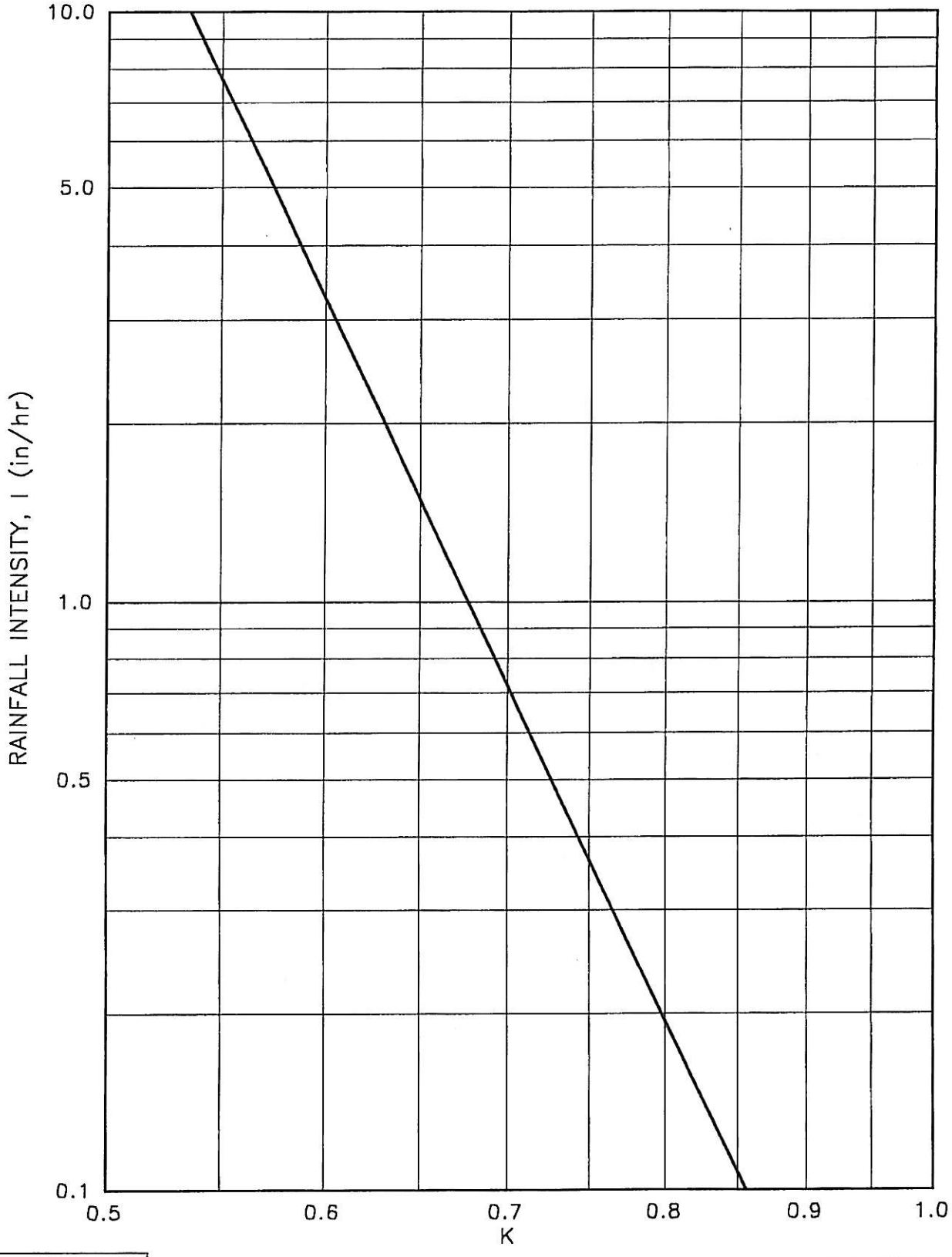
Appendix E

APPENDIX G K Factor for Burned Watersheds



Equation:

$K = 0.677 * I^{-0.102}$

Where: K = The ratio of burned to unburned infiltration rates (Burn Factor = f_b/f_u).
I = The rainfall intensity (in/hr).

Los Angeles County
Department of Public Works

BURN FACTOR CURVE

BRNFAC...PG

Burn Factor

Rainfall Intensity (in/hr)	Burn Factor K	Rainfall Intensity (in/hr)	Burn Factor K	Rainfall Intensity (in/hr)	Burn Factor K
.1	.856	3.5	.596	6.8	.557
.2	.798	3.6	.594	6.9	.556
.3	.765	3.7	.592	7.0	.555
.4	.743	3.8	.591	7.1	.554
.5	.727	3.9	.589	7.2	.554
.6	.713	4.0	.588	7.3	.553
.7	.702	4.1	.586	7.4	.552
.8	.693	4.2	.585	7.5	.551
.9	.684	4.3	.583	7.6	.550
1.0	.677	4.4	.582	7.7	.550
1.1	.670	4.5	.581	7.8	.549
1.2	.665	4.6	.579	7.9	.548
1.3	.659	4.7	.578	8.0	.548
1.4	.654	4.8	.577	8.1	.547
1.5	.650	4.9	.576	8.2	.546
1.6	.645	5.0	.575	8.3	.546
1.7	.641	5.1	.573	8.4	.545
1.8	.638	5.2	.572	8.5	.544
1.9	.634	5.3	.571	8.6	.544
2.0	.631	5.4	.570	8.7	.543
2.1	.628	5.5	.569	8.8	.542
2.2	.625	5.6	.568	8.9	.542
2.3	.622	5.7	.567	9.0	.541
2.4	.619	5.8	.566	9.1	.540
2.5	.617	5.9	.565	9.2	.540
2.6	.614	6.0	.564	9.3	.539
2.7	.612	6.1	.563	9.4	.539
2.8	.610	6.2	.562	9.5	.538
2.9	.607	6.3	.561	9.6	.538
3.0	.605	6.4	.560	9.7	.537
3.1	.603	6.5	.559	9.8	.536
3.2	.601	6.6	.558	9.9	.536
3.3	.599	6.7	.558	10.0	.535
3.4	.598				

BURN.TAB

Equation:

$$K = 0.677 * I^{-0.102}$$

Where:

K = The Ratio of Burned to Unburned Infiltration Rates (Burn Factor).
I = The Rainfall Intensity (in/hr).

Los Angeles County
Department of Public Works

BURN FACTOR

B. CALCULATING "BURNED" *Q*'S FROM "UNBURNED" COMPREHENSIVE PLAN Q'S

B-1. Application

After a watershed burns, the soil infiltration rate decreases due to physical and chemical changes in the soil. With decreased infiltration comes increased runoff and the inclusion of inorganic debris in the flow. Altering the undeveloped runoff coefficient, C_u, is therefore the necessary first step in converting rainfall to runoff for drainage areas subject to burning. The procedures for actually "bulking" the flow are in the Sedimentation Manual.

Normally, this coefficient alteration is performed in the course of using the Rational or Modified Rational methods for finding peak flow rates. However, in the case of the Flood Control District's early ground-work, called the Comprehensive Plans, which were performed before soil "burning" was required but where a peak flow rate is already known, some or all of the drainage area needs to be burned before bulked flows can be found. This procedure describes how to calculate an augmented peak flow for a watershed in which some or all of the tributary area is subject to burning and an "unburned" peak flow rate is already known.

B-2. Finding Peak "Burned" Flow Rates

(See the example in Appendix L)

For burned drainage areas, the classic Rational Method equation becomes: $Q_b = C_bIA$, in which Q_b and C_b are respectively the peak runoff rate and runoff coefficient for burned conditions. The relationship between burned and unburned conditions then is:

$$Q_b \cdot AI(1 \cdot K) \cdot KQ_u$$

where:
- Q_b = Peak runoff rate from a burned drainage area, in cfs
- A = Drainage area, in acres
- I = Rainfall intensity, in in/hr
- K = Ratio of burned to unburned infiltration rate for a given rainfall intensity (see Appendix G)
- Q_u = Peak runoff from an unburned drainage area, in cfs

Follow these steps and use the above equation to determine a burned *Q*:

(1) For a single watershed small enough to be treated as a subarea, the "I" value is the same as used in calculating the time of concentration for the subarea.

