APPENDIX G

Appendix G – Hydrology and Hydraulics Study

Hydrology & Hydraulics Report

For

Rancho Cielito

Chino Hills, California

November 2017
(Revised October 2018)

Prepared For
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INTRODUCTION

The subject property consists of all of APN 1025-561-04, 05 & 06, containing a total of 48.37 acres, located at Los Serranos Boulevard, Pipeline Avenue, and Ramona Avenue, in the City of Chino Hills, County of San Bernardino, California. Hydrologic methodology used herein is per the San Bernardino County Hydrology Manual. The subject property is rural in nature with un-paved roads and sparse impervious coverage (Existing impervious cover is less than 1% of on-site dry land watershed).

The existing land use is primarily open space with miscellaneous existing structures, 3% of which are inhabited. The property owner proposes to develop the property as a multi-family complex, which will increase the impervious cover to 55% of the on-site dry land watershed area.

The Project site ranges in elevation from approximately 626 to 670 feet above mean sea level (MSL), trending generally from the south to the north.
The Project site includes Lake Los Serranos with an approximate water surface area of 18.87 acres with an average water surface elevation of 642.5 feet above MSL
Lake Los Serranos is contained by an earthen dam reportedly constructed between 1880 and 1901 and listed with the State of California in 1912 (Rancho Cielito Dam No. 808). The lake has a capacity of approximately 110 acre-feet with a dam crest/spillway elevation of 644.3 feet above MSL.

The Project is regionally accessible from Highway 71 at Chino Hills Parkway/Ramona Avenue and is located within Section 22 and 27, Township 2 South and Range 8 West, San Bernardino Meridian, of the United States Geological Survey Prado Dam, California Quadrangle.

Existing Zoning and Land Use
City of Chino Hills General Plan Land Use Designation: Medium Density Residential
City of Chino Hills Zoning: RM-1
Land Use: Mostly vacant with scattered existing buildings, 3 of which are occupied.

Drainage/Hydrology/Water Quality

Existing Runoff
Most of the watershed upstream from the Project is urban development, in a fully developed condition. The few remaining areas of significant contiguous open space to not comprise a large enough percentage of the watershed to significantly lower the area runoff factor from the single-family development category. Runoff from outside the Project boundaries enters from three locations:

Watershed A – the westernmost location, which enters the Project approximately 330 feet north of the intersection of Pipeline Avenue and Los Serranos Boulevard, is the uppermost reaches of Hickory Creek.

- Major entry point with a flow of approximately 1,125 cfs in a hundred-year event, with a watershed of 493 acres. (Note: The City of Chino Hills Storm Drain Master Plan shows a 425-acre watershed and 739 cfs peak runoff)
- Enters the Property via a 12'x6' box culvert under Pipeline Avenue flowing directly into Lake Los Serranos.
- The Project adds no runoff to this flow.

Watershed B - Enters the Project from the north side of Los Serranos Boulevard, roughly halfway between Montecito Drive and El Molino Boulevard.

- Approximately 35 cfs is discharged from a 36" storm drain constructed by the City of Chino Hills in 2015 (Note: City Storm Drain plans indicate a flow rate of 56 cfs)
- The storm drain collects runoff from the single-family neighborhood to the south and enters the property and extends north of the property line to a velocity reducing facility.
- From there, discharge flows approximately 400 feet to the lake via a natural channel with a concrete bottom constructed by the City of Chino Hills in 2015.
- The project adds approximately 24 cfs to the flow prior to joining the lake.

Watershed C – North of the intersection of El Molino, Valle Vista, and Country Club Drive.

- Runoff is discharged from two existing storm drain pipes almost directly into the lake.
- The total runoff from offsite at this location is approximately 111 cfs.
- The project does not add directly to this flow because the pipes discharge into the lake. However, watershed C adds approximately 40 cfs to the watershed runoff along the lake shore.

Watershed D – South and mostly west of the intersection of Ramona Avenue and Valle Vista.

- The off-site watershed does not contribute to the onsite runoff but joins the site runoff at the northeast corner of the Project.
- Unlike the remainder of the Project, in the existing condition approximately 8.5 acres does not flow to the lake, but instead flows towards the northeast corner of the site.
- In the developed condition, only approximately 5.3 acres of runoff will flow toward the northeast corner, with the remaining 3.2 acres diverted toward the lake.
- This runoff will be collected by area drains and catch basins and conveyed by storm drain pipes to a proposed detention/retention-filtration basin. The prescribed low flows will be treated in the basin, while runoff exceeding the prescribed treatment rate will be discharged into a proposed 30" storm drain in Ramona Avenue. This basin will perform the function of removing pollutants. The storm drain will be designed to convey the 100-year developed condition runoff plus the existing off-site runoff to the existing master drainage culvert, where the channel crosses Ramona Avenue to the north.
- The estimated basin volume required to mitigate water quality is 0.25 AC.FT., provided as shown on the conceptual grading plan.

The remainder of the Project receives very minor amounts of runoff from the adjacent streets. Presumably, this condition will change when the adjacent streets are improved so that curb and gutter will collect and convey flows from the streets, and the parkways are sloped toward the street, so that there is no sheet flow onto the Property.

The majority of runoff from outside the Project boundaries will be conveyed to the lake in much the same manner as the existing condition. One exception being that runoff from watersheds B and C will be diverted into naturalized streambeds to be constructed by the Project, a condition which will remove a good portion of the urban contaminants prior to flowing into the lake.

To help prevent erosion and to maintain the integrity of the lake shoreline, between 2007 and 2009, native plants such as willow, cottonwood, sycamore, and alder root systems were planted to stabilize the banks. In addition, 12 – 24-inch rock was hand placed around the entire lake edge to create a "stone toe" which contains the 100-year storm flows and provides protection from wave action.

Proposed Drainage and Water Quality

The majority of the runoff on the Property drains toward the lake in both the existing and proposed developed condition. These areas are indicated as areas "A", "B" and "C" on "Rancho Cielito Conceptual Drainage Plan Sheets 2 through 5. Area "D" drains to the northeast corner of the site (Insert A). The site runoff will be conveyed primarily by surface flow within parking areas and across open spaces toward the lake. There is a proposed trail around the southerly perimeter of the lake. Immediately upstream from the trail there will be a bio-swale/bio-trench to intercept the surface runoff so that urban runoff pollutants are captured and treated prior to discharge into the lake.

The following pages include calculations for runoff for the on-site pre-development condition, on-site developed condition, and off-site watershed, pre-development condition.

Existing Lake

Existing Lake Los Serranos was not intended as a flood control reservoir. It was originally constructed as a water supply primarily for agricultural purposes. The Greening Family has maintained the reservoir since the 1940's and, as a matter of practice, maintain the lake level at approximately 642.5, which allows approximately 2 feet of freeboard, which will act, to some extent, as a flood control measure. The lake level is maintained by the operation of a valve in a 36" drain pipe, which draws the water surface down following periods of excess runoff. The responsibility for maintaining the lake level will convey to successive property owners.

The existing spillway at elevation 644.3 at the north-easterly end of the lake is approximately 160 feet wide. It is a broad crested weir capable of discharging the peak runoff contributing to the lake at a depth of about 2 feet over the spillway. This means that the project developed condition runoff, plus the existing runoff would result in a peak water surface of 646.3, even if the lake were assumed to be at full capacity at the time of the storm. Discharge

from the spillway is directed to the flood control channel at Circle Park Lane immediately north of the spillway. The channel was constructed to convey a peak flow based on a fully developed upstream condition which included the subject property, zoned for multi-family residential at the time. Engineering Solutions has confirmed that the Storm Drain Master Plan based the hydrology on this assumption.

ASSUMPTIONS

Off-Site Hydrology

- Fully developed watershed
- Predominantly Single Family Residential
- Predominantly Soils Group B

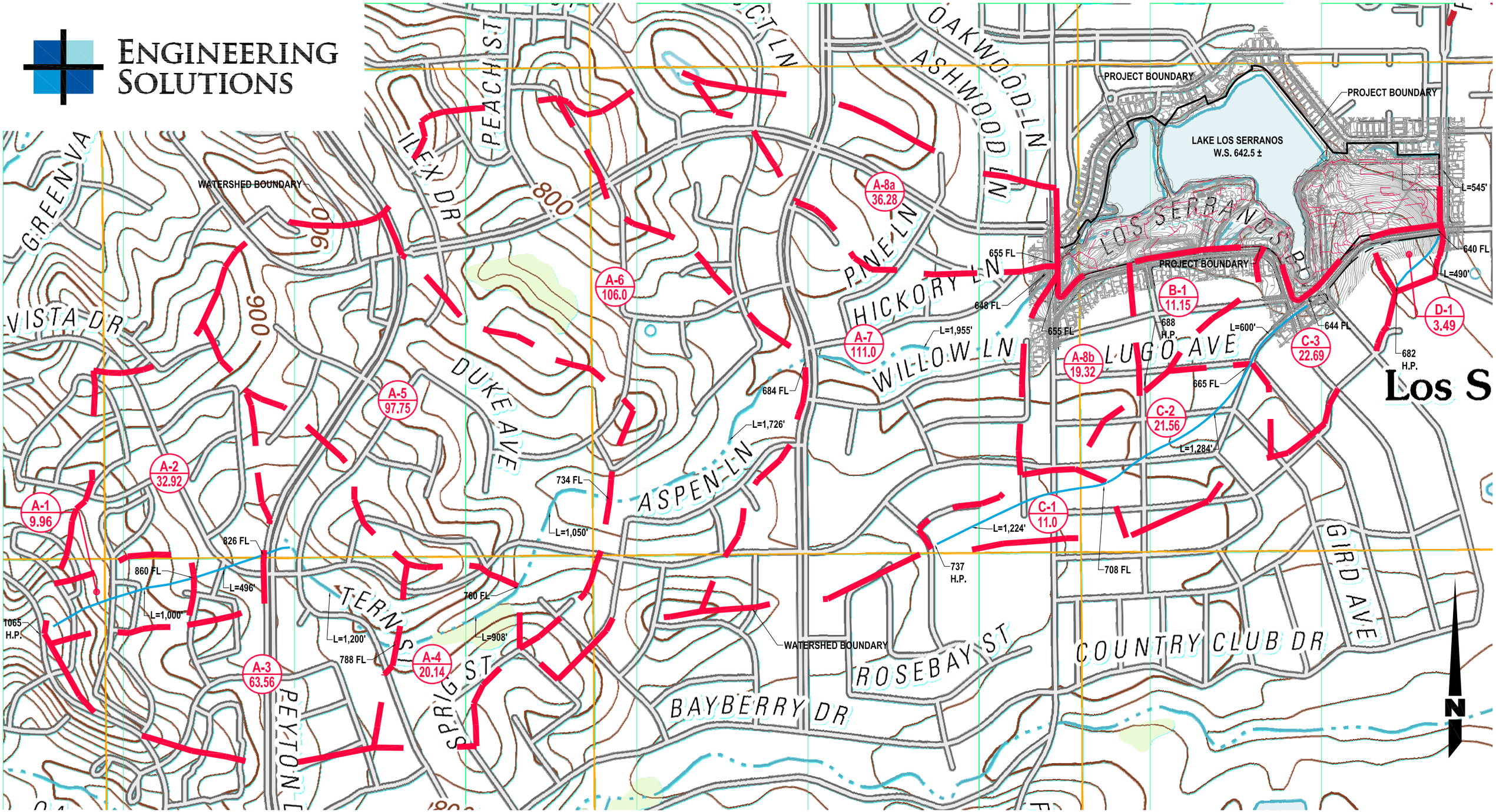
On-Site Pre-Development Condition Hydrology

- Undeveloped (Less than 1% Impervious cover)
- Good Vegetative Cover
- Predominantly Soils Group B

On-Site Developed Condition Hydrology

- Fully developed watershed
- Predominantly Multi-Family Residential
- Predominantly Soils Group B

ENGINEERING SOLUTIONS



GRAPHIC SCALE

600 300 0 600 1200 1800

SCALE: 1"=600'

