2021

DRAINAGE STUDY

CALIBER COLLISION
CITY OF MENIFEE

February 2022

PREPARED BY: latitude 33 PLANNING & ENGINEERING

PREPARED FOR: Victory Development

JOB NUMBER: 1799.00

DRAINAGE STUDY

Caliber Collision

COUNTY OF SAN DIEGO, CALIFORNIA

FEBRUARY 9, 2022

Prepared For:

Victory Development
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02/07/2022

Nick Psyhogios, P.E. — Date
R.C.E. 67697 — Expires: 06/30/2023

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DECLARATION OF RESPONSIBLE CHARGE

I, HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

02/07/2022

Nick Psyhogios R.C.E. 67697 DATE

REGISTERED CIVIL ENGINEER

INTRODUCTION

The purpose of this report is to evaluate the existing and the proposed drainage conditions associated with the proposed Auto Repair Shop on Zeiders Road, APN 384-130-028, in the City of Menifee, in the County of Riverside, California. This project was analyzed in conformance with the County of Riverside Hydrology Manual, dated April 1978.

PROJECT DESCRIPTION

EXISTING CONDITION

The project site consists of approximately 2.37 acres of undeveloped land. The site lies immediately west of Zeiders Road and approximately 1000 feet south of Scott Road (see Appendix A for Vicinity Map). It is bordered by existing, light industrial developments in the north and west, and a residential property in the south. The vegetation consists of mostly grass and one tree. Stormwater generally drains from the southeast corner towards the northwest corner of the property. Offsite run-on from the property to the south enters the site along the southern property line and continues northwest through the site. The tributary area of offsite run-on from the south was not calculated, however, in final engineering further investigation and analysis of offsite run-on will be performed. Runoff leaving the site enters a natural drainage channel on the adjacent property to the west which continues north and connects to a series of man-made drainage channels and culverts which outlet to Canyon Lake, which discharges to the San Jacinto River, which discharges to Lake Elsinore. The onsite soil is classified as 30% HSG C and 70% HSG D according to the USDA NRCS Soil Survey (see Appendix E for HSG Map). See Existing Condition Drainage Map in **Appendix A** for more information.

DEVELOPED CONDITION

The proposed project consists of an autobody repair shop and a parking lot. The project footprint includes approximately 50,000 square feet of parking lot, 51,000 square feet of landscaping, and an 18,500 square foot building. In the proposed condition, the overall drainage pattern is maintained with runoff flowing towards the northwest corner of the site. Runoff from the eastern and northern areas of proposed site including driveways, walkways, parking, and landscaped areas will be directed towards a concrete ditch along the northern edge of the property, which will enter a stormdrain and convey runoff towards the proposed biofiltration basin to the west. The runoff from the building roof will be captured with roof drains which connect underground to a proposed stormdrain pie along the southern property line which continues west and outlets to the biofiltration basin for treatment and detention. This stormdrain line also receives runoff from the DG pathway along the southern edge of the proposed building via three catch basin inlets. Inlet capacity of catch basins will be calculated in final engineering. Runoff from the western parking area will sheet flow to the west and enter a gutter along the western parking edge and will be directed to the basin via curb cuts with rip-rap outlets. Curb cut and rip-rap sizing will be provided in final engineering.

The proposed biofiltration basin will provide water quality treatment, hydro mitigation, and peak flow rate detention for the 100-year storm. The basin is sized to have over 11,000 cubic feet of above-ground storage volume which will provide adequate detention to keep proposed peak flow rates leaving the site to less than or equal to peak flow rates leaving the site in the pre-project condition. Stormwater will outlet from this basin via an outlet control structure and stormdrain pipe at the northwest corner of the property where it will enter the existing drainage channel on the adjacent property to the west and continue to flow north towards Canyon Lake, the San Jacinto River, and Lake Elsinore.

Off-site run-on from the property to the south will no longer be able to flow northwest through the property because of the proposed development. To manage this off-site run-on, a stormdrain culvert is proposed midway along the southern property line which will intercept the run-on flow and convey it west and then north where it will discharge at the northwest corner of the property into the natural drainage ditch that continues north. The proposed bypass stormdrain pipe will be sized in final engineering to have adequate capacity to convey the off-site run-on from the 100-year storm. See Proposed Condition Drainage Map in **Appendix A** for more information.

METHODOLOGY

The existing and proposed stormwater peak flow rates have been calculated in conformance with the County of Riverside guidelines utilizing the Rational Method to estimate the 100-year storm runoff values. The determination of the Rational Method parameters is explained below, and the values are summarized in Tables 4-10 in Appendix C.

Time of Concentration

Existing Conditions

Due to the size and existing condition of the project site, the entire site was determined to be the initial subarea (see Existing Conditions Drainage Map in Appendix B). The time of concentration for this area was found by plotting the length of the longest flow path and the slope on the chart found on Plate D-3 (see **Appendix D**).

Proposed Conditions

In the proposed condition, the site was divided into three subbasins; P10, P11, and P12. The initial subarea for subbasins P10 and P12 were determined to be the areas where water flows over a surface (pavement or roof) before entering the proposed stormdrain network (see Proposed Conditions Drainage Map in Appendix D for delineation). Subbasin P11 was determined to consist only of initial subarea. Subbasin P10 represents the eastern portion of the proposed site and comprises parking, walkways, drive aisles and landscaping. Runoff from

this area drains north across pavement and through shallow gutters before entering a stormdrain culvert inlet at node 10.20. This stormdrain continues west where it discharges to the stormwater detention BMP at node 10.30. Subbasin P11 represents the western portion of the site which comprises parking, drive aisles, landscaping, and some building roof. This area drains overland northwest across the parking lot and discharges via gutters and a drainage ditch to the detention BMP at node 11.20. The proposed drainage ditch is very short (less than 20') and so the travel time through this segment was omitted from the calculations. Subbasin P12 represents the building roof. This area drains from north to south and enters roof drains which tie into a proposed stormdrain along the south of the building which continues west and discharges west to the biofiltration basin. This discharge point is represented by node 12.30. The time of concentration for each initial subbasin was determined from the charts on Plate D-3. The travel time for flow segments downstream of the initial subarea which represented by pipe flow were determined by plotting the flow from the initial subarea, the pipe diameter, and the slope of the pipe on the chart on Plate D-8.1 (see Appendix D). Using this diameter, the flow of the pipe flowing full was found, and this was used to determine the velocity of the pipe flowing full. The time of concentration was found by dividing the length of the pipe by this velocity. The total time of concentrations for each flow path was determined by adding the time of concentration of the initial subareas and the downstream subarea.

Rainfall Intensity

The rainfall intensity was found using the time of concentration and the 100-year storm rainfall intensity values from the chart for Sun City located on Plate D-4.1, sheet 5 (see Appendix D).

Runoff Coefficient

The runoff coefficient for the existing, undeveloped condition was found using Plate D-5.7 (see Appendix D) and interpolating between the provided C values. For the proposed condition, HSG was assumed to be D and plate D-5.4 was used. The runoff coefficients were found using the rainfall intensity and the curve for the 65% impervious condition for P11 and 90% impervious-Commercial developed condition was used for the rest. The antecedent moisture condition (AMC) was assumed to be II.

Peak Flow Rate Analysis

A Point of Compliance (POC) was determined at the northwest corner of the property where runoff leaves the site in both the existing and proposed condition. This is labeled as POC 1 on the Existing and Proposed Drainage Maps in **Appendix A**. Peak flow rates at POC 1 were calculated using the Rational Method formula Q=CIA from the values obtained above for the existing and proposed condition. In the post-development condition, the peak flow rates and time of concentrations from the three subbasins were combined at the BMP using the

confluence equations calculation methods on plate D-1 of the County Hydrology Manual to achieve a singular peak flow rate and time of concentration.

Due to the increase in proposed impervious area, peak flow rates will increase in the post-development unmitigated condition, and so a Biofiltration Basin will be included in the design to provide peak flow rate attenuation. The BMP has been designed to satisfy the requirements for stormwater pollutant control and hydromodification in accordance with the Water Quality Management Plan guidance for the Santa Ana Region of Riverside County. See associated Water Quality Management Plan for more information. Storage volume in addition to the water quality volume will be included to achieve adequate storage to detain runoff in the 100-year storm. As proposed, the BMP has over 11,000 cubic feet of storage. Further calculations to confirm BMP sizing will be performed in final engineering.

In final engineering, Autodesk Storm and Sanitary Analysis (SSA) software will be used to create a model for BMP-mitigation. In the model, the proposed biofiltration basin will be represented by a storage node with an inflow equal to the proposed-unmitigated flow that was calculated using the Rational Method. An HMP orifice, mid-flow orifice and emergency spillway weir will connect to this node as outlets. The different outlet devices will provide outflow rates which will optimize detention as storm intensities vary. Since the runoff will leave the site after it leaves the basin, the peak flow rate from the model will be compared to the existing condition peak flow rate. The required detention volume of the biofiltration basin will be determined by using SSA to ensure that the peak flow rate from the basin is less than that of the existing leaving the site in the 100-year storm., and (in final engineering) **Appendix F** for Biofiltration Basin Sizing and Detention Analysis.

RESULTS AND CONCLUSION

The existing and proposed-unmitigated condition results are summarized in Tables 1, 2, and 3 below.

Table 1

Existing Runoff	
CA	1.97
I (in/hr)	2.89
Q (cfs)	**5.68**

Table 2

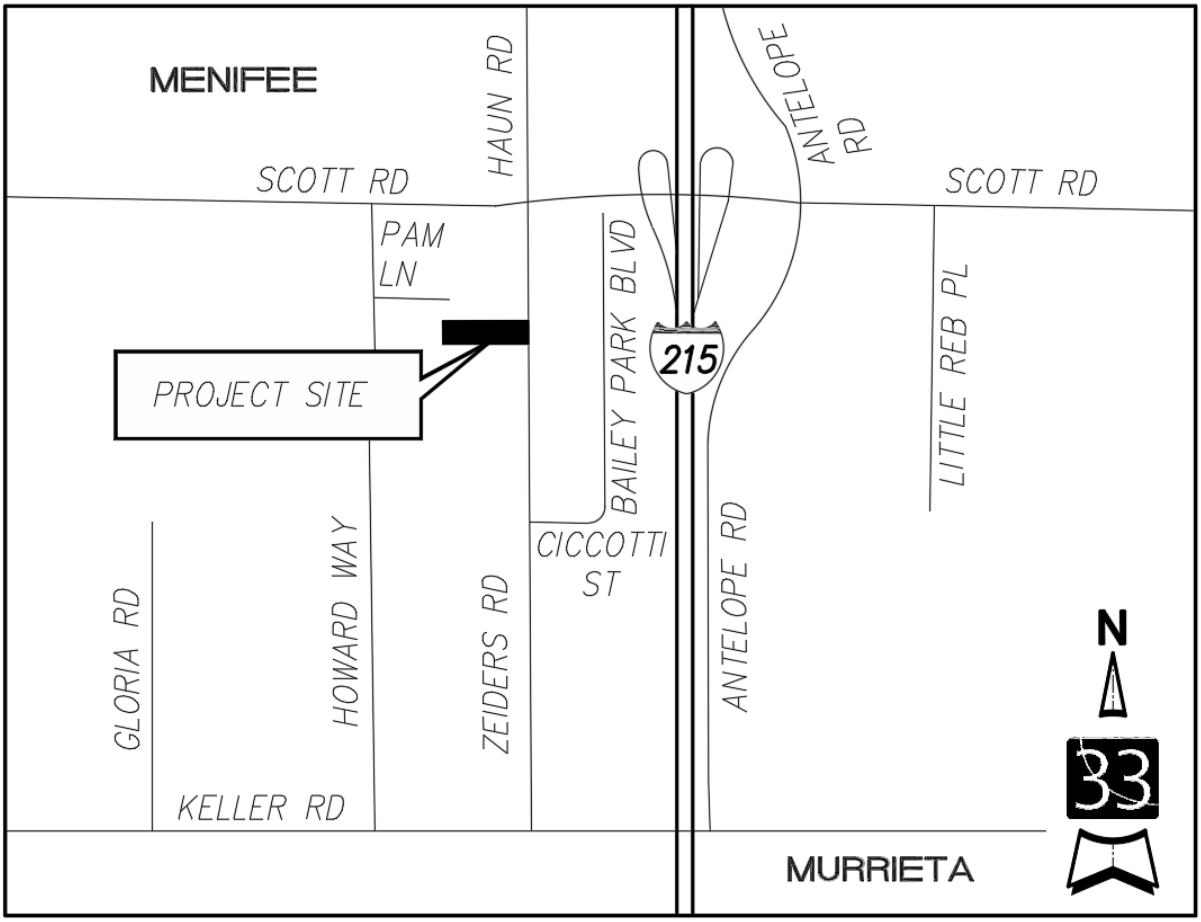
Proposed Runoff			
	CA	I (in/hr)	**Q (cfs)**
P10	0.51	3.69	**1.89**
P11	1.16	4.27	**4.94**
P12	0.42	4.25	**1.80**

