

HYDROLOGY STUDY

APRIL 12, 2024

**121, 155, 175 & 197 MARINWOOD AVE.
SAN RAFAEL, CA 94903
APN 165-47-64; 165-471-65;
165-471-69; 165-471-70**

PROJECT #: 2023014

PREPARED BY



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INTRODUCTION

121, 155, 175, & 197 Marinwood Ave (Project) are located ~400 feet southwest of the Miller Creek Road overpass of Highway 101 within the County of Marin. The Project totals 5.06 acres of parking and a central existing market. The existing storm drain on site contributes to Miller Creek which is located 600 feet to the south. The property is bound by the Casa Marinwood subdivision to the West, Miller Creek Road to the North, Highway 101 to the East and a bus depot to the South. This project triggers BASMAA stormwater low impact development requirements due to creating/replacing greater than 5,000 square feet of impervious surface. The proposed buildout of the site will reconfigure existing parking, construct 1 residential building to the North of the market and 3 Residential buildings to the South of the Market.

EXISTING CONDITIONS

This site currently contains an existing ~15,000 square foot market within the center of the property which is surrounded by parking which formerly facilitated additional buildings throughout the project site which have been subsequently been demolished. The site is generally flat and flows from the center of the property out towards the perimeter of the project. One of the previous buildings on site was a laundromat which through their operations had contaminated some of the underlying soils through the middle of the property, the current owner of the property is completing soil remediation which is anticipated to be cleared by the Regional Water Quality Control Board prior to commencement of construction. There are two storm drain systems on the east side of the property which distribute to CALTRANS property on the east side. There is one storm drain system on the west side of the property which distributes to Miller Creek to the south. There is an existing cell tower on the southeast corner of the property and overhead utility lines within a PG&E Overhead Utility easement on the east side of the property which cuts across the north half of the property. An existing water main cuts across the northeast side of the property.

The existing watershed for the property covers an area of 5.79 acres which contains the 4 parcels of the project (5.02 acres) and the easterly half of Marinwood Avenue along this project's frontage.

PROPOSED CONDITIONS

This project will preserve the existing market and paving on the west and east sides of it. Existing paving within the footprint of the proposed development will be removed. Existing drainage patterns will be maintained with slight adjustments to tributary areas to accommodate the proposed development. The 3 drainage systems throughout the property will be expanded and reconfigured within the property to accommodate the proposed development.

DESIGN ASSUMPTIONS

The County of Marin drainage and flood control standards set forth in the Municipal Code require that a proposed drainage system take into consideration the effects of any runoff on other drainage systems and the ability of the proposed drainage system and affected drainage systems to convey run-off volumes generated by the 100-year storms.

As there were buildings on site with the construction of the storm drain systems for this site, the historical building footprints have been included within existing hydrology tabulation.

Coefficient of Runoff

A coefficient of 0.90 is used for imperious surfaces. Per the Cal-Trans Highway design manual figure 819.2A a c-value of 0.34 will be used for the existing undeveloped areas around the site.

Time of Concentration

The Kirpich equation was used to estimate flow times for this site. Time of Concentration was calculated using Chart “K”, Zone C within Appendix D

P₆₀ Isopleths

Based on the Caltrans – District 4: Design Rainfall Intensities – Map “I,” the project has a 1-hour, 100-year intensity of 1.3 in/hr.

Drainage Subzone

Based on the Caltrans – District 4: Design Rainfall Variations – Map “V,” the project is located in the “C2” drainage subzone.

HYDROLOGY

All hydrology calculations were performed in accordance with the County of Marin Department of Public Works, Hydrology Manual Simplified Instructions (*Revision: 8/2/00*).

PROJECT DRAINAGE IMPACTS

Comparing the existing and proposed drainage volumes to each of the 3 existing storm drain connections, there is a slight decrease in volume into the existing storm drain within Marinwood Avenue (PRE-C & PRE-D) and a slight increase in volume into the two existing storm drain systems on the east side of the property (PRE-A & PRE-B). Although there is an increase in the volume to the two easterly storm drain systems, the potential impacts appear to be negligible. This project’s easterly existing storm drains extend under the 101 South freeway on-ramp before distributing to a ~200’ open channel before passing through a box culvert under Highway 101 to the east. Should there be flooding of the

downstream drainage system, the open channel between the freeway and on-ramp will provide relief. The grading along the east side of the property keeps the easterly drain inlets a few feet lower than the proposed and existing buildings which would provide relief should the immediate downstream storm drain were to be impacted.

CONCLUSIONS

The proposed storm drain system shall be analyzed and designed with Construction Documents. Hydrologic analysis shows that there is a slight increase in runoff due to the development of this project but redirects the increase in runoff towards downstream storm drain with more flexibility to provide overland relief. Although there was no reference drainage study available for the storm drain system, the decrease in Marinwood Ave drainage is more favorable due to the proximity of residential development next to Marinwood Avenue. This project is feasible from a flood control perspective.