LEGEND

PROPERTY LINE/PROJECT BOUNDARY

OFF-SITE WATERSHED BOUNDARY

OFF-SITE WATERSHED SUB-AREAS

A-1 / 1.25 — AREA DESIGNATION / ACREAGE

CITY OF CHINO HILLS INCORPORATED 1991

RANCHO CIELITO

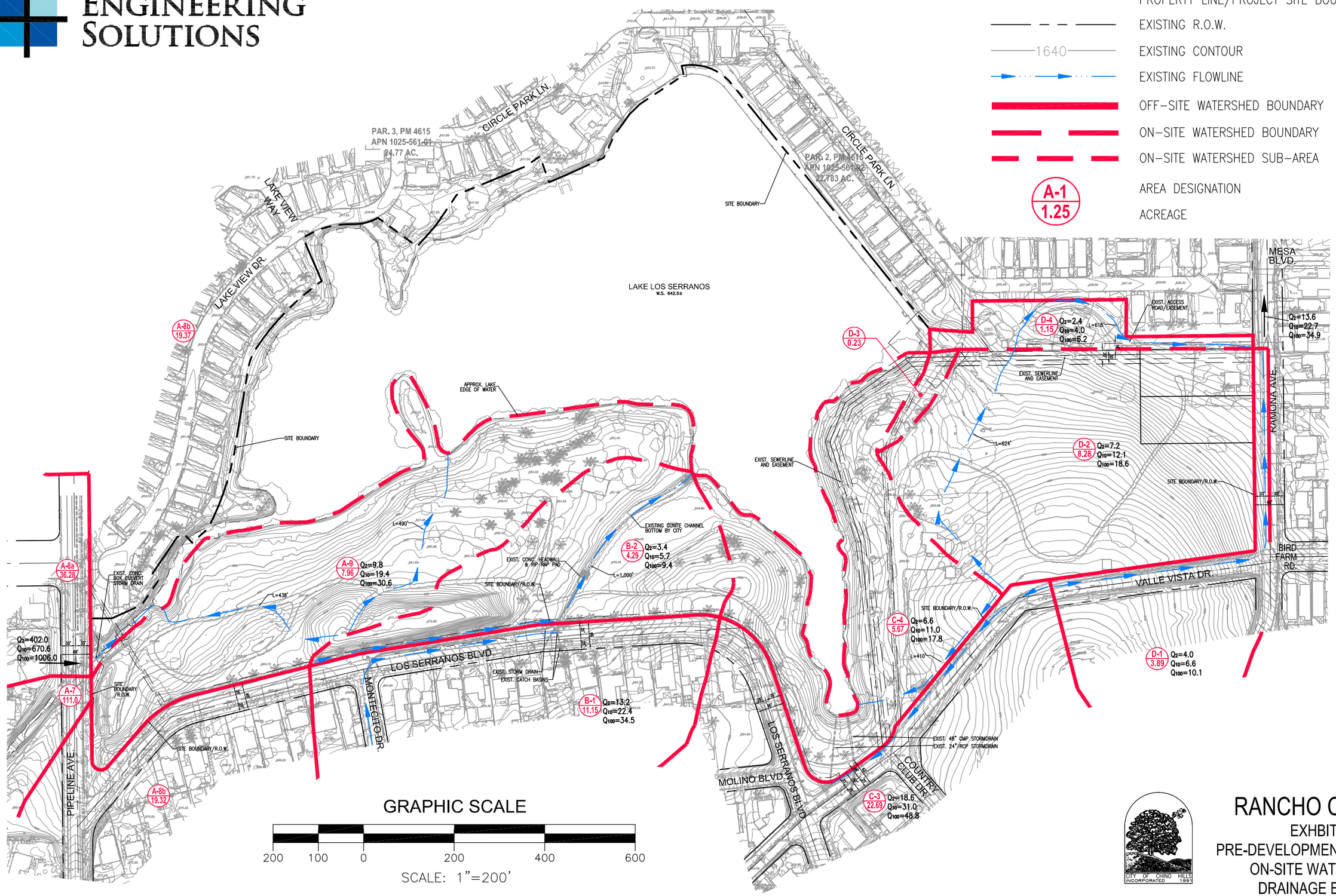
EXHIBIT A

OFF-SITE WATERSHED DRAINAGE EXHIBIT

ENGINEERING SOLUTIONS

LEGEND

- PROPERTY LINE/PROJECT SITE BOUNDARY
- EXISTING R.O.W.
- 1640 — EXISTING CONTOUR
- EXISTING FLOWLINE
- OFF-SITE WATERSHED BOUNDARY
- ON-SITE WATERSHED BOUNDARY
- ON-SITE WATERSHED SUB-AREA
- A-1 / 1.25 — AREA DESIGNATION / ACREAGE



RANCHO CIELITO

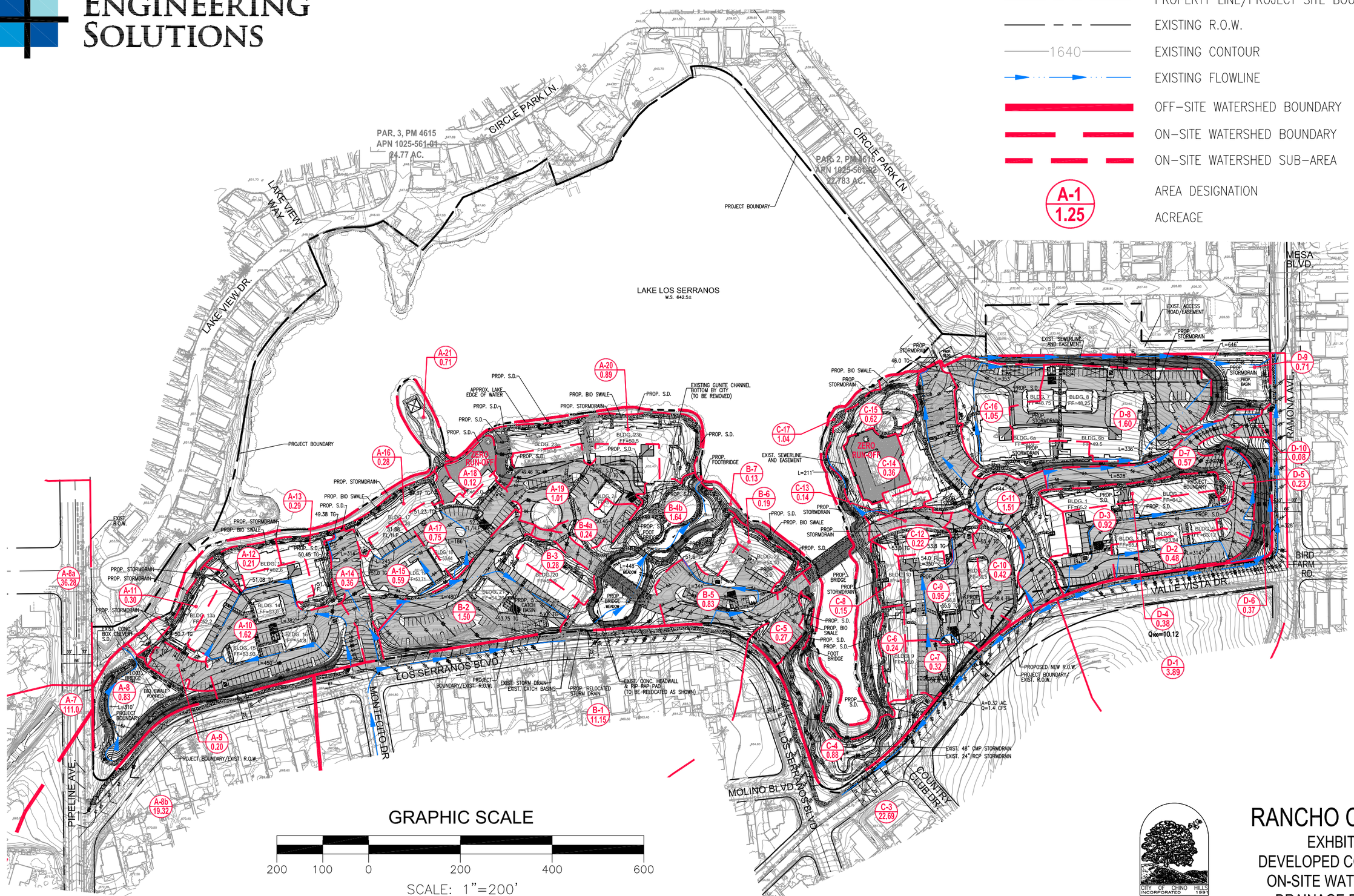
EXHBIT B
PRE-DEVELOPMENT CONDITION
ON-SITE WATERSHED
DRAINAGE EXHIBIT

CITY OF CHINO HILLS INCORPORATED 1991

ENGINEERING SOLUTIONS

LEGEND

- PROPERTY LINE/PROJECT SITE BOUNDARY
- EXISTING R.O.W.
- 1640 — EXISTING CONTOUR
- EXISTING FLOWLINE
- OFF-SITE WATERSHED BOUNDARY
- ON-SITE WATERSHED BOUNDARY
- ON-SITE WATERSHED SUB-AREA
- A-1 — AREA DESIGNATION
- 1.25 — ACREAGE



GRAPHIC SCALE

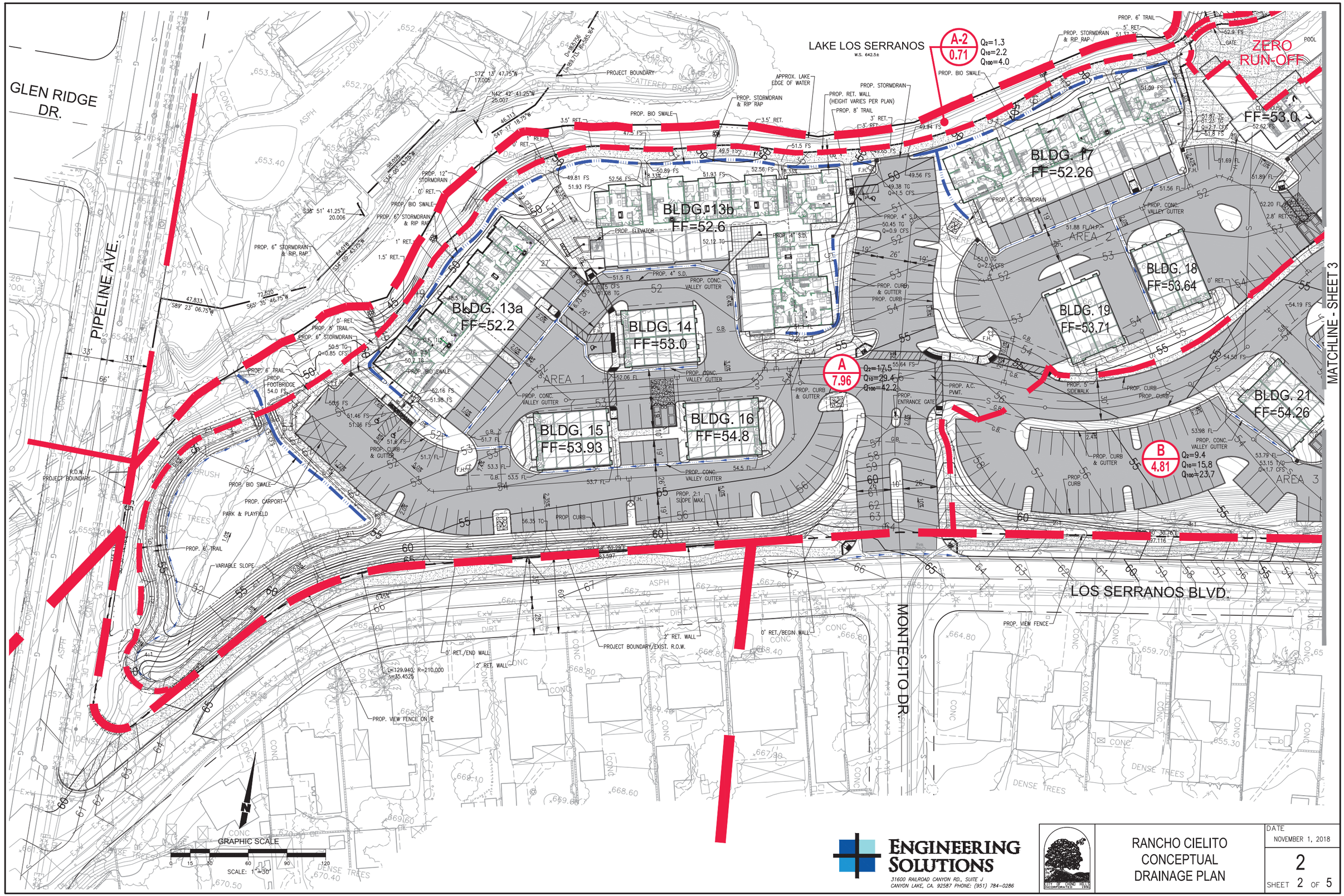
200 100 0 200 400 600

SCALE: 1"=200'

CITY OF CHINO HILLS INCORPORATED 1991

RANCHO CIELITO

EXHIBIT C
DEVELOPED CONDITION
ON-SITE WATERSHED
DRAINAGE EXHIBIT



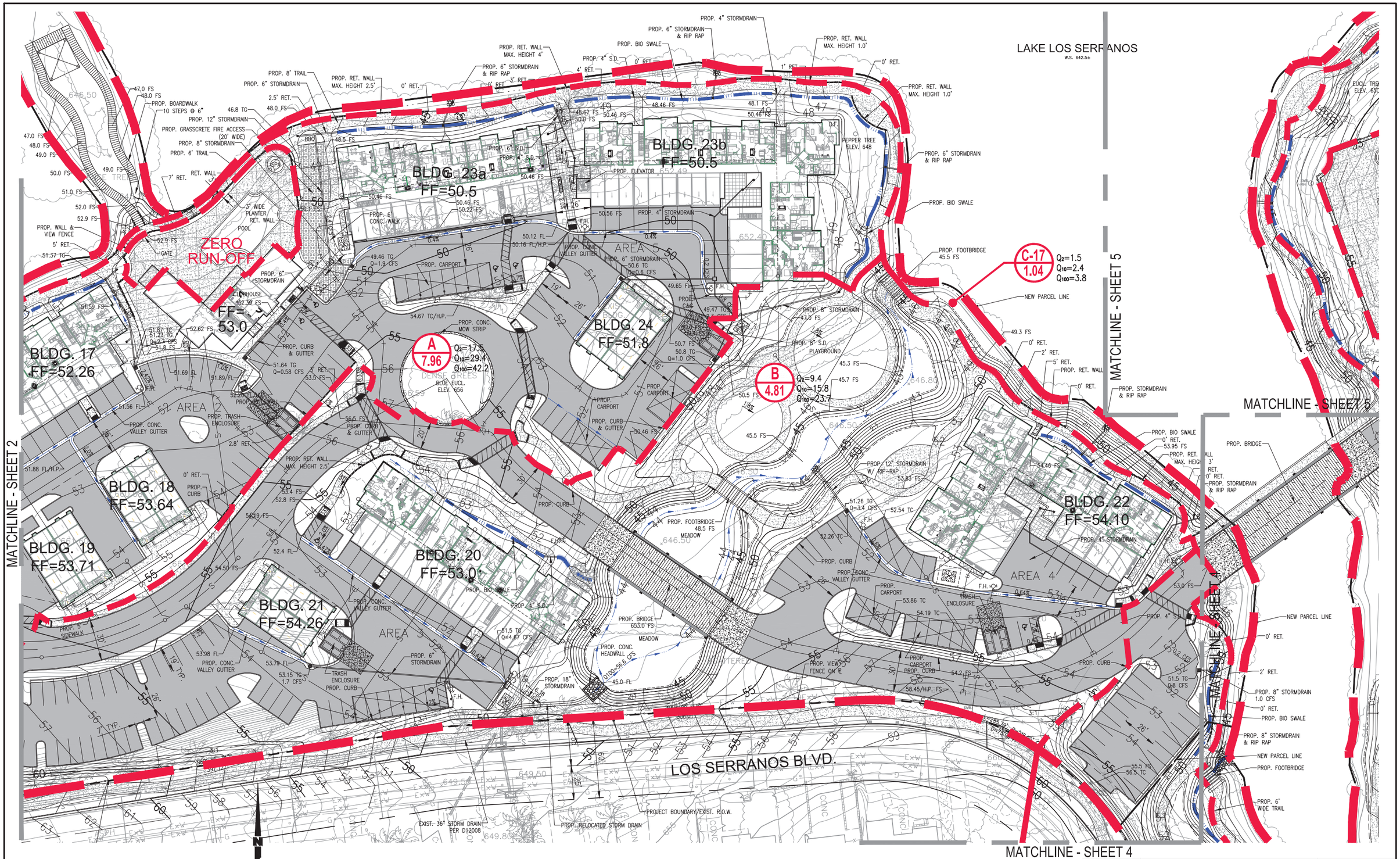
ENGINEERING SOLUTIONS
31600 RAILROAD CANYON RD., SUITE J
CANYON LAKE, CA. 92587 PHONE: (951) 784-0286

RANCHO CIELITO
CONCEPTUAL
DRAINAGE PLAN

DATE
NOVEMBER 1, 2018

2

SHEET 2 OF 5



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CITY OF CHINO HILLS INCORPORATED 1991

RANCHO CIELITO
CONCEPTUAL
DRAINAGE PLAN

DATE
NOVEMBER 1, 2018

SHEET 3 OF 5

MATCHLINE - SHEET 5

MATCHLINE - SHEET 3

LAKE LOS SERRANOS
W.S. 642.5±

BLDG. 22
FF=55.5

AREA 4

B
4.81
Q_2=9.4
Q_{10}=15.8
Q_{100}=23.7

C-17
1.04
Q_2=1.5
Q_{10}=2.4
Q_{100}=3.8

BLDG. 10
FF=55.0

C
6.77
Q_2=14.6
Q_{10}=24.4
Q_{100}=36.6

AREA 3

BLDG. 11
FF=56.8

BLDG. 12
FF=58.5

BLDG. 9
FF=55.0

BLDG. 1
FF=65.2

BLDG. 3
FF=65.8

BLDG. 4
FF=63.94

D
5.26
Q_2=
Q_{10}=
Q_{100}=

AREA 1

PROP. ENTRANCE GATE

VALLE VISTA DR.