Table 3

Overall Runoff Summary		
	Existing Condition	Proposed-Unmitigated Condition
Time of Concentration (min)	20.7	6.30
Contributing Area (acres)	2.40	2.37
Total 100-year Q (cfs)	5.68	8.16
*Proposed mitigated peak flow will be calculated in final engineering, but will be equal to or less than existing condition		

From existing to proposed-unmitigated conditions, the overall peak Q_{100} increased due to the increase in impervious areas on the site. However, the proposed biofiltration basin will be sized appropriately to mitigate the peak flow rates to be at or below the pre-development flow rates. An analysis for the detention provided by the biofiltration basin will be included in final engineering.

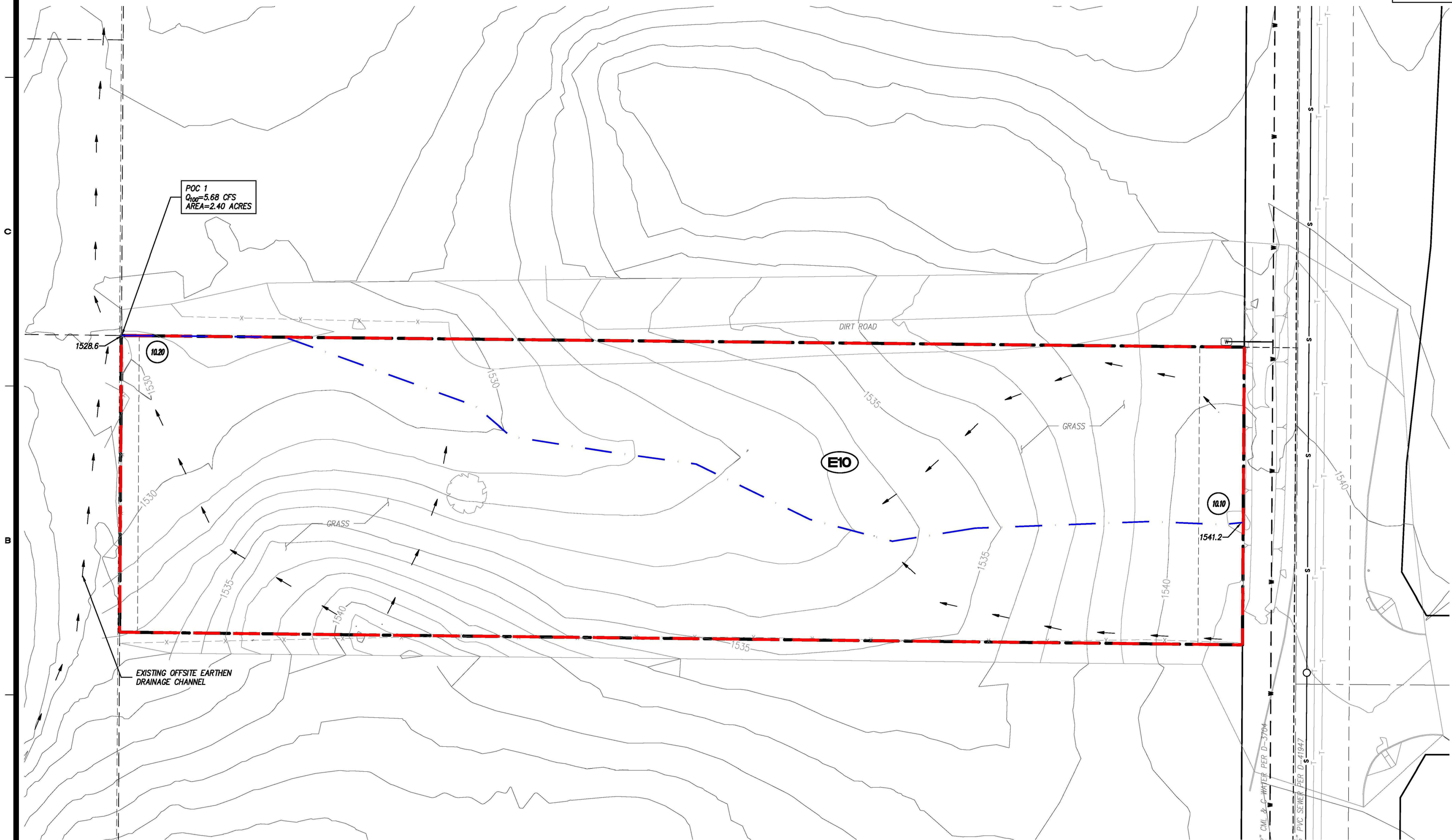
APPENDIX A – VICINITY MAP

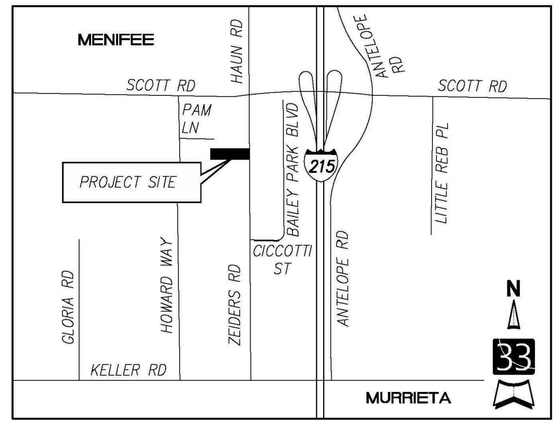


VICINITY MAP
NO SCALE

APPENDIX B – EXISTING AND PROPOSED DRAINAGE MAPS

EXISTING CONDITIONS





VICINITY MAP
NO SCALE

LEGEND

- RIGHT-OF-WAY LINE
- PROPERTY LINE
- MAJOR CONTOUR (365)
- MINOR CONTOUR
- K-RAIL
- FENCE
- TREES/SHRUBS
- MAJOR BASIN DIVIDE/ PROJECT LIMITS
- SUB-BASINS
- DRAINAGE PATTERNS
- FLOWLINE
- CONVEYANCE LINK
- SUB-BASIN ID (XXXX)
- NODE ID

N

0 15 30 60 90
(IN FEET)
1 inch = 30 ft.

latitude 33
PLANNING & ENGINEERING
9968 Hibert Street 2nd Floor, San Diego, CA 92131
Tel 858.751.0633

DATE	REVISION	BY
10.27.2021	CUP APPLICATION	MAM
02.11.2022	2ND CUP SUBMITTAL	MAM

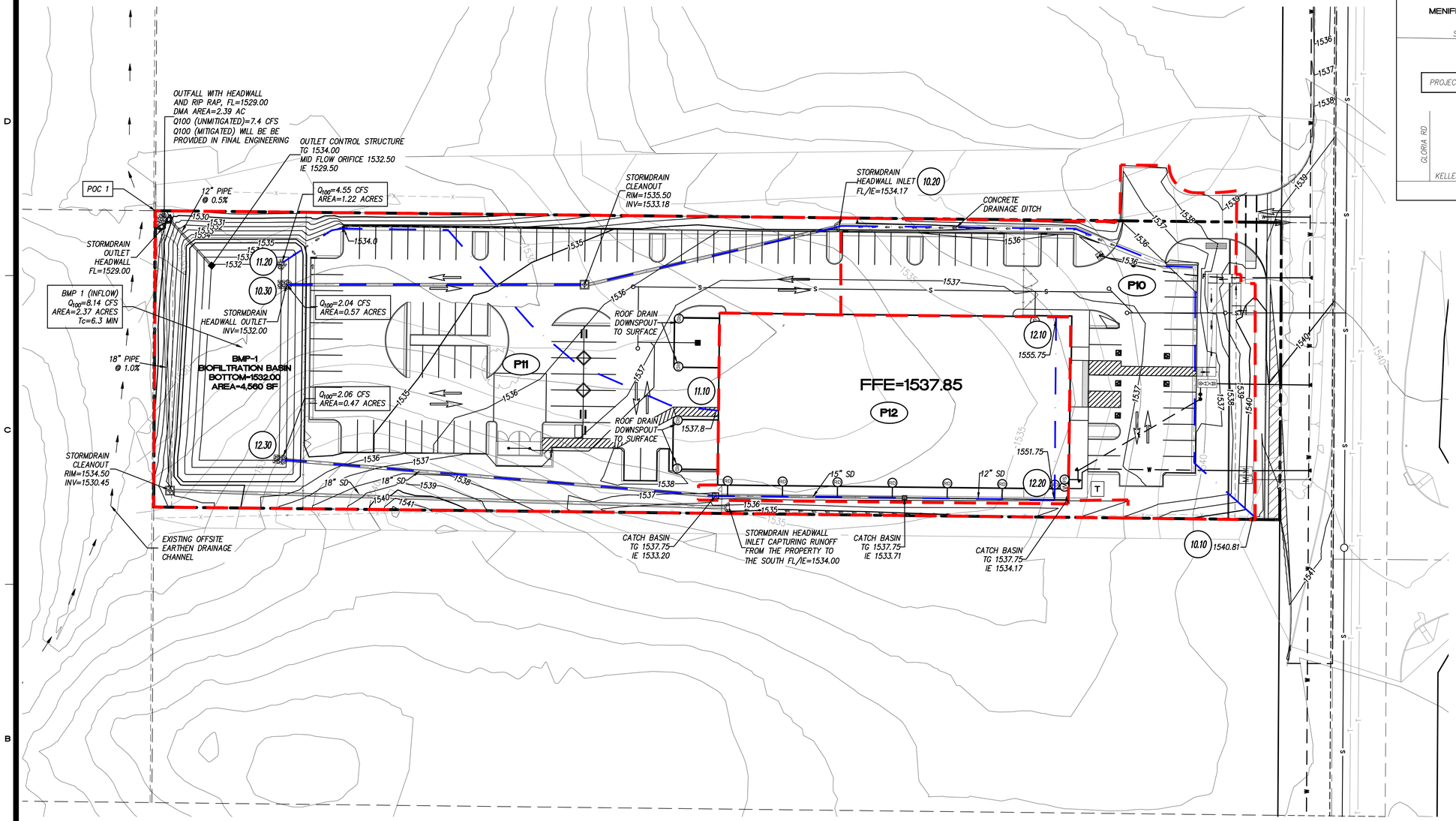
CALIBER COLLISION

33235-33185 ZEIDERS RD, MENIFEE, CA 92584

L33 PROJECT NUMBER (PN): 1799.00
OTHER PN: XXXX.XX
DESIGNED BY: MAM DATE: 10.27.2021
DRAWN BY: MAM DATE: 10.27.2021
CHECKED BY: SDD DATE: 10.27.2021

