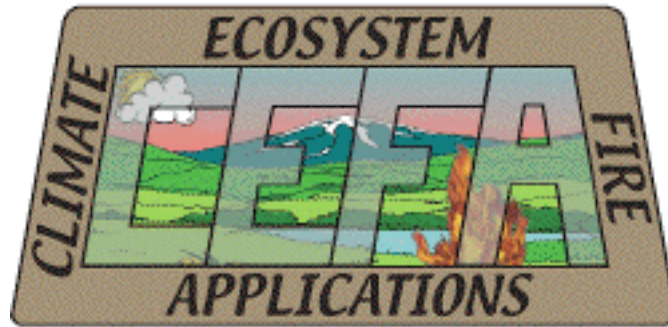


*Program for Climate, Ecosystem and Fire Applications*



# Quality Control of California Historical RAWS Data

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Division of Atmospheric Sciences

## **Quality Control of California Historical RAWS Data**

### **Forward**

This report describes the data and methods used in performing quality control on historical data from 242 Remote Automatic Weather Stations in and near California. The project was done under Task Order 6 of the Cooperative Assistance Agreement No. 1422F915A80010 between the Bureau of Land Management Nevada State Office and the Desert Research Institute Program for Climate, Ecosystem and Fire Applications, and Standard Agreement 7CA00653 between the California Department of Forestry and Fire Protection and the Desert Research Institute Program for Climate, Ecosystem and Fire Applications. For further information regarding this report or project, please contact either:

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# **Quality Control of California Historical RAWS Data**

by

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## **1. Introduction**

Historical weather information from Remote Automatic Weather Stations (RAWS) has many uses for fire management, such as assessments of fire danger, fire severity, fire behavior, prescribed burn planning and ecosystem health to name a few. In order to use this information effectively, data need to be “clean” with respect to erroneous values. In some cases, estimates for missing or erroneous values may be obtainable to achieve a more complete record; in other cases, original values, if unreasonable, may have to be changed to missing.

This report describes the process of performing a quality control (QC) analysis of data from 242 RAWS sites in California. These sites represent historical data of interest to land management agencies within the state, including the California Department of Forestry and Fire Protection (CDF), USDA Forest Service (USFS), Bureau of Land Management (BLM), the National Park Service (NPS) and several county fire departments. The QC analysis was accomplished using a combination of computer software code and manual checks. Data for the historical period of record through the year 2001 were included in the analysis. New data files of revised historical RAWS are available to California fire agencies on CD-ROM media format. The master national RAWS archive is maintained at the Western Regional Climate Center (WRCC).

## **2. Data**

RAWS data for this project were made available from two primary sources: 1) data transmitted from the National Interagency Fire Center (NIFC) and archived on a near-real time basis at WRCC, and 2) historical data provided to WRCC by CDF on CD-ROM media. RAWS stations were selected by the California agencies noted above that also operate and maintain the sites. Figure 1 shows the location of the 242 sites processed in the project.

Appendix 1 provides a list of metadata site information, including NWS ID, station name, type (Table 1), agency (Table 2), latitude, longitude, elevation, Federal Information Processing Standard (FIPS) county code and county name. FP number represents the numerical county code based on FIPS. Appendix 2 contains additional metadata, including the starting date of available data, ending date, and the total number of hourly observations during the period. Ending dates of

31 December 2001 only reflect the stopping point of the QC analysis, and not necessarily the end of available data.

Table 1. Type codes for the metadata site information.

2	Manual NFDRS
3	RAWS non-NFDRS
4	RAWS NFDRS
7	Historic non-active

Table 2. Agency codes for the metadata site information.

1	USDA Forest Service
2	USDI Bureau of Land Management
3	USDI National Park Service
5	State
6	Local
8	Other federal



Figure 1. Locations of RAWS used in the QC analysis.

Field values that were checked in the QC process included air temperature, relative humidity, wind speed and direction, precipitation, fuel temperature, solar radiation and atmospheric pressure. The total number of observation hours processed for all 242 stations was 15,994,440. Multiplying this number by the five common sensors (air temperature, relative humidity, precipitation, wind speed and wind direction and excluding pressure, fuel temperature

and solar radiation) for each hourly observation yields a minimum of 79,972,200 values that were checked by computer software. Hand checks were done on approximately 2000 values that were flagged by the computer software as suspect but not necessarily erroneous.