PROP. 6' VIEW FENCE

PROPOSED NEW R.O.W.

PROJECT BOUNDARY/EXIST. R.O.W.

SCATTERED BRUSH

6' VIEW FENCE ON 3.2' RET. WALL T/S=62.8

PROP. CARPORT

PROP. CARPORT

6' VIEW FENCE ON 4.5' RET. WALL T/S=57.32

PROP. 6' VIEW FENCE ON 4.5' MAX. RET. WALL

6' VIEW FENCE ON 4' RET. WALL

2' RET.

3' RET.

BEGIN RET. WALL 0' RET.

APPROX LOCATION EXIST. 48" CMP

COUNTRY CLUB DR.

LOS SERRANOS BLVD.

EL MOLINO BLVD.

PROP. BRIDGE

PROP. 6' WIDE TRAIL

PROP. BIO SWALE

EXIST. 12" SEWER (TO BE ABANDONED)

PARCEL LINE

PROP. FOOT BRIDGE

PROP. 6' VIEW FENCE

CUT EXIST. STORMDRAINS & PLACE HEADWALLS AS SHOWN FOR DRAINAGE INTO PROPOSED BIO SWALE (EXIST. PIPES AT LAKE TO BE REMOVED)

APPROX LOCATION EXIST. 24" RCP

GRAPHIC SCALE

0 15 30 60 90 120

SCALE: 1"=30'

ENGINEERING SOLUTIONS

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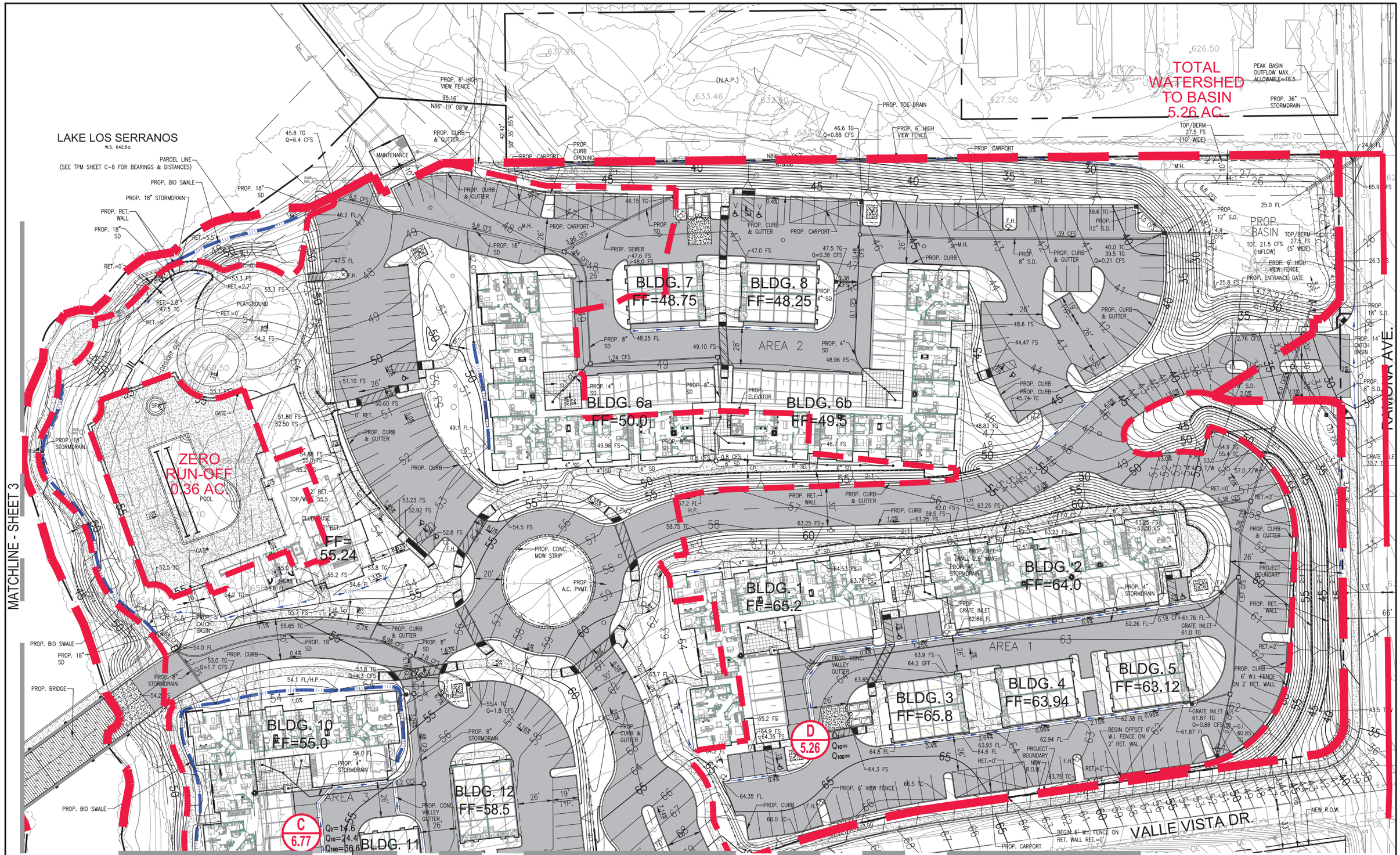
RANCHO CIELITO
CONCEPTUAL
DRAINAGE PLAN

DATE
NOVEMBER 1, 2018

SHEET 4 OF 5



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CONCEPTUAL
DRAINAGE PLAN

DATE
NOVEMBER 1, 2018

5

SHEET 5 OF 5

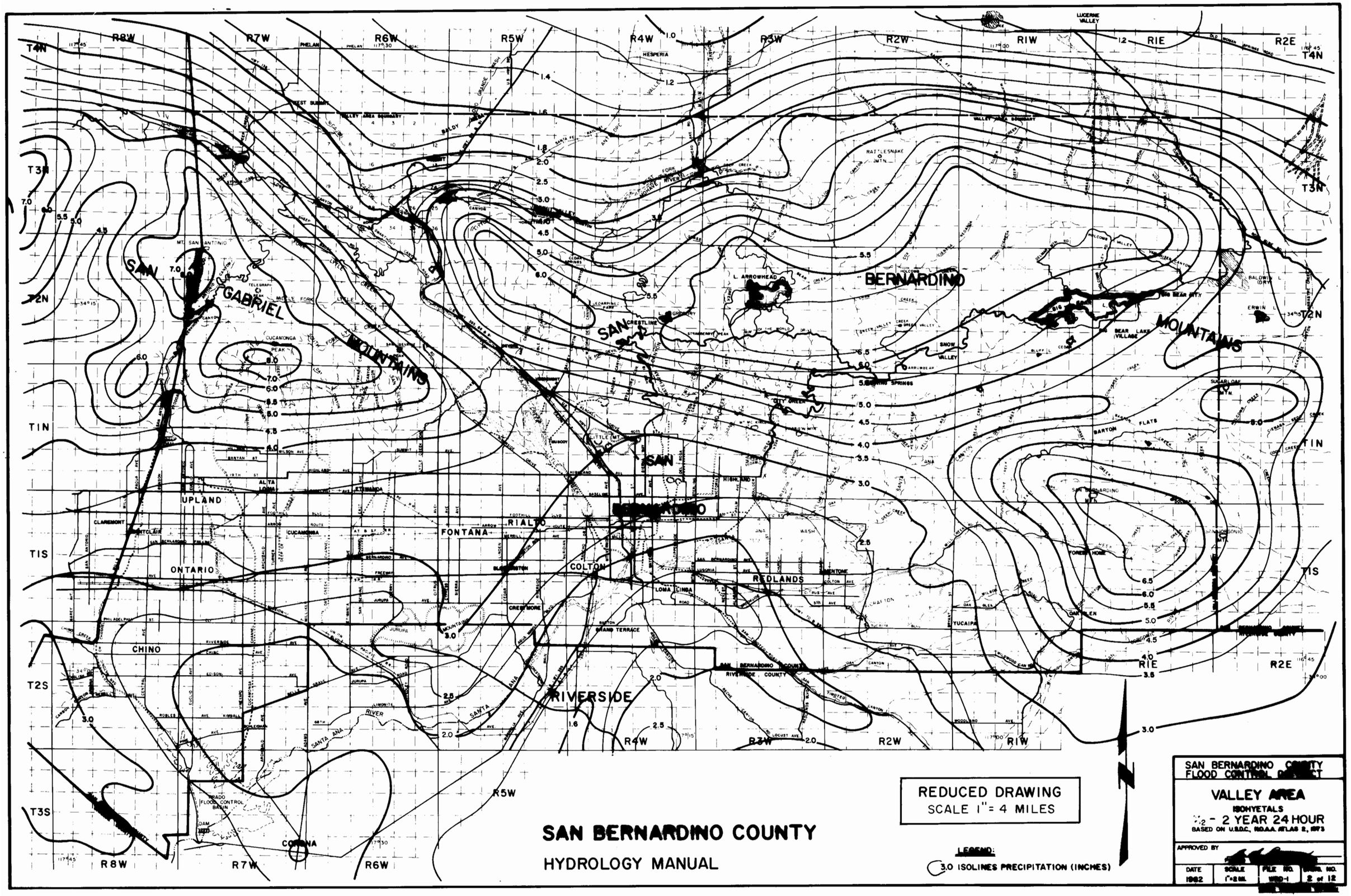
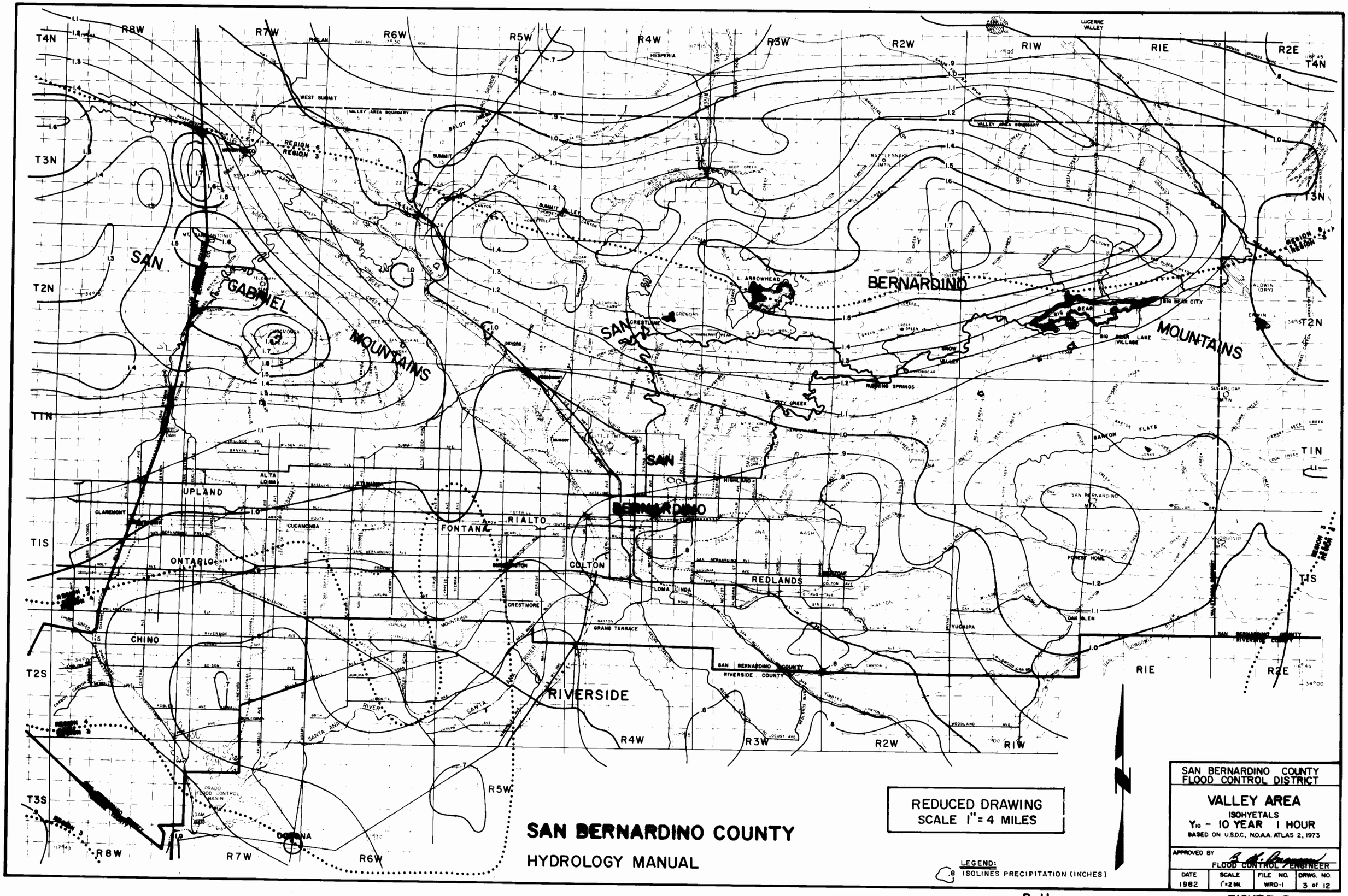

