# APPENDIX C

## BASIC EQUATIONS USED IN DEVELOPING DESIGN NOMOGRAPHS

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## I. OVERLAND FLOW SEDIMENT TRANSPORT EQUATIONS

$$g_t = a_1 q^{b_1}$$

where: $a_1 = 1.8 \times 10^a S^c K_g^d$

$$b_1 = b + e \log S + fK_g + gK_g \log S$$

where: $g_t$ = sediment transport in tons/ft/hour

$q$ = unit discharge of water in cfs/ft

$S$ = slope

$K_g$ = roughness

$a_1$, $b_1$, a, b, c, d, e, f, g are constants

| Size | 1.414 | 0.316 | 0.0707 | 0.010 |
|---|---|---|---|---|
| a | 2.3528 | 4.2803 | 5.41128 | 6.03605 |
| b | 0.8953 | 0.93503 | 1.18880 | 1.24488 |
| c | 1.4956 | 1.57333 | 0.94274 | 0.60139 |
| d | -0.4795 | -1.17952 | -1.20217 | -1.166244 |
| e | 0.0255 | -0.00603 | -0.13248 | -0.070568 |
| f | $5.788\times10^{-4}$ | $-4.879\times10^{-5}$ | $-1.0857\times10^{-5}$ | $-4.0342\times10^{-6}$ |
| g | $-2.9483\times10^{-3}$ | $-4.1868\times10^{-4}$ | $-5.9671\times10^{-5}$ | $-9.56907\times10^{-6}$ |

## II. CRITICAL DISCHARGE FOR OVERLAND FLOW

$$q_c = C_1 (K_g/S)^2$$

where: $q_c$ = critical unit discharge of water in cfs/ft

$C_1$ = critical flow coefficient

| Size | $C_1$ |
|---|---|
| 1.414 | $6.85\times10^{-9}$ |
| 0.316 | $7.65\times10^{-11}$ |
| 0.0707 | $8.57\times10^{-13}$ |
| 0.010 | $2.42\times10^{-15}$ |

## III. DIVERSION AND CONVEYANCE SEDIMENT TRANSPORT EQUATIONS

$$g_t = aV^b d_h^c$$

where: $g_t$ = sediment transport rate in tons/ft/hour
$V$ = velocity in feet/second
$d_h$ = hydraulic depth in feet
a, b, c are constants

| Size | 1.414 | 0.316 | 0.0707 | 0.010 |
|---|---|---|---|---|
| a | 0.0140 | 0.0792 | 0.1323 | 0.943 |
| b | 3.917 | 3.461 | 3.348 | 3.230 |
| c | 0.554 | 0.433 | 0.540 | 0.628 |

## IV. CRITICAL VELOCITY FOR CHANNEL FLOW

$$V_c = a\, d_h^{0.667}$$

where: $V_c$ = critical velocity in ft/sec
$d_h$ = hydraulic depth in feet
a = constant

| Size | 1.414 | 0.316 | 0.0707 | 0.010 |
|---|---|---|---|---|
| a | 1.41 | 0.666 | 0.315 | 0.119 |

## V. MAXIMUM OVERLAND FLOW COEFFICIENT

$$C_1 = 43{,}560 \left[ 15{,}894 \frac{P_1}{C_s} a \, (0.50)^b \right]^{\frac{1}{1-b}}$$

where: $C_1$ = overland flow coefficient

$P_1$ = decimal percent of silt in soil

$C_s$ = sediment concentration in parts per million

a and b are constants, where

$$a = 2.794 \times 10^5 \, (K_g/S)^{-0.917}$$

$$b = 1.246 + 4.024 \times 10^{-4} \sqrt{\frac{K_g}{S}} - 3.12 \times 10^{-8} \frac{K_g}{S}$$

## VI. STRUCTURE LENGTH COEFFICIENT

$$C_f = a + b \, (t_e K)$$

where: $C_f$ = structure length coefficient

$t_e$ = duration of rainfall excess in hours

K = flow rate per unit area in ft/hr

a and b are constants, where

$$a = 1.862 S_x^{-1.016}$$

$$b = 1.707 \, S_x^{0.05976}$$

$S_x$ = slope immediately above the structure

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