DEVELOPMENT C-VALUE

155 Marinwood Ave
 San Rafael, CA
 Prepared by Carlile Macy
 April 12, 2024

Existing Conditions Hydrology

Surface Type	AC/Conc	Rooftop	Gravel/DG	Open
C-Value	0.90	0.90	0.90	0.34

Pre-Development Drainage Area	Area Attributes					100-yr Runoff						
	AC/Conc ft ²	Rooftop ft ²	Gravel/DG ft ²	Open ft ²	Total Area ft ²	Total Area acres	Longest Length ft	Slope ft/ft	C-Value	Tc min	I ₁₀₀ [*] in/hr	Q ₁₀₀ ^{**} cfs
PRE-A	40437	11644	0	30772	82853	1.90	300	0.013	0.69	16.7	2.45	3.22
PRE-B	17130	14731	0	5564	37425	0.86	230	0.010	0.82	12.7	2.80	1.96
PRE-C	65434	19853	0	11987	97274	2.23	400	0.005	0.83	17.2	2.45	4.55
PRE-D	42454	0	0	3486	45940	1.05	700	0.006	0.86	18.7	2.25	2.03

Proposed Conditions Hydrology

Surface Type	Concrete	Rooftop	Gravel/DG	Open
C-Value	0.90	0.90	0.90	0.34

Post-Development Drainage Area	Area Attributes					100-yr Runoff			Pre-Drainage Area				
	AC/Conc ft ²	Rooftop ft ²	Gravel/DG ft ²	Open ft ²	Total Area ft ²	Total Area acres	Longest Length ft	Slope ft/ft		C-Value	Tc min	I ₁₀₀ [*] in/hr	Q ₁₀₀ ^{**} cfs
A	17480	9188	0	3182	29850	0.69	200	0.02	0.84	10.2	2.80	1.61	PRE-B
B	4307	0	0	2116	6423	0.15	75	0.02	0.72	9.8	2.95	0.31	PRE-B
C	2886	0	0	918	3804	0.09	90	0.02	0.76	9.5	2.95	0.20	PRE-C
D	0	2861	0	1403	4264	0.10	90	0.02	0.72	10.2	2.95	0.21	PRE-C
E	0	2814	0	3687	6501	0.15	100	0.02	0.58	12.4	2.70	0.23	PRE-C
F	1838	2861	0	2872	7571	0.17	90	0.01	0.69	12.0	2.70	0.32	PRE-C
G	6314	0	0	187	6501	0.15	90	0.02	0.88	7.9	3.30	0.44	PRE-B
H	875	2315	0	5146	8336	0.19	105	0.01	0.55	15.1	2.45	0.26	PRE-C
I	1667	0	0	2977	4644	0.11	90	0.01	0.54	14.5	2.45	0.14	PRE-C
J	8656	0	0	245	8901	0.20	150	0.02	0.88	8.8	3.10	0.56	PRE-B
K	1396	0	0	303	1699	0.04	50	0.02	0.80	8.0	3.30	0.10	PRE-C
L	2619	0	0	244	2863	0.07	70	0.02	0.85	8.0	3.30	0.18	PRE-C
M	0	3803	0	4467	8270	0.19	125	0.01	0.60	15.1	2.45	0.28	PRE-C
N	371	3803	0	1812	5986	0.14	80	0.01	0.73	10.9	2.80	0.28	PRE-C
O	5362	0	0	594	5956	0.14	140	0.02	0.84	9.3	3.10	0.36	PRE-A
P	11675	3886	0	3353	18914	0.43	120	0.02	0.80	9.7	2.95	1.03	PRE-A
Q	7128	0	0	1404	8532	0.20	80	0.02	0.81	8.7	3.10	0.49	PRE-A
R	546	1398	0	1253	3197	0.07	60	0.02	0.68	9.6	2.95	0.15	PRE-A
S	159	1476	0	2422	4057	0.09	80	0.02	0.57	11.8	2.70	0.14	PRE-A
T	1560	1042	0	310	2912	0.07	70	0.02	0.84	8.1	3.30	0.19	PRE-A
U	1312	1123	0	640	3075	0.07	80	0.02	0.78	9.0	3.10	0.17	PRE-A
V	0	1125	0	3321	4446	0.10	150	0.02	0.48	15.8	2.40	0.12	PRE-A
W	0	1965	0	2051	4016	0.09	100	0.02	0.61	11.9	2.70	0.15	PRE-A
X	1939	3145	1823	3850	10757	0.25	150	0.02	0.70	12.0	2.70	0.47	PRE-A
Y	2762	0	0	612	3374	0.08	50	0.01	0.80	8.8	3.10	0.19	PRE-C
OFF1	40506	0	0	2292	42798	0.98	720	0.01	0.87	16.1	2.40	2.05	PRE-D
OFF2	16358	3870	0	1377	21605	0.50	240	0.01	0.86	11.6	2.70	1.16	PRE-C
OFF3	6765	7781	0	0	14546	0.33	210	0.01	0.90	10.2	2.95	0.89	PRE-A


