PRELIMINARY HYDROLOGY STUDY

FOR

Moreno Valley Commercial Center

NWC Alessandro Blvd & Lasselle St.,
Moreno Valley, CA 92553
PEN21-0273 (LST21-0081 & LWQ21-0062)

Prepared By:
PLUMP ENGINEERING, INC.
914 E. Katella Avenue
Anaheim, CA 92805
(714)385-1835
troy@peica.com

This Drainage Report was prepared under my supervision:

By: _____ Date: 3/29/2022
Troy Tryfonopoulos

PEI Job No. 2001078

TABLE OF CONTENTS

	Page No.
TABLE OF CONTENTS	1
INTRODUCTION	2
VICINITY MAP	3
HYDROLOGY ANALYSIS	4
CONCLUSION	7

ATTACHMENTS

ATTACHMENT 1 – Flow and Volume Calculation (2-year, 10-year, 100-year)

ATTACHMENT 2 – Hydrology Exhibits
- Existing Condition
- Proposed Condition

ATTACHMENT 3 – Infiltration Trench Calculations

INTRODUCTION

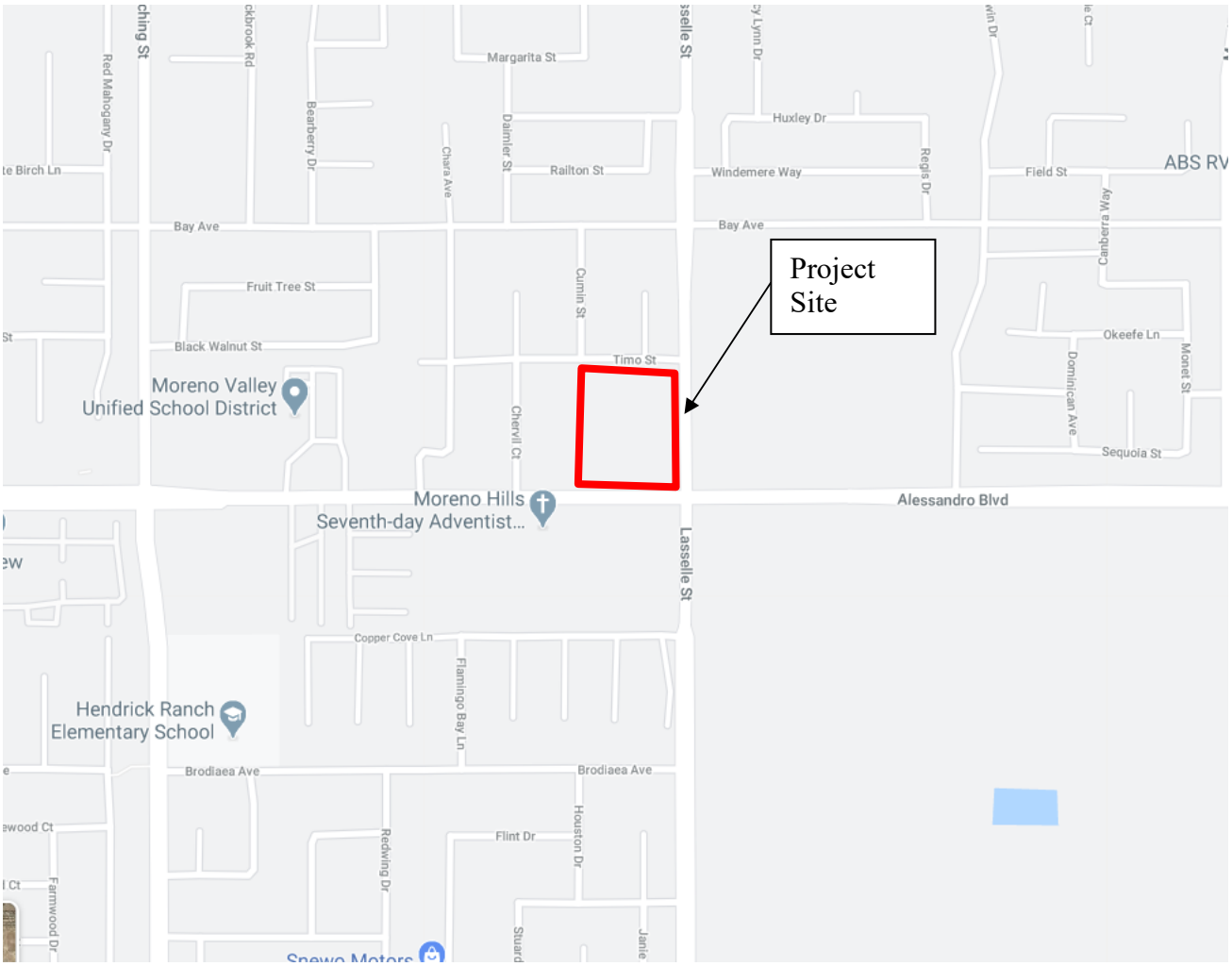
The site is located at the northwest corner of Alessandro Blvd. and Lasselle St. in the City of Moreno Valley, California 92553. The site is bounded to the west by developed residential lots, to the north by Timo Street, to the east by Lasselle Street, and to the south by Alessandro Boulevard. The general location of the site is shown on the Site Vicinity Map included on page 3 this report. The subject site property size is approximately 7.97± acres with disturbed area of 7.97± acres, presently vacant and undeveloped with good ground cover. Ground cover consists of sparse amounts of native grass and weed growth located throughout the entire site. Overall site topography slopes downward to the southwest corner of the property at a gradient of approximately less than 2.15 percent. There was estimated to be ±13.5 feet of elevation differential across the overall subject site.

The site also includes off-site street improvements for this project. The site will be designed to also detain the off-site street improvement portions of this project. The off-site improvements are roughly 2.27 acres and consist of near 100% impervious improvements. A BMP Easement will be provided to the city (see Post-Development Hydrology Map) for offsite infiltration trenches.

The preliminary site plan for the proposed development indicates that the site will be developed for commercial use. The site will be developed with two (2) offices (9,900 SF), two (2) retail buildings (3,200 SF), one (1) bank (3,775 SF), two (2) restaurant buildings with drive-thru (6,640 SF), one (1) restaurant with patio (1,595.50 SF) and one (1) gas station with canopy, express car wash, and store (14,915 SF). The site plan indicates that the proposed buildings will generally be surrounded by asphalt concrete pavement with some areas of concrete flatwork. Several landscape planters are proposed to be located around the perimeter of the property and within the parking lot areas of the site.

Stormwater runoff from the site drains to the west along Alessandro Boulevard. The stormwater runoff is collected by a catch basin located 1,800 ft west of the property near the intersection of Alessandro Boulevard and Kitching Street. Stormwater collected by the public storm drain system is discharged to Canyon Lake.

SITE VICINITY MAP



HYDROLOGY ANALYSIS

Hydrologic calculations were performed in accordance with Riverside County Hydrology Manual (April 1978) guidelines. The Hydrology Manual was used to determine the existing and proposed peak flows for the, 2-year, 10-year and 100-year storms as well as the runoff volumes generated for , 2-year, 10-year and 100-year storm events. Figures and Tables below are referenced to that Manual. The previous pre-development use is vacant undeveloped land with pervious cover.

ON-SITE PEAK RUNOFF FLOWS

Table 1: Rational Method Peak Flow

Tributary Area	DA-1	DA-2	DA-3	DA-4	Totals
Acreage, acres; Pre (Post)	- (3.12)	- (1.34)	- (1.54)	- (1.97)	7.97 (7.97)
Time of Concentration, Tc; Pre (Post)	- (8.5)	- (6.5)	- (8.0)	- (8.0)	32 6.5
2 year Pre- Develop. Runoff; Q_2 (cfs)	-	-	-	-	2.46
2 year Post- Develop. Runoff; Q_2 (cfs)	2.88	1.24	1.42	1.82	4.11
10 year Pre- Develop. Runoff; Q_{10} (cfs)	-	-	-	-	3.91
10 year Post- Develop. Runoff; Q_{10} (cfs)	4.75	2.04	2.34	3.00	6.79
100 year Pre-Develop. Runoff; Q_{100} (cfs)	-	-	-	-	9.75
100 year Post-Develop. Runoff; Q_{100} (cfs)	7.86	3.38	3.88	4.96	20.07

ON-SITE RUNOFF VOLUMES

Table 2: Estimated Storm Runoff Volumes

Tributary Area	DA-1	DA-2	DA-3	DA-4	Totals
Acreage (Pre Development) Acres Acreage (Post Development) Acres	- (3.12)	- (1.34)	- (1.54)	- (1.97)	7.97 (7.97)
24-hr. Precipitation Depth(inches) P_{24} (2 yr)	1.96	1.96	1.96	1.96	-
24-hr. Precipitation Depth(inches) P_{24} (10 yr)	3.10	3.10	3.10	3.10	-

24-hr. Precipitation Depth(inches) P_{24} (100 yr)	4.83	4.83	4.83	4.83	-
CN (AMC II) Pre Development	74				
CN (AMC II) Post Development	90				
CN (AMC I) Pre Development	55				
CN (AMC I) Post Development	81				
CN (AMC III) Pre Development	88				
CN (AMC III) Post Development	96				
2 year Pre-Develop. Volume V_2 (Ac-ft)	-	-	-	-	0.008
2 year Post-Develop. Volume V_2 (Ac-ft)	0.151	0.065	0.074	0.095	0.385
10 year Pre-Develop. Volume V_{10} (Ac-ft)	-	-	-	-	1.267
10 year Post-Develop. Volume V_{10} (Ac-ft)	0.690	0.296	0.340	0.435	1.760
100 year Pre-Develop. Volume V_{100} (Ac-ft)	-	-	-	-	2.331
100 year Post-Develop. Volume V_{100} (Ac-ft)	1.13	0.487	0.560	0.716	2.898

OFF-SITE RUNOFF VOLUMES

Table 3: Estimated Storm Runoff Volumes

Tributary Area	**DA-A**	**DA-B**	**-**	**-**	**Totals**
Acreage (Pre Development) Acres Acreage (Post Development) Acres	0.40 (0.40)	1.87 (1.87)	- -	- -	2.27 (2.27)
24-hr. Precipitation Depth(inches) P_{24} (2 yr)	1.96	1.96	-	-	-
24-hr. Precipitation Depth(inches) P_{24} (10 yr)	3.10	3.10	-	-	-
24-hr. Precipitation Depth(inches) P_{24} (100 yr)	4.83	4.83	-	-	-
CN (AMC II) Pre Development	74				
CN (AMC II) Post Development	90				
CN (AMC I) Pre Development	55				
CN (AMC I) Post Development	81				
CN (AMC III) Pre Development	88				
CN (AMC III) Post Development	96				
2 year Pre-Develop. Volume V_2 (Ac-ft)	0.000	0.002	-	-	0.002
2 year Post-Develop. Volume V_2 (Ac-ft)	0.019	0.090	-	-	0.110
10 year Pre-Develop. Volume V_{10} (Ac-ft)	0.060	0.300	-	-	0.361
10 year Post-Develop. Volume V_{10} (Ac-ft)	0.090	0.413	-	-	0.501
100 year Pre-Develop. Volume V_{100} (Ac-ft)	0.120	0.550	-	-	0.664
100 year Post-Develop. Volume V_{100} (Ac-ft)	0.150	0.680	-	-	0.825

RUNOFF SUMMARY, ONSITE AND OFFSITE				
Storm Event	**V_{pre} (ac-ft)**	**V_{post} (ac-ft)**	**Change in Volume (ac-ft)**	**Change in Volume (cf)**
2-yr	0.010	0.495	**0.485**	**21127**
10-yr	1.628	2.261	**0.633**	**27573**
100-yr	2.994	3.723	**0.729**	**31816**

CONCLUSION

The existing peak runoff flow from the project area was calculated to be 3.91 cfs, and 9.75 cfs for the 10-year and 100-year storms, respectively. The proposed peak runoff flow from the project area after improvements was calculated to be 6.79 cfs, and 20.07 cfs for the 10-year and 100-year storms, respectively. Therefore, peak runoff increased after development and the proposed outlet retention will protect downstream storm drains and account for increased runoff. Refer to attachment 2 for the pre-development and post-development exhibits.