SHEET
1 OF 2

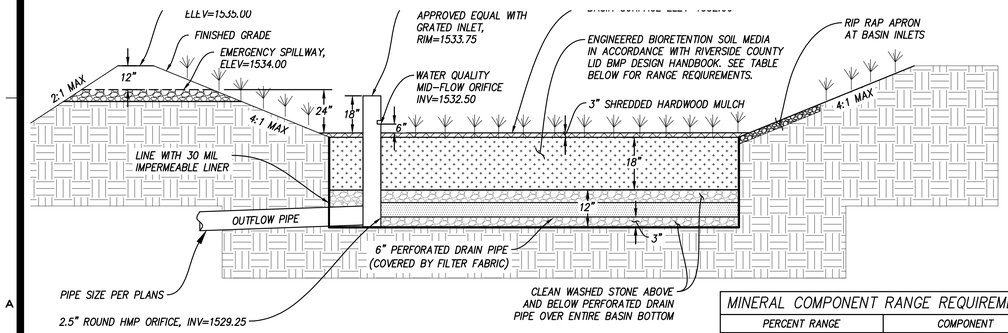
PROPOSED CONDITIONS



VICINITY MAP
NO SCALE

LEGEND

- RIGHT-OF-WAY LINE
- PROPERTY LINE
- MAJOR CONTOUR
- MINOR CONTOUR (365)
- K-RAIL
- FENCE
- TREES/SHRUBS
- SUB-BASINS
- DRAINAGE PATTERNS
- FLOWLINE
- CONVEYANCE LINK
- INITIAL SUB-BASIN ID (XXXX)
- NODE ID (XXXX)
- ELEVATION AT NODE XX.XX



MINERAL COMPONENT RANGE REQUIREMENTS	
PERCENT RANGE	COMPONENT
70–80	SAND
15–20	SILT
5–10	CLAY

NOTE: BIOFILTRATION BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH RIVERSIDE COUNTY LOW IMPACT DEVELOPMENT BMP DESIGN HANDBOOK AND PROJECT SPECIFIC WATER QUALITY MANAGEMENT PLAN FOR THE SANTA ANA WATERSHED REGION

BIOFILTRATION BASIN 1
NTS

SUBBASIN TABLE

SUBBASIN ID	AREA (AC)	CURVE NUMBER (C)	TC (MIN)	I (IN/HR)	Q100 (CFS)
P10	0.57	0.896	8.27	3.69	189
P11	1.32	0.875	6.3	4.27	4.94
P12	0.47	0.8970	6.39	4.25	1.80
SUM	2.37				

N

0 15 30 60 90
(IN FEET)
1 inch = 30 ft.

latitude 33
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DATE	REVISION	BY
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SHEET 2 OF 2

APPENDIX C – RATIONAL METHOD PARAMETERS

Pre-Development Rational Method Parameters

Table 4	
Tc for Initial Subarea - E10 (Node 10.10 to 10.20)	
L (ft)	650
Upstream Elev (ft)	1541.2
Downstream Elev (ft)	1528.6
H (ft)	12.6
K	Undeveloped - Fair Cover
Tc from Plate D-3 (min)	**20.7**

Table 5	
Runoff Coefficient - E10	
Cover	Grass - 30% C, 70% D
RI	82.5
Intensity (in/hr)	2.89
C	0.82
Area (acres)	2.40

Table 6	
Rainfall Intesity for 100-year Storm for Sun City	
Tc (min)	20.7
Rainfall Intensity (in/hr)	2.89

Table 7	
Existing Runoff	
CA	1.97
I (in/hr)	2.89
Q (cfs)	**5.68**

Post-Development Rational Method Parameters

Table 8

Tc for Initial Subarea - P10 (Node 10.10 to 10.20)	
L (ft)	356
Upstream Elev (ft)	1540.81
Downstream Elev (ft)	1534.35
H (ft)	6.46
K	Commercial - Paved
Tc from Plate D-3 (min)	**7.25**
Tc for Remaining Flow Path (Node 10.20 to 10.30)	
Initial Q (cfs)	2.04
Slope (ft/ft)	0.0075
Length (ft)	315
D from Plate D-8.1 (in)	12
Q_{full} (cfs)	4.05
A_{full} (ft^2)	0.79
V_{full} (fps)	5.16
Tc (min)	**1.02**
Total Tc from Node 10.10 to 10.30	**8.27**

Table 9

Tc for Initial Subarea - P11 (Node 11.10 to 11.20)	
L (ft)	246
Upstream Elev (ft)	1537.8
Downstream Elev (ft)	1534
H (ft)	3.8
K	Commercial - Paved
Tc from Plate D-3 (min)	**6.3**

Table 10

Tc for Initial Subarea -P12 (Node 12.10 to 12.20)	
L (ft)	100
Upstream Elev (ft)	1555.75
Downstream Elev (ft)	1551.75
H (ft)	4
K	Commercial - Paved
Tc from Plate D-3 (min)	**5**
Tc for Remaining Flow Path (Node 12.20 to 12.30)	
Initial Q (cfs)	2.06
Slope (ft/ft)	0.0075
Length (ft)	430
D from Plate D-8.1 (in)	12
Q_{full} (cfs)	4.05
A_{full} (ft^2)	0.79
V_{full} (fps)	5.16
Tc (min)	**1.39**
Total Tc from Node 10.10 to 10.30	**6.39**

Table 11

Rainfall Intensity for 100-year Storm for Sun City (Plate D-4.1)		
	Tc (min)	Rainfall Intensity (in/hr)
Node 10.10 to 10.20	7.25	3.99
Node 10.10 to 10.30	8.27	3.69
Node 11.10 to 11.20	6.30	4.27
Node 12.10 to 12.20	5.00	4.85
Node 12.10 to 12.30	6.39	4.25

Table 12

Runoff Coefficient					
	Cover	RI	Intensity (in/hr)	C	Area (acres)
P10	90% Impervious	-	3.69	0.90	0.57
P11	65% Impervious	-	4.27	0.88	1.32
P12	90% Impervious	-	4.25	0.90	0.47

Table 13

Proposed Runoff			
	CA	I (in/hr)	**Q (cfs)**
P10	0.51	3.69	**1.89**
P11	1.16	4.27	**4.94**
P12	0.42	4.25	**1.80**

Table 14

Junction Analysis

Junction Calculation 1				
P10			P11	
Qa	1.89		Qb	4.94
Ta	8.27		Tb	6.30
Ia	3.69		Ib	4.27
Qp1=	**6.39**	<--- NEW Q		
Tp1=	**6.30**	<--- NEW Tc		

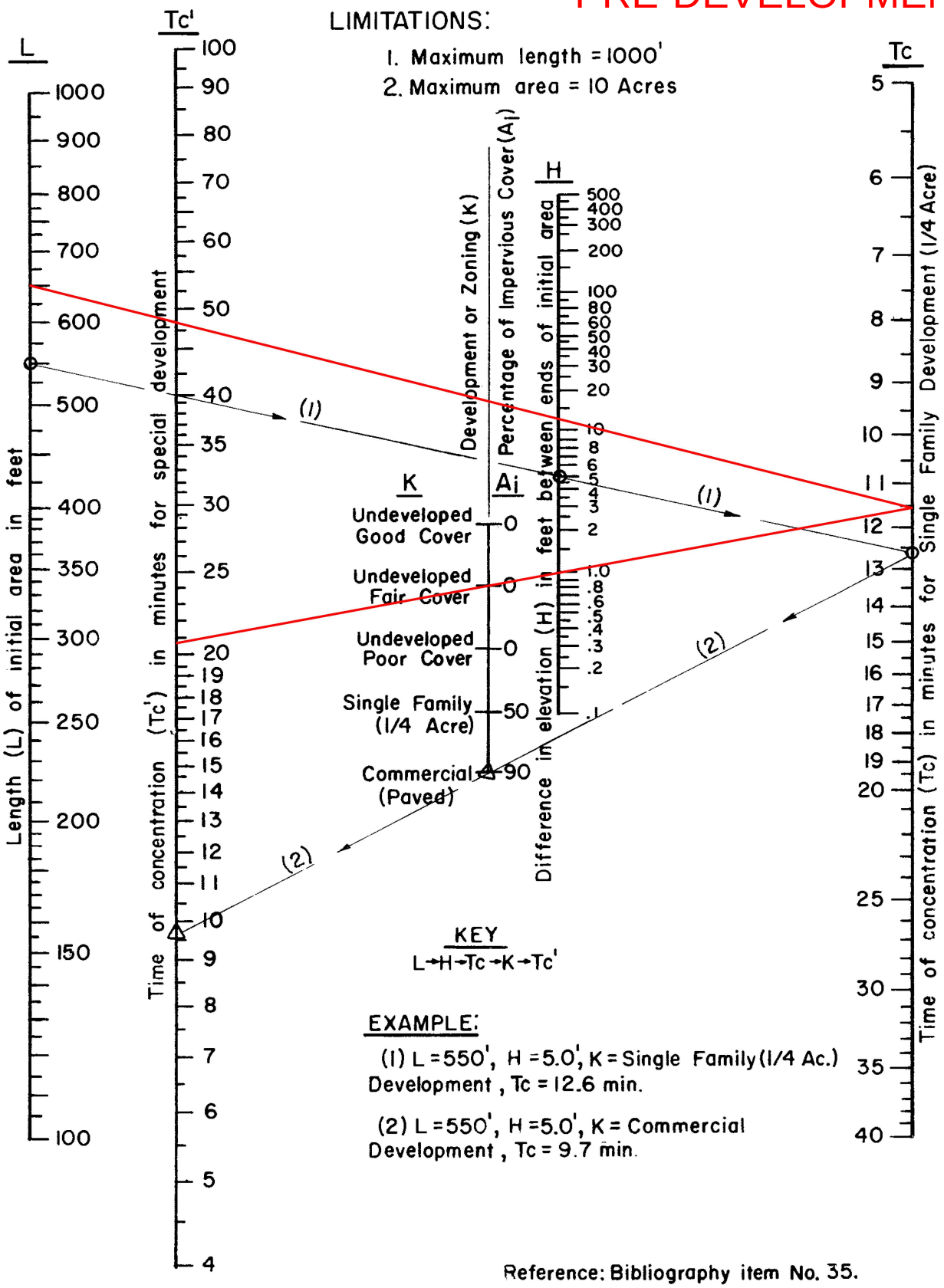
Junction Calculation 2				
P12			Above	
Qa	1.80		Qb	6.39
Ta	6.39		Tb	6.30
Ia	4.25		Ib	-
Qp2=	**8.16**	<--- NEW Q		
Tp2=	**6.30**	<--- NEW Tc		