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
3.0 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
1/2 - 2 YEAR 24 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
DATE 1982
SCALE 1"=2 MI.
FILE NO. WRD-1
DWG. NO. 2 of 12
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
SAN BERNARDINO
RIVERSIDE
UPLAND
ONTARIO
CHINO
FONTANA
RIALTO
COLTON
REDLANDS
LOMA LINDA
CRESTMORE
GRAND TERRACE
CORONA
CLAREMONT
CUCAMONGA
ALTA LOMA
ETIWANDA
MT. SAN ANTONIO
CUCAMONGA PEAK
L. ARROWHEAD
L. GREGORY
CREST LINE
HESPERIA
LUCERNE VALLEY
RATTLESNAKE MTN.
SNOW VALLEY
ARROWBEAR
BIG BEAR CITY
BIG BEAR LAKE
BIG BEAR VILLAGE
SUGARLOAF MTN.
SAN BERNARDINO MTN.
FOREST HOME
YUCAIPA
OAK GLEN
BARTON FLATS
SANTA ANA RIVER
PRADO FLOOD CONTROL BASIN
DAM
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
T4N
T3N
T2N
T1N
T1S
T2S
T3S
R8W
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E

FIGURE B-2


SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
.8 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
Y10 - 10 YEAR 1 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
FLOOD CONTROL ENGINEER
DATE 1982
SCALE 1"=2 MI.
FILE NO. WRD-1
DRWG. NO. 3 of 12
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
SAN BERNARDINO
RIVERSIDE
UPLAND
ONTARIO
CHINO
FONTANA
RIALTO
COLTON
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LOMA LINDA
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BIG BEAR
BIG BEAR CITY
BIG BEAR LAKE VILLAGE
ARROWHEAD
HESPERIA
LUCERNE VALLEY
RIW
RIE
R2E
R2W
R3W
R4W
R5W
R6W
R7W
R8W
T4N
T3N
T2N
T1N
T1S
T2S
T3S
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY

FIGURE B-3

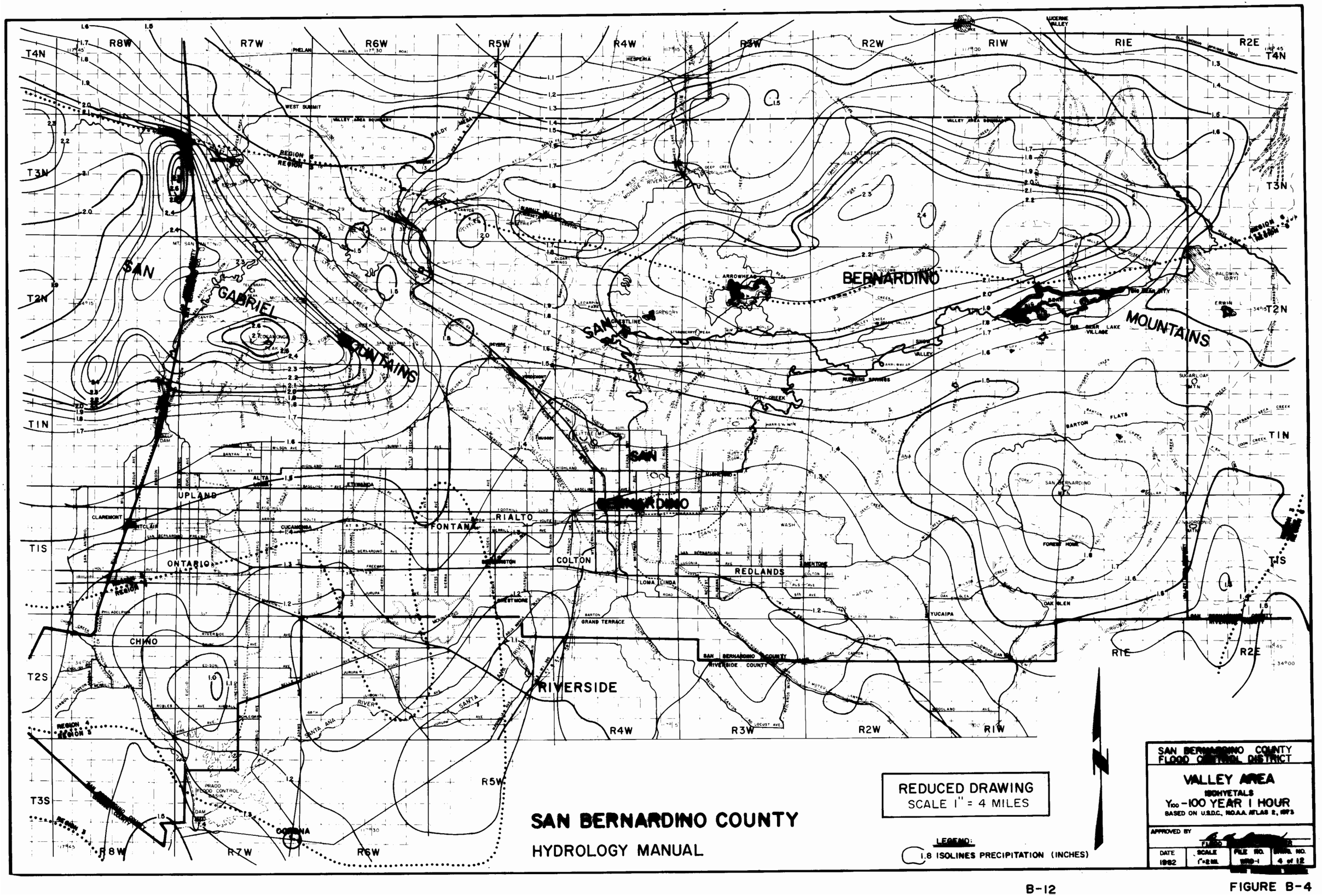

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
1.8 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
Y100 -100 YEAR 1 HOUR
BASED ON U.S.D.C., NOAA ATLAS 2, 1973
APPROVED BY
DATE
1982
SCALE
1"=2 MI.
FILE NO.
SHEET NO.
4 of 12
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
UPLAND
ONTARIO
CHINO
CLAREMONT
FONTANA
RIALTO
COLTON
REDLANDS
LOMA LINDA
RIVERSIDE
YUCAIPA
GRAND TERRACE
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
R8W
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E
T4N
T3N
T2N
T1N
T1S
T2S
T3S

FIGURE B-4

Curve (1) 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
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, 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	71	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	25	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)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

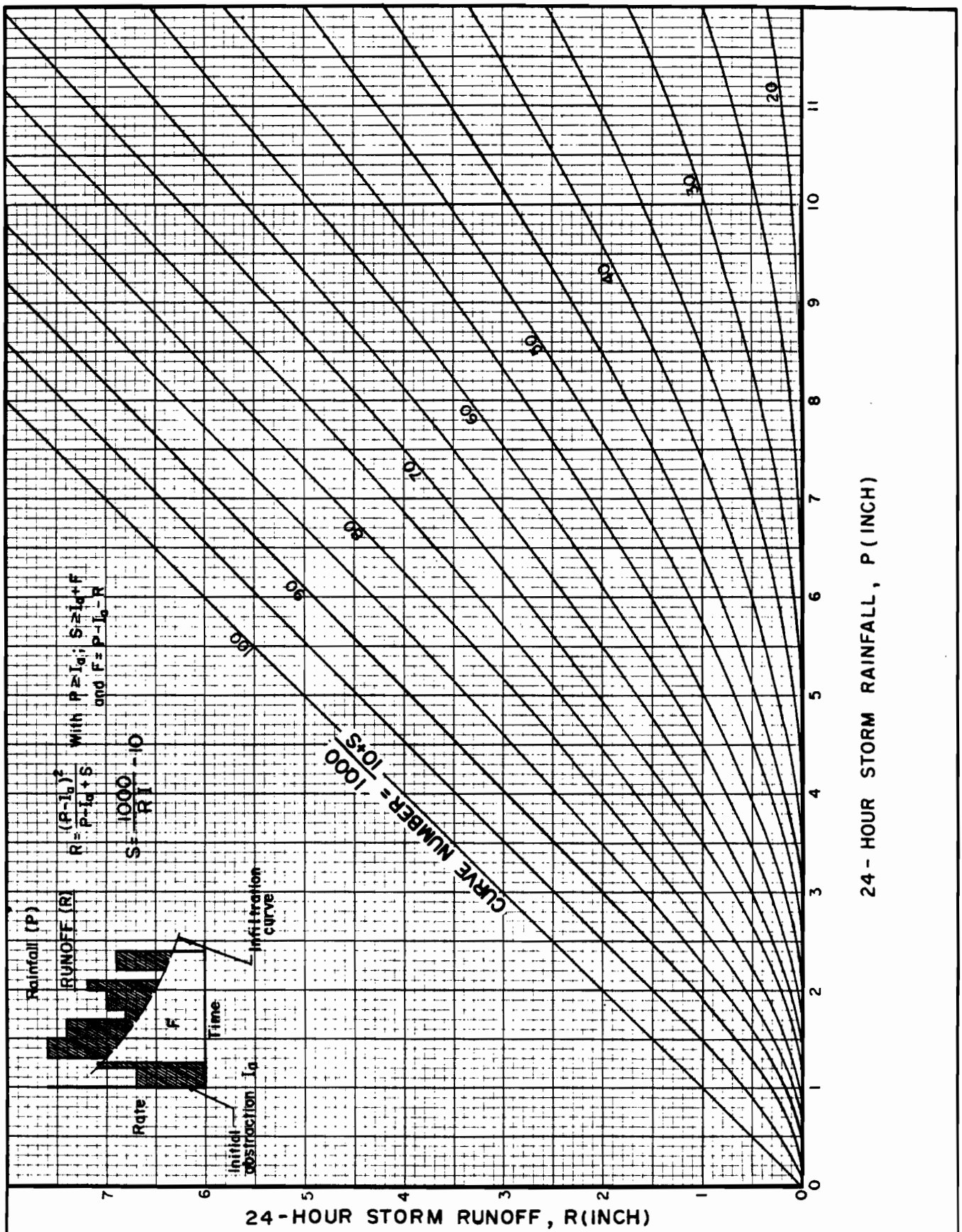
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

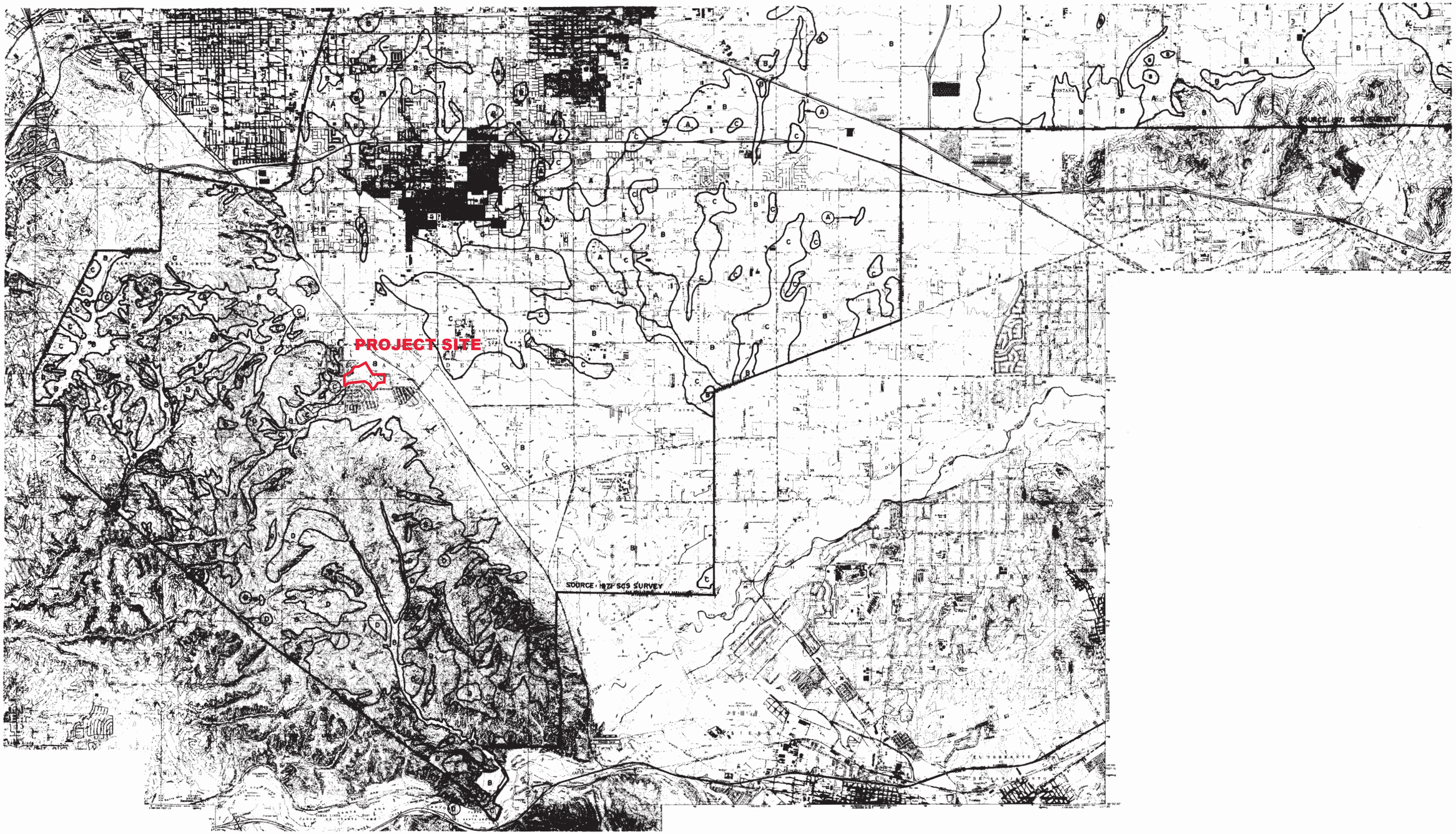
Figure C-3 (2 of 2)