The existing runoff volumes from the project area was calculated to be 0.010 Ac-ft, 1.628 Ac-ft, and 2.994 Ac-ft. for the 2-year, 10-year, and 100-year storms, respectively. The proposed runoff volume based on the project improvements was calculated to be 0.495 Ac-ft, 2.261 Ac-ft, and 3.723 Ac-ft for the 2-year, 10-year, and 100-year storms, respectively. Post-development condition has a greater runoff volume than the pre-development condition, with the difference between pre and post development volume being 0.485 Ac-ft, 0.633 Ac-ft, and 0.729 Ac-ft for the 2-year, 10-year, and 100-year storms, respectively. Pre-development 100-year volumes for offsite are found to be 0.120 Ac-ft for the northerly end of the site (DA-A) and 0.550 Ac-ft for the southerly end of the site (DA-B). Post-development 100-year volumes for offsite are found to be 0.150 Ac-ft for the northerly end of the site (DA-A) and 0.680 Ac-ft for the southerly end of the site (DA-B). Please for refer to Table 3. Post development condition for the 100-year storm event is 19.5% higher than the pre-development condition. The difference in volume between the pre and post development for both onsite and offsite combined is 31,816 cf.

The change in the pre and post development volume is addressed by providing infiltration trenches for each DMA area with a total capacity of 34,093 cf onsite. The infiltration trenches are designed with connection pipes in case any of the trenches overflow. The northerly infiltration trenches are connected together and will overflow to an on-site storm drain with an outlet to the offsite curb and gutter. The curb and gutter then conveys the runoff to a downstream catch basin.

Similarly, the overflow of the southerly infiltration trenches will be distributed to each other via connecting pipes. In the event the 100-year design storm volume is exceeded, the overflow will drain to a catch basin on the southwesterly side of the property. Refer to Attachment 1 for offsite and onsite 100-year design storm volumes, as well as, the post-development hydrology exhibit (Attachment 2) for the provided capacity of each infiltration trench. Refer to Attachment 3 for the infiltration volume calculations as well. The provided capacity of the infiltration trenches exceeds the change in the pre and post development volume. Therefore, there are no hydraulic conditions of concern (HCOC's) that exist for this project. The proposed infiltration trenches are designed per the Riverside County BMP Handbook.

Attachment 1
Flow and Volume Calculation
(2-year,10-year,100-year)

ONSITE PEAK Runoff Flow Calculations

Q = CIA

Where :

Q = runoff in cubic feet per second (cfs) from a given area.
C= Coefficient of Runoff
I = the time-averaged rainfall intensity per NOAA (inches/hour) - corresponding to the TC
A = Drainage area (acres)

Return Frequency = **2 years**

PRE-DEVELOPMENT						
Drainage Area	**A (acres)**	**Soils Group**	**Coefficient C**	**TC (min)**	**I_{TC-2YR} (In/hr)**	**Q (cfs)**
TOTAL	7.97	C	0.455	32	0.678	2.46
					TOTAL	**2.46**

Return Frequency = **2 years**

POST-DEVELOPMENT						
Drainage Area	**A (acres)**	**Soils Group**	**Coefficient C**	**TC (min)**	**I_{TC-2YR} (In/hr)**	**Q (cfs)**
1	3.12	C	0.870	8.5	1.06	2.88
2	1.34	C	0.870	6.5	1.06	1.24
3	1.54	C	0.870	8.0	1.06	1.42
4	1.97	C	0.870	8.0	1.06	1.82
					TOTAL	**4.11**

Return Frequency = **10 years**

PRE-DEVELOPMENT						
Drainage Area	**A (acres)**	**Soils Group**	**Coefficient C**	**TC (min)**	**$I_{TC-10YR}$ (In/hr)**	**Q (cfs)**
TOTAL	7.97	C	0.535	32	0.916	3.91
					TOTAL	**3.91**

Return Frequency = **10 years**

POST-DEVELOPMENT						
Drainage Area	**A (acres)**	**Soils Group**	**Coefficient C**	**TC (min)**	**$I_{TC-10YR}$ (In/hr)**	**Q (cfs)**
1	3.12	C	0.880	8.5	1.73	4.75
2	1.34	C	0.880	6.5	1.73	2.04
3	1.54	C	0.880	8.0	1.73	2.34
4	1.97	C	0.880	8.0	1.73	3.00
					TOTAL	**6.79**

Return Frequency = **100 years**

PRE-DEVELOPMENT						
Drainage Area	**A (acres)**	**Soils Group**	**Coefficient C**	**TC (min)**	**$I_{TC-100YR}$ (In/hr)**	**Q (cfs)**
TOTAL	7.97	C	0.665	32	1.84	9.75
					TOTAL	**9.75**

Return Frequency = **100 years**

POST-DEVELOPMENT						
Drainage Area	**A (acres)**	**Soils Group**	**Coefficient C**	**TC (min)**	**$I_{TC-100YR}$ (In/hr)**	**Q (cfs)**
1	3.12	C	0.890	8.5	2.83	7.86
2	1.34	C	0.890	6.5	2.83	3.38
3	1.54	C	0.890	8.0	2.83	3.88
4	1.97	C	0.890	8.0	2.83	4.96
					TOTAL	**20.07**

HYDROLOGY CALCULATIONS

Plump Engineering, Inc.
914 E. Katella Avenue
Anaheim, CA 92805
By: NA

ONSITE Runoff Volume Calculations

$$V = \frac{Y*A*P_{24}}{12}$$

Where :

V= Volume in acre-ft.

Y = 24-hour storm runnoff yield factor for subarea A

$$= \frac{(P_{24} - I_a)^2}{(P_{24} - I_a + S)P_{24}}$$

P_{24} = 24-hour storm rainfall from NOAA Precipitation Frequency Server (in.)

I_a = initial abstraction

= 0.2S

$$S = \frac{1000}{CN} - 10$$

A= Drainage area in acres

Return Frequency = **2 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC I**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
TOTAL	7.97	C	74	55	8.18	1.64	1.96	0.01	0.008
								TOTAL	**0.008**

Return Frequency = **2 Years, 24 hour**

POST-DEVELOPMENT									
Drainage Area	**A (Acres)**	**Soils Group**	**CN AMC II**	**CN AMC I**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
1	3.12	C	90	81	2.35	0.47	1.96	0.30	0.151
2	1.34	C	90	81	2.35	0.47	1.96	0.30	0.065
3	1.54	C	90	81	2.35	0.47	1.96	0.30	0.074
4	1.97	C	90	81	2.35	0.47	1.96	0.30	0.095
								TOTAL	**0.385**

Return Frequency = **10 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
TOTAL	7.97	C	74	88	1.36	0.27	3.1	0.62	1.27
								TOTAL	**1.267**

Return Frequency = **10 Years, 24 hour**

POST-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
1	3.12	C	90	96	0.42	0.08	3.1	0.86	0.69
2	1.34	C	90	96	0.42	0.08	3.1	0.86	0.296
3	1.54	C	90	96	0.42	0.08	3.1	0.86	0.340
4	1.97	C	90	96	0.42	0.08	3.1	0.86	0.435
								TOTAL	**1.760**

Plump Engineering, Inc.
914 E. Katella Avenue
Anaheim, CA 92805
By: CB

HYDROLOGY CALCULATIONS

Return Frequency = **100 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
1	7.97	C	74	88	1.36	0.27	4.83	0.73	2.330
								TOTAL	**2.330**

Return Frequency = **100 Years, 24 hour**

POST-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
1	3.12	C	90	96	0.42	0.08	4.83	0.90	1.135
2	1.34	C	90	96	0.42	0.08	4.83	0.90	0.487
3	1.54	C	90	96	0.42	0.08	4.83	0.90	0.560
4	1.97	C	90	96	0.42	0.08	4.83	0.90	0.716
								TOTAL	**2.898**

HYDROLOGY CALCULATIONS

Plump Engineering, Inc.
914 E. Katella Avenue
Anaheim, CA 92805
By: NA

OFFSITE Runoff Volume Calculations

$$V = \frac{Y*A*P_{24}}{12}$$

Where :

V= Volume in acre-ft.

Y = 24-hour storm runnoff yield factor for subarea A

$$= \frac{(P_{24} - I_a)^2}{(P_{24} - I_a + S)P_{24}}$$

P_{24} = 24-hour storm rainfall from NOAA Precipitation Frequency Server (in.)

I_a = initial abstraction

= 0.2S

$$S = \frac{1000}{CN} - 10$$

A= Drainage area in acres

Return Frequency = **2 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC I**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
A	0.40	C	74	55	8.18	1.64	1.96	0.01	0.000
B	1.87	C	74	55	8.18	1.64	1.96	0.01	0.002
								TOTAL	**0.002**

Return Frequency = **2 Years, 24 hour**

POST-DEVELOPMENT									
Drainage Area	**A (Acres)**	**Soils Group**	**CN AMC II**	**CN AMC I**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
A	0.40	C	90	81	2.35	0.47	1.96	0.30	0.019
B	1.87	C	90	81	2.35	0.47	1.96	0.30	0.090
								TOTAL	**0.110**

Return Frequency = **10 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
A	0.40	C	74	88	1.36	0.27	3.1	0.62	0.06
B	1.87	C	74	88	1.36	0.27	3.1	0.62	0.30
								TOTAL	**0.361**

Return Frequency = **10 Years, 24 hour**

POST-DEVELOPMENT									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
A	0.40	C	90	96	0.42	0.08	3.1	0.86	0.09
B	1.87	C	90	96	0.42	0.08	3.1	0.86	0.413
								TOTAL	**0.501**