Final Qpeak into BMP = Qp2

Final Tc into BMP = Tp2

APPENDIX D – COUNTY OF RIVERSIDE HYDROLOGY MANUAL REFERENCES

PRE-DEVELOPMENT



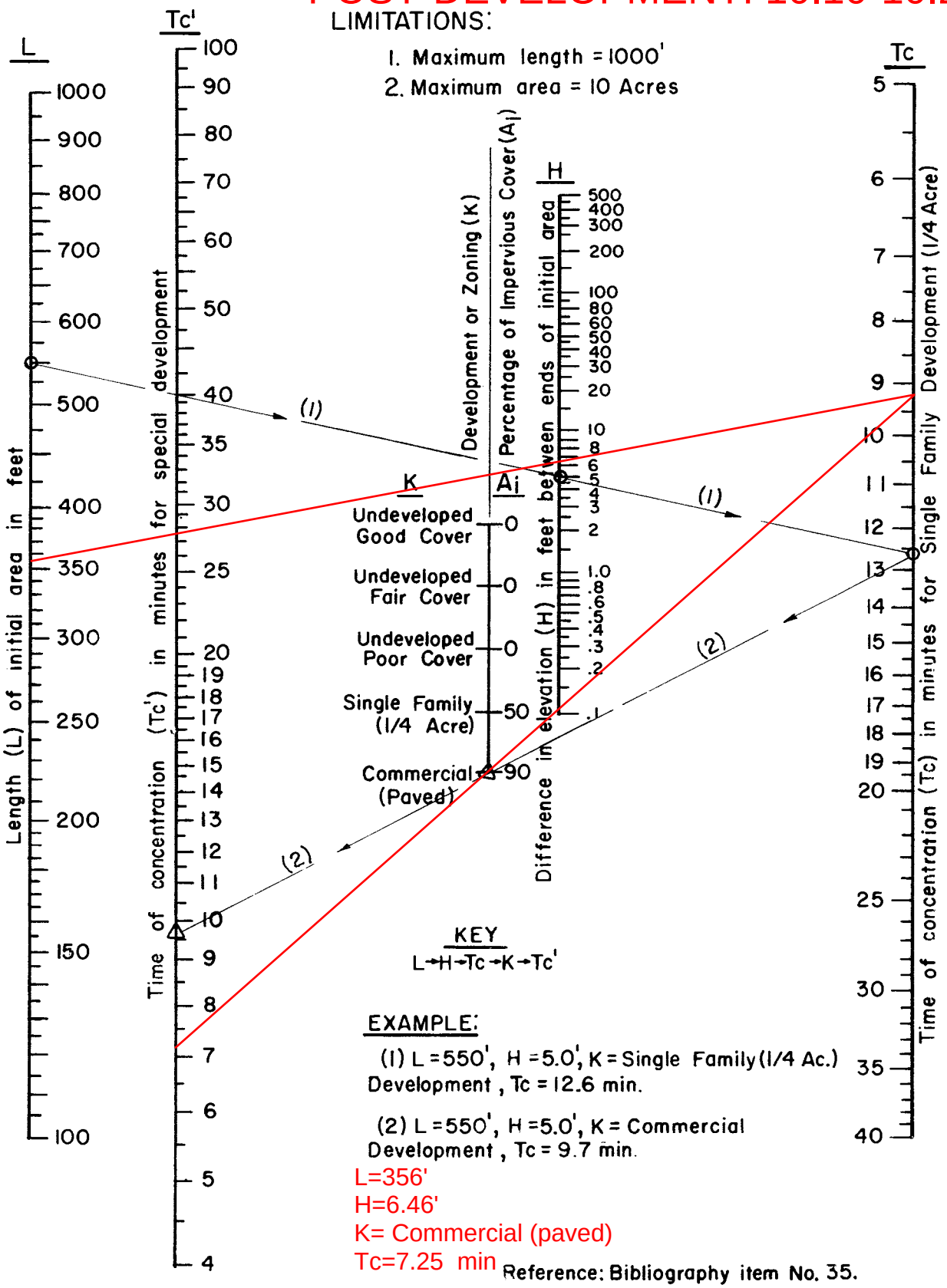
Reference: Bibliography item No. 35.

RCFC & WCD
HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

POST-DEVELOPMENT: 10.10-10.20



Reference: Bibliography item No. 35.

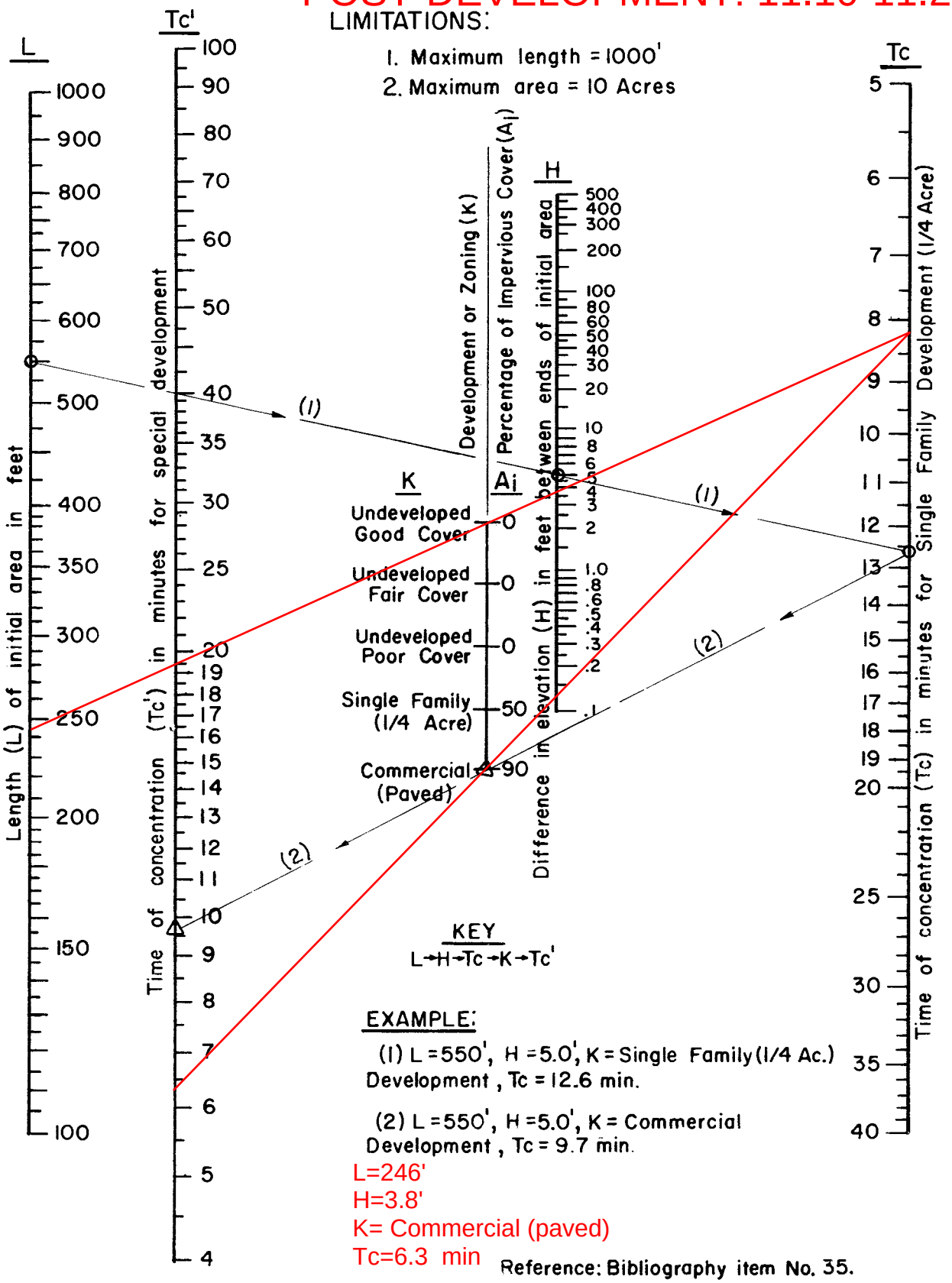
RCFC & WCD

HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

POST-DEVELOPMENT: 11.10-11.20



Reference: Bibliography item No. 35.

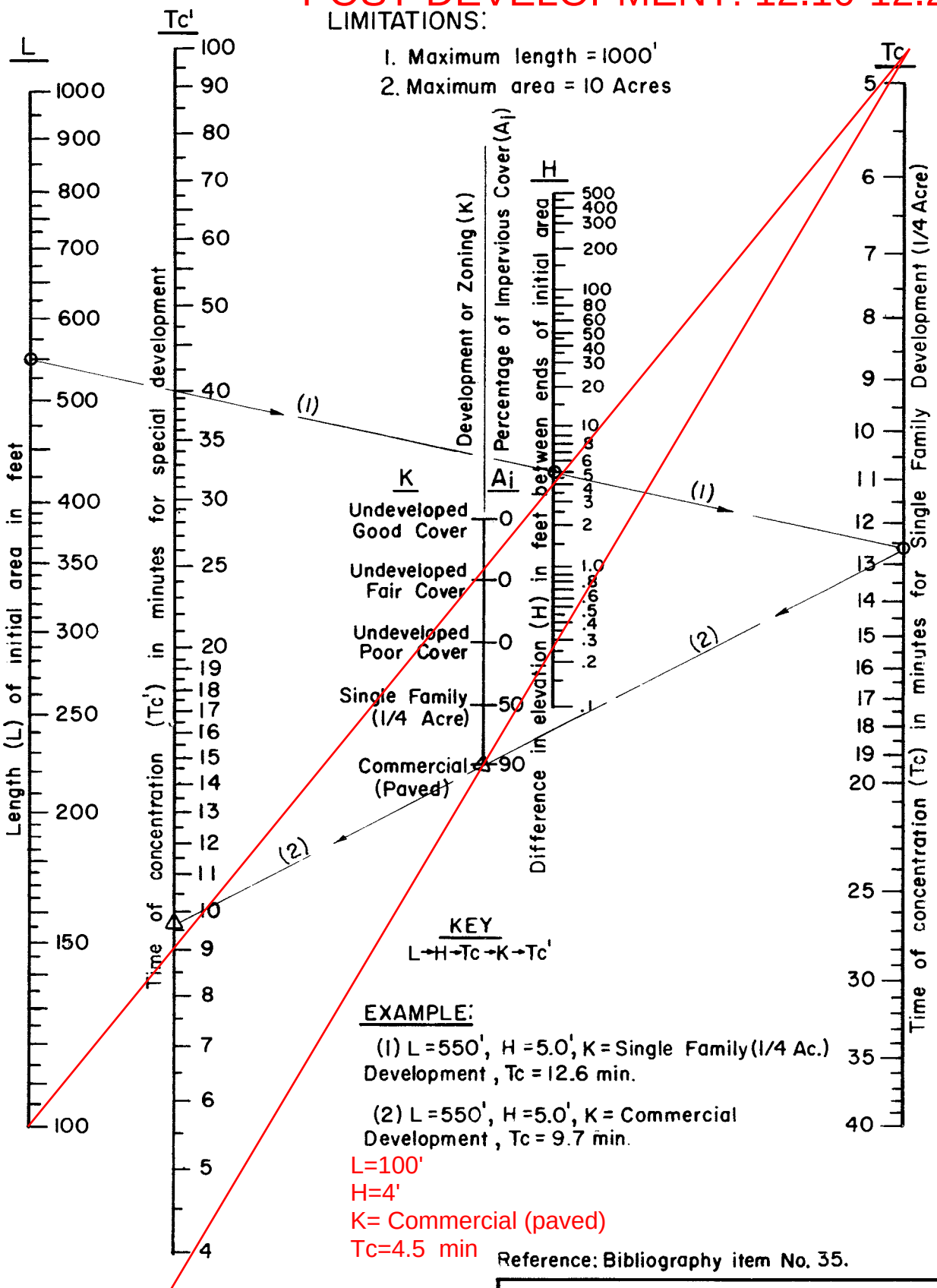
RCFC & WCD

HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

POST-DEVELOPMENT: 12.10-12.20



Reference: Bibliography item No. 35.