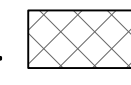
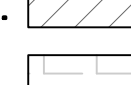


*Value obtained from Chart "K", Zone C within Appendix D of County of Marin Flood Control Manual

** Q = CIA

Pre-Drainage Area	Pre-Dev Total Q	Post-Dev Total Q
Pre-A	3.22	4.14
Pre-B	1.96	2.92
Pre-C	4.55	3.37
Pre-D	2.03	2.05

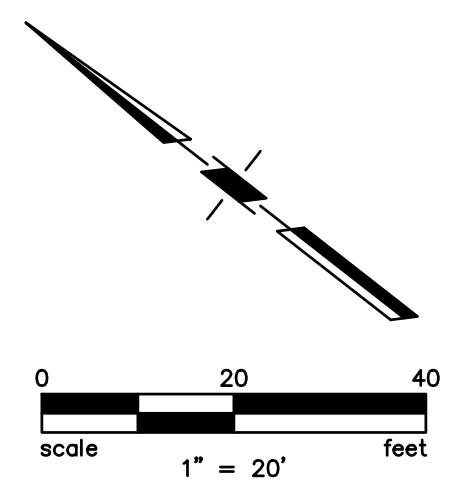
PRE-DEVELOPMENT HYDROLOGY MAP

LEGEND

- TRIBUTARY AREA 
- HISTORICAL ROOF 
- EXISTING ROOF 
- EXISTING ASPHALT 
- EXISTING CONCRETE 



MATCH LINE - CONT. ON SHT. C.08



PRELIMINARY EXISTING HYDROLOGY - NORTH

MARINWOOD APTS. | MARIN COUNTY, CA

SHT 1

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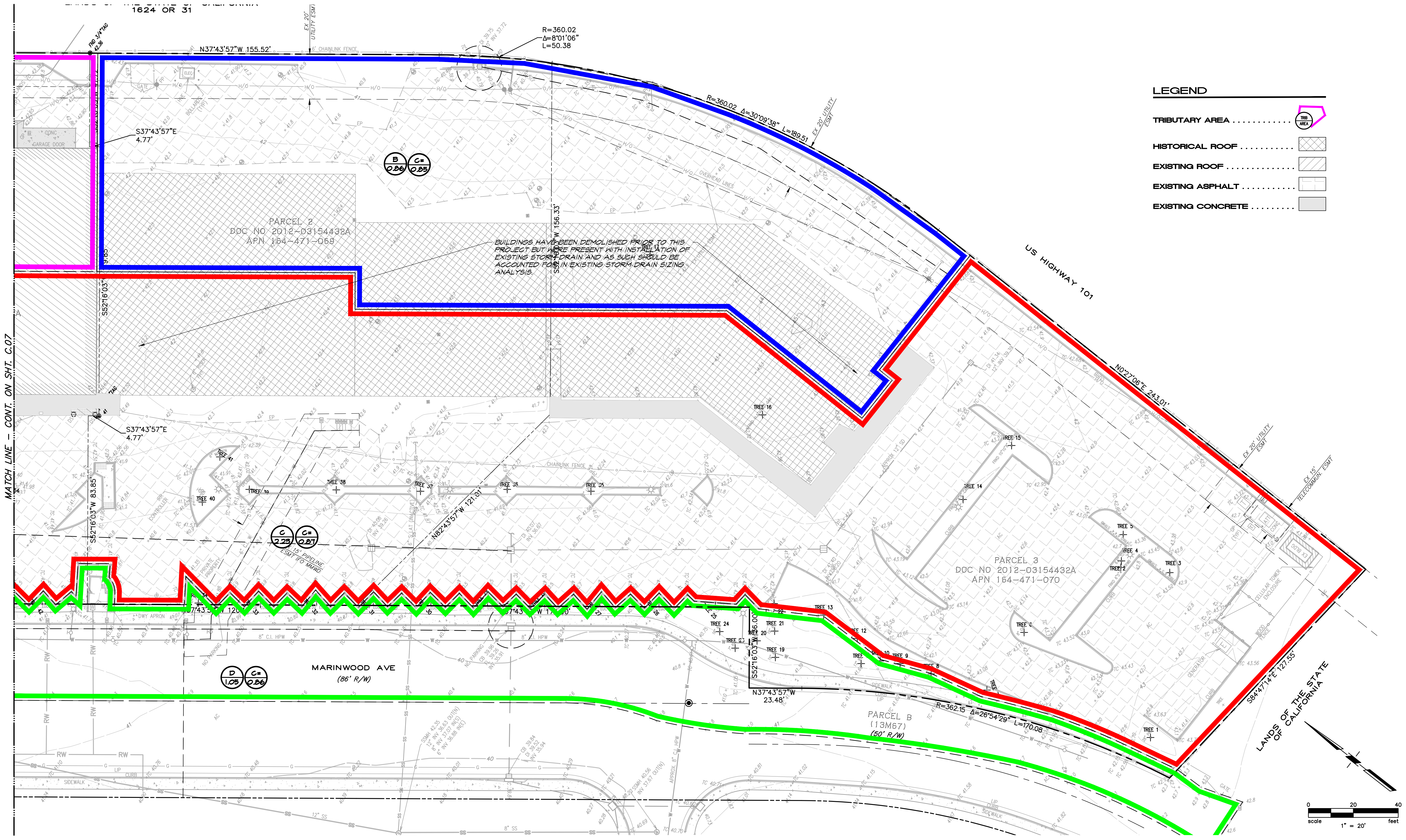
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PRELIMINARY EXISTING HYDROLOGY - SOUTH