HYDROLOGY CALCULATIONS

Plump Engineering, Inc.
914 E. Katella Avenue
Anaheim, CA 92805
By: NA

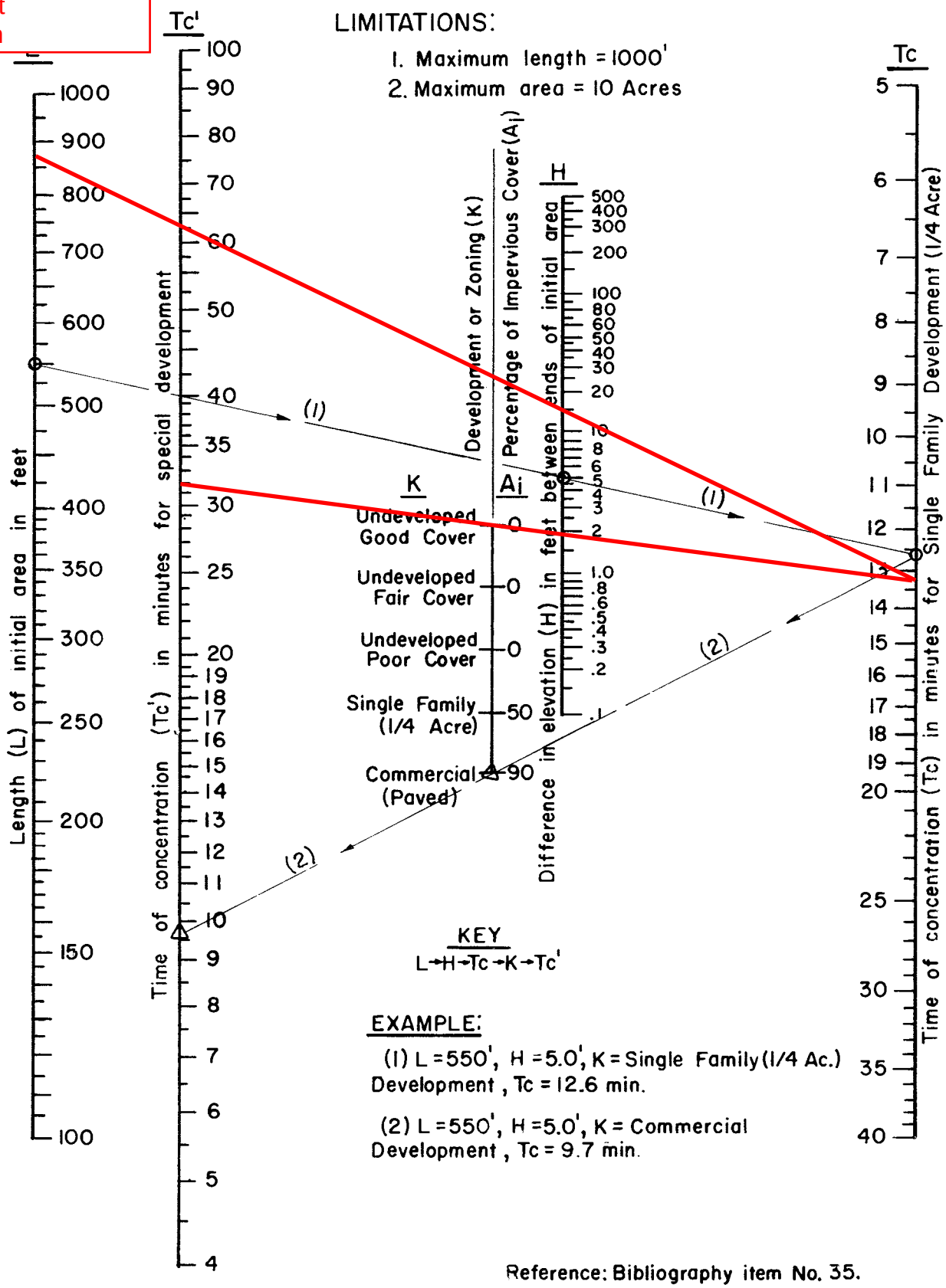
Return Frequency = **100 Years, 24 hour**

PRE-DEVELOPMENT OFFSITE									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
A	0.40	C	74	88	1.36	0.27	4.83	0.73	0.12
B	1.87	C	74	88	1.36	0.27	4.83	0.73	0.55
								TOTAL	**0.664**

Return Frequency = **100 Years, 24 hour**

POST-DEVELOPMENT OFF SITE									
Drainage Area	**A (acres)**	**Soils Group**	**CN AMC II**	**CN AMC III**	**S**	**I_a**	**P_{24}**	**Y**	**V (Ac-ft)**
A	0.40	C	90	96	0.42	0.08	4.83	0.90	0.15
B	1.87	C	90	96	0.42	0.08	4.83	0.90	0.680
								TOTAL	**0.825**

Pre-development
Flow Length = ~875 feet
H = ~15 feet
Tc' = 32 min



LIMITATIONS:

1. Maximum length = 1000'
2. Maximum area = 10 Acres

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (1/4 Ac.) Development, Tc = 12.6 min.

(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

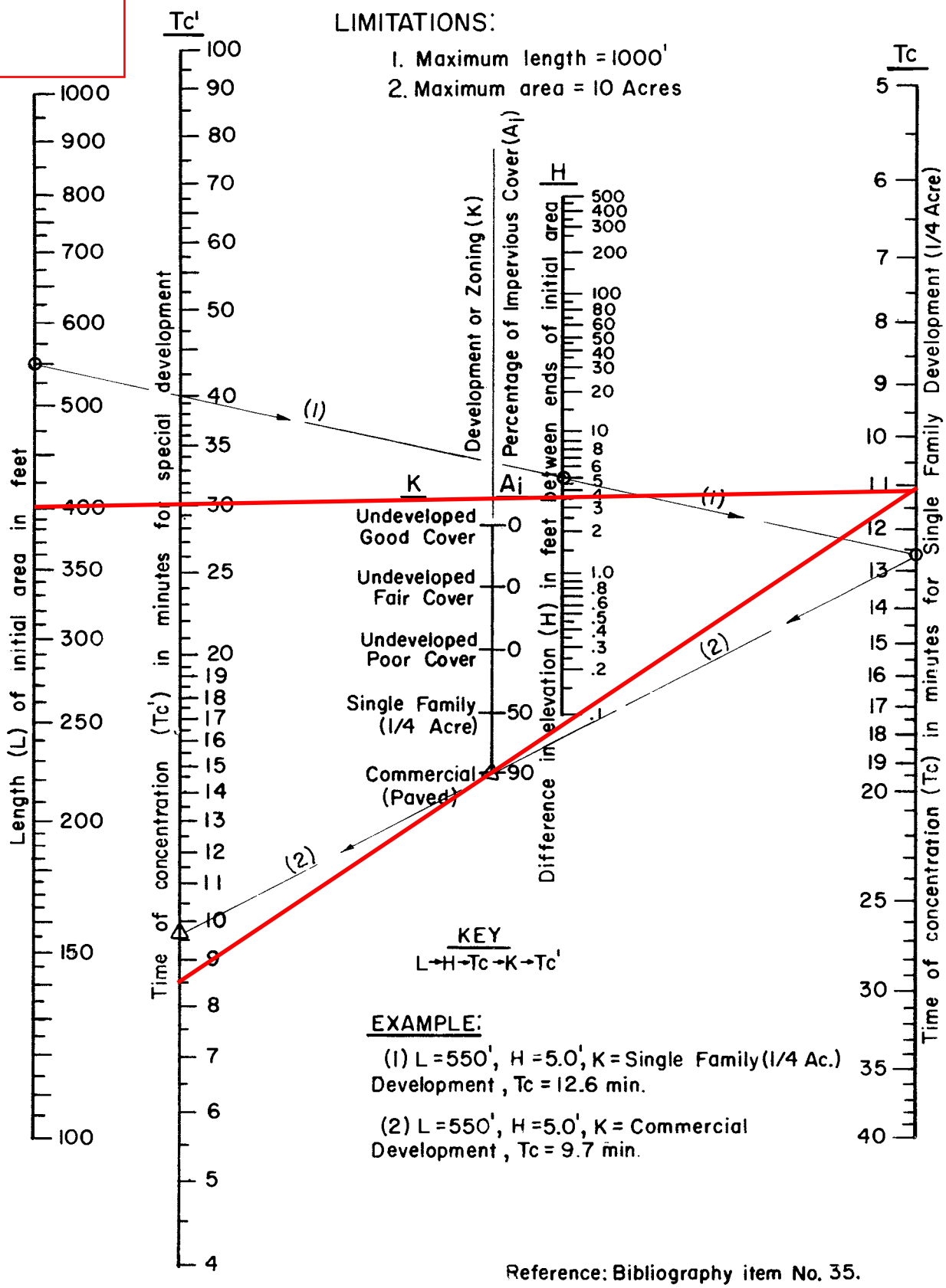
Reference: Bibliography item No. 35.

RCFC & WCD
HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

Post-development DA-1
Flow Length = ~401 feet
H = ~3.6 feet
Tc' = 8.5 min



LIMITATIONS:

1. Maximum length = 1000'
2. Maximum area = 10 Acres

KEY

L→H→Tc→K→Tc'

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (1/4 Ac.) Development, Tc = 12.6 min.

(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

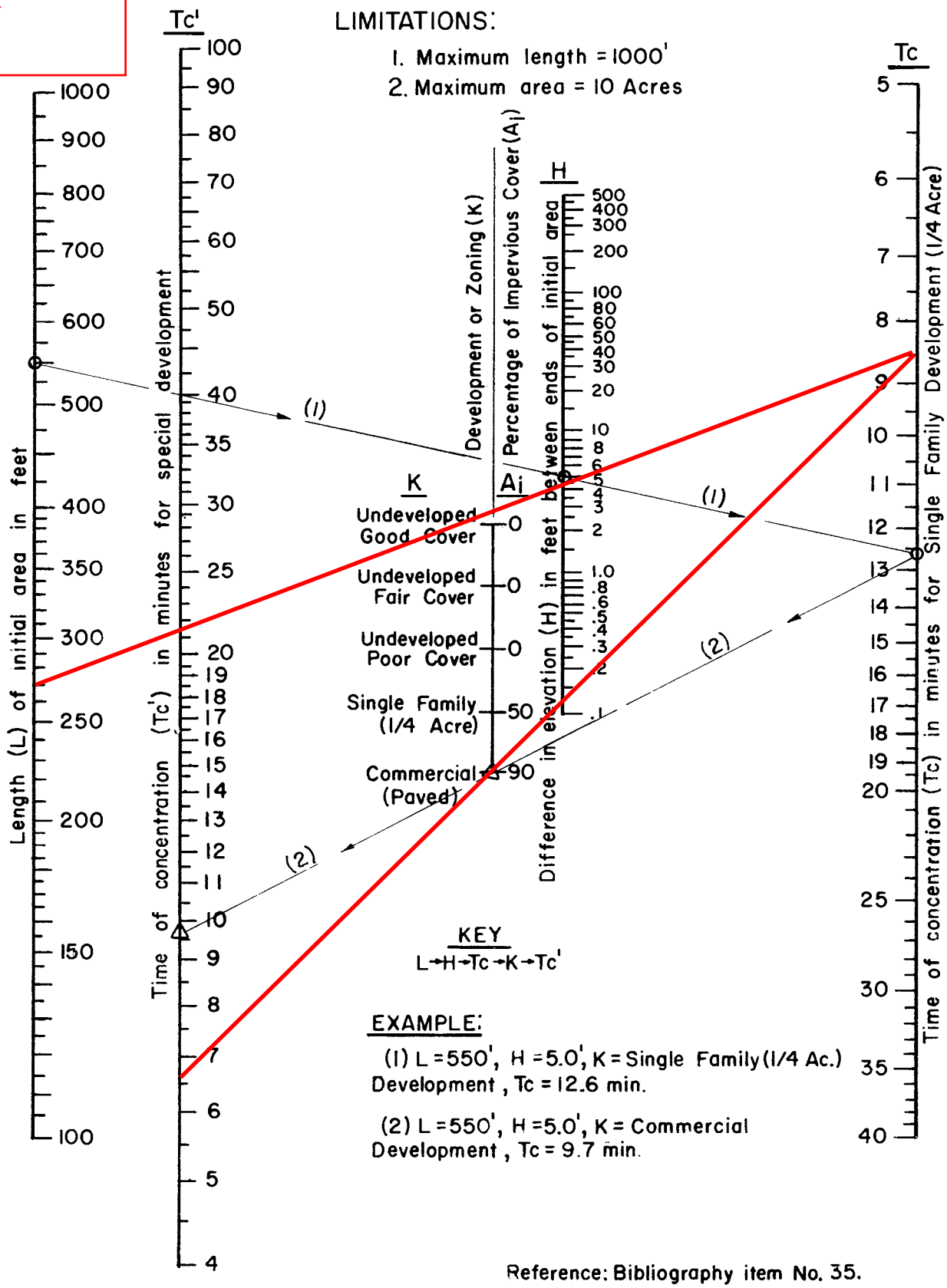
Reference: Bibliography item No. 35.