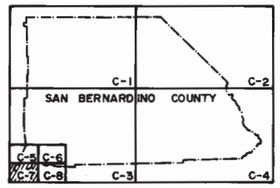


SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

SCS 24-HOUR STORM
RAINFALL-RUNOFF
RELATIONSHIPS

Figure C-5





INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

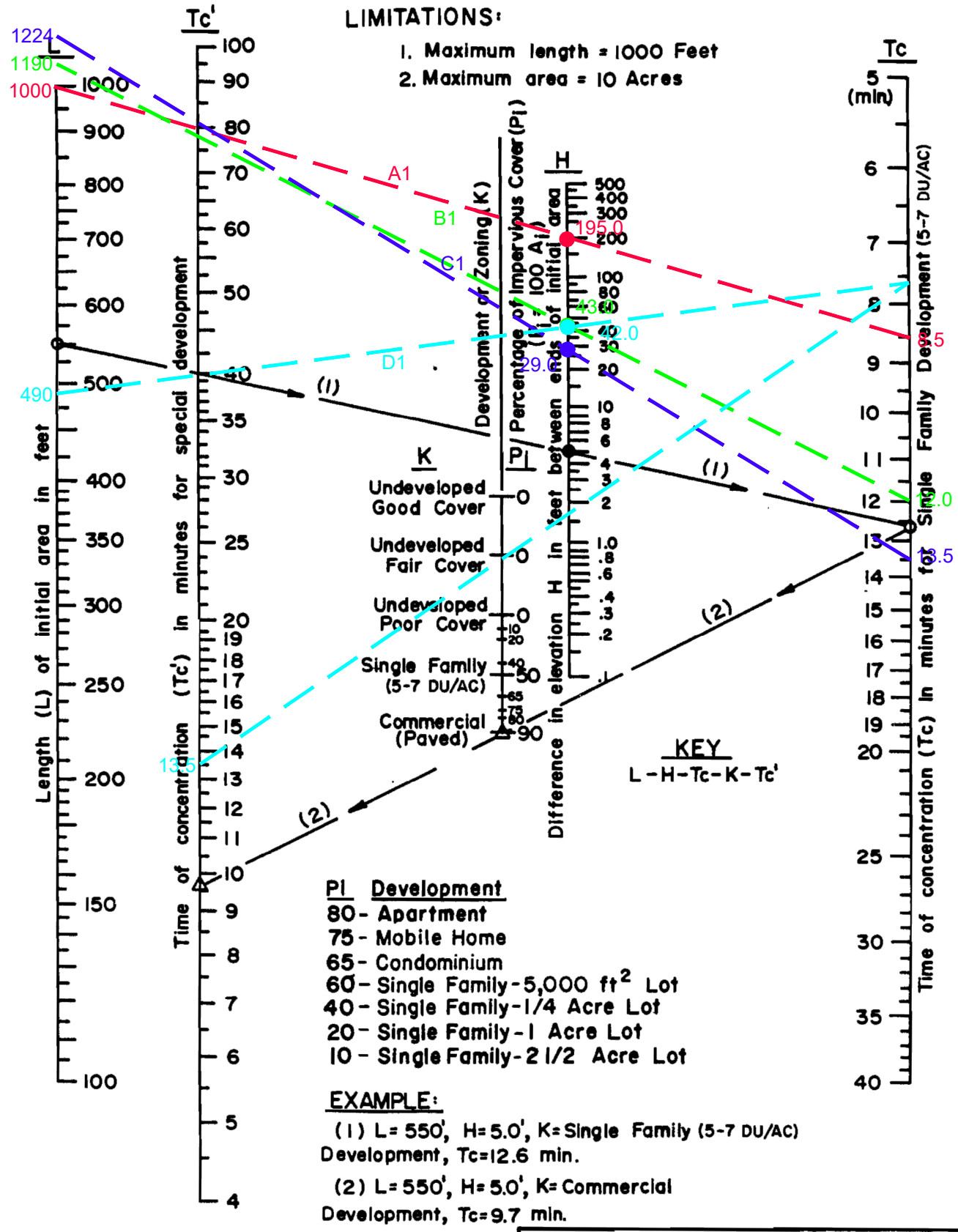
SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-C AREA

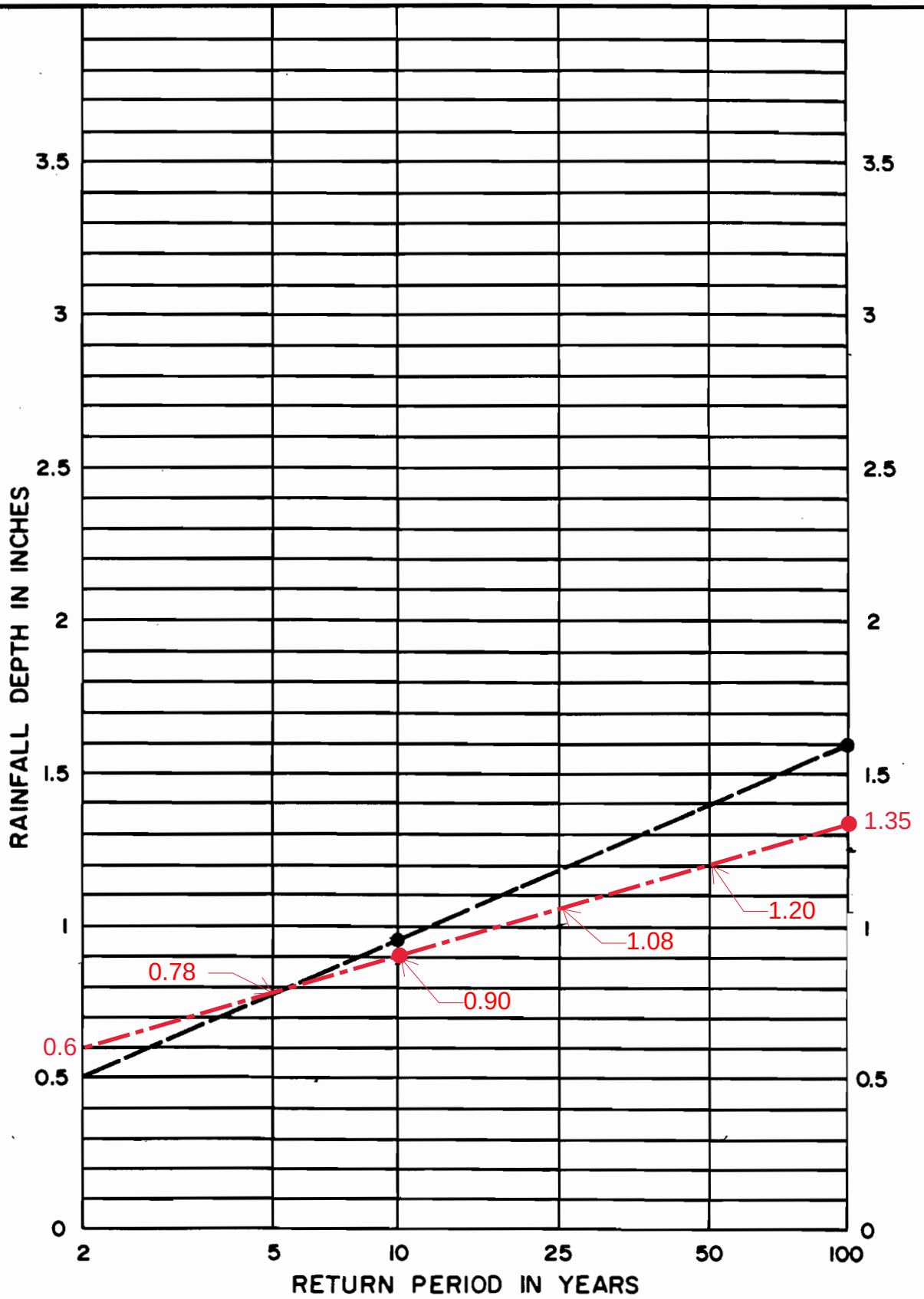
FIGURE C-15



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1a



NOTE:

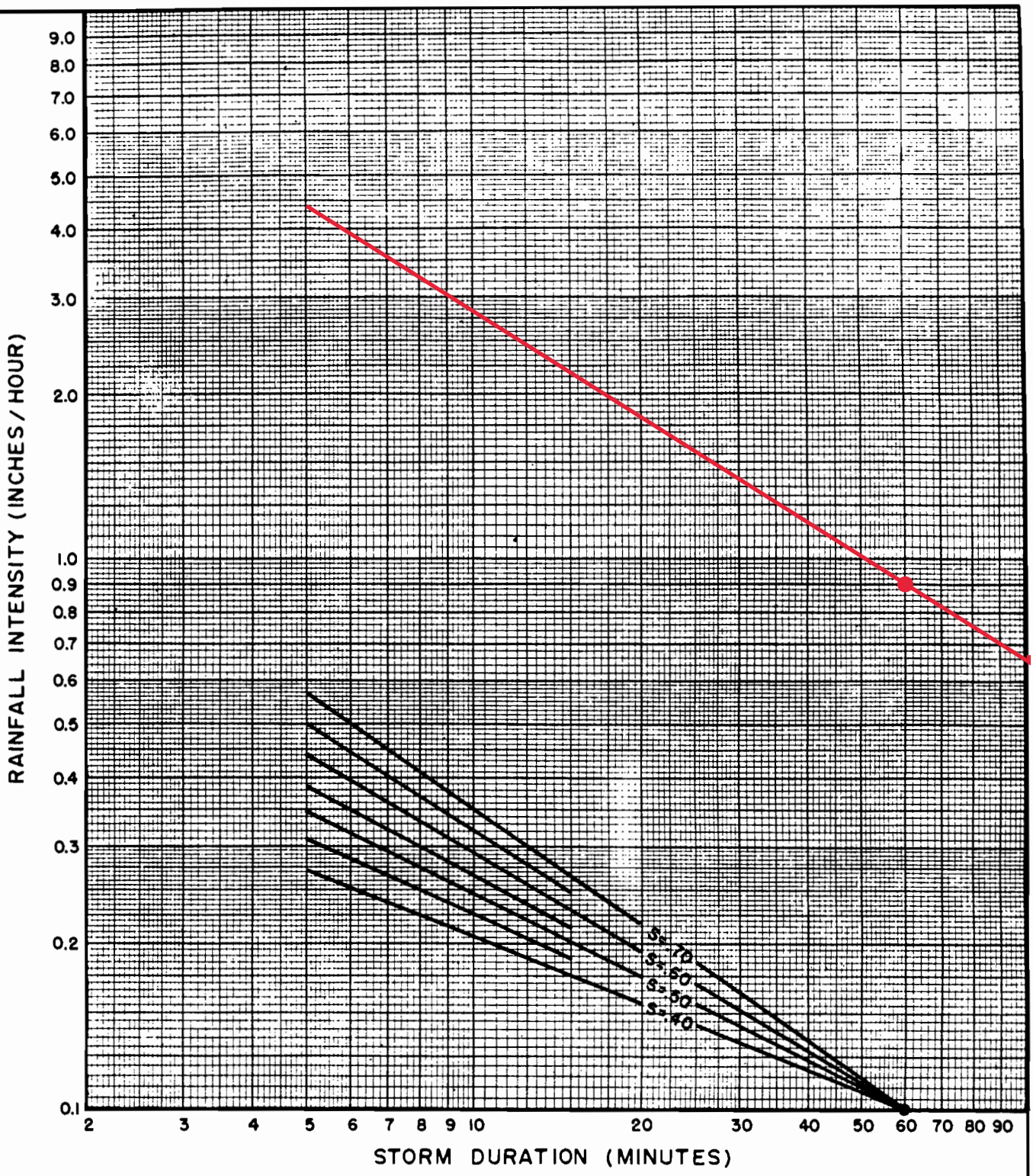
1. FOR INTERMEDIATE RETURN PERIODS PLOT 10-YEAR AND 100-YEAR ONE HOUR VALUES FROM MAPS, THEN CONNECT POINTS AND READ VALUE FOR DESIRED RETURN PERIOD. FOR EXAMPLE GIVEN 10-YEAR ONE HOUR = 0.95" AND 100-YEAR ONE HOUR = 1.60", 25-YEAR ONE HOUR = 1.18".

