- REV. 4-15-06: REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.
- REV. 4-1-08: DRAWING EDITS UPDATE TABLE AND REVISIONS TO GENERAL NOTES.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 1

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
SEE NOTE BELOW	4.0	56.6	40.0	32.7	28.3	25.3	23.1
	10.0	141.4	100.0	81.6	70.7	63.2	57.7
	25.0	353.6	250.0	204.1	176.8	158.1	144.3
128.0	35.3	499.2	353.0	288.2	249.6	223.3	203.8
150.0	39.8	562.9	398.0	325.0	281.4	251.7	229.8
200.0	49.4	698.6	494.0	403.3	349.3	312.4	285.2
250.0	58.5	826.9	584.7	477.4	413.4	369.8	337.6
300.0	67.2	950.4	672.0	548.7	475.2	425.0	388.0
400.0	83.5	1180.9	835.0	681.8	590.4	528.1	482.1
500.0	98.8	1397.2	988.0	806.7	698.6	624.9	570.4
600.0	113.3	1602.8	1133.3	925.4	801.4	716.8	654.3
700.0	127.3	1800.9	1273.4	1039.7	900.4	805.4	735.2
800.0	140.8	1991.2	1408.0	1149.6	995.6	890.5	812.9
900.0	153.9	2176.5	1539.0	1256.6	1088.2	973.3	888.5
1000.0	166.7	2357.5	1667.0	1361.1	1178.7	1054.3	962.4
1100.0	179.1	2532.9	1791.0	1462.3	1266.4	1132.7	1034.0
1200.0	191.3	2705.4	1913.0	1562.0	1352.7	1209.9	1104.5
1300.0	203.2	2873.7	2032.0	1659.1	1436.8	1285.1	1173.2

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > OR = 128 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 3

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
SEE NOTE BELOW	10.0	141.4	100.0	81.6	70.7	63.2	57.7
	25.0	353.6	250.0	204.1	176.8	158.1	144.3
	50.0	707.1	500.0	408.2	353.6	316.2	288.7
109.0	69.3	980.0	693.0	565.8	490.0	438.3	400.1
150.0	89.1	1260.1	891.0	727.5	630.0	563.5	514.4
200.0	111.8	1581.1	1118.0	912.8	790.5	707.1	645.5
250.0	133.4	1886.6	1334.0	1089.2	943.3	843.7	770.2
300.0	154.0	2177.9	1540.0	1257.4	1088.9	974.0	889.1
400.0	193.2	2732.3	1932.0	1577.5	1366.1	1221.9	1115.4
500.0	230.4	3258.3	2304.0	1881.2	1629.2	1457.2	1330.2
600.0	266.1	3763.2	2661.0	2172.7	1881.6	1683.0	1536.3
700.0	300.5	4249.7	3005.0	2453.6	2124.9	1900.5	1734.9
800.0	333.9	4722.1	3339.0	2726.3	2361.0	2111.8	1927.8
900.0	366.4	5181.7	3664.0	2991.6	2590.8	2317.3	2115.4
1000.0	398.2	5631.4	3982.0	3251.3	2815.7	2518.4	2299.0
1100.0	429.3	6071.2	4293.0	3505.2	3035.6	2715.1	2478.6
1200.0	459.8	6502.6	4598.0	3754.3	3251.3	2908.0	2654.7
1300.0	489.8	6926.8	4898.0	3999.2	3463.4	3097.8	2827.9

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > OR = 109 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 2