RCFC & WCD

HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

Post-development DA-2
Flow Length = ~254 feet
H = ~5.23 feet
Tc' = 6.5 min



LIMITATIONS:

1. Maximum length = 1000'
2. Maximum area = 10 Acres

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (1/4 Ac.) Development, Tc = 12.6 min.

(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

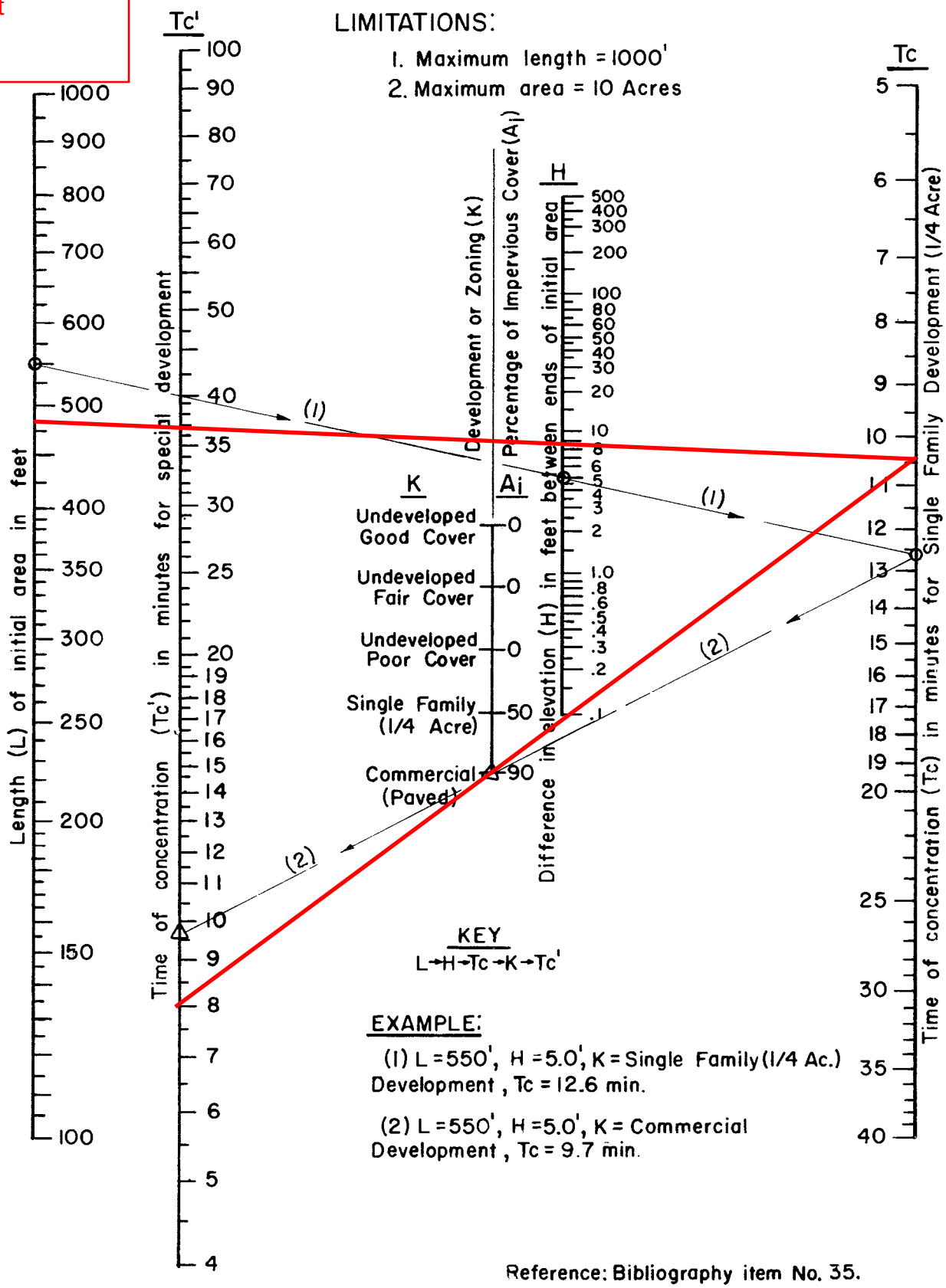
Reference: Bibliography item No. 35.

RCFC & WCD
HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

Post-development DA-3
Flow Length = ~488 feet
H = ~8.55 feet
Tc' = 8 min



LIMITATIONS:

1. Maximum length = 1000'
2. Maximum area = 10 Acres

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (1/4 Ac.) Development, Tc = 12.6 min.

(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

Reference: Bibliography item No. 35.

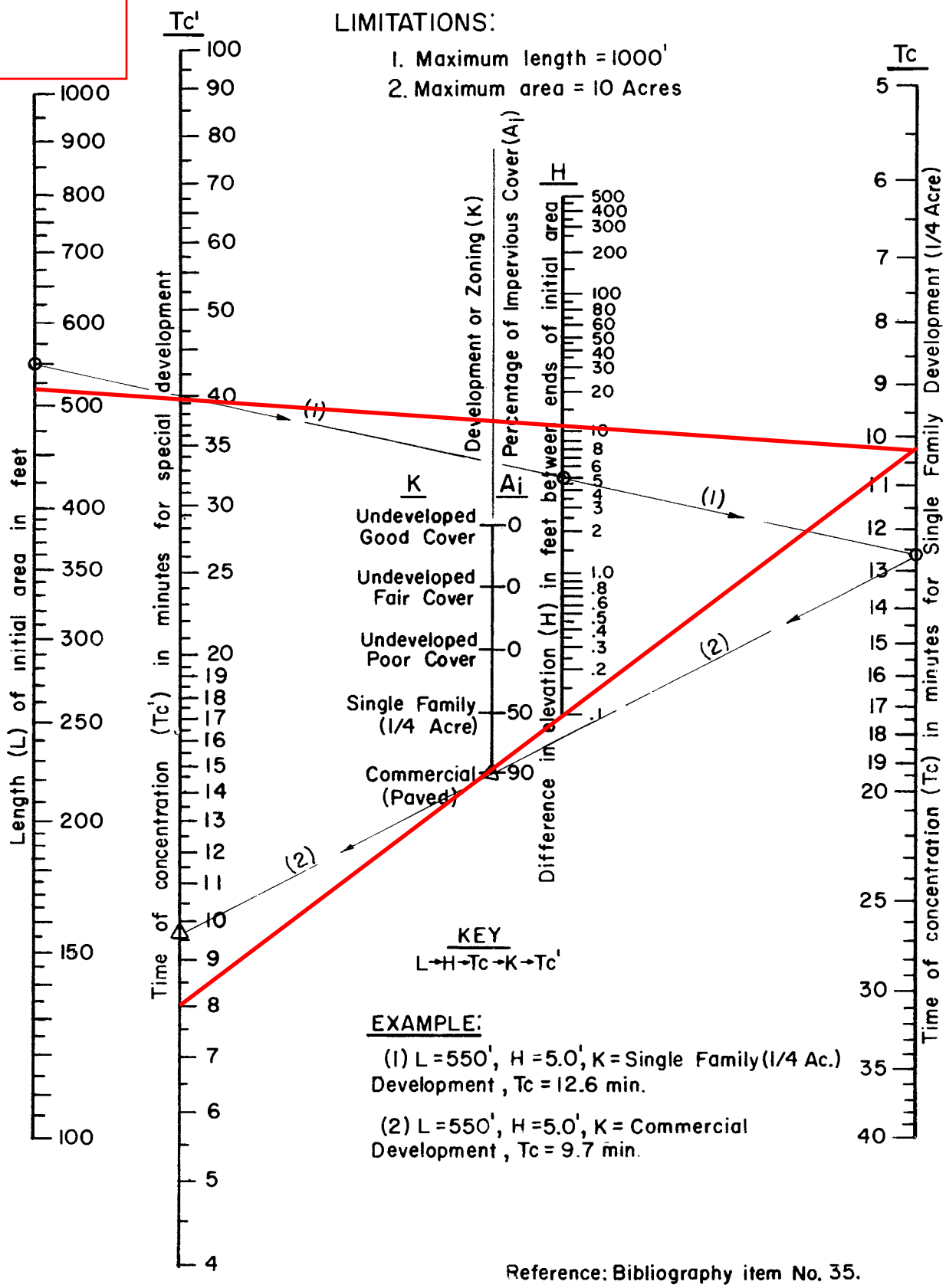
RCFC & WCD

HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

PLATE D-3

Post-development DA-4
Flow Length = ~540 feet
H = ~10 feet
Tc' = 8 min



Reference: Bibliography item No. 35.