### 3. Tasks

Four processing steps were required to produce a revised and corrected historical archive of RAWS data. First, the building of a RAWS data archive was necessary to access and analyze the information. A substantial and time-consuming challenge was matching NESS ID's to physical installation location in order to combine pieces of station data into a consistent site record. For some stations with little physical change (e.g., station moves, type change, name change), this was a relatively trivial task. However, for many stations, substantial examination of station histories was necessary in order to determine consistent station data over the period of record. Once pieces of data were identified with a specific RAWS site, a file was generated containing the complete station record. The second step was writing and running computer software that contained a number of checks for impossible and unlikely values. The checking process is described below. The output of the computer software consisted of various files listing flagged stations that included the date, hour and nature of the potential problem. The third step involved a manual check of the field value to assess its reasonableness for those cases of unlikely values. An example would be 24 consecutive hours of unchanging temperature, which is possible, but unlikely. Based upon the various conditions, field values were either set to missing, estimated, or corrected in the archive database. The last processing step was writing and running computer software that produced the final output data files for distribution, including weather observation data transfer format (FW9) and text (comma delimited) files. The *fw9* format allows for the observations to be input into Fire Family Plus. All quality control procedures are reflected in these products and have not been applied to the permanent RAWS archive at the WRCC.

The process of the actual QC analysis was to determine, using a combination of computer software and human inspection, whether 1) the field value appeared to be acceptable; 2) the field value was questionable or unlikely and was retained, replaced or removed after a manual check (flagged in the latter two cases); and 3) the field value was impossible and was removed and flagged missing. Each field (variable) has a well-defined range of expected values. For example, it is unreasonable to expect a relative humidity value of less than 0% or greater than 100%. The following QC criteria were used in the analysis; categories for the QC statistics shown in Appendix 3 are given in parentheses and also described below:

## *Air Temperature*

- a. If the hourly value was less than  $-70^{\circ}\text{F}$  or greater than  $150^{\circ}\text{F}$ , the value was changed to missing (Scenario 1).
- b. If a single hourly value was missing, and ONLY if the two surrounding hours had identical values, then the missing hour was given the value of the two surrounding hours (Estimated value).
- c. If a single hourly value was missing, and the air temperature *trend* of the two hours before and the two hours after were the same (both increasing or both decreasing) then the missing hour was computed to be the average of the two surrounding hourly values (Estimated value).
- d. If 24 consecutive hourly values were identical, those 24 hours and all unchanging hours afterward were changed to missing (Scenario 2).
- e. If 3 or more consecutive hours were  $5^{\circ}\text{F}$  or less, those hours were identified as suspect and then hand checked. If it was determined that those hours were likely bad data, then those 3 hours and all consecutive hours afterward with temperature less than  $5^{\circ}\text{F}$  were made missing (Scenario 2).
- f. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).
- g. Hand checks were made on any temperature values outside the range of  $-25^{\circ}\text{F}$  and  $125^{\circ}\text{F}$ .

## *2. Relative Humidity*

- a. If the hourly value was less than 0% or greater than 100%, the value was changed to missing (Impossible).
- b. If a single hourly value was missing, and ONLY if the two surrounding hours had identical values, then the missing hour was given the value of the two surrounding hours (Estimated value).
- c. If a single hourly value was missing, and the relative humidity trend of the two hours before and the two hours after were the same (both increasing or both decreasing) then the missing hour was computed to be the average of the two surrounding hourly values (Estimate value).
- d. If the hourly value remained constant for 24 consecutive hours or more, those hourly values were changed to missing (Scenario 2).
- e. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