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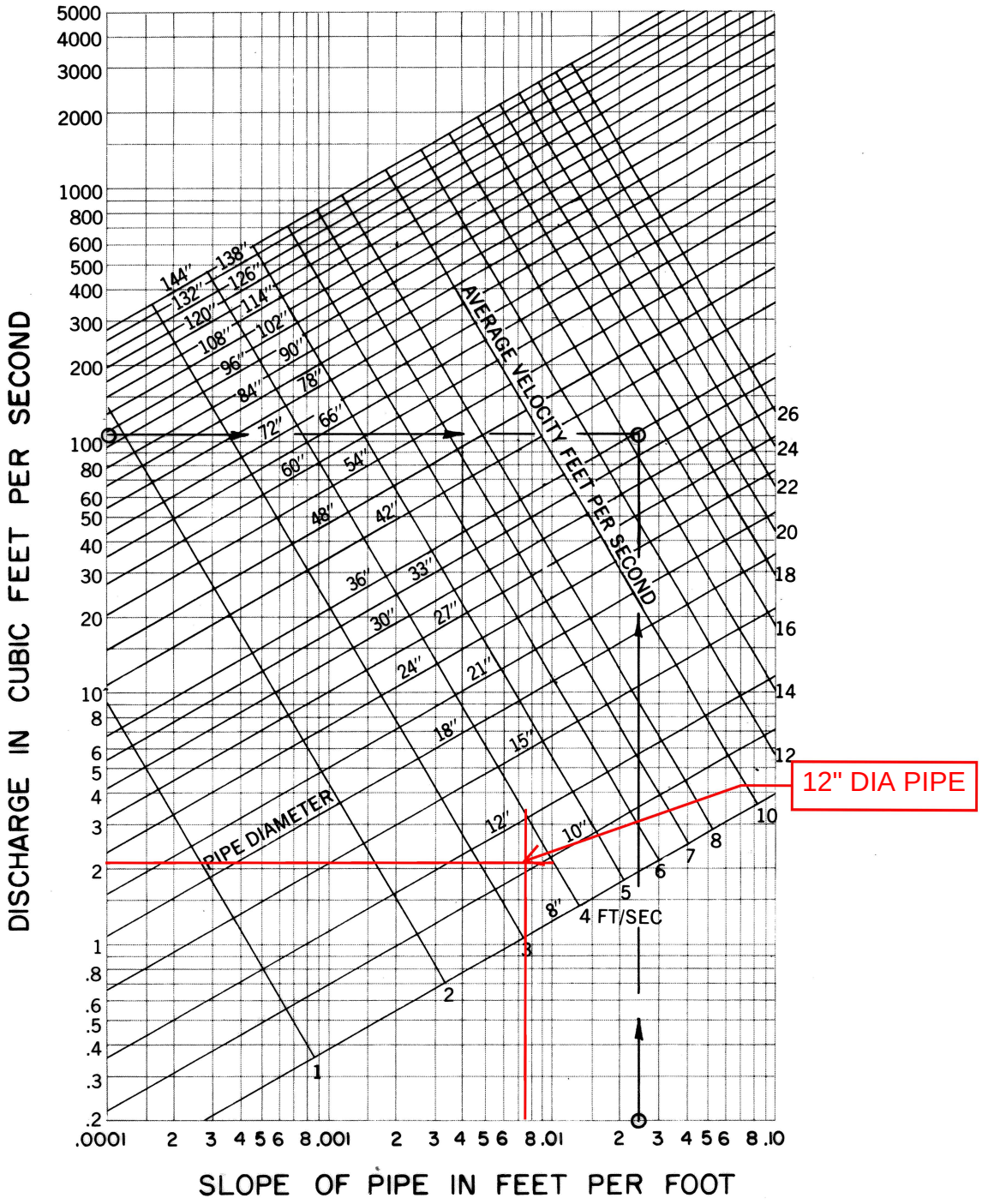
HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

REQUIRED PIPE SIZE

BASED ON MANNING'S EQUATION n=0.013



EXAMPLE:

Given Q = 105 cfs and S = 2.5 % find required pipe size and velocity. From curves required Size = 36"ϕ and Velocity = 14.8 fps

Reference: Bibliography item No. 10.

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HYDROLOGY MANUAL

VELOCITY DISCHARGE CURVE
CIRCULAR CONCRETE PIPES FLOWING FULL

PLATE D-8.1

RUNOFF INDEX NUMBER TO FIND C VALUE

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

Weighted
RI=0.7*84+.3*79=82.5

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HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS FOR PERVIOUS AREA

PLATE D-5.5 (1 of 2)

RUNOFF COEFFICIENT FOR RI=82

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HYDROLOGY MANUAL

RUNOFF COEFFICIENT CURVE DATA

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 76

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.49	.63	.70	.74	.77	.79	.80	.81	.83	.84
5.	.04	.51	.65	.71	.75	.78	.79	.81	.82	.83	.84
10.	.09	.53	.66	.72	.76	.78	.80	.81	.82	.84	.85
15.	.13	.55	.67	.73	.77	.79	.81	.82	.83	.84	.85
20.	.18	.57	.69	.74	.77	.80	.81	.82	.83	.84	.85
25.	.22	.59	.70	.75	.78	.80	.82	.83	.84	.85	.86
30.	.27	.61	.71	.76	.79	.81	.82	.83	.84	.85	.86
35.	.31	.63	.73	.77	.80	.82	.83	.84	.84	.85	.86
40.	.36	.65	.74	.78	.81	.82	.83	.84	.85	.86	.86
45.	.40	.67	.75	.79	.81	.83	.84	.85	.85	.86	.87
50.	.45	.69	.77	.80	.82	.84	.84	.85	.86	.87	.87
55.	.49	.71	.78	.81	.83	.84	.85	.86	.86	.87	.87
60.	.54	.74	.79	.82	.84	.85	.86	.86	.87	.87	.88
65.	.58	.76	.81	.83	.85	.85	.86	.87	.87	.88	.88
70.	.63	.78	.82	.84	.85	.86	.87	.87	.87	.88	.88
75.	.67	.80	.83	.85	.86	.87	.87	.88	.88	.88	.89
80.	.72	.82	.85	.86	.87	.87	.88	.88	.88	.89	.89
85.	.76	.84	.86	.87	.88	.88	.88	.89	.89	.89	.89
90.	.81	.86	.87	.88	.88	.89	.89	.89	.89	.89	.89
95.	.86	.88	.89	.89	.89	.89	.89	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 78

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.51	.65	.72	.76	.78	.80	.81	.82	.84	.85
5.	.04	.53	.67	.73	.76	.79	.80	.82	.83	.84	.85
10.	.09	.55	.68	.74	.77	.79	.81	.82	.83	.84	.85
15.	.13	.57	.69	.75	.78	.80	.81	.83	.83	.85	.85
20.	.18	.59	.70	.76	.79	.81	.82	.83	.84	.85	.86
25.	.22	.61	.72	.76	.79	.81	.82	.83	.84	.85	.86
30.	.27	.63	.73	.77	.80	.82	.83	.84	.85	.86	.86
35.	.31	.65	.74	.78	.81	.82	.83	.84	.85	.86	.87
40.	.36	.67	.75	.79	.81	.83	.84	.85	.85	.86	.87
45.	.40	.69	.76	.80	.82	.84	.84	.85	.86	.87	.87
50.	.45	.71	.78	.81	.83	.84	.85	.86	.86	.87	.87
55.	.49	.73	.79	.82	.84	.85	.85	.86	.87	.87	.88
60.	.54	.75	.80	.83	.84	.85	.86	.87	.87	.87	.88
65.	.58	.76	.81	.84	.85	.86	.86	.87	.87	.88	.88
70.	.63	.78	.83	.85	.86	.86	.87	.87	.88	.88	.88
75.	.67	.80	.84	.85	.86	.87	.87	.88	.88	.88	.89
80.	.72	.82	.85	.86	.87	.88	.88	.88	.88	.89	.89
85.	.76	.84	.86	.87	.88	.88	.88	.89	.89	.89	.89
90.	.81	.86	.88	.88	.89	.89	.89	.89	.89	.89	.89
95.	.86	.88	.89	.89	.89	.89	.89	.89	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 80

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.54	.67	.74	.77	.79	.81	.82	.83	.84	.85
5.	.04	.56	.69	.74	.78	.80	.81	.83	.83	.85	.86
10.	.09	.58	.70	.75	.78	.80	.82	.83	.84	.85	.86
15.	.13	.59	.71	.76	.79	.81	.82	.83	.84	.85	.86
20.	.18	.61	.72	.77	.80	.82	.83	.84	.84	.86	.86
25.	.22	.63	.73	.78	.80	.82	.83	.84	.85	.86	.86
30.	.27	.65	.74	.79	.81	.83	.84	.85	.85	.86	.87
35.	.31	.67	.75	.79	.82	.83	.84	.85	.86	.86	.87
40.	.36	.68	.76	.80	.82	.84	.85	.85	.86	.87	.87
45.	.40	.70	.78	.81	.83	.84	.85	.86	.86	.87	.87
50.	.45	.72	.79	.82	.84	.85	.86	.86	.87	.87	.88
55.	.49	.74	.80	.83	.84	.85	.86	.86	.87	.87	.88
60.	.54	.76	.81	.83	.85	.86	.86	.87	.87	.88	.88
65.	.58	.77	.82	.84	.86	.86	.87	.87	.88	.88	.88
70.	.63	.79	.83	.85	.86	.87	.87	.88	.88	.88	.89
75.	.67	.81	.84	.86	.87	.87	.88	.88	.88	.89	.89
80.	.72	.83	.86	.87	.87	.88	.88	.88	.89	.89	.89
85.	.76	.85	.87	.88	.88	.88	.89	.89	.89	.89	.89
90.	.81	.86	.88	.88	.88	.89	.89	.89	.89	.89	.90
95.	.86	.88	.89	.89	.89	.89	.90	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 82