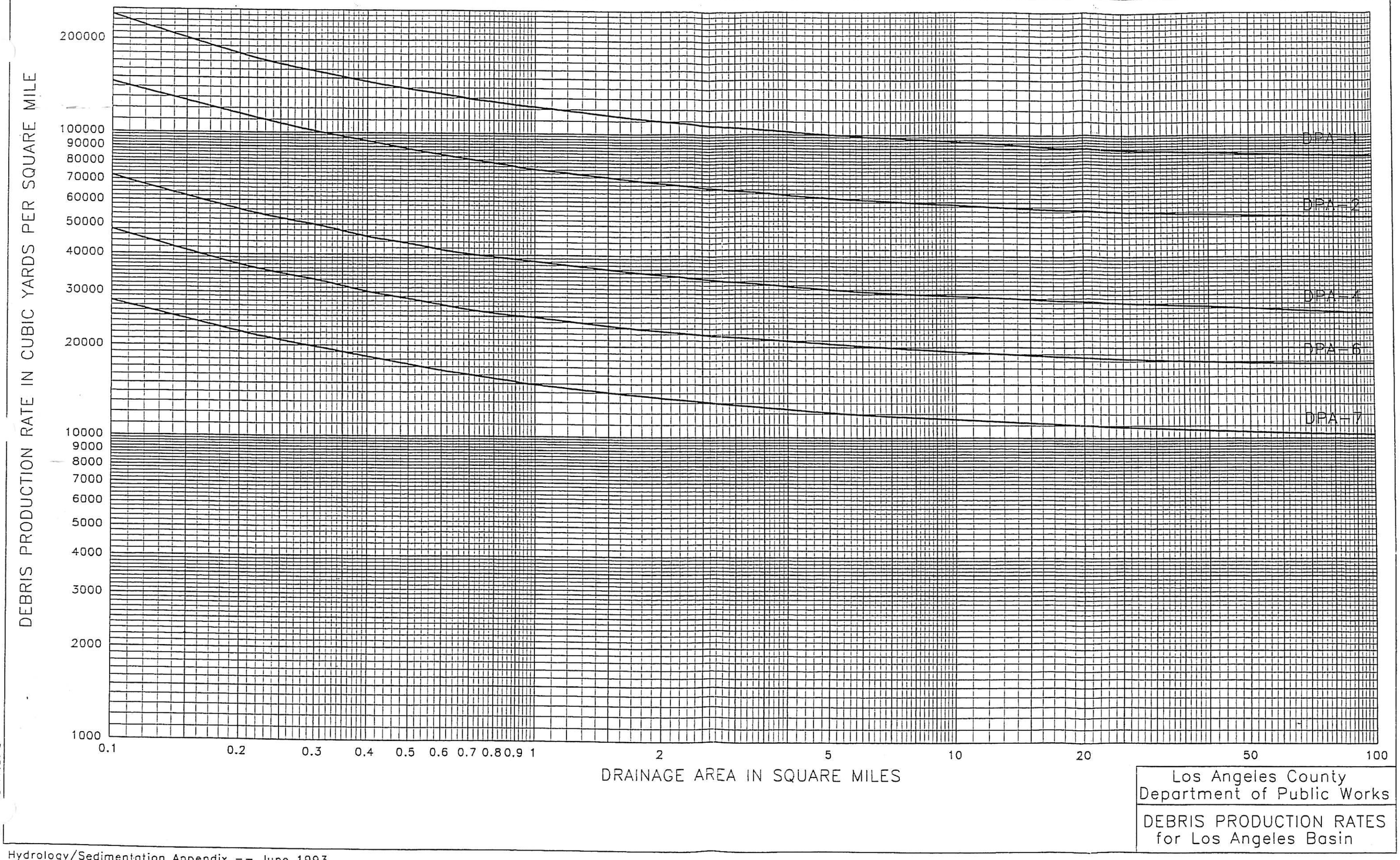
(2) For a larger watershed that is broken up into subareas, "I" is a weighted value found by the following method:

(a) Divide the total unburned peak flow rate by the total drainage area to get the product CI.

(b) Multiply the soil runoff coefficient of each subarea by the ratio of the subarea size to the total area. Add each proportioned coefficient to get the weighted soil coefficient, C_w.

(c) Divide the product CI found above by C_w to get the representative I value for the whole watershed for use in the equation above.

(3) Substitute Q_u, K, I, and A into the equation to get Q_b.