REFERENCE: NOAA ATLAS 2, VOLUME XI - CAL., 1973

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

FIGURE D-2



DESIGN STORM FREQUENCY = 10 YEARS

ONE HOUR POINT RAINFALL = 0.90 INCHES

LOG-LOG SLOPE = 0.6

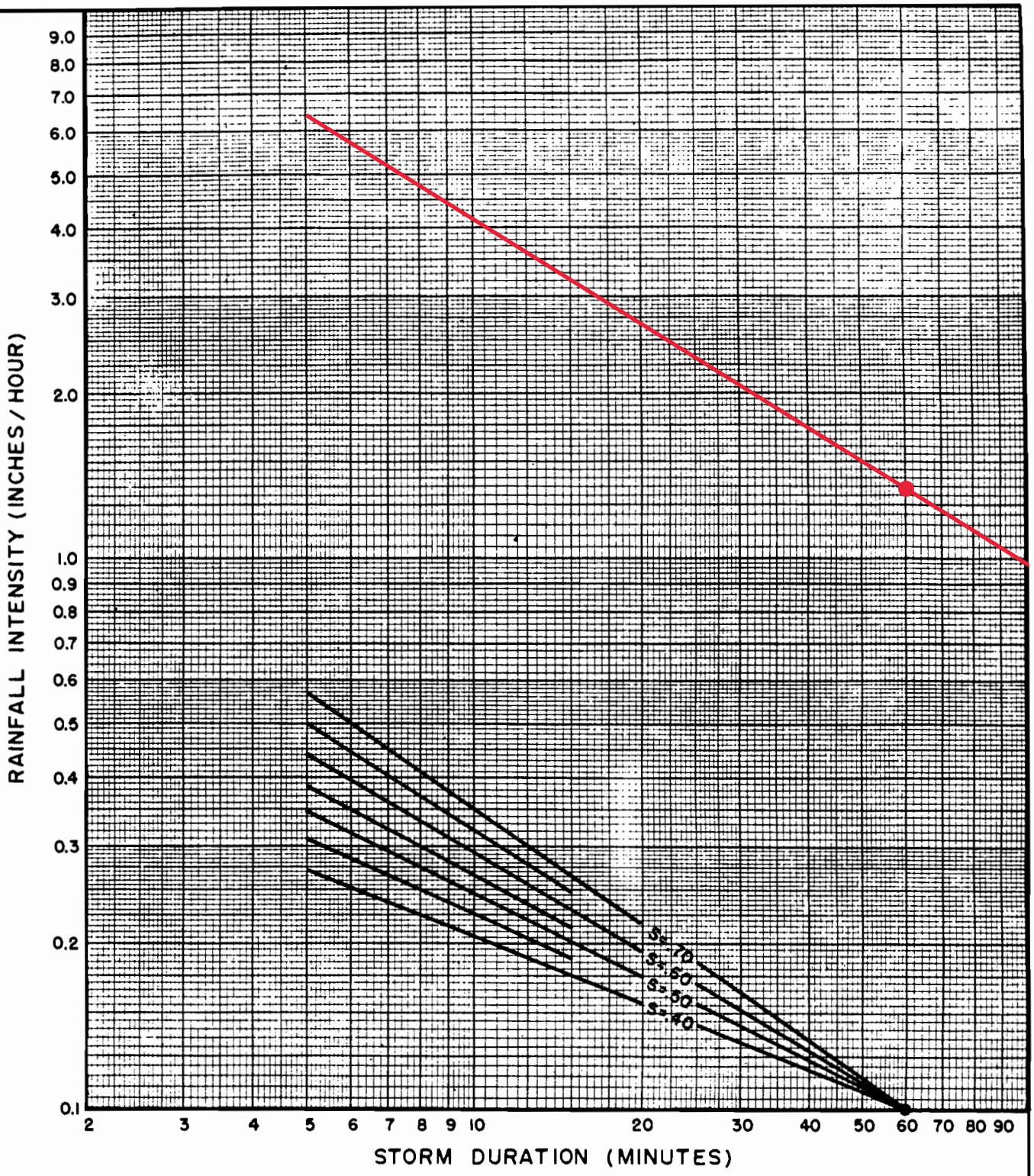
PROJECT LOCATION = Los Serranos

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3



DESIGN STORM FREQUENCY = 100 YEARS

ONE HOUR POINT RAINFALL = 1.35 INCHES

LOG-LOG SLOPE = 0.6

PROJECT LOCATION = Los Serranos

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3

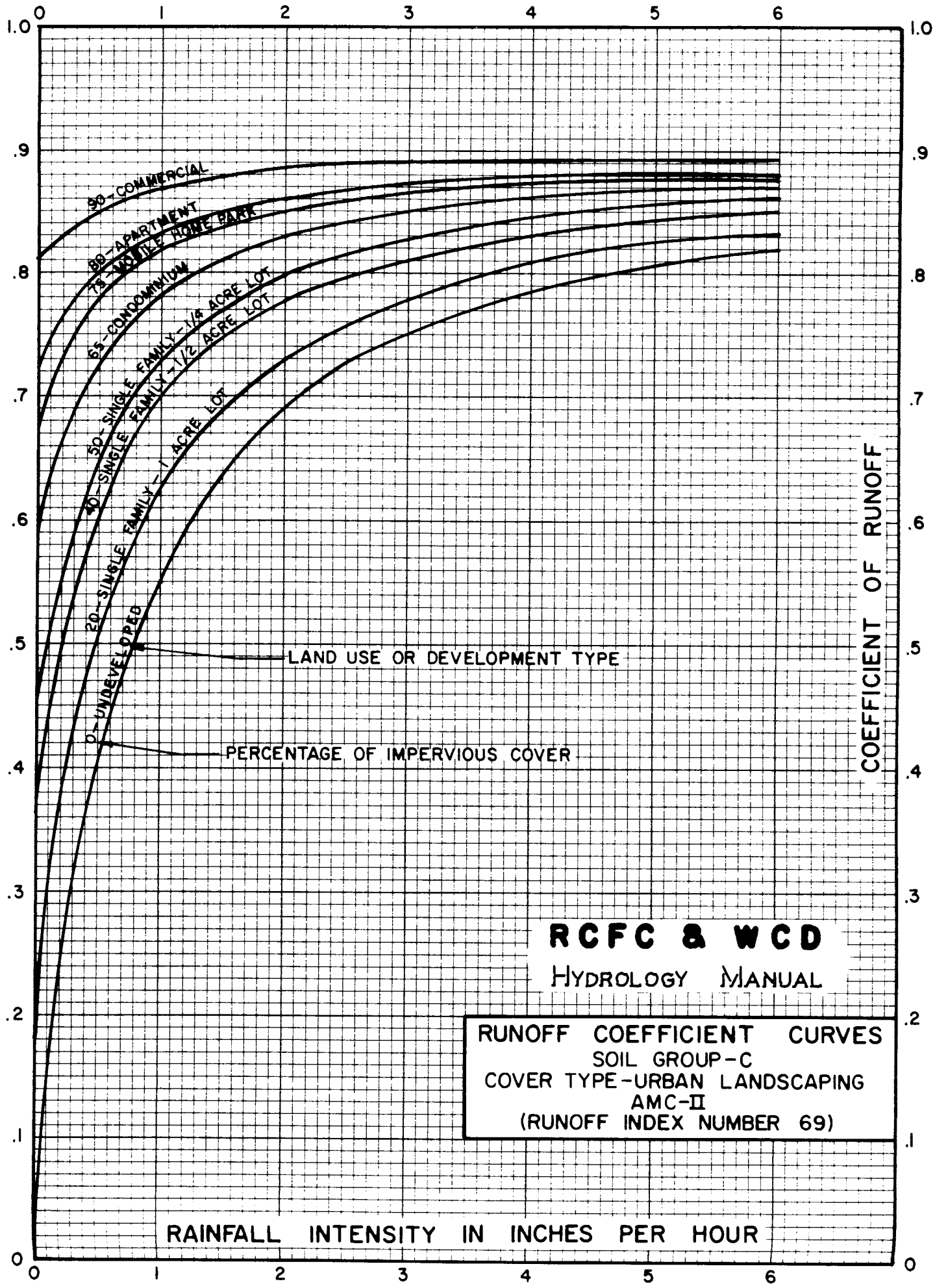

90-COMMERCIAL
80-APARTMENT
75-MOBILE HOME PARK
65-CONDOMINIUM
50-SINGLE FAMILY-1/4 ACRE LOT
40-SINGLE FAMILY-1/2 ACRE LOT
20-SINGLE FAMILY-1 ACRE LOT
0-UNDEVELOPED
LAND USE OR DEVELOPMENT TYPE
PERCENTAGE OF IMPERVIOUS COVER
COEFFICIENT OF RUNOFF
RAINFALL INTENSITY IN INCHES PER HOUR
RCFC & WCD
HYDROLOGY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

PLATE D-5.3

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito Off-Site - 2 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 2 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
								NAT. VALLEY	195		1000	8.50		
A1	B-Residential	9.96	1.86	0.85	15.75								8.50	INITIAL AREA (Figure D-1)
						15.75	0.0685	NAT. VALLEY	34	8.5	496	0.97		
A2	B-Residential	32.92	1.68	0.85	47.01								9.47	
						62.76	0.0317	NAT. VALLEY	38	6.5	1200	3.08		
A3	B-Residential	63.56	1.56	0.84	83.29								12.55	
						146.05	0.0308	NAT. VALLEY	28	6.6	908	2.29		
A4	B-Residential	20.14	1.32	0.83	22.07								14.84	
						168.11	0.0248	NAT. VALLEY	26	7.2	1050	2.43		
A5	B-Residential	97.75	1.14	0.83	92.49								17.27	
						260.60	0.0290	NAT. VALLEY	50	7.3	1726	3.94		
A6	B-Residential	106.00	0.99	0.82	86.05								21.21	
						346.65	0.0184	NAT. VALLEY	36	7.4	1955	4.40		
A7	B-Residential	111.00	0.90	0.81	80.92								25.62	
						427.57	0.0085	NAT. VALLEY	5.5	7.5	648	1.44		
A8a	B-Residential	32.28	0.87	0.81	22.75								27.06	
						450.32	0.0085	NAT. VALLEY	5.5	7.5	648	1.44		
A8b	B-Residential	19.32	0.83	0.80	12.80								28.50	
						13.77	0.0361	STREET	43		1190	12.00		
B1	B-Residential	11.15	1.47	0.84	13.77								12.00	INITIAL AREA (Figure D-1)
						12.33	0.0237	STREET	29		1224	13.50		
C1	B-Residential	11.00	1.35	0.83	12.33								13.50	INITIAL AREA (Figure D-1)
						24.65	0.0335	STREET	43	5.0	1284	4.28		
C2	B-Residential	21.56	1.11	0.82	19.62								17.78	GUTTER
						44.27	0.0326	STREET	21	5.0	644	2.15		
C3	B-Residential	22.69	1.05	0.82	19.54								19.93	GUTTER
						3.63	0.0857	OVERLAND	42	8.8	490	13.50		
D1	B-Undeveloped*	3.49	1.35	0.77	3.63								13.50	INITIAL AREA (Figure D-1)

* Developed as Condos, but with detention

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito Off-Site - 10 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 10 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
								NAT. VALLEY	195		1000	8.50		
A1	B-Residential	9.96	3.10	0.83	25.63								8.50	INITIAL AREA (Figure D-1)
						25.63	0.0685	NAT. VALLEY	34	8.5	496	0.97		
A2	B-Residential	32.92	2.80	0.82	75.58								9.47	
						101.21	0.0317	NAT. VALLEY	38	6.5	1200	3.08		
A3	B-Residential	63.56	2.60	0.82	135.51								12.55	
						236.72	0.0308	NAT. VALLEY	28	6.6	908	2.29		
A4	B-Residential	20.14	2.20	0.81	35.89								14.84	
						272.61	0.0248	NAT. VALLEY	26	7.2	1050	2.43		
A5	B-Residential	97.75	1.90	0.79	146.72								17.27	
						419.33	0.0290	NAT. VALLEY	50	7.3	1726	3.94		
A6	B-Residential	106.00	1.65	0.78	136.42								21.21	
						555.76	0.0184	NAT. VALLEY	36	7.4	1955	4.40		
A7	B-Residential	111.00	1.50	0.75	124.88								25.62	
						680.63	0.0085	NAT. VALLEY	5.5	7.5	648	1.44		
A8a	B-Residential	32.28	1.45	0.75	35.10								27.06	
						715.74	0.0085	NAT. VALLEY	5.5	7.5	648	1.44		
A8b	B-Residential	19.32	1.38	0.75	20.00								28.50	
						22.40	0.0361	STREET	43		1190	12.00		
B1	B-Residential	11.15	2.45	0.82	22.40								12.00	INITIAL AREA (Figure D-1)
						20.05	0.0237	STREET	29		1224	13.50		
C1	B-Residential	11.00	2.25	0.81	20.05								13.50	INITIAL AREA (Figure D-1)
						40.10	0.0335	STREET	43	5.0	1284	4.28		
C2	B-Residential	21.56	1.85	0.79	31.51								17.78	GUTTER
						71.60	0.0326	STREET	21	5.0	644	2.15		
C3	B-Residential	22.69	1.75	0.78	30.97								19.93	GUTTER
						6.56	0.0857	OVERLAND	42	8.8	490	13.50		
D1	B-Undeveloped*	3.89	2.25	0.75	6.56								13.50	INITIAL AREA (Figure D-1)

* Developed as Condos, but with detention

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito Off-Site - 100 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 100 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
								NAT. VALLEY	195		1000	8.50		
A1	B-Residential	9.96	4.65	0.85	39.37								8.50	INITIAL AREA (Figure D-1)
						39.37	0.0685	NAT. VALLEY	34	8.5	496	0.97		
A2	B-Residential	32.92	4.20	0.85	117.52								9.47	
						156.89	0.0317	NAT. VALLEY	38	6.5	1200	3.08		
A3	B-Residential	63.56	3.90	0.84	208.22								12.55	
						365.11	0.0308	NAT. VALLEY	28	6.6	908	2.29		
A4	B-Residential	20.14	3.30	0.83	55.16								14.84	
						420.28	0.0248	NAT. VALLEY	26	7.2	1050	2.43		
A5	B-Residential	97.75	2.85	0.83	231.23								17.27	
						651.50	0.0290	NAT. VALLEY	50	7.3	1726	3.94		
A6	B-Residential	106.00	2.48	0.82	215.13								21.21	
						866.63	0.0184	NAT. VALLEY	36	7.4	1955	4.40		
A7	B-Residential	111.00	2.25	0.81	202.30								25.62	
						1068.93	0.0085	NAT. VALLEY	5.5	7.5	648	1.44		
A8a	B-Residential	32.28	2.18	0.81	56.87								27.06	
						1125.80	0.0085	NAT. VALLEY	5.5	7.5	648	1.44		
A8b	B-Residential	19.32	2.07	0.80	31.99								28.50	
						34.42	0.0361	STREET	43		1190	12.00		
B1	B-Residential	11.15	3.68	0.84	34.42								12.00	INITIAL AREA (Figure D-1)
						30.81	0.0237	STREET	29		1224	13.50		
C1	B-Residential	11.00	3.38	0.83	30.81								13.50	INITIAL AREA (Figure D-1)
						61.63	0.0335	STREET	43	5.0	1284	4.28		
C2	B-Residential	21.56	2.78	0.82	49.06								17.78	GUTTER
						110.69	0.0326	STREET	21	5.0	644	2.15		
C3	B-Residential	22.69	2.63	0.82	48.84								19.93	GUTTER
						9.07	0.0857	OVERLAND	42	8.8	490	13.50		
D1	B-Undeveloped*	3.49	3.38	0.77	9.07								13.50	INITIAL AREA (Figure D-1)