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.57	.70	.75	.79	.81	.82	.83	.84	.85	.86
5.	.04	.58	.71	.76	.79	.81	.82	.83	.84	.85	.86
10.	.09	.60	.72	.77	.80	.82	.83	.84	.84	.86	.86
15.	.13	.62	.73	.78	.80	.82	.83	.84	.85	.86	.86
20.	.18	.63	.74	.78	.81	.82	.84	.84	.85	.86	.87
25.	.22	.65	.75	.79	.81	.83	.84	.85	.85	.86	.87
30.	.27	.67	.76	.80	.82	.83	.84	.85	.86	.87	.87
35.	.31	.68	.77	.80	.83	.84	.85	.85	.86	.87	.87
40.	.36	.70	.78	.81	.83	.84	.85	.86	.86	.87	.87
45.	.40	.72	.79	.82	.84	.85	.86	.86	.87	.87	.88
50.	.45	.73	.80	.83	.84	.85	.86	.87	.87	.88	.88
55.	.49	.75	.81	.83	.85	.86	.86	.87	.87	.88	.88
60.	.54	.77	.82	.84	.85	.86	.87	.87	.88	.88	.88
65.	.58	.78	.83	.85	.86	.87	.87	.88	.88	.88	.89
70.	.63	.80	.84	.86	.87	.87	.88	.88	.88	.89	.89
75.	.67	.82	.85	.86	.87	.88	.88	.88	.88	.89	.89
80.	.72	.83	.86	.87	.88	.88	.88	.89	.89	.89	.89
85.	.76	.85	.87	.88	.88	.89	.89	.89	.89	.89	.89
90.	.81	.87	.88	.89	.89	.89	.89	.89	.89	.90	.90
95.	.86	.88	.89	.89	.89	.90	.90	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENT FOR RI=84

RCFC & WCD

HYDROLOGY MANUAL

RUNOFF COEFFICIENT CURVE DATA

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 84

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.60	.72	.77	.80	.82	.83	.84	.85	.86	.86
5.	.04	.61	.73	.78	.80	.82	.83	.84	.85	.86	.87
10.	.09	.63	.74	.78	.81	.83	.84	.85	.85	.86	.87
15.	.13	.64	.75	.79	.81	.83	.84	.85	.85	.86	.87
20.	.18	.66	.75	.80	.82	.83	.84	.85	.86	.87	.87
25.	.22	.67	.76	.80	.82	.84	.85	.85	.86	.87	.87
30.	.27	.69	.77	.81	.83	.84	.85	.86	.86	.87	.87
35.	.31	.70	.78	.82	.83	.85	.85	.86	.87	.87	.88
40.	.36	.72	.79	.82	.84	.85	.86	.86	.87	.87	.88
45.	.40	.73	.80	.83	.84	.85	.86	.87	.87	.88	.88
50.	.45	.75	.81	.83	.85	.86	.86	.87	.87	.88	.88
55.	.49	.76	.82	.84	.85	.86	.87	.87	.88	.88	.88
60.	.54	.78	.83	.85	.86	.87	.87	.88	.88	.88	.89
65.	.58	.79	.84	.85	.86	.87	.88	.88	.88	.88	.89
70.	.63	.81	.85	.86	.87	.88	.88	.88	.88	.89	.89
75.	.67	.82	.85	.87	.87	.88	.88	.88	.89	.89	.89
80.	.72	.84	.86	.87	.88	.88	.89	.89	.89	.89	.89
85.	.76	.85	.87	.88	.88	.89	.89	.89	.89	.89	.89
90.	.81	.87	.88	.89	.89	.89	.89	.89	.89	.90	.90
95.	.86	.88	.89	.89	.89	.90	.90	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 86

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.63	.74	.79	.81	.83	.84	.85	.85	.86	.87
5.	.04	.64	.75	.79	.82	.83	.84	.85	.86	.86	.87
10.	.09	.65	.76	.80	.82	.84	.85	.85	.86	.87	.87
15.	.13	.67	.76	.80	.83	.84	.85	.86	.86	.87	.87
20.	.18	.68	.77	.81	.83	.84	.85	.86	.86	.87	.87
25.	.22	.70	.78	.81	.83	.85	.85	.86	.87	.87	.88
30.	.27	.71	.79	.82	.84	.85	.86	.86	.87	.87	.88
35.	.31	.72	.80	.83	.84	.85	.86	.87	.87	.88	.88
40.	.36	.74	.80	.83	.85	.86	.86	.87	.87	.88	.88
45.	.40	.75	.81	.84	.85	.86	.87	.87	.87	.88	.88
50.	.45	.76	.82	.84	.86	.86	.87	.87	.88	.88	.88
55.	.49	.78	.83	.85	.86	.87	.87	.88	.88	.88	.89
60.	.54	.79	.84	.85	.86	.87	.88	.88	.88	.89	.89
65.	.58	.80	.84	.86	.87	.87	.88	.88	.88	.89	.89
70.	.63	.82	.85	.87	.87	.88	.88	.88	.89	.89	.89
75.	.67	.83	.86	.87	.88	.88	.88	.89	.89	.89	.89
80.	.72	.85	.87	.88	.88	.89	.89	.89	.89	.89	.89
85.	.76	.86	.88	.88	.89	.89	.89	.89	.89	.89	.90
90.	.81	.87	.88	.89	.89	.89	.89	.89	.90	.90	.90
95.	.86	.89	.89	.89	.90	.90	.90	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

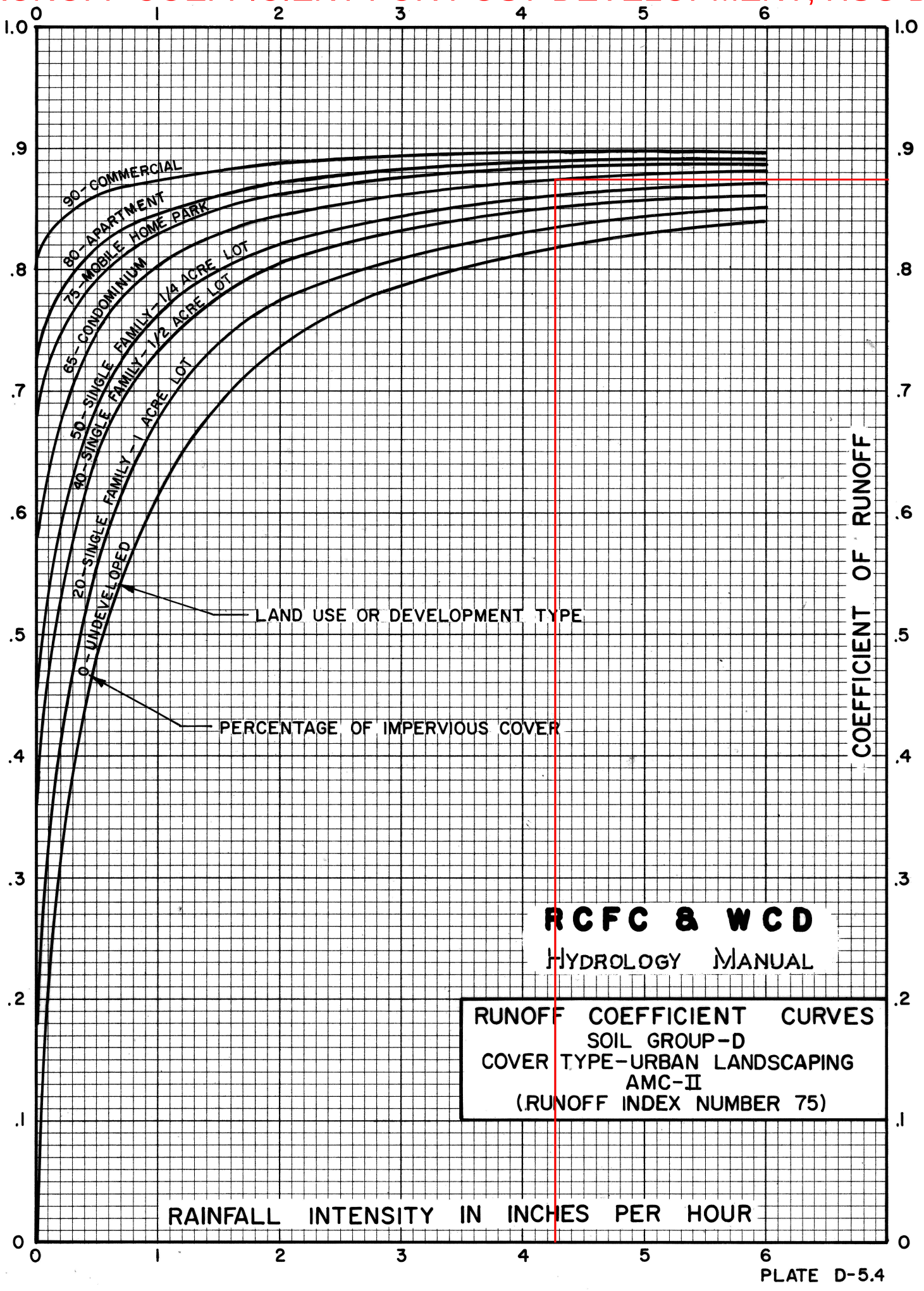
RUNOFF COEFFICIENTS FOR RI INDEX NO. = 88

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.66	.76	.80	.82	.84	.85	.86	.86	.87	.87
5.	.04	.67	.77	.81	.83	.84	.85	.86	.86	.87	.87
10.	.09	.68	.78	.81	.83	.85	.85	.86	.86	.87	.88
15.	.13	.70	.78	.82	.84	.85	.86	.86	.87	.87	.88
20.	.18	.71	.79	.82	.84	.85	.86	.86	.87	.87	.88
25.	.22	.72	.80	.83	.84	.85	.86	.87	.87	.88	.88
30.	.27	.73	.80	.83	.85	.86	.86	.87	.87	.88	.88
35.	.31	.74	.81	.84	.85	.86	.87	.87	.87	.88	.88
40.	.36	.76	.82	.84	.85	.86	.87	.87	.88	.88	.88
45.	.40	.77	.82	.85	.86	.87	.87	.88	.88	.88	.89
50.	.45	.78	.83	.85	.86	.87	.87	.88	.88	.88	.89
55.	.49	.79	.84	.86	.87	.87	.88	.88	.88	.89	.89
60.	.54	.80	.84	.86	.87	.88	.88	.88	.88	.89	.89
65.	.58	.82	.85	.87	.87	.88	.88	.88	.89	.89	.89
70.	.63	.83	.86	.87	.88	.88	.88	.89	.89	.89	.89
75.	.67	.84	.87	.88	.88	.88	.89	.89	.89	.89	.89
80.	.72	.84	.87	.88	.88	.89	.89	.89	.89	.89	.89
85.	.76	.85	.88	.88	.89	.89	.89	.89	.89	.89	.89
90.	.81	.88	.89	.89	.89	.89	.89	.90	.90	.90	.90
95.	.86	.89	.89	.90	.90	.90	.90	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENTS FOR RI INDEX NO. = 90

IMPERVIOUS PERCENT	INTENSITY - INCHES/HOUR										
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0
0.	.00	.69	.78	.82	.84	.85	.86	.86	.87	.87	.88
5.	.04	.70	.79	.82	.84	.85	.86	.87	.87	.88	.88
10.	.09	.71	.80	.83	.84	.85	.86	.87	.87	.88	.88
15.	.13	.73	.80	.83	.85	.86	.86	.87	.87	.88	.88
20.	.18	.74	.81	.84	.85	.86	.87	.87	.87	.88	.88
25.	.22	.75	.81	.84	.85	.86	.87	.87	.88	.88	.88
30.	.27	.76	.82	.84	.86	.86	.87	.87	.88	.88	.88
35.	.31	.77	.82	.85	.86	.87	.87	.88	.88	.88	.89
40.	.36	.78	.83	.85	.86	.87	.87	.88	.88	.88	.89
45.	.40	.79	.84	.86	.87	.87	.88	.88	.88	.89	.89
50.	.45	.80	.84	.86	.87	.87	.88	.88	.88	.89	.89
55.	.49	.81	.85	.86	.87	.88	.88	.88	.89	.89	.89
60.	.54	.82	.85	.87	.88	.88	.88	.89	.89	.89	.89
65.	.58	.83	.86	.87	.88	.88	.89	.89	.89	.89	.89
70.	.63	.84	.87	.88	.88	.88	.89	.89	.89	.89	.89
75.	.67	.85	.87	.88	.88	.89	.89	.89	.89	.89	.89
80.	.72	.86	.88	.88	.89	.89	.89	.89	.89	.89	.90
85.	.76	.87	.88	.89	.89	.89	.89	.89	.90	.90	.90
90.	.81	.88	.89	.89	.89	.89	.90	.90	.90	.90	.90
95.	.86	.89	.89	.90	.90	.90	.90	.90	.90	.90	.90
100.	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90