Los Angeles County
Department of Public Works

DEBRIS PRODUCTION RATES
for Los Angeles Basin

DF .BH1.SPG

Appendix F

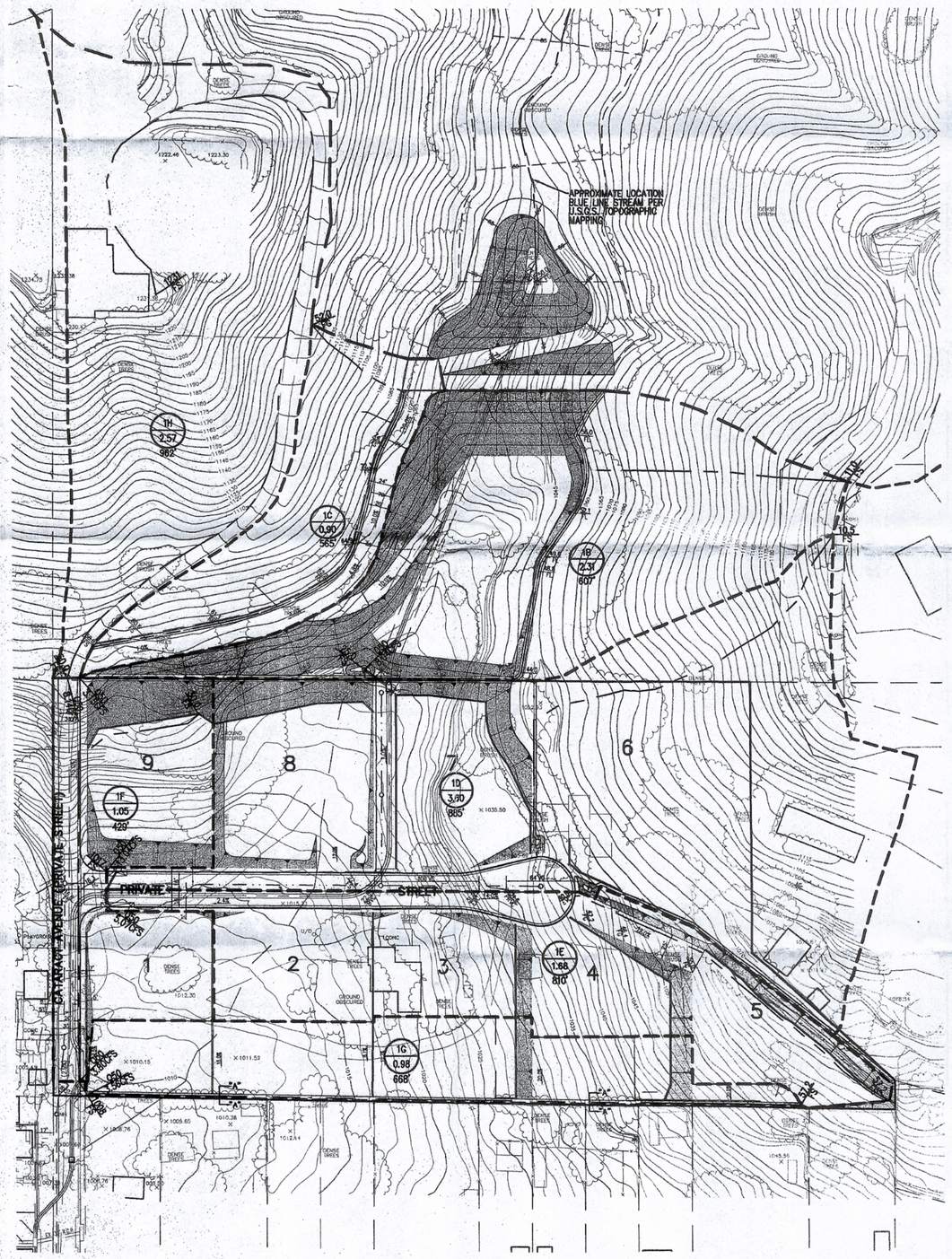
PENDING

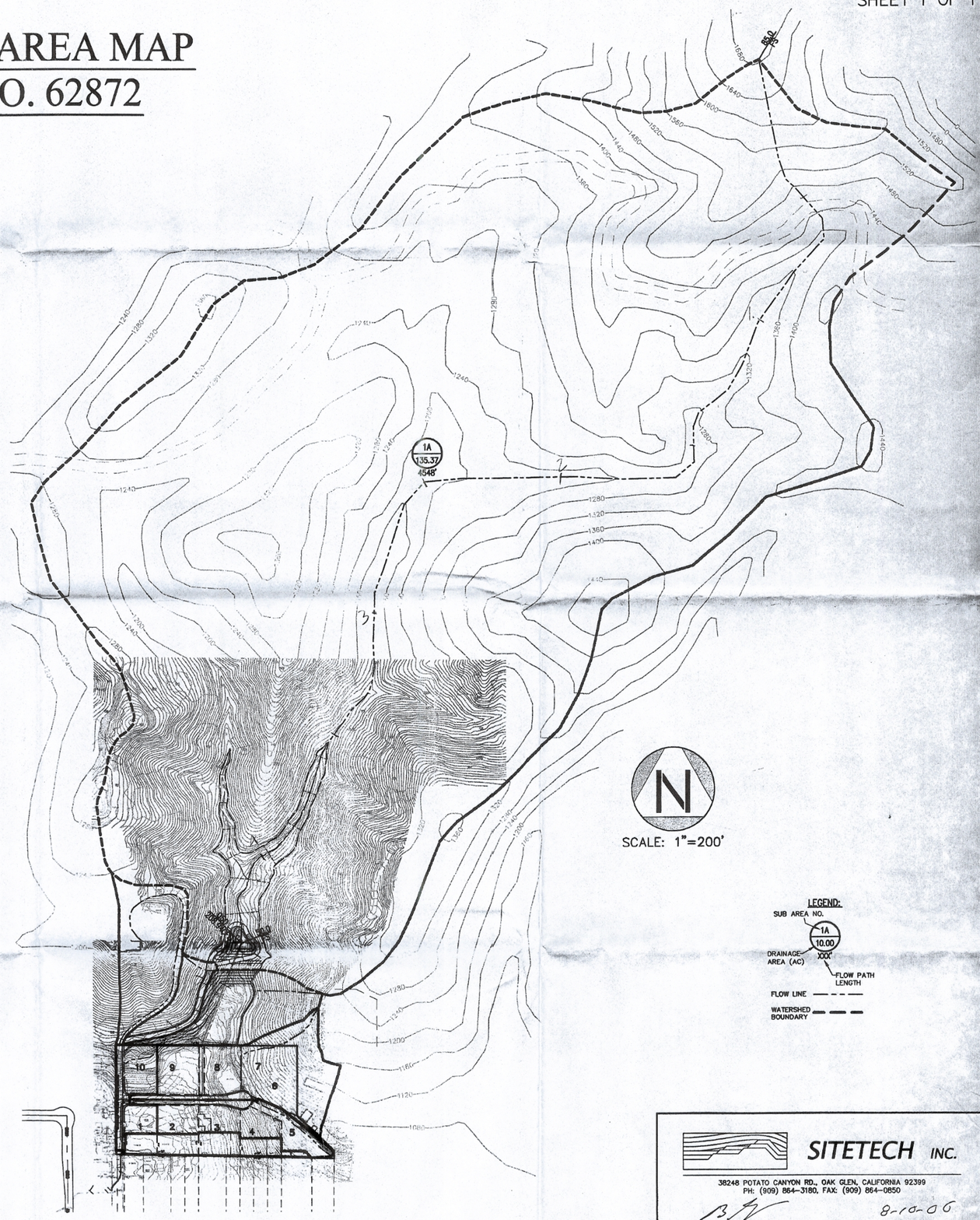
Appendix G

DRAINAGE AREA MAP
TRACT NO. 62872

N

SCALE: 1"=60'





N

SCALE: 1"=200'

LEGEND:
SUB AREA NO. 1A
DRAINAGE AREA (AC) 10.00
FLOW PATH LENGTH XXX'
FLOW LINE
WATERSHED BOUNDARY

SITETECH INC.
38248 POTATO CANYON RD., OAK GLEN, CALIFORNIA 92399
PH: (909) 864-3180, FAX: (909) 864-0850

BERNHARD K. MAYER R.C.E. 36866 DATE 8-10-06

4/19/07

PRELIMINARY DRAINAGE STUDY
AND
HYDRAULIC CALCULATIONS

PREPARED FOR:

TRACT NO. 62872

CITY OF SAN DIMAS

PREPARED BY:

SITETECH, INC.
38248 POTATO CANYON RD.
OAK GLEN, CA. 92399
PH: (909) 864-3180

B. K. M.

BERNHARD K. MAYER — R.C.E. 36866 — 8-10-06 DATE

INTRODUCTION

TTM 62872 is located in the City of San Dimas near the northerly terminus of Cataract Avenue. The project is comprised of 33.36 Ac (gross) and 6.18 Ac (developed). Development will consist of the construction of 9 residential lots and 1 debris basin located upstream of the lots with a storm drain to convey flows through the development.

The purpose of this study is determine the rate of stormwater runoff (both onsite and offsite), and to provide calculations to determine the sizes of the proposed storm drain facilities including the proposed debris basin, in conformance with local regulations.

WATERSHED DESCRIPTION

Existing Condition

The development area in the existing condition is gradually sloped from 5% to 15% grade and covered with perennial grasses and bordered with steep hills to the north. Off-site storm runoff generated in the foothills amount to 135 acres of tributary drainage area. In this condition, the site drains generally to the southwest corner of the site and toward Cataract Avenue.

The total study area comprises 146 acres in the existing condition.

Developed Condition

When developed, on-site runoff will be conveyed through the proposed streets, then into catch basins to be conveyed downstream through an underground storm drain.

Off-site runoff is collected in a proposed debris basin and then conveyed by a proposed storm drain in the streets and outlet downstream of the development back into a natural drainage course.

METHODOLOGY

Modified Rational Method Hydrology

Modified Rational method hydrology calculations were undertaken in conformance with the Los Angeles Department of Public Works Hydrology Manual (December 1991). The following scenario was modeled:

Off-site Existing condition	50-year
On-site Existing condition	50-year
On-site Developed condition	50-year

Rainfall depth was derived from the Manual's isohyetal maps and intensity-duration charts.

Hydrologic soil classification was no. 80 which is described as Upper San Gabriel River (USGR-F).

Modified Rational method computations were performed using the Tc Calculator ver. 2.03. Intensity, runoff coefficients, and discharge were calculated for each sub area by the software, based on user input of rainfall, soil type, acreage, and land use parameters.

Printouts of the modified rational method calculations, as well as applicable tables from the Manual, are included in this report.

Discharges for each subarea are shown on the Drainage Area Maps included with this report. The proposed storm drain system, with catch basin locations, are shown on the map for reference.

Preliminary Design of Debris/Detention Basin

The proposed debris/detention basin is designed to mitigate the debris production and also mitigate increased run-off due to this development for storms up to and including the 50-year event. The outlet works will be designed to convey up to 50-year flows. Flows greater than the 50-year storm are conveyed through a secondary outlet structure which also acts as an emergency spillway in the event of the failure of the outlet works.

The debris production is determined based on being in a debris potential area zone of DPA-1 and the tributary drainage area to the basin of 0.21 sq. mi. The design volume of the basin is determine based on a calculated debris cone slope finish surface.

In accordance with Los Angeles County Department of Public Works procedures, preliminary calculations resulted in the following:

Offsite debris production: 37,170 cu. yd.
Actual design volume: ~~37,170~~ 40,570 cu. yd. **OK**

Additional analysis was performed to quantify the reduction in downstream flow due to the detention capabilities of the basin. The minimum detention requirements were determined by comparing the following 2 calculations:

Onsite: 50-year / 24-hour existing and developed condition

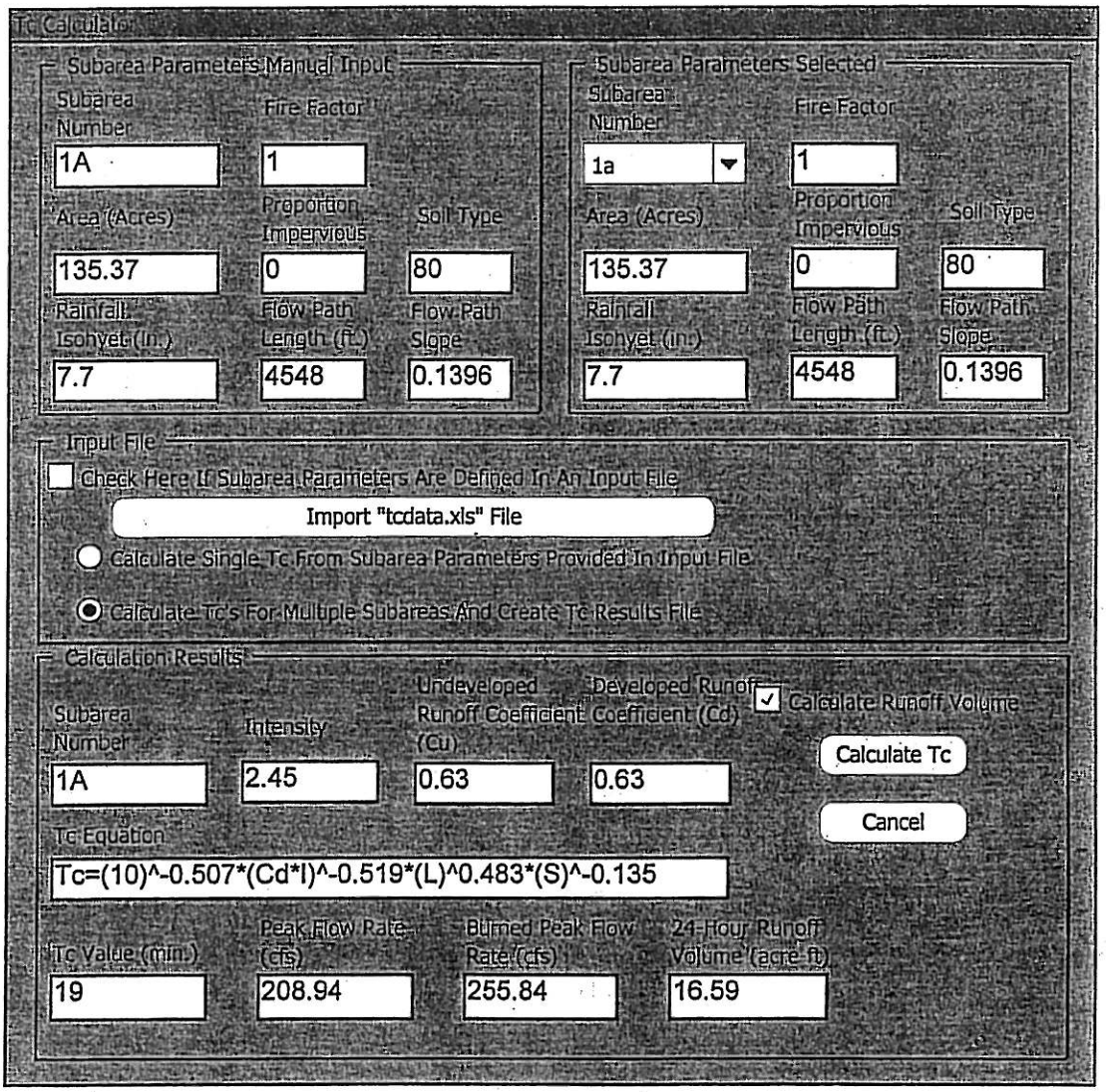
In accordance with Los Angeles County Department of Public Works procedures, preliminary calculations resulted in the following:

Onsite increased volume from development: 61,942 cu. ~~yd.~~ Ac-ft. 2.355
Actual design volume in excess of debris storage: 91,851 cu. ~~yd.~~ Ac-ft. **OK** 3400 C.Y.

CONCLUSIONS

This preliminary study and the calculations presented herein demonstrate the adequacy of the proposed drainage improvements to protect structures from flooding in the 50-year storm event, and conformance to hydrologic and hydraulic concepts and criteria, as mandated by the participating regulatory agencies.