RCFC & WCD
HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

NOAA Atlas 14, Volume 6, Version 2
Location name: Moreno Valley, California, USA*
Latitude: 33.9183°, Longitude: -117.2099°
Elevation: 1586.5 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.09 (0.912-1.32)	1.48 (1.24-1.79)	1.99 (1.66-2.42)	2.42 (1.99-2.98)	3.01 (2.40-3.83)	3.48 (2.71-4.51)	3.95 (3.00-5.26)	4.45 (3.29-6.10)	5.14 (3.64-7.34)	5.68 (3.88-8.41)
10-min	0.780 (0.648-0.942)	1.06 (0.882-1.28)	1.43 (1.19-1.74)	1.73 (1.43-2.13)	2.16 (1.72-2.74)	2.49 (1.94-3.23)	2.83 (2.15-3.77)	3.19 (2.35-4.37)	3.68 (2.60-5.26)	4.07 (2.78-6.03)
15-min	0.628 (0.524-0.760)	0.852 (0.712-1.04)	1.15 (0.960-1.40)	1.40 (1.15-1.72)	1.74 (1.39-2.21)	2.01 (1.56-2.60)	2.28 (1.74-3.04)	2.57 (1.90-3.52)	2.97 (2.10-4.24)	3.28 (2.24-4.86)
30-min	0.498 (0.416-0.604)	0.678 (0.564-0.822)	0.916 (0.760-1.11)	1.11 (0.916-1.36)	1.38 (1.10-1.75)	1.60 (1.24-2.07)	1.81 (1.38-2.41)	2.04 (1.51-2.80)	2.36 (1.67-3.37)	2.61 (1.78-3.86)
60-min	0.349 (0.292-0.423)	0.475 (0.396-0.575)	0.641 (0.533-0.779)	0.778 (0.642-0.954)	0.968 (0.771-1.23)	1.12 (0.870-1.45)	1.27 (0.964-1.69)	1.43 (1.06-1.96)	1.65 (1.17-2.36)	1.83 (1.24-2.70)
2-hr	0.259 (0.216-0.314)	0.340 (0.284-0.412)	0.446 (0.372-0.543)	0.534 (0.440-0.655)	0.654 (0.521-0.830)	0.748 (0.582-0.969)	0.842 (0.640-1.12)	0.941 (0.694-1.29)	1.08 (0.760-1.54)	1.18 (0.806-1.75)
3-hr	0.214 (0.178-0.259)	0.277 (0.231-0.336)	0.361 (0.300-0.439)	0.430 (0.354-0.526)	0.523 (0.416-0.663)	0.595 (0.464-0.772)	0.668 (0.507-0.889)	0.745 (0.549-1.02)	0.848 (0.599-1.21)	0.928 (0.633-1.38)
6-hr	0.150 (0.125-0.182)	0.193 (0.161-0.234)	0.249 (0.207-0.303)	0.296 (0.244-0.362)	0.358 (0.285-0.454)	0.406 (0.316-0.526)	0.454 (0.345-0.604)	0.504 (0.372-0.691)	0.572 (0.404-0.818)	0.624 (0.426-0.925)
12-hr	0.096 (0.080-0.116)	0.125 (0.104-0.152)	0.163 (0.135-0.198)	0.193 (0.159-0.237)	0.235 (0.187-0.298)	0.266 (0.207-0.345)	0.298 (0.226-0.397)	0.331 (0.244-0.453)	0.375 (0.265-0.536)	0.408 (0.278-0.605)
24-hr	0.061 (0.054-0.071)	0.082 (0.072-0.094)	0.108 (0.095-0.125)	0.129 (0.113-0.151)	0.158 (0.134-0.190)	0.179 (0.149-0.221)	0.201 (0.163-0.254)	0.224 (0.176-0.290)	0.254 (0.192-0.342)	0.277 (0.203-0.386)
2-day	0.036 (0.032-0.041)	0.048 (0.043-0.056)	0.065 (0.057-0.075)	0.078 (0.068-0.091)	0.096 (0.081-0.116)	0.110 (0.091-0.135)	0.123 (0.100-0.155)	0.138 (0.108-0.178)	0.157 (0.119-0.211)	0.171 (0.125-0.239)
3-day	0.025 (0.022-0.029)	0.035 (0.031-0.040)	0.047 (0.041-0.054)	0.057 (0.049-0.066)	0.070 (0.059-0.084)	0.080 (0.067-0.099)	0.091 (0.073-0.114)	0.101 (0.080-0.131)	0.116 (0.088-0.156)	0.127 (0.093-0.177)
4-day	0.020 (0.018-0.024)	0.028 (0.025-0.033)	0.038 (0.034-0.044)	0.047 (0.041-0.055)	0.058 (0.049-0.070)	0.067 (0.055-0.082)	0.076 (0.061-0.095)	0.085 (0.067-0.110)	0.097 (0.074-0.131)	0.107 (0.078-0.149)
7-day	0.013 (0.011-0.015)	0.018 (0.016-0.021)	0.025 (0.022-0.029)	0.031 (0.027-0.036)	0.038 (0.032-0.046)	0.044 (0.037-0.054)	0.050 (0.041-0.063)	0.057 (0.045-0.073)	0.065 (0.050-0.088)	0.072 (0.053-0.101)
10-day	0.009 (0.008-0.011)	0.013 (0.012-0.015)	0.018 (0.016-0.021)	0.023 (0.020-0.026)	0.029 (0.024-0.034)	0.033 (0.028-0.041)	0.038 (0.031-0.048)	0.043 (0.034-0.055)	0.050 (0.038-0.067)	0.055 (0.040-0.076)
20-day	0.005 (0.005-0.006)	0.008 (0.007-0.009)	0.011 (0.010-0.013)	0.014 (0.012-0.016)	0.017 (0.015-0.021)	0.020 (0.017-0.025)	0.023 (0.019-0.030)	0.027 (0.021-0.035)	0.031 (0.024-0.042)	0.035 (0.025-0.049)
30-day	0.004 (0.004-0.005)	0.006 (0.005-0.007)	0.008 (0.007-0.010)	0.010 (0.009-0.012)	0.013 (0.011-0.016)	0.016 (0.013-0.019)	0.018 (0.015-0.023)	0.021 (0.016-0.027)	0.025 (0.019-0.033)	0.028 (0.020-0.038)
45-day	0.003 (0.003-0.004)	0.005 (0.004-0.005)	0.006 (0.006-0.007)	0.008 (0.007-0.009)	0.010 (0.009-0.013)	0.012 (0.010-0.015)	0.014 (0.012-0.018)	0.016 (0.013-0.021)	0.019 (0.015-0.026)	0.022 (0.016-0.031)
60-day	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.009 (0.007-0.010)	0.010 (0.009-0.013)	0.012 (0.010-0.015)	0.014 (0.011-0.018)	0.016 (0.012-0.022)	0.019 (0.014-0.026)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

NOAA Atlas 14, Volume 6, Version 2
Location name: Moreno Valley, California, USA*
Latitude: 33.9183°, Longitude: -117.2099°
Elevation: 1586.5 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.091 (0.076-0.110)	0.123 (0.103-0.149)	0.166 (0.138-0.202)	0.202 (0.166-0.248)	0.251 (0.200-0.319)	0.290 (0.226-0.376)	0.329 (0.250-0.438)	0.371 (0.274-0.508)	0.428 (0.303-0.612)	0.473 (0.323-0.701)
10-min	0.130 (0.108-0.157)	0.176 (0.147-0.214)	0.238 (0.198-0.290)	0.289 (0.239-0.355)	0.360 (0.287-0.457)	0.415 (0.323-0.538)	0.472 (0.359-0.628)	0.532 (0.392-0.728)	0.614 (0.434-0.877)	0.679 (0.463-1.00)
15-min	0.157 (0.131-0.190)	0.213 (0.178-0.259)	0.288 (0.240-0.350)	0.350 (0.288-0.429)	0.435 (0.347-0.552)	0.502 (0.391-0.651)	0.571 (0.434-0.760)	0.643 (0.474-0.880)	0.742 (0.524-1.06)	0.821 (0.559-1.22)
30-min	0.249 (0.208-0.302)	0.339 (0.282-0.411)	0.458 (0.380-0.556)	0.556 (0.458-0.681)	0.692 (0.550-0.877)	0.798 (0.621-1.03)	0.907 (0.689-1.21)	1.02 (0.753-1.40)	1.18 (0.833-1.69)	1.30 (0.889-1.93)
60-min	0.349 (0.292-0.423)	0.475 (0.396-0.575)	0.641 (0.533-0.779)	0.778 (0.642-0.954)	0.968 (0.771-1.23)	1.12 (0.870-1.45)	1.27 (0.964-1.69)	1.43 (1.06-1.96)	1.65 (1.17-2.36)	1.83 (1.24-2.70)
2-hr	0.518 (0.432-0.627)	0.680 (0.567-0.824)	0.893 (0.743-1.09)	1.07 (0.881-1.31)	1.31 (1.04-1.66)	1.50 (1.16-1.94)	1.69 (1.28-2.24)	1.88 (1.39-2.58)	2.15 (1.52-3.08)	2.36 (1.61-3.50)
3-hr	0.642 (0.536-0.777)	0.833 (0.694-1.01)	1.08 (0.901-1.32)	1.29 (1.06-1.58)	1.57 (1.25-1.99)	1.79 (1.39-2.32)	2.01 (1.52-2.67)	2.24 (1.65-3.06)	2.55 (1.80-3.64)	2.79 (1.90-4.13)
6-hr	0.898 (0.750-1.09)	1.16 (0.964-1.40)	1.49 (1.24-1.82)	1.77 (1.46-2.17)	2.14 (1.71-2.72)	2.43 (1.89-3.15)	2.72 (2.07-3.62)	3.02 (2.23-4.14)	3.43 (2.42-4.90)	3.74 (2.55-5.54)
12-hr	1.16 (0.966-1.40)	1.51 (1.26-1.83)	1.96 (1.63-2.38)	2.33 (1.92-2.86)	2.83 (2.25-3.59)	3.21 (2.50-4.16)	3.59 (2.73-4.78)	3.99 (2.94-5.46)	4.51 (3.19-6.45)	4.92 (3.36-7.29)
24-hr	1.48 (1.31-1.70)	1.96 (1.73-2.26)	2.59 (2.28-3.00)	3.10 (2.71-3.62)	3.79 (3.21-4.56)	4.31 (3.57-5.30)	4.83 (3.92-6.09)	5.37 (4.23-6.95)	6.09 (4.61-8.21)	6.64 (4.86-9.26)
2-day	1.72 (1.52-1.98)	2.32 (2.05-2.68)	3.11 (2.74-3.60)	3.75 (3.28-4.37)	4.61 (3.90-5.55)	5.26 (4.37-6.47)	5.93 (4.80-7.46)	6.60 (5.21-8.55)	7.52 (5.69-10.1)	8.22 (6.02-11.5)
3-day	1.82 (1.61-2.10)	2.48 (2.20-2.87)	3.36 (2.96-3.89)	4.07 (3.56-4.75)	5.03 (4.26-6.07)	5.77 (4.79-7.10)	6.52 (5.28-8.21)	7.29 (5.75-9.44)	8.33 (6.31-11.2)	9.14 (6.69-12.7)
4-day	1.96 (1.74-2.27)	2.71 (2.39-3.13)	3.69 (3.25-4.27)	4.49 (3.92-5.24)	5.57 (4.72-6.72)	6.41 (5.32-7.89)	7.26 (5.88-9.15)	8.14 (6.42-10.5)	9.34 (7.07-12.6)	10.3 (7.51-14.3)
7-day	2.16 (1.91-2.49)	3.03 (2.68-3.50)	4.18 (3.69-4.84)	5.13 (4.49-5.99)	6.43 (5.45-7.75)	7.44 (6.17-9.15)	8.47 (6.86-10.7)	9.53 (7.52-12.3)	11.0 (8.32-14.8)	12.1 (8.87-16.9)
10-day	2.23 (1.97-2.57)	3.16 (2.79-3.65)	4.41 (3.88-5.10)	5.44 (4.75-6.34)	6.86 (5.81-8.26)	7.96 (6.61-9.79)	9.10 (7.37-11.5)	10.3 (8.10-13.3)	11.9 (9.01-16.0)	13.2 (9.64-18.3)
20-day	2.58 (2.28-2.98)	3.71 (3.28-4.28)	5.25 (4.62-6.07)	6.53 (5.71-7.62)	8.34 (7.06-10.1)	9.77 (8.11-12.0)	11.3 (9.12-14.2)	12.8 (10.1-16.6)	15.0 (11.4-20.2)	16.7 (12.2-23.3)
30-day	2.96 (2.62-3.41)	4.24 (3.75-4.90)	6.02 (5.30-6.97)	7.52 (6.58-8.78)	9.66 (8.18-11.6)	11.4 (9.44-14.0)	13.2 (10.7-16.6)	15.1 (11.9-19.5)	17.7 (13.4-23.9)	19.8 (14.5-27.7)
45-day	3.47 (3.07-4.00)	4.92 (4.35-5.68)	6.95 (6.13-8.04)	8.70 (7.60-10.1)	11.2 (9.50-13.5)	13.3 (11.0-16.3)	15.4 (12.5-19.4)	17.7 (14.0-22.9)	21.0 (15.9-28.3)	23.6 (17.3-33.0)
60-day	3.94 (3.49-4.54)	5.51 (4.87-6.36)	7.73 (6.81-8.95)	9.66 (8.45-11.3)	12.5 (10.6-15.0)	14.8 (12.3-18.2)	17.2 (14.0-21.7)	19.9 (15.7-25.7)	23.7 (17.9-31.9)	26.8 (19.6-37.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