### 3. *Wind Speed*

- a. If the hourly value was less than 0 mph, the value was changed to missing (Impossible).
- b. If the hourly value was greater than 200 mph, the value was changed to missing (Scenario 1).
- c. If only a single hourly value was missing, the missing hour was estimated by taking the average of the two surrounding hourly values (Estimate value).
- d. If up to 12 hourly values were missing and the two surrounding values were less than 3 mph, then the missing hourly values were estimated by linear interpolation using the two surrounding values (Estimated value).
- e. If the hourly value remained constant at 0 mph for 24 consecutive hours or more, those hourly values were changed to missing (Scenario 2).
- f. If the hourly value was less than 2 mph and remained unchanged for 18 consecutive hours or more, those hours were made missing (Scenario 2).
- g. If the hourly value was greater than or equal to 2 mph and remained unchanged for 12 consecutive hours or more, those hours were changed to missing (Scenario 2).
- h. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

### 4. *Wind direction*

- a. If the hourly value was less than 0 or greater than 360 degrees, the value was changed to missing (Impossible).
- b. If the hourly value remained constant for 8 consecutive hours or more, those hourly values were changed to missing (Scenario 2).
- c. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

### 5. *Precipitation (running total, not hourly increment)*

- a. If hourly values were missing for up to and including 96 consecutive hours, and both hourly accumulated values surrounding the missing period were identical, then the missing hourly values were changed to the hourly value immediately prior to the missing period (Estimated value).
- b. If an hourly value decreased from the previous hourly value and yet did not go lower than 0.2 (as a result of a counter reset), the hourly value was reset to the lower value. Hand checks were made to verify data (Impossible).
- c. If there was an increase in an hourly value that was greater than 2 inches, it was noted and hand checked.
- d. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

## 6. Fuel Temperature

- a. If the hourly value was less than  $-90^{\circ}\text{F}$  or greater than  $170^{\circ}\text{F}$ , the value was changed to missing (Scenario 1).
- b. If a single hourly value was missing, and ONLY if the two surrounding hours had identical values, then the missing hour was given the value of the two surrounding hours (Estimated value).
- c. If a single hourly value was missing, and the fuel temperature *trend* of the two hours before and the two hours after were the same (both increasing or both decreasing) then the missing hour was computed to be the average of the two surrounding hourly values (Estimated value).
- d. If 24 consecutive hourly values were identical, those 24 hours and all unchanging hours afterward were changed to missing (Scenario 2).
- e. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

## 7. Atmospheric Pressure

- a. If the hourly value was less than 677 mb or greater than 1119 mb, it was changed to missing (Scenario 1).
- b. If the hourly value remained constant for 24 or more consecutive hours, those hourly values were changed to missing (Scenario 2).
- c. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

## 8. Solar Radiation

- a. If the hourly value was less than 0 or greater than 2000 watts/m<sup>2</sup> the hourly value was changed to missing (Scenario 1).
- b. If the original data had been hand checked and flagged as estimated in the database, this estimated value was accounted for (Estimated value).

Appendix 3 provides statistics from the QC analysis. The *estimated values* column gives the percentage of values that was estimated via the QC process. These estimates were generated using the QC conditions described above. Averaged over all stations approximately 0.8% of values were estimated.

The *impossible values* column gives the percentage of values that met the ‘impossible’ criteria given above (e.g., wind speed less than 0 mph). This condition occurred only 0.04% of the time on average. When ‘impossible’ criteria were met, original values were changed to missing.

The *scenario 1* and *scenario 2* columns give the percentage of observations that met the criteria of unlikely observed values. The specific test conditions for each scenario were given in the QC criteria described earlier. Scenario 1 indicates single value extremes (e.g., air temperature less than  $-70^{\circ}\text{F}$ ) that are theoretically possible, but highly unlikely to occur in



California. On average, scenario 1 occurred only .05% of the time, though a few stations did have larger values (e.g., slightly over 3% for Rattlesnake). Scenario 2 describes an outlying event integrated over time, such as 24 or more hours of unchanging air temperature. These conditions occurred more frequently on average than scenario 1 though still a small percentage (.28%). A few individual stations exceeded 1% in this category. For both scenarios, original values were changed to missing. Adding the impossible, scenario 1 and scenario 2 columns yields the percent number of original values changed to missing. On average this value is 0.36%.