TC CALCULATOR ANALYSIS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Subarea Number
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Fire Factor
1
Area (Acres)
135.37
Proportion Impervious
0
Soil Type
80
Rainfall Isohyet (in.)
7.7
Flow Path Length (ft.)
4548
Flow Path Slope
0.1396
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
135.37
Proportion Impervious
0
Soil Type
80
Rainfall Isohyet (in.)
7.7
Flow Path Length (ft.)
4548
Flow Path Slope
0.1396
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Check Here If Subarea Parameters Are Defined In An Input File
Import "tcdata.xls" File
Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
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Intensity
2.45
Undeveloped Runoff Coefficient (Cu)
0.63
Developed Runoff Coefficient (Cd)
0.63
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
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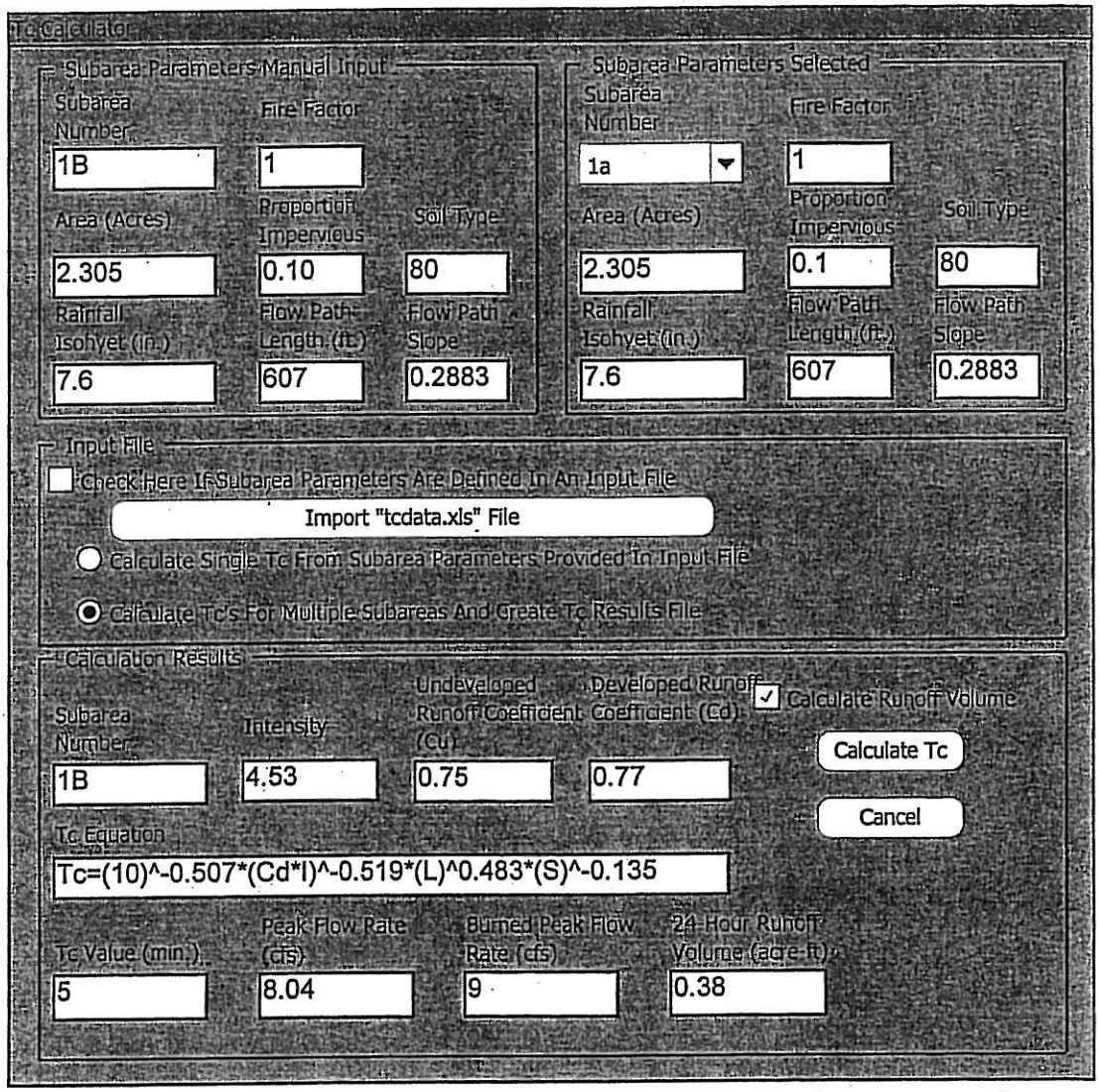
19
Peak Flow Rate (cfs)
208.94
Burned Peak Flow Rate (cfs)
255.84
24-Hour Runoff Volume (acre-ft)
16.59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1B
Fire Factor
1
Area (Acres)
2.305
Proportion Impervious
0.10
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
607
Flow Path Slope
0.2883
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
2.305
Proportion Impervious
0.1
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
607
Flow Path Slope
0.2883
Input File
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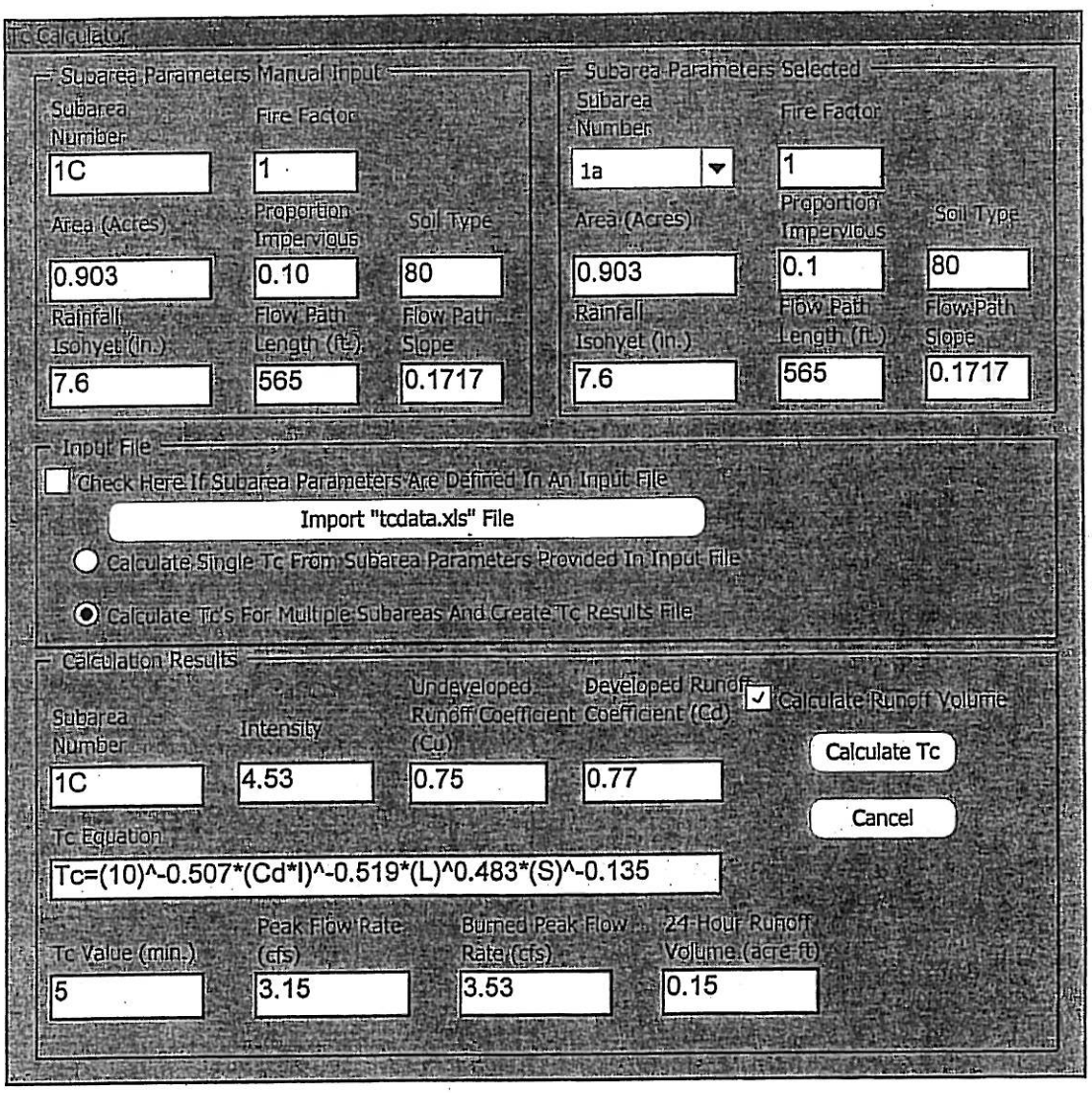
Import "tcdata.xls" File
Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
Subarea Number
1B
Intensity
4.53
Undeveloped Runoff Coefficient (Cu)
0.75
Developed Runoff Coefficient (Cd)
0.77
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Tc Value (min.)
5
Peak Flow Rate (cfs)
8.04
Burned Peak Flow Rate (cfs)
9
24-Hour Runoff Volume (acre-ft)
0.38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1C
Fire Factor
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Area (Acres)
0.903
Proportion Impervious
0.10
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
565
Flow Path Slope
0.1717
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
0.903
Proportion Impervious
0.1
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
565
Flow Path Slope
0.1717
Input File
Check Here If Subarea Parameters Are Defined In An Input File
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Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