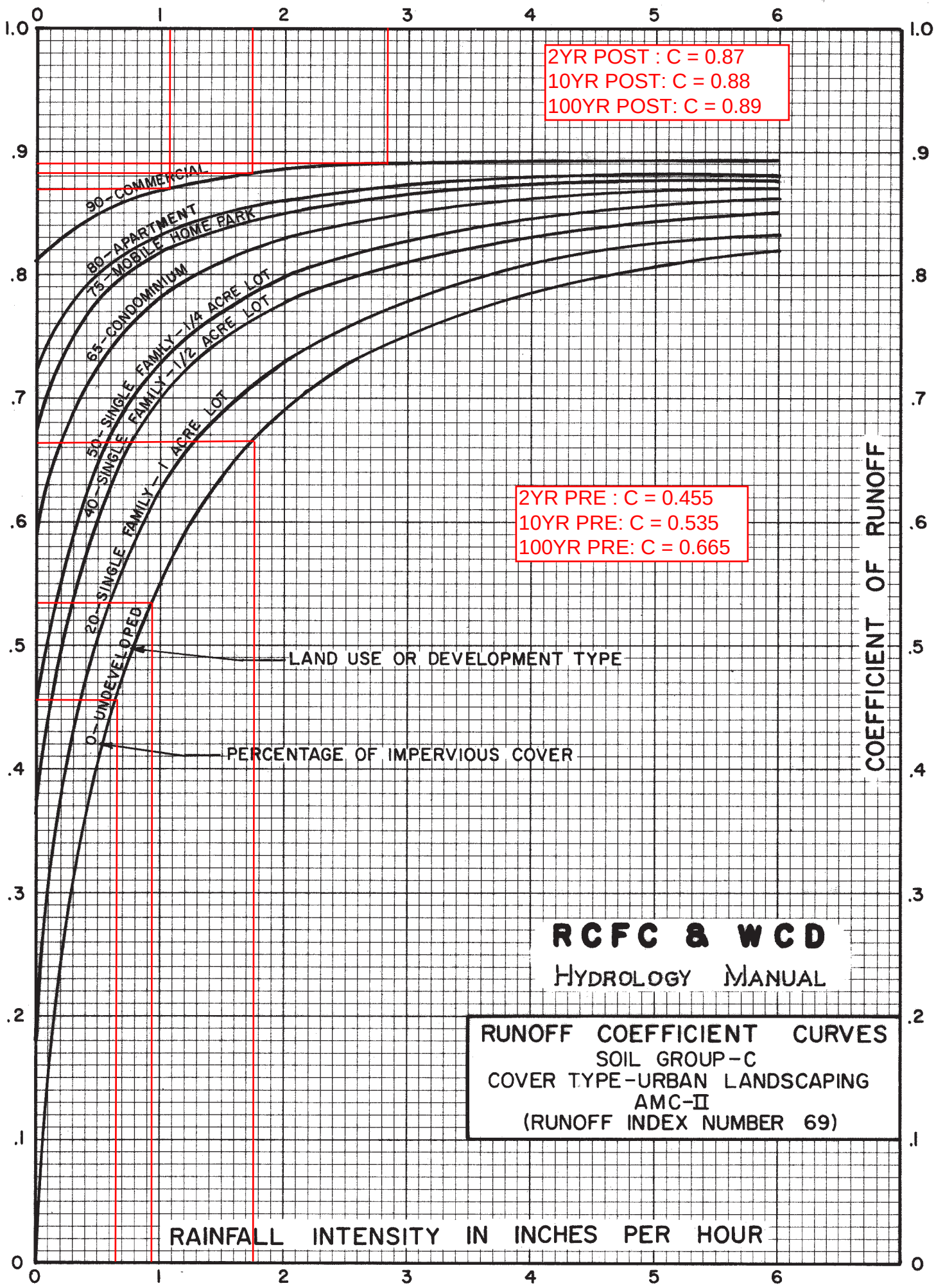
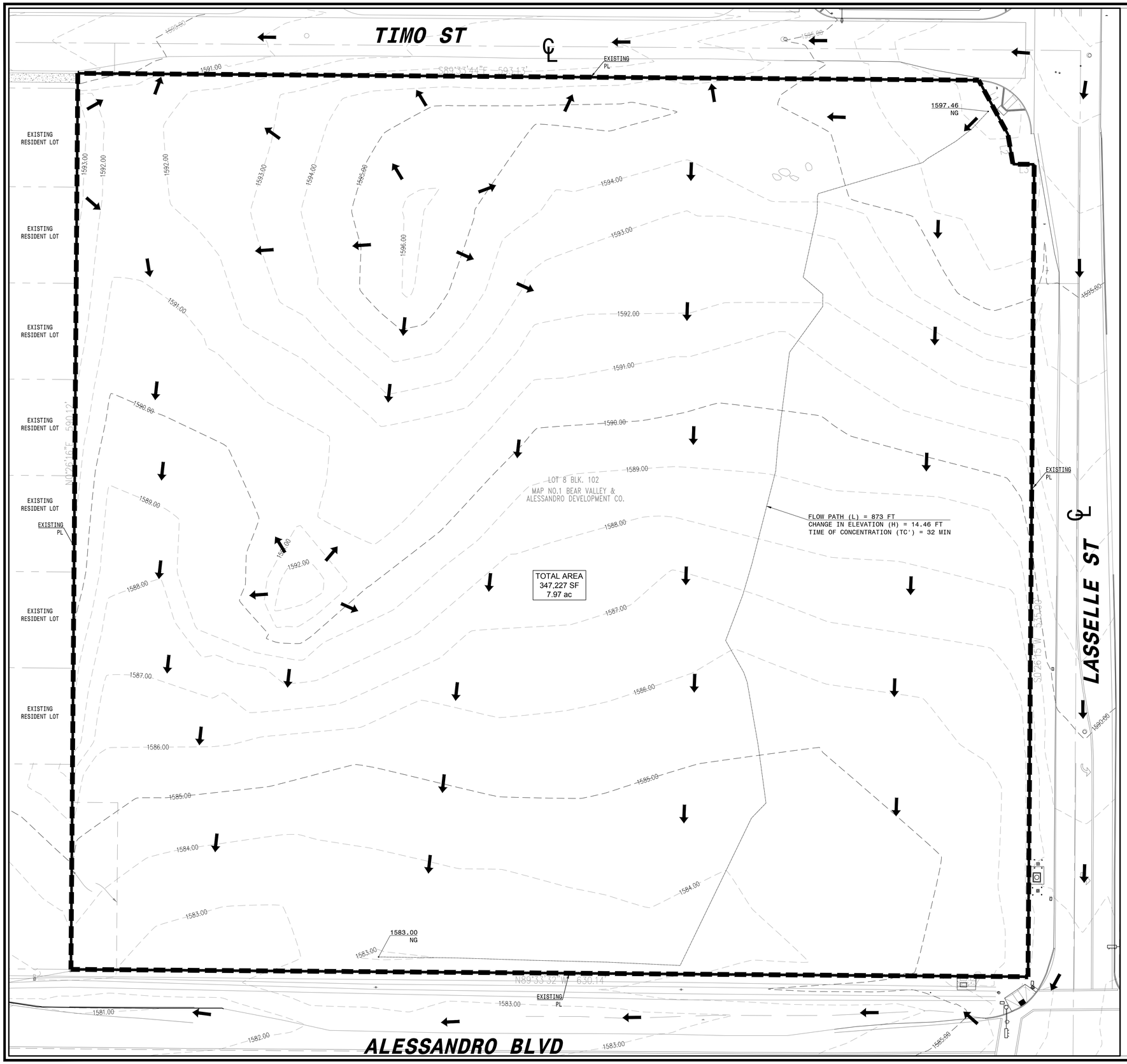

2YR POST : C = 0.87
10YR POST: C = 0.88
100YR POST: C = 0.89
2YR PRE : C = 0.455
10YR PRE: C = 0.535
100YR PRE: C = 0.665
90-COMMERCIAL
80-APARTMENT
75-MOBILE HOME PARK
65-CONDOMINIUM
50-SINGLE FAMILY-1/4 ACRE LOT
40-SINGLE FAMILY-1/2 ACRE LOT
20-SINGLE FAMILY-1 ACRE LOT
0-UNDEVELOPED
LAND USE OR DEVELOPMENT TYPE
PERCENTAGE OF IMPERVIOUS COVER
COEFFICIENT OF RUNOFF
RAINFALL INTENSITY IN INCHES PER HOUR
RCFC & WCD
HYDROLOGY MANUAL
RUNOFF COEFFICIENT CURVES
SOIL GROUP-C
COVER TYPE-URBAN LANDSCAPING
AMC-II
(RUNOFF INDEX NUMBER 69)

PLATE D-5.3

Attachment 2
Hydrology Exhibits



LEGEND:

- DRAINAGE FLOW DIRECTION
- DMA BOUNDARY
- PARCEL BOUNDARY
- DMA-X / X,XXX SF / XX.XX ac — DMA INFORMATION

PEAK RUN-OFF FLOW

Return Frequency = **2 years**

PRE-DEVELOPMENT						
Drainage Area	A (acres)	Soils Group	Coefficient C	TC (min)	$I_{TC\text{-}2YR}$ (In/hr)	Q (cfs)
TOTAL	7.97	C	0.455	32	0.678	2.46
					TOTAL	2.46

Return Frequency = **10 years**

PRE-DEVELOPMENT						
Drainage Area	A (acres)	Soils Group	Coefficient C	TC (min)	$I_{TC\text{-}10YR}$ (In/hr)	Q (cfs)
TOTAL	7.97	C	0.535	32	0.916	3.91
					TOTAL	3.91

Return Frequency = **100 years**

PRE-DEVELOPMENT						
Drainage Area	A (acres)	Soils Group	Coefficient C	TC (min)	$I_{TC\text{-}100YR}$ (In/hr)	Q (cfs)
TOTAL	7.97	C	0.665	32	1.84	9.75
					TOTAL	9.75

RUN-OFF VOLUME

Return Frequency = **2 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	A (acres)	Soils Group	CN AMC II	CN AMC I	S	I_a	P_{24}	Y	V (Ac-ft)
TOTAL	7.97	C	74	55	8.18	1.64	1.96	0.01	0.008
								TOTAL	0.008

Return Frequency = **10 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	A (acres)	Soils Group	CN AMC II	CN AMC III	S	I_a	P_{24}	Y	V (Ac-ft)
TOTAL	7.97	C	74	88	1.36	0.27	3.1	0.62	1.27
								TOTAL	1.267

Return Frequency = **100 Years, 24 hour**

PRE-DEVELOPMENT									
Drainage Area	A (acres)	Soils Group	CN AMC II	CN AMC III	S	I_a	P_{24}	Y	V (Ac-ft)
TOTAL	7.97	C	74	88	1.36	0.27	4.83	0.73	2.33
								TOTAL	2.331