The percentages noted above suggest that the process of a QC analysis is beneficial to improve the overall quality of the dataset. A fairly large number of original values were changed to missing because of impossible and highly unlikely values. While a rather small percentage of values were discarded or estimated, these values could have strongly skewed a typical statistical analysis of the data. These values could have led to erroneous results in a fire danger or other analyses. The estimation of values to replace original missing or erroneous observations occurred a much smaller percentage of the time. Obviously, it would have been desirable to include more estimates, but the lack of information at hand did not permit this action. However, those estimates that were done are beneficial in allowing for a more complete dataset.

#### 4. Deliverables

The final products from this QC analysis are available to agency users via CD-ROM media. All daily and hourly times given in each file are local standard time. Each CD contains the following files:

- 04xxxx.fw9 - Daily 1300 in fw9 format.
- 04xxxx.hrly.fw9 - Hourly in fw9 format; self-extracting.
- 04xxxx.dat - Hourly comma delimited text files with flag fields; self-extracting.
- qcreport.pdf - Project final report in .pdf format.
- readme.txt - The document you are reading.

The *04xxxx* in the filenames above refer to the station name (NWS ID). The *fw9* format contains the 1300 local time observation and was primarily designed for input into FireFamily+. Similarly, the *hrly.fw9* file names contain hourly local time observations for input primarily into FireFamily+. The *04xxx.dat* files contain the hourly observations in a comma delimited text format, and also include the flag fields as follows:

- 0 - original value was acceptable and unchanged
- 1 - original value was missing and kept missing
- 2 - original value was questionable or impossible and made missing
- 3 - original value was estimated and replaced with a non-missing value
- 4 - original value never recorded because station not sensor equipped (e.g., solar radiation, pressure)

The *readme.txt* file contains a brief description of the files on the CD. The file *qcreport.pdf* is a PDF version of this document.

#### Acknowledgements

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NWS ID	RAWS Name	Type	Agency	Latitude	Longitude	Elevation	FP_	County
44503	FENCEMDW	4	1	36.967	-119.183	5256	19	Fresno
44505	MT REST	2	1	37.054	-119.371	4100	19	Fresno
44508	PINEHURST	2	1	36.685	-119.000	4060	19	Fresno
44510	TRIMMER	4	1	36.900	-119.300	1540	19	Fresno
44511	MT TOM	2	1	37.382	-119.169	9018	19	Fresno
44514	PANOCHÉ	4	5	36.630	-120.638	500	19	Fresno
44516	FANCHER CREEK	4	5	36.900	-119.500	920	19	Fresno
44517	HURLEY	4	5	37.000	-119.600	1260	19	Fresno
44520	HIGH SIERRA	2	1	37.315	-119.039	7403	19	Fresno
44522	SHAVER	4	5	37.144	-119.258	5800	19	Fresno
41101	ALDER SPRINGS	4	1	39.650	-122.725	4500	21	Glenn
41102	SACRAMENTO WILDLIFE	2	1	39.417	-122.183	120	21	Glenn
40402	BIG HILL	4	4	41.100	-123.633	3577	23	Humboldt
40408	HOOPA	4	4	41.067	-123.700	365	23	Humboldt
40421	EEL RIVER CAMP	2	1	41.183	-123.823	470	23	Humboldt
40422	COOSKIE MOUNTAIN	3	2	40.258	-124.250	2950	23	Humboldt
40423	ALDER POINT	4	5	40.186	-123.590	923	23	Humboldt
40424	MAPLE CREEK	4	5	40.796	-123.937	1680	23	Humboldt
45802	FISH CREEK MOUNTAIN	4	2	32.983	-116.058	760	25	Imperial
44803	OWENS VALLEY	4	1	37.386	-118.552	4635	27	Inyo
44804	OAK CREEK	2	1	36.843	-118.093	4855	27	Inyo
44806	PANAMINT	4	2	36.117	-117.083	6880	27	Inyo
45005	KERNVILLE	4	1	35.767	-118.417	2635	29	Kern
45013	JAWBONE	7	2	35.295	-118.226	4300	29	Kern
45014	WALKER PASS	4	2	35.665	-118.057	5572	29	Kern
44602	KETTLEMAN HILLS	4	2	36.033	-120.057	801	31	Kings
41402	HIGH GLADE LOOKOUT	4	1	39.208	-122.808	4840	33	Lake
41406	SODA CREEK	4	1	39.425	-122.479	1773	33	Lake
41408	LYONS VALLEY	3	2	39.125	-123.071	3200	33	Lake
41409	KNOXVILLE CREEK	3	2	38.883	-122.417	2200	33	Lake
41410	COUNTY LINE	3	2	39.019	-122.412	2085	33	Lake
41411	KONOCI	4	5	38.917	-122.686	2000	33	Lake