Subarea Number
1C
Intensity
4.53
Undeveloped Runoff Coefficient (Cu)
0.75
Developed Runoff Coefficient (Cd)
0.77
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Tc Value (min.)
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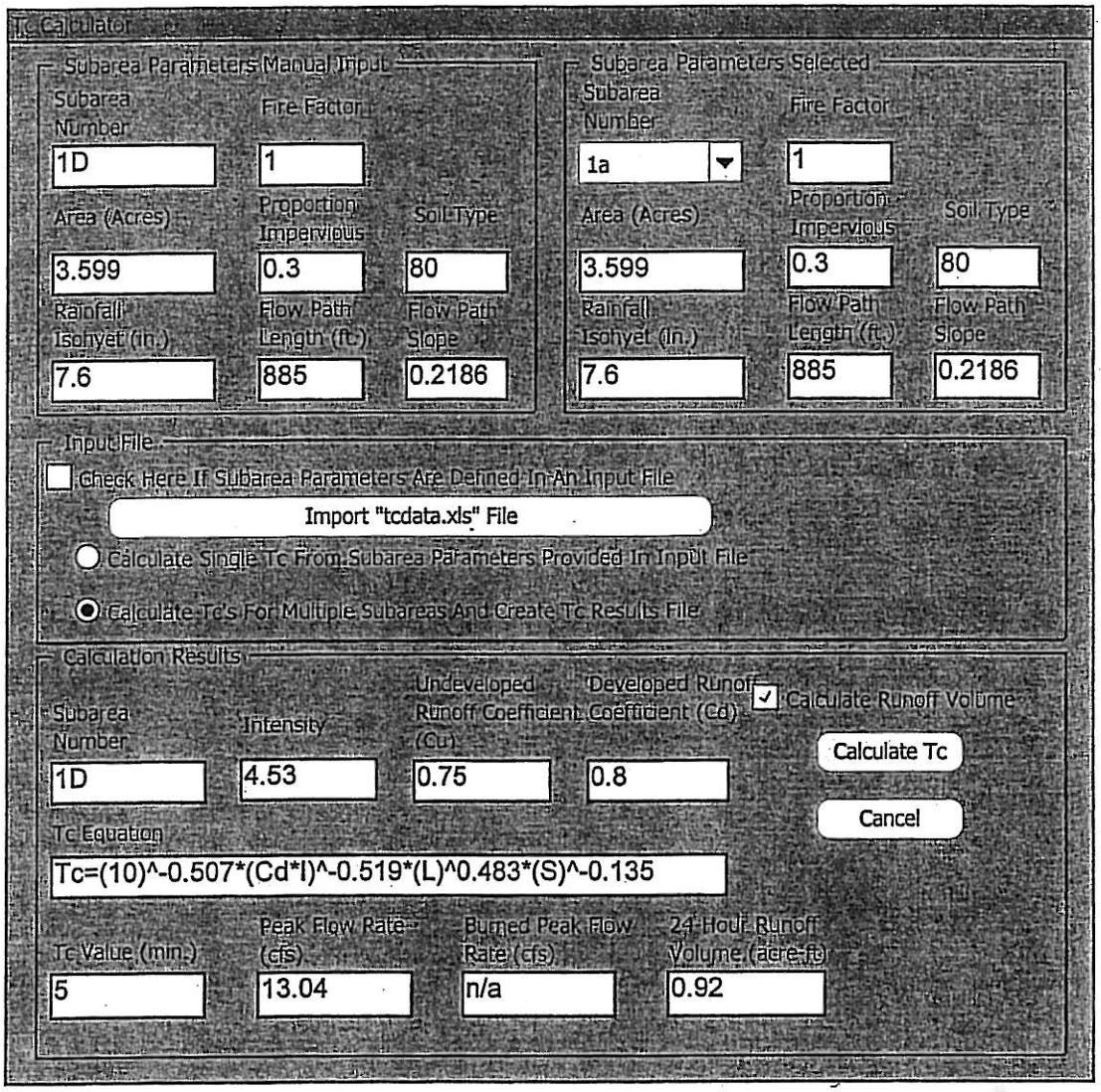
Peak Flow Rate (cfs)
3.15
Burned Peak Flow Rate (cfs)
3.53
24-Hour Runoff Volume (acre-ft)
0.15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Area (Acres)
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0.3
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
885
Flow Path Slope
0.2186
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
3.599
Proportion Impervious
0.3
Soil Type
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Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
885
Flow Path Slope
0.2186
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Calculate Tc's For Multiple Subareas And Create Tc Results File
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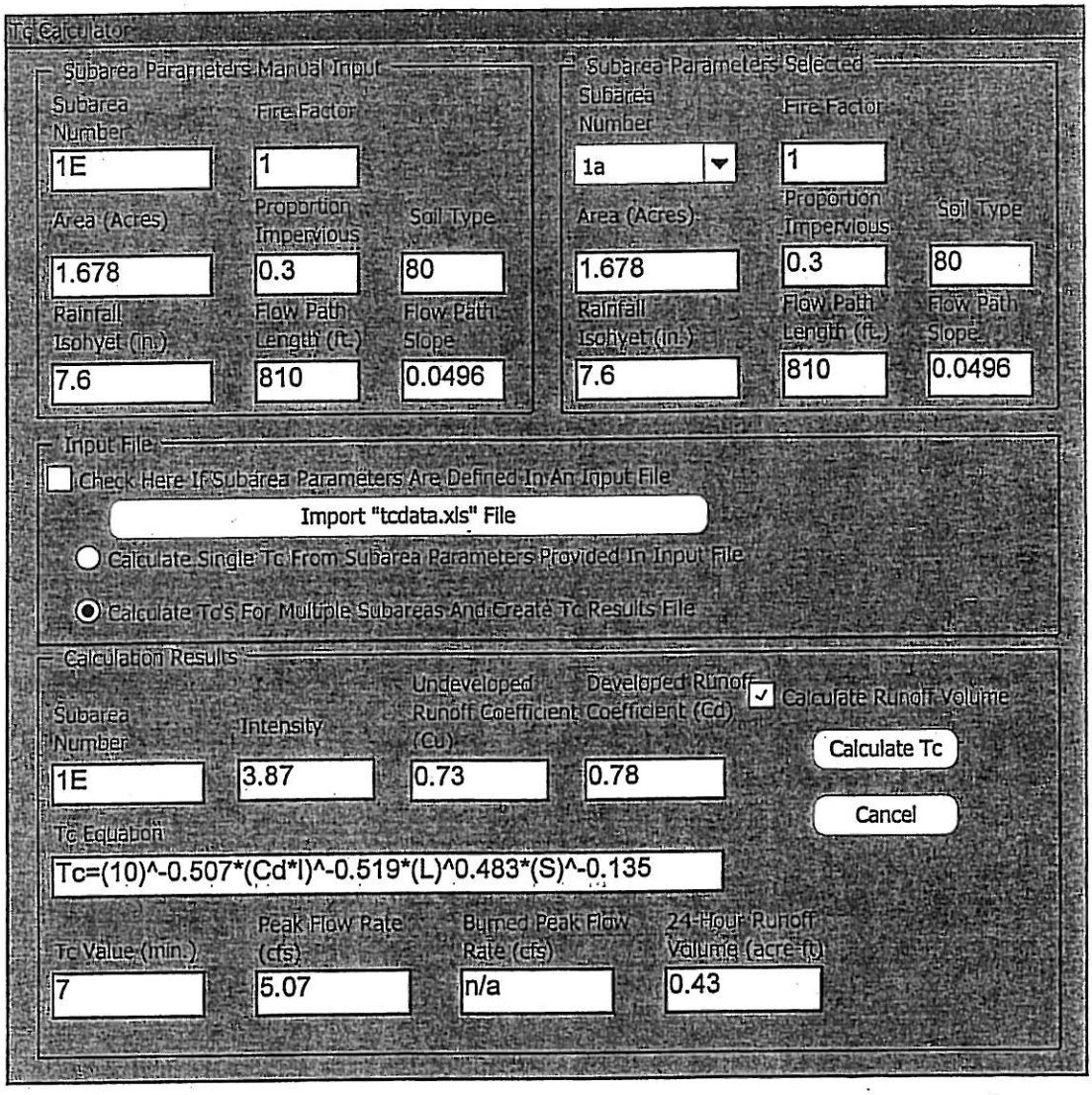
1D
Intensity
4.53
Undeveloped Runoff Coefficient (Cu)
0.75
Developed Runoff Coefficient (Cd)
0.8
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Tc Value (min.)
5
Peak Flow Rate (cfs)
13.04
Burned Peak Flow Rate (cfs)
n/a
24-Hour Runoff Volume (acre-ft)
0.92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1.678
Proportion Impervious
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Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
810
Flow Path Slope
0.0496
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
1.678
Proportion Impervious
0.3
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
810
Flow Path Slope
0.0496
Input File
Check Here If Subarea Parameters Are Defined In An Input File
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Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
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Intensity
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Undeveloped Runoff Coefficient (Cu)
0.73
Developed Runoff Coefficient (Cd)
0.78
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
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Burned Peak Flow Rate (cfs)
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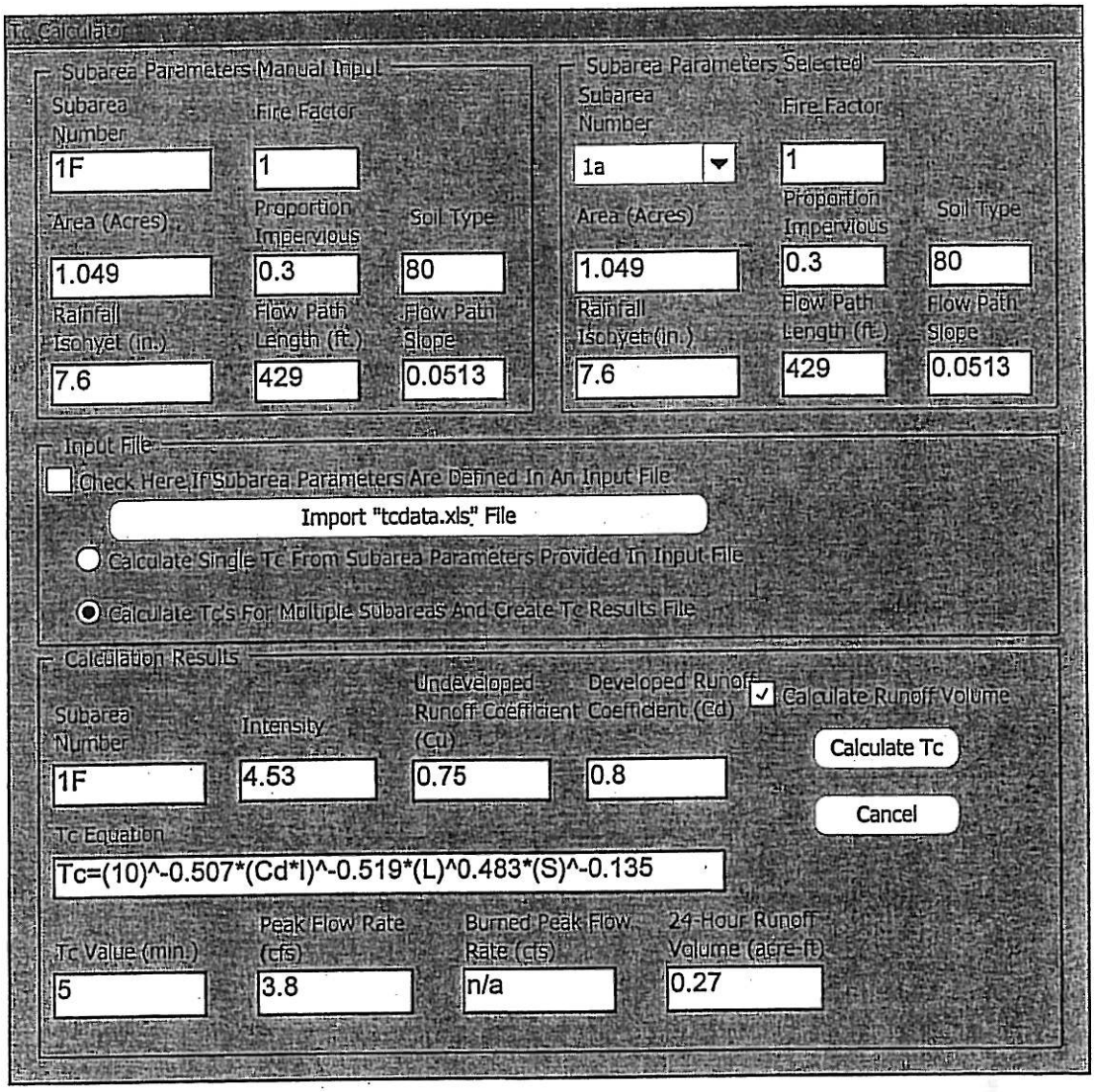
24-Hour Runoff Volume (acre-ft)
0.43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1F
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Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
429
Flow Path Slope