RUNOFF COEFFICIENT FOR POST-DEVELOPMENT, HSG D



RCFC & WCD

HYDROLOGY MANUAL

RUNOFF COEFFICIENT CURVES
SOIL GROUP-D
COVER TYPE-URBAN LANDSCAPING
AMC-II
(RUNOFF INDEX NUMBER 75)

PLATE D-5.4

RAINFALL INTENSITY FOR SUN CITY BASED ON TIME OF CONCENTRATION. PRE AND POST-DEVELOPMENT CONDITIONS

RCFC & WCD
HYDROLOGY MANUAL

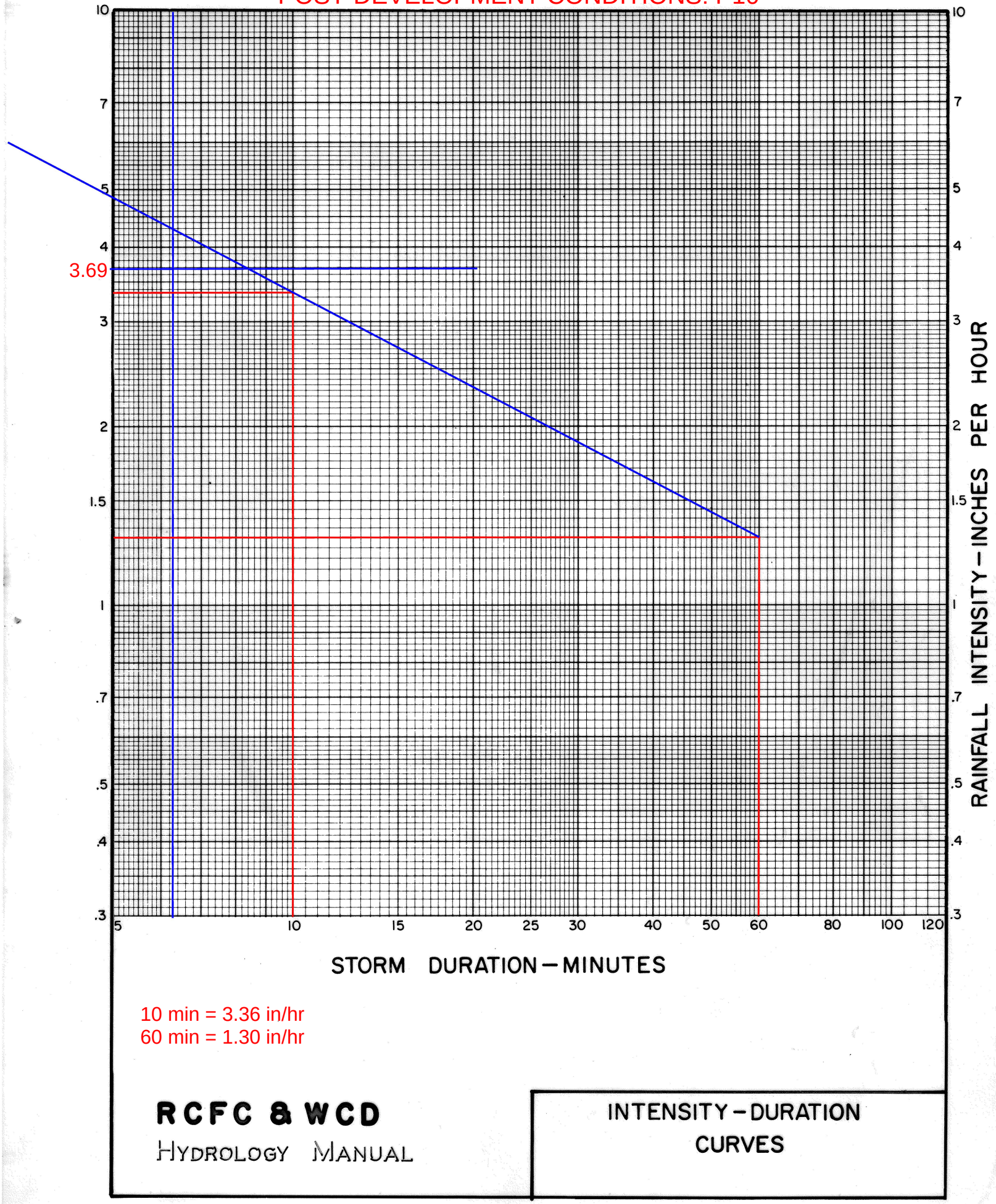
RAINFALL INTENSITY—INCHES PER HOUR

RIVERSIDE			RIVERSIDE (FOOTHILL AREAS)			RUBIDOUX			SAN JACINTO			SUN CITY		
DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR
5	2.75	3.92	5	3.14	4.71	5	3.18	4.71	5	2.81	4.16	5	3.25	4.85
6	2.48	3.55	6	2.84	4.26	6	2.87	4.26	6	2.56	3.79	6	2.95	4.40
7	2.28	3.26	7	2.61	3.91	7	2.64	3.91	7	2.37	3.51	7	2.72	4.06
8	2.12	3.03	8	2.42	3.63	8	2.45	3.63	8	2.22	3.29	8	2.53	3.78
9	1.99	2.84	9	2.27	3.41	9	2.30	3.41	9	2.09	3.10	9	2.38	3.55
10	1.88	2.68	10	2.14	3.21	10	2.17	3.21	10	1.98	2.94	10	2.25	3.36
11	1.78	2.54	11	2.03	3.05	11	2.06	3.05	11	1.89	2.80	11	2.14	3.19
12	1.70	2.42	12	1.94	2.91	12	1.96	2.91	12	1.81	2.68	12	2.04	3.05
13	1.62	2.32	13	1.86	2.78	13	1.88	2.78	13	1.74	2.58	13	1.96	2.92
14	1.56	2.23	14	1.78	2.67	14	1.80	2.67	14	1.68	2.48	14	1.88	2.81
15	1.50	2.14	15	1.71	2.57	15	1.74	2.57	15	1.62	2.40	15	1.81	2.71
16	1.45	2.07	16	1.66	2.48	16	1.68	2.48	16	1.57	2.32	16	1.75	2.62
17	1.40	2.00	17	1.60	2.40	17	1.62	2.40	17	1.52	2.25	17	1.70	2.54
18	1.36	1.94	18	1.55	2.33	18	1.57	2.33	18	1.48	2.19	18	1.65	2.46
19	1.32	1.88	19	1.51	2.26	19	1.52	2.26	19	1.44	2.13	19	1.60	2.39
20	1.28	1.83	20	1.46	2.20	20	1.48	2.20	20	1.40	2.08	20	1.56	2.33
22	1.22	1.74	22	1.39	2.08	22	1.41	2.08	22	1.34	1.98	22	1.48	2.21
24	1.16	1.66	24	1.32	1.99	24	1.34	1.99	24	1.28	1.90	24	1.41	2.11
26	1.11	1.58	26	1.27	1.90	26	1.28	1.90	26	1.23	1.82	26	1.36	2.03
28	1.06	1.52	28	1.22	1.82	28	1.23	1.82	28	1.19	1.76	28	1.30	1.95
30	1.02	1.46	30	1.17	1.76	30	1.19	1.76	30	1.15	1.70	30	1.26	1.88
32	.99	1.41	32	1.13	1.70	32	1.14	1.70	32	1.11	1.64	32	1.21	1.81
34	.96	1.37	34	1.09	1.64	34	1.11	1.64	34	1.08	1.59	34	1.18	1.76
36	.93	1.32	36	1.06	1.59	36	1.07	1.59	36	1.05	1.55	36	1.14	1.70
38	.90	1.29	38	1.03	1.54	38	1.04	1.54	38	1.02	1.51	38	1.11	1.66
40	.87	1.25	40	1.00	1.50	40	1.01	1.50	40	.99	1.47	40	1.08	1.61
45	.82	1.17	45	.94	1.41	45	.95	1.41	45	.94	1.39	45	1.01	1.51
50	.77	1.11	50	.88	1.33	50	.90	1.33	50	.89	1.31	50	.96	1.43
55	.73	1.05	55	.84	1.26	55	.85	1.26	55	.85	1.25	55	.91	1.36
60	.70	1.00	60	.80	1.20	60	.81	1.20	60	.81	1.20	60	.87	1.30
65	.67	.96	65	.77	1.15	65	.78	1.15	65	.78	1.15	65	.83	1.25
70	.64	.92	70	.73	1.10	70	.74	1.10	70	.75	1.11	70	.80	1.20
75	.62	.88	75	.71	1.06	75	.72	1.06	75	.72	1.07	75	.77	1.15
80	.60	.85	80	.68	1.02	80	.69	1.02	80	.70	1.04	80	.75	1.12
85	.58	.83	85	.66	.99	85	.67	.99	85	.68	1.01	85	.72	1.08
SLOPE = .550			SLOPE = .550			SLOPE = .550			SLOPE = .500			SLOPE = .530		

STANDARD INTENSITY-DURATION CURVES DATA

PLATE D-4.1(5 of 6)