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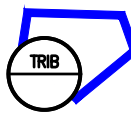

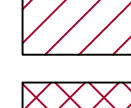
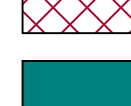


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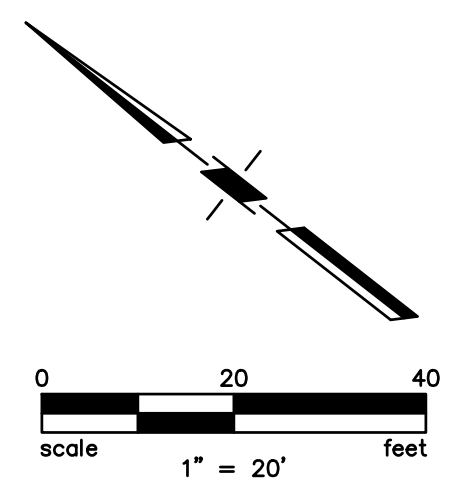
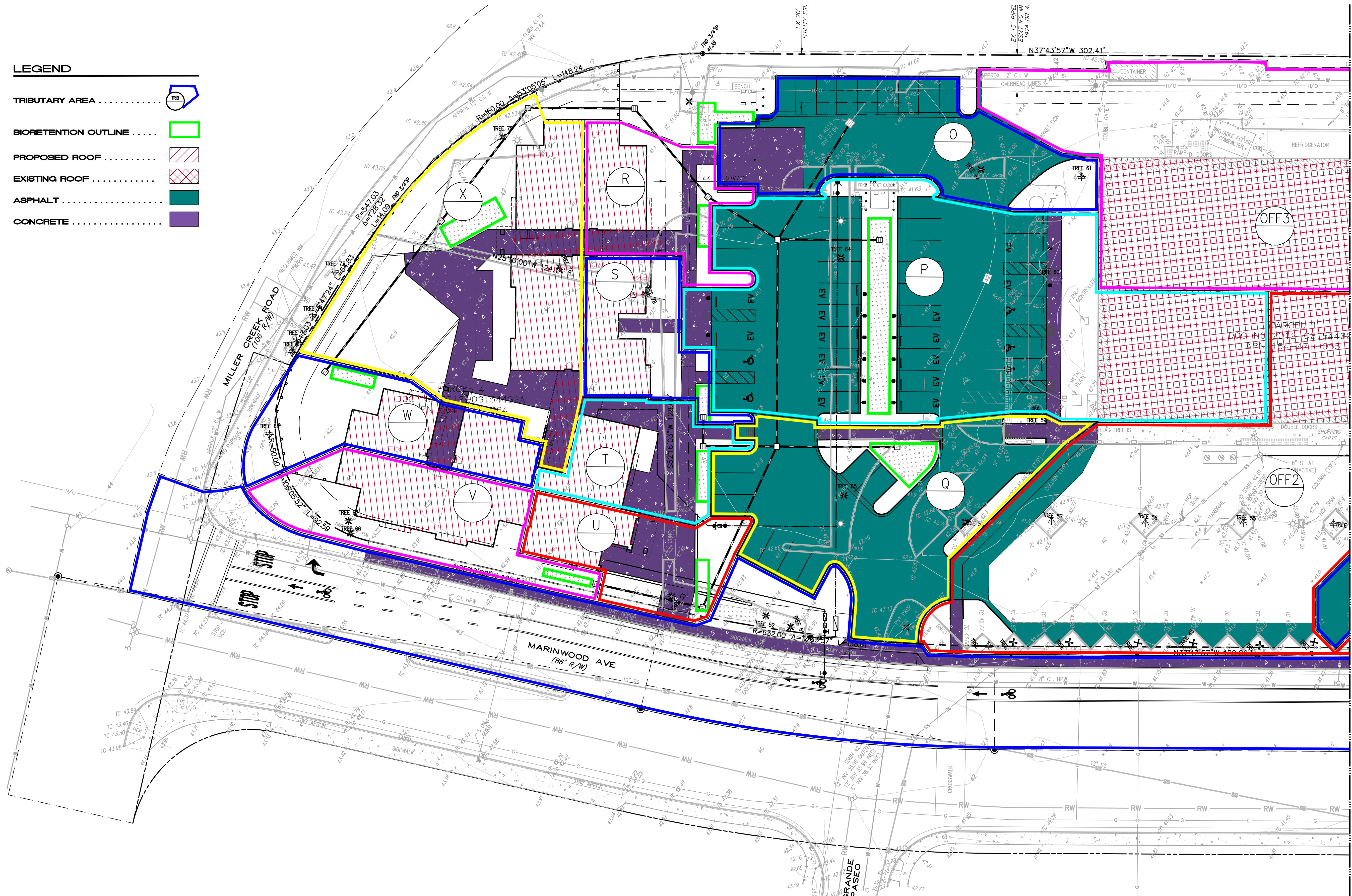
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POST-DEVELOPMENT HYDROLOGY MAP

LEGEND

- TRIBUTARY AREA 
- BIORETENTION OUTLINE 
- PROPOSED ROOF 
- EXISTING ROOF 
- ASPHALT 
- CONCRETE 



PRELIMINARY PROPOSED HYDROLOGY - NORTH

MARINWOOD APTS. | MARIN COUNTY, CA

SHT 1

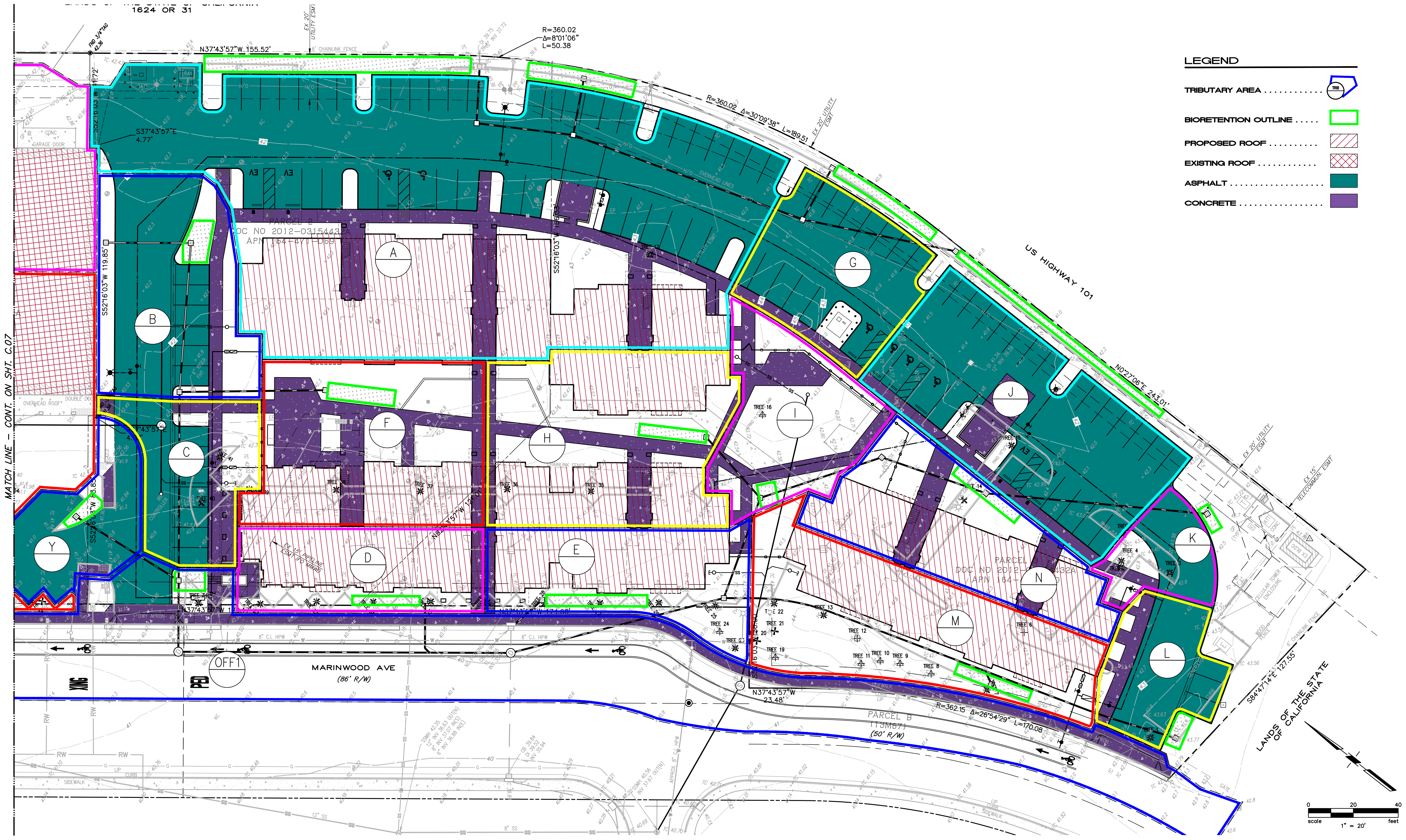
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LEGEND