0.0513
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Subarea Number
1a
Fire Factor
1
Area (Acres)
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Proportion Impervious
0.3
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
429
Flow Path Slope
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Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
Subarea Number
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Intensity
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Undeveloped Runoff Coefficient (Cu)
0.75
Developed Runoff Coefficient (Cd)
0.8
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
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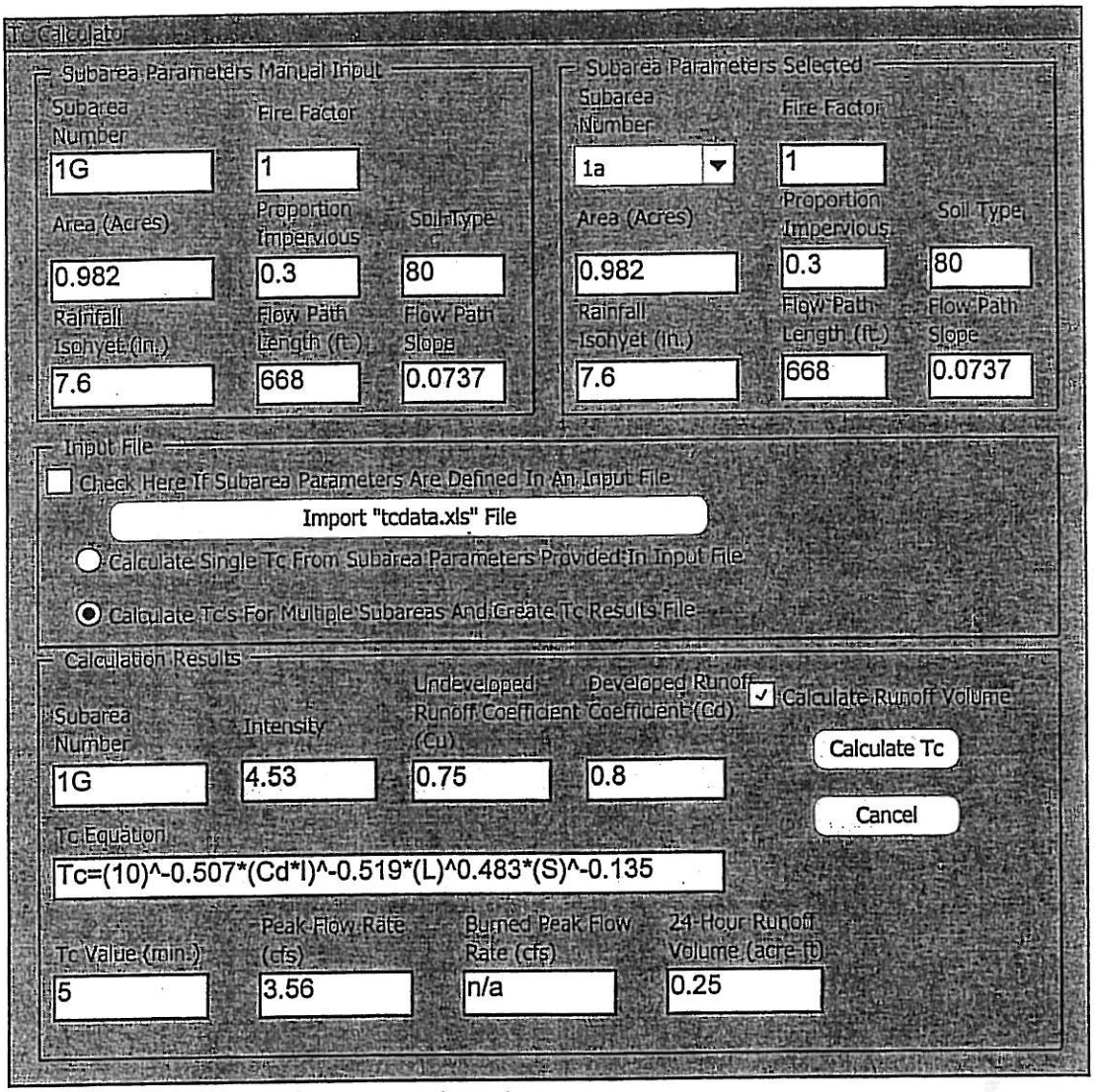
3.8
Burned Peak Flow Rate (cfs)
n/a
24-Hour Runoff Volume (acre-ft)
0.27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1G
Fire Factor
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Area (Acres)
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Proportion Impervious
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Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
668
Flow Path Slope
0.0737
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
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Area (Acres)
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Proportion Impervious
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Soil Type
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Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
668
Flow Path Slope
0.0737
Input File
Check Here If Subarea Parameters Are Defined In An Input File
Import "tcdata.xls" File
Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
Subarea Number
1G
Intensity
4.53
Undeveloped Runoff Coefficient (Cu)
0.75
Developed Runoff Coefficient (Cd)
0.8
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
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Tc Value (min.)
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Burned Peak Flow Rate (cfs)
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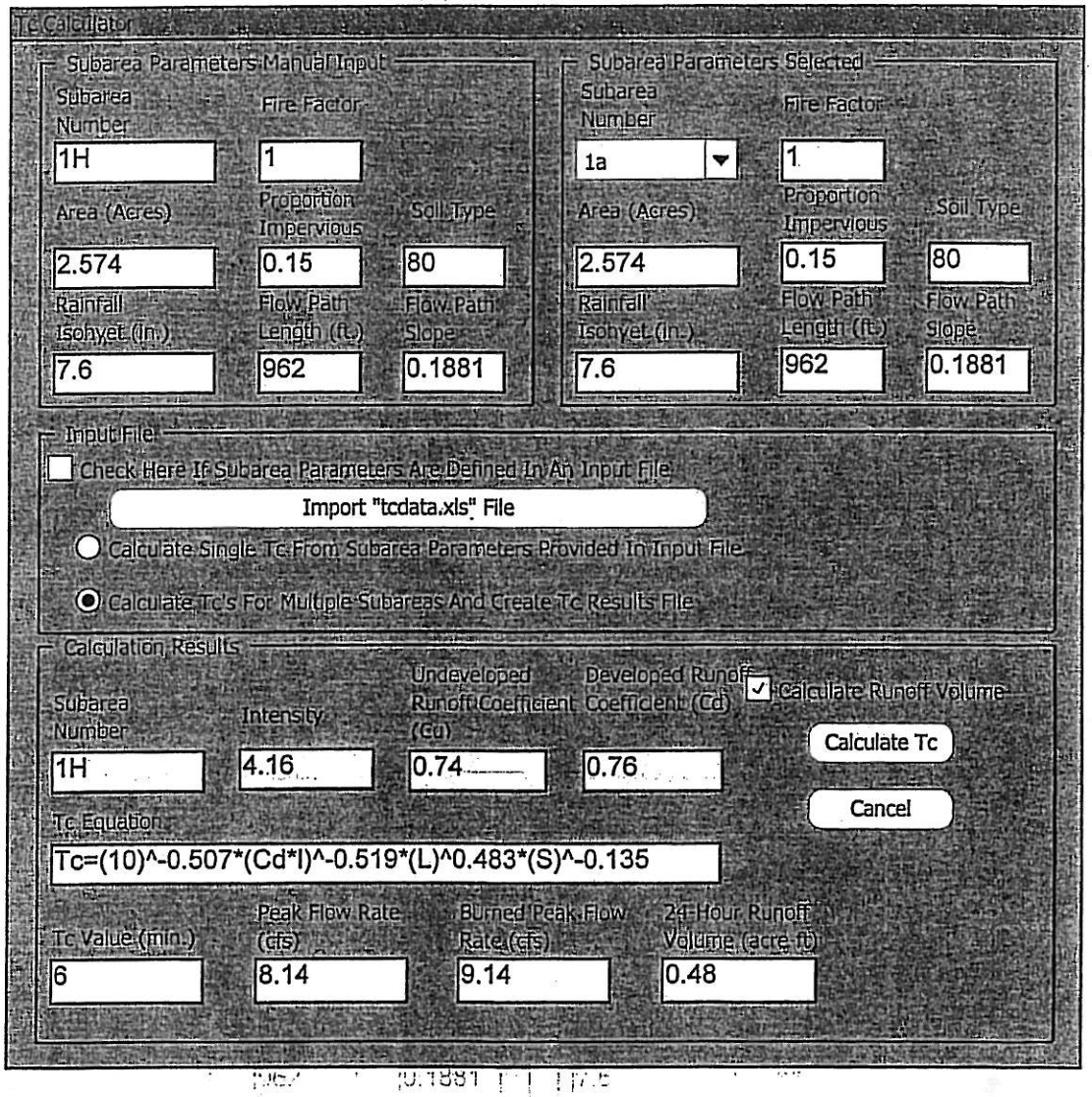
24-Hour Runoff Volume (acre-ft)
0.25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Subarea Number
1H
Fire Factor
1
Area (Acres)
2.574
Proportion Impervious
0.15
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
962
Flow Path Slope
0.1881
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
2.574
Proportion Impervious
0.15
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