* Developed as Condos, but with detention

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Pre-Development - 2 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 2 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
						12.23		NAT. VALLEY	32.9		490	8.0		
A9	C-Undeveloped	7.96	1.92	0.8	12.23								8.0	INITIAL AREA (Figure D-1)
						3.76	0.0025	NAT. VALLEY	2.5	0.9	1000	20.0		
B2	C-Undeveloped	4.29	1.17	0.75	3.76								20.0	INITIAL AREA (Figure D-1)
						7.12	0.0671	NAT. VALLEY	27.5	1.8	410	11.2		
C4	C-Undeveloped	5.67	1.59	0.79	7.12								11.2	
							0.0513	NAT. VALLEY	32.0	9.5	624	17.00		
D2	C-Undeveloped	8.28	1.20	0.75	7.45								17.0	INITIAL AREA (Figure D-1)
						7.45								
D3	C-Undeveloped	0.23	2.64	0.82	0.50									
						7.95	0.0210	NAT. VALLEY	13.0	4.0	618	2.58		
D4	C-Undeveloped	1.15	2.64	0.74	2.25								2.6	
						10.20		NAT. VALLEY						
D Comp		8.51	1.24	0.75	7.89									

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Pre-Development - 10 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 10 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
						19.36		NAT. VALLEY	32.9		490	8.0		
A9	C-Undeveloped	7.96	3.20	0.76	19.36	5.73	0.0025	NAT. VALLEY	2.5	0.9	1000	20.0	8.0	INITIAL AREA (Figure D-1)
B2	C-Undeveloped	4.29	1.95	0.685	5.73	11.04	0.0671	NAT. VALLEY	27.5	1.8	410	11.2	20.0	INITIAL AREA (Figure D-1)
C4	C-Undeveloped	5.67	2.65	0.735	11.04		0.0513	NAT. VALLEY	32.0	9.5	624	17.00	11.2	
D2	C-Undeveloped	8.28	2.00	0.73	12.09	12.09							17.0	INITIAL AREA (Figure D-1)
D3	C-Undeveloped	0.23	4.40	0.795	0.80	12.89	0.0210	NAT. VALLEY	13.0	4.0	618	2.58	17.0	
D4	C-Undeveloped	1.15	4.40	0.795	4.02	16.92		NAT. VALLEY					19.6	
D Composite		8.51	2.06	0.74	12.97									

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Pre-Development - 100 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 100 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
						30.57		NAT. VALLEY	32.9		490	8.0		
A9	C-Undeveloped	7.96	4.80	0.8	30.57								8.0	INITIAL AREA (Figure D-1)
						9.41	0.0025	NAT. VALLEY	2.5	0.9	1000	20.0		
B2	C-Undeveloped	4.29	2.93	0.75	9.41								20.0	INITIAL AREA (Figure D-1)
						17.81	0.0671	NAT. VALLEY	27.5	1.8	410	11.2		
C4	C-Undeveloped	5.67	3.98	0.79	17.81								11.2	
							0.0513	NAT. VALLEY	32.0	9.5	624	17.00		
D2	C-Undeveloped	8.28	3.00	0.75	18.63								17.0	INITIAL AREA (Figure D-1)
						18.63								
D3	C-Undeveloped	0.23	6.60	0.82	1.24									
						19.87	0.0210	NAT. VALLEY	13.0	4.0	618	2.58		
D4	C-Undeveloped	1.15	6.60	0.74	5.62								2.6	
						25.49		NAT. VALLEY						
D Comp		8.51	3.09	0.75	19.72									

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 2 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 2 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.0726	OVERLAND	22.5		310	15.5	15.5	INITIAL AREA (FIGURE D-1)
A-8	C-Open Space	0.83	1.32	0.76	0.83	0.83		STREET				5.0	5.0	
A-9	C-Apartment	0.20	2.61	0.88	0.46	1.29	0.0333	STREET	15.0		450	7.5	7.5	
A-10	C-Apartment	1.62	2.01	0.88	2.87	4.16		ROOF				5.0	5.0	
A-11	C-Apartment	0.30	2.61	0.88	0.69	4.85		ROOF				5.0	5.0	
A-12	C-Apartment	0.21	2.61	0.88	0.48	5.33		ROOF				5.0	5.0	
A-13	C-Apartment	0.29	2.61	0.88	0.67	5.99	0.0510	STREET	16.0		314	6.5	6.5	
A-14	C-Apartment	0.36	2.19	0.88	0.69	6.69		STREET				5.0	5.0	
A-15	C-Apartment	0.59	2.61	0.88	1.36	8.04		STREET				5.0	5.0	
A-16	C-Apartment	0.28	2.61	0.88	0.64	8.69		STREET				5.0	5.0	
A-17	C-Apartment	0.75	2.61	0.88	1.72	10.41		STREET				5.0	5.0	
A-18	Pool	0.12	0.00	0	0.00	10.41		STREET				5.0	5.0	
A-19	C-Apartment	1.01	2.61	0.88	2.32	12.73		ROOF				5.0	5.0	
A-20	C-Apartment	0.89	2.61	0.88	2.04	14.77		OVERLAND				5.0	5.0	
A-21*	C-Open Space	0.71	2.61	0.82	1.52	16.29		OVERLAND				5.0	5.0	
A-Composite	Composite	8.04	2.46	0.88	17.40									

* Does not contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 2 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 2 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.0250	STREET	12.0		480	8.5		
B-2	C-Apartment	1.50	1.86	0.88	2.46								8.5	INITIAL AREA (FIGURE D-1)
						2.46		STREET				5.0		
B-3	C-Apartment	0.28	2.61	0.88	0.64								5.0	
						3.10		STREET				5.0		
B-4a	C-Apartment	0.24	2.61	0.88	0.55								5.0	
						3.65	0.0040	NAT. VALLEY	1.8		448	33.0		
B-4b	C-Open Space	1.64	0.76	0.61	0.76								33.0	
						4.41		STREET				5.0		
B-5	C-Apartment	0.83	2.61	0.88	1.91								5.0	
						6.32		ROOF				5.0		
B-6	C-Apartment	0.19	2.61	0.88	0.44								5.0	
						6.75		OVERLAND				5.0		
B-7	C-Open Space	0.13	2.61	0.82	0.28								5.0	
B-Composite	Composite	4.81	2.24	0.88	9.47									
							0.0213		11.5		540	18.5		
C-4	C-Open Space	0.88	1.14	0.68	0.68								18.5	INITIAL AREA (FIGURE D-1)
						0.68		ROOF				5.0		
C-5	C-Apartment	0.27	2.61	0.88	0.62								5.0	
						1.30		STREET				5.0		
C-6	C-Apartment	0.24	2.61	0.88	0.55								5.0	
						1.85		ROOF				5.0		
C-7	C-Apartment	0.32	2.61	0.88	0.73								5.0	
						2.59		STREET				5.0		
C-8	C-Apartment	0.15	2.61	0.88	0.34								5.0	
						2.93		STREET				5.0		
C-9	C-Apartment	0.95	2.61	0.88	2.18								5.0	
						5.12		STREET				5.0		
C-10	C-Apartment	0.42	2.61	0.88	0.96								5.0	
						6.08	0.0417	STREET	24.00		576	5.0		
C-11	C-Apartment	1.51	2.61	0.88	3.47								5.0	
						9.55		STREET				5.0		
C-12	C-Apartment	0.22	2.61	0.88	0.51								5.0	
						10.05		STREET				5.0		
C-13	C-Apartment	0.14	2.61	0.88	0.32								5.0	
						10.37						5.0		
C-14	C-Pool	0.36	2.61	0.88	0.83								5.0	
						11.20						5.0		
C-15	C-Apartment	0.62	2.61	0.88	1.42								5.0	
						12.63			11.00		335	7.0		
C-16	C-Apartment	1.05	2.07	0.88	1.91								7.0	
						14.54						7.0		
C-17*	Open Space	1.04	1.86	0.76	1.47								7.0	
						16.01								
C-Composite	Composite	6.77	2.454	0.88	14.62								0.0	

*Does not contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 2 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 2 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.01	STREET	4.50		314	7.5		
D-2	C-Apartment	0.48	2.04	0.88	0.86								7.5	INITIAL AREA (FIGURE D-1)
						0.86		PIPE	0.65	4.2	134	0.5		
D-3	C-Apartment	0.92	2.01	0.88	1.63								8.0	
						2.49		PIPE	2.00	5.0	60	0.2		
D-4	C-Apartment	0.38	1.95	0.88	0.65								8.2	
						3.14		PIPE	20.00	18.3	55	0.1		
D-5	C-Apartment	0.23	1.92	0.88	0.39								8.3	
						3.53		PIPE	4.00	10.0	48	0.1		
D-6	C-Open Space	0.37	1.89	0.72	0.50								8.4	
						4.03		PIPE	2.50		27	0.1		
D-7	C-Apartment	0.57	1.89	0.88	0.95								8.5	
						4.98		PIPE	14.00		20	0.0		
D-8	C-Apartment	1.6	1.86	0.88	2.62								8.5	
						7.60		PIPE	6.00		20	0.0		
D-9	C-Open Space	0.71	1.86	0.72	0.95								8.5	
						8.55						10.0		
D-10*	C-Apartment	0.08	1.86	0.88	0.13								10.0	BASIN
						8.68						10.0		
D Composite	Composite	5.26	1.91	0.87	8.76								10.0	BASIN INFLOW

*Does not Contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 10 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 10 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.0726	OVERLAND	22.5		310	15.5		
A-8	C-Open Space	0.83	2.2	0.71	1.30								15.5	INITIAL AREA (FIGURE D-1)
						1.30		STREET				5.0		
A-9	C-Apartment	0.20	4.35	0.86	0.75								5.0	
						2.04	0.0333	STREET	15.0		450	7.5		
A-10	C-Apartment	1.62	3.35	0.87	4.72								7.5	
						6.77		ROOF				5.0		
A-11	C-Apartment	0.30	4.35	0.88	1.15								5.0	
						7.91		ROOF				5.0		
A-12	C-Apartment	0.21	4.35	0.88	0.80								5.0	
						8.72		ROOF				5.0		
A-13	C-Apartment	0.29	4.35	0.88	1.11								5.0	
						9.83	0.0510	STREET	16.0		314	6.5		
A-14	C-Apartment	0.36	3.65	0.88	1.16								6.5	
						10.98		STREET				5.0		
A-15	C-Apartment	0.59	4.35	0.88	2.26								5.0	
						13.24		STREET				5.0		
A-16	C-Apartment	0.28	4.35	0.88	1.07								5.0	
						14.32		STREET				5.0		
A-17	C-Apartment	0.75	4.35	0.88	2.87								5.0	
						17.19		STREET				5.0		
A-18	Pool	0.12	0	0	0.00								5.0	
						17.19		STREET				5.0		
A-19	C-Apartment	1.01	4.35	0.88	3.87								5.0	
						21.05		ROOF				5.0		
A-20	C-Apartment	0.89	4.35	0.88	3.41								5.0	
						24.46		OVERLAND				5.0		
A-21*	C-Open Space	0.71	4.35	0.71	2.19								5.0	
						26.65		OVERLAND				5.0		
A-Composite	Composite	8.04	4.1	0.88	29.01								5.0	

* Does not contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 10 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 10 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.0250	STREET	12.0		480	8.5		
B-2	C-Apartment	1.50	3.10	0.87	4.05								8.5	INITIAL AREA (FIGURE D-1)
						4.05		STREET				5.0		
B-3	C-Apartment	0.28	4.35	0.88	1.07								5.0	
						5.12		STREET				5.0		
B-4a	C-Apartment	0.24	4.35	0.88	0.92								5.0	
						6.04	0.0040	NAT. VALLEY	1.8		448	33.0		
B-4b	C-Open Space	1.64	1.27	0.61	1.27								33.0	
						7.31		STREET				5.0		
B-5	C-Apartment	0.83	4.35	0.88	3.18								5.0	
						10.48		ROOF				5.0		
B-6	C-Apartment	0.19	4.35	0.88	0.73								5.0	
						11.21		OVERLAND				5.0		
B-7	C-Open Space	0.13	4.35	0.76	0.43								5.0	
B-Composite	Composite	4.81	3.73	0.85	15.25									
							0.0213		11.5		540	18.5		
C-4	C-Open Space	0.88	1.90	0.68	1.14								18.5	INITIAL AREA (FIGURE D-1)
						1.14		ROOF				5.0		
C-5	C-Apartment	0.27	4.35	0.88	1.03								5.0	
						2.17		STREET				5.0		
C-6	C-Apartment	0.24	4.35	0.88	0.92								5.0	
						3.09		ROOF				5.0		
C-7	C-Apartment	0.32	4.35	0.88	1.22								5.0	
						4.31		STREET				5.0		
C-8	C-Apartment	0.15	4.35	0.88	0.57								5.0	
						4.89		STREET				5.0		
C-9	C-Apartment	0.95	4.35	0.88	3.64								5.0	
						8.53		STREET				5.0		
C-10	C-Apartment	0.42	4.35	0.88	1.61								5.0	
						10.13	0.0417	STREET	24.00		576	5.0		
C-11	C-Apartment	1.51	4.35	0.88	5.78								5.0	
						15.91		STREET				5.0		
C-12	C-Apartment	0.22	4.35	0.88	0.84								5.0	
						16.76		STREET				5.0		
C-13	C-Apartment	0.14	4.35	0.88	0.54								5.0	
						17.29						5.0		
C-14	C-Pool	0.36	4.35	0.88	1.38								5.0	
						18.67						5.0		
C-15	C-Apartment	0.62	4.35	0.88	2.37								5.0	
						21.04			11.00		335	7.0		
C-16	C-Apartment	1.05	3.45	0.88	3.19								7.0	
						24.23						7.0		
C-17*	Open Space	1.04	3.1	0.75	2.42								7.0	
						26.65								
C-Composite	Composite	6.77	4.09	0.88	24.37								0.0	

*Does not contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 10 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 10 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.01	STREET	4.50		314	7.5		
D-2	C-Apartment	0.48	3.40	0.88	1.44								7.5	INITIAL AREA (FIGURE D-1)
						1.44		PIPE	0.65	4.2	134	0.5		
D-3	C-Apartment	0.92	3.35	0.88	2.71								8.0	
						4.15		PIPE	2.00	5.0	60	0.2		
D-4	C-Apartment	0.38	3.25	0.88	1.09								8.2	
						5.24		PIPE	20.00	18.3	55	0.1		
D-5	C-Apartment	0.23	3.2	0.88	0.65								8.3	
						5.88		PIPE	4.00	10.0	48	0.1		
D-6	C-Open Space	0.37	3.15	0.72	0.84								8.4	
						6.72		PIPE	2.50		27	0.1		
D-7	C-Apartment	0.57	3.15	0.88	1.58								8.5	
						8.30		PIPE	14.00		20	0.0		
D-8	C-Apartment	1.6	3.1	0.88	4.36								8.5	
						12.67		PIPE	6.00		20	0.0		
D-9	C-Open Space	0.71	3.10	0.72	1.58								8.5	
						14.25						10.0		
D-10*	C-Apartment	0.08	3.10	0.88	0.22								10.0	BASIN
						14.47						10.0		
D Composite	Composite	5.26	3.19	0.87	14.60								10.0	BASIN INFLOW