- TRIBUTARY AREA
- BIORETENTION OUTLINE
- PROPOSED ROOF
- EXISTING ROOF
- ASPHALT
- CONCRETE



PRELIMINARY PROPOSED HYDROLOGY - SOUTH

MARINWOOD APTS. | MARIN COUNTY, CA SHT 2

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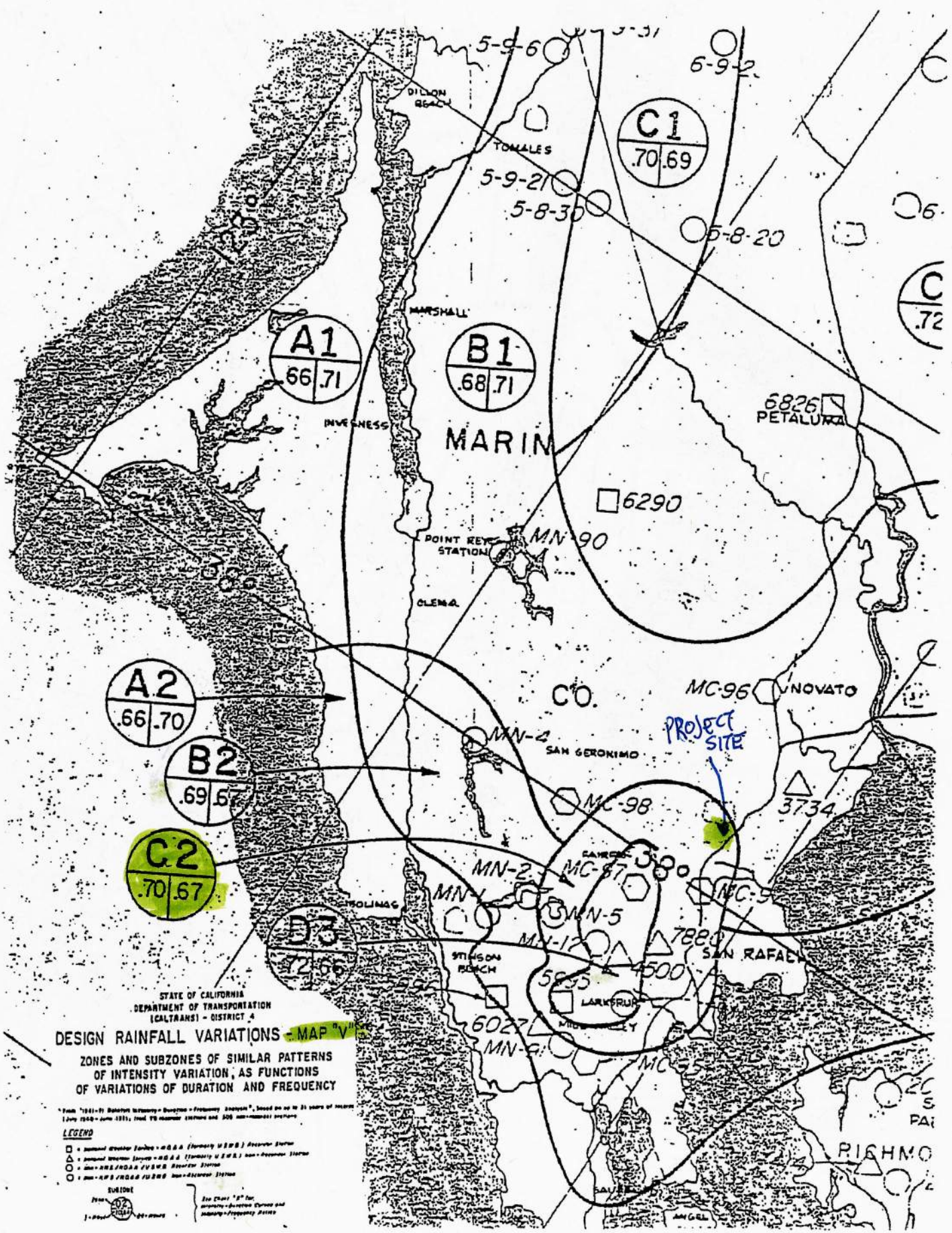
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REFERENCE INFORMATION



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
CALTRANS - DISTRICT 4

DESIGN RAINFALL VARIATIONS - MAP "V"

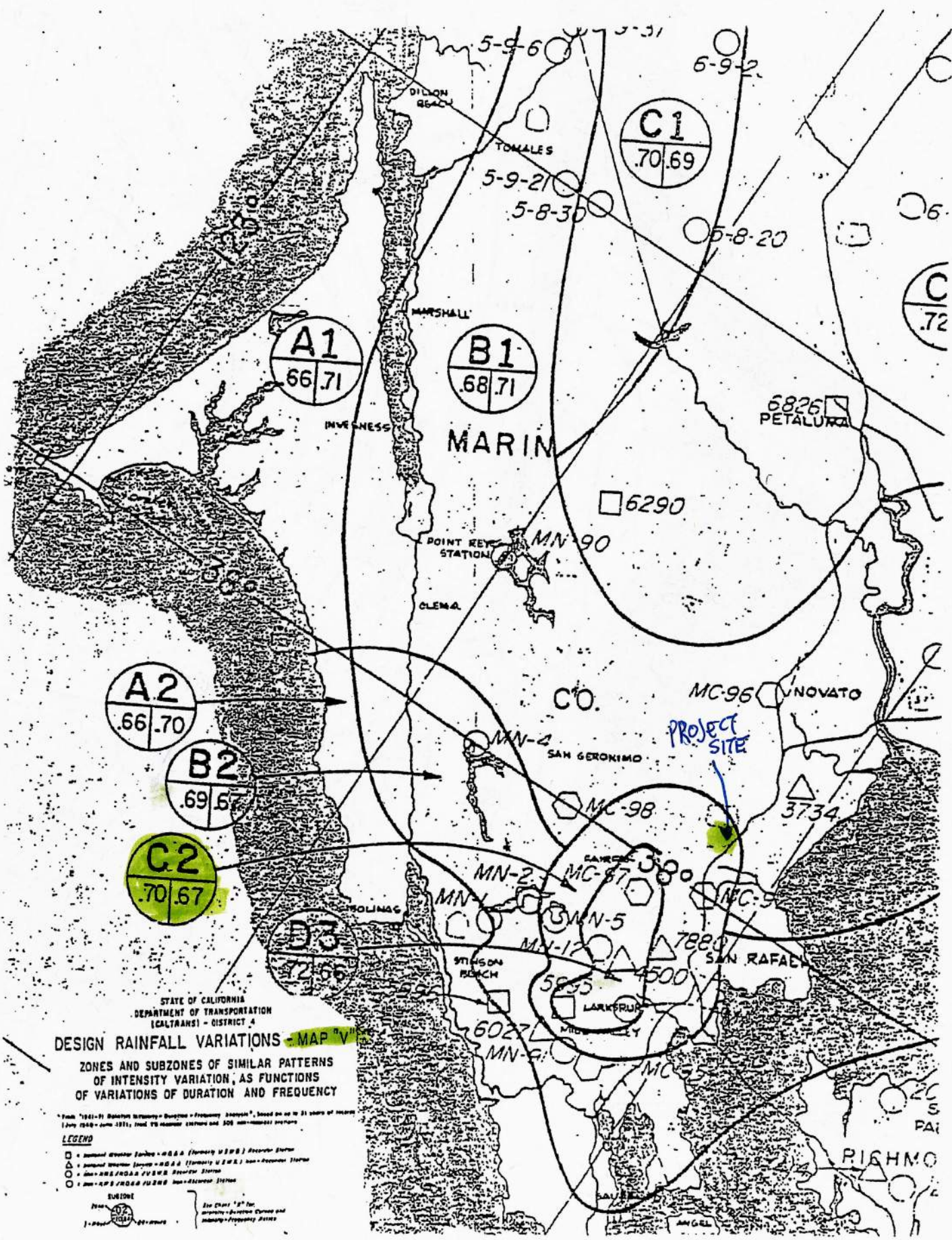
ZONES AND SUBZONES OF SIMILAR PATTERNS
OF INTENSITY VARIATION, AS FUNCTIONS
OF VARIATIONS OF DURATION AND FREQUENCY

* From "1961-71 Report Summary - Duration - Frequency Analysis", based on up to 31 years of records
(July 1940 - June 1971), from 78 automatic stations and 308 non-automatic stations.

- LEGEND**
- - National Weather Service - NOAA (Formerly USWB) Recorder Station
 - △ - National Weather Service - NOAA (Formerly USWB) Non-Recorder Station
 - - San Francisco Peaks Recorder Station
 - - San Francisco Peaks Non-Recorder Station

SURFICIAL

See Chart "S" for
Intensity-Duration-Frequency and
Intensity-Frequency Plots



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
(CALTRANS) - DISTRICT 4

DESIGN RAINFALL VARIATIONS - MAP "V"