RAINFALL INTENSITY
POST-DEVELOPMENT CONDITIONS: P10



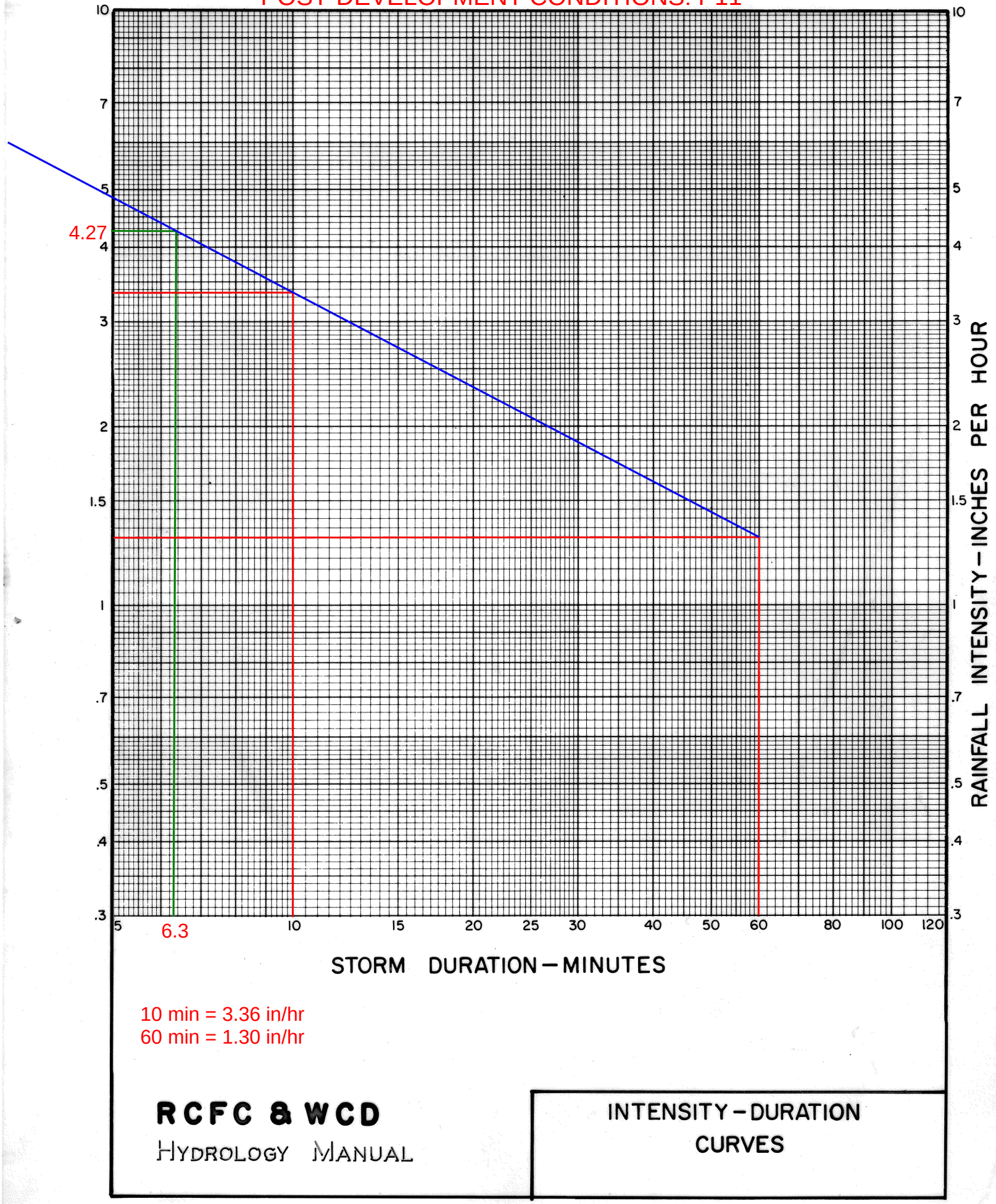
10 min = 3.36 in/hr
60 min = 1.30 in/hr

RCFC & WCD
HYDROLOGY MANUAL

INTENSITY – DURATION CURVES

PLATE D-4.2

RAINFALL INTENSITY
POST-DEVELOPMENT CONDITIONS: P11

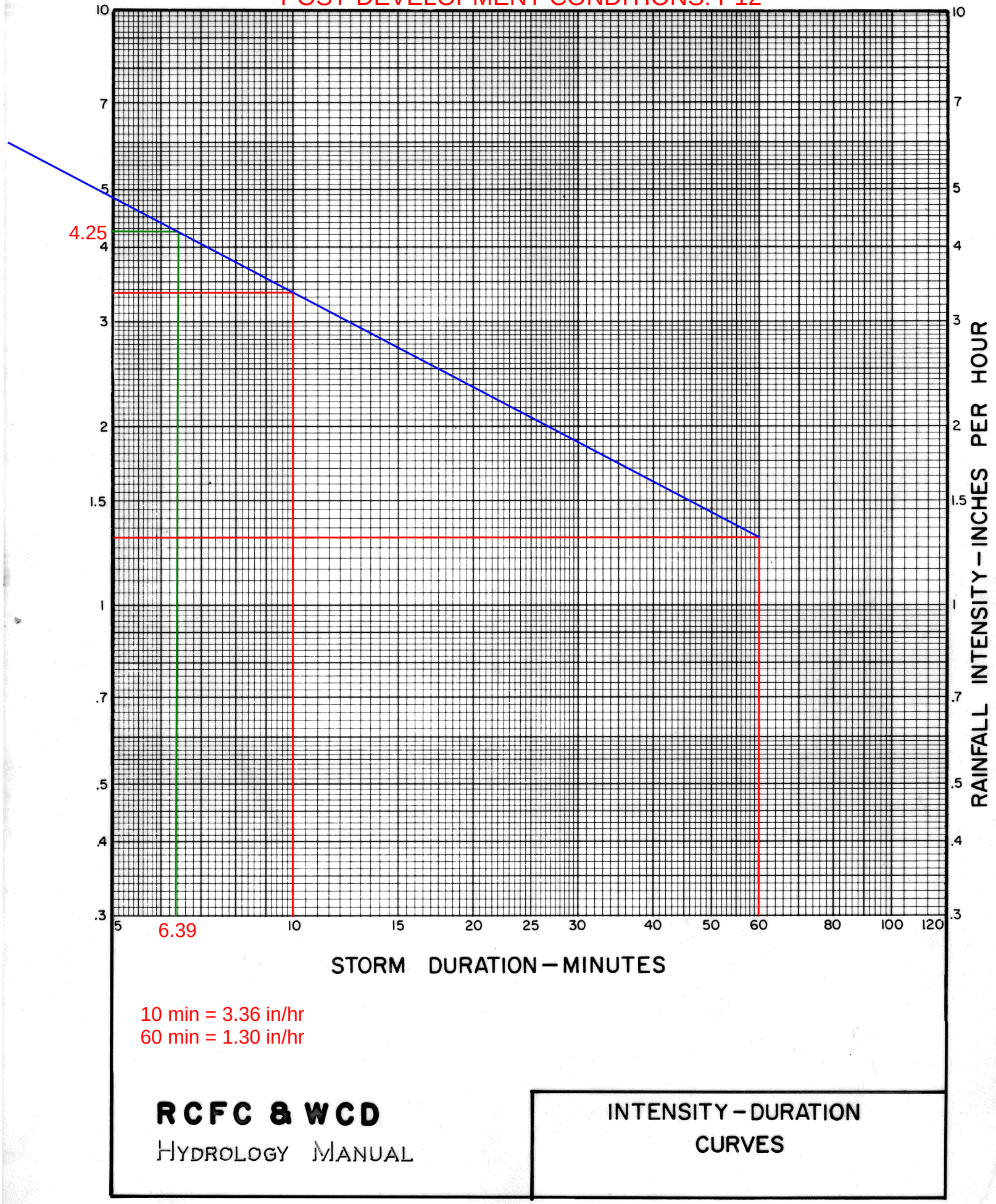


RCFC & WCD
HYDROLOGY MANUAL

INTENSITY – DURATION CURVES

PLATE D-4.2

RAINFALL INTENSITY
POST-DEVELOPMENT CONDITIONS: P12



RCFC & WCD

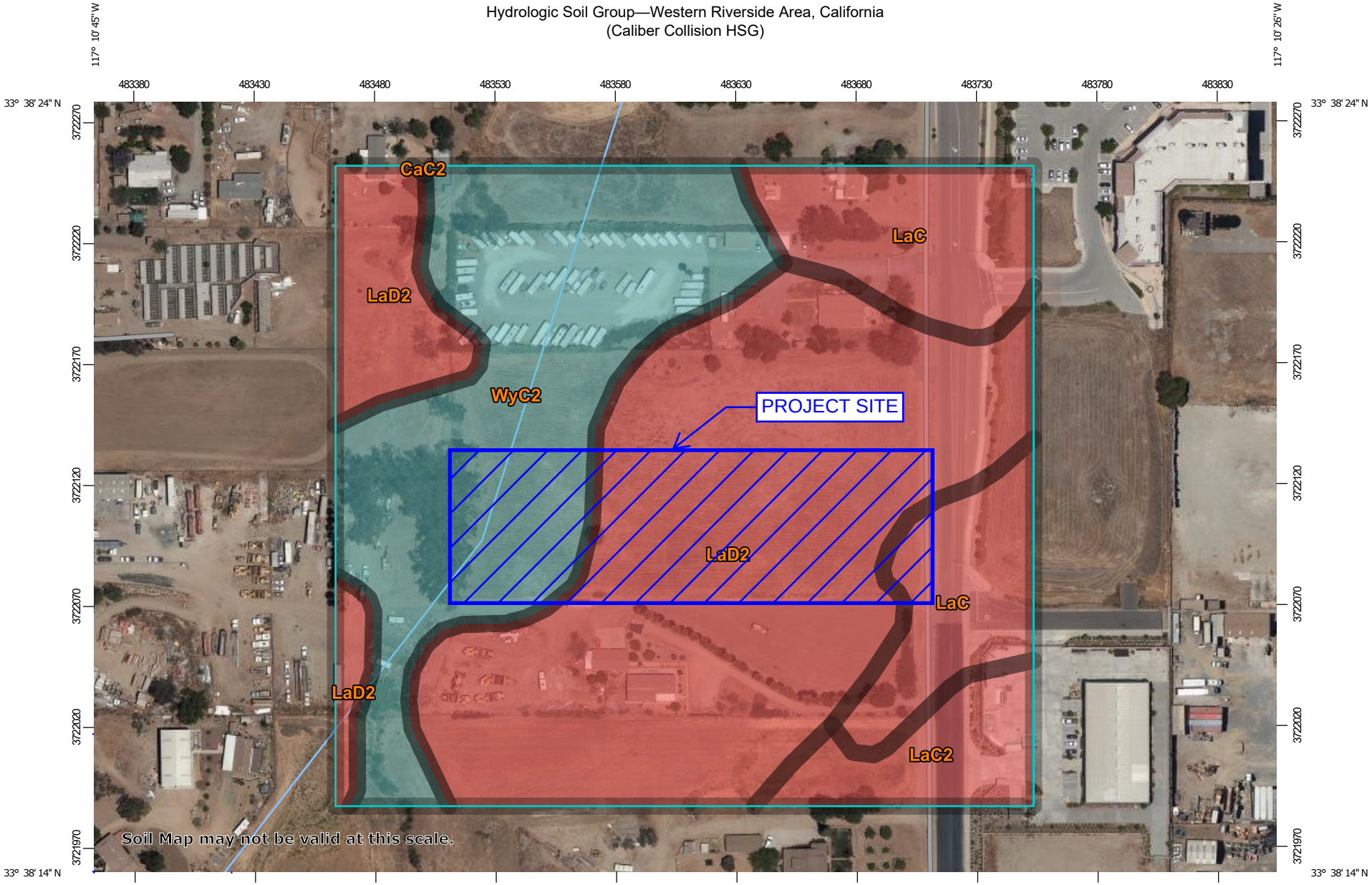
HYDROLOGY MANUAL

INTENSITY – DURATION CURVES

PLATE D-4.2

APPENDIX E – HYDROLOGIC SOIL GROUP MAP

Hydrologic Soil Group—Western Riverside Area, California
(Caliber Collision HSG)



Map Scale: 1:2,250 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 14, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 15, 2018—Jun 25, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CaC2	Cajalco fine sandy loam, 2 to 8 percent slopes, eroded	C	0.0	0.0%
LaC	Las Posas loam, 2 to 8 percent slopes	D	3.0	15.5%
LaC2	Las Posas loam, 5 to 8 percent slopes, eroded	D	1.0	5.2%
LaD2	Las Posas loam, 8 to 15 percent slopes, eroded	D	9.6	50.4%
WyC2	Wyman loam, 2 to 8 percent slopes, eroded	C	5.5	28.9%
Totals for Area of Interest			**19.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher