT | B |
| HI VISTA | C | HIRSCHDALE | C | HOLMAN | A | HOPEKA | D | HUDSON | C |
| HIARC | C | HISEGA | C | HOLMDEL | C | HOPKINS | B | HUECO | C |
| HIBAR | C | HISKEY | B | HOLMES | B | HOPLAND | B | HUEL | A |
| HIBBARD | C | HISLE | D | HOLOHAN | B | HOPLEY | B | HUENEME | C |
| HIBBING | C | HITCHCOCK | B | HOLOMUA | B | HOPSONVILLE | C | HUENEME, MODERATELY WET | B |
| HIBERNIA | C | HITILO | A | HOLOPAW | B/D | HOQUIAM | B | | |
| HIBRITEN | B | HITT | B | HOLOPAW, DEPRESSIONAL | D | HORD | B | HUENEME, DRAINED | B |
| HICKMAN | B | HIVAL | D | | | HOREB | C | HUERFANO | D |
| HICKORY | C | HIWAN | D | HOLOPAW, FREQUENTLY FLOODED | D | HOREB, GRAVELLY SUBSTRATUM | B | HUEY | D |
| HICKS | B | HIWASSEE | B | | | | | HUFFINE | B |
| HICKSVILLE | B | HIWOOD | A | | | HORNELL | D | HUFFMAN | B |
| HICKSVILLE, BEDROCK SUBSTRATUM | C | HIXTON | B | HOLSINE | B | HORNING | B | HUFFTON | B |
| | | HOADLY | C | HOLSTEIN | B | HORNITOS | D | HUGGINS | C |
| | | HOBACKER | B | HOLSTON | B | HORNSBY | C | HUGHES | B |
| HICOTA | B | HOBAN | B | HOLT | B | HORNSVILLE | C | HUGHESVILLE | C |
| HIDALGO | B | HOBBS | B | HOLTER | B | HORROCKS | B | HUGO | B |
| HIDATSA | B | HOBCAW | D | HOLTLE | B | HORSECAMP | D | HUGUS | B |
| HIDEAWAY | D | HOBE | A | HOLTON | C | HORSERIDGE | B | HUGUSTON | D |
| HIDEWOOD | B/D | HOBERG | C | HOLTVILLE | C | HORSESHOE | B | HUICHICA | C |
| HIERRO | B | HOBIT | C | HOLYOKE | C/D | HORSETHIEF | B | HUICHICA, PONDED | D |
| HIGGINS | D | HOBO | D | HOMA | C | HORSLEY | D | HUIKAU | A |
| HIGGINSVILLE | C | HOBOG | D | HOME CAMP | C | HORST | B | HUKILL | B |
| HIGH GAP | C | HOBONNY | D | HOMELAKE | B | HORTONVILLE | B | HULETT | B |
| HIGHAMS | D | HOBSON | C | HOMELAND | C | HOSKIN | C | HULLS | C |
| HIGHBANK | C | HOBUCKEN | D | HOMER | B | HOSKINNINI | D | HULLT | B |
| HIGHCAMP | B | HOCAR | D | HOMESTAKE | C | HOSLEY | D | HULUA | D |
| HIGHFIELD | B | HOCHHEIM | B | HOMESTEAD | B | HOSMER | C | HUM | B |
| HIGHHORN | B | HOCKINSON | D | HOMEWOOD | C | HOSSICK | B | HUMACAO | B |
| HIGHMORE | B | HOCKINSON, MODERATELY WET | C | HOMME | C | HOSTAGE | B | HUMATAS | C |
| HIGHPOINT | D | | | HOMME, MODERATELY WET | B | HOT LAKE | C | HUMBARGER | B |
| HIGHROCK | D | HOCKINSON, DRAINED | B | | | HOTAW | C | HUMBIG | C |
| HIGHTOWER | C | HOCKLEY | C | HOMOSASSA | D | HOTCREEK | D | HUMBIRD | B |
| HIGHWOOD | C | HOCKLEY, GRADED | D | HONAUNAU | C | HOTEL | C | HUMBOLDT | D |
| HIHIMANU | B | HODA | C | HONCUT | B | HOTSPRINGS | B | HUMBOLDT, MODERATELY WET, SALINE-ALKALI | B |
| HIIBNER | C | HODEDD | C | HONDALE | D | HOUDEK | B | | |
| HIKO PEAK | B | HODENPYL | B | HONDOHO | B | HOUGH | B | | |
| HIKO SPRINGS | B | HODGE | A | HONEOYE | B | HOUGHTON | A/D | HUMBOLDT, MODERATELY WET, SALINE | B |
| HILAIRE | B | HODGINS | B | HONEYDEW | C | HOUGHTON, PONDED | D | | |
| HILAND | B | HODGSON | C | HONEYGROVE | B | HOUGHTONVILLE | C | | |
| HILDEBRECHT | C | HOEHNE | A | HONEYJONES | B | HOUK | C | HUMBOLDT, DRAINED, STRONGLY SALINE | B |
| HILDRETH | D | HOFFLAND | D | HONEYVILLE | C | HOULA | B | | |
| HILEA | D | HOFFMANVILLE | C | HONKER | D | HOULKA | D | HUMBOLDT, DRAINED, NONSALINE | B |
| HILES | B | HOFFSTADT | B | HONLAK | C | HOURGLASS | B | | |
| HILGER | B | HOFLY | C | HONLAK, DRAINED | B | HOUSE MOUNTAIN | D | HUMBOLDT, MODERATELY WET | B |
| HILGRAVE | B | HOGADERO | B | HONLU | B | HOUSER | D | | |
| HILIGHT | D | HOGANSBURG | B | HONN | B | HOUSEROCK | D | HUMBOLDT, DRAINED | B |
| HILINE | D | HOGBACK | C | HONOBIA | C | HOUSTAKE | C | HUMDUN | B |
| HILLBRICK | D | HOGG | C | HONOKAA | A | HOUSTON | D | HUME | C |
| HILLCO | B | HOGMALAT | D | HONOLUA | B | HOUSTON BLACK | D | HUMESTON | C/D |
| HILLEMANN | C | HOGRIS | B | HONOMANU | A | HOVDE | D | HUMKER | C |
| HILLERY | C | HOH | B | HONONEGAH | A | HOVEN | D | HUMMINGTON | C |
| HILLET | B/D | HOHMANN | C | HONOULIULI | B | HOVENWEEP | C | HUMPHREYS | B |
| HILLFIELD | B | HOKO | C | HONTAS | B | HOVERT | D | HUMPTULIPS | B |
| HILLGATE | D | HOLBORN | C | HONTOON | B/D | HOVEY | C | HUMSKEL | C |
| HILLIARD | B | HOLBROOK | B | HONUAULU | A | HOWARD | A | HUN | B |
| HILLIARD, MODERATELY WELL DRAINED | C | HOLCOMB | D | HOOD | B | HOWARDSVILLE | A | HUNCHBACK | D |
| | | HOLDAWAY | D | HOODLE | B | HOWCAN | B | HUNDRAW | D |
| | | HOLDEN | B | HOODOO | D | HOWCREE | C | HUNEWILL | B |
| HILLON | C | HOLDER | B | HOODSPORT | C | HOWE | C | HUNGRY | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| HUNNTON | C | ILDECARB | B | IPISH | C | JACAGUAS | B | JEHEMY | D |
| HUNSINGER | B | ILDEFONSO | B | IPSON | B | JACANA | D | JEKLEY | C |
| HUNTERS | B | ILES | C | IPSWICH | D | JACEE | C | JELLICO | C |
| HUNTERSVILLE | B | ILIFF | C | IRA | C | JACINTO | B | JEMEZ | C |
| HUNTIMER | C | ILTILI | D | IRAAN | B | JACK CREEK | A | JENA | B |
| HUNTING | C | ILION | D | IREDELL | C/D | JACKET | C | JENKINS | C |
| HUNTINGTON | B | ILLABOT | C | IRELAND | C | JACKLAND | D | JENKINSON | D |
| HUNTMOUNT | B | ILLAHEE | B | IRENE | B | JACKMAN | B | JENKS | B |
| HUNTPOCK | B | ILLER | B | IRETEBA | B | JACKNIFE | C | JENNESS | B |
| HUNTSBURG | D | ILLITO | D | IRIGUL | D | JACKPORT | D | JENNINGS | C |
| HUNTSVILLE | B | ILTON | C | IRIM | C | JACKPOT | C | JENNY | D |
| HUPP | B | ILWACO | B | IRMULCO | B | JACKS | C | JENOR | C |
| HURDS | B | IMA | B | IROCK | C | JACKSON | B | JERAG | D |
| HURLBUT | C | IMBLER | B | IRON BLOSSOM | C | JACKTONE | D | JERAULD | D |
| HURLEY | D | IMLAY | D | IRON MOUNTAIN | D | JACOB | D | JERICHO | D |
| HURRICANE | C | IMMIG | C | IRON RIVER | B | JACOBSEN | D | JEROME | D |
| HURRY BACK | B | IMMIGRANT | C | IRONCO | B | JACOBY | C | JERRY | C |
| HURRYBACK | B | IMMOKALEE | B/D | IRONDALE | C | JACOT | B | JERRYSLU | C |
| HURST | D | IMMOKALEE, | D | IRONDYKE | B | JACQUES | C | JERU | B |
| HURWAL | B | DEPRESSIONAL | | IRONSPRINGS | B | JACQUITH | C | JERVAL | B |
| HUSE | D | IMOGENE | D | IRONTON | C | JACRATZ | D | JESBEL | D |
| HUSKA | D | IMONIL | B | IROQUOIS | B/D | JACWIN | B | JESSE CAMP | B |
| HUSSA | D | IMPACT | A | IRRAWADDY | C | JADIS | B | JESSIETOWN | B |
| HUSSA, CLAYEY | C | IMPERIAL | D | IRRIGON | C | JAFA | B | JESSO | C |
| SUBSTRATUM | | INARAJAN | D | IRSON | D | JAGUEYES | B | JESSUP | C |
| HUSSA, MODERATELY | C | INARAJAN, | C | IRVINE | D | JAL | B | JETCOP | D |
| WET | | STRATIFIED | | IRVINGTON | C | JALMAR | A | JETSTER | C |
| HUSSA, DRAINED | B | SUBSTRATUM | | IRWIN | D | JAMES | D | JETT | B |
| HUSSELL | B | INAVALE | A | ISAAC | C | JAMES CANYON | C | JEVETS | C |
| HUSSMAN | D | INCELL | D | ISABELLA | B | JAMES CANYON, | B | JEWETT | B |
| HUSUM | B | INCHAU | C | ISAN | A/D | DRAINED | | JIGGS | B |
| HUTCHINSON | C | INCHELIUM | B | ISANTI | A/D | JAMESTON | C/D | JIGSAW | C |
| HUTCHLEY | D | INCY | A | ISBELL | B | JANISE | C | JILSON | D |
| HUTSON | B | INDART | C | ISELLA | B | JANISE, OVERBLOWN, | B | JIM | C |
| HUTT | D | INDEX | A | ISHI PISHI | C | DRAINED | | JIMBO | B |
| HUTTON | D | INDIAHOMA | D | ISHPEMING | A | JANSEN | B | JIMCREEK | C |
| HUXLEY | C | INDIAN CREEK | D | ISIDOR | D | JANUDE | B | JIMEK | C |
| HUYSINK | B | INDIANO | C | ISKNAT | C | JANUDE, CLAY | C | JIMENEZ | C |
| HYALL | C | INDIANOLA | A | ISKNAT, COOL | D | SUBSTRATUM | | JIMLAKE | B |
| HYANNIS | B | INDIO | B | ISLAND | B | JARAB | D | JIMMERSON | C |
| HYAS | B | INDLETON | B | ISLES | D | JARBOE | D | JIMSAGE | B |
| HYATTVILLE | C | INDUS | D | ISLES, SLOUGH | A/D | JARDIN | D | JIMTOWN | C |
| HYDABURG | D | INEZ | D | ISLOTE | B | JAREALES | D | JIPPER | B |
| HYDE | B/D | INFERNAL | D | ISMAY | B | JARITA | C | JIVAS | B |
| HYDER | D | INGALLS | B | ISMO | C | JARMILLO | B | JOACHEM | D |
| HYDRO | C | INGENIO | B | ISOLDE | A | JAROLA | C | JOB | C |
| HYE | B | INGERSOLL | B | ISOM | B | JAROSO | B | JOBOS | C |
| HYLOC | D | INGRAM | D | ISTER | C | JARRE | B | JOBPEAK | D |
| HYMAS | D | INKLER | B | ISTOKPOGA | B/D | JARRON | D | JOCAL | B |
| HYPRAIRIE | B | INKOM | D | ITANO | C | JARVIS | B | JOCITY | B |
| HYRUM | B | INKOM, DRAINED | C | ITASCA | B | JASCO | D | JOCITY, LOAMY | C |
| HYSHAM | D | INKOSR | D | ITAT | B | JASON | D | SURFACE | |
| HYSHOT | D | INKS | D | ITCA | D | JASPER | B | JOCKO | B |
| HYTOP | D | INKSTER | B | ITHACA | C | JAUCAS | A | JOCERO | B |
| HYZEN | D | INLOW | C | ITMANN | C | JAUCAS, SALINE | C | JOEL | B |
| IAO | B | INMACHUK | D | ITME | A | JAURIGA | B | JOEMRE | B |
| IBERIA | D | INMAN | C | ITSWOOT | B | JAVA | B | JOENEY | D |
| ICARIA | D | INMO | A | IUKA | C | JAWBONE | D | JOES | B |
| ICENE | D | INNINGER | C | IVA | C | JAY | C | JOEVAR | B |
| ICESLEW | D | INPENDENCE | B | IVAN | B | JAYAR | C | JOHNS | C |
| ICHBOD | D | INSAK | D | IVANELL | C | JAYBEE | D | JOHNSBURG | D |
| ICHETUCKNEE | D | INSIDERT | C | IVANHOE | D | JAYEL | D | JOHNSON | B |
| ICICLE | B | INSKIP | C | IVER | B | JAYEM | B | JOHNSTON | D |
| IDA | B | INSULA | D | IVERSEN | C | JAYNES | D | JOHNSTOWN | B |
| IDABEL | B | INTERIOR | B | IVES | B | JEAGER | C | JOHNSWOOD | B |
| IDAHOME | B | INTON | B | IVES, WET | D | JEAN | A | JOHNTOM | D |
| IDAMONT | B | INVERNESS | B | IVIE | A | JEAN LAKE | B | JOICE | D |
| IDEE | C | INVERSHIEL | C | IVINS | C | JEANERETTE | D | JOINER | B |
| IDLEWILD | D | INVILLE | B | IVYWILD | C | JEBE | B | JOKODOWSKI | D |
| IDLEWILD, DRAINED | C | IO | B | IXIAN | C | JEBO | B | JOLAN | C |
| IDMON | B | IOLEAU | C | IYERS | D | JEDBURG | C | JOLIET | D |
| IGDELL | C | IONA | B | IZAGORA | C | JEDD | C | JOLLY | C |
| IGERT | C | IONIA | B | IZAR | D | JEDDITO | C | JONALE | B |
| IGNACIO | C | IOSCO | B | IZEE | C | JEDDITO, | B | JONAS | B |
| IGO | D | IOSEPA | D | IZO | A | SALINE-ALKALI | | JONATHAN | B |
| IGUALDAD | D | IOTLA | B | IZOD | D | JEDDO | C/D | JONCA | C |
| IHLEN | B | IPAGE | A | IZUSER | B | JEFFERS | B/D | JONDA | B |
| IJAM | D | IPANO | C | JABU | B | JEFFERSON | B | JONES | B |
| ILACHETOMEL | D | IPAVA | B | JABU, WET | C | JEFFREY | B | JONESVILLE | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| JONNIC | C | KAHANA | B | KAPLAN | D | KEEI | D | KERMIT | A |
| JOPLIN | C | KAHANUI | D | KAPOO | B | KEEKEE | B | KERNAN | C |
| JOPPA | B | KAHLER | B | KAPOWSIN | D | KEEL | C | KERR | B |
| JORAIBI | B | KAHLOTUS | B | KAPTURE | B | KEELDAR | B | KERRDAM | C |
| JORDAN | D | KAHOLA | B | KAPUHIKANI | D | KEELE | B | KERRFIELD | D |
| JORGE | B | KAHUA | D | KARAMIN | A | KEELER | B | KERRICK | B |
| JORNAHAM | B | KAIDERS | B | KARANKAWA | D | KEELINE | B | KERRVILLE | C |
| JORY | B | KAIKLI | D | KARBANA | C | KEENE | C | KERSHAW | A |
| JORY, STONY | C | KAILUA | A | KARCAL | D | KEENO | C | KERSICK | D |
| JOSBURG | C | KAIMU | A | KARDE | B | KEESE | D | KERSTON | A/D |
| JOSEPH | C | KAINALIU | A | KARHEEN | D | KEESEHA | C | KERT | C |
| JOSEPHINE | B | KAIPOIOI | B | KARLAN | C | KEESIAN | B | KESSLER | C |
| JOSHUA | C | KAIWIKI | A | KARLIN | A | KEETER | C | KESSON | D |
| JOSIE | B | KALAE | B | KARLO | D | KEEWATIN | C | KESTERSON | D |
| JOSLIN | B | KALALOCH | B | KARLSBURG | B | KEG | B | KESWICK | C |
| JOSSET | C | KALAMA | C | KARLSRUHE | B | KEGEL | D | KETCHLY | B |
| JOURDANTON | B | KALAMAZOO | B | KARLSTAD | A | KEGEL, DRAINED | C | KETCHUM | B |
| JOWEC | D | KALAPA | B | KARLUK | D | KEGONSA | B | KETONA | D |
| JOY | B | KALAUPAPA | D | KARMA | B | KEHAR | D | KETTENBACH | C |
| JUAB | B | KALEETAN | B | KARNAK | D | KEHENA | C | KETTLE | B |
| JUANA DIAZ | B | KALEETAN, TILL | C | KARNES | B | KEHOE | B | KETTLEBELLY | B |
| JUBILEE | D | SUBSTRATUM | | KAROC | B | KEIGLEY | B | KETTLEMAN | C |
| JUBILEE, DRAINED | B | KALIFONSKY | D | KARPP | D | KEISER | B | KETTLEMAN, | B |
| JUDA | B | KALIGA | B/D | KARRO | B | KEITH | B | GRAVELLY | |
| JUDD | C | KALIGA, FLOODED | D | KARS | A | KEITHVILLE | C | KETTNER | D |
| JUDELL | B | KALIHI | D | KARSHNER | D | KEKAHA | B | KEUTERVILLE | B |
| JUDICE | D | KALISPELL | B | KARTA | C | KEKAKE | D | KEVANTON | C |
| JUDITH | B | KALKASKA | A | KARTAR | B | KEKAWAKA | B | KEVIN | C |
| JUDKINS | C | KALLIO | C | KASEBERG | D | KELK | C | KEWACH | C |
| JUDSON | B | KALMARVILLE | B/D | KASHWITNA | B | KELLER | C | KEWAUNEE | C |
| JUDY | C | KALMIA | B | KASKI | B | KELLERBUTTE | B | KEWEENAW | A |
| JUG | B | KALO | C | KASOTA | C | KELLY | D | KEYA | B |
| JUGET | D | KALOKO | D | KASSLER | A | KELSEY | B | KEYES | D |
| JUGHANDLE | B | KALONA | C | KASSON | C | KELSO | C | KEYESPOINT | D |
| JUGSON | C | KALSIN | D | KATAMA | B | KELTNER | B | KEYNER | D |
| JULES | B | KALSTED | B | KATEMCY | C | KELTYS | B | KEYPORT | C |
| JULESBURG | B | KAMACK | B | KATHER | C | KELVIN | C | KEYSTONE | A |
| JULIN | D | KAMAKOA | B | KATO | B/D | KEMAH | D | KEZAN | D |
| JUMBO | B | KAMAN | D | KATSEANES | D | KEMAN | B | KEZAR | C |
| JUMPCREEK | C | KAMAOA | B | KATULA | C | KEMMERER | C | KIAKUS | C |
| JUMPE | B | KAMAOLE | B | KATY | D | KEMOO | B | KIAN | C |
| JUMPER | C | KAMATO | C | KATYBLAY | B | KEMP | C | KIAWAH | B/D |
| JUMPMORE | B | KAMAY | D | KAUDER | D | KEMPSVILLE | B | KIBBIE | B |
| JUMPOFF | C | KAMELA | C | KAUFMAN | D | KENAI | C | KIBESILLAH | C |
| JUNALUSKA | B | KAMIE | B | KAUKAUNA | C | KENANSVILLE | A | KICKAPOO | B |
| JUNCAL | C | KAMPVILLE | C | KAUPO | A | KENDAIA | C | KICKERVILLE | B |
| JUNCOS | D | KAMRAR | B | KAUPPI | B | KENDALL | B | KIDD | D |
| JUNCTION | B | KANACKEY | D | KAVETT | D | KENDALLVILLE | B | KIDDER | B |
| JUNEAU | B | KANAKA | B | KAVON | B | KENDRICK | A | KIDMAN | B |
| JUNG | D | KANAPAHA | B/D | KAWAIHAE | C | KENEFICK | B | KIEHL | B |
| JUNGO | B | KANARANZI | B | KAWAIHAPAI | B | KENESAW | B | KIESEL | C |
| JUNIPERBUTE | A | KANARRA | D | KAWBAWGAM | C | KENMOOR | B | KIETZKE | D |
| JUNIPERO | B | KANASKAT | B | KAWICH | A | KENN | B | KIEV | B |
| JUNIUS | C | KANAWHA | B | KAWKAWLIN | C | KENNAN | B | KIKI | C |
| JUNKETT | C | KANDALY | A | KAYMINE | C | KENNEBEC | B | KIKONI | B |
| JUNO | A | KANDIK | B | KAYO | B | KENNER | D | KILAGA | C |
| JUNQUITOS | C | KANDOTA | B | KEAAU | D | KENNEWICK | B | KILARC | D |
| JUNTURA | D | KANE | B | KEAHUA | B | KENNEY | A | KILAUEA | B |
| JUPITER | B/D | KANEBREAK | C | KEALAKEKUA | A | KENNEY LAKE | C | KILBURN | B |
| JURA | D | KANEOHE | B | KEALIA | D | KENO | D | KILCHIS | D |
| JURYANNAH | C | KANEPUU | B | KEANSBURG | D | KENOMA | D | KILDOR | C |
| JUSTESEN | C | KANER | A | KEAPL | C | KENOTRAIL | C | KILFOIL | C |
| JUSTESEN, LOAMY | B | KANG | C | KEARNS | B | KENRAY | A | KILGORE | D |
| SUBSTRATUM | | KANGAS | A | KEARSARGE | B | KENSAL | B | KILKENNY | B |
| JUSTIN | B | KANIO | B | KEATING | C | KENSETT | B | KILLARNEY | C |
| JUVA | B | KANIKSU | B | KEAUKAHA | D | KENSPUR | B | KILLBUCK | C/D |
| JUVAN | D | KANIMA | C | KEAWAKAPU | B | KENT | D | KILLDUFF | B |
| KAALUALU | A | KANKAKEE | B | KEBLER | B | KENUSKY | D | KILLEY | D |
| KACHEMAK | B | KANLEE | C | KECH | D | KENYON | B | KILLEY, MODERATELY | C |
| KACHESS | B | KANONA | D | KECKO | B | KEO | B | WET | |
| KADE | D | KANOSH | C | KECKSROAD | C | KEOKUK | B | KILLINGTON | D |
| KADLETZ | B | KANTISHNA | D | KEDA | B | KEOMAH | C | KILLPACK | C |
| KADOKA | B | KANUTCHAN | D | KEDDIE | C | KEOTA | B | KILMANAGH | C |
| KAENA | D | KANZA | D | KEDRON | C | KEOWNS | B/D | KILMER | C |
| KAFING | B | KAPAA | B | KEE | B | KEPLER | C | KILMERQUE | C |
| KAGMAN | C | KAPAPALA | B | KEECHELUS | C | KERBER | B | KILN | D |
| KAGMAN, VERY | B | KAPAPALA, BEDROCK | C | KEECHI | C | KERBY | B | KILOA | A |
| GRAVELLY | | SUBSTRATUM | | KEEFA | B | KERHAYDEN | B | KILOHANA | A |
| KAHALUU | D | KAPIN | C | KEEFERS | C | KERL | B | KILOWAN | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KILWINNING | D | KITTITAS | D | KODRA | C | KRESSON | C | LACONNER | C |
| KIM | B | KITTITAS, DRAINED | C | KOEHLER | C | KREYENHAGEN | B | LACOOCHEE | D |
| KIM, SALINE | C | KITTREDGE | B | KOELE | B | KRIER | D | LACOSTE | C |
| KIMAMA | B | KITTSON | C | KOEPKE | B | KRIEST | B | LACOTA | B/D |
| KIMBALL | D | KIVA | A | KOERLING | C | KRON | D | LACRESCENT | B |
| KIMBERLINA | B | KIWANIS | F | KOETHER | D | KROTO | B | LACROL | D |
| KIMBERLY | B | KIZHUYAK | E | KOFA | D | KRUBATE | B | LACY | D |
| KIMBROUGH | D | KJAR | D | KOFA, SALINE | C | KRUEGER | B | LADD | B |
| KIMMERLING | D | KLABER | D | KOFFGO | B | KRUM | D | LADELLE | B |
| KIMO | C | KLABER, DRAINED | C | KOGISH | D | KRUSE | B | LADERLY | C |
| KIMPER | B | KLADNICK | A | KOHALA | B | KUBE | B | LADNER | D |
| KINA | D | KLADNICK, STONY | B | KOKAN | A | KUBLER | C | LADOGA | B |
| KINAN | B | KLAMATH | D | KOKEE | B | KUBLI | D | LADRON | B |
| KINCHELOE | D | KLANELNEECHENA | D | KOKERNOT | C | KUCERA | B | LADUE | B |
| KINCO | A | KLANELNEECHENA, | C | KOKO | B | KUCK | C | LADYCOMB | D |
| KINDER | C | LACUSTRINE | | KOKOKAHI | D | KUDLAC | D | LADYSMITH | D |
| KINDIG | B | SUBSTRATUM | | KOKOKAHI, STONY | B | KUHL | D | LAFE | D |
| KINDY | C | KLAPATCHE | C | KOKOMO | B/D | KUKAIAU | A | LAFITTE | D |
| KINESAVA | B | KLAUS | C | KOLAR | D | KUKAIAU, BEDROCK | C | LAG | B |
| KINGDON | B | KLAWASI | D | KOLBERG | C | SUBSTRATUM | | LAGITOS | C |
| KINGFISHER | B | KLAWASI, | B | KOLEKOLE | C | KULA | B | LAGLORIA | B |
| KINGHORN | D | LACUSTRINE | | KOLIN | C | KULLIT | B | LAGNAF | B |
| KINGILE | C | SUBSTRATUM | | KOLLS | D | KULSHAN | C | LAGONDA | C |
| KINGINGHAM | C | KLAWATTI | C | KOLLUTUK | D | KUMA | B | LAGRANGE | D |
| KINGMAN | D | KLAWHOP | B | KOLOA | C | KUNATON | D | LAGROSS | A |
| KINGMONT | B | KLAYENT | C | KOLOB | B | KUNAYOSH | A | LAGUNITA | A |
| KINGS | D | KLECKNER | C | KOLOB, STONY | C | KUNIA | B | LAGUNITA, WET | C |
| KINGSBURY | D | KLEINBUSH | C | KOLOKOLO | B | KUNUWEIA | B | LAHAINA | B |
| KINGSDOWN | B | KLEJ | B | KOLONOKI | B | KUNZ | B | LAHONTAN | D |
| KINGSLAND | A/D | KLICKER | C | KOMO | B | KUNZLER | B | LAHRITY | C |
| KINGSLEY | B | KLICKITAT | B | KONA | D | KUPREANOF | B | LAIDIG | C |
| KINGSPOINT | B | KLICKSON | B | KONAWA | B | KUPREANOF, | C | LAIDLAW | C |
| KINGSTON | B | KLINE, COBBLY | B | KONERT | D | MODERATELY WET | | LAIL | C |
| KINGSVILLE | A/D | KLINE, PROTECTED | C | KONERT, DRAINED | C | KUREB | A | LAIRD | B |
| KINGTAIN | B | KLINESVILLE | C/D | KONNER | D | KURO | D | LAIRDSVILLE | D |
| KINKEAD | C | KLINGER | B | KONNER, DRAINED | C | KURTH | C | LAJARA | D |
| KINKEL | C | KLISKON | C | KONOCTI | C | KURTZ | C | LAJITAS | D |
| KINKEL, GRAVELLY | B | KLISTAN | B | KONOCTI, STONY | B | KUSHNEAHIN | D | LAKE | A |
| KINKORA | D | KLONDIKE | D | KONSIL | B | KUSKOKWIM | D | LAKE, CLAYEY | C |
| KINMAN | C | KLONE | B | KOOLAU | C | KUSLINA | D | SURFACE | |
| KINNEAR | B | KLOOCHMAN | C | KOONICH | A | KUTCH | C | LAKE CHARLES | D |
| KINNEY | B | KLOOTCH | C | KOONTZ | D | KUTLER | C | LAKE CREEK | C |
| KINROSS | A/D | KLOOTCHIE | B | KOOSHAREM | B | KUY | A | LAKE JANEE | B |
| KINSMAN | C | KLOTEN | D | KOOSKIA | C | KVICHAK | B | LAKEFIELD | B |
| KINSTON | B/D | KLUG | B | KOOTENAI | B | KWEO | A | LAKEHELEN | C |
| KINTA | D | KLUM | B | KOPIE | D | KYBURZ | B | LAKEHURST | A |
| KINTON | C | KLUMP | B | KOPPERL | B | KYDAKA | D | LAKELAND | A |
| KINZEL | B | KLUTINA | B | KOPPES | A | KYDESTEA | D | LAKEMONT | D |
| KIOMATIA | A | KNAPKE | B | KORCHEA | B | KYLE | D | LAKEPORT | B |
| KIONA | B | KNAPPA | B | KORENT | C | KYLER | D | LAKESHORE | D |
| KIOTE | B | KNAPPTON | B | KORNMAN | B | KZIN | D | LAKESIDE | B |
| KIPER | B | KNEELAND | C | KOROPAGO | C | LA BRIER | D | LAKESOL | B |
| KIPLING | D | KNEP | C | KORONIS | B | LA FARGE | B | LAKETON | C |
| KIPPEN | A | KNICKERBOCKER | A | KORTTY | B | LA FONDA | B | LAKEVIEW | C |
| KIPSON | D | KNIESLEY | C | KOSCIUSKO | B | LA GRANDE | C | LAKEWIN | B |
| KIRBY | A | KNIFFIN | C | KOSETH | B | LA HOGUE | B | LAKEWOOD | A |
| KIRBYVILLE | B | KNIGHT | B/D | KOSMOS | D | LA LANDE | B | LAKI | B |
| KIRK | D | KNIK | B | KOSSE | B | LA PALMA | C | LAKIN | A |
| KIRKENDALL | C | KNIKLIK | B | KOSSUTH | B/D | LA POSTA | B | LAKOA | B |
| KIRKHAM | C | KNIPPA | C | KOSZTA | B | LA PRAIRIE | B | LAKOMA | D |
| KIRKLAND | D | KNOB HILL | B | KOTO | D | LA ROSE | B | LAKRIDGE | C |
| KIRKSEY | C | KNOBTOP | C | KOTZMAN | B | LABENZO | B | LALAAU | A |
| KIRKVILLE | C | KNOCO | D | KOURY | C | LABETTE | C | LALINDA | B |
| KIRLEY | C | KNOKE | B/D | KOVICH | D | LABISH | D | LALLIE | D |
| KIRTLEY | C | KNOLLE | B | KOYEN | B | LABKEY | B | LALOS | B |
| KIRVIN | C | KNOSS | C | KOYNIK | D | LABORCITA | B | LAM | D |
| KIRVIN, GRADED | D | KNOTT | D | KOYUKUK | B | LABOU | D | LAMA | C |
| KISATCHIE | D | KNOWLES | B | KRACKLE | B | LABOUNTY | D | LAMANGA | C |
| KISHONA | B | KNOX | B | KRADE | B | LABRE | B | LAMAR | B |
| KISHONA, ALKALI | C | KNULL | B | KRAKON | D | LABSHAFT | D | LAMARSH | C |
| KISRING | C | KNUTSEN | B | KRAM | D | LABU | D | LAMARTINE | C |
| KISRING, WET | D | KOBAR | C | KRANSKI | B | LABUCK | B | LAMATH | D |
| KISSICK | C | KOBEH | B | KRANZBURG | B | LACAMAS | D | LAMAWA | B |
| KISTIAN | B | KOBEL | D | KRATKA | B/D | LACERDA | D | LAMBERT | B |
| KITCHELL | B | KOCH | D | KRAUSE | B | LACHAPELLA | D | LAMBETH | B |
| KITCHEN CREEK | B | KOCH, DRAINED | C | KREAMER | C | LACITA | B | LAMBMAN | D |
| KITI | D | KODAK | B | KREBS | B | LACKAWANNA | C | LAMBRING | B |
| KITSAP | C | KODAK, NONFLOODED | C | KREM | A | LACKS | C | LAMEDEER | B |
| KITTERLL | D | KODIAK | B | KREMLIN | B | LACLEDE | B | LAMINGTON | D |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| LAMKIN | B | LARIAT | B | LAVINA | D | LEETONIA | C | LEW | B |
| LAMO | C | LARIM | B | LAVON | C | LEEVAN | C | LEWBEACH | C |
| LAMOILLE | B | LARIMER | B | LAWAI | B | LEFOR | B | LEWDLAC | D |
| LAMONDI | B | LARIOSCAMP | D | LAWEN | B | LEGALL | B | LEWIS | D |
| LAMONI | C | LARKIN | B | LAWET | B/D | LEGAULT | D | LEWISBERRY | B |
| LAMONT | B | LARKSON | C | LAWET, | B | LEGGETT | C | LEWISBURG | C |
| LAMONTA | D | LARMINE | D | SALINE-ALKALI | | LEGLER | B | LEWISTON | C |
| LAMOOSE | D | LAROQUE | B | LAWLER | B | LEGORE | B | LEWISVILLE | B |
| LAMOTTE | B | LAROSE | D | LAWNDALE | B | LEHEW | C | LEWKALB | C |
| LAMOURE | C | LARRUPIN | B | LAWNWOOD | B/D | LEHIGH | C | LEX | B |
| LAMPASAS | D | LARRY | D | LAWNWOOD, | D | LEHMANS | D | LEXINGTON | B |
| LAMPHIER | B | LARRY, DRAINED | C | DEPRESSIONAL | | LEHR | B | LEXTON | B |
| LAMPSHIRE | D | LARSON | D | LAWRENCE | C | LEICESTER | C | LEYBA | B |
| LAMSON | B/D | LARTON | A | LAWRENCEVILLE | C | LEIDL | C | LEYDEN | C |
| LANARK | B | LARUE | A | LAWSHE | D | LEIGHCAN | B | LIBBINGS | D |
| LANCASTER | B | LARUSH | B | LAWSON | C | LEILEHUA | B | LIBEG | B |
| LANCE | B | LARVIE | D | LAWTHER | D | LEISY | B | LIBERAL | D |
| LAND | C | LAS | C | LAWTON | C | LELA | D | LIBORY | A |
| LAND, DRAINED | B | LAS ANIMAS | C | LAWYER | B | LELAND | D | LIBRARY | D |
| LANDAVASO | B | LAS FLORES | D | LAX | C | LEMAH | A | LIBUSE | C |
| LANDCO | C | LAS LUCAS | B | LAXAL | B | LEMBOS | C | LICHA | B |
| LANDER | C | LAS POSAS | C | LAXTON | C | LEMCO | C | LICK | B |
| LANDES | B | LAS VEGAS | D | LAYCOCK | B | LEMERT | D | LICKDALE | D |
| LANDLOW | C | LASA | A | LAYOINT | C | LEMETA | D | LICKING | C |
| LANDMAN | B | LASALLE | D | LAYTON | A | LEMING | C | LICKSKILLET | D |
| LANDSEND | C | LASAUSES | D | LAYVIEW | D | LEMITAR | D | LIDAN | C |
| LANE | C | LASCO | B | LAZAN | D | LEMM | B | LIDDELL | B/D |
| LANESBORO | C | LASIL | D | LAZEAR | D | LEMOLO | D | LIDDIEVILLE | B |
| LANEXA | D | LASKA | B | LE BAR | B | LEMOND | B/D | LIDY | B |
| LANEY | B | LASSEL | C | LE SUEUR | B | LEMONEX | C | LIEBERMAN | B |
| LANG | C | LASSEN | D | LEA | C | LEMOORE | C | LIEN | D |
| LANGFORD | C | LASSITER | B | LEADER | B | LEMPIRA | B | LIESNOI | D |
| LANGHEI | B | LASTANCE | B | LEADORE | B | LEN | C | LIGGET | B |
| LANGLADE | B | LATAH | D | LEADPOINT | C | LENA | A/D | LIGHTNING | D |
| LANGLOIS | D | LATAH, HIGH | C | LEADVALE | C | LENA, FLOODED | D | LIGNUM | C |
| LANGOLA | B | RAINFALL, DRAINED | | LEADVILLE | B | LENAPAH | D | LIGON | D |
| LANGRELL | B | LATAH, DRAINED | C | LEAF | D | LENAWEE | B/D | LIGURTA | B |
| LANGSPRING | B | LATAHCO | C | LEAFRIVER | A/D | LENAWEE, PONDED | D | LIHEN | A |
| LANGSTON | B | LATAHCO, WET | D | LEAFU | C | LENBERG | C | LIHUE | B |
| LANGTRY | D | LATANIER | D | LEAGUEVILLE | B/D | LENNEP | C | LIKES | A |
| LANIER | A | LATCH | A | LEAKSVILLE | D | LENOIR | D | LILAH | A |
| LANIGER | B | LATENE | B | LEAL | B | LENZ | B | LILBERT | B |
| LANIGER, GRAVELLY | C | LATES | C | LEALANDIC | D | LENZ, STONY | C | LILBOURN | B |
| LANKBUSH | B | LATEX | C | LEANNA | D | LENZ, VERY STONY | C | LILLINGS | B |
| LANKIN | C | LATHAM | D | LEANTO | D | LENZBURG | B | LILLINGTON | B |
| LANKTREE | C | LATHER | D | LEAPS | C | LEO | A | LILLYLANDS | C |
| LANDAK | B | LATHROP | B | LEATHAM | C | LEOLA | B | LILTEN | C |
| LANONA | B | LATIGO | B | LEATHERMAN | D | LEON | B/D | LILY | B |
| LANSDALE | B | LATINA | D | LEAVENWORTH | C | LEONARD | D | LIM | C |
| LANSDOWNE | C | LATIUM | D | LEAVERS | B | LEONARDO | B | LIMA | B |
| LANSING | B | LATOM | D | LEAVITT | B | LEONARDTOWN | D | LIMBER | B |
| LANTERN | B | LATONIA | B | LEAVITTVILLE | B | LEONI | B | LIMEKILN | D |
| LANTIS | B | LATOUCHE | D | LEBAM | B | LEQUIEU | D | LIMERICK | C |
| LANTON | D | LATOUR | B | LEBANON | C | LERDAL | C | LIMERIDGE | D |
| LANTON, LOW | C | LATOURELL | B | LEBEAU | D | LERDO | C | LIMKING | B |
| PRECIPITATION | | LATTAS | D | LEBEC | B | LEROY | B | LIMON | C |
| LANTONIA | B | LATTY | D | LEBO | B | LERROW | C | LIMON, WET | D |
| LANTRY | B | LAUDERDALE | D | LEBSACK | C | LESHARA | B | LIMONES | B |
| LANTZ | D | LAUDERHILL | B/D | LECK KILL | B | LESHO | C | LIMPIA | C |
| LANVER | C | LAUFER | D | LECRAG | D | LESLIE | D | LINCO | B |
| LANYON | C/D | LAUGENOUR, LOAMY | C | LEDFORD | B | LESON | D | LINCOLN | A |
| LAP | D | SUBSTRATUM | | LEDGEFORK | A | LESPATE | C | LINDAAS | C/D |
| LAPARITA | C | LAUGENOUR, SILTY | B | LEDMOUNT | D | LESTER | B | LINDALE | C |
| LAPOUN | B | SUBSTRATUM | | LEDOW | B | LESWILL | B | LINDELL | C |
| LAPED | D | LAUGENOUR, DRAINED | B | LEDRU | D | LETA | C | LINDEN | B |
| LAPEER | B | LAUGHLIN | C | LEDUB | B | LETCHER | D | LINDER | B |
| LAPHAM | A | LAUMAIA | B | LEDWITH | B/D | LETHA | C | LINDLEY | C |
| LAPINE | A | LAUREL | D | LEE | D | LETHENT | D | LINDRITH | B |
| LAPLATTA | C | LAURELWOOD | B | LEEBENCH | D | LETNEY | A | LINDSIDE | C |
| LAPON | D | LAUREN | B | LEEDS | C | LETON | D | LINDSTROM | B |
| LAPORTE | D | LAURENTZEN | B | LEEFIELD | C | LETORT | B | LINDY | C |
| LAPOSA | C | LAVACREEK | B | LEEKO | C | LETRI | B/D | LINE | B |
| LAPWAI | B | LAVALLEE | B | LEEKO, WARM | B | LETTIA | B | LINEVILLE | C |
| LARAND | B | LAVATE | B | LEELANAU | A | LEVASY | C | LINGANORE | B |
| LARCHMOUNT | B | LAVEAGA | C | LEEMONT | D | LEVELTON | D | LINHART | A |
| LARDELL | C | LAVEEN | B | LEEPER | D | LEVELTON, DRAINED | C | LININGER | C |
| LAREDO | B | LAVENTANA | B | LEERAY | D | LEVERETT | C | LINKER | B |
| LARES | C | LAVERKIN | C | LEESBURG | B | LEVIATHAN | B | LINKUP | D |
| LARGO | B | LAVIC | B | LEESVILLE | B | LEVY | D | LINKVILLE | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| LINLITHGO | B | LODI | B | LOPEZ | D | LOZANO | B | LYLES | B/D |
| LINNE | C | LODICO | D | LOPWASH | B | LOZIER | D | LYMAN | C/D |
| LINNET | C | LODO | D | LORACK | B | LUALUALEI | D | LYMANSON | C |
| LINNEUS | B | LOFFTUS | C | LORADALE | C | LUANA | B | LYME | C |
| LINO | B | LOFTON | D | LORAIN | C/D | LUAP | C | LYNCH | D |
| LINOYER | B | LOGAN | D | LORAN | B | LUBBOCK | B | LYNCHBURG | C |
| LINROSE | C | LOGDELL | B | LORAY | A | LUBRECHT | C | LYNDEN | B |
| LINSLAW | D | LOGGERT | B | LORDSTOWN | C | LUCAS | D | LYNN HAVEN | B/D |
| LINT | B | LOGHOUSE | B | LOREAUVILLE | C | LUCE | C | LYNNBOW | D |
| LINTON | B | LOGRING | D | LORELLA | D | LUCEDALE | B | LYNNDYL | A |
| LINVELDT | B | LOGY | B | LORENA | C | LUCERNE | B | LYNNE | B/D |
| LINVILLE | B | LOHLER | C | LORENZO | B | LUCERO | B | LYNNVILLE | C |
| LINWELL | C | LOHMILLER | C | LORETTO | B | LUCIEN | C | LYNNWOOD | A |
| LINWOOD | A/D | LOHNES | A | LORING | C | LUCILE, MODERATELY | C | LYNX | B |
| LIPAN | D | LOHSMAN | D | LORMAN | D | WET | | LYNXCREEK | B |
| LIPKE | D | LOIRE | B | LORTA | B | LUCILE, DRAINED | B | LYONMAN | B |
| LIPPINCOTT | B/D | LOKEN | C | LOS ALAMOS | C | LUCKENBACH | C | LYONS | D |
| LIPPITT | C | LOKERN | C | LOS BANOS | C | LUCKIAMUTE | D | LYONSVILLE | B |
| LIRIOS | B | LOKERN, | D | LOS GATOS | C | LUCKY | C | LYRA | D |
| LISADE | B | SALINE-ALKALI, | | LOS GUINEOS | C | LUCKY STAR | B | LYRE | B |
| LISAM | D | WET | | LOS OSOS | C | LUCKYRICH | B | LYSTAIR | B |
| LISBON | B | LOKERN, | D | LOS ROBLES | B | LUCY | A | LYTELL | B |
| LISCO | C | SALINE-ALKALI | | LOS TANOS | C | LUD | D | LYVILLE | B |
| LISCOMB | B | LOKOSEE | B/D | LOSANTVILLE | C | LUDDEN | D | LYX | B |
| LISK | B | LOLAK | D | LOSEE | B | LUDINGTON | B | MABANK | D |
| LISMAS | D | LOLALITA | B | LOSTBASIN | C | LUDLOW | C | MABEL | C |
| LISMORE | B | LOLEKAA | B | LOSTCREEK | B | LUEDERS | C | MABEN | C |
| LITCHFIELD | A | LOLETA | C | LOSTINE | B | LUFKIN | D | MABI | D |
| LITHGOW | C | LOLITE | D | LOSTPOINT | D | LUGERT | B | MABRAY | D |
| LITIMBER | B | LOLO | B | LOSTSPRING | B | LUGOFF | B | MACAR | B |
| LITLE | D | LOLON | B | LOSTVALLEY | C | LUHON | B | MACAREENO | D |
| LITRO | D | LOLOPEAK | A | LOSTWELLS | B | LUKE | C | MACE | B |
| LITTLE HORN | C | LOMA | C | LOSTWELLS, WET | C | LUKIN | C | MACEDONIA | B |
| LITTLE POLE | D | LOMAKI | B | LOTHAIR | C | LULA | B | MACFARLANE | B |
| LITTLE WOOD | B | LOMALTA | D | LOTT | C | LULING | D | MACHETE | C |
| LITTLEAXE | B | LOMART | B | LOTUS | C | LULUDE | C | MACHIAS | B |
| LITTLEBEAR | B | LOMAX | B | LOTUSPOINT | C | LUMBEE | B/D | MACHUELO | D |
| LITTLEJOHN | C | LOMETA | C | LOU | B | LUMBERLY | B | MACK | B |
| LITTLENAN | C | LOMILL | D | LOUDERBACK | C | LUMMER | B | MACK, LOAMY | C |
| LITTLETON | B | LOMIRA | B | LOUDON | C | LUMMI | D | SUBSTRATUM | |
| LITTSAN | C | LOMITAS | D | LOUDONVILLE | C | LUMMI, DRAINED | C | MACKEN | D |
| LITZ | C | LOMOINE | D | LOUELLA | B | LUMMUS | C | MACKERRICHER | A |
| LIV | D | LOMOND | B | LOUGHBORO | C | LUNA | C | MACKEY | C |
| LIVEOAK | B | LONCAO | B | LOUIE | C | LUNDBR | D | MACKSBURG | B |
| LIVERMORE | B | LONDO | C | LOUIECREEK | B | LUNDS | C | MACMEAL | B |
| LIVIA | D | LONDONDERRY | C/D | LOUIN | D | LUNDY | D | MACOMB | B |
| LIVINGSTON | D | LONE | C | LOUISA | B | LUNING | A | MACOMBER | C |
| LIVONA | B | LONE ROCK | B | LOUISBURG | B | LUNT | C | MACON | B |
| LIZE | B | LONEBEAR | D | LOUP | D | LUPE | B | MADALIN | D |
| LIZZANT | B | LONELY | C | LOUPLOUP | B | LUPINTO | B | MADAWASKA | B |
| LLANOS | C | LONEPINE | B | LOURDES | C | LUPINTO, SALINE | C | MADDEN | C |
| LOARC | B | LONERIDGE | C | LOUSCOT | C | LUPOYOMA | B | MADDOCK | A |
| LOBDELL | B | LONESTAR | B | LOUVIERS | D | LUPPINO | D | MADELIA | B/D |
| LOBELVILLE | C | LONETREE | A | LOVEJOY | C | LUPTON | A/D | MADELINE | D |
| LOBERG | C | LONEWOOD | B | LOVELACE | B | LUPTON, PONDED | D | MADERA | D |
| LOBERT | B | LONGCREEK | D | LOVELAND | C | LURA | C/D | MADGE | B |
| LOBITOS | C | LONGFORD | C | LOVELAND, | D | LURAY | C/D | MADILL | B |
| LOBO | D | LONGJIM | D | ELEVATION>6500 | | LURNICK | C | MADISON | B |
| LOBURN | D | LONGLOIS | B | LOVELL | D | LUSETTI | B | MADONNA | C |
| LOCANE | D | LONGMARE | D | LOVELOCK | D | LUSK | C | MADRAK | C |
| LOCEY | C | LONGMONT | C | LOVELOCK, | C | LUTA | B | MADRAS | C |
| LOCHLOOSA | C | LONGRIE | B | SALINE-ALKALI | | LUTAK | B | MADRID | B |
| LOCHSA | B | LONGVAL | B | LOVELOCK, DRAINED | C | LUTE | D | MADRONE | C |
| LOCKE | B | LONGVIEW | C | LOVEWELL | B | LUTH | C | MADUREZ | B |
| LOCKERBY | C | LONIGAN | B | LOVLINE | C | LUTHER | B | MAES | B |
| LOCKERBY, COBBLY | D | LONIGAN, COBBLY | C | LOWELL | C | LUTIE | B | MAGALLON | B |
| LOCKHART | B | SUBSTRATUM | | LOWERCREEK | A | LUTON | D | MAGDALENA | D |
| LOCKPORT | B | LONNOM | B | LOWNDES | B | LUTZKELOH | B | MAGEBE | B |
| LOCKTON | B | LONNA | B | LOWRY | B | LUVERNE | C | MAGGIN | C |
| LOCKWOOD | B | LONOKE | B | LOWS | B/D | LUXOR | D | MAGHILLS | B |
| LOCKWOOD, WET | C | LONTI | D | LOWVILLE | B | LUZENA | D | MAGIC | D |
| LOCO | C | LOOKINGGLASS | C | LOX | C | LYBROOK | D | MAGINNIS | D |
| LOCODA | D | LOOKOUT | C | LOXLEY | A/D | LYDA | D | MAGNA | D |
| LOCUST | C | LOOMER | D | LOYAL | B | LYDICK | B | MAGNET | C |
| LODALLEY | D | LOOMIS | D | LOYALTON | D | LYERLY | D | MAGNOR | C |
| LODAR | D | LOONY | C | LOYSVILLE | D | LYFORD | C | MAGNUS | C |
| LODE | B | LOPER | C | LOZA | D | LYKENS | C | MAGOTHA | D |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MAGOTSU | D | MANAWA | C | MARGO | B | MARYSTOWN | C | MAY | B |
| MAGUAYO | C | MANBURN | D | MARIA | B | MASADA | C | MAY DAY | D |
| MAHALA | D | MANCELONA | A | MARIANA | C | MASARDIS | A | MAYACAMA | C |
| MAHALASVILLE | B/D | MANCHESTER | A | MARIAS | D | MASARYK | A | MAYBELL | A |
| MAHAN | C | MANDAN | B | MARIAVILLE | D | MASCAMP | D | MAYBERRY | D |
| MAHANA | B | MANDARIN | C | MARICAO | B | MASCARENAS | C | MAYBESO | D |
| MAHASKA | B | MANDERFIELD | B | MARICOPA | B | MASCHETAH | B | MAYBID | D |
| MAHOGAN | C | MANDEVILLE | B | MARIETTA | C | MASCOTTE | B/D | MAYDOL | B |
| MAHONING | D | MANDY | C | MARILLA | C | MASCOTTE, | D | MAYER | B/D |
| MAHOOSUC | A | MANET | B | MARIMEL | C | DEPRESSIONAL | | MAYES | D |
| MAHTOMEDI | A | MANFRED | D | MARIMEL, DRAINED | B | MASET | B | MAYFIELD | B |
| MAHTOWA | C/D | MANGUM | D | MARINA | B | MASHAM | D | MAYFLOWER | C |
| MAHUKONA | B | MANHATTAN | A | MARINE | C | MASHEL | B | MAYGER | C |
| MAIA | B | MANHEIM | C | MARION | D | MASHULAVILLE | B/D | MAYHEW | D |
| MAIDEN | C | MANI | C | MARIPO | B | MASKELL | B | MAYHEAD | B |
| MAILE | A | MANIKAN | B | MARIPOSA | C | MASON | B | MAYMEN | D |
| MAINSTAY | D | MANILA | C | MARISCAL | D | MASONFORT | D | MAYNARD LAKE | A |
| MAITLAND | B | MANISTEE | A | MARISSA | C | MASONTOWN | D | MAYO | B |
| MAJADA | B | MANITA | C | MARKES | D | MASSACK | C | MAYODAN | B |
| MAJUBA | C | MANITOWISH | B | MARKESAN | B | MASSACK, DRAINED | B | MAYOWORTH | C |
| MAKAALAE | B | MANLEY | B | MARKET | D | MASSADONA | D | MAYQUEEN | B |
| MAKAH | B | MANLIUS | C | MARKEY | A/D | MASSANETTA | B | MAYSDORF | B |
| MAKALAPA | D | MANN | B/D | MARKHAM | C | MASSANUTTEN | B | MAYSPRINGS | B |
| MAKAPILI | B | MANNING | B | MARKLAKE | D | MASSBACH | B | MAYTAG | D |
| MAKAWAO | B | MANOGUE | D | MARKLAND | C | MASSENA | C | MAYTOWN | C |
| MAKAWELI | B | MANOR | B | MARKLEPASS | D | MASSIE | D | MAYVILLE | B |
| MAKENA | B | MANSELO | B | MARKTON | C | MASTERSON | B | MAYWOOD | B |
| MAKI | C | MANSFIELD | D | MARLA | D | MATA | C | MAZARN | C |
| MAKIKI | B | MANSIC | B | MARLAKE | D | MATAGORDA | D | MAZASKA | C/D |
| MAKLAK | A | MANSKER | B | MARLBORO | B | MATAMOROS | C | MAZDALE | B |
| MAKOTI | B | MANSONIA | B | MARLEAN | B | MATANUSKA | B | MAZDURKA | C |
| MAL | C | MANTACHIE | C | MARLETTE | B | MATANZAS | B | MAZUMA | B |
| MALA | B | MANTECA | C | MARLOW | C | MATAPEAKE | B | MC CORT | B |
| MALABAR | B/D | MANTEO | C/D | MARLTON | C | MATAWAN | C | MCAFEE | C |
| MALABAR, | D | MANTER | B | MARMARTH | B | MATCHER | A | MCALLEN | B |
| DEPRESSIONAL | | MANTON | B | MARMARTH, COOL | C | MATFIELD | C | MCALLISTER | C |
| MALABAR, | D | MANU | C | MARNA | C/D | MATGO | D | MCALPIN | C |
| FREQUENTLY | | MANVEL | B | MAROSA | B | MATHENY | B | MCBEE | C |
| FLOODED | | MANVEL, SALINE | C | MAPOTZ | C | MATHERS | B | MCBETH | D |
| MALABON | C | MANZANAR | C | MARPA | C | MATHERTON | B | MCBETH, SALINE | C |
| MALACHY | B | MANZANITA | C | MARPLEEN | D | MATHESON | B | MCBETH, DRAINED | C |
| MALAGA | B | MANZANITA, | B | MARQUETTE | A | MATHIAS | B | MCBIGGAM | C |
| MALAGA, STONY | A | GRAVELLY | | MARQUEZ | C | MATHIS | C | MCBRIDE | B |
| MALAMA | A | MANZANO | B | MARR | B | MATHISTON | C | MCCAFFERY | A |
| MALARGO | B | MANZANOLA | C | MARRIOTT | B | MATHON | B | MCCAIN | C |
| MALAYA | D | MAPLE MOUNTAIN | B | MARROWBONE | C | MATLACHA | C | MCCALEB | B |
| MALBIS | B | MAPLECREST | B | MARSDEN | B | MATNEFLAT | B | MCCALL | B |
| MALCOLM | B | MAPLEHILL | C | MARSEILLES | B | MATOY | C | MCCALLY | D |
| MALDEN | A | MAPLETON | C | MARSELL | B | MATTAMUSKEET | D | MCCAMMON | C |
| MALEZA | B | MAPLETON, STONY | C/D | MARSHALL | B | MATTAN | D | MCCANN | B |
| MALHEUR | C | MARACK | C | MARSHAN | B/D | MATTAPEX | C | MCCAREY | C |
| MALIBU | D | MARAGUEZ | B | MARSHBROOK | D | MATTAPONI | C | MCCARRAN | B |
| MALIN | C | MARANA | B | MARSHDALE | D | MATUNUCK | D | MCCARTHY | B |
| MALJAMAR | B | MARATHON | B | MARSHDALE, DRAINED | C | MAU | C | MCCASH | B |
| MALLORY | C | MARBLE | A | MARSHFIELD | B/D | MAUBILA | C | MCCLAVE | C |
| MALM | C | MARBLECREEK | B | MARSING | B | MAUDE | B | MCCLEARY | D |
| MALMESA | D | MARBLEMOUNT | B | MART | B | MAUDLIN | B | MCCLELLAN | B |
| MALO | B | MARBLEMOUNT, | C | MARTEL | D | MAUGHAN | C | MCCLOUD | C |
| MALOTERPE | D | CHANNERY | | MARTELLA | C | MAUKEY | C | MCCLURE | C |
| MALOTT | B | MARCADO | D | MARTIN | C | MAUMEE | A/D | MCCOIN | D |
| MALOY | B | MARCELINAS | D | MARTIN PENA | D | MAUNABO | D | MCCOLL | D |
| MALPAIS | B | MARCELLON | C | MARTINECK | D | MAUPIN | C | MCCOLLUM | B |
| MALSTROM | B | MARCETTA | B | MARTINEZ | D | MAUREPAS | D | MCCONNEL | B |
| MALVERN | C | MARCIAL | D | MARTINI | B | MAURERTOWN | D | MCCONNEL, FLOODED | A |
| MAMALA | D | MARCLAY | D | MARTINSBURG | B | MAURICE | B | MCCOOK | B |
| MAMOU | C | MARCOLA | C | MARTINSDALE | B | MAURY | B | MCCORNICK | C |
| MANAHAA | C | MARCONI | C | MARTINSON | C | MAUVAIS | C | MCCORT | B |
| MANAHAWKIN | D | MARCOTT | C | MARTINSVILLE | B | MAVCO | C | MCCOY | C |
| MANANA | C | MARCOU | B | MARTINTON | C | MAVEPICK | C | MCCREE | B |
| MANARD | D | MARCUM | C | MARTIS | B | MAVIF | B/D | MCCRORY | D |
| MANARD, GRAVELLY | C | MARCUS | B/D | MARTISCO | B/D | MAWAE | A | MCCRDSKET | B |
| SUBSTRATUM | | MARCUSE | D | MARTY | B | MAWER | B | MCCULLDUGH | B |
| MANASSA | C | MARCY | D | MARUMSCO | C | MAX | B | MCCULLY | C |
| MANASSAS | B | MARDIN | C | MARVAN | D | MAXCREEK | B/D | MCCUMBER | B |
| MANASTASH | C | MARENGO | C/D | MARVELL | B | MAXEY | C | MCCUNE | D |
| MANATEE | B/D | MARESUA | B | MARVIN | C | MAXFIELD | B/D | MCCURDY | C |
| MANATEE, | D | MARGATE | B/D | MARVYN | B | MAXTON | B | MCCUTCHEN | D |
| DEPRESSIONAL | | MARGERUM | B | MARY | C | MAXVILLE | B | MCDADE | C |
| MANATEE, FLOODED | D | MARGIE | C | MARYSLAND | B/D | MAXWELL | D | MCDANIEL | B |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MCDERMOTT | B | MECKLENBURG | C | MERDEN | D | MIKIM, WET | C | MINNEOSA | B |
| MCDOLE | B | MECOSTA | A | MEREDITH | B | SUBSTRATUM | | MINNEQUA | C |
| MCDONALD | C | MEDA | B | MERETA | C | MIKKALO | C | MINNETONKA | D |
| MCDONALDSVILLE | C/D | MEDANO | D | MERGEL | B | MILACA | C | MINNETONKA, SILTY | C/D |
| MCDUFF | C | MEDARY | C | MERIDIAN | B | MILAN | B | SUBSTRATUM | |
| MCELMO | C | MEDBURN | B | MERINO | D | MILBURY | C | MINNEWAUKAN | A/C |
| MCELROY | B | MEDCO | D | MERKEL | B | MILBY | B | MINNIECE | D |
| MCEWEN | B | MEDFORD | B | MERLIN | D | MILCAN | C | MINNIEPEAK | A |
| MCFADDEN | B | MEDFRA | D | MERMENTAU | D | MILDRED | C | MINNIEPEAK, | B |
| MCFAIN | C | MEDICINE | B | MERMILL | B/D | MILES | B | OVERBLOWN, | |
| MCFARLAND | B | MEDLEY | B | MERNA | B | MILFORD | B/D | GRAVELLY | |
| MCFAUL | C | MEDLIN | D | MEROS | A | MILHAM | B | MINNIEPEAK, | B |
| MCGAFFEY | B | MEDOMAK | D | MERRICK | B | MILITARY | B | OVERBLOWN | |
| MCGARR | C | MEDORA | B | MERRILL | C | MILL HOLLOW | B | MINNIEVILLE | C |
| MCGARVEY | C | MEDWAY | B | MERRILLAN | C | MILLADORE | C | MINNIMAUD | C |
| MCGARY | C | MEEGERNOT | B | MERRIMAC | A | MILLARD | B | MINNITH | C |
| MCGEHEE | C | MEEGERO | B | MERRITT | C | MILLBORO | D | MINNYE | B |
| MCGILVERY | D | MEEHAN | B | MERRITT, CLAYEY | B | MILLBROOK | B | MINOA | C |
| MCGINNIS | C | MEEKS | B | SUBSTRATUM, | | MILLBURNE | B | MINOCQUA | B/D |
| MCGINTY | B | MEETEETSE | D | DRAINED | | MILLER | D | MINTER | D |
| MCGIRK | C | MEGALOS | D | MERRITT, DRAINED | B | MILLERLAKE | B | MINTO | C |
| MCGIRK, LOW | D | MEGGETT | D | MERSHON | C | MILLERLUX | D | MINU | D |
| PRECIPITATION | | MEGONOT | C | MERTON | B | MILLERTON | D | MINVALE | B |
| MCGOWAN | B | MEGUIN | B | MERTZ | C | MILLERVILLE | A/D | MINVENO | D |
| MCGRATH | B | MEHLHORN | C | MERWIN | A/D | MILLETT | B | MINWELLS | C |
| MCGREW | B | MEIKLE | D | MESA | B | MILLGROVE | B/D | MION | D |
| MCGUFFEY | D | MEISS | D | MESABA | C | MILLHEIM | C | MIPPON | C |
| MCGUIRE | B | MEKINOCK | D | MESCAL | C | MILLHI | D | MIRABAL | C |
| MCHENRY | B | MELAKWA | C | MESCALERO | C | MILLHOPPER | A | MIRACLE | C |
| MCILWAINE | B | MELAND | C | MESEI | D | MILLICH | D | MIRAGE | C |
| MCINTOSH | B | MELBOURNE | B | MESPUN | A | MILLICOMA | C | MIRAMAR | B |
| MCINTYRE | B | MELBY | B | MESSER | C | MILLIGAN | C | MIRAND | D |
| MCIVEY | C | MELD | C | MET | B | MILLING | D | MIRANDA | D |
| MCKAMIE | D | MELDER | B | METAMORA | B | MILLINGTON | B/D | MIRES | A |
| MCKAY | C | MELGA | D | METCALF | D | MILLIS | C | MIRES, STONY | B |
| MCKEE | D | MELHOMES | D | METEA | B | MILLPAW | C | MIRKWOOD | D |
| MCKEETH | B | MELITA | A | METH | C | MILLPOT | B | MIRROR | C |
| MCKELVIE | A | MELLENTHIN | D | METIGOSHE | B | MILLRACE | B | MIRROR LAKE | A |
| MCKENNA | D | MELLOR | D | METOLIUS | B | MILLPOCK | A | MISAD | B |
| MCKENNA, DRAINED | C | MELLOR, STRATIFIED | C | METRE | D | MILLSAP | D | MISENHEIMER | C |
| MCKENZIE | D | SUBSTRATUM | | METZ | B | MILLSDALE | B/D | MISHAK | D |
| MCKINLEY | B | MELLOTT | B | MEXICO | D | MILLSHOLM | D | MISHAK, DRAINED | C |
| MCKINNEY | C | MELOCHE | D | MEXISPRING | D | MILLSITE | B | MISSION | D |
| MCKNIGHT | B | MELOLAND | C | MEYSTRE | B | MILLVILLE | B | MISSISQUOI | A |
| MCLAIN | C | MELROSE | C | MHOON | D | MILLWOOD | D | MISSLER | B |
| MCLAURIN | B | MELTON | D | MIAMI | B | MILNER | B | MISSOULA | D |
| MCLEDD | B | MELVILLE | B | MIAMIAN | C | MILOK | B | MITCH | B |
| MCLOUGHLIN | B | MELVIN | D | MICANOPY | C | MILPITAS | C | MITCH, RARELY | C |
| MCMEEN | C | MEMALOOSE | C | MICCO | B/D | MILREN | C | FLOODED | |
| MCMILLE | B | MEMPHIS | B | MICHELSON | B | MILTON | C | MITCHELL | B |
| MCMULLIN | D | MENAHGA | A | MICHIGAMME | C | MILVAR | C | MITIWANGA | C |
| MCMURDIE | C | MENARD | B | MICKEY | D | MIMBRES | B | MITKOF | D |
| MCMURRAY | D | MENASHA | D | MICROY | C | MIMOSA | C | MITKOF, MODERATELY | C |
| MCMURRAY, DRAINED | C | MENBO | C | MIDAS | C | MINA | B | WET | |
| MCNARY | D | MENDEBOURE | C | MIDCO | A | MINALOOSA | B | MITRE | C |
| MCNEAL | B | MENDELTNA | D | MIDDLE | C | MINAM | B | MITRING | C |
| MCNULL | C | MENDELTNA, | B | MIDDLEBURY | B | MINAT | B | MITTEN | B |
| MCNULTY | B | LACUSTRINE | | MIDDLEMARCH | B | MINATARE | D | MIVIDA | B |
| MCPAUL | B | SUBSTRATUM | | MIDDLETOWN | B | MINCHEY | B | MIZEL | D |
| MCPHIE | B | MENDENHALL | D | MIDDLEWOOD | D | MINCHUMINA | D | MOAB | B |
| MCQUARRIE | D | MENDI | B | MIDELIGHT | B | MINCO | B | MOAG | D |
| MCQUEEN | C | MENDOCINO | B | MIDESSA | B | MINDEGO | C | MOANO | D |
| MCRAE | B | MENDON | B | MIDFORK | B | MINDEN | B | MOAPA | C |
| MCRAVEN | C | MENDOTA | B | MIDLAND | D | MINE | B | MOAULA | A |
| MCTAGGART | B | MENEFEE | D | MIDMONT | C | MINEOLA | A | MOBATE | D |
| MCVEGAS | D | MENFRO | B | MIDNIGHT | D | MINER | D | MOBEETIE | B |
| MCVICKERS | C | MENLO | D | MIDO | A | MINERAL | C | MOBERG | B |
| MEAD | D | MENO | C | MIDRAW | D | MINERAL MOUNTAIN | C | MOBL | B |
| MEADIN | A | MENOKEN | C | MIDVALE | C | MINERSVILLE | B | MOBRIDGE | B |
| MEADLAND | C | MENOMINEE | A | MIDWAY | D | MINESINGER | C | MOCA | D |
| MEADOWBROOK | B/D | MENTO | C | MIERHILL | C | MINETA | C | MOCAREY | D |
| MEADOWCREEK | C | MENTOR | B | MIERUF | B | MINGO | C | MOCHO | B |
| MEADOWLAKE | C | MENZEL | B | MIESEN | C | MINGUS | D | MOCKLEP | B |
| MEADOWVILLE | B | MEOUON | C | MIFFLIN | B | MINIDOKA | C | MOCMONT | B |
| MEANS | C | MER ROUGE | B | MIGERN | B | MINKLER | D | MOCTILEME | C |
| MEARES | D | MERCED | D | MIGUEL | D | MINLITH | D | MODA | D |
| MECAN | B | MERCEDES | D | MIKE | D | MINNEHA | C | MODALE | C |
| MECHANICSBURG | C | MERCER | C | MIKESELL | C | MINNEISKA | B | MODENA | B |
| MECKESVILLE | C | MERCEY | C | MIKIM | B | MINNEOPA | B | MODESTO | C |

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MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MODJESKA | B | MONTCALM | A | MORTENSON | C | MUIR | B | MYOMA, WET | B |
| MODKIN | C | MONTE | B | MORTENSON, COBBLY | D | MUIRKIRK | B | MYRA | C |
| MODOC | C | MONTE CRISTO | D | MORTON | B | MUKILTEO | D | MYRICK | C |
| MODYON | C | MONTECITO | B | MORVAL | B | MUKILTEO, DRAINED | C | MYRTLE | B |
| MOE | B | MONTEGRANDE | D | MOSBY | C | MULAT | D | MYSTEN | A |
| MOEN | C | MONTELL | D | MOSCA | B | MULDOON | B | MYSTIC | C |
| MOENKOPIE | D | MONTELLO | C | MOSCOW | C | MULDPOW | D | NAALEHU | B |
| MOEPITZ | B | MONTEOCHA | D | MOSEL | C | MULETT | D | NAALEHU, BEDROCK | C |
| MOFFAT | B | MONTEOLA | D | MOSES | B | MULGON | B | SUBSTRATUM | |
| MOGG | D | MONTEROSA | D | MOSES, BOULDERY | C | MULHALL | B | NABESNA | D |
| MOGLIA | C | MONTESA | C | MOSHANNON | B | MULHOLLAND | B | NACHES | B |
| MOGOLLON | B | MONTEVALLO | D | MOSHEIM | D | MULHOP | D | NACHUSA | B |
| MOGOTE | C | MONTEZ | B | MOSHER | D | MULKEY | C | NACIMIENTO | C |
| MOHALL | B | MONTGOMERY | D | MOSHERVILLE | C | MULLICA | C | NACLINA | D |
| MOHAVE | B | MONTICELLO | B | MOSHUP | C | MULLIG | B | NACOGDOCHES | B |
| MOHAWK | B | MONTIETH | B | MOSIDA | B | MULLINS | D | NADA | D |
| MOHOCKEN | C | MONTLID | C | MOSINEE | B | MULLYON | D | NADEAU | B |
| MOIESE | B | MONTMORENCI | B | MOSLANDER | D | MULSHOE | C | NADINA | D |
| MOINES | C | MONTNEVA | C | MOSMAN | D | MULSTAY | C | NADRA | D |
| MOINGONA | B | MONTOSO | B | MOSO | B | MULT | C | NAEGELIN | D |
| MOJO | C | MONTOUR | D | MOSQUET | D | MULTEY | B | NAFF | B |
| MOKELUMNE | D | MONTOYA | D | MOSROC | D | MULTNOMAH | B | NAGITSY | C |
| MOKENA | C | MONTPELLIER | C | MOSSYROCK | B | MULTORPOR | A | NAGLE | B |
| MOKIAK | B | MONTROSS | C | MOSWELL | D | MUNDAL | C | NAGROM | C |
| MOKINS | D | MONTVALE | D | MOTA | B | MUNDELEIN | B | NAHA | C |
| MOKO | D | MONTVERDE | B/D | MOTEN | C | MUNDEN | B | NAHATCHE | C |
| MOKULEIA | B | MONTWEL | C | MOTLEY | B | MUNDOS | B | NAHMA | B/D |
| MOLALLA | B | MONTWEL, ALKALI | B | MOTOQUA | D | MUNDT | C | NAHON | D |
| MOLAND | B | MONUE | B | MOTT | B | MUNI | D | NAHRUB | D |
| MOLAS | D | MONVERO | A | MOTTLAND | B | MUNISING | B | NAHUNTA | C |
| MOLCAL | B | MOODY | B | MOTTO | D | MUNJOR | B | NAIWA | B |
| MOLENA | A | MOOHOO | B | MOTTSVILLE | A | MUNK | C | NAKAI | B |
| MOLION | D | MOOLACK | A | MOULTON | C | MUNNELL | B | NAKARNA | B |
| MOLLICY | C | MOONLIGHT | B | MOULTRIE | D | MUNSET | D | NAKINA | B/D |
| MOLLMAN | B | MOONSHINE | D | MOUND | C | MUNSON | D | NAKNEK | D |
| MOLLVILLE | D | MOONSTONE | C | MOUNDHAVEN | A | MUNUSCONG | B/D | NAKOCHNA | D |
| MOLLY | B | MOONVILLE | B | MOUNDPRAIRIE | B/D | MURAD | B | NALAKI | C |
| MOLOKAI | B | MOOREVILLE | C | MOUNDPRAIRIE, | D | MURANCH | C | NALDO | B |
| MOLSON | B | MOOSE RIVER | D | PONDED | | MURDO | B | NALL | D |
| MOLYNEUX | B | MOOSED | C | MOUNDVILLE | A | MURDOCK | C | NAMBE | B |
| MOMOLI | B | MOOSELAKE | A/D | MOUNT HOME | B | MUREN | B | NAMELA | C |
| MONA | B | MOOSHAUNEE | C | MOUNT LUCAS | C | MURNEN | B | NAMEOKI | D |
| MONACAN | C | MOOSILAUKE | C | MOUNTADAMS | B | MUROC | D | NAMON | B |
| MONACHE | B | MOPANA | D | MOUNTAINBOY | D | MURPHY | C | NAMUR | D |
| MONAD | B | MOPANG | B | MOUNTAINBURG | D | MURRIETA | D | NANAMKIN | A |
| MONADNOCK | B | MOQUAH | B | MOUNTAINEER | C | MURRILL | B | NANCY | B |
| MONAHANS | B | MORA | C | MOUNTAINVIEW | C | MURTIP | B | NANIAK | D |
| MONARDA | D | MORADO | C | MOUNTAINVILLE | B | MURVILLE | A/D | NANKIN | C |
| MONASTERIO | C | MORALES | D | MOUNTMED | D | MUSCATINE | B | NANNY | B |
| MONAVILLE | B | MORAN | B | MOUNTMED, | C | MUSE | C | NANNYTON | B |
| MONBUTTE | C | MORANCH | B | MODERATELY WET | | MUSELLA | B | NANSEMOND | C |
| MONCHA | B | MORAPOS | C | MOUNTVIEW | B | MUSICK | B | NANSENE | B |
| MONDAMIN | C | MORD | C | MOUZON | D | MUSINIA | B | NANSEPSEP | C |
| MONDEY | C | MOREAU | D | MOVILLE | C | MUSKEGO | A/D | NANSUS | D |
| MONDOVI | B | MOREHEAD | C | MOWATA | D | MUSKEGO, MARSHY | D | NANTAHALA | B |
| MONEE | D | MOREHOUSE | D | MOWEBA | B | MUSKEGO, CLAY LOAM | D | NANTUCKET | C |
| MONGAUP | C | MORELAND | D | MOWER | C | SUBSTRATUM | | NANUM | B |
| MONICO | C | MORENO | C | MOWICH | D | MUSKELLUNGE | D | NAPA | D |
| MONIDA | C | MORET | D | MOXEE | D | MUSKINGUM | C | NAPIER | B |
| MONIERCO | D | MOREY | D | MOYERS | C | MUSKOGEE | C | NAPLENE | B |
| MONITEAU | C/D | MORFITT | B | MOYERSON | D | MUSOFARE | C | NAPOLEON | A/D |
| MONITOR | C | MORGALA | C | MOYINA | D | MUSQUIZ | C | NAPPANEE | D |
| MONJEAU | D | MORGANFIELD | B | MT. AIRY | A | MUSSEL | B | NAPTOWNE | B |
| MONOCLINE | C | MORIARTY | D | MT. CARROLL | B | MUSSELSHELL | B | NARANJITO | C |
| MONOGRAM | B | MORICAL | C | MT. HOOD | B | MUSSERHILL | C | NARANJO | C |
| MONONA | B | MORLEY | C | MT. OLIVE | C | MUSSEY | B/D | NARCISSE | C |
| MONONGAHELA | C | MORLING | D | MT. VERNON | C | MUSTANG | A/D | NARCOOSSEE | C |
| MONROE | B | MORMON MESA | D | MUCARA | D | MUTNALA | B | NARD | B |
| MONROEVILLE | C/D | MOROCCO | B | MUCKALEE | D | MUZZLER | D | NAREL | B |
| MONSE | B | MORONI | D | MUD SPRINGS | C | MYAKKA | B/D | NARGAR | B |
| MONSERATE | C | MOROP | C | MUDCO | D | MYAKKA, | D | NARK | C |
| MONSERATE, THIN | D | MORPH | B/D | MUDLAVIA | B | DEPRESSIONAL | | NARLON | D |
| SURFACE | | MORRILL | B | MUDRAY | D | MYAKKA, TIDAL | D | NARNETT | B |
| MONSON | C/D | MORRIS | C | MUES | C | MYATT | D | NARON | B |
| MONTAGUE | D | MORRISON | B | MUFF | C | MYERS | D | NARRAGANSETT | B |
| MONTALTO | C | MORRISTOWN | C | MUG | D | MYERSVILLE | B | NARRAGUINNEP | D |
| MONTARA | D | MORROW | C | MUGGINS | C | MYFORD | D | NARROWS | D |
| MONTAUK | C | MORSE | D | MUGHOUSE | C | MYLREA | C | NARTA | D |
| MONTBORNE | C | MORSET | B | MUGHUT | C | MYOMA | A | NARU | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NASER | B | NEHALEM, FLOODED | C | NEWALBIN, MUCK | D | NIKAL | B | NOONAN | D |
| NASH | B | NEHAR | B | SUBSTRATUM | | NIKEY | B | NOPAH | C |
| NASHMEAD | B | NEHAR, STONY | C | NEWALBIN, PONDED | D | NIKFUL | D | NORA | B |
| NASHOBA | C | NEIBER | C | NEWALLA | D | NIKISHKA | B | NORAD | B |
| NASHVILLE | B | NEICE | B | NEWAMNA | C | NIKLASON | B | NORBERT | D |
| NASHWAUK | C | NEILTON | A | NEWARK | C | NIKOLAI | D | NORBORNE | B |
| NASKEAG | C | NEISSENBERG | C | NEWARK, PONDED | D | NILAND | C | NORCAN | C |
| NASON | C | NEKIA | C | NEWARK, PONDED, | D | NILER | D | NORD | B |
| NASON, GRAVELLY | D | NEKKEN | B | COOL | | NILRAP | B | NORDBY | B |
| NASS | D | NEKOMA | B | NEWAUKUM | B | NIMBRO | B | NORDEN | B |
| NASSAU | C | NELDORE | D | NEWAYGO | B | NIMERICK | C | NORDIC | B |
| NASSET | B | NELLA | B | NEWBELL | B | NIMMO | D | NORDICOL | B |
| NATAGA | A | NELLIS | B | NEWBERG | B | NIMROD | C | NORDNESS | B |
| NATAL | D | NELMAN | C | NEWBERG, WET | C | NIMS | C | NORFOLK | B |
| NATANK | C | NELSCOTT | C | NEWBERN | C | NIMUE | B | NORFORK | D |
| NATCHEZ | B | NELSE | B | NEWBERRY | C | NINCH | B | NORGE | B |
| NATCHITOCHES | D | NELSON | C | NEWBON | B | NINEKAR | D | NORGO | D |
| NATHALE | C | NEMADJI | B | NEWCO | D | NINEMILE | D | NORKA | B |
| NATHROP | C | NEMAH | D | NEWCOMB | A | NINEPIPE | B | NORKOOL | B |
| NATHROP, NONSTONY | B | NEMAH, DRAINED | C | NEWDALE | B | NINEVEH | B | NORLAND | B |
| NATHROP, COBBLY | B | NEMICO | D | NEWELL | B | NINIGRET | B | NORMA | D |
| NATI | C | NEMOTE | A | NEWELLTON | D | NIOBELL | C | NORMA, DRAINED | C |
| NATIONAL | B | NEMOURS | C | NEWFIELDS | B | NIOTA | D | NORMANGEE | D |
| NATKIM | B | NENANA | B | NEWFLAT | D | NIOTAZE | C | NORMANIA | B |
| NATOMAS | B | NENNO | C | NEWFORK | D | NIPE | B | NOROB | C |
| NATROY | D | NEOLA | D | NEWFOUND | C | NIPINTUCK | D | NORREST | C |
| NATURITA | B | NEOTOMA | B | NEWGLARUS | B | NIPPT | B | NORRIS | D |
| NAUKATI | D | NEPALTO | A | NEWHAN | A | NIPSUM | C | NORRISTON | A |
| NAUMBURG | C | NEPESTA | B | NEWHOUSE | B | NIRA | B | NORTE | C |
| NAUVOO | B | NEPHI | C | NEWKIRK | D | NIRAC | C | NORTEZ | C |
| NAVACA | D | NEPONSET | C | NEWLANDS | B | NIRE | C | NORTH POWDER | C |
| NAVAJO | D | NEPPEL | B | NEWLANDS, WARM | C | NISENE | B | NORTHBORO | C |
| NAVAN | D | NEPTUNE | A | NEWLIN | B | NISHNA | C/D | NORTHCASTLE | B |
| NAVASAN | A | NERESON | B | NEWNAN | C | NISHNA, PONDED | D | NORTHCOTE | C/D |
| NAVIDAD | B | NESBITT | B | NEWNATA | C | NISHON | D | NORTHDALE | C |
| NAVINA | B | NESDA | B | NEWPASS | C | NISQUALLY | A | NORTHFIELD | D |
| NAVO | D | NESHAMINY | B | NEWPORT | C | NISULA | B | NORTHMORE | C |
| NAWNEY | D | NESHOBA | C | NEWRY | B | NITCHLY | B | NORTHRUP | C |
| NAWT | D | NESIKA | B | NEWSKAH | B | NITTAW | D | NORTHSTAR | C |
| NAXING | B | NESIUS | A | NEWSON | A/D | NIU | B | NORTHWATER | B |
| NAYE | C | NESKAHI | B | NEWSROCK | B | NIULII | C | NORTHWOOD | B/D |
| NAYPEO | B | NESKOWIN | C | NEWSTEAD | C | NIWANA | B | NORTON | C |
| NAYRIB | D | NESO | D | NEWTON | A/D | NIWOT | C | NORTONVILLE | C |
| NAZ | B | NESPELEM | C | NEWTONIA | B | NIX | D | NORWELL | C |
| NAZATON | B | NESS | D | NEWTOWN | C | NIXA | C | NORWICH | D |
| NEABSCO | C | NESSEL | B | NEWULM | B | NIXON | B | NORWOOD | B |
| NEBAGO | C | NESTER | C | NEWVIENNA | B | NIXONTON | B | NOSRAC | B |
| NEBEKER | C | NESTORIA | C/D | NEWVILLE | D | NIZINA | A | NOTAL | D |
| NEBGEN | D | NESTUCCA | D | NEYGAT | D | NOARK | B | NOTCHER | B |
| NEBISH | B | NET | C | NEZ PERCE | C | NOBE | D | NOTI | D |
| NEBONA | D | NETARTS | B | NGARDMAU | B | NOBLE | B | NOTNED | B |
| NECANICUM | B | NETCONG | B | NGARDOK | B | NOBLETON | C | NOTSPIER | D |
| NECESSITY | C | NETO | B | NGATPANG | C | NOBOCO | B | NOTTAWA | B |
| NECHE | C | NETOMA | B | NGEDEBUS | A | NOBSCOT | A | NOTTER | B |
| NECONDA | C | NETRAC | A | NGERSUUL | C | NOBUCK | C | NOTUS | C |
| NECTAR | C | NETTLES | D | NGERUNGOR | D | NOCKEN | C | NOTUS, DRAINED | B |
| NEDA | C | NETTLETON | C | NIAGARA | C | NODAWAY | B | NOUQUE | D |
| NEDERLAND | B | NEUBERT | B | NIARADA | B | NODEN | B | NOVACAN | D |
| NEEDLE | D | NEUNS | C | NIAPT | B | NODINE | B | NOVARK | B |
| NEEDLE PEAK | C | NEURALIA | C | NIBBS | B | NOELKE | D | NOVARY | D |
| NEEDLE PEAK, LOAMY | B | NEURALIA, SANDY | B | NIBLEY | C | NOGAL | C | NOVATO | D |
| SUBSTRATUM | | SUBSTRATUM | | NIBSON | D | NOHILI | D | NOVINA | B |
| NEEDLE PEAK, | B | NEUSKE | B | NICANOR | D | NOKASIPPI | B/D | NOWATA | B |
| OCCASIONALLY | | NEVADANILE | C | NICHOLFLAT | D | NOKAY | C | NOWEN | B/D |
| FLOODED | | NEVADOR | B | NICHOLIA | D | NOKHU | C | NOWOY | B |
| NEEDLETON | B | NEVARC | C | NICHOLS | B | NOLAM | B | NOYER | B |
| NEEDLEYE | C | NEVAT | B | NICHOLSON | C | NOLICHUCKY | B | NOYES | C/D |
| NEEDMORE | C | NEVEE | B | NICHOLVILLE | C | NOLIN | B | NOYO | C |
| NEELEY | B | NEVERSINK | D | NICKEL | B | NOLO | D | NOYSON | C |
| NEEN | C | NEVILLE | B | NICKIN | B | NOLTEN | C | NUAHS | B |
| NEEN, WET | D | NEVILLE, WET | C | NICKSVILLE | C | NOMARA | C | NUBY | D |
| NEEN, DRAINED | B | NEVIN | B | NICODEMUS | B | NOME | D | NUBY, DRAINED | C |
| NEENAH | C | NEVINE | B | NICODEMUS, FLOODED | C | NOMIE | B | NUBY, PROTECTED | C |
| NEER | B | NEVKA | C | NICOLAS | A | NONDALTON | B | NUC | C |
| NEESES | C | NEVOYER | D | NICOLLET | B | NONOPAHU | D | NUCKOLLS | B |
| NEESOPAH | B | NEVTAH | C | NIDO | C | NONPAREIL | D | NUCLA | B |
| NEFF | C | NEVU | C | NIELSEN | D | NOOK | C | NUECES | C |
| NEGLEY | B | NEW CAMBRIA | C | NIGHTHAWK | B | NOOKACHAMPS | D | NUEVA | B |
| NEHALEM | B | NEWALBIN | B/D | NIHILL | B | NOOKSACK | C | NUFF | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NUGENT | A | OCONALUFTEE | B | OLD CAMP | D | OPENLAKE | D | OSAKIS | B |
| NUKRUM | D | OCONEE | C | OLDENBURG | B | OPEQUON | C | OSBORN | C |
| NULEY | B | OCONTO | B | OLDHAM | C/D | OPHIR | C | OSBORN, MODERATELY WET | D |
| NULLIGAN | B | OCOSTA | D | OLDS | D | OPINIKAO | D | | |
| NUMA | B | OCQUEOC | A | OLDSFERRY | C | OPLIN | C | OSCAR | D |
| NUNDA | C | OCQUEOC, MODERATELY WET | B | OLDSMAR | B/D | OPPIO | D | OSCURA | C |
| NUNEMAKER | D | | | OLDSMAR, DEPRESSIONAL | D | OPPIO, STONY | C | OSGOOD | C |
| NUNICA | C | OCRAIG | D | | | OQUAGA | C | OSHA | B |
| NUNN | C | OCTAGON | B | OLELO | B | OQUIN | C | OSHAWA | D |
| NUNN, MODERATELY WET | B | OCTAVIA | B | OLENO | D | ORA | C | OSHKOSH | C |
| | | ODAS | D | OLENTANGY | A/D | ORACLE | D | OSHONE | D |
| NUNNSTON | C | ODELL | B | OLEQUA | B | ORAGRAN | D | OSHTEMO | B |
| NUPART | D | ODEM | A | OLETE | C | ORAID | C | OSIER | A/D |
| NUPPER | D | ODENSON | D | OLEX | B | ORAN | B | OSITO | C |
| NURKEY | B | ODERMOTT | C | OLF | D | ORANGE | D | OSKA | C |
| NUSS | D | ODERMOTT, STONY | B | OLGA | C | ORANGEBURG | B | OSMUND | B |
| NUTALL | D | ODESSA | D | OLI | B | ORANGEVALE | B | OSO | C |
| NUTIVOLI | A | ODIN | C | OLIAGA | C | ORCAP | C | OSOBB | D |
| NUTLEY | C | ODNE | D | OLICAL | B | ORCAS | D | OSOLL | D |
| NUTRAS | C | ODO | B | OLIN | B | ORCHARD | B | OSORIDGE | D |
| NUTRIOSO | B | ODONNELL | C | OLINDA | B | ORCKY | B | OSOTF | D |
| NUVALDE | B | OELOP | B | OLIPHANT | B | ORD | B | OSSIAN | B/D |
| NUYOBE | C | OEST | B | OLIVENHAIN | D | ORDNA | D | OSSIPEE | D |
| NYALA | B | OESTERLE | C | OLIVIER | C | ORDNANCE | C | OST | B |
| NYE | B | OFFENBACHER | C | OLJETO | A | ORDWAY | D | OSTLER | C |
| NYJACK | C | OFU | B | OLLEI | D | OREANA | B | OSTRANDER | B |
| NYMORE | A | OGARTY | C | OLLIERIVAS | D | OREANNA | B | OSWALD | D |
| NYSERVA | B | OGEECHEE | B/D | OLMITO | D | OREJAS | D | OTANYA | B |
| NYSSA | C | OGEMAW | C/D | OLMITZ | B | ORELIA | D | OTEEN | C |
| NYSSATON | B | OGILVIE | B/D | OLMOS | C | ORELLA | D | OTERO | B |
| NYSWONGER | D | OGLALA | B | OLMSTED | B/D | ORENDA | B | OTHELLO | C/D |
| O'BRIEN | B | OGLE | B | OLNES | B | ORENEVA | C | OTISCO | A |
| O'NEILL | B | OGLESBY | D | OLNEY | B | ORFORD | B | OTISVILLE | A |
| OAHE | B | OGRAL | B | OLOAVA | B | ORHOOD | D | OTLEY | B |
| OAK GLEN | B | OHACO | C | OLOKUI | D | ORICTO | B | OTOMO | D |
| OAK GROVE | B | OHANA | C | OLOMOUNT | C | ORIDIA | D | OTOOLE | C |
| OAKALLA | B | OHIA | A | OLOMPALI | D | ORIF | A | OTTER | B/D |
| OAKBORO | C | OHOP | C | OLOT | C | ORIGO | B | OTTERHOLT | B |
| OAKDALE | B | OHSCOW | B | OLOTANIA | B | ORINOCO | C | OTTERSON | A |
| OAKDEN | D | OIDEM | A | OLPE | C | ORIO | B/D | OTTMAR | B |
| OAKES | B | OJATA | D | OLSON | D | ORION | C | OTTOKEE | A |
| OAKHILL | B | OJIBWAY | C | OLTON | C | ORITA | B | OTTOSEN | B |
| OAKHURST | D | OJITO | C | OLUSTEE | B/D | ORIZABA | C | OTTUMWA | D |
| OAKLAND | C | OJITOS | B | OLYIC | B | ORIZABA, DRAINED | B | OTWAY | D |
| OAKLET | C | OKANOGAN | B | OLYMPIC | B | ORLA | B | OTWELL | C |
| OAKLIMETER | C | OKATON | D | OMADI | B | ORLAND | B | OTWIN | C |
| OAKVILLE | A | OKAW | D | OMAK | C | ORLANDO | A | OUACHITA | C |
| OAKWOOD | B | OKAY | B | OMEGA | A | ORLIE | C | OUARD | D |
| OANAPUKA | B | OKEE | B | OMENA | B | ORMAS | B | OULA | D |
| OASIS | B | OKEECHOBEE | B/D | OMIO | B | ORMISTON | C | OUPICO | C |
| OATLANDS | B | OKEELANTA | B/D | OMNI | D | ORMSBY | C | OURAY | B |
| OATMAN | B | OKEELANTA, DEPRESSIONAL | D | OMRO | C | ORNBAUN | B | OUSLEY | C |
| OATUU | D | | | OMSTOTT | C | ORO FINO | B | OUTERKIRK | B |
| OBAN | C | OKEELANTA, TIDAL | D | OMULGA | C | ORO GRANDE | D | OUTLET | C |
| OBANION | C | OKEELANTA, FLOODED | D | ONA | B/D | OROGNEN | D | OUTLOOK | D |
| OBARO | B | OKEETEE | D | ONAMIA | B | ORONOCO | B | OUTLOOK, DRAINED | C |
| OBEN | C | OKEMAH | C | ONAQUI | D | OROSE | C | OVALL | C |
| OBISPO | D | OKIOTA | D | ONARGA | B | OROVADA | B | OVAN | D |
| OBRAST | D | OKLARED | B | ONASON | D | ORPARK | C | OVANDO | A |
| OBRAY | D | OKLARK | B | ONAWA | D | ORPHA | A | OVERGAARD | C |
| OBSCURITY | B | OKLAWAHA | B/D | ONAWAY | B | ORPHANT | D | OVERLAND | C |
| OBSERVATION | C | OKO | D | ONDAWA | B | ORR | B | OVERLY | C |
| OBURN | D | OKO, STONY | C | ONECO | B | ORR, GRAVELLY SUBSTRATUM | C | OVERTON | D |
| OCALA | C | OKOBOJI | B/D | ONEIL | C | | | OVIATT | B |
| OCAMBEE | C | OKOBOJI, PONDED | D | ONEONTA | B | ORRUB | D | OVID | C |
| OCANA | B | OKOLONA | D | ONITA | C | ORRVILLE | C | OVINA | B |
| OCCOOU N | B | O REEK | D | NITE | B | O SA | A | OWANKA | C |
| OCCUM | B | OKRIST | B | ONKEYO | D | ORSET | B | OWEGO | D |
| OCEANET | D | OKTAHA | B | ONOTA | B | ORSINO | A | OWEN CREEK | C |
| OCEANO | A | OKTIBBEHA | D | ONSLOW | B | ORTEGA | A | OWENS | D |
| OCHEYEDAN | B | OLA | C | ONTARIO | B | ORTELLO | B | OWENTOWN | B |
| OCHLOCKONEE | B | OLAA | A | ONTEORA | C | ORTING | D | OWHI | B |
| OCHO | D | OLAC | D | ONTKO | D | ORTIZ | C | OWINZA | D |
| OCHOCO | C | OLANCHA | B | ONTONAGON | D | ORTON | B | OWLCAN | B |
| OCHOPEE | B/D | OLAND | B | ONYX | B | ORWASH | A | OWOSSO | B |
| OCIE | C | OLANTA | B | OOKALA | A | ORWET | A/D | OWSEL | B |
| OCILLA | C | OLASHES | B | OOSEN | A | ORWIG | B | OWYHEE | B |
| OCKLEY | B | OLATHE | D | OPAL | D | ORWOOD | B | OXBOW | C |
| OCOEE | B/D | OLBUT | D | OPELIKA | D | OSAGE | D | OXCOREL | D |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OXENDINE | D | PALIX | B | PAPALOTE | C | PATIO | C | PELEE | B |
| OXERINE | C | PALLS | C | PAPINEAU | C | PATIT CREEK | B | PELELIU | D |
| OXFORD | D | PALM BEACH | A | PAPOOSE | D | PATNA | B | PELHAM | B/D |
| OXHEAD | B | PALMA | B | PARA | B | PATOS | C | PELIC | D |
| OXLEY | C | PALMAR | D | PARACHUTE | B | PATOUTVILLE | C | PELION | B/D |
| OXWALL | D | PALMAREJO | C | PARADISE | C | PATRICIA | B | PELKIE | A |
| OYHUT | C | PALMER CANYON | B | PARADOX | B | PATRICK | B | PELLA | B/D |
| OYLEN | C | PALMERDALE | B | PARANAT | C | PATROLE | C | PELLEJAS | B |
| OZAMIS | D | PALMETTO | B/D | PARANAT, DRAINED, | B | PATTANI | D | PELLICER | D |
| OZAN | D | PALMETTO, | D | SALINE | | PATTEE | B | PELONCILLO | D |
| OZAUKEE | C | DEPRESSIONAL | | PARASOL | B | PATTENBURG | B | PELTIER | C |
| OZETTE | C | PALMICH | B | PARCELAS | D | PATTER | B | PEMBERTON | B |
| OZIAS | D | PALMS, OVERWASH | A/D | PARCHIN | D | PATTERSON | C | PEMBROKE | B |
| PAAIKI | B | PALMS, MAAT>50 | A/D | PARCHIN, COOL | C | PATTON | B/D | PEMENE | B |
| PAALOA | B | PALMS, MAAT<50 | A/D | PARDALOE | B | PAUL | B | PEMI | C |
| PAAUHAU | A | PALMS, PONDED | D | PARDEE | D | PAULDING | D | PENA | B |
| PABLO | D | PALMS, SANDY | A/D | PARDEEVILLE | B | PAULINA | D | PENAPON | B |
| PACHAPPA | B | SUBSTRATUM | | PAREHAT | C | PAULSON | B | PENASCO | D |
| PACHECO | C | PALMS, GRAVELLY | A/D | PARENT | B/D | PAULVILLE | B | PENCE | B |
| PACHECO, DRAINED | B | SUBSTRATUM | | PARIATO | D | PAUMALU | B | PEND OREILLE | B |
| PACIFICO | C | PALMYRA | B | PARIETTE | C | PAUNSAUGUNT | D | PENDANT | D |
| PACK | C | PALO | D | PARISA | C | PAUSANT | B | PENDARVIS | C |
| PACKARD | B | PALODURO | B | PARISIAN | D | PAUWELA | B | PENDEN | B |
| PACKER | B | PALOMARIN | B | PARKALLEY | B | PAVAIAI | C | PENDER | C |
| PACKHAM | B | PALOMAS | B | PARKAY | B | PAVANT | D | PENDERGRASS | D |
| PACKTRAIL | C | PALOMINO | D | PARKDALE | B | PAVER | B | PENDLETON | C |
| PACKWOOD | D | PALON | B | PARKE | B | PAVILLION | B | PENDROY | D |
| PACO | C | PALOPINTO | D | PARKER | B | PAVO | B | PENELAS | D |
| PACOLET | B | PALOS VERDES | D | PARKFIELD | C | PAVOHROO | B | PENEY | D |
| PACTOLA | B | PALOUSE | B | PARKHILL | B/D | PAWCATUCK | D | PENGILLY | B/D |
| PACTOLUS | A | PALSGROVE | B | PARKINSON | B | PAWHUSKA | D | PENGRA | C |
| PADDOCK | C/D | PALUXY | B | PARKS | B | PAWLING | B | PENINSULA | B |
| PADEN | C | PAMISON | B | PARKVIEW | B | PAWNEE | D | PENISTAJA | B |
| PADILLA | C | PAMLICO | D | PARKVILLE | C | PAXICO | B | PENITENTE | B |
| PADINA | B | PAMOA | B | PARKWOOD | B/D | PAXTON | C | PENLAW | C |
| PADRES | B | PAMSDEL | C | PARLEYS | B | PAXVILLE | B/D | PENN | C |
| PADRONES | B | PAMUNKEY | B | PARLIN | C | PAYETTE | B | PENNEKAMP | A |
| PADUCAH | B | PANA | B | PARLO | B | PAYMASTER | B | PENNELL | D |
| PADUS | B | PANAEWA | D | PARMELE | C | PAYNE | C | PENNEY | A |
| PAESL | B | PANAK | B | PARMELOW | C | PAYNECREEK | B | PENNICHUCK | B |
| PAGARI | B | PANAMA | B | PARMENTER | B | PAYSON | D | PENNSUCO | D |
| PAGEBROOK | D | PANAMINT | B | PARMLEED | C | PEACHAM | D | PENO | C |
| PAGINA | C | PANASOFFKEE | C/D | PARNELL | C/D | PEACHLAND | D | PENOYER | B |
| PAGODA | C | PANCHERI | B | PAROUAT | B | PEARL | B | PENROSE | D |
| PAGOSA | C | PANDO | B | PARR | B | PEARL HARBOR | D | PENSORE | D |
| PAGUATE | C | PANDOAH | C | PARRAN | D | PEARSOLL | D | PENTHOUSE | D |
| PAHAKA | B | PANDORA | B/D | PARRISH | C | PEASLEY | D | PENTZ | D |
| PAHOKEE | B/D | PANDURA | D | PARRITA | D | PEASPEAR | D | PENWELL | A |
| PAHRANAGAT | C | PANE | B | PARSHALL | B | PEAVINE | C | PENWOOD | A |
| PAHRANAGAT, VERY | D | PANGBORN | D | PARSIPPANY | C/D | PEAWICK | D | PENZANCE | C |
| POORLY DRAINED | | PANGUITCH | B | PARSONS | D | PEBBLEPOINT | C | PEOGA | C |
| PAHRANGE | C | PANHANDLE | B | PARTLOW | D | PECATONICA | B | PEOH | D |
| PAHREAH | C | PANHILL | B | PARTOV | D | PECKHAM | C | PEOH, DRAINED | C |
| PAHROC | D | PANIN | B | PARTRI | C | PECKISH | D | PEOLA | C |
| PAHRUMP | C | PANIOGUE | B | PARTRIDGE | A | PECOS | D | PEONE | D |
| PAHSIMEROI | B | PANIOGUE, WET | C | PASAGSHAK | D | PECTURE | B | PEONE, DRAINED | C |
| PAIA | B | PANITCHEN | B | PASCO | D | PEDCAT | D | PEORIA | D |
| PAICE | D | PANKY | C | PASCO, DRAINED | C | PEDEE | C | PEOTONE | B/D |
| PAILO | B | PANMOO | C | PASO SECO | D | PEDERNALES | C | PEPAL | B |
| PAINESVILLE | C | PANOCHE | B | PASQUETTI | D | PEDIGO | C | PEPOON | D |
| PAINT | D | PANOCHE, | C | PASQUETTI, | C | PEDLEFORD | C | PEPPER | D |
| PAISLEY | D | SALINE-ALKALI, | | MODERATELY WET | | PEDOLI | B | PEPTON | D |
| PAIT | B | WET | | PASQUETTI, DRAINED | C | PEDRICK | B | PEQUAMING | A |
| PAJARA | C | PANOLA | D | PASQUOTANK | B/D | PEDRO | C | PEQUEA | B |
| PAJARITO | B | PANOR | B | PASS CANYON | D | PEEBLES | C | PEQUOP | B |
| PAJUELA | B | PANORAMA | B | PASSAR | C | PEEKO | D | PERALTA | C |
| PAKA | B | PANOZA | B | PASSCREEK | C | PEEL | C | PERAZZO | B |
| PAKALA | B | PANSEY | D | PASTERN | D | PEELER | B | PERCETON | B |
| PAKINI | B | PANTANO | D | PASTIK | C | PEERLESS | B | PERCHAS | D |
| PALACIOUS | D | PANTEGO | B/D | PASTORIUS | B | PEETZ | A | PERCILLA | D |
| PALAFOX | C | PANTERA | B | PASTURA | D | PEEVER | C | PERCIVAL | C |
| PALANUSH | C | PANTHER | D | PATAHA | C | PEEVYWELL | C | PERCOUN | C |
| PALAPALAI | B | PANTON | D | PATCHIN | D | PEGLEG | C | PERCY | B/D |
| PALATINE | B | PAOLA | A | PATE | C | PEGLER | D | PERDIN | C |
| PALAU | B | PAOLI | B | PATELZICK | D | PEGRAM | B | PERELLA | B/D |
| PALAZZO | C | PAPAA | D | PATENT | C | PEKAY | C | PERELLA, | B |
| PALBOONE | B | PAPAC | C | PATHEAD | C | PEKIN | C | MODERATELY WET | |
| PALINOR | C | PAPAGUA | C | PATILLAS | B | PELAHATCHIE | C | PERHAM | B |
| PALISADE | B | PAPAI | A | PATILO | B | PELAN | B | PERICO | B |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PERIDGE | B | PHILO | B | PINELLAS | B/D | PLASKETT | D | POKEGEMA | B |
| PERILLA | B | PHILOMATH | D | PINELLI | B | PLATA | B | POKEMAN | C |
| PERINOS | C | PHING | D | PINETOP | C | PLATEA | C | POKER | C |
| PERITSA | C | PHIPPS | C | PINETUCKY | B | PLATNER | C | POKERGAP | B |
| PERKINS | C | PHLISS | D | PINETUCKY, GRADED | C | PLATO | C | POKEY | C |
| PERKS | A | PHOEBE | B | PINEVAL | B | PLATORO | B | POLACCA | C |
| PERLA | C | PHOENIX | D | PINEVILLE | B | PLATTE | B | POLALLIE | C |
| PERLOR | D | PHYS | B | PINEZ | B | PLATTE, WET | D | POLAR | B |
| PERMA | B | PIANKESHAW | B | PINGREE | D | PLATTE, CHANNELED | D | POLATIS | C |
| PERN | B | PIASA | D | PINHOOK | B/D | PLATTVILLE | B | POLAWANA | A/D |
| PERNITAS | C | PIBLER | D | PINICON | B | PLAYCO | B | POLE | D |
| PERNOG | D | PICABO | C | PINITOS | B | PLAYER | D | POLECREEK | D |
| PERNTY | D | PICACHO | C | PINKEL | C | PLAYMOOR | C/D | POLELINE | B |
| PERQUIMANS | D | PICANTE | D | PINKHAM | A | PLAZA | C | POLEPATCH | A |
| PERREAU | B | PICAYUNE | B | PINKSTON | B | PLEASANT | C | POLEY | C |
| PERRIN | B | PICEANCE | C | PINNACLES | C | PLEASANT, PONDED | D | POLEY, COBBLY | D |
| PERRINE | D | PICKAWAY | C | PINNEBOG | A/D | PLEASANT GROVE | B | POLICH | C |
| PERRINTON | C | PICKENS | D | PINNOBIE | B | PLEASANT VALE | B | POLKING | D |
| PERRY | D | PICKETT | C | PINO | C | PLEASANT VIEW | B | POLLARD | C |
| PERRYPARK | B | PICKFORD | D | PINOLE | B | PLEASANTON | B | POLLASKY | B |
| PERRYVILLE | B | PICKNEY | A/D | PINON | D | PLEDGER | D | POLLUX | C |
| PERSANTI | C | PICKNEY, FLOODED | D | PINONES | D | PLEGOMIR | D | POLLY | B |
| PERSAYO | D | PICKRELL | D | PINRIDGE | B | PLEINE | D | POLO, MODERATELY | C |
| PERSHING | C | PICKTON | A | PINSPRING | C | PLEIOVILLE | C | SLOW PERM | |
| PERSIS | B | PICKUP | C | PINTAS | B | PLEITO | C | POLO, MODERATE | B |
| PERT | D | PICKWICK | B | PINTLAR | B | PLEVNA | D | PERMEABILITY | |
| PERU | C | PICO | B | PINTO | C | PLINCO | B | POLONIO | B |
| PERVINA | B | PICOSA | C | PINTURA | A | PLITE | B | POLSON | B |
| PERWICK | C | PIDCOKE | D | PINTWATER | D | PLOME | B | POLUM | B |
| PESCADERO | D | PIDINEEN | D | PIOCHE | D | PLOVER | C | POMADE | D |
| PESCAR | C | PIE CREEK | D | PIOPOLIS | C/D | PLUCK | C | POMAN | C |
| PESHASTIN | B | PIEGON | B | PIPELINE | D | PLUMAS | B | POMAT | C |
| PESHEKEE | D | PIERIAN | B | PIPEP | C | PLUMMER | B/D | POMAT, DRY | B |
| PESMO | C | PIERKING | D | PIPESTONE | B | PLUSH | B | POMELLO | C |
| PESMORE | C | PIERPONT | C | PIPPIN | A | PLUTOS | B | POMERENE | C |
| PESO | C | PIERRE | D | PIRD | B | PLYMOUTH | A | POMFRET | A |
| PESOWYO | C | PIERSONTE | A | PIRODEL | B | POALL | C | POMO | B |
| PETACA | D | PIERZ | B | PIROUETTE | D | POARCH | B | POMONA | B/D |
| PETAL | C | PIETOWN | B | PIRUM | B | POBER | C | POMONA, | D |
| PETAN | D | PIGTAIL | D | PISGAH | C | POCALLA | A | DEPRESSIONAL | |
| PETEETNEET | D | PIIHONUA | A | PISHKUN | B | POCAN | B | POMPANO | B/D |
| PETERMAN | D | PIKE | B | PISMO | D | POCASSET | B | POMPANO, | D |
| PETERMAN, SANDY | C | PIKEVILLE | B | PIT | D | POCATELLO | B | DEPRESSIONAL | |
| SUBSTRATUM, | | PILABO | B | PITCHER | B | POCATY | D | POMPANO, FLOODED | D |
| ALKALI | | PILCHUCK | C | PITCO | D | POCKER | C | POMPEII | D |
| PETERS | D | PILCHUCK, | A | PITNEY | C | POCOLA | D | POMPONIO | C |
| PETERSON | B | PROTECTED | | PITTMAN | C | POCOMOKE, PONDED | B/D | POMPTON | B |
| PETESCREEK, STONY | B | PILINE | D | PITTSFIELD | B | POCOMOKE, DRAINED | B | POMROY | C |
| PETESCREEK, | C | PILLIKEN | B | PITTSTOWN | C | POCONO | B | PONCA | B |
| GRAVELLY | | PILLOT | B | PITZER | C | PODEN | B | PONCENA | D |
| PETRIE | D | PILLSBURY | C | PIUTE | D | PODMOR | C | PONCHA | A |
| PETROLIA | C/D | PILOT PEAK | D | PIVOT | A | PODO | D | PONCIANO | C |
| PETROS | D | PILOT ROCK | C | PIXLEY | D | PODUNK | B | POND | D |
| PETSPRING | D | PILOTPEAK | D | PIZENE | B | PODUS | C | POND CREEK | B |
| PETTICOAT | B | PILTDOWN | B | PLACEDO | D | POE | C | PONDER | D |
| PETTIGREW | B/D | PILTZ | C | PLACENTIA | D | POGAL | C | PONIL | D |
| PETTUS | C | PIMA | B | PLACERITOS, | B | POGANEAB | C | PONINA | D |
| PETTY | B | PIMER | B | SALINE, DRAINED | | POGANEAB, CLAYEY | D | PONOZZO | C |
| PEVETO | A | PINAL | D | PLACERITOS, | C | SUBSTRATUM | | PONTO | B |
| PEWAMO | C/D | PINALENO | B | SALINE-ALKALI | | POGANEAB, SALINE | D | PONTOTOC | B |
| PEYTON | B | PINAMT | B | PLACERITOS, | B | POGANEAB, HIGH | D | PONZER | D |
| PFEIFFER | B | PINATA | C | MODERATELY WET | | RAINFALL | | POOCHAM | B |
| PHAGE | B | PINAVETES | A | PLACERITOS, WET | C | POGANEAB, STRONGLY | D | POOKU | B |
| PHALANX | B | PINBIT | B | PLACERITOS, | B | SALINE | | POOLER | D |
| PHANTOM | C | PINCHER | C | DRAINED | | POGANEAB, | D | POOLEVILLE | C |
| PHARO | B | PINCHOT | B | PLACID | B/D | FREQUENTLY | | POORCAL | B |
| PHARR | B | PINCKNEY | C | PLACID, | D | FLOODED | | POORMA | B |
| PHEBA | C | PINCONNING | B/D | DEPRESSIONAL | | POGANEAB, | D | POOSE | D |
| PHEENEY | C | PINE FLAT | B | PLACID, FREQUENTLY | D | SALINE-ALKALI | | POOTATUCK | B |
| PHELAN | D | PINEAL | D | FLOODED | | POGUE | B | POPASH | D |
| PHELPS | B | PINEBUTTE | B | PLACITAS | C | POHAKUPU | B | POPE | B |
| PHERSON | B | PINECREEK | B | PLACK | D | POIN | D | POPHERS | C |
| PHIFERSON | C | PINEDA | B/D | PLAINBO | A | POINDEXTER | B | POPLE | C/D |
| PHILBON | D | PINEDA, | D | PLAINFIELD | A | POINSETT | B | POPLIMENTO | C |
| PHILDER | D | DEPRESSIONAL | | PLAISTED | C | POINT | C | POPOSHIA | B |
| PHILIPPA | C | PINEDALE | B | PLANK | D | POINT ISABEL | C | POPOTOSA | B |
| PHILIPSBURG | B | PINEGUEST | B | PLANKINTON | D | POISONCREEK | D | POPPLETON | A |
| PHILLCHER | B | PINEHURST | B | PLANO | B | POJO | C | POQUETTE | A |
| PHILLIPS | C | PINEISLE | B | PLANTATION | B/D | POJOAQUE | B | POQUITA | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| POQUONOCK | C | PREMIER | B | PUNCHBOWL | D | QUINLIVEN | C | RAMROD | C |
| PORFIRIO | C | PRENTISS | C | PUNG | C | QUINN | B/D | RAMSDELL | D |
| PORRETT | D | PRESA | B | PUNGO | D | QUINNEY | C | RAMSDELL, DRAINED | C |
| PORRONE | B | PRESHER | B | PUNOHU | A | QUINTANA | B | RAMSEY | D |
| PORT | B | PRESTO | B | PUNSIT | C | QUINTO | D | RAMSHORN | B |
| PORT BYRON | B | PRESTON | A | PUNTA | B/D | QUINTON | C | RANA | D |
| PORTAGE | D | PREWITT | B | PUNTILLA | B | QUITERIA | B | RANCE | C |
| PORTAGEVILLE | D | PREY | C | PURCELLA | B | QUITMAN | C | RANCHOSECO | D |
| PORTALES | B | PRICE | B | PURCHES | C | QUIVERA | C | RANDADO | C |
| PORTALTO | B | PRIDA | C | PURDAM | C | QUONSET | A | RANDALL | D |
| PORTERFIELD | C | PRIDHAM | D | PURDY | D | QUOPANT | D | RANDCORE | D |
| PORTERS | B | PRIESTLAKE | B | PURETT | B | QUOSATANA | D | RANDMAN | D |
| PORTERVILLE | D | PRIETA | D | PURGATORY | C | RABBITEX | B | RANDOLPH | C |
| PORTHILL | D | PRIM | D | PURNER | D | RABER | C | RANDS | C |
| PORTIA | C | PRIMEAUX | C | PUROB | D | RABIDEUX | B | RANDSBURG | D |
| PORTINO | C | PRIMEN | D | PURSLEY | B | RABUN | B | RANGEE | D |
| PORTLAND | D | PRINGHAR | B | PURVES | D | RACE | B | RANGER | C |
| PORTMOUNT | B | PRINCETON | B | PUSHMATAHA | C | RACINE | B | RANPUFF | D |
| PORTNEUF | B | PRINEVILLE | C | PUSTOI | B | RACKER | A | RANSLO | D |
| PORTOLA | B | PRING | B | PUTNAM | D | RACOMBES | B | RANSOM | B |
| PORTSMOUTH | B/D | PRINGLE | D | PUTNEY | B | RACOON | C/D | RANSTEIN | B |
| PORUM | D | PRITCHARD | C | PUTT | C | RAD | B | RANTOUL | D |
| POSANT | D | PRITCHETT | C | PUTTSTER | C | RAD, LACUSTRINE | C | RAPATEE | D |
| POSEN | B | PROCHASKA | A/D | PUU OO | A | SUBSTRATUM | | RAPELJE | B |
| POSEY | B | PROCTOR | B | PUU OPAE | B | RAD, FLOODED | C | RAPH | B |
| POSEYVILLE | C | PROGRESSO | C | PUU PA | A | RADDLE | B | RAPHO | B |
| POSITAS | D | PROMISE | D | PUU PA, NONSTONY | B | RADER | D | RAPIDAN | B |
| POSKIN | C | PROMO | D | PUUKALA | D | RADERSBURG | B | RAPLEE | C |
| POSO | B | PRONG | C | PUUONE | C | RADFORD | B | RAPPAHANNOCK | D |
| POSOS | C | PROPHETSTOWN | B/D | PUYALLUP | B | RADLEY | B | RAPSON | B |
| POST | D | PROSPECT | B | PYBURN | D | RADNOR | C | RARDEN | C |
| POTAMUS | B | PROSPER | B | PYLE | B | RAFAEL | D | RARICK | C |
| POTCHUB | C | PROSSER | C | PYLON | D | RAFTON | D | RARITAN | C |
| POTEET | C | PROTIVIN | C | PYOTE | A | RAFTRIVER | C | RASBAND | B |
| POTELL | B | PROUT | C | PYRAMID | D | RAGLAN | B | RASILLE | B |
| POTH | C | PROUTY | C | PYRMONT | D | RAGNAR | B | RASSER | B |
| POTLATCH | C | PROVIDENCE | C | PYRMONT, BEDROCK | C | RAGNEL | B | RASSET | B |
| POTOMAC | A | PROVIG | C | SUBSTRATUM | | RAGO | C | RASTUS | C |
| POTOSI | A | PROVO | D | PYWELL | D | RAGPIE | D | RATAKE | D |
| POTRATZ | C | PROVO BAY | D | QUAFENO | C | RAGSDALE | B/D | RATHBUN | C |
| POTSDAM | C | PROW | D | QUAKER | C | RAGSDALE, OVERWASH | B | RATHDRUM | B |
| POTTER | C | PRUDY | B | QUAKERTOWN | C | RAGTOWN | C | RATLAKE | D |
| POTTINGER | B | PRUE | B | QUAM | B/D | RAHAL | C | RATLEFLAT | B |
| POTTS | B | PRUITTON | B | QUAMON | A | RAHM | C | RATLIFF | B |
| POTTSBURG | B/D | PRUNIE | D | QUANAH | B | RAHWORTH | B | RATON | D |
| POUDRE | D | PRYOR | C | QUANDER | B | RAIL | D | RATSOW | C |
| POUJADE | D | PSUGA | B | QUANTICO | B | RAILCITY | A | RATTLER | D |
| POULSBO | D | PTARMIGAN | C | QUARLES | D | RAINBOW | C | RATTO | C |
| POUNCEY | D | PUAPUA | D | QUARTZBURG | C | RAINEY | C | RATTO, STONY | D |
| POVERTY | D | PUAULU | A | QUARTZVILLE | B | RAINIER | C | RAUB | C |
| POVEY | B | PUCHYAN | B | QUARZ | C | RAINO | D | RAUGHT | B |
| POWDER | B | PUDDLE | B | QUATAMA | C | RAINS | B/D | RAUVILLE | D |
| POWDERHORN | C | PUERCO | D | QUAY | B | RAINS, FLOODED | D | RAUZI | B |
| POWDERWASH | C | PUERTA | D | QUAZO | D | RAINSBORO | C | RAVALLI | D |
| POWEEN | C | PUERTECITO | D | QUEALMAN | C | RAINSVILLE | B | RAVALLI, BEDROCK | B |
| POWELL | C | PUETT | D | QUEALY | D | RAIRDENT | B | SUBSTRATUM | |
| POWER | B | PUFFER | D | QUEBRADA | C | RAISIO | C | RAVEN | A |
| POWERLINE | C | PUGET | D | QUEENY | D | RAKANE | C | RAVENDALE | D |
| POWLEY | D | PUGET, PROTECTED | C | QUEETS | B | RAKE | D | RAVENELL | D |
| POWMENT | C | PUGSLEY | C | QUEMADO | C | RAKIED | C | RAVENNA | C |
| POWWAHKEE | B | PUHI | B | QUENZER | D | RALEIGH | D | RAVENSWOOD | C |
| POWWATKA | C | PUHIMAU | D | QUERC | C | RALLOD | D | RAVIA | C |
| POY | D | PUICE | C | QUERENCIA | B | RALLS | B | RAVOLA | B |
| POYGAN | D | PULA | C | QUETICO | D | RALPH | B | RAWAH | C |
| POYNOR | B | PULANTAT | C | QUICKSELL | C | RALPHSTON | B | RAWE | C |
| POZO | C | PULASKI | B | QUICKSILVER | D | RALSEN | D | RAWLES | B |
| POZO BLANCO | B | PULCAN | C | QUICKVERT | C | RAMADERO | B | RAWLINS | B |
| PRAG | C | PULEHU | B | QUIDEN | B | RAMBLA | C | RAWSON | B |
| PRAIRIEVILLE | B | PULEXAS | B | QUIENSABE | C | RAMBOUILLET | B | RAWSONVILLE | C |
| PRAMISS | C | PULLMAN | D | QUIETUS | C | RAMELLI | D | RAYBURN | D |
| PRATHER | C | PULPIT | C | QUIGLEY | B | RAMIRES | C | RAYEX | D |
| PRATLEY | C | PULS | D | QUIHI | C | RAMMEL | C | RAYFORD | C |
| PRATT | A | PULSIPHER | D | QUILCENE | C | RAMO | C | RAYLAKE | D |
| PREACHER | B | PULTNEY | C | QUILLAYUTE | B | RAMONA | B | RAYMONDVILLE | D |
| PREAKNESS | B/D | PUMEL | D | QUILOTOSA | D | RAMONA, HARD | C | RAYNE | B |
| PREATORSON | B | PUMEL, NONGRAVELLY | C | QUILT | D | SUBSTRATUM | | RAYNESFORD | B |
| PREBISH | C/D | PUMPER | B | QUIMA | B | RAMPART | B | RAYNHAM | C |
| PREBLE | D | PUNA | A | QUINCY | A | RAMPARTER | B | RAYNOLDSON | B |
| PRELO | B | PUNALUU | D | QUINLAN | C | RAMPS | B | RAYOHILL | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RAYPOL | C | REDSTONE | A | RENOX | B | RICOT | C | RITIDIAN | D |
| RAZ | D | REDSUN | D | RENSHAW | B | RICREST | B | RITNER | C |
| RAZITO | A | REDTHAYNE | B | RENSLOW | B | RIDD | C | RITO | B |
| RAZOR | C | REDTOM | B | RENSSELAER | B/D | RIDDLES | B | RITTER | B |
| RAZORBA | B | REDVALE | C | RENSSELAER, | C | RIDENBAUGH | D | RITTMAN | C |
| RAZORT | B | REDVIEW | B | NONSTRATIFIED | | RIDGE | B | RITZ | D |
| RAZSUN | D | REDVIEW, WET | C | SUBSTRATUM | | RIDGEBURY | C | RITZ, DRAINED | C |
| READING | B | REDVINE | C | RENTILL | B | RIDGECREST | C | RITZCAL | B |
| READINGTON | C | REDWASH | D | RENTON | D | RIDGEDALE | B | RITZVILLE | B |
| READLYN | B | REE | B | RENTON, DRAINED | C | RIDGELAND | B/D | RIVALIER | B |
| REAGAN | B | REEBOK | D | RENTSAC | D | RIDGELAWN | B | RIVERDALE | A |
| REAKOR | B | REED | D | RENTZEL | C | RIDGELAWN, WET | D | RIVERHEAD | B |
| REAL | D | REED, DRAINED | C | REPARADA | D | RIDGELITE | D | RIVEROAD | B |
| REALLIS | B | REED, PROTECTED | C | REPP | B | RIDGEPORT | B | RIVERSIDE | A |
| REAP | D | REEDER | B | REPPART | B | RIDGEVIEW | D | RIVERTON | B |
| REARDAN | C | REEDER, COOL | C | REPUBLIC | B | RIDGEVILLE | B | RIVERVIEW | B |
| REAVILLE | C | REEDSBURG | C | RESCUE | B | RIDGEWOOD | C | RIVIERA | C/D |
| REAVIS | B | REEDSPORT | C | RESNER | B | RIDIT | C | RIVIERA, | D |
| REBA | C | REEDY | D | RESORT | D | RIDLEY | C | DEPRESSIONAL | |
| REBEL | B | REEFRIDGE | D | RESOTA | A | RIDOTT | C | RIVIERA, LIMESTONE | B/D |
| RECAPTURE | B | REELFOOT | C | RESTING | C | RIEDEL | C | SUBSTRATUM | |
| RECK | D | REEPO | C | RESTON | D | RIEDTOWN | C | RIVIERA, LIMESTONE | D |
| RECLUSE | B | REESE | C | RET | D | RIEPE | C | SUBSTRATUM, | |
| RED BAY | B | REESER | C | RETRIEVER | D | RIESEL | C | DEPRESSIONAL | |
| RED BLUFF | C | REESVILLE | C | RETROP | C | RIETBROCK | C | RIVRA | D |
| RED BLUFF, | B | REEVES | B | RETRYDE | C | RIFLE | A/D | RIXIE | C |
| GRAVELLY | | REFLECTION | B | REVA | D | RIGA | D | RIXON | C |
| RED BUTTE | B | REFUGE | C | REVEL | C | RIGDON | C | RIZ | D |
| RED HILL | B | REGAL | B/D | REVENTON | B | RIGGINS | D | RIZNO | D |
| RED HOOK | C | REGAN | B/D | REVERE | B/D | RIGGS | D | RIZOZO | D |
| RED ROCK | B | REGENT | C | REVIT | C | RIGLEY | B | ROANE | C |
| RED SPUR | B | REGGAD | A | REWARD | B | RIGOLETTE | C | ROANHIDE | C |
| REDARROW | D | REGGEAR | D | REXBURG | B | RILEY | B | ROANOKE | D |
| REDBANK | B | REGGEAR, COOL | C | REXFORD | C | RILLA | B | ROARING | B |
| REDBELL | B | REGNAPS | C | REXMONT | D | RILLINO | B | ROB ROY | C |
| REDBIRD | B | REGNIER | D | REXOR | A | RILLITO | B | ROBANA | B |
| REDBOW | C | REHBURG | C | REYAB | B | RIMER | C | ROBBS | D |
| REDBY | B | REHFIELD | B | REYES | D | RIMINI | A | ROBCO | C |
| REDCAMERON | D | REHFIELD | C | REYNOSA | B | RIMROCK | D | ROBER | C |
| REDCAN | D | REHN | C | REYWAT | D | RIMTON | C | ROBERTSDALE | C |
| REDCAP | B | REICESS | B | REZAVE | D | RIN | B | ROBERTSVILLE | D |
| REDCHIEF | C | REICHEL | B | RHAME | B | RINCON | C | ROBIN | B |
| REDCLIFF | C | REIFF | B | RHEA | B | RINDA | D | ROBINETTE | B |
| REDCLOUD | B | REILLY | A | RHINEBECK | D | RINDGE | D | ROBINSONVILLE | B |
| REDCO | D | REINA | D | RHOADES | D | RINDGE, DRAINED | C | ROBOZO | C |
| REDCREEK | D | REINACH | B | RHOAME | C | RINEARSON | B | ROBRODST | B |
| REDDALE | D | REINER | B | RHOAMETT | C | RINEY | B | ROBSON | D |
| REDDICK | B/D | REKOP | D | RHOAMETT, STONY | D | RING | C | ROBY | C |
| REDDING | D | RELAN | B | RHONE | B | RINGLE | B | ROCA | D |
| REDEYE | B | RELAY | B | RIB | B/D | RINGLING | A | ROCHE | D |
| REDFEATHER | D | RELIANCE | C | RIBERA | C | RINGO | D | ROCHELLE | C |
| REDFIELD | B | RELIZ | D | RIBHILL | B | RINGWOOD | B | ROCHER | B |
| REDFIELD, WET | C | RELLEY | B | RICCO | D | RINKER | C | ROCHESTER | A |
| REDFLAME | B | RELSOB | B | RICEBORO | B/D | RIO | D | ROCIO | C |
| REDHOUSE | B | RELUCTAN | C | RICECROSS | B | RIO ARRIBA | D | ROCK CREEK | D |
| REDIG | B | REMBERT | D | RICERT | B | RIO DIABLO | C | ROCK RIVER | B |
| REDINGTON | D | REMEDIOS | C | RICETON | B | RIO GRANDE | B | ROCKABIN | C |
| REDLAKE | D | REMLAP | C | RICEVILLE | C | RIO LAJAS | A | ROCKAWAY | C |
| REDLANDS | B | REMLIK | A | RICH | C | RIO PIEDRAS | B | ROCKBRIDGE | B |
| REDLEVEL | C | REMMIT | B | RICH, WET | D | RIOBLANCHO | C | ROCKCASTLE | D |
| REDLODGE | D | REMNOY | D | RICHARDSON | B | RIDCONCHO | C | ROCKDALE | A |
| REDMANSON | B | REMOTE | B | RICHENS | C | RIOLINDA | C | ROCKDALE | B |
| REDMOND | C | RENSEN | D | RICHEY | C | RION | B | ROCKERS | C |
| REDMOUNT | B | REMUNDA | C | RICHFIELD | B | RIPEC | D | ROCKFIELD | B |
| REDNIK | B | REMUS | B | RICHFORD | A | RIPLEY | B | ROCKFORD | B |
| REDNIK, NONSTONY | C | RENBAC | D | RICHLAND | B | RIPLEY, | C | ROCKHOUSE | A |
| REDNUN | C | RENCALSON | C | RICHMOND | D | SALINE-ALKALI, | | ROCKINCHAIR | C |
| REDOLA | B | RENCOT | D | RICHSUM | B | WET | | ROCKLIN | D |
| REDONA | B | RENFROW | D | RICHTER | B | RIPON | B | ROCKLY | D |
| REDONDO | B | RENICK | D | RICHVALE | B | RIPPLE | B | ROCKOA | B |
| REDPOP | C | RENISH | C | RICHVIEW | C | RIPPOWAM | C | ROCKTON | B |
| REDPORT | B | RENNER | B | RICHVILLE | C | RIRIE | B | ROCKWELL | B/D |
| REDRIDGE | B | RENNIE | D | RICHWOOD | B | RISBECK | B | ROCKWOOD | C |
| REDRIVER | C | RENNIE, DRAINED | C | RICKER | A | RISLEY | D | ROCKY FORD | B |
| REDROB | C | RENNIE, PROTECTED | C | RICKETTS | C | RISLEY, STONY | C | ROCKYBAR | B |
| REDSPEAR | D | RENO | D | RICKMAN | C | RISUE | D | RODAD | D |
| REDSPRINGS | B | RENOHILL | C | RICKMORE | C | RISWOLD | B | RODELL | D |
| REDSPRINGS, GRADED | D | RENOL | C | RICKREALL | D | RITA | D | RODEO | D |
| REDSTOE | B | RENOVA | B | RICKS | A | RITCHEY | D | RODESSA | D |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RODIE | B | ROSENDALE | C | RUBY | B | SABENYO | B | SAMINIEGO | C |
| RODMAN | A | ROSENWALL | D | RUBYHILL | C | SABINA | C | SAMISH | D |
| RODROF | D | ROSEVILLE | B | RUCH | B | SABINE | A | SAMMAMISH | D |
| ROEBUCK | D | ROSEWOOD | A/D | RUCKER | B | SABLE | B/D | SAMOIST | D |
| ROELLEN | D | ROSEWOOD, WET | D | RUCKLES | D | SAC | B | SAMOR | D |
| ROEMER | C | ROSEWORTH | D | RUCLICK | C | SACHEEN | A | SAMPSEL | D |
| ROETEX | D | ROSHE SPRINGS | D | RUDD | D | SACHETT | C | SAMPSON | B |
| ROFISS | B | ROSHE SPRINGS, | C | RUDDLEY | D | SACO | D | SAMSIL | D |
| ROGAN | B | DRAINED | | RUDEEN | C | SACRAMENTO | D | SAMSULA | B/D |
| ROGERSON | D | ROSHOLT | B | RUDYARD | D | SACTUS | D | SAN ANDREAS | B |
| ROGERT | D | ROSINE | B | RUEDLOFF | B | SACUL | C | SAN ANTON | B |
| ROGRUBE | B | ROSITAS | A | RUELLA | B | SADDLE | C | SAN ANTONIO | C |
| ROGUE | B | ROSITAS, CLAYEY | C | RUFUS | D | SADDLEBACK | C/D | SAN ARCACIO | C |
| ROHAN | D | SUBSTRATUM | | RUGAR | C | SADDLEGAP | B | SAN BENITO | B |
| ROHNERVILLE | B | ROSITAS, LOAMY, | C | RUGG | B | SADDLEROCK | D | SAN EMIGDIO | B |
| ROHONDA | C | WET | | RUGLES | B | SADER | D | SAN GERMAN | D |
| ROHRERSVILLE | D | ROSITAS, WET | C | RUHE | D | SADIE | C | SAN ISABEL | A |
| ROIC | D | ROSLYN | B | RUIDOSO | C | SADLER | C | SAN JOAQUIN | D |
| ROJO | C | ROSMAN | B | RUINPOINT | B | SAFFELL | B | SAN JON | C |
| ROLETTE | C | ROSNEY | B | RUIZ | A | SAG | B | SAN JOSE | B |
| ROLFE | C | ROSS | B | RUKO | D | SAGANING | A/D | SAN JUAN | A |
| ROLIE | D | ROSSBURG | B | RULE | B | SAGASER | B | SAN LUIS | C |
| ROLISS | B/D | ROSSFIELD | B | RUMBLECREEK | B | SAGE | D | SAN MATEO | B |
| ROLLA | C | ROSSMOOR | B | RUMSO | C | SAGECREEK | B | SAN MIGUEL | D |
| ROLLINGSTONE | C | ROSSMOYNE | C | RUMFORD | B | SAGEDALE | C | SAN SABA | D |
| ROLOC | D | ROSWELL | A | RUNLEY | B | SAGEHILL | B | SAN SEBASTIAN | B |
| ROLOFF | C | ROSY | B | RUNNEY | C | SAGEMOOR | B | SAN SIMEON | D |
| ROMBERG | B | ROTAMER | B | RUMPAH | D | SAGERS | B | SAN TIMOTEO | C |
| ROMBO | C | ROTAN | C | RUMPLE | C | SAGERTON | C | SAN YSIDRO | D |
| ROME | B | ROTHICAN | B | RUMUNG | C | SAGLE | C | SANCHEZ | D |
| ROMEO | D | ROTHIEMAY | C | RUNE | C | SAGO | D | SANCLEMENTE | D |
| ROMERO | D | ROTHSAY | B | RUNEBERG | C/D | SAGOUSPE | C | SANDALL | C |
| ROMGAN | C | ROTINOM | B | RUNGE | B | SAGOUSPE, DRAINED | B | SANDBRANCH | B |
| ROMIA | B | ROTO | C | RUNN | D | SAGUACHE | B | SANDCREEK | D |
| ROMINE | B | ROTTULEE | C | RUPLE | C | SAHALIE | B | SANDERSON | B |
| ROMINELL | C | ROUBIDEAU | C | RUPLEY | A | SAHUARITA | B | SANDHILL | B |
| ROMNELL | B/D | ROUEN | C | RUSCO | C | SAID | B | SANDIA | B |
| ROMSTOCK | B | ROUGHCREEK | D | RUSCO, PONDED | D | SAIDO | B | SANDOSE | A |
| ROMULUS | D | ROUGHLOCK | B | RUSE | D | SAILBOAT | C | SANDOVAL | D |
| RONAN | D | ROUGHMOUNT | C | RUSH | B | SAILBOAT, DRAINED | B | SANDRIDGE | A |
| ROND | C | ROUND BUTTE | D | RUSHMORE | B/D | SAIPAN | B | SANDSPRING | B |
| RONDEAU | A/D | ROUNDABOUT | C | RUSHTOWN | A | SAL | D | SANDUN | B |
| RONDELL | B | ROUNDBARN | B | RUSHVILLE | D | SALADAR | D | SANDUSKY | D |
| RONDOWA | B | ROUNDHEAD | B/D | RUSO | B | SALADON | D | SANDVIEW | B |
| RONNEBY | C | ROUNDOR | C | RUSON | C | SALAL | C | SANDWASH | C |
| RONSEL | B | ROUNDTOP | C | RUSS | B | SALAMATOF | D | SANDWICK | B |
| RONSON | B | ROUNDUP | C | RUSSELL | B | SALANDER | B | SANELI | D |
| ROONEY | D | ROUNDY | C | RUSSIAN | B | SALAS | C | SANFORD | B |
| ROOSET | C | ROUSSEAU | A | RUSSLER | C | SALCHAKET | B | SANGER | D |
| ROOSEVELT | C | ROUTON | D | RUSTICO | B | SALCO | B | SANGO | C |
| ROOT | B/D | ROUTT | C | RUSTIGATE | C | SALEM | B | SANHEDRIN | B |
| ROOTEL | C | ROYAL | D | RUSTON | B | SALERATUS | C | SANIBEL | B/ |
| ROPER | B/D | ROWDEN | C | RUSTY | B | SALERNO | B/D | SANILAC | B |
| ROSALIE | B | ROWDY | B | RUTAB | B | SALGA | C | SANJE | B |
| ROSAMOND | B | ROWE | D | RUTERSVILLE | C | SALIDA | A | SANLOREN | B |
| ROSAMOND, | C | ROWEL | D | RUTHERFORD | C | SALINAS | B | SANPETE | B |
| SALINE-ALKALI, | | ROWENA | C | RUTLAND | C | SALISBURY | C | SANPITCH | C |
| FLOODED | | ROWLAND | C | RUTLEGE | B/D | SALIX | B | SANPOIL | D |
| ROSANE | D | ROWLEY | C | RYAN | D | SALKUM | B | SANSARC | D |
| ROSANKY | C | ROXAL | D | RYAN PARK | B | SALLISAW | B | SANTA | D |
| ROSARIO | C | ROXANA | B | RYARK | A | SALLYANN | C | SANTA CLARA | C |
| ROSCOE | D | ROXBURY | B | RYCO | D | SALMO | C/D | SANTA FE | D |
| ROSCOMMON | A/D | ROXER | B | RYDE | C | SALMON | B | SANTA ISABEL | D |
| ROSE CREEK | C | ROXTON | D | RYDER | C | SALONIE | D | SANTA LUCIA | C |
| ROSE CREEK, | B | ROY | B | RYDOLPH | C | SALT CHUCK | A | SANTA MARTA | C |
| DRAINED | | ROYAL | B | RYEGATE | C | SALT LAKE | D | SANTA YNEZ | D |
| ROSE VALLEY | D | ROYCE | C | RYELL | B | SALTAIR | D | SANTANA | D |
| ROSEBERRY | D | ROYGORGE | D | RYELL, SALINE | D | SALTER | B | SANTANELA | D |
| ROSEBLOOM | D | ROYOSA | A | RYEPATCH | C | SALTERY | D | SANTAQUIN | A |
| ROSEBOROUGH | B | ROYST | C | RYER | C | SALTESE | D | SANTAROSA | B |
| ROSEBUD | B | ROYSTONE | B | RYKER | B | SALTINE | C | SANTEE | D |
| ROSEBURG | B | ROZA | C | RYMAN | C | SALTON | D | SANTIAGO | B |
| ROSEDHU | B/D | ROZELLVILLE | B | RYORP | C | SALUDA | C | SANTIAM | C |
| ROSEGLEN | B | ROZETTA | B | RYPOD | B | SALVISA | C | SANTO | B |
| ROSEHAVEN | B | ROZLEE | C | RYUS | B | SALZER | D | SANTO TOMAS | B |
| ROSEHILL | D | RUARK | B/D | SAAR | C | SALZER, PROTECTED | C | SANTONI | D |
| ROSELAND | B | RUBICON | A | SABANA | D | SAMBA | D | SANWELL | B |
| ROSELLA | D | RUBIO | C/D | SABANA SECA | D | SAMBRITO | B | SAPEHA | B |
| ROSELMS | D | RUBSON | B | SABE | B | SAMDAY | D | SAPELO | D |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SAPINERO | B | SAWTOWN | C | SCOTCH | D | SEITZ | C | SHAKER | C |
| SAPKIN | C | SAWYER | C | SCOTCO | A | SEJITA | D | SHAKESPEARE | C |
| SAPPHIRE | C | SAXBY | D | SCOTIA | B | SEKIL | B | SHAKOPEE | C |
| SAPPINGTON | B | SAXON | C | SCOTT | D | SEKIU | D | SHALAKE | C |
| SARA | D | SAY | B | SCOTT LAKE | B | SELAH | C | SHALAKO | D |
| SARAGOSA | B | SAYBROOK | B | SCOTTCAS | B | SELBIT | B | SHALBA | D |
| SARAHSVILLE | D | SAYDAB | C | SCOTTIES | B | SELDEN | C | SHALCAR | D |
| SARALEGUI | B | SAYERS | A | SCOTTSVILLE | C | SELEVIN | D | SHALCAR, DRAINED | C |
| SARANAC | C/D | SAYLES | D | SCOUT | B | SELFRIDGE | B | SHALCLEAV | D |
| SARANAC, GRAVELLY | C | SAYLESVILLE | C | SCRABBLERS | B | SELIA | C | SHALET | D |
| SUBSTRATUM | | SAYNER | A | SCRANTON | A/D | SELIGMAN | D | SHALONA | B |
| SARAPH | D | SAYPO | C | SCRAVO | B | SELKIRK | C | SHALPER | D |
| SARATON | C | SAZI | C | SCRIBA | C | SELLE | B | SHAM | D |
| SARAZAN | B | SCALA | B | SCRIBNER | C | SELLERS | B/D | SHAMBO | B |
| SARBEN | B | SCALADE | D | SCRIVER | B | SELMA | B/D | SHAMEL | B |
| SARCILLO | D | SCALFAR | B | SCROGGIN | C | SELMAC | D | SHAMOCK | C |
| SARDINIA | C | SCALLEY | B | SCULLIN | C | SELON | B | SHANAHAN | B |
| SARDIS | C | SCAMMAN | D | SCUPPERNONG | D | SELTI | B | SHANDEP | B/D |
| SARGEANT | D | SCANDARD | C | SEABROOK | C | SELWAY | B | SHANE | D |
| SARILDA | C | SCANTIC | D | SEAFIELD | B | SEMIAHMOO | D | SHANGHAI | C |
| SARITA | A | SCAPONIA | B | SEAFORTH | B | SEMIAHMOO, DRAINED | C | SHANGHAI, DRAINED | B |
| SARKAR | D | SCAR | B | SEAGATE | A/D | SEMINOLE | D | SHANKLER | A |
| SARNOSA | B | SCARBORO | D | SEAGOVILLE | D | SEMPER | C | SHANO | B |
| SARONA | B | SCARIBOU | B | SEALY | B | SEN | B | SHANTA | B |
| SARPY | A | SCARPER | C | SEAMAN | B | SENCHERT | C | SHARATIN | B |
| SARTELL | A | SCATLAKE | D | SEAMAN, STRONGLY | C | SENECAVILLE | B | SHARESNOUT | C |
| SARUCHE | D | SCAVE | C | SALINE | | SENSABAUGH | B | SHARKEY | D |
| SASABE | C | SCHAFFENAKER | A | SEAMAN, MODERATELY | C | SEQUATCHIE | B | SHARLAND | B |
| SASALAGUAN | C | SCHALLER | A | WET | | SEQUIM | A | SHARON | B |
| SASCO | B | SCHAMBER | A | SEAQUEST | C | SEQUOIA | C | SHARONDALE | B |
| SASKA | B | SCHAMP | C | SEAP | B | SERDEN | A | SHARPS | C |
| SASPAMCO | B | SCHAPVILLE | C | SEARING | B | SERENE | C | SHARPSBURG | B |
| SASSAFRAS | B | SCHATTEL | C | SEARLA | B | SEROCO | A | SHARROTT | D |
| SASSER | B | SCHAUSON | B | SEARLES | C | SERPEN | C | SHARVANA | C |
| SATAGO | D | SCHAWANA | D | SEARSPORT | D | SERPENTANO | B | SHASER | B |
| SATANKA | C | SCHENCO | D | SEARSVILLE | D | SERPOD | C | SHASKIT | C |
| SATANTA | B | SCHERRARD | D | SEASTRAND | D | SERRANO | D | SHASTA | B |
| SATATTON | D | SCHLEY | B | SEATON | B | SERVILLETA | D | SHASTINA | B |
| SATELLITE | C | SCHMUTZ | B | SEATTLE | D | SESAME | C | SHATRUCE | C |
| SATILLA | D | SCHNEBLY | D | SEATTLE, DRAINED | C | SESPE | C | SHATTA | C |
| SATIN | C | SCHNEIDER | B | SEAVERSON | D | SESSIONS | C | SHATTUCK | B |
| SATSOP | B | SCHNIPPER | C | SEAWILLOW | B | SESSUM | D | SHAUSON | B |
| SATT | C | SCHNOORSON | C | SEBAGO | D | SET | C | SHAVANO | B |
| SATTLEY | B | SCHNORBUSH | B | SEBASTIAN | D | SETH | C | SHAVASH | C |
| SATTRE | B | SCHODSON | C | SEBASTOPOL | C | SETTERS | D | SHAVER | B |
| SATURN | B | SCHOENS | A | SEBEWA | B/D | SETTLEMENT | D | SHAWA | B |
| SATUS | B | SCHOFIELD | C | SEBREE | D | SETTLEMEYER | C | SHAWANO | A |
| SAUCEL | D | SCHOHARIE | C | SEBRING | B/D | SETTLEMEYER, | D | SHAWMUT | B |
| SAUCIER | C | SCHOLLE | B | SEBUD | B | SALINE-ALKALI | | SHAY | D |
| SAUDE | B | SCHOODIC | D | SECCA | C | SETTLEMEYER, | D | SHAYLA | D |
| SAUGATUCK | C | SCHOOLCRAFT | B | SECESH | B | FLOODED | | SHEAR | C |
| SAUGUS | B | SCHOOLEY | D | SECONDSET | C | SETTLEMEYER, COOL | D | SHEAVILLE | D |
| SAUK | B | SCHOOLEY, DRAINED | C | SECRET CREEK | B | SETTLEMEYER, | B | SHEBANG | D |
| SAULICH | D | SCHOOLEY, | C | SECURITY | C | CHANNELED | | SHEBEON | C |
| SAUM | B | PROTECTED | | SED | C | SEVAL | C | SHEDADO | C |
| SAUNDERS | D | SCHOOLHOUSE | D | SEDALE | D | SEVENMILE | B | SHEDD | C |
| SAURIN | C | SCHOONER | D | SEDGEFIELD | C | SEVERN | B | SHEDHORN | D |
| SAUTER | B | SCHRADER | D | SEDGWAY | B | SEVIER | D | SHEECAL | B |
| SAUVIE | D | SCHRAP | D | SEDILLO | B | SEVILLE | D | SHEEGE | D |
| SAUVIE, MODERATELY | C | SCHRIER | B | SEDMAR | D | SEVY | B | SHEEK | B |
| WET | | SCHROCK | B | SEDROWOOLLEY | C | SEWANEE | B | SHEEP CREEK | C |
| SAUVIE, PROTECTED | B | SCHROON | B | SEDWELL | C | SEWARD | B | SHEEPCAN | B |
| SAUVOLA | C | SCHUELKE | C | SEEDSKADEE | D | SEWELL | C | SHEEPHEAD | C |
| SAUZ | B | SCHULINE | B | SEELEZ | A | SEXTON | C/D | SHEEPROCK | A |
| SAVAGE | C | SCHUMACHER | B | SEELOVERS | C | SEYMOUR | D | SHEEPSCOT | B |
| SAVAGETON | D | SCHUSTER | B | SEELYEVILLE | A/D | SEZNA | D | SHEETIRON | C |
| SAVANNAH | C | SCHUYLER | B | SEELYEVILLE, | D | SHAAK | C | SHEFFIELD | D |
| SAVENAC | C | SCIO | B | SLOPING | | SHABLISS | D | SHEFFIT | D |
| SAVO | C | SCIOTOVILLE | C | SEEPRID | B | SHACK | B | SHEFFLEIN | B |
| SAVOIA | B | SCISM | C | SEES | C | SHADELAND | C | SHELBIANA | B |
| SAVONA | C | SCITICO | C | SEEWEE | B | SHADELEAF | C | SHELBURNE | C |
| SAWABE | D | SCITUATE | C | SEFFNER | C | SHADOW | B | SHELBY | B |
| SAWATCH | B/D | SCLOME | B | SEGIDAL | D | SHADYGROVE | C | SHELBYVILLE | B |
| SAWBUCK | B | SCOAP | B | SEGNO | C | SHAFFTON | B | SHELD | B |
| SAWCREEK | C | SCOBEY | C | SEGUIN | B | SHAFTER | D | SHELL | B |
| SAWDUST | B | SCOGGIN | D | SEGURA | D | SHAGEL | D | SHELLABARGER | B |
| SAWMILL | B/D | SCOON | D | SEHOME | C | SHAGNASTY | C | SHELLBLUFF | B |
| SAWTELL | C | SCOOTENEY | B | SEHORN | D | SHAKAMAK | C | SHELLCREEK | C |
| SAWTELPEAK | D | SCORUP | C | SEIS | C | SHAKAN | C | SHELLDRAKE | A |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SHELLROCK | A | SHOTGUN | C | SIMON | B | SKYHIGH | C | SNOWDANCE, | C |
| SHELMADINE | D | SHOTWELL | D | SIMONA | D | SKYKOMISH | B | MODERATELY WET | |
| SHELOCTA | B | SHOUNS | B | SIMONIN | B | SKYLICK | B | SNOWDON | D |
| SHELTON | C | SHOWALTER | C | SIMONTON | B | SKYLINE | D | SNOWLIN | B |
| SHENA | D | SHOWALTER, STONY | B | SIMPARK | D | SKYMOR | D | SNOWMORE | C |
| SHENANDOAH | D | SHOWLOW | C | SIMPATICO | B | SKYROCK | D | SNOWSHOE | B |
| SHENKS | B/D | SHREE | B | SIMPSON | C | SKYVILLAGE | D | SNOWSLIDE | B |
| SHENON | B | SHREWDER | B | SIMS | D | SKYWAY | B | SNOWVILLE | D |
| SHENVAL | B | SHREWSBURY | C/D | SINAI | C | SLAB | D | SNUFFUL | C |
| SHEP | B | SHRINE | B | SINAMOX | B | SLABTOWN | B | SOAKPAK | B |
| SHEPAN | C | SHROE | C | SINCLAIR | C | SLACKS | C | SOAPCREEK | C |
| SHEPPARD | A | SHROUTS | D | SINGATSE | D | SLAGLE | C | SOAPLAKE | D |
| SHEPSTER | D | SHUBUTA | C | SINGERTON | B | SLAPJACK | B | SOAR | D |
| SHERANDO | B | SHUE | C | SINGLETREE | C | SLATERY | C | SOBEGA | C |
| SHERAR | C | SHUKASH | A | SINGSAAS | B | SLAUGHTER | C | SOBOBA | A |
| SHERBURNE | C | SHUKSAN | C | SINKER | C | SLAUGHTERVILLE | B | SOBOL | C |
| SHERIDAN | B | SHULE | C | SINKSON | B | SLAVEN | C | SOBRANTE | B |
| SHERLESS | B | SHULLSBURG | C | SINLOC | C | SLAW | C | SOBSON | C |
| SHERLOCK | B | SHUMLA | C | SINNICE | B | SLAYTON | D | SOCORRO | C |
| SHERM | D | SHUMWAY | D | SINNIGAM | D | SLEEPER | C | SODA | B |
| SHERMORE | B | SHUPERT | C | SINTON | B | SLEETH | C | SODA LAKE | B |
| SHERRY | B/D | SHURLEY | A | SINUK | D | SLICKROCK | B | SODA LAKE, WET | C |
| SHERRY, STONY | D | SHUSTER | C | SION | B | SLIDECREEK | B | SODABAY | B |
| SHERRYL | B | SHUTTLE | B | SIOUX | A | SLIDELL | D | SODASPRING | B |
| SHERWOOD | B | SI | C | SIOUXON | B | SLIGHTS | C | SODERVILLE | A |
| SHEYLIN | C | SIBELIA | B | SIPPLE | B | SLIGTING | C | SODHOUSE | D |
| SHIDLER | D | SIBLEY | B | SIPSEY | B | SLIKOK | D | SODUS | C |
| SHIELDS | C | SIBLEYVILLE | B | SIPOPAK | A | SLIMBUTTE | B | SOELBERG | B |
| SHIFFER | C | SICKLES | B/D | SIRI | B | SLINGER | B | SOEN | C |
| SHILLY | C | SICKLESTEETS | B | SIROCO | C | SLIPBACK | B | SOFIA | C |
| SHILOH | B/D | SIDDOWAY | A | SIRREF | D | SLIPMAN | B | SOFTSCRABBLE | C |
| SHIMA | C | SIDELL | B | SIRPETTA | C | SLOAN | B/D | SOFTSCRABBLE, | B |
| SHIMMON | C | SIDLAKE | C | SISK | C | SLOCAVE | D | RARELY FLOODED | |
| SHINAKU | D | SIDON | C | SISKIYOU | B | SLOCUM | C | SOGI | C |
| SHINBARA | D | SIEBEN | B | SISSETON | B | SLUICE | C | SOGN | D |
| SHINDLER | C | SIEBERT | A | SISSON | B | SLUKA | C | SOGO | B |
| SHINER | C | SIECHE | C | SISTEPS | A | SLY | B | SOGZIE | B |
| SHINGLE | D | SIELO | D | SITAR | B | SMACKOUT | B | SOHAPPY | B |
| SHINGLEMILL | D | SIEROCLIFF | C | SITDOWN | A | SMALL | C | SOJUR | D |
| SHINGLETOWN | C | SIERRA | B | SITES | C | SMALLCONE | D | SOLAK | D |
| SHINKEE | C | SIERRAVILLE | B | SIWELL | C | SMARTS | B | SOLAND | D |
| SHINNPEAK | D | SIESTA | D | SIXBEACON | B | SMAUG | B | SOLDATNA | B |
| SHINROCK | C | SIEVERS | C | SIXMILE | C | SMEDLEY | D | SOLDIER | C |
| SHIOCTON | C | SIFTON | B | SIZER | B | SMELTER | C | SOLDUC | B |
| SHIOYA | A | SIG | D | SKAGGS | C | SMILEY | B/D | SOLEDAD | B |
| SHIPLEY | B | SIGNAL | C | SKAGIT | D | SMILEYVILLE | D | SOLIER | D |
| SHIPLEY, | C | SIGURD | B | SKAGWAY | C | SMILO | C | SOLIS | C |
| SALINE-ALKALI | | SIKESTON | B/D | SKAHA | A | SMITHBORO | D | SOLLEKS | C |
| SHIPPA | D | SILAS | B | SKALAN | C | SMITHDALE | B | SOLLER | D |
| SHIPROCK | B | SILAS, WET | C | SKAMANIA | B | SMITHNECK | C | SOLO | C |
| SHIPS | D | SILAS, GRAVELLY | C | SKAMO | C | SMITHNECK, DRAINED | B | SOLOMON | D |
| SHIPSHE | B | SUBSTRATUM | | SKANEE | C | SMITHTON | D | SOLONA | C |
| SHIRK | C | SILAWA | B | SKANID | D | SMITHVILLE | B | SOLWAY | B |
| SHIRLEY | B | SILCOX | B | SKATE | B | SMITHWICK | D | SOMBORDORD | D |
| SHIRO | C | SILENT | D | SKEDADDLE | D | SMOCREEK | C | SOMBRERO | C |
| SHIRTTAIL | B | SILEP | B | SKEIN | D | SMOKEY | C | SOMERS | B |
| SHIVELY | B | SILERTON | B | SKELLOCK | B | SMOLAN | C | SOMERVELL | B |
| SHIVIGNY | B | SILHOUETTE | C | SKELON | C | SMYRNA | B/D | SOMSEN | C |
| SHIVLUM | B | SILI | C | SKELTON | B | SNAG | B | SONAHNPIL | B |
| SHOALS | C | SILKIE | D | SKERRY | C | SNAHOPISH | B | SONDOA | B |
| SHOAT | D | SILSTIO | A | SKIPO | B | SNAKE | C | SONLET | D |
| SHOBA | D | SILVA | C | SKIDMORE | B | SNAKE HOLLOW | A | SONOCAN | C |
| SHOEPEG | C | SILVER | C | SKINNER | B | SNAKELUM | B | SONOITA | B |
| SHOESTRING | B | SILVER CREEK | D | SKIPANON | B | SNAKER | D | SONOMA | C |
| SHOKEN | D | SILVERADO | B | SKIPOPA | D | SNAPP | C | SONOMA, MODERATELY | B |
| SHONKIN | D | SILVERBELL | C | SKIYOU | B | SNEAD | D | WET, SALINE | |
| SHONTIK | C | SILVERBOW | D | SKOKOMISH | D | SNEFFELS | C | SONOMA, SALINE, | B |
| SHOOFLIN | D | SILVERCHIEF | C | SKOKOMISH, DRAINED | C | SNELL | C | DRAINED | |
| SHOOFLY | D | SILVERCLIFF | B | SKOLY | B | SNELLING | B | SONOMA, STRATIFIED | D |
| SHOOK | C | SILVERDALE | A | SKOOKUM | C | SNELLMAN | B | SUBSTRATUM | |
| SHOOKER | C | SILVERN | A | SKOS | D | SNIDER | C | SONOMA, DRAINED, | B |
| SHOREEK | C | SILVERTON | C | SKOWHEGAN | B | SNOHOMISH | D | SLIGHTLY SALINE | |
| SHOREWOOD | C | SILVIES | D | SKULL CREEK | C | SNOMO | C | SONOMA, DRAINED, | B |
| SHORIM | C | SIMAS | C | SKULLGULCH | C | SNOOK | D | FLOODED | |
| SHORT CREEK | C | SIMCOE | C | SKULLWAK | D | SNOPOC | B | SONOMA, DRAINED | B |
| SHORTCUT | C | SIMEON | A | SKUMPAH | D | SNOQUALMIE | C | SONORA | B |
| SHORTHORN | D | SIMEROI | B | SKUTUM | C | SNOTOWN | B | SONTAG | D |
| SHORTYORK | C | SIMMONT | C | SKYBERG | C | SNOW | B | SOOLAKE | B |
| SHOSHONE | C | SIMODA | C | SKYHAVEN | C | SNOWDANCE | D | SOONAHBE | B |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOONAKER | C | SPINEKOP | B | STABLER | B | STEUBER | B | STRELNA, SILTY | B |
| SOOSAP | C | SPINEKOP, SALINE | C | STADY | B | STEVENS | B | SUBSTRATUM | |
| SOPER | C | SPINEKOP, | C | STAFFORD | C | STEVENSON | B | STREVELL | B |
| SOQUEL | B | MODERATELY WET | | STAGECOACH | B | STEWART | D | STRICKER | B |
| SORENSEN | B | SPINKS | A | STAHL | C | STEWVAL | D | STRICKLAND | C |
| SORF | C | SPINLIN | C | STAKE | C | STICKNEY | C | STRINGAM | B |
| SORRENTO | B | SPINNEY | B | STALEY | B | STIDHAM | B | STRINGTOWN | B |
| SORTER | D | SPIRES | D | STALLINGS | C | STIEN | B | STRINGTOWN, GRADED | C |
| SORUM | D | SPIRIT | C | STAMBAUGH | B | STIGLER | D | STROLE | C |
| SOSA | C | SPIRO | B | STAMFORD | D | STILES | C | STROM | C |
| SOSTIEN | D | SPIVEY | B | STAMP | D | STILGAR | B | STROMAL | B |
| SOTIM | B | SPLAWN | C | STAMPEDE | D | STILL | B | STRONGHOLD | B |
| SOUGHE | D | SPLENDORA | C | STAN | B | STILLMAN | B | STRONGHURST | B |
| SOULAJULE | C | SPLITEN | D | STANDLEY | C | STILLWATER | D | STROUPE | C |
| SOUTHACE | B | SPLITRO | D | STANDUP | B | STILSKIN | C | STROZI | C |
| SOUTHAM | D | SPLITTOP | C | STANEY | D | STILSON | B | STRYCH | B |
| SOUTHFORK | D | SPOFFORD | D | STANFIELD | C | STIMCA | B | STRYKER | C |
| SOUTHGATE | D | SPOFMORE | C | STANISLAUS | C | STIMSON | D | STUBBLEFIELD | C |
| SOUTHMOUNT | C | SPOKANE | C | STANISLAUS, WET | D | STINES | B | STUBBS | C |
| SOUTHRIDGE | B | SPOKEL | B | STANROD | C | STINGAL | B | STUCKY | B |
| SOUTHWICK | C | SPONSELLER | B | STAPALOOP | B | STINGDORN | D | STUDEBAKER | B |
| SOWCAN | B | SPOOL | D | STAPLES | B/D | STIPE | C | STUKEL | D |
| SOWCAN, SOMEWHAT | C | SPOONER | C/D | STAPLETON | B | STIRK | D | STUMBLE | A |
| POORLY DRAINED | | SPOTSYLVANIA | C | STAPP | C | STIRRUP | B | STUMPP | D |
| SPAA | D | SPOTTSWOOD | B | STARBUCK | D | STIRUM | B/D | STUMPTOWN | B |
| SPACE CITY | A | SPRABAT | B | STARGO | B | STIRUM, PONDED | D | STUNNER | B |
| SPADE | B | SPRAY | B | STARHOPE | D | STISSING | C | STUNTZ | C |
| SPADRA | B | SPRECKELS | C | STARICHKOF | D | STIVERSVILLE | B | STURGEON | B |
| SPAGER | D | SPRIGGS | C | STARKEY | C | STOCKADE | B/D | STURGILL | D |
| SPALDING | D | SPRING | C | STARKS | C | STOCKBRIDGE | C | STURKIE | B |
| SPANA | D | SPRINGDALE | A | STARLEY | D | STOCKEL | D | STUTTGART | D |
| SPANAWAY | A | SPRINGDALE, STONY | B | STARMAN | D | STOCKLAND | B | STUTZMAN | C |
| SPANEL | D | SPRINGER | B | STARR | C | STOCKPEN | D | STUTZMAN, WET | D |
| SPANG | B | SPRINGERVILLE | D | STARVEOUT | B | STODA | B | STUTZVILLE | C |
| SPANGENBURG | C | SPRINGFIELD | D | STASER | B | STODICK | D | STYERS | D |
| SPANGENBURG, | D | SPRINGGULCH | B | STATE | B | STOHLMAN | D | STYX | B |
| PONDED | | SPRINGLAKE | A | STATELINE | D | STOKES | D | SUAK | C |
| SPANGLER | C | SPRINGMEYER | B | STATLER | B | STOKLY | B | SUBACO | D |
| SPARANK | D | SPRINGSTEEN | C | STATZ | D | STOMAR | C | SUBLETTE | B |
| SPARHAM | D | SPRINGWATER | C | STAVELY | B | STONEBERGER | D | SUBLIGNA | B |
| SPARKHULE | D | SPROUL | D | STAYTON | D | STONEBURG | B | SUBWELL | B |
| SPARMO | B | SPRUCEDALE | D | STEARNS | D | STONEHAM | B | SUCARNOOCHEE | D |
| SPARR | C | SPUD | C | STECOAH | B | STONEHEAD | C | SUCCESS | A |
| SPARTA, SILTY CLAY | B | SPUDROCK | C | STECUM | C | STONELICK | B | SUCCOR | D |
| LOAM SUBSTRATUM | | SPUKWUSH | B | STEED | A | STONELL | B | SUCHES | B |
| SPARTA, LOAMY | A | SPUR | B | STEEDMAN | D | STONER | B | SUDBURY | B |
| SUBSTRATUM | | SPURGER | C | STEEDMAN, STONY | C | STONEVILLE | B | SUDDUTH | C |
| SPARTA, MAAT>50 | A | SPURLOCK | B | STEEKEE | C | STONEWALL | C | SUDLEY | B |
| SPARTA, MAAT<50 | A | SQUALICUM | B | STEELE | C | STONEWELL | A | SUDWORTH | B |
| SPARTA, BEDROCK | A | SQUALLY | B | STEENS | C | STONO | B/D | SUEPERT | C |
| SUBSTRATUM | | SQUAW | B | STEEPCAN | D | STONYFORD | D | SUEY | B |
| SPASPREY | C | SQUAWCREEK | D | STEESE | B | STOOKMOOR | C | SUFFIELD | C |
| SPEAKER | C | SQUAWROCK | C | STEEVER | B | STORDEN | B | SUFFOLK | B |
| SPEAKS | A | SQUAWTIP | C | STEFF | C | STORLA | B | SUGAKOOL | B |
| SPEARFISH | D | SQUIRES | C | STEGALL | C | STORMITT | B | SUGARBOWL | B |
| SPEARHEAD | B | ST. ALBANS | B | STEIGER | A | STOTT | C | SUGARDEE | B |
| SPEARMAN | B | ST. ANTHONY | B | STEILACOOM | C | STOUGH | C | SUGARLOAF | B |
| SPEARVILLE | C | ST. AUGUSTINE | C | STEINAUER | B | STOUT | D | SUGLO | B |
| SPECIE | B | ST. AUGUSTINE, | B | STEINBECK | B | STOVHO | C | SUISUN | D |
| SPECK | D | ORGANIC | | STEINSBURG | C | STOWE | C | SULA | B |
| SPECTACLE | C | SUBSTRATUM | | STEIWER | C | STOWELL | D | SULLIVAN | B |
| SPECTER | C | ST. CHARLES | B | STELLA | C | STOY | C | SULLY | B |
| SPEELYAI | D | ST. CLAIR | D | STELLAR | C | STRABER | C | SULOAF | B |
| SPEER | B | ST. ELMO | A | STEMBER | C | STRAHAN | B | SULPHURA | D |
| SPEIGLE | B | ST. GEORGE | B | STEMILT | B | STRAIGHT | C | SULSAVAR | B |
| SPENARD | D | ST. GEORGE, SALINE | C | STEMLEY | C | STRANDLINE | B | SULTAN | C |
| SPENCER | B | ST. GEORGE, WET | D | STEMPLE | B | STRANDQUIST | B/D | SUMAN | B/D |
| SPENLO | B | ST. HELENS | B | STENDAL | C | STRAT | B | SUMAS | D |
| SPENS | A | ST. IGNACE | D | STEPHEN | C | STRATFORD | B | SUMATRA | B |
| SPERRY | C/D | ST. JOHNS | B/D | STEPHENVILLE | B | STRATTON | C | SUMINE | C |
| SPEXARTH | C | ST. JOHNS, | D | STEPROCK | B | STRAW | B | SUMMERFIELD | D |
| SPHINX | D | DEPRESSIONAL | | STEPSTONE | B | STRAWN | B | SUMMERS | B |
| SPICER | B/D | ST. LUCIE | A | STEPTOE | B | STREATOR | B/D | SUMMERTON | B |
| SPICERTON | D | ST. MARTIN | D | STERLING | B | STRELNA | C | SUMMERVILLE | D |
| SPICEWOOD | C | ST. MARYS | B | STERLINGTON | B | STRELNA, | B | SUMMIT | C |
| SPIKE | B | ST. NICHOLAS | D | STERRETT | D | LACUSTRINE | | SUMMITVILLE | C |
| SPILLCO | B | ST. ONGE | B | STETSON | B | SUBSTRATUM | | SUMPF | D |
| SPILLVILLE | B | ST. PAUL | B | STETTER | D | STRELNA, TILL | B | SUMTER | C |
| SPILOCK | D | ST. THOMAS | D | STEUBEN | B | SUBSTRATUM | | SUMTERVILLE | C |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SUMYA | D | SWANTOWN. | D | TACOMA | D | TANQUE | B | TEHAMA | C |
| SUN | D | SWANVILLE | C | TACONIC | C/D | TANSEM | B | TEHRAN | A |
| SUNAPEE | B | SWANWICK | D | TACOOSH | B/D | TANTALUS | B | TEIGEN | C |
| SUNBURG | B | SWAPPS | C | TADLOCK | B | TANTILE | C/D | TEJA | D |
| SUNBURST | C | SWARTSWOOD | C | TAFFOM | B | TANWAX | D | TEJABE | D |
| SUNBURY | B | SWARTZ | D | TAFOYA | C | TANWAX, DRAINED | C | TEJANA | B |
| SUNCITY | D | SWASEY | D | TAFT | C | TANYARD | C | TEKENINK | B |
| SUNCOOK | A | SWASTIKA | C | TAFTOWN | B | TAOPI | B | TEKISON | C |
| SUND | C | SWAUK | D | TAFUNA | A | TAPCO | D | TEKLANIKA | A |
| SUNDANCE | B | SWAYNE | C | TAGGART | C | TAPIA | B | TEKOA | C |
| SUNDAY | A | SWEATMAN | C | TAGLAKE | B | TAPICITOES | D | TEKOA, EXTREMELY | B |
| SUNDELL | B | SWEDE | B | TAHKENITCH | B | TAPPAN | B/D | STONY | |
| SUNDOWN | A | SWEEN | C | TAHOMA | B | TARA | B | TELA | B |
| SUNEV | B | SWEENEY | B | TAHOULA | D | TARBORD | A | TELCHER | B |
| SUNFIELD | B | SWEET | C | TAHOUATS | B | TARGHEE | C | TELECAN | B |
| SUNLIGHT | D | SWEETAPPLE | B | TAINTOR | C/D | TARKINGTON | C | TELEFONO | C |
| SUNNYHAY | D | SWEETGRASS | B | TAJO | C | TARKIO | D | TELEMON | D |
| SUNNYSIDE | B | SWEETWATER | D | TAKEUCHI | C | TARKLIN | C | TELEPHONE | D |
| SUNNYVALE | C | SWEITBERG | C | TAKILMA | B | TARLOC | B | TELESCOPE | A |
| SUNRAY | B | SWEITING | C | TAKOTNA | B | TARNACH | D | TELFER | A |
| SUNRISE | C | SWEM | C | TAKPOCHAO | D | TARNAV | B | TELFERNER | D |
| SUNSET | B | SWENODA | B | TALAG | D | TARPLEY | D | TELL | B |
| SUNSHINE | C | SWIFT | B | TALAMANTES | B | TARR | A | TELLER | B |
| SUNSWEET | C | SWIFT CREEK | B | TALANTE | D | TARRANT | D | TELLICO | B |
| SUNUP | D | SWIFTON | B | TALAPUS | B | TARRETE | D | TELLMAN | B |
| SUNY | D | SWIMLEY | C | TALBOTT | C | TARRYALL | C | TELLURA | C |
| SUOMI | C | SWIMS | B | TALCO | D | TARRYTOWN | C | TELOS | C |
| SUP | B | SWINGLER | B | TALCOT | B/D | TASAYA | C | TELSTAD | C |
| SUPAN | B | SWINGLER, WET, | C | TALIHINA | D | TASCOSA | B | TEMAN | B |
| SUPERIOR | D | STRONGLY SALINE | | TALKEETNA | B | TASSEL | D | TEMBLOR | D |
| SUPERSTITION | A | SWINGLER, WET | C | TALLA | C | TASSELMAN | D | TEMESCAL | D |
| SUPERVISOR | C | SWINK | D | TALLAC | B | TASSO | B | TEMO | C |
| SUPPLEE | B | SWINOMISH | C | TALLADEGA | C | TATAI | C | TEMPLE | C |
| SUR | C | SWINT | B | TALLAPOOSA | C | TATE | B | TEMPLETON | B |
| SURFSIDE | D | SWISBOB | D | TALLEYVILLE | B | TATERHEAP | B | TEMVIK | B |
| SURGEM | C | SWISSHELM | B | TALLOWBOX | C | TATIYEE | C | TENABO | D |
| SURGH | B | SWISSTAG | B | TALLS | B | TATLUM | D | TENAHA | B |
| SURNUF | B | SWISSVALE | D | TALLULA | B | TATOUCHE | B | TENAS | C |
| SURPLUS | C | SWITCHBACK | C | TALLY | B | TATTON | D | TENCEE | D |
| SURPRISE | B | SWITZERLAND | B | TALMAGE | B | TATUM | B | TENDOY | D |
| SURRENCY | D | SWOPE | C | TALMO | A | TAUNTON | C | TENERIFFE | A |
| SURRETT | C | SWORMVILLE | C | TALMOON | D | TAVARES | A | TENEX | B |
| SURVEYORS | B | SWYGERT | C | TALOKA | D | TAWAH | B | TENINO | C |
| SURVYA | C | SYBLON | D | TALPA | D | TAWAS | A/D | TENMILE | C |
| SUSANNA | C/D | SYCAMORE, | B | TALOUIN | B/D | TAWCAW | C | TENNO | D |
| SUSANVILLE | D | MODERATELY WET, | | TALUCE | D | TAYLOR | C | TENORIO | B |
| SUSIE CREEK | C | SALINE | | TAMA | B | TAYLOR CREEK | C | TENOT | C |
| SUSITNA | B | SYCAMORE, | C | TAMAHA | D | TAYLORSFLAT | B | TENPIN | D |
| SUSQUEHANNA | D | MODERATELY WET, | | TAMALCO | D | TAYLORSFLAT, | C | TENRAG | B |
| SUTA | B | CLAYEY SUBSTRATUM | | TAMALPAIS | C | SALINE-ALKALI | | TENSAS | D |
| SUTCLIFF | B | SYCAMORE, | C | TAMANEEN | B | TAYLORSVILLE | C | TENSED | C |
| SUTHER | C | MODERATELY WET | | TAMBA | D | TAZLINA | A | TENSLEEP | B |
| SUTHERLAND | D | SYCAMORE, DRAINED | B | TAMELY | B | TEAGULF | C | TENSNOIR | B |
| SUTHERLIN | C | SYCAMORE, FLOODED | C | TAMFLAT | D | TEAKEAN | B | TENVORRO | D |
| SUTKIN | B | SYCAMORE, CLAY | B | TAMFORD | D | TEALSON | D | TEO | B |
| SUTLEY | B | SUBSTRATUM | | TAMMANY CREEK | B | TEALWHIT | D | TEOCULLI | B |
| SUTPHEN | D | SYCAN | A | TAMMING | B | TEANAWAY | B | TEPETE | D |
| SUTRO | C | SYCLE | B | TAMP | B | TEAPO | C | TEQUESTA | B/D |
| SUTTLER | B | SYCOLINE | D | TAMPICO | B | TEASDALE | B | TERADA | B |
| SUTTON | B | SYENITE | C | TANAMA | D | TEASPOON | D | TERBIES | B |
| SUVER | D | SYLACAUGA | D | TANANA | D | TEBAY | B | TERENCE | B |
| SUWANEE | B | SYLCO | C | TANANA, THAWED | B | TEBBS | B | TERESA | D |
| SVEA | B | SYLVAN | B | TANANA, MODERATELY | C | TEBO | B | TERINO | D |
| SVENSEN | B | SYLVANIAM | C | WET | | TECHADD | D | TERLAN | D |
| SVERDRUP | B | SYLVESTER | B | TANASEE | B | TECHICK | B | TERLCO | B |
| SWAGER | C | SYLVIA | C | TANAZZA | B | TECO | B | TERLINGUA | D |
| SWAINOW | B | SYMCO | C | TANBARK | D | TECOLOTE | B | TERMINAL | D |
| SWAKANE | D | SYMERTON | B | TANDY | D | TECOMAR | D | TERMO | D |
| SWALER | D | SYNAREP | B | TANEUM | B | TECOPA | D | TEROMOTE | B |
| SWALESILVER | D | SYRACUSE | B | TANEY | C | TEDROW | B | TEROUGE | D |
| SWAMPYDRAW | B | SYRENE | B/D | TANGAIR | C | TEEL | B | TERRA CEIA | B/D |
| SWAN | D | SYPETT | C | TANGI | C | TEELER | B | TERRA CEIA, TIDAL | D |
| SWANBOY | D | TABECHEDING | C | TANGLE | C | TEEMAT | B | TERRA CEIA, | D |
| SWANDAD | B | TABERNASH | B | TANNA | D | TEESTO | D | FREQUENTLY | |
| SWANLAKE | B | TABLE MOUNTAIN | B | TANNAHILL | B | TEETERS | C | FLOODED | |
| SWANNER | D | TABLER | D | TANNER | C | TEEWINOT | D | TERRAD | C |
| SWANSEA | D | TABOR | D | TANNER, LOW | D | TEFTON | C | TERRETON | D |
| SWANSON | C | TACAN | B | PRECIPITATION | | TEGURO | D | TERRETON, STONY | C |
| SWANTON | C/D | TACHI | D | TANOB | B | TEHACHAPI | C | TERRIL | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TERRO | C | THURLONI | C | TINTON | A | TOLTEC | C | TORSIDO | D |
| TERRY | C | THURLOW | B | TINYTOWN | B | TOLUCA | B | TORTUGAS | D |
| TERT | D | THURMAN | A | TIOCANO | D | TOLVAR | B | TORULL | D |
| TERWILLIGER | C | THURMONT | B | TIOGA | B | TOMAH | B | TOSCA | B |
| TESAJO | B | THWOOP | C | TIPPAH | C | TOMAHAWK | A | TOSSER | B |
| TESSFIVE | D | TIAGOS | B | TIPPECANOE | B | TOMALES | D | TOSTON | C |
| TETHRICK | B | TIAK | C | TIPPER | C | TOMASAKI | C | TOTAVI | A |
| TETON | C | TIBAN | B | TIPPERARY | A | TOMAST | C | TOTELAKE | B |
| TETONIA | B | TIBBITTS | B | TIPPIPAH | B | TOMBAR | C | TOTEM | B |
| TETONKA | C/D | TIBS | C | TIPPO | C | TOMBSTONE | B | TOTIER | C |
| TETONVIEW | D | TIBSON | B | TIPTON | B | TOME | B | TOTO | B/D |
| TETONVILLE | D | TIBURONES | D | TIPTONVILLE | B | TOMEL | D | TOTTEN | C/D |
| TETONVILLE, | C | TICA | D | TIPTOP | B | TOMERA | C | TOUCHET | C |
| GRAVELLY | | TICE | B | TIRO | C | TOMERA, CEMENTED | D | TOUHEY | B |
| TETOTUM | C | TICELL | D | TISBURY | B | SUBSTRATUM | | TOULA | C |
| TEVIS | B | TICHNOR | D | TISCH | D | TOMICHI | A | TOULON | B |
| TEW | C | TICINO | C | TISDALE | C | TOMOKA | B/D | TOURN | C |
| TEWA | B | TICKAPOO | D | TISHAR | B | TOMOTLEY | B/D | TOURNQUIST | B |
| TEX | B | TICKASON | B | TISONIA | D | TOMS | C | TOURS | B |
| TEXANA | D | TIDINGS | B | TISWORTH | C | TOMSHERRY | C | TOUTLE | A |
| TEXARK | D | TIDWELL | D | TITUS | B/D | TOMTY | D | TOUTLE, FLOODED | B |
| TEXLINE | B | TIERRA | D | TITUSVILLE | C | TONALEA | C | TOVAR | C |
| TEXROY | B | TIERRANEGRE | B | TIVOLI | A | TONASKET | B | TOWAVE | B |
| TEZUMA | C | TIESIDE | D | TIVY | C | TONATA | D | TOWHEE | D |
| THACKER | D | TIETON | B | TOA | B | TONCANA | B | TOWNER | B |
| THACKERY | B | TIFFANY | B/D | TOADLAKE | B | TONEY | D | TOWNLEY | C |
| THADER | C | TIFTON | B | TOANO | B | TONGUE RIVER | C | TOWNSEND | C |
| THAGE | C | TIGER CREEK | B | TOANO | B | TONIO | B | TOWOSAHGY | B |
| THATCHER | B | TIGERON | B | TOBICO | A/D | TONKA | C/D | TOXAWAY | B/D |
| THATUNA | C | TIGIT | C | TOBIN | B | TONKAWAR | A | TOY | D |
| THAYNE | B | TIGIWON | B | TOBISH | C | TONKAWA | A | TOYAH | B |
| THEBES | B | TIGLEY | B | TOBLER | B | TONKEY | B/D | TOYUSKA | B |
| THEBO | D | TIGON | D | TOBOSA | D | TONKIN | B | TOZE | B |
| THEDALUND | C | TIGUA | D | TOBY | B | TONKIN, MODERATELY | C | TRABUCO | C |
| THEEDLE | C | TIJERAS | B | TOCAL | C | WET | | TRACHUTE | B |
| THENAS | C | TIKI | D | TOCALOMA | C | TONKS | C | TRACK | D |
| THEODOR | D | TILFER | B/D | TOCAN | B | TONOPAH | A | TRACK, DRAINED | C |
| THEON | D | TILFORD | B | TOCCOA | B | TONOP | C | TRACOSA | D |
| THERESA | B | TILLEDA | B | TOCK | C | TONOWEK | B | TRACY | B |
| THERIOT | D | TILLICUM | B | TOCOI | B/D | TONRA | B | TRADEDOLLAR | B |
| THERMO | D | TILLMAN | C | TODDLER | B | TONSINA | B | TRAER | B/D |
| THERMOPOLIS | D | TILLMONT | B | TODDSTAV | D | TONTI | C | TRAG | B |
| THESS | B | TILLOU | C | TODDVILLE | B | TONUCO | D | TRAG, COOL | C |
| THETFORD | A | TILMA | C | TODOS | C | TOOLES | D | TRAHAM | C |
| THETIS | B | TILSIT | C | TOEHEAD | B | TOOLESBORO | B | TRAIL | A |
| THIEFRIVER | B/D | TILTON | B | TOEJA | B | TOOMES | D | TRAILAMP | D |
| THIEL | B | TIMBALIER | D | TOEM | C | TOONE | C | TRAILCREEK | C |
| THIESSEN | C | TIMBERG | C | TOGCHA | B | TOONE, LOAMY | B | TRAILHEAD | B |
| THIKE | D | TIMBERHEAD | B | TOGNONI | D | SUBSTRATUM, STONY | | TRAINER | B |
| THIOKOL | B | TIMBERLY | B | TOGO | B | TOP | C | TRAITORS | D |
| THIRST | D | TIMBERVILLE | B | TOGUS | D | TOPEKI | D | TRAMPAS | C |
| THISTLEBURN | B | TIMBLIN | D | TOHONA | C | TOPEMAN | D | TRAMWAY | B |
| THISTLEDEW | B | TIMBUCTOO | C | TOIMI | C | TOPIA | D | TRANQUILAR | C |
| THOENY | D | TIMENTWA | B | TOINE | B | TOPLIFF | B | TRANSYLVANIA | B |
| THOMAS | B/D | TIMHILL | D | TOISNOT | B/D | TOPONCE | C | TRAPPER | B |
| THOMHILL | B | TIMHUS | B | TOISNOT, PONDED | D | TOPPENISH | D | TRAPPIST | C |
| THOMS | D | TIMKEN | D | TOIYABE | C | TOPPENISH, DRAINED | C | TRAPPS | B |
| THORNBURGH | B | TIMMERMAN | B | TOKAY | B | TOPPER | B | TRASK | C |
| THORNDALE | D | TIMMONS | B | TOKEEN | C | TOPSEY | C | TRAVELERS | D |
| THORNDIKE | C/D | TIMPAHUTE | D | TOKLAT | D | TOQUERVILLE | D | TRAVER | B |
| THORNOCK | D | TIMPANOGOS | B | TOKOPER | D | TOQUI | D | TRAVERTINE | C |
| THORNTON | D | TIMPANOGOS, | C | TOKUL | C | TOQUOP | A | TRAVESSILLA | D |
| THOROUGHFARE | B | MODERATELY WELL | | TOLANY | B | TOR | D | TRAVIS | C |
| THORP | C/D | DRAINED | | TOLEY | B | TORBOY | A | TRAYSON | D |
| THOUT | C | TIMPER | D | TOLEDO | D | TORCHLIGHT | C | TRAWICK | B |
| THOW | B | TIMULA | B | TOLEX | D | TORDIA | D | TRAY | C |
| THOWSON | B | TINA | C | TOLICHA | D | TOREX | B | TREADWAY | D |
| THRASH | B | TINAJA | B | TOLKE | B | TORHUNTA | C | TREATY | B/D |
| THREADGILL | B | TINAMOU | C | TOLL | A | TORNEY | D | TREBLE | B |
| THREECHOP | B | TINDAHAY | B | TOLLGATE | B | TORNILLO | B | TREBLOC | D |
| THREEDOT | D | TINDAHAY, GRAVELLY | A | TOLLHOUSE | D | TORNING | B | TREBOR | C |
| THREEK | C | TINE | A | TOLMAN | D | TORODA | B | TREEKOR | D |
| THREEMILE | B | TINEMAN | B | TOLNA | B | TORONTO | C | TREEKOR, NONSTONY | C |
| THREETOP | C | TINEMAN, WET | C | TOLO | B | TORPEDO LAKE | D | TREEN | D |
| THROCK | C | TINGEY | B | TOLONIER | B | TORREON | C | TREGO | C |
| THULEPAH | C | TINKER | C | TOLSONA | D | TORREON, COBBLY | D | TREHARNE | C |
| THUMBERLAND | B | TINN | D | TOLSONA, TILL | B | TORRES | A | TRELK | B |
| THUNDERBIRD | D | TINNIN | A | SUBSTRATUM | | TORRO | B | TRELONA | D |
| THURBER | D | TINSLEY, | A | TOLSTOI | D | TORRY | B/D | TREMANT | B |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TREMBLES | B | TRUSCREEK | B | TURSON | C | UHLAND | B | UTABA | A |
| TREMBLES, | C | TRUSSEL | C | TURTON | D | UHLIG | B | UTALINE | B |
| MODERATELY WET | | TRUVAR | D | TUSAYAN | C | UHLORN | C | UTE | D |
| TREMONA | C | TRYON | D | TUSCAN | D | UINTA | B | UTICA | B |
| TREMPE | A | TSALI | C | TUSCARAWAS | C | UKIAH | D | UTLEY | B |
| TREMPEALEAU | B | TSCHICOMA | B | TUSCAWILLA | D | ULA | C | UTSO | B |
| TRENARY | B | TSIRKU | C | TUSCOLA | B | ULEN | B | UTUADO | B |
| TRENHOLM | D | TSOSIE | B | TUSCOSSO | B | ULIDA | D | UVADA | D |
| TRENT | B | TUB | C | TUSCUMBIA | D | ULLOA | B | UVALDE | B |
| TRENTON | D | TUBAC | C | TUSEL | B | ULM | C | UVI | B |
| TREON | D | TUBERET | C | TUSIP | B | ULRANT | B | UWALA | B |
| TREP | B | TUCANNON | C | TUSK | B | ULRIC | C | UWHARRIE | B |
| TRES HERMANDS | B | TUCKAHOE | B | TUSKAHOMA | D | ULRICHER | B | UZONA | D |
| TRESANO | B | TUCKER | C | TUSKEEGO | C/D | ULTRA | D | VABEM | D |
| TRESED | C | TUCKERMAN | D | TUSLER | B | ULUPALAKUA | B | VABUS | C |
| TRESTLE | B | TUCSON | B | TUSQUITEE | B | ULY | B | VACHERIE | C |
| TRETTEN | B | TUCUMCARI | B | TUSSY | D | ULYSSES | B | VADAHO | D |
| TREVINO | D | TUFFIT | C | TUSTELL | C | UMA | A | VADER | B |
| TREVLAC | B | TUFFO | D | TUSTIN | B | UMAPINE | D | VADNAIS | C |
| TREY | A | TUGHILL | D | TUSTUMENA | B | UMAPINE, DRAINED | C | VADO | B |
| TRIANGLE | D | TUJUNGA | A | TUTE | B | UMATILLA | B | VAEDA | D |
| TRIBBEY | C | TUKEY | C | TUTHILL | B | UMBARG | C | VAIDEN | D |
| TRICON | C | TUKUHNIK | C | TUTNI | B | UMBERLAND | D | VAILTON | B |
| TRID | C | TUKWILA | D | TUTTLE | C | UMIAT | D | VAIVA | D |
| TRID, NONSTONY | B | TUKWILA, DRAINED | C | TUTUILLA | C | UMIKOA | B | VALBY | C |
| TRIDELL | B | TULA | C | TUTWILER | B | UMIL | D | VALCO | C |
| TRIGGER | D | TULANA, DRAINED | B | TUWEEP | B | UMPA | B | VALCREEK | B |
| TRIGO | D | TULANA, NONFLOODED | C | TUXEKAN | B | UMPCOOS | D | VALCREST | C |
| TRIMAD | B | TULARE | D | TWEBA | D | UMPUMP | B | VALDEZ, CLAYEY | D |
| TRIMBLE | B | TULARGO | B | TWEBA, MODERATELY | B | UNA | D | SUBSTRATUM | |
| TRIMMER | C | TULAROSA | B | WET | | UNADILLA | B | VALDEZ, SALINE | D |
| TRINIDAD | D | TULASE | B | TWEBA, DRAINED | C | UNAKA | B | VALDEZ, CLAYEY | C |
| TRINITY | D | TULCH | B | TWEEDY | C | UNAKWIK | D | SUBSTRATUM, | |
| TRIO | D | TULECAN | C | TWEENER | D | UNAWEEP | B | SALINE | |
| TRIOMAS | B | TULELAKE | D | TWICK | D | UNCAS | D | VALDEZ, DRAINED | C |
| TRIPIT | C | TULIA | B | TWIG | D | UNCOMPAHGRE | D | VALDOSTA | A |
| TRIPLEN | B | TULIK | B | TWILIGHT | B | UNDERWOOD | B | VALE | B |
| TRIPOLI | B/D | TULLAHASSEE | C | TWIN CREEK | B | UNDUSK | B | VALENCIA | B |
| TRIPP | B | TULLER | D | TWINING | C | UNGERS | B | VALENT | A |
| TRISTAN | B | TULLOCK | C | TWINSI | C | UNICOI | B | VALENTINE | A |
| TRITON | D | TULLY | C | TWISSELMAN | C | UNION | C | VALERA | C |
| TRIX | B | TULOSO | D | TWISSELMAN, | D | UNIONTOWN | B | VALHALLA | A |
| TROCKEN | B | TUMAC | B | SALINE-ALKALI, | | UNIONVILLE | B | VALKARIA | B/D |
| TROJAN | B | TUMALO | C | WET | | UNISON | B | VALKARIA, | D |
| TROMP | C | TUMARION | D | TWISSELMAN, | D | UNIUS | D | DEPRESSIONAL | |
| TRONSEN | B | TUMBLETON | C | SALINE-ALKALI | | UNIVEGA | D | VALLAN | D |
| TROOK | B | TUMTUM | D | TWOMILE | C/D | UNLIC | B | VALLE | B |
| TROOK, SALINE | C | TUNBRIDGE | C | TWOTOP | D | UNSEL | B | VALLECITOS | D |
| TROPAL | D | TUNEHILL | D | TYBO | D | UNSON | B | VALLEONO | B |
| TROPIC | B | TUNICA | D | TYEE | D | UPDEGRAFF | B | VALLERS | C |
| TROSI | D | TUNIS | D | TYGART | D | UPDIKE | D | VALLEYCITY | D |
| TROSKY | B/D | TUNITAS | C | TYGH | C | UPSATA | B | VALMAR | C |
| TROUGHS | D | TUNK | A | TYLER | D | UPSHUR | D | VALMONT | C |
| TROUP | A | TUNKHANNOCK | A | TYNDALL | C | UPSON | B | VALMY | B |
| TROUT CREEK | C | TUNNEL | B | TYNDALL, DRAINED | B | UPSON, STONY | C | VALNOR | C |
| TROUT RIVER | A | TUNNISON | D | TYNER | A | UPSPRING | D | VALOIS | B |
| TROUTDALE | C | TUOMI | B | TYONEK | D | UPSTEER | B | VALPAC | C |
| TROUTER | C | TUPELO | D | TYRE | A/D | UPTMOR | C | VALSETZ | C |
| TROUTVILLE | B | TUPUKNUK | D | TYRONE | C | UPTON | C | VALTO | D |
| TROVE | B | TUQUE | B | TYSON | B | UPVILLE | B | VALTON | B |
| TROXEL | B | TURBEVILLE | C | TYZAK | D | URACCA | B | VALVERDE | B |
| TRUAX | B | TURBOTVILLE | C | UANA | D | URBANA | C | VAMER | D |
| TRUBLE | C | TURBYFILL | B | UBANK | B | URBO | D | VAMONT | D |
| TRUCE | C | TURK | C | UBAR | D | UREAL | D | VAMP | C |
| TRUCHOT | C | TURKEYSPRINGS | B | UBEHEBE | C | URICH | C/D | VAN DUSEN | B |
| TRUCKEE | C | TURLEY | B | UBIK | B | URIPNES | D | VAN HORN | B |
| TRUCKEE, DRAINED | B | TURLIN | B | UBLY | B | URIPNES, GRAVELLY | C | VAN NOSTERN | C |
| TRUCKTON | B | TURLOCK | D | UCHEE | A | URLAND | C | VAN WAGONER | D |
| TRUDAU | B | TURMOUND | D | UCOLO | D | URNE | B | VANAJO | D |
| TRUDE | A | TURNBACK | C | UCOPIA | B | URNESS | B/D | VANANDA | D |
| TRUEFISSURE | B | TURNBULL | D | UDAHO | B | URSA | C | VANBRUNT | C |
| TRUESDALE | C | TURNER | B | UDEL | D | URSINE | D | VANCE | C |
| TRUHOY | D | TURNERCREST | C | UDELOPE | D | URTAH | C | VANDA | D |
| TRULAE | D | TURNERVILLE | B | UDOLPHO | B/D | URWIL | C | VANDALIA | D |
| TRULON | C | TURNEY | B | UFFENS | B | USAL | C | VANDAMME | B |
| TRUMAN | B | TURRAH | C | UFFENS, FLOODED | C | USAL, GRAVELLY | B | VANDAMORE | B |
| TRUMBULL | D | TURRET | B | UGAK | D | USHAR | B | VANDERGRIFT | C |
| TRUMP | D | TURRIA | B | UHALDI | B | USINE | A | VANDERHOFF | C |
| TRUNK | D | TURRIA, WET | C | UHL | B | USK | C | VANDERLIP | A |

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# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| VANEPPS | C | VERDE | C | VILLY, DRAINED | B | WABASSO | B/D | WALES, OVERBLOWN | C |
| VANET | D | VERDEL | D | VILOT | C | WABASSO, | D | WALFORD | B/D |
| VANG | B | VERDICO | D | VIMVILLE | D | DEPRESSIONAL | | WALHALLA | B |
| VANGUARD | C | VERDIGRIS | B | VINA | B | WABBASEKA | D | WALKE | C |
| VANMETER | C | VERDUN | D | VINCENNES | C/D | WABEK | A | WALKNOLLS | D |
| VANNI | B | VERENDRYE | B/D | VINCENT | C | WABEN | B | WALKON | C |
| VANNOY | C | VERGAS | C | VINCOM | C | WABUSKA | C | WALL | B |
| VANOCKER | B | VERGENNES | C | VINDICATOR | D | WACA | B | WALLA WALLA | B |
| VANOSS | B | VERHALEN | D | VINEGARROON | C | WACAHOOTA | D | WALLACE | B |
| VANPETTEN | B | VERICK | C | VINEYARD | C | WACOTA | B | WALLEN | B |
| VANSICKLE | D | VERITAS | B | VINGO | B | WACOUSTA | B/D | WALLER | B/D |
| VANSON | B | VERJELES | D | VINING | C | WADAMS | B | WALLINGTON | C |
| VANSTEL | B | VERLAND | D | VININI | D | WADDOUPS | B | WALLKILL | C/D |
| VANTAGE | | VERLOT | D | VINITA | C | WADELL | B | WALLKILL, | B/D |
| VANVOR | B | VERMEJO | D | VINJE | B | WADENA | B | NONFLOODED | |
| VANWYPER | C | VERMILLION | C | VINLAND | D | WADENILL | B | WALLOWA | C |
| VANZANDT | C | VERMISA | D | VINSAD | C | WADER | C | WALLROCK | C |
| VAQUERO | D | VERNADO | D | VINSON | B | WADESPRINGS | C | WALLSBURG | D |
| VARCO | D | VERNAL | B | VINT | B | WADLEIGH | D | WALLSON | B |
| VARDEN | B | VERNALIS | B | VINT, WET | C | WADMALAW | D | WALLUSKI | C |
| VARELUM | B | VERNDALE | B | VINTAS | A | WADSWORTH | C | WALNETT | C |
| VARELUM, CLAY LOAM | C | VERNIA | A | VINTON | B | WAGES | B | WALONG | B |
| SUBSTRATUM | | VERNON | D | VIOLA | D | WAGNER | D | WALPOLE | C |
| VARGAS | C | VERNONIA | B | VIPONT | C | WAGONBOX | D | WALREES | C |
| VARICK | D | VERO | B/D | VIRATON | C | WAGONTIRE | D | WALSH | B |
| VARINA | C | VERO, DEPRESSIONAL | D | VIRDEN | B/D | WAGRAM | A | WALSTEAD | B |
| VARNA | C | VERSHIRE | C | VIRGELLE | C | WAHA | C | WALTERS | B |
| VARNEY | B | VERSON | C | VIRGIL | B | WAHATOYA | C | WALTERSHOW | B |
| VARRO | B | VERTEL | D | VIRGIN PEAK | D | WAHEE | D | WALTI | D |
| VARYSBURG | B | VERTREES | B | VIRGIN RIVER | C | WAHGUYHE | D | WALUM | B |
| VASA | B | VES | B | VIRKULA | C | WAHIAWA | B | WALVAN | B |
| VASHTI | C | VESEY | B | VIRTUE | C | WAHIKULI | C | WALVILLE | B |
| VASQUEZ | C | VESPER | D | VISTA | B | WAHKEENA | B | WAMBA | D |
| VASSALBORO | D | VESSER | C | VITALE | C | WAHLUKE | B | WAMBA, DRAINED | C |
| VASSAR | B | VESSILLA | D | VITZTHUM | D | WAHOO | D | WAMDUSKA | A |
| VASSETT | B | VESTA | B | VIUDA | D | WAHPETON | C | WAMEGO | C |
| VASTINE | C | VESTABURG | A/C | VIUM | D | WAHREKDAM | C | WAMIC | B |
| VASTINE, | D | VESTON | D | VIVES | B | WAHSTAL | D | WAMPOO | D |
| SALINE-ALKALI | | VETA | B | VIVI | B | WAHTIGUP | B | WAMPSVILLE | B |
| VAUCLUSE | C | VETAL | B | VIXEN | B | WAHTUM | D | WANAGAN | B |
| VAUGHAN | D | VETEADO | C | VIZCAINO | D | WAHWEAP | D | WANBLEE | D |
| VAUGHNSVILLE | C | VEYO | D | VIZCAPOINT | D | WAIAHA | D | WANDA | B |
| VAY | B | VIA | B | VLASATY | C | WAIAKOA | C | WANDO | A |
| VAYAS | D | VIAN | B | VLECK | D | WAIALEALE | D | WANETTA | B |
| VEAL | B | VIBLE | A | VLY | C | WAIALUA | B | WANILLA | C |
| VEATCH | B | VIBO | B | VOATS | B | WAIAWA | D | WANN | B |
| VEATCH, STONY | C | VIBORAS | D | VOCA | C | WAIHUNA | C | WANNACOTT | B |
| VEAZIE | A | VIBORG | B | VODEPMAIER | B | WAIKALOA | B | WANOGA | B |
| VEBAR | B | VICEE | B | VOIGHT | B | WAIKANE | B | WANOMIE | C |
| VECONT | D | VICK | C | VOLADORA | B | WAIKAPU | B | WANSER | D |
| VEEDUM | D | VICKERY | C | VOLASH | B | WAIKOMO | D | WANSER, DRAINED | B |
| VEET | B | VICKING | B | VOLBORG | D | WAILUKU | B | WAPAL | A |
| VEGA | C | VICKING, DRY | D | VOLCO | D | WAIMEA | B | WAPAL, BEDROCK | B |
| VEGA ALTA | B | VICKSBURG | B | VOLENTE | C | WAINEE | B | SUBSTRATUM | |
| VEGA BAJA | C | VICKTON | B | VOLINIA | B | WAINOLA | B | WAPAL, BEDROCK | B |
| VEKOL | D | VICTINE | D | VOLKMAR | B | WAIPAHU | C | SUBSTRATUM | |
| VEKOL, COOL | C | VICTOR | B | VOLNEY | B | WAISKA | B | WAPATO | D |
| VELASCO | D | VICTORIA | D | VOLPERIE | C | WAITS | B | WAPELLO | B |
| VELDA | B | VICTORVILLE | B | VOLTA | D | WAKE | D | WAPI | D |
| VELDKAMP | B | VICTORY | B | VOLTAGE | B | WAKEEN | B | WAPINITIA | B |
| VELMA | B | VICU | C | VOLTAIRE | D | WAKEFIELD | B | WAPPING | B |
| VELOW | B | VIDA | C | VOLTAIRE, DRAINED | C | WAKELAND | C | WAPPINGER | B |
| VELVA | B | VIDAURI | D | VOLTAIRE, GRAVELLY | C | WAKEPISH | B | WAPPO | D |
| VENA | C | VIDRINE | D | SUBSTRATUM | | WAKITA | D | WAPSHILLA | B |
| VENABLE | D | VIEJA | D | VOLUSIA | C | WAKONDA | B | WAPSIE | B |
| VENADITO | D | VIENNA | B | VONA | B | WAKONDA, TILL | C | WAPTUS | C |
| VENANGO | C | VIEQUES | B | VONALEE | B | SUBSTRATUM | | WARBA | B |
| VENAPASS | D | VIGAR | C | VONASON | B | WAKULLA | A | WARDBORO | A |
| VENATOR | C | VIGIA | D | VOORHIES | C | WALCAN | C | WARDELL | C |
| VENETA | D | VIGNOLD | C | VORE | B | WALCOTT | B | WARDEN | B |
| VENEZIA | D | VIGO | D | VOSBURG | B | WALDBILLIG | B | WARDENOT | A |
| VENICE | C | VIGUS | B | VOSS | B | WALDECK | C | WARDWELL | C |
| VENLO | D | VIKING | D | VOSSET | B | WALDEN | D | WARE | B |
| VENTRIS | D | VIL | D | VULCAN | C | WALDO | D | WAREAGLE | B |
| VENTURE | D | VILAS | A | VYLACH | D | WALDORF | C/D | WAREHAM | C |
| VENUM | D | VILLA | B | WAAS | B | WALDPORT | A | WARM SPRINGS | D |
| VENUS | B | VILLA GROVE | B | WABANICA | C | WALDRON | D | WARM SPRINGS, | C |
| VERBOORT | D | VILLEGREEN | C | WABASH | D | WALDROUP | D | DRAINED, CLAY | |
| VERCLIFF | C | VILLY | D | WABASHA | D | WALES | B | SUBSTRATUM | |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WARM SPRINGS, DRAINED, ALKALI | C | WAUPECAN | B | WELD | C | WETTERHORN | C | WIBAUX | B |
| WARM SPRINGS, DRAINED | C | WAUQUIE | B | WELDA | C | WETZEL | D | WICHITA | C |
| WARM SPRINGS, COOL | C | WAURIKA | D | WELLER | C | WEVERTON | B | WICHUP | D |
| WARMAN | B/D | WAUSEON | B/D | WELLINGTON | D | WEWELA | B | WICKAHONEY | D |
| WARMAN, GRAVELLY SUBSOIL | A/D | WAUTOMA | B/D | WELLMAN | B | WEWOKA | C | WICKENBURG | D |
| WARNEKE | D | WAVELAND | B/D | WELLS | B | WEYERS | C/D | WICKERSHAM | B |
| WARNERS | C/D | WAVELAND, DEPRESSIONAL | D | WELLSBORO | C | WEYMOUTH | B | WICKETT | C |
| WARNOCK | B | WAVERLY | B/D | WELLSCREEK | B | WHAKANA | B | WICKHAM | B |
| WARRENTON | D | WAWASEE | B | WELLSED | C | WHALAN | B | WICKIUP | C |
| WARSAW | B | WAWINA | A | WELLSTON | B | WHALEY | D | WICKSBURG | B |
| WARSING | B | WAX | C | WELLSVILLE | B | WHARTON | C | WICUP | C |
| WARWICK | A | WAXPOOL | D | WELLTON | B | WHATCOM | C | WIDEMAN | A |
| WASA | D | WAYAH | B | WELOY | C | WHATELY | D | WIDEN | C |
| WASATCH | A | WAYBE | D | WELRING | D | WHEATLEY | A/D | WIDTSOE | B |
| WASCO | B | WAYCUP | B | WELSUM | D | WHEATRIDGE | B | WIEHL | C |
| WASDA | B/D | WAYDEN | D | WELTER | D | WHEATVILLE | B | WIELAND | C |
| WASEPI | B | WAYLAND | C/D | WEMPLE | B | WHEELER | B | WIERGATE | D |
| WASHBURN | D | WAYMOR | B | WENAS | D | WHEELERVILLE | B | WIFFO | B |
| WASHINGTON | B | WAYNECO | D | WENAS, DRAINED | C | WHEELING | B | WIGGLER | D |
| WASHINGTON, WET SUBSTRATUM | C | WAYNESBORO | B | WENATCHEE | C | WHEELON | D | WIGGLETON | B |
| WASHOE | B | WAYNETOWN | C | WENDANE | C | WHETROCK | C | WIGTON | A |
| WASHOUGAL | B | WEA | B | WENDANE, DRAINED | B | WHETSTONE | C | WILAHA | B |
| WASHTENAW | C/D | WEASH | C | WENDOVER | D | WHICHMAN | B | WILBANKS | D |
| WASILLA | D | WEATHERFORD | B | WENDTE | D | WHIDBEY | C | WILBRAHAM | C |
| WASIOJA | B | WEAVER | C | WENDNA | C | WHILPHANG | D | WILBUR | B |
| WASKISH | D | WEAVERVILLE | B | WENTWORTH | B | WHIPPANY | C | WILBURTON | B |
| WASKOM | C | WEBB | C | WEOGUFKA | C | WHIPPLE | D | WILCO | C |
| WASPO | D | WEBBRIDGE | C | WEPO | C | WHIPSTOCK | C | WILCOX | D |
| WASSAIC | B | WEBBTOWN | B | WERELO | B | WHIRLO | B | WILCOXSON | C |
| WASSIT | D | WEBER | C | WERLOG | C | WHISKEYDICK | C | WILDALE | C |
| WATAB | C | WEBILE | B | WERNER | D | WHISPERING | C | WILDCAT | D |
| WATAMA | C | WEBSTER | C | WERNOCK | B | WHISTLE | B | WILDERNESS | C |
| WATAUGA | B | WEDEKIND | B/D | WESCONNETT | D | WHIT | B | WILDGEN | B |
| WATCHABOB | C | WEDERTZ | D | WESDY | C | WHITAKER | C | WILDHORSE | A |
| WATCHAUG | B | WEDGE | B | WESFIL | D | WHITE HOUSE | C | WILDORS | C |
| WATCHUNG | D | WEDLAR | A | WESIX | D | WHITE STORE | D | WILDWOOD | D |
| WATERBURY | D | WEDOWEE | C | WESKA | D | WHITE SWAN | D | WILE | C |
| WATERCANYON | B | WEED | B | WESLEY | B | WHITECAP | D | WILEY | B |
| WATEREE | B | WEEDING | B | WESO | B | WHITECLOUD | B | WILHITE | C/D |
| WATERMAN | D | WEEDMARK | D | WESPAC | D | WHITECOW | B | WILHOIT | B |
| WATERTOWN | A | WEEKIWACHEE | B | WESPAC, SANDY SUBSTRATUM | C | WHITECROSS | D | WILKES | C |
| WATERVILLE | B | WEEKS | D | | | WHITEFISH | B | WILKESON | B |
| WATKINS | B | WEEKSVILLE | C | WESSEL | C | WHITEFORD | B | WILKINS | D |
| WATKINS RIDGE | B | WEENA | B/D | WESTBROOK | D | WHITEHALL | B | WILL | B/D |
| WATO | B | WEEPAH | D | WESTBURY | C | WHITEHILLS | C | WILLABY | C |
| WATONGA | D | WEESATCHE | C | WESTBUTTE | C | WHITEHORN | D | WILLACY | B |
| WATOOPAH | B | WEGA | B | WESTCAMP | C | WHITEHORSE | B | WILLAKENZIE | C |
| WATROUS | B | WEGANDKEE | B | WESTCREEK | B | WHITEKNOB | B | WILLAMAR | B |
| WATSEKA | B | WEIGANG | D | WESTE | C | WHITELAKE | B | WILLAMETTE | B |
| WATSON | C | WEIGLE | C | WESTERVILLE | B | WHITEMAN | D | WILLAMETTE, WET | C |
| WATSONIA | D | WEIKERT | D | WESTFORK | D | WHITEPEAK | D | WILLANCH | D |
| WATSONVILLE | D | WEIMER | C/D | WESTHAVEN | B | WHITERIVER | C | WILLAPA | C |
| WATT | D | WEINBACH | D | WESTHAVEN, SALINE-ALKALI | C | WHITEROCK | D | WILLARD | B |
| WATTON | C | WEINGART | C | | | WHITESBORO | C | WILLETTE | A/D |
| WATUSI | C | WEINGARTEN | D | WESTINDIAN | C | WHITESBURG | C | WILLHILL | C |
| WAUBAY | B | WEIR | C | WESTLAKE | D | WHITESON | D | WILLHO | D |
| WAUBEEK | B | WEIRMAN | D | WESTLAND | B/D | WHITESTONE | B | WILLIAMS | B |
| WAUBERG | D | WEIRMAN, WET | C | WESTMORE | C | WHITETHORN | B | WILLIAMSBURG | B |
| WAUBONSIE | B | WEISER | D | WESTMORELAND | B | WHITEWATER | D | WILLIAMSON | C |
| WAUCEDAH | D | WEISHAUPT | A | WESTON | D | WHITEWOLF | A | WILLIAMSPORT | C |
| WAUCHULA | B/D | WEISSENFELS | B | WESTOVER | B | WHITEWOOD | C/D | WILLIAMSTOWN | C |
| WAUCHULA, DEPRESSIONAL | D | WEITAS | C | WESTPHALIA | B | WHITEWOOD, NONFLOODED | B/D | WILLIAMSVILLE | C |
| WAUCOBA | D | WEITCHPEC | B | WESTPLAIN | D | | | WILLIMAN | B/D |
| WAUCOMA | B | WEKODA | C | WESTPORT | A | WHITEWRIGHT | C | WILLIS | C |
| WAUCONDA | B | WELAKA | D | WESTPORT, THIN SURFACE | B | WHITING | B | WILLISTON | C |
| WAUKEE | B | WELBY | A | | | WHITINGER | C | WILLOW CREEK | B |
| WAUKEGAN | B | WELCH | B | WESTSHORE | D | WHITLEY | B | WILLOWDALE | B |
| WAUKENA | D | WELCH, GRAVELLY SUBSTRATUM, DRAINED | D | WESTVACO | C | WHITLOCK | B | WILLOWEMOC | C |
| WAUKON | B | | B | WESTVIEW | B | WHITMAN | D | WILLOWMAN | B |
| WAULD | C | WELCH, RARELY FLOODED, DRAINED | B | WESTVILLE | B | WHITNEY | C | WILLOWS | D |
| WAUMAC | B | WELCH, DRAINED | C | WESTWEGO | D | WHITORE | B | WILLWOOD | A |
| WAUMBEK | B | WELCHLAND | B | WESWIND | C | WHITSOL | B | WILMA | B |
| WAUNA | C | WELCOME | B | WESWOOD | B | WHITSON | D | WILMER | C |
| WAUPACA | B/D | WELD | B | WETA | D | WHITTIER | B | WILMINGTON | D |
| | | | | WETHERSFIELD | C | WHITWELL | C | WILMONT | B |
| | | | | WETHEY | C | WHOBREY | C | WILMONTON | B |
| | | | | WETHEY, DRAINED | A | WHOLAN | B | WILPAR | C |
| | | | | WETMORE | D | WHORLED | C | WILPOINT | D |
| | | | | WETSAW | C | WHY | B | WILSHIRE | A |

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| WILSON | D | WISHARD | C | WOODS CROSS | D | WYNOOSE | D | YEGEN | B |
| WILSONGULCH | B | WISHBONE | B | WOODSEYE | D | WYOCENA | B | YEGUAS | C |
| WILSONVILLE | D | WISHEYLU | C | WOODSFIELD | C | WYOMING | A | YELJACK | B |
| WILSOR | B | WISHKAH | D | WOODSIDE | B | WYRENE | B | YELLOWBAY | B |
| WILST | C | WISHKAH, DRAINED | C | WOODSLAKE | D | WYSOCKING | C/D | YELLOWHOUND | B |
| WILTON | B | WISKAN | C | WOODSON | D | XANA | B | YELLOWROCK | A |
| WINADA | C | WISKIFLAT | B | WOODSTOCK | C/D | XANADU | B | YELLOWSTONE | D |
| WINBERRY | C | WISNER | B/D | WOODSTOWN | C | XAVIER | B | YELM | C |
| WINCHESTER | A | WISTER | C | WOODTELL | D | XENIA | B | YEMASSEE | C |
| WINCHUCK | C | WITBECK | B/D | WOODVILLE | D | XENO | B | YENCE | C |
| WIND RIVER | B | WITEFELS | B | WOODWARD | B | XERTA | C | YENLO | B |
| WINDCOAT | D | WITHAM | D | WOODWEST | D | XERXES | D | YENRAB | A |
| WINDER | B/D | WITHEE | C | WOOFUS | D | XICA | C | YEOMAN | B |
| WINDER, | D | WITHERBEE | A/D | WOOLPER | C | XINE | C | YEOPIM | B |
| DEPRESSIONAL | | WITHERELL | D | WOOLSEY | B | XIPE | D | YERINGTON | A |
| WINDHAM | B | WITHERS | C | WOOLSTALF | B | XIPE, MODERATELY | C | YERMO | B |
| WINDICREEK | A | WITT | B | WOOLSTED | B | WET | | YESUM | B |
| WINDMILL | B | WITTEN | D | WOONSOCKET | B | XMAN | D | YETTEM | B |
| WINDSOR | A | WITTENBERG | B | WOOSLEY | C | YACOLT | B | YETULL | A |
| WINDTHORST | C | WITZEL | D | WOOSTER | C | YAGO | C | YIGO | B |
| WINDWHISTLE | C | WIX | C | WORCESTER | C | YAHANA | C | YIPOR | B |
| WINDWHISTLE, WARM | B | WIXOM | B | WORDEN | C | YAHARA | C | YLIG | C |
| WINDY | B | WOCKLEY | C | WORF | D | YAHNE | C | YOBE | C |
| WINDYPOINT | B | WODA | D | WORFKA | D | YAHOLA | B | YOCHUM | C |
| WINEG | B | WODEN | B | WORFMAN | D | YAHOO | D | YOCKEY | C |
| WINEMA | C | WODSKOW | C | WORFSTONE | C | YAINAX | B | YODER | B |
| WINETTI | B | WODSKOW, DRAINED | B | WORK | C | YAKI | D | YODY | C |
| WINEVADA | C | WOHLY | B | WORK, GRAVELLY | B | YAKIMA | B | YOHURT | D |
| WINFALL | B | WOLCO | C | WORLAND | C | YAKUS | D | YOKAYO | D |
| WINFIELD | B | WOLCOTT | B/D | WORLEY | D | YAKUTAT | A | YOKOHL | D |
| WING | D | WOLDALE | D | WORMSER | C | YALELAKE | B | YOKUT | B |
| WINGATE | B | WOLDALE, DRAINED | C | WOROCK | B | YALESVILLE | C | YOLLABOLLY | D |
| WINGER | B/D | WOLF | B | WORSHAM | D | YALLANI | B | YOLO | B |
| WINGINAW | D | WOLF POINT | C | WORTH | C | YALMER | B | YOLOGO | D |
| WINGVILLE | D | WOLFCREEK | B | WORTHEN | B | YAMAC | B | YOMBA | B |
| WINIFRED | C | WOLFESON | C | WORTHING | D | YAMHILL | C | YOMONT | B |
| WINK | B | WOLFESON, WET | D | WORTHAN | D | YAMO | B | YONGES | D |
| WINKEL | D | WOLFEY | C | WORTHAN, SANDY | A | YAMSAY | D | YONNA | D |
| WINKLEMAN | C | WOLFPEN | A | WOVOKA | D | YANA | B | YORBA | D |
| WINKLEMAN, WET | D | WOLFTEVER | C | WRANGELL | D | YANCY | D | YORK | C |
| WINKLER | B | WOLLARD | C | WRANGO | A | YANKEE | D | YORKTOWN | D |
| WINLER | D | WOLLENT | D | WRAYHA | D | YANKTON | B | YORKTREE | C |
| WINLO | D | WOLOT | B | WREDAH | B | YANUSH | B | YORKVILLE | D |
| WINN | C | WOLVERINE | A | WRENCOE | D | YAP | B | YOST | D |
| WINNEBAGO | B | WOMACK | C | WRENMAN | C | YAPOAH | B | YOST, DRAINED | C |
| WINNECONNE | C | WOO | B | WRENTHAM | C | YAQUI | B | YOUD | D |
| WINNECOOK | C | WOO, OVERWASH | C | WRIGHT | C | YAQUINA | D | YOUGA | B |
| WINNEMUCCA | B | WOO, WET | C | WRIGHTMAN | C | YAQUINA, DRAINED | C | YOUGA, SANDY | D |
| WINNESHIEK | B | WOOD RIVER | D | WRIGHTSBORO | C | YARCO | D | SUBSTRATUM | |
| WINNETT | D | WOODBECK | B | WRIGHTSVILLE | D | YARDLEY | C | YOUJAY | D |
| WINNSBORO | D | WOODBINE | B | WRIGHTWOOD | B | YARTS | B | YOUMAN | C |
| WINOM | D | WOODBRIDGE | C | WUKOKI | B | YATAHONEY | C | YOUNGSTON | B |
| WINONA | D | WOODBURN | C | WUKSI | A | YATAHONEY, STONY | D | YOUNGSTON, WET | C |
| WINOOSKI | B | WOODBURY | D | WULFERT | D | YATES | D | YOURAME | B |
| WINOPEE | B | WOODCOCK | B | WUNJEY | B | YAUCO | C | YOUTLKUE | D |
| WINRIDGE | D | WOODFORD | D | WUPATKI | D | YAUHANNAH | B | YOVIMPA | D |
| WINSHIP | C | WOODGULCH | A | WURNO | C | YAUPON | D | YPSI | C |
| WINSPECT | B | WOODHALL | C | WURSTEN | B | YAWDIM | D | YRIBARREN | D |
| WINSTON | B | WOODHURST | C | WURTSBORO | C | YAWHEE | B | YSIDORA | C |
| WINT | D | WOODIN | C | WYALUSING | D | YAWKEY | B | YTURBIDE | A |
| WINTERFIELD | A/D | WOODINGTON | B/D | WYANDOTTE | D | YAXON | B | YTURRIA | A |
| WINTERHAVEN | B | WOODINVILLE | D | WYANT | C | YEAGER | A | YUBA | D |
| WINTERIDGE | B | WOODINVILLE, | C | WYARD | B | YEARY | C | YUKO | D |
| WINTERS | C | DRAINED | | WYARNO | B | YEATES HOLLOW | B | YUKON | D |
| WINTERSBURG | C | WOODLAWN | B | WYATT | C | YEATES HOLLOW, | C | YULEE | D |
| WINTERSET | C | WOODLEAF | C | WYCOLO | C | LOAMY SUBSTRATUM, | | YUNES | D |
| WINTHROP | A | WOODLY | B | WYE | B | STONY | | YUNQUE | C |
| WINTLEY | B | WOODLYN | D | WYEAST | D | YEATES HOLLOW, | C | YURM | D |
| WINTON | C | WOODMANSIE | B | WYETH | B | LOAMY SUBSTRATUM | | YUTRUE | D |
| WINTONER | B | WOODMERE | B | WYEVILLE | C | YEATES HOLLOW, | C | YUVAS | D |
| WINU | C | WOODMONT | C | WYICK | D | STONY | | ZAAR | D |
| WINZ | D | WOODPASS | B | WYKEHAM | B | YEATES HOLLOW, | C | ZABA | B |
| WIOTA | B | WOODROCK | C | WYKOFF | B | NONSTONY | | ZACA | D |
| WIPPLE | C | WOODROW | B | WYMAN | B | YEATES HOLLOW, DRY | C | ZACHARIAS | B |
| WIRT | B | WOODROW, | C | WYMORE | D | YEATES HOLLOW, | C | ZACHARY | C |
| WISCOW | D | SALINE-ALKALI | | WYNDMERE | B | COBBLY | | ZACK | D |
| WISE | C | WOODROW, | C | WYNN | B | YEATON | C | ZADOG | A/D |
| WISEMAN | A | OCCASIONALLY | | WYNNVILLE | C | YECROSS | A | ZADVAR | D |
| WISFLAT | D | FLOODED | | WYNONA | C | YEDLICK | B | ZAFRA | B |

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

## Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | | | | | |
|---|---|---|---|---|---|
| ZAGG | C | ZOHNER | D | | |
| ZAHILL | C | ZOLA | C | | |
| ZAHL | B | ZOLFO | C | | |
| ZAIDY | C | ZOLTAY | C | | |
| ZAKME | D | ZOOK | C/D | | |
| ZALCO | A | ZOOK, SILTY | C | | |
| ZALDA | D | SUBSTRATUM | | | |
| ZALLA | A | ZORRA | D | | |
| ZAMORA | B | ZORRAVISTA | A | | |
| ZAMSCAN | B | ZOYER | D | | |
| ZANBUR | B | ZUBER | C | | |
| ZANE | B | ZUFELT | C | | |
| ZANEIS | B | ZUKAN | D | | |
| ZANESVILLE | C | ZULCH | D | | |
| ZANGO | D | ZUMAN | D | | |
| ZAPA | C | ZUMAN, PROTECTED | C/D | | |
| ZAPATA | C | ZUMBRO | A | | |
| ZARK | C | ZUMWALT | C | | |
| ZATOVILLE | C | ZUNDELL | C | | |
| ZAU | C | ZUNHALL | C | | |
| ZAVALA | B | ZUNI | D | | |
| ZAVCO | C | ZURICH | B | | |
| ZAYANTE | A | ZWICKER | C | | |
| ZAZA | D | ZWIEFEL | C | | |
| ZEALE | B | ZWINGLE | D | | |
| ZEB | B | ZYGORE | B | | |
| ZEBA | B | ZYME | D | | |
| ZECANYON | C | ZYMER | B | | |
| ZEEBAR | B | ZYNBAR | B | | |
| ZEEKA | C | ZYNBAR, TILL | C | | |
| ZEELNOT | B | SUBSTRATUM | | | |
| ZEESIX | C | ZYPLAR | D | | |
| ZEGRO | C | ZYZYL | B | | |
| ZEIBRIGHT | B | ZYZZI | D | | |
| ZELL | B | ZYZZUG | D | | |
| ZEN | C | | | | |
| ZENDA | C | | | | |
| ZENI | C | | | | |
| ZENIFF | B | | | | |
| ZENITH | B | | | | |
| ZENKER | B | | | | |
| ZENOD | B | | | | |
| ZENOR | B | | | | |
| ZENORIA | C | | | | |
| ZEOMONT | A | | | | |
| ZEONA | A | | | | |
| ZEORELY | B | | | | |
| ZEPHAN | C | | | | |
| ZEPHYR | D | | | | |
| ZEPP | B | | | | |
| ZER | B | | | | |
| ZERK | B | | | | |
| ZERKER | B | | | | |
| ZEVADEZ | C | | | | |
| ZIA | B | | | | |
| ZIBATE | D | | | | |
| ZIEGENFUSS | D | | | | |
| ZIEGLER | C | | | | |
| ZIGWEID | B | | | | |
| ZILABOY | D | | | | |
| ZILLAH | D | | | | |
| ZILLAH, DRAINED | C | | | | |
| ZILLION | B | | | | |
| ZILLMAN | B | | | | |
| ZIMMERMAN | A | | | | |
| ZINEB | B | | | | |
| ZING | C | | | | |
| ZINZER | B | | | | |
| ZINZER, SALINE | C | | | | |
| ZION | C | | | | |
| ZIPP | D | | | | |
| ZIPPEL | B/D | | | | |
| ZIRAM | D | | | | |
| ZITA | B | | | | |
| ZITTAU | C | | | | |
| ZOAR | C | | | | |
| ZOATE | D | | | | |
| ZOE | D | | | | |
| ZOESTA | D | | | | |

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
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# Appendix B: Synthetic rainfall distributions and rainfall data sources

The highest peak discharges from small watersheds in the United States are usually caused by intense, brief rainfalls that may occur as distinct events or as part of a longer storm. These intense rainstorms do not usually extend over a large area and intensities vary greatly. One common practice in rainfall-runoff analysis is to develop a synthetic rainfall distribution to use in lieu of actual storm events. This distribution includes maximum rainfall intensities for the selected design frequency arranged in a sequence that is critical for producing peak runoff.

## Synthetic rainfall distributions

The length of the most intense rainfall period contributing to the peak runoff rate is related to the time of concentration ($T_c$) for the watershed. In a hydrograph created with SCS procedures, the duration of rainfall that directly contributes to the peak is about 170 percent of the $T_c$. For example, the most intense 8.5-minute rainfall period would contribute to the peak discharge for a watershed with a $T_c$ of 5 minutes; the most intense 8.5-hour period would contribute to the peak for a watershed with a 5-hour $T_c$.

Different rainfall distributions can be developed for each of these watersheds to emphasize the critical rainfall duration for the peak discharges. However, to avoid the use of a different set of rainfall intensities for each drainage area size, a set of synthetic rainfall distributions having "nested" rainfall intensities was developed. The set "maximizes" the rainfall intensities by incorporating selected short duration intensities within those needed for longer durations at the same probability level.

For the size of the drainage areas for which SCS usually provides assistance, a storm period of 24 hours was chosen for the synthetic rainfall distributions. The 24-hour storm, while longer than that needed to determine peaks for these drainage areas, is appropriate for determining runoff volumes. Therefore, a single storm duration and associated synthetic rainfall distribution can be used to represent not only the peak discharges but also the runoff volumes for a range of drainage area sizes.

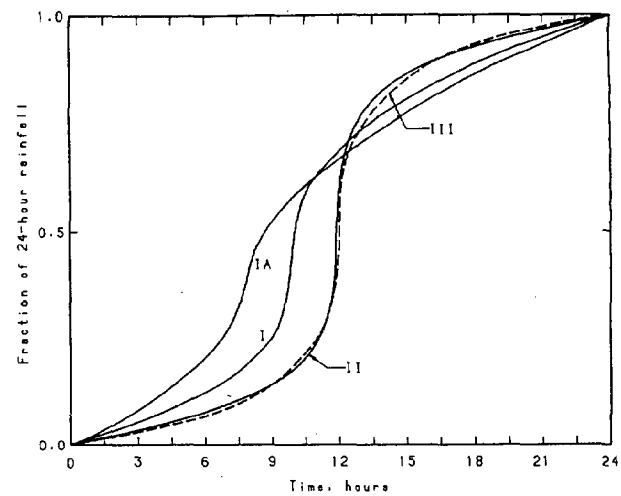



Figure B-1.—SCS 24-hour rainfall distributions.

The intensity of rainfall varies considerably during a storm as well as over geographic regions. To represent various regions of the United States, SCS developed four synthetic 24-hour rainfall distributions (I, IA, II, and III) from available National Weather Service (NWS) duration-frequency data (Hershfield 1961; Frederick et al., 1977) or local storm data. Type IA is the least intense and type II the most intense short duration rainfall. The four distributions are shown in figure B-1, and figure B-2 shows their approximate geographic boundaries.

Types I and IA represent the Pacific maritime climate with wet winters and dry summers. Type III represents Gulf of Mexico and Atlantic coastal areas where tropical storms bring large 24-hour rainfall amounts. Type II represents the rest of the country. For more precise distribution boundaries in a state having more than one type, contact the SCS State Conservation Engineer.

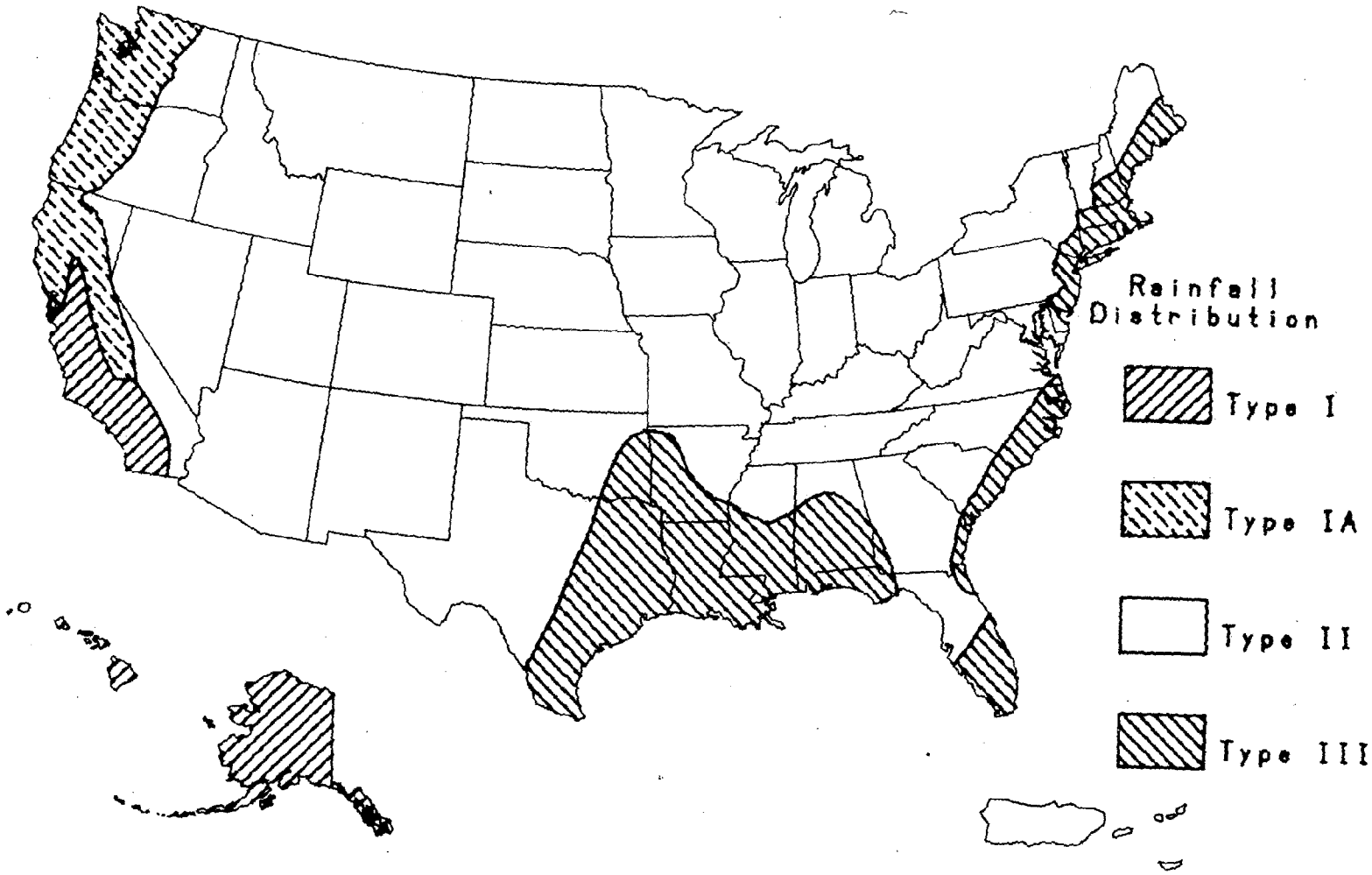



Figure B-2.—Approximate geographic boundaries for SCS rainfall distributions.

## Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Oceanic and Atmospheric Administration.