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Flow Path Slope
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Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
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Developed Runoff Coefficient (Cd)
0.76
Calculate Runoff Volume
Calculate Tc
Cancel
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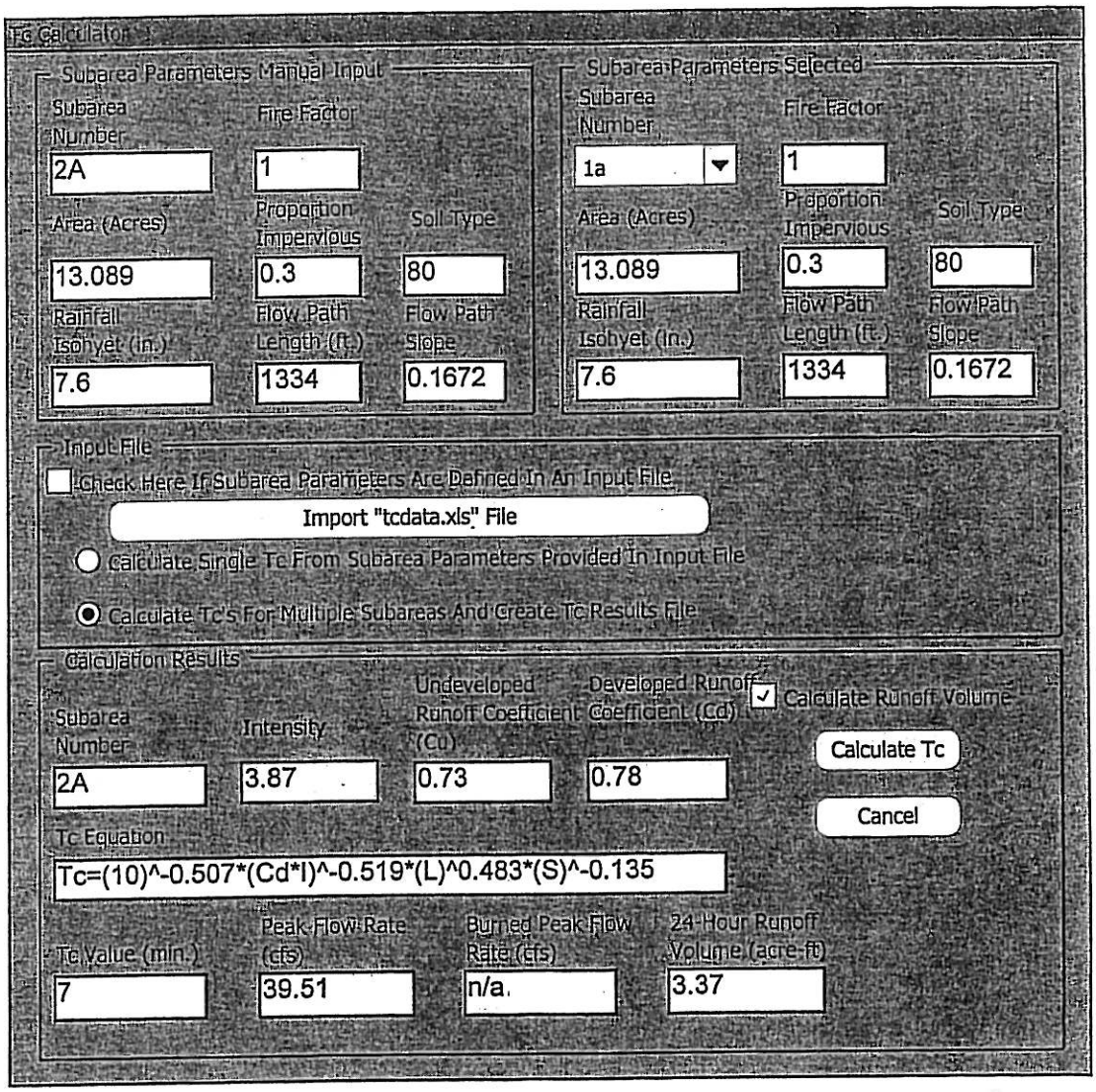
Burned Peak Flow Rate (cfs)
9.14
24-Hour Runoff Volume (acre-ft)
0.48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2A
Fire Factor
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Area (Acres)
13.089
Proportion Impervious
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Soil Type
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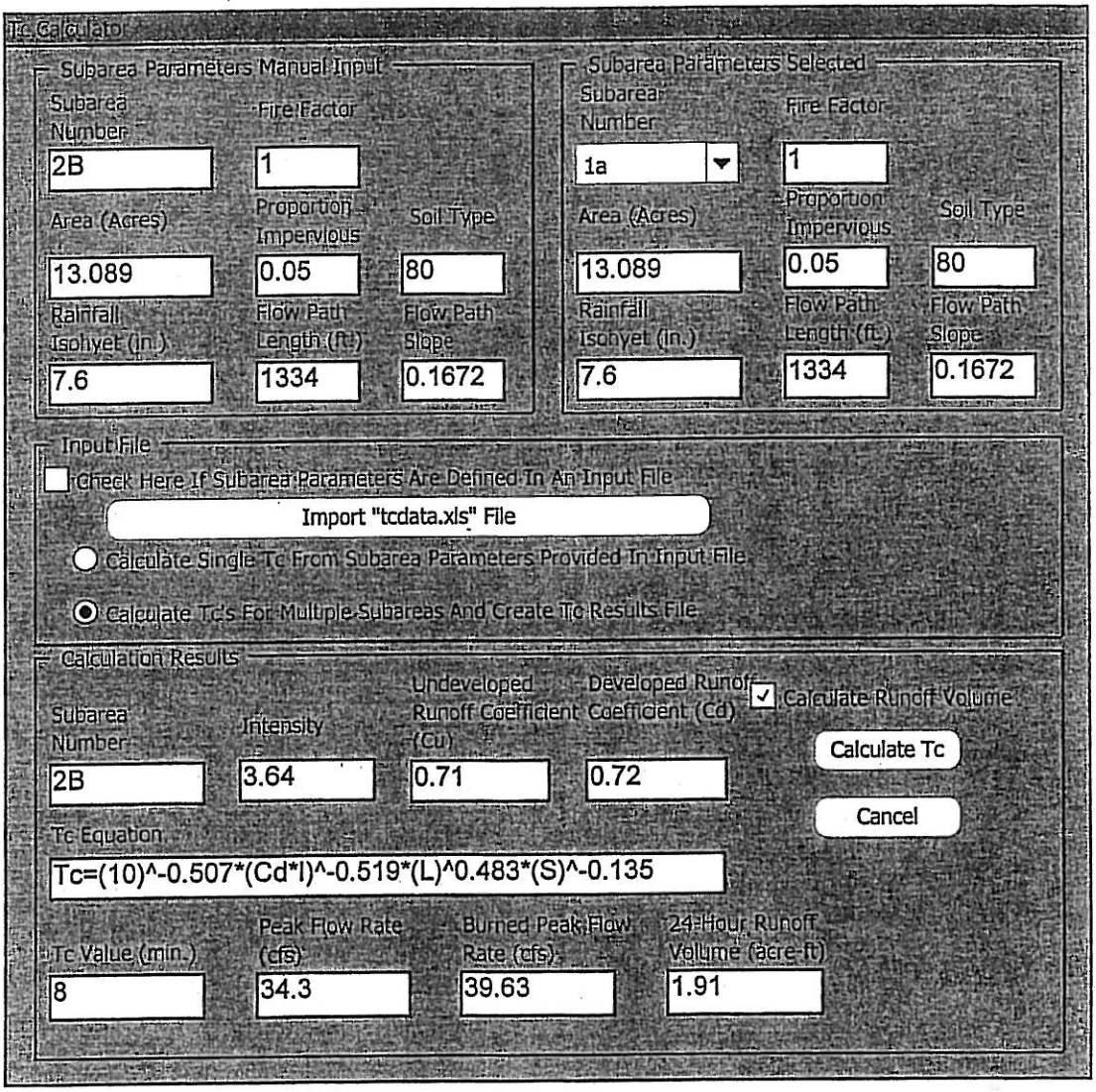
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
1334
Flow Path Slope
0.1672
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
13.089
Preportion Impervious
0.3
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
1334
Flow Path Slope
0.1672
Input File
Check Here If Subarea Parameters Are Defined In An Input File
Import "tcdata.xls" File
Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
Subarea Number
2A
Intensity
3.87
Undeveloped Runoff Coefficient (Cu)
0.73
Developed Runoff Coefficient (Cd)
0.78
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Tc Value (min.)
7
Peak Flow Rate (cfs)
39.51
Burned Peak Flow Rate (cfs)
n/a
24 Hour Runoff Volume (acre-ft)
3.37


Tc Calculator
Subarea Parameters Manual Input
Subarea Number
2B
Fire Factor
1
Area (Acres)
13.089
Proportion Impervious
0.05
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
1334
Flow Path Slope
0.1672
Subarea Parameters Selected
Subarea Number
1a
Fire Factor
1
Area (Acres)
13.089
Proportion Impervious
0.05
Soil Type
80
Rainfall Isohyet (in.)
7.6
Flow Path Length (ft.)
1334
Flow Path Slope
0.1672
Input File
Check Here If Subarea Parameters Are Defined In An Input File
Import "tcdata.xls" File
Calculate Single Tc From Subarea Parameters Provided In Input File
Calculate Tc's For Multiple Subareas And Create Tc Results File
Calculation Results
Subarea Number
2B
Intensity
3.64
Undeveloped Runoff Coefficient (Cu)
0.71
Developed Runoff Coefficient (Cd)
0.72
Calculate Runoff Volume
Calculate Tc
Cancel
Tc Equation
Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Tc Value (min.)
8
Peak Flow Rate (cfs)
34.3
Burned Peak Flow Rate (cfs)
39.63
24-Hour Runoff Volume (acre-ft)
1.91