*Does not Contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 100 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 100 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.0726	OVERLAND	22.5		310	15.5		
A-8	C-Open Space	0.83	3.3	0.76	2.08								15.5	INITIAL AREA (FIGURE D-1)
						2.08		STREET				5.0		
A-9	C-Apartment	0.20	6.53	0.88	1.15								5.0	
						3.23	0.0333	STREET	15.0		450	7.5		
A-10	C-Apartment	1.62	5.03	0.88	7.16								7.5	
						10.39		ROOF				5.0		
A-11	C-Apartment	0.30	6.53	0.88	1.72								5.0	
						12.12		ROOF				5.0		
A-12	C-Apartment	0.21	6.53	0.88	1.21								5.0	
						13.32		ROOF				5.0		
A-13	C-Apartment	0.29	6.53	0.88	1.67								5.0	
						14.99	0.0510	STREET	16.0		314	6.5		
A-14	C-Apartment	0.36	5.48	0.88	1.73								6.5	
						16.72		STREET				5.0		
A-15	C-Apartment	0.59	6.53	0.88	3.39								5.0	
						20.11		STREET				5.0		
A-16	C-Apartment	0.28	6.53	0.88	1.61								5.0	
						21.72		STREET				5.0		
A-17	C-Apartment	0.75	6.53	0.88	4.31								5.0	
						26.02		STREET				5.0		
A-18	Pool	0.12	0.00	0	0.00								5.0	
						26.02		STREET				5.0		
A-19	C-Apartment	1.01	6.53	0.88	5.80								5.0	
						31.82		ROOF				5.0		
A-20	C-Apartment	0.89	6.53	0.88	5.11								5.0	
						36.93		OVERLAND				5.0		
A-21*	C-Open Space	0.71	6.53	0.82	3.80								5.0	
						40.73		OVERLAND				5.0		
A-Composite	Composite	8.04	6.15	0.88	43.51								5.0	

* Does not contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 100 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 100 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.0250	STREET	12.0		480	8.5		
B-2	C-Apartment	1.50	4.65	0.88	6.14								8.5	INITIAL AREA (FIGURE D-1)
						6.14		STREET				5.0		
B-3	C-Apartment	0.28	6.53	0.88	1.61								5.0	
						7.75		STREET				5.0		
B-4a	C-Apartment	0.24	6.53	0.88	1.38								5.0	
						9.12	0.0040	NAT. VALLEY	1.8		448	33.0		
B-4b	C-Open Space	1.64	1.91	0.61	1.91								33.0	
						11.03		STREET				5.0		
B-5	C-Apartment	0.83	6.53	0.88	4.77								5.0	
						15.80		ROOF				5.0		
B-6	C-Apartment	0.19	6.53	0.88	1.09								5.0	
						16.89		OVERLAND				5.0		
B-7	C-Open Space	0.13	6.53	0.82	0.70								5.0	
B-Composite	Composite	4.81	5.60	0.88	23.68									
							0.0213		11.5		540	18.5		
C-4	C-Open Space	0.88	2.85	0.68	1.71								18.5	INITIAL AREA (FIGURE D-1)
						1.71		ROOF				5.0		
C-5	C-Apartment	0.27	6.53	0.88	1.55								5.0	
						3.26		STREET				5.0		
C-6	C-Apartment	0.24	6.53	0.88	1.38								5.0	
						4.63		ROOF				5.0		
C-7	C-Apartment	0.32	6.53	0.88	1.84								5.0	
						6.47		STREET				5.0		
C-8	C-Apartment	0.15	6.53	0.88	0.86								5.0	
						7.33		STREET				5.0		
C-9	C-Apartment	0.95	6.53	0.88	5.45								5.0	
						12.79		STREET				5.0		
C-10	C-Apartment	0.42	6.53	0.88	2.41								5.0	
						15.20	0.0417	STREET	24.00		576	5.0		
C-11	C-Apartment	1.51	6.53	0.88	8.67								5.0	
						23.87		STREET				5.0		
C-12	C-Apartment	0.22	6.53	0.88	1.26								5.0	
						25.13		STREET				5.0		
C-13	C-Apartment	0.14	6.53	0.88	0.80								5.0	
						25.94						5.0		
C-14	C-Pool	0.36	6.53	0.88	2.07								5.0	
						28.00						5.0		
C-15	C-Apartment	0.62	6.53	0.88	3.56								5.0	
						31.56			11.00		335	7.0		
C-16	C-Apartment	1.05	5.18	0.88	4.78								7.0	
						36.35						7.0		
C-17*	Open Space	1.04	4.65	0.76	3.68								7.0	
						40.02								
C-Composite	Composite	6.77	6.135	0.88	36.55								0.0	

*Does not contribute to BMP

SAN BERNARDINO COUNTY HYDROLOGY MANUAL
RATIONAL METHOD CALCULATION FORM

PROJECT **Rancho Cielito On-Site Post-Development - 100 YEAR** Calculated by David Currington Date 10/30/18

FREQUENCY 100 YR Checked by _____ Date _____

DRAINAGE AREA	Soil & Development	A Acres	I in/hr.	C	Δ Q C F S	∑ Q C F S	SLOPE	SECTION	H FT.	V F P S	L FT.	T MIN.	∑ T	REMARKS
							0.01	STREET	4.50		314	7.5		
D-2	C-Apartment	0.48	5.10	0.88	2.15	2.15		PIPE	0.65	4.2	134	0.5	7.5	INITIAL AREA (FIGURE D-1)
D-3	C-Apartment	0.92	5.03	0.88	4.07	6.22		PIPE	2.00	5.0	60	0.2	8.0	
D-4	C-Apartment	0.38	4.88	0.88	1.63	7.85		PIPE	20.00	18.3	55	0.1	8.2	
D-5	C-Apartment	0.23	4.8	0.88	0.97	8.82		PIPE	4.00	10.0	48	0.1	8.3	
D-6	C-Open Space	0.37	4.73	0.72	1.26	10.08		PIPE	2.50		27	0.1	8.4	
D-7	C-Apartment	0.57	4.73	0.88	2.37	12.45		PIPE	14.00		20	0.0	8.5	
D-8	C-Apartment	1.6	4.65	0.88	6.55	19.00		PIPE	6.00		20	0.0	8.5	
D-9	C-Open Space	0.71	4.65	0.72	2.38	21.38						10.0	8.5	
D-10*	C-Apartment	0.08	4.65	0.88	0.33	21.70						10.0	10.0	BASIN
D Composite	Composite	5.26	4.79	0.87	21.90								10.0	BASIN INFLOW

*Does not Contribute to BMP

RANCHO CIELITO

SITE RUNOFF SUMMARY

Drainage Area	Pre-Development				Post-Development				ΔQ		
	Acres	Q_2	Q_{10}	Q_{100}	Acres	Q_2	Q_{10}	Q_{100}	Q_2	Q_{10}	Q_{100}
A	7.96	12.23	19.36	30.57	8.04	17.40	29.01	43.51	5.18	9.65	12.95
B	4.29	3.76	5.73	9.41	4.81	9.47	15.25	23.68	5.71	9.52	14.27
C	5.67	7.12	11.04	17.81	6.77	14.62	24.37	36.55	7.50	13.32	18.74
D(3)	8.51	7.89	12.97	19.72	5.26	8.76	14.60	21.90	0.87	1.63	2.18
A-18(4)					0.12	0.00	0.00	0.00	0.00	0.00	0.00
A-21(1)					0.71	1.52	2.19	3.80	1.52	2.19	3.80
C-14					0.36	0.83	1.38	2.07	0.83	1.38	2.07
C-17(1)					1.04	1.47	2.42	3.68	1.47	2.42	3.68
D-10(2)					0.08	0.13	0.22	0.33	0.13	0.22	0.33
TOTAL SITE	**26.43**	**31.00**	**49.11**	**77.50**	**27.19**	**54.20**	**89.43**	**135.51**	**23.20**	**40.32**	**58.01**

(1) Undeveloped runoff directly to lake
(2) Uncontrolled runoff to Ramona Ave.
(3) Includes areas D-2 and D-3 in the pre-development condition
(4) Pool area - No runoff

RANCHO CIELITO

2-YEAR 24-HOUR SITE RUNOFF SUMMARY

Drainage Area	Pre-Development				Post-Development				Δ Runoff
	Acres	Q_2	Runoff Rate (1)	Runoff Volume (3)	Acres	Q_2	Runoff Rate (1)	Runoff Volume (3)	Q_2
A	7.96	12.23	0.075	0.60	8.04	17.40	0.096	0.77	0.17
B	4.29	3.76	0.075	0.32	4.81	9.47	0.096	0.46	0.14
C	5.67	7.12	0.075	0.43	6.77	14.62	0.096	0.65	0.22
D	8.51	7.89	0.075	0.64	5.26	8.76	0.096	0.50	-0.13
(4)			0.075	0.00	1.55		0.075	0.12	0.12
TOTAL SITE	**26.43**	**31.00**		**1.98**	**26.43**	**50.26**		**2.50**	**0.52**

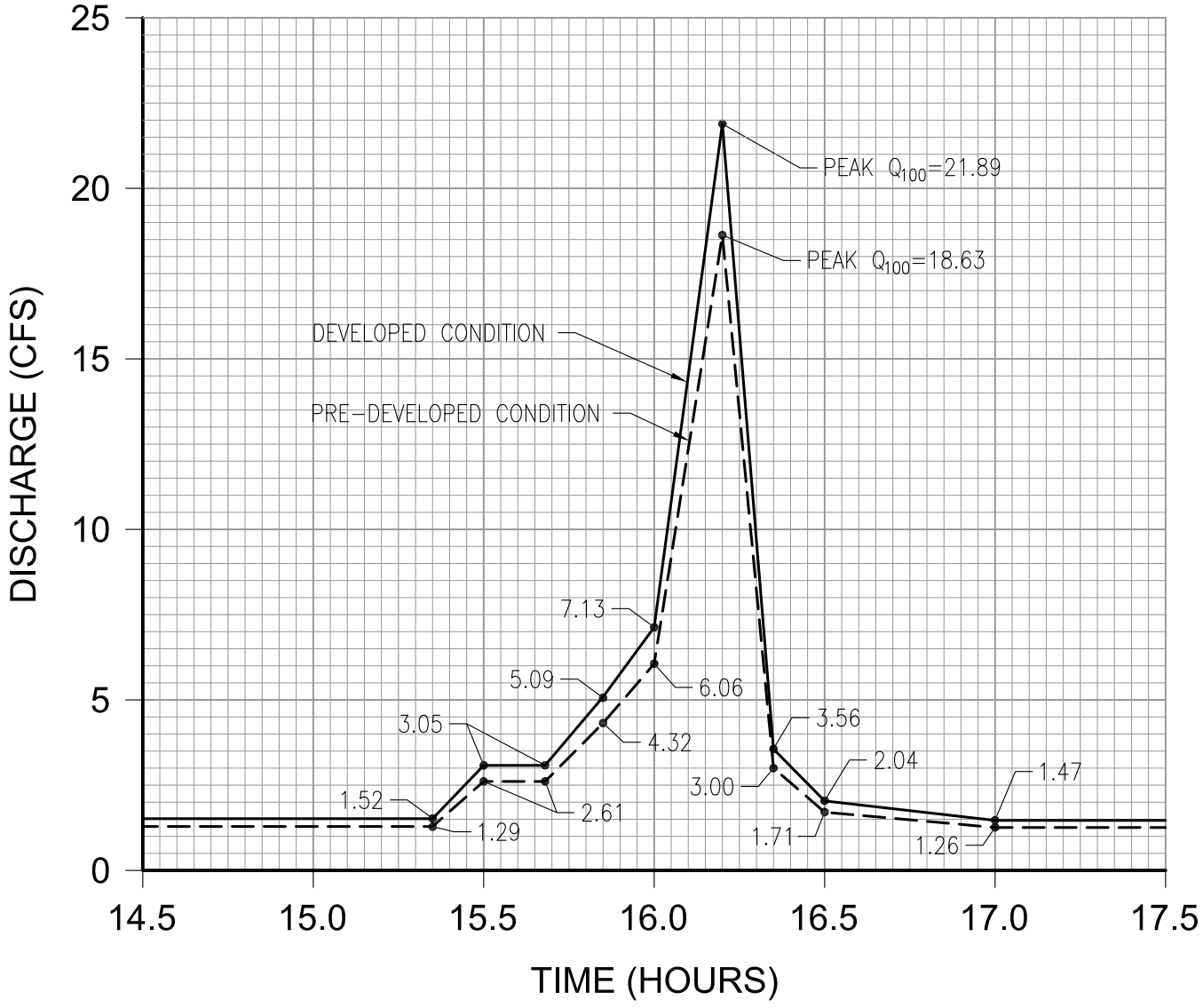
2-Year, 24-Hour Rainfall from Figure B-2 = 2.5"

(1) 2-Year, 24-Hour Runoff, based on 2.5" Rainfall from Fig. C-5 = 0.9"
0.9"/12 = 0.075'

(2) 2-Year, 24-Hour Runoff, based on 2.5" Rainfall from Fig. C-5=1.15"
1.15"/12=0.096'

(3) Acres x Runoff Rate = Runoff Volume in Ac.Ft.

(4) Non-Contributing Areas



PRE-DEVELOPMENT RUNOFF = 33,312 CF = 0.76 AC/FT

DEVELOPED RUNOFF = 37,894 CF = 0.87 AC/FT

INCREASE IN RUNOFF = 0.11 AC/FT

REQUIRED STORAGE = 0.11 AC/FT

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RANCHO CIELITO

PRE-DEVELOPED & DEVELOPED CONDITIONS
BASIN RUNOFF HYDROGRAPH
EXHIBIT D