PRE-DEVELOPMENT HYDROLOGY MAP

PEN21-0273
(LST21-0081)
(LWQ21-0062)

30' 0 30' 60' 90'
SCALE: 1" = 30'

N

PLUMP ENGINEERING INC.
CONSULTING ENGINEERS IN CIVIL, SURVEYING, AND STRUCTURAL ENGINEERING
914 E. KATELLA AVENUE
ANAHEIM, CALIFORNIA 92805
(714) 385-1835, FAX (714) 385-1834

ARCHITECT:
EMPIRE DESIGN GROUP Inc.
24861 Washington Ave.
Murrieta, Calif. 92562
Tel 951-696-1490 Fax 951-696-1443

CLIENT:
NORTHWEST MORENO PROPERTIES LLC

COMMERCIAL RETAIL
APN: 479-631-010
NWC ALESSANDRO BLVD. & LASSELLE ST.
MORENO VALLEY, CA 92553

ENGINEER OF RECORD:
TRYFON TRYFONOPOULOS, PE
914 E KATELLA AVE.
ANAHEIM, CA 92805
(714)385-1835

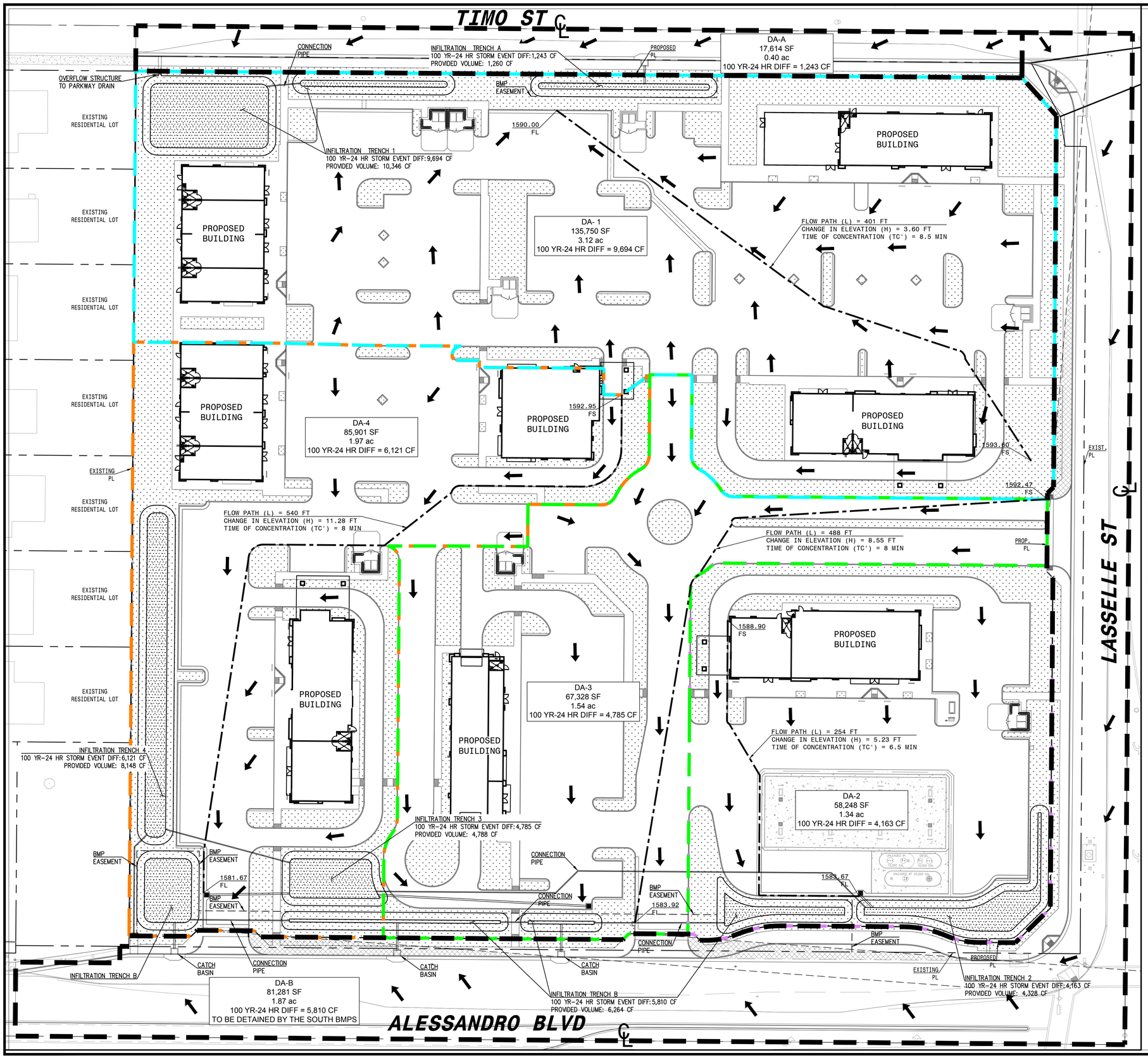
SEAL:
REGISTERED PROFESSIONAL ENGINEER
TRYFON P. TRYFONOPOULOS
NO. 65859
EXP.12/31/21
CIVIL
STATE OF CALIFORNIA

Date: 3/29/2022
Project Number: 2001078

NO.	DATE	REVISION DESCRIPTION

DESIGNED BY: TT
CHECKED BY: TT
DRAWN BY: AA/JT/NA
DRAWING TITLE:

SHEET NO:



LEGEND:

- DA BOUNDARY 1
- DA BOUNDARY 2
- DA BOUNDARY 3
- DA BOUNDARY 4
- OFFSITE DA BOUNDARY A AND B
- LANDSCAPE AREA
- DRAINAGE FLOW DIRECTION
- DMA-X X,XXX SF XX.XX ac — DMA INFORMATION

PEAK RUN-OFF FLOW

Return Frequency = **2 years**

POST-DEVELOPMENT

Drainage Area	A (acres)	Soils Group	Coefficient C	TC (min)	I_{TC-2YR} (In/hr)	Q (cfs)
1	3.12	C	0.870	8.5	1.06	2.88
2	1.34	C	0.870	6.5	1.06	1.24
3	1.54	C	0.870	8.0	1.06	1.42
4	1.97	C	0.870	8.0	1.06	1.82
					TOTAL	4.11

Return Frequency = **10 years**

POST-DEVELOPMENT

Drainage Area	A (acres)	Soils Group	Coefficient C	TC (min)	$I_{TC-10YR}$ (In/hr)	Q (cfs)
1	3.12	C	0.880	8.5	1.73	4.75
2	1.34	C	0.880	6.5	1.73	2.04
3	1.54	C	0.880	8.0	1.73	2.34
4	1.97	C	0.880	8.0	1.73	3.00
					TOTAL	6.79

Return Frequency = **100 years**

POST-DEVELOPMENT

Drainage Area	A (acres)	Soils Group	Coefficient C	TC (min)	$I_{TC-100YR}$ (In/hr)	Q (cfs)
1	3.12	C	0.890	8.5	2.83	7.86
2	1.34	C	0.890	6.5	2.83	3.38
3	1.54	C	0.890	8.0	2.83	3.88
4	1.97	C	0.890	8.0	2.83	4.96
					TOTAL	20.07

RUN-OFF VOLUME

Return Frequency = **2 Years, 24 hour**

POST-DEVELOPMENT

Drainage Area	A (Acres)	Soils Group	CN AMC II	CN AMC I	S	I_a	P_{24}	Y	V (Ac-ft)
1	3.12	C	90	81	2.35	0.47	1.96	0.30	0.151
2	1.34	C	90	81	2.35	0.47	1.96	0.30	0.065
3	1.54	C	90	81	2.35	0.47	1.96	0.30	0.074
4	1.97	C	90	81	2.35	0.47	1.96	0.30	0.095
								TOTAL	0.385

Return Frequency = **10 Years, 24 hour**

POST-DEVELOPMENT

Drainage Area	A (acres)	Soils Group	CN AMC II	CN AMC III	S	I_a	P_{24}	Y	V (Ac-ft)
1	3.12	C	90	96	0.42	0.08	3.1	0.86	0.69
2	1.34	C	90	96	0.42	0.08	3.1	0.86	0.296
3	1.54	C	90	96	0.42	0.08	3.1	0.86	0.340
4	1.97	C	90	96	0.42	0.08	3.1	0.86	0.435
								TOTAL	1.760

Return Frequency = **100 Years, 24 hour**

POST-DEVELOPMENT

Drainage Area	A (acres)	Soils Group	CN AMC II	CN AMC III	S	I_a	P_{24}	Y	V (Ac-ft)
1	3.12	C	90	96	0.42	0.08	4.83	0.90	1.13
2	1.34	C	90	96	0.42	0.08	4.83	0.90	0.487
3	1.54	C	90	96	0.42	0.08	4.83	0.90	0.560
4	1.97	C	90	96	0.42	0.08	4.83	0.90	0.716
								TOTAL	2.898

Return Frequency = **100 Years, 24 hour**

POST-DEVELOPMENT OFF SITE

Drainage Area	A (acres)	Soils Group	CN AMC II	CN AMC III	S	I_a	P_{24}	Y	V (Ac-ft)
A	0.40	C	90	96	0.42	0.08	4.83	0.90	0.15
B	1.87	C	90	96	0.42	0.08	4.83	0.90	0.680
								TOTAL	0.825

POST-DEVELOPMENT HYDROLOGY MAP

*NOTE:
ADDITIONAL CAPACITY PROVIDED TO DETAIN THE DIFFERENCE BETWEEN THE PRE AND POST-DEVELOPMENT, 100-YR 24-HR STORM EVENTS. (31,816 CUBIC FEET)

TOTAL VOLUME PROVIDED BY INFILTRATION TRENCHES IS 34,093 CUBIC FEET, MEETING THE REQUIRED AMOUNT.