### East of 105th meridian

Hershfield, D. M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 115 p.

### West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I, Montana; Vol. II, Wyoming; Vol. III, Colorado; Vol. IV, New Mexico; Vol. V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dep. Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

### Alaska

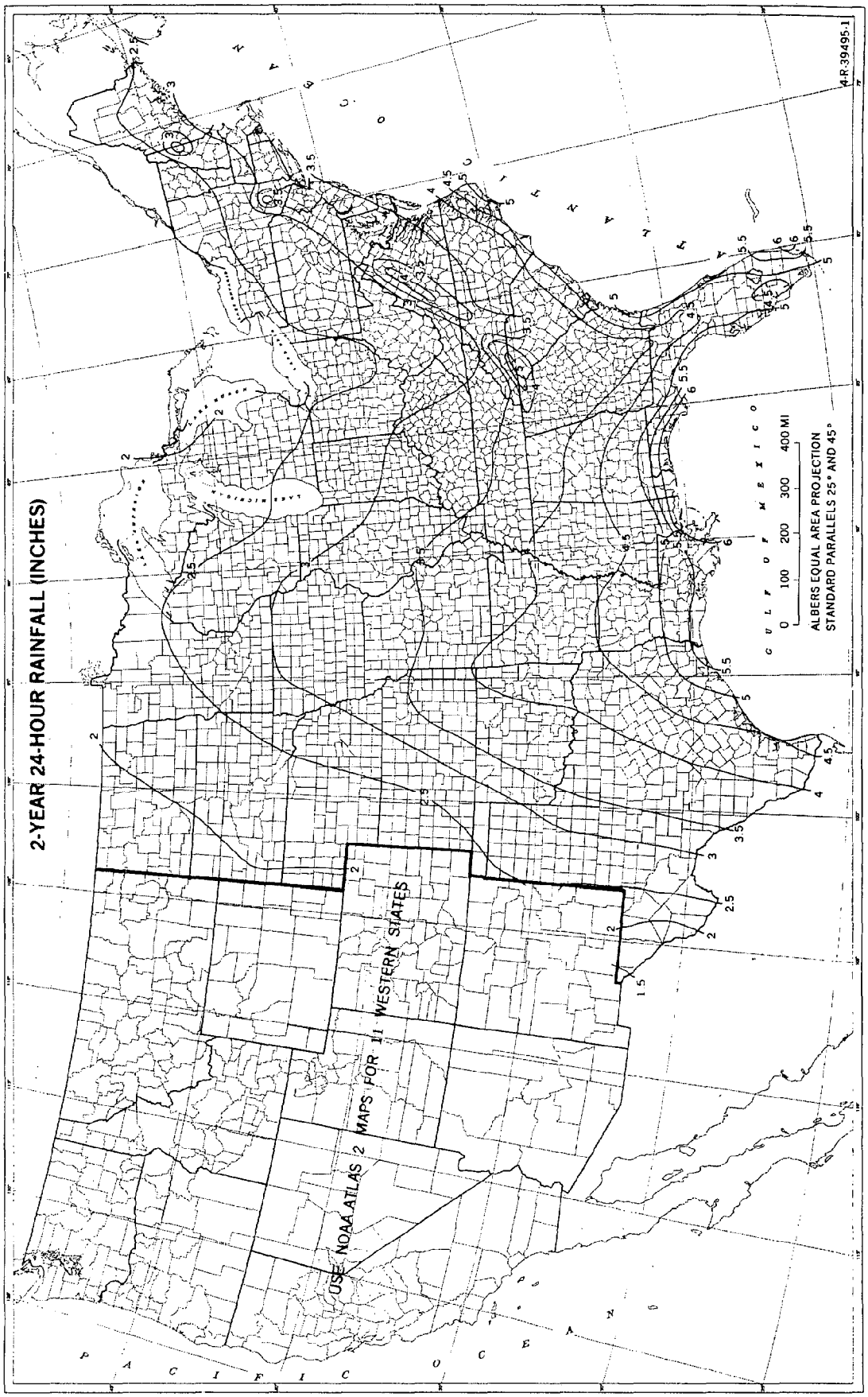
Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

### Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

### Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 p.




Fig[illegible]-3.—[illegible]ear, [illegible]r rai[illegible]

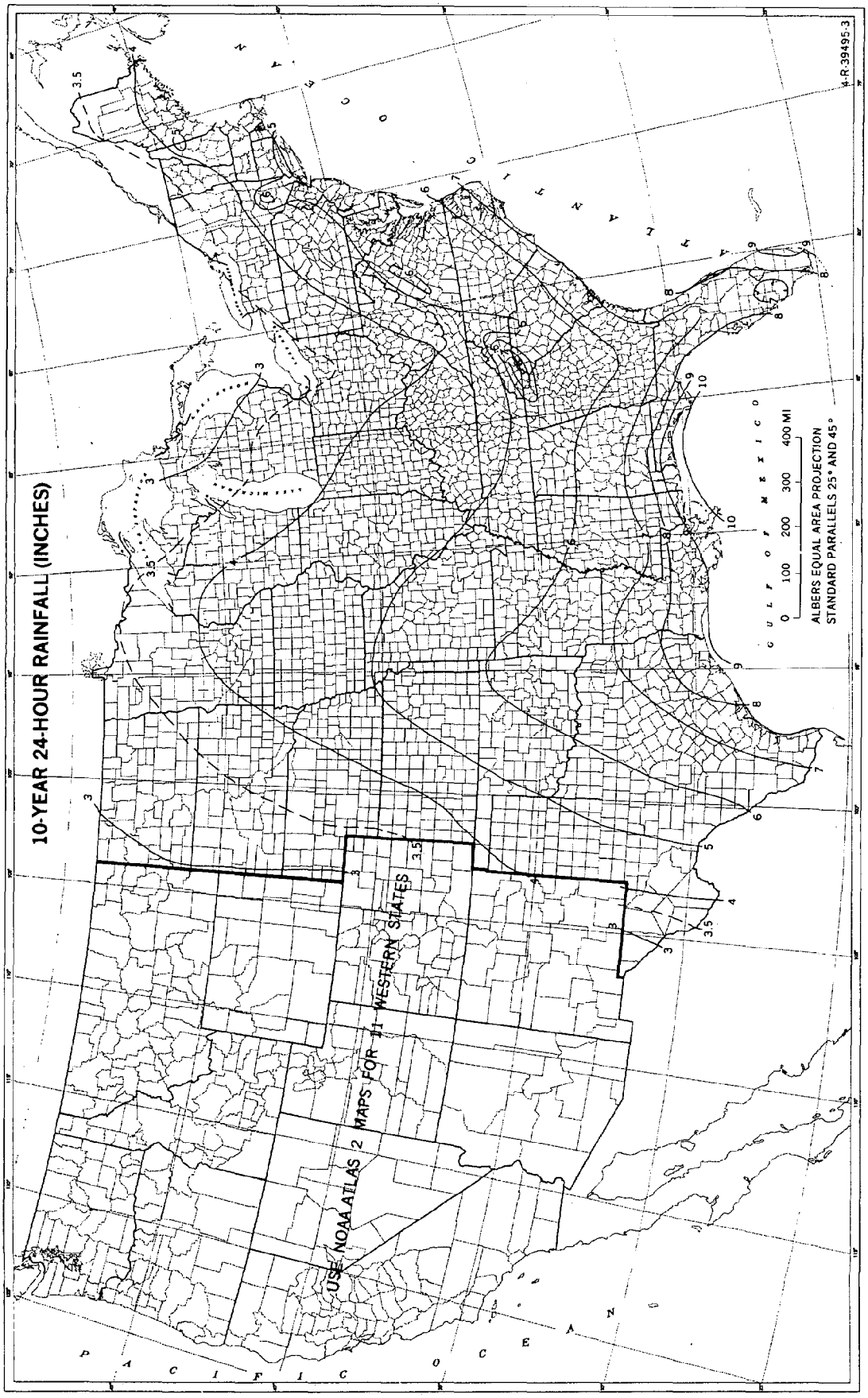



Figure B-5.—Ten-year, 24-hour rainfall.

Figure B-4.—Five-year, 24-hour rainfall.

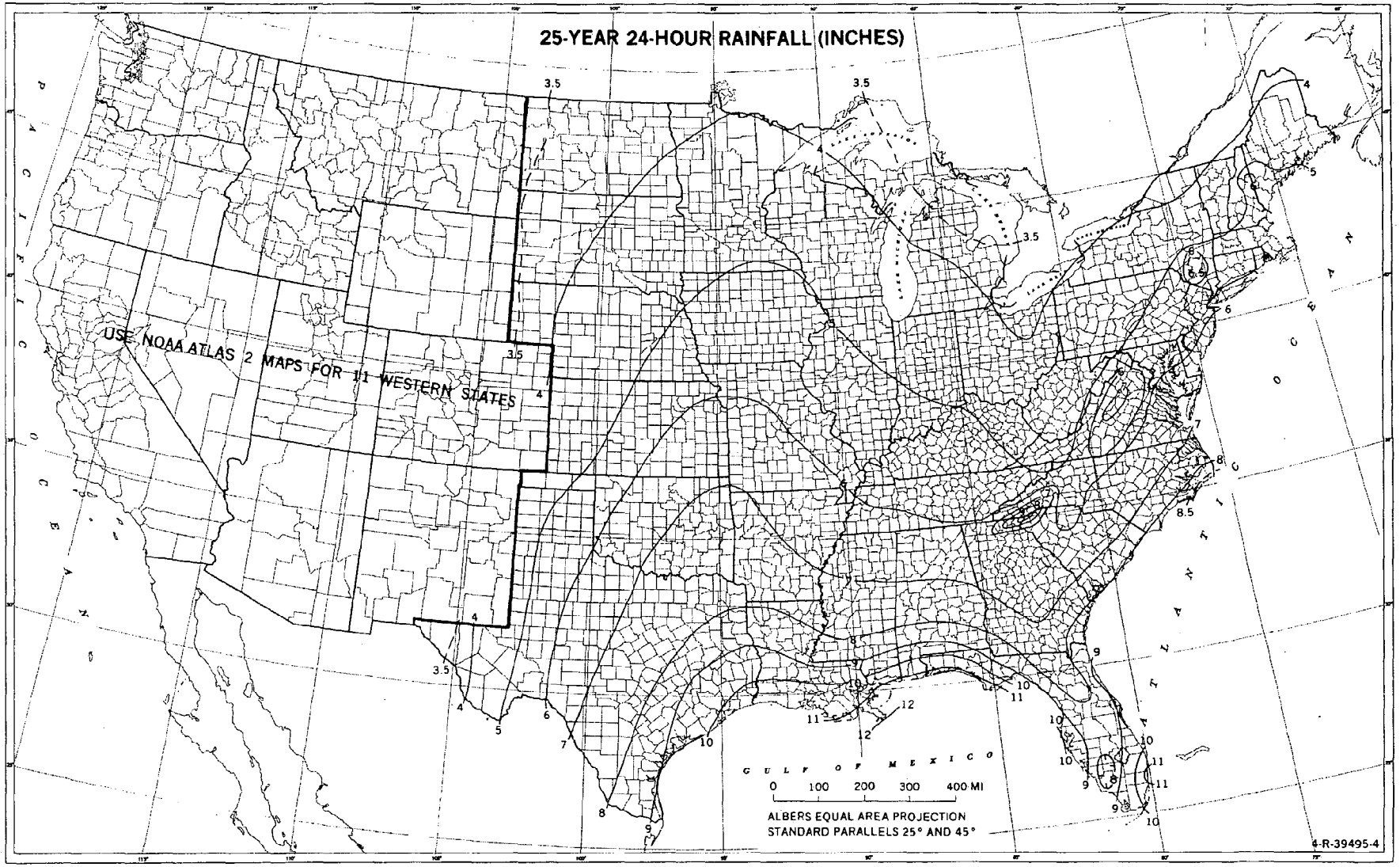



Figure B-6.—Twenty-five-year, 24-hour rainfall.

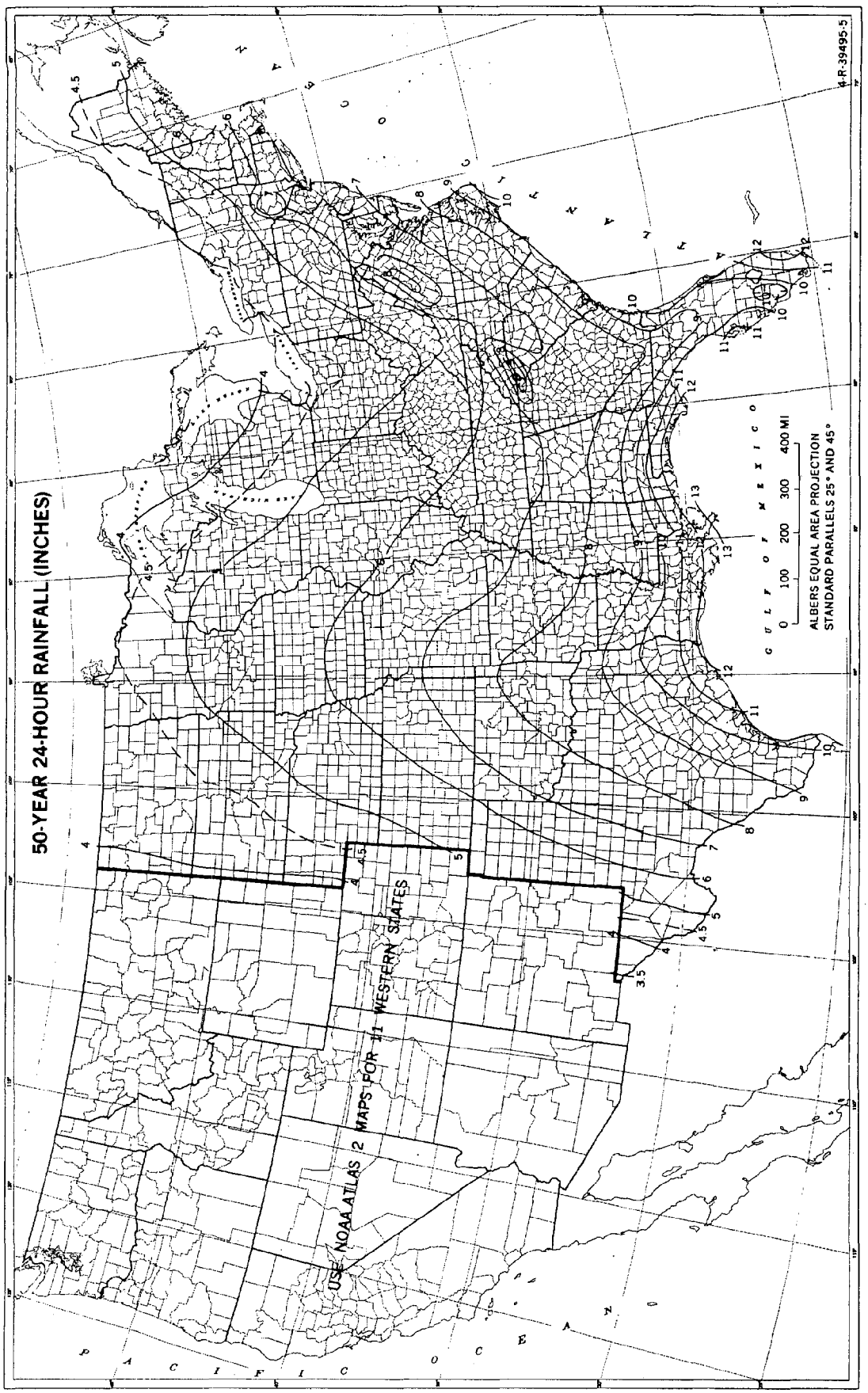



Figure B-7.—Fifty-year, 24-hour rainfall.

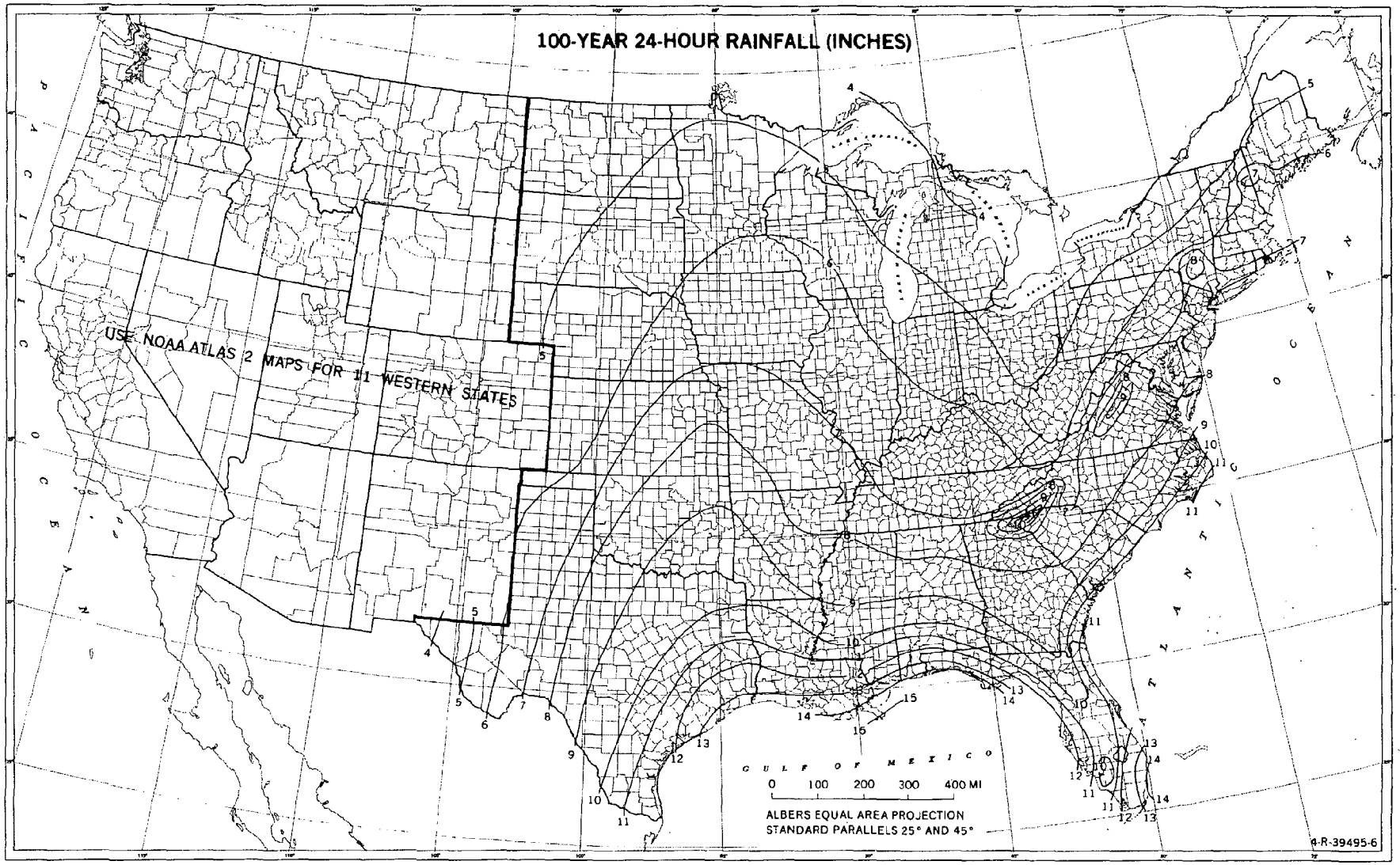



Figure B-8.—One-hundred-year, 24-hour rainfall.

# Appendix C: Computer program

The TR-55 procedures have been incorporated in a computer program. The program, written in BASIC, requires less than 256K memory to operate and was developed for an MS-DOS operating system. Users of the program, however, still need to be familiar with the procedures in this TR. Features of the program include the following:

- The full screen (24 lines, 80 columns) is used to enter data. Flexibility of coding allows movement about the screen for quick data modifications.

- Function keys provide menu power to move to different modules (TR-55 chapters) within the program. Some keys are permanently defined while others vary by module.

- "Help" screens provide pertinent information to the user depending on location in the program. Two types of information are included: (1) define system operation and (2) describe input parameters.

- User files provide for optional entry of local data, such as rainfall-frequency, graphic peak discharge equation coefficients, and tabular hydrographs for other rainfall distributions.

Copies of the program can be obtained from—

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
Telephone (703) 487-4650

# Appendix D: Worksheets

This appendix contains seven worksheets that can be reproduced for use with chapters 2 through 6. There is no worksheet for chapter 1.

| *Chapter* | *Worksheet* |
|---|---|
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5a, 5b |
| 6 | 6a, 6b |

# Worksheet 2: Runoff curve number and runoff

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

1. Runoff curve number (CN)

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Fig. 2-3 | CN 1/ Fig. 2-4 | Area ☐ acres ☐ $mi^2$ ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| | | | | | | |
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| | | | | | | |
| | | | | | | |
| | | | | Totals = | | |

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = ☐

2. Runoff

| | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|
| Frequency ..... yr | | | |
| Rainfall, P (24-hour) ..... in | | | |
| Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.) | | | |

# Worksheet 3: Time of concentration ($T_c$) or travel time ($T_t$)

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

Circle one: $T_c$ $T_t$ through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

| Sheet flow (Applicable to $T_c$ only) | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) ..... | | | | | | |
| 2. Manning's roughness coeff., n (table 3-1) .. | | | | | | |
| 3. Flow length, L (total L $\leq$ 300 ft) ..... | ft | | | | | |
| 4. Two-yr 24-hr rainfall, $P_2$ ..... | in | | | | | |
| 5. Land slope, s ..... | ft/ft | | | | | |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ ..... | hr | | + | | = | |

| Shallow concentrated flow | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) ..... | | | | | | |
| 8. Flow length, L ..... | ft | | | | | |
| 9. Watercourse slope, s ..... | ft/ft | | | | | |
| 10. Average velocity, V (figure 3-1) ..... | ft/s | | | | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ ..... | hr | | + | | = | |

| Channel flow | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 12. Cross sectional flow area, a ..... | $ft^2$ | | | | | |
| 13. Wetted perimeter, $p_w$ ..... | ft | | | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... | ft | | | | | |
| 15. Channel slope, s ..... | ft/ft | | | | | |
| 16. Manning's roughness coeff., n ..... | | | | | | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ..... | ft/s | | | | | |
| 18. Flow length, L ..... | ft | | | | | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ ..... | hr | | + | | = | |
| 20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) ..... | hr | | | | | |

## Worksheet 4: Graphical Peak Discharge method

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

1. Data:

Drainage area ..... $A_m$ = _____ $mi^2$ (acres/640)

Runoff curve number .... CN = _____ (From worksheet 2)

Time of concentration .. $T_c$ = _____ hr (From worksheet 3)

Rainfall distribution type = _____ (I, IA, II, III)

Pond and swamp areas spread throughout watershed ..... = _____ percent of $A_m$ (____ acres or $mi^2$ covered)

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| 2. Frequency ..... | yr | | | |
| 3. Rainfall, P (24-hour) ..... | in | | | |
| 4. Initial abstraction, $I_a$ ..... (Use CN with table 4-1.) | in | | | |
| 5. Compute $I_a/P$ ..... | | | | |
| 6. Unit peak discharge, $q_u$ ..... (Use $T_c$ and $I_a/P$ with exhibit 4-____) | csm/in | | | |
| 7. Runoff, Q ..... (From worksheet 2). | in | | | |
| 8. Pond and swamp adjustment factor, $F_p$ .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.) | | | | |
| 9. Peak discharge, $q_p$ ..... (Where $q_p = q_u A_m Q F_p$) | cfs | | | |

## Worksheet 5a: Basic watershed data

Project _____ Location _____ By _____ Date _____

Circle one: Present Developed _____ Frequency (yr) _____ Checked _____ Date _____

| Subarea name | Drainage area $A_m$ ($mi^2$) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr Rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_m Q$ ($mi^2$-in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
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↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ From worksheet 3

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ From worksheet 2

↑ ↑ ↑ ↑ From table 5-1

# Worksheet 5b: Tabular hydrograph discharge summary

Project _____ Location _____ By _____ Date _____

Circle one: Present Developed _____ Frequency (yr) _____ Checked _____ Date _____

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5- 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sub-area $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ($mi^2$-in) | | | | | | | | | | | | |
| | | | | | Discharges at selected hydrograph times 3/ - - - - - - - - - - - - - - - - - - - - (cfs) - - - - - - - - - - - - - - - - - - - - | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | | | | | | | | | | | | |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

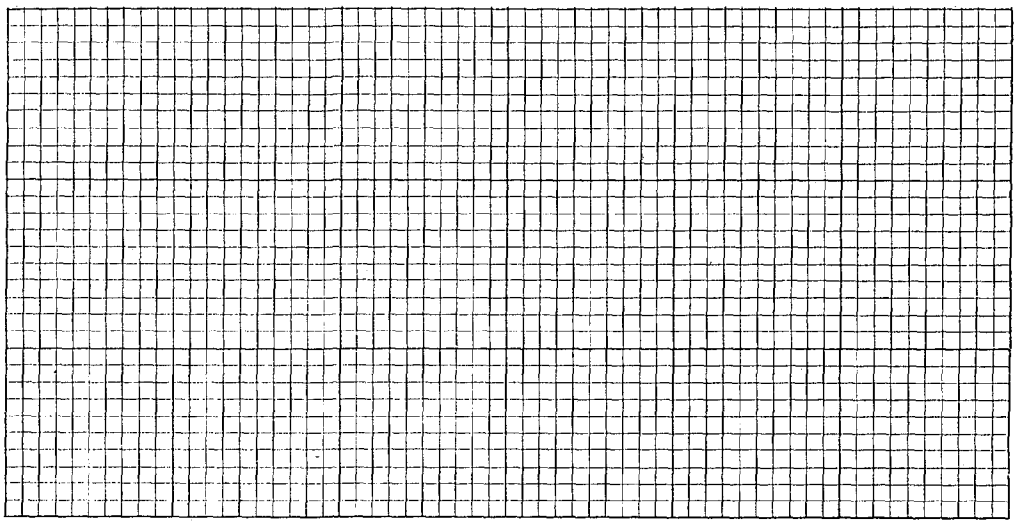
# Worksheet 6a: Detention basin storage, peak outflow discharge ($q_o$) known

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

Elevation or stage



Detention basin storage

1. Data:
   Drainage area ..... $A_m$ = _____ $mi^2$
   Rainfall distribution type (I, IA, II, III) = _____

| | 1st stage | 2nd stage |
|---|---|---|
| 2. Frequency ..... yr | | |
| 3. Peak inflow discharge, $q_i$ .... cfs (From worksheet 4 or 5b) | | |
| 4. Peak outflow discharge, $q_o$ .... cfs 1/ | | |
| 5. Compute $\frac{q_o}{q_i}$ ..... | | |
| 6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1) | | |
| 7. Runoff, Q ..... in (From worksheet 2) | | |
| 8. Runoff volume, $V_r$ ..... ac-ft ($V_r = QA_m 53.33$) | | |
| 9. Storage volume, $V_s$ ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$) | | |
| 10. Maximum stage, $E_{max}$ (From plot) | | |

1/ 2nd stage $q_o$ includes 1st stage $q_o$.

# Worksheet 6b: Detention basin peak outflow, storage volume ($V_s$) known

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

Elevation or stage

Detention basin storage

1. Data:
   Drainage area ..... $A_m$ = _____ $mi^2$
   Rainfall distribution type (I, IA, II, III) = _____

| | 1st stage | 2nd stage |
|---|---|---|
| 2. Frequency ..... yr | | |
| 3. Storage volume, $V_s$ ..... ac ft | | |
| 4. Runoff, Q ..... in (From worksheet 2) | | |
| 5. Runoff volume, $V_r$ ..... ac-ft ($V_r = QA_m 53.33$) | | |
| 6. Compute $\frac{V_s}{V_r}$ ..... | | |
| 7. $\frac{q_o}{q_i}$ ..... in (Use $\frac{V_s}{V_r}$ and figure 6-1) | | |
| 8. Peak inflow discharge, $q_i$ .... cfs (From worksheet 4 or 5b) | | |
| 9. Peak outflow discharge, $q_o$ .... cfs ($q_o = q_i(\frac{q_o}{q_i})$) 1/ | | |
| 10. Maximum stage, $E_{max}$ (From plot) | | |

1/ 2nd stage $q_o$ includes 1st stage $q_o$.

# Appendix E: References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# Appendix F: Equations for figures and exhibits

This appendix presents the equations used in procedure applications to generate figures and exhibits in TR-55.

**Figure 2-1 (runoff equation):**

$$Q = \frac{\left[P - 0.2\left(\frac{1000}{CN} - 10\right)\right]^2}{P + 0.8\left(\frac{1000}{CN} - 10\right)}$$

where

$Q$ = runoff (in),
$P$ = rainfall (in), and
$CN$ = runoff curve number.

**Figure 2-3 (composite CN with connected impervious area):**

$$CN_c = CN_p + (P_{imp}/100)(98 - CN_p)$$

where

$CN_c$ = composite runoff curve number,
$CN_p$ = pervious runoff curve number, and
$P_{imp}$ = percent imperviousness.

**Figure 2-4 (composite CN with unconnected impervious areas and total impervious area less than 30%):**

$$CN_c = CN_p + (P_{imp}/100)(98 - CN_p)(1 - 0.5R)$$

where $R$ = ratio of unconnected impervious area to total impervious area.

**Figure 3-1 (average velocities for estimating travel time for shallow concentrated flow):**

Unpaved $V = 16.1345\ (s)^{0.5}$
Paved $V = 20.3282\ (s)^{0.5}$

where

$V$ = average velocity (ft/s), and
$s$ = slope of hydraulic grade line (watercourse slope, ft/ft).

These two equations are based on the solution of Manning's equation (Eq. 3-4) with different assumptions for n (Manning's roughness coefficient) and r (hydraulic radius, ft). For unpaved areas, n is 0.05 and r is 0.4; for paved areas, n is 0.025 and r is 0.2.

**Exhibit 4 (unit peak discharges for SCS type I, IA, II, and III distributions):**

$$\log(q_u) = C_0 + C_1 \log(T_c) + C_2 [\log(T_c)]^2$$

where

$q_u$ = unit peak discharge (csm/in),
$T_c$ = time of concentration (hr) (minimum, 0.1; maximum, 10.0), and
$C_0, C_1, C_2$ = coefficients from table F-1.

**Figure 6-1 (approximate detention basin routing through single- and multiple-stage structures for 24-hour rainfalls of the indicated type):**

$$V_s/V_r = C_0 + C_1 (q_o/q_i) + C_2 (q_o/q_i)^2 + C_3 (q_o/q_i)^3$$

where

$V_s/V_r$ = ratio of storage volume ($V_s$) to runoff volume ($V_r$),
$q_o/q_i$ = ratio of peak outflow discharge ($q_o$) to peak inflow discharge ($q_i$), and
$C_0, C_1, C_2, C_3$ = coefficients from table F-2.

Table F-1.—Coefficients for the equation used to generate exhibits 4-I through 4-III

| Rainfall type | $I_a/P$ | $C_0$ | $C_1$ | $C_2$ |
|---|---|---|---|---|
| I | 0.10 | 2.30550 | -0.51429 | -0.11750 |
| | 0.20 | 2.23537 | -0.50387 | -0.08929 |
| | 0.25 | 2.18219 | -0.48488 | -0.06589 |
| | 0.30 | 2.10624 | -0.45695 | -0.02835 |
| | 0.35 | 2.00303 | -0.40769 | 0.01983 |
| | 0.40 | 1.87733 | -0.32274 | 0.05754 |
| | 0.45 | 1.76312 | -0.15644 | 0.00453 |
| | 0.50 | 1.67889 | -0.06930 | 0.0 |
| IA | 0.10 | 2.03250 | -0.31583 | -0.13748 |
| | 0.20 | 1.91978 | -0.28215 | -0.07020 |
| | 0.25 | 1.83842 | -0.25543 | -0.02597 |
| | 0.30 | 1.72657 | -0.19826 | 0.02633 |
| | 0.50 | 1.63417 | -0.09100 | 0.0 |
| II | 0.10 | 2.55323 | -0.61512 | -0.16403 |
| | 0.30 | 2.46532 | -0.62257 | -0.11657 |
| | 0.35 | 2.41896 | -0.61594 | -0.08820 |
| | 0.40 | 2.36409 | -0.59857 | -0.05621 |
| | 0.45 | 2.29238 | -0.57005 | -0.02281 |
| | 0.50 | 2.20282 | -0.51599 | -0.01259 |
| III | 0.10 | 2.47317 | -0.51848 | -0.17083 |
| | 0.30 | 2.39628 | -0.51202 | -0.13245 |
| | 0.35 | 2.35477 | -0.49735 | -0.11985 |
| | 0.40 | 2.30726 | -0.46541 | -0.11094 |
| | 0.45 | 2.24876 | -0.41314 | -0.11508 |
| | 0.50 | 2.17772 | -0.36803 | -0.09525 |

Table F-2.—Coefficients for the equation used to generate figure 6-1

| Rainfall distribution (appendix B) | $C_0$ | $C_1$ | $C_2$ | $C_3$ |
|---|---|---|---|---|
| I, IA | 0.660 | -1.76 | 1.96 | -0.730 |
| II, III | 0.682 | -1.43 | 1.64 | -0.804 |

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