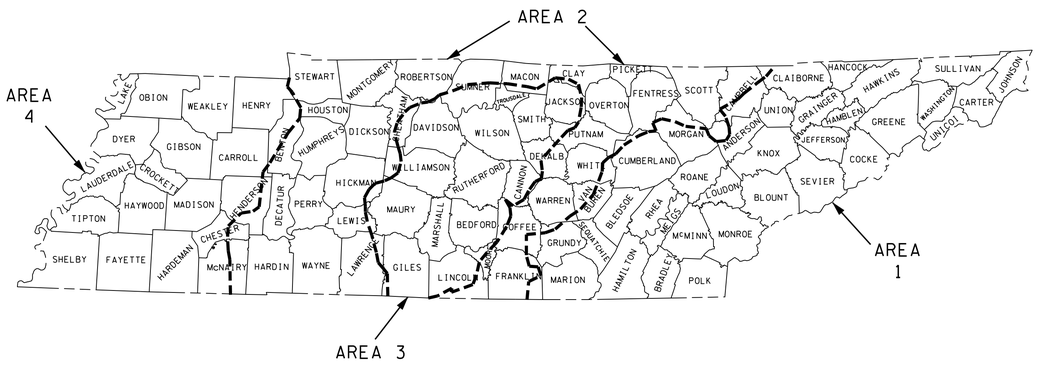
DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
SEE NOTE BELOW	6.0	84.9	60.0	49.0	42.4	37.9	34.6
	15.0	212.1	150.0	122.5	106.1	94.9	86.6
	30.0	424.3	300.0	244.9	212.1	189.7	173.2
	50.0	707.1	500.0	408.2	353.6	316.2	288.7
	70.0	989.9	700.0	571.5	495.0	442.7	404.1
	90.0	1272.8	900.0	734.8	636.4	569.2	519.6
	100.0	1414.2	1000.0	816.5	707.1	632.5	577.4
300.0	117.6	1663.1	1176.0	960.2	831.6	743.8	679.0
400.0	145.0	2050.6	1450.0	1183.9	1025.3	917.1	837.2
500.0	170.5	2411.2	1705.0	1392.1	1205.6	1078.3	984.4
600.0	194.6	2752.1	1946.0	1588.9	1376.0	1230.8	1123.5
700.0	217.7	3078.7	2177.0	1777.5	1539.4	1376.9	1256.9
800.0	239.9	3392.7	2399.0	1958.8	1696.3	1517.3	1385.1
900.0	261.4	3696.8	2614.0	2134.3	1848.4	1653.2	1509.2
1000.0	282.2	3990.9	2822.0	2304.2	1995.5	1784.8	1629.3
1100.0	302.4	4276.6	3024.0	2469.1	2138.3	1912.5	1745.9
1200.0	322.2	4556.6	3222.0	2630.8	2278.3	2037.8	1860.2
1300.0	341.5	4829.5	3415.0	2788.3	2414.8	2159.8	1971.7

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > OR = 300 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 4

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
SEE NOTE BELOW	15.0	212.1	150.0	122.5	106.1	94.9	86.6
	30.0	424.0	299.8	244.8	212.0	189.6	173.1
	60.0	848.1	599.7	489.6	424.0	379.3	346.2
	100.0	1414.2	1000.0	816.5	707.1	632.5	577.4
	150.0	2121.3	1500.0	1224.7	1060.7	948.7	866.0
	200.0	2828.4	2000.0	1633.0	1414.2	1264.9	1154.7
	250.0	3535.5	2500.0	2041.2	1767.8	1581.1	1443.4
	300.0	4242.6	3000.0	2449.5	2121.3	1897.4	1732.1
	350.0	4949.7	3500.0	2857.7	2474.9	2213.6	2020.7
486.0	377.1	5333.0	3771.0	3079.0	2666.5	2385.0	2177.2
600.0	421.4	5959.5	4214.0	3440.7	2979.7	2665.2	2433.0
700.0	457.1	6464.4	4571.0	3732.2	3232.2	2891.0	2639.1
800.0	490.4	6935.3	4904.0	4004.1	3467.7	3101.6	2831.3
900.0	521.8	7379.4	5218.0	4260.5	3689.7	3300.2	3012.6
1000.0	551.6	7800.8	5516.0	4503.8	3900.4	3488.6	3184.7
1100.0	580.0	8202.4	5800.0	4735.7	4101.2	3668.2	3348.6
1200.0	607.2	8587.1	6072.0	4957.8	4293.6	3840.3	3505.7
1300.0	633.4	8957.6	6334.0	5171.7	4478.8	4006.0	3656.9

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > OR = 486 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.



SOURCE: "FLOOD FREQUENCY PREDICTION METHODS FOR UNREGULATED STREAMS OF TENNESSEE" WATER RESOURCES INVESTIGATIONS REPORT 03-4176. USGS 2000.

DIVERSION CHANNEL DEPTH TABLES GENERAL NOTES

(A1) THE TABLES ON THIS DRAWING MAY BE USED TO DESIGN TEMPORARY DIVERSION CHANNELS AS SHOWN ON STANDARD DRAWING EC-STR-31.

(A2) THE "K" VALUES PROVIDED IN THE TABLES REPRESENT "CONVEYANCE" WHICH MEASURES THE CAPACITY OF A CHANNEL TO PASS THE FLOW OF WATER. CONVEYANCE IS A TERM IN MANNING'S EQUATION AND IS CONSIDERED TO BE DIMENSIONLESS.

(A3) FOR EACH COMBINATION OF FLOW RATE AND CHANNEL SLOPE IN THE TABLES, THE CORRESPONDING "K" VALUE IS THE CONVEYANCE REQUIRED TO PASS THAT FLOW.