PEN21-0273
(LST21-0081)
(LWQ21-0062)

30' 0 30' 60' 90'
SCALE: 1" = 30'
N

PLUMP ENGINEERING INC.
CONSULTING ENGINEERS IN CIVIL, SURVEYING, AND STRUCTURAL ENGINEERING
914 E. KATELLA AVENUE
ANAHEIM, CALIFORNIA 92805
(714) 385-1835, FAX (714) 385-1834

ARCHITECT:
EMPIRE DESIGN GROUP Inc.
24861 Washington Ave.
Murrieta, Calif. 92562
Tel 951-696-1490 Fax 951-696-1443

CLIENT:
NORTHWEST MORENO PROPERTIES LLC

COMMERCIAL RETAIL
APN: 479-631-010
NWC ALESSANDRO BLVD. & LASSELLE ST.
MORENO VALLEY, CA 92553

ENGINEER OF RECORD:
TRYFON TRYFONOPOULOS, PE
914 E KATELLA AVE.
ANAHEIM, CA 92805
(714)385-1835

SEAL:
REGISTERED PROFESSIONAL ENGINEER
TRYFON P. TRYFONOPOULOS
NO. 65859
EXP.12/31/21
CIVIL
STATE OF CALIFORNIA

Date: 3/29/2022
Project Number: 2001078

NO.	DATE	REVISION DESCRIPTION

DESIGNED BY: TT
CHECKED BY: TT
DRAWN BY: AA/JT/NA
DRAWING TITLE:
SHEET NO:

Attachment 3
Infiltration Trench Calculations

Infiltration Trench - Design Procedure	BMP ID INF-1	Legend:	Required Entries / Calculated Cells

Company Name:	Plump Engineering inc.	Date:	3/29/2022
Designed by:		County/City Case No.:	

Design Volume

Enter the area tributary to this feature, Max = 10 acres	A_t=	3	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	9,694	ft^3

Calculate Maximium Depth of the Reservoir Layer

Enter Infiltration rate	I =	2.6	in/hr
Enter Factor of Safety, FS (unitless)	FS =	3	

Obtain from Table 1, Appendix A: "Infiltration Testing" of this BMP Handbook

	n =	40	%
Calculate D_1. $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times (n/100) \times FS}$	D_1 =	12.85	ft
Enter depth to historic high groundwater mark (measured from finished grade)		20	ft
Enter depth to top of bedrock or impermeable layer (measured from finished grade)		15	ft

D_2 is the smaller of:

Depth to groundwater - 11 ft; & Depth to impermeable layer - 6 ft	D_2 =	9.0	ft
D_{MAX} is the smaller value of D_1 and D_2, must be less than or equal to 8 feet.	D_{MAX} =	8.0	ft

Trench Sizing

Enter proposed reservoir layer depth D_R, must be ≤ D_{MAX}	D_R =	7.00	ft
Calculate the design depth of water, d_W			
Design $d_W = (D_R) \times (n/100)$	Design d_W=	2.80	ft
Minimum Surface Area, A_S $A_S = \frac{V_{BMP}}{d_W}$	A_S =	3,462	ft^2
Proposed Design Surface Area	A_D =	3,695	ft^2
Minimum Width = D_R + 1 foot pea gravel		8.00	ft
Sediment Control Provided? (Use pulldown)			
Geotechnical report attached? (Use pulldown)		Yes	

If the trench has been designed correctly, there should be no error messages on the spreadsheet.

Notes: V = dw * Ad

V = 10,345.6 CF

Infiltration Trench - Design Procedure	BMP ID INF-2	Legend:	Required Entries / Calculated Cells

Company Name:	Plump Engineering inc.	Date:	3/29/2022
Designed by:		County/City Case No.:	

Design Volume

Enter the area tributary to this feature, Max = 10 acres	A_t=	1	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	4,163	ft^3

Calculate Maximium Depth of the Reservoir Layer

Enter Infiltration rate	I =	1.6	in/hr
Enter Factor of Safety, FS (unitless)	FS =	3	

Obtain from Table 1, Appendix A: "Infiltration Testing" of this BMP Handbook

	n =	40	%
Calculate D_1. $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times (n/100) \times FS}$	D_1 =	8.00	ft
Enter depth to historic high groundwater mark (measured from finished grade)		20	ft
Enter depth to top of bedrock or impermeable layer (measured from finished grade)		15	ft
D_2 is the smaller of: Depth to groundwater - 11 ft; & Depth to impermeable layer - 6 ft	D_2 =	9.0	ft
D_{MAX} is the smaller value of D_1 and D_2, must be less than or equal to 8 feet.	D_{MAX}=	8.0	ft

Trench Sizing

Enter proposed reservoir layer depth D_R, must be ≤ D_{MAX}	D_R =	7.00	ft
Calculate the design depth of water, d_W			
Design d_W = $(D_R) \times (n/100)$	Design d_W=	2.80	ft
Minimum Surface Area, A_S $A_S = \frac{V_{BMP}}{d_W}$	A_S =	1,487	ft^2
Proposed Design Surface Area	A_D =	1,545	ft^2
Minimum Width = D_R + 1 foot pea gravel		8.00	ft
Sediment Control Provided? (Use pulldown)			
Geotechnical report attached? (Use pulldown)		Yes	

If the trench has been designed correctly, there should be no error messages on the spreadsheet.

Notes: V = dw * Ad

V = 4,327.7 CF

Infiltration Trench - Design Procedure	BMP ID INF-3	Legend:	Required Entries / Calculated Cells

Company Name:	Plump Engineering inc.	Date:	3/29/2022
Designed by:		County/City Case No.:	

Design Volume

Enter the area tributary to this feature, Max = 10 acres	A_t=	2	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	4,785	ft^3

Calculate Maximium Depth of the Reservoir Layer

Enter Infiltration rate	I =	1.6	in/hr
Enter Factor of Safety, FS (unitless)	FS =	3	

Obtain from Table 1, Appendix A: "Infiltration Testing" of this BMP Handbook

	n =	40	%
Calculate D_1. $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times (n/100) \times FS}$	D_1 =	8.00	ft
Enter depth to historic high groundwater mark (measured from finished grade)		20	ft
Enter depth to top of bedrock or impermeable layer (measured from finished grade)		15	ft
D_2 is the smaller of: Depth to groundwater - 11 ft; & Depth to impermeable layer - 6 ft	D_2 =	9.0	ft
D_{MAX} is the smaller value of D_1 and D_2, must be less than or equal to 8 feet.	D_{MAX}=	8.0	ft

Trench Sizing

Enter proposed reservoir layer depth D_R, must be ≤ D_{MAX}	D_R =	7.00	ft
Calculate the design depth of water, d_W			
Design d_W = (D_R) x (n/100)	Design d_W=	2.80	ft
Minimum Surface Area, A_S $A_S = \frac{V_{BMP}}{d_W}$	A_S =	1,709	ft^2
Proposed Design Surface Area	A_D =	1,710	ft^2
Minimum Width = D_R + 1 foot pea gravel		8.00	ft
Sediment Control Provided? (Use pulldown)			
Geotechnical report attached? (Use pulldown)		Yes	

If the trench has been designed correctly, there should be no error messages on the spreadsheet.

Notes: V = dw * Ad

V = 4,788 CF

Infiltration Trench - Design Procedure	BMP ID INF-4	Legend:	Required Entries / Calculated Cells

Company Name:	Plump Engineering inc.	Date:	3/29/2022
Designed by:		County/City Case No.:	

Design Volume

Enter the area tributary to this feature, Max = 10 acres	A_t=	2	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	6,121	ft^3

Calculate Maximium Depth of the Reservoir Layer

Enter Infiltration rate	I =	1.6	in/hr
Enter Factor of Safety, FS (unitless)	FS =	3	

Obtain from Table 1, Appendix A: "Infiltration Testing" of this BMP Handbook

	n =	40	%
Calculate D_1. $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times (n/100) \times FS}$	D_1 =	8.00	ft
Enter depth to historic high groundwater mark (measured from finished grade)		20	ft
Enter depth to top of bedrock or impermeable layer (measured from finished grade)		15	ft
D_2 is the smaller of: Depth to groundwater - 11 ft; & Depth to impermeable layer - 6 ft	D_2 =	9.0	ft
D_{MAX} is the smaller value of D_1 and D_2, must be less than or equal to 8 feet.	D_{MAX}=	8.0	ft

Trench Sizing

Enter proposed reservoir layer depth D_R, must be ≤ D_{MAX}	D_R =	7.00	ft
Calculate the design depth of water, d_W			
Design d_W = $(D_R) \times (n/100)$	Design d_W=	2.80	ft
Minimum Surface Area, A_S $A_S = \frac{V_{BMP}}{d_W}$	A_S =	2,186	ft^2
Proposed Design Surface Area	A_D =	2,910	ft^2
Minimum Width = D_R + 1 foot pea gravel		8.00	ft
Sediment Control Provided? (Use pulldown)			
Geotechnical report attached? (Use pulldown)		Yes	

If the trench has been designed correctly, there should be no error messages on the spreadsheet.

Notes: V = dw * Ad

V = 8,148 CF

Infiltration Trench - Design Procedure	BMP ID INF-A	Legend:	Required Entries / Calculated Cells

Company Name:	Plump Engineering inc.	Date:	3/29/2022
Designed by:		County/City Case No.:	

Design Volume

Enter the area tributary to this feature, Max = 10 acres	A_t=	0	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,243	ft^3

Calculate Maximium Depth of the Reservoir Layer

Enter Infiltration rate	I =	1.6	in/hr
Enter Factor of Safety, FS (unitless)	FS =	3	
Obtain from Table 1, Appendix A: "Infiltration Testing" of this BMP Handbook			
	n =	40	%
Calculate D_1. $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times (n/100) \times FS}$	D_1 =	8.00	ft
Enter depth to historic high groundwater mark (measured from finished grade)		20	ft
Enter depth to top of bedrock or impermeable layer (measured from finished grade)		15	ft
D_2 is the smaller of: Depth to groundwater - 11 ft; & Depth to impermeable layer - 6 ft	D_2 =	9.0	ft
D_{MAX} is the smaller value of D_1 and D_2, must be less than or equal to 8 feet.	D_{MAX}=	8.0	ft

Trench Sizing

Enter proposed reservoir layer depth D_R, must be $\leq D_{MAX}$	D_R =	7.00	ft
Calculate the design depth of water, d_W			
Design $d_W = (D_R) \times (n/100)$	Design d_W=	2.80	ft
Minimum Surface Area, A_S $A_S = \frac{V_{BMP}}{d_W}$	A_S =	444	ft^2
Proposed Design Surface Area	A_D =	450	ft^2
Minimum Width = D_R + 1 foot pea gravel		8.00	ft
Sediment Control Provided? (Use pulldown)			
Geotechnical report attached? (Use pulldown)		Yes	

If the trench has been designed correctly, there should be no error messages on the spreadsheet.

Notes: V = dw * Ad

V = 1,260.3 CF

Infiltration Trench - Design Procedure	BMP ID INF-B	Legend:	Required Entries / Calculated Cells

Company Name:	Plump Engineering inc.	Date:	3/29/2022
Designed by:		County/City Case No.:	

Design Volume

Enter the area tributary to this feature, Max = 10 acres	A_t=	2	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	5,810	ft^3

Calculate Maximium Depth of the Reservoir Layer

Enter Infiltration rate	I =	1.6	in/hr
Enter Factor of Safety, FS (unitless)	FS =	3	

Obtain from Table 1, Appendix A: "Infiltration Testing" of this BMP Handbook

	n =	40	%
Calculate D_1. $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times (n/100) \times FS}$	D_1 =	8.00	ft
Enter depth to historic high groundwater mark (measured from finished grade)		20	ft
Enter depth to top of bedrock or impermeable layer (measured from finished grade)		15	ft
D_2 is the smaller of: Depth to groundwater - 11 ft; & Depth to impermeable layer - 6 ft	D_2 =	9.0	ft
D_{MAX} is the smaller value of D_1 and D_2, must be less than or equal to 8 feet.	D_{MAX}=	8.0	ft

Trench Sizing

Enter proposed reservoir layer depth D_R, must be ≤ D_{MAX}	D_R =	7.00	ft
Calculate the design depth of water, d_W			
Design d_W = $(D_R) \times (n/100)$	Design d_W=	2.80	ft
Minimum Surface Area, A_S $A_S = \frac{V_{BMP}}{d_W}$	A_S =	2,075	ft^2
Proposed Design Surface Area	A_D =	2,237	ft^2
Minimum Width = D_R + 1 foot pea gravel		8.00	ft
Sediment Control Provided? (Use pulldown)			
Geotechnical report attached? (Use pulldown)		Yes	

If the trench has been designed correctly, there should be no error messages on the spreadsheet.

Notes: V = dw * Ad

V = 6,263.6 CF