ZONES AND SUBZONES OF SIMILAR PATTERNS
OF INTENSITY VARIATION, AS FUNCTIONS
OF VARIATIONS OF DURATION AND FREQUENCY

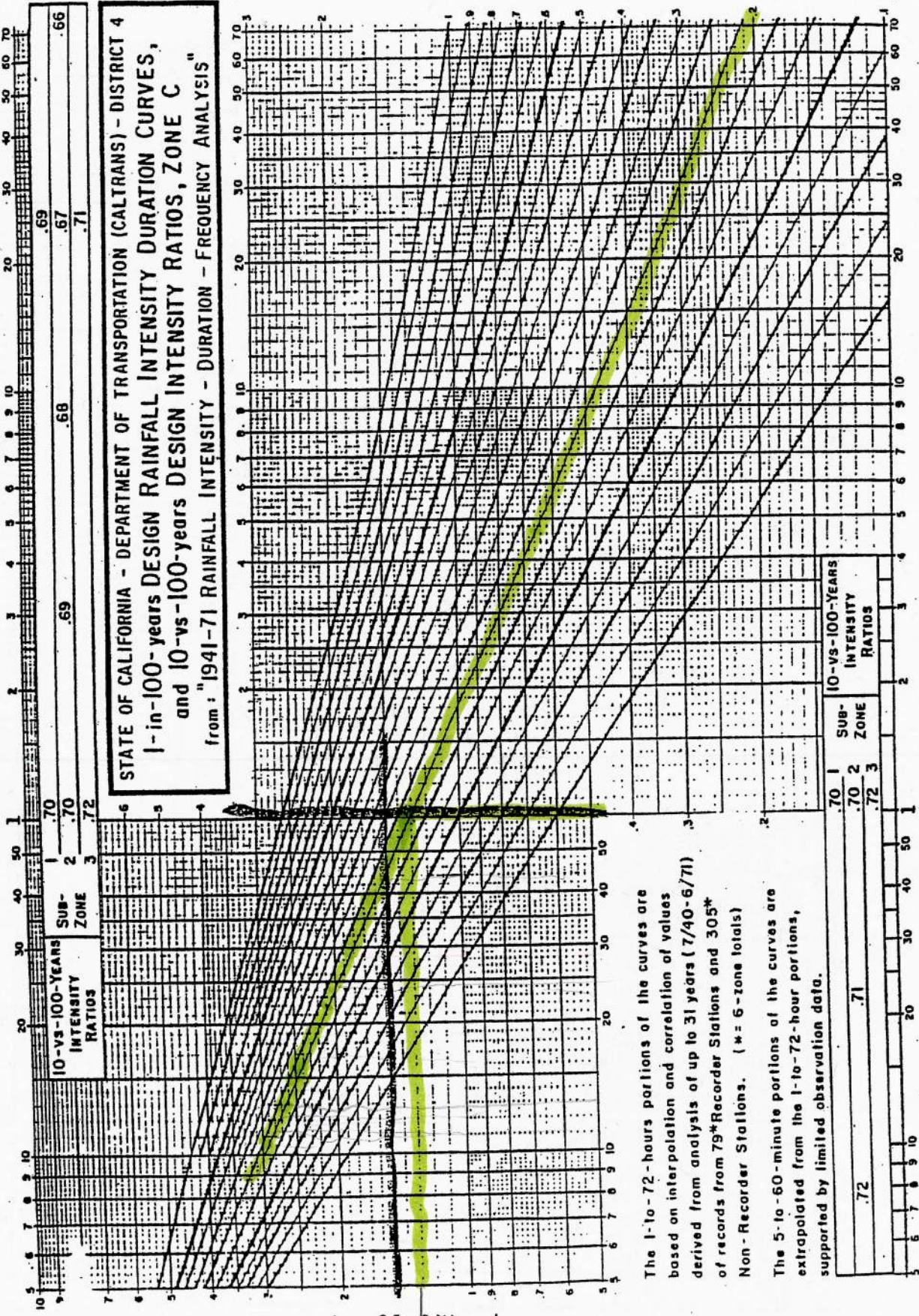
* From "1961-71 Duration - Frequency - Intensity Analysis", based on 10 to 24 years of records
(July 1944 - June 1971); used 70 maximum intensity and 500 mm (20-inch) duration.

LEGEND

- = National Weather Service - NOAA (Formerly USWB) Recorder Station
- △ = National Weather Service - NOAA (Formerly USWB) Non-Recorder Station
- = San-AEB/NOAA PWSWB Recorder Station
- = San-AEB/NOAA PWSWB Non-Recorder Station

SUBZONE
See Chart "B" for
intensity-duration curves and
intensity-frequency curves

DECIA



STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4
 1-in-100-years DESIGN RAINFALL INTENSITY DURATION CURVES,
 and 10-vs-100-years DESIGN INTENSITY RATIOS, ZONE C
 from: "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"

The 1-to-72-hour portions of the curves are based on interpolation and correlation of values derived from analysis of up to 31 years (7/40-6/71) of records from 79*Recorder Stations and 305* Non-Recorder Stations. (* = 6-zone totals)

The 5-to-60-minute portions of the curves are extrapolated from the 1-to-72-hour portions, supported by limited observation data.

I=13