(A4) WHERE APPLICABLE, THE FLOW RATES SHOWN IN THE TABLES ARE BASED ON THE 2-YEAR EVENT AND ARE DETERMINED FROM THE USGS REGRESSION EQUATIONS FOR RURAL AREAS (2000 EDITION). THE REMAINING FLOW RATES ARE PROVIDED AS A REFERENCE FOR FINDING THE REQUIRED CONVEYANCE.

(A5) AS DESCRIBED IN THE PROCEDURE BELOW, THESE TABLES MAY BE USED TO DETERMINE THE 2-YEAR FLOW DEPTH IN A DIVERSION CHANNEL FOR THE FLOW RATES SHOWN. THE FLOW DEPTHS DETERMINED BY THIS PROCEDURE ACCOUNT FOR DIFFERENCES IN HYDRAULIC ROUGHNESS DUE TO THE DIFFERENT CLASSES OF RIPRAP REQUIRED. THE PROCEDURE IS A SIMPLE ALTERNATIVE TO ITERATIVE ANALYSIS USING THE MANNING EQUATION.

(A6) ALL TEMPORARY DIVERSION CHANNELS SHALL HAVE A TRAPEZOIDAL SHAPE AND THE BOTTOM WIDTH SHALL BE EQUAL TO OR GREATER THAN THE NATURAL CHANNEL BOTTOM WIDTH.

PROCEDURE FOR TEMPORARY DIVERSION CHANNEL DESIGN

(B1) USING THE FIGURE PROVIDED ON THIS DRAWING DETERMINE THE HYDROLOGIC AREA IN WHICH THE PROJECT SITE IS LOCATED.

(B2) INTERPOLATE THE REQUIRED "K" VALUE USING THE APPROPRIATE "K" VALUE TABLE, BASED ON THE DESIGN FLOW RATE AND AVERAGE STREAM SLOPE AT THE SITE. WHERE A PROJECT FALLS ON THE BOUNDARY BETWEEN TWO HYDROLOGIC AREAS, USE THE GREATER "K" VALUE. BASED ON THIS "K" VALUE, INTERPOLATE "A" AND "B" VALUES FROM THE TABLE "PARAMETERS FOR DEPTH OF FLOW EQUATION".

(B3) DETERMINE THE BOTTOM WIDTH OF THE EXISTING NATURAL CHANNEL. USE THIS AS THE BOTTOM WIDTH IN THE DEPTH OF FLOW EQUATION PRESENTED ON THIS DRAWING IN ORDER TO COMPUTE THE 2-YEAR FLOW DEPTH IN DIVERSION CHANNEL.

(B4) THE HEIGHT OF THE RIPRAP IN THE CHANNEL WILL BE EQUAL TO THE 2-YEAR FLOW DEPTH PLUS THE REQUIRED FREEBOARD. THE REQUIRED FREEBOARD WILL EITHER BE EQUAL TO THE FLOW DEPTH OR ONE FOOT, WHICHEVER IS LESS. THE TOP OF THE CHANNEL MUST BE EQUAL TO OR GREATER THAN THE HEIGHT OF THE RIPRAP. SEE THE FIGURE PROVIDED ON STANDARD DRAWING EC-STR-31.

(B5) COMPUTE FLOW AREA AS (DEPTH X BOTTOM WIDTH) + (Z X DEPTH^2), WHERE Z IS Z:1 FOR THE SIDE SLOPE.

(B6) COMPUTE VELOCITY AS (FLOW RATE / FLOW AREA). USE COMPUTED VELOCITY TO SELECT RIPRAP CLASS BASED ON APPROVED TDOT METHODS. IF THE COMPUTED VELOCITY IS LESS THAN 2.5 FEET PER SECOND, RIPRAP WILL NOT BE REQUIRED.

PARAMETERS FOR DEPTH OF FLOW EQUATION

K VALUE	A	B
20	-0.213	0.856
30	-0.238	0.998
60	-0.291	1.311
100	-0.323	1.545
175	-0.360	1.846
275	-0.373	2.064
350	-0.378	2.183
400	-0.384	2.260
500	-0.380	2.356
650	-0.401	2.535
750	-0.464	2.796
850	-0.494	2.944
1000	-0.540	3.162
2000	-0.812	4.406
3000	-1.000	5.321
4000	-1.100	5.960
5000	-1.176	6.567
6000	-1.241	7.072
7000	-1.300	7.515
8000	-1.323	7.895

DEPTH OF FLOW EQUATION

FLOW DEPTH = A X *ln* (BOTTOM WIDTH) + B

ln IS THE NATURAL LOG FUNCTION OF THE BOTTOM WIDTH OF THE CHANNEL.

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

TEMPORARY DIVERSION CHANNEL DESIGN

1-20-06 | EC-STR-31A