NWS ID	RAWS Name	Type	Agency	Latitude	Longitude	Elevation	FP_	County
40703	BOGARD	4	1	40.592	-121.087	5680	35	Lassen
40709	LAUFMAN	4	1	40.137	-120.345	4858	35	Lassen
40714	RAVENDALE	2	1	40.731	-120.316	5298	35	Lassen
40719	WESTWOOD	4	5	40.299	-120.892	5800	35	Lassen
40721	GRASSHOPPER	4	5	40.780	-120.778	6050	35	Lassen
40723	LADDER BUTTE	4	1	40.807	-121.297	5644	35	Lassen
40724	DOYLE	4	2	40.022	-120.106	4240	35	Lassen
40725	BLUE DOOR	4	2	41.055	-120.338	5615	35	Lassen
40726	ASH VALLEY	4	2	41.052	-120.686	5100	35	Lassen
40727	HORSE LAKE	4	2	40.631	-120.503	5100	35	Lassen
40728	BULL FLAT	4	2	40.481	-120.114	4395	35	Lassen
45412	SAUGUS	4	6	34.425	-118.525	1450	37	Los Angeles
45421	TANBARK	4	1	34.200	-117.757	2730	37	Los Angeles
45426	WARM SPRINGS LOOKOUT	4	1	34.595	-118.577	4006	37	Los Angeles
45433	MALIBU	4	6	34.058	-118.633	1575	37	Los Angeles
45435	MILL CREEK (ANF)	4	1	34.388	-118.090	4999	37	Los Angeles
45436	CHILAO	4	1	34.330	-118.037	5235	37	Los Angeles
45437	SANTA FE	4	6	34.121	-117.946	500	37	Los Angeles
45438	ACTON	4	6	34.446	-118.200	2600	37	Los Angeles
45440	POPPY PARK	4	6	34.733	-118.383	2760	37	Los Angeles
45441	CAMP 9	4	6	34.402	-118.402	4000	37	Los Angeles
45442	BEVERLY HILLS	4	6	34.125	-118.420	1260	37	Los Angeles
45443	CLAREMONT	4	6	34.139	-117.712	1645	37	Los Angeles
45444	SADDLEBACK BUTTE	4	6	34.668	-117.821	2590	37	Los Angeles
45445	DEL VALLE	4	6	34.431	-118.666	1278	37	Los Angeles
45446	WHITTIER HILLS PARK	4	6	33.984	-118.010	950	37	Los Angeles
45447	LEO CARRILLO	4	6	34.046	-118.936	50	37	Los Angeles
44201	BATTERSON	2	1	37.367	-119.617	3160	39	Madera
44204	NORTHFORK	4	1	37.233	-119.516	2664	39	Madera
44208	DEVILS POSTPILE	4	1	37.619	-119.085	7560	39	Madera
44209	METCALF GAP	4	5	37.410	-119.767	3300	39	Madera
42308	BARNABE	4	6	38.028	-122.707	820	41	Marin
44106	MARIPOSA	4	5	37.502	-120.986	2100	43	Mariposa
44113	MARIPOSA GROVE	4	3	37.500	-119.600	6400	43	Mariposa
44114	CATHEYS VALLEY	4	5	37.465	-120.075	1200	43	Mariposa
41001	BOONVILLE	4	5	38.950	-123.340	840	45	Mendocino
41005	EEL RIVER	4	1	39.825	-123.083	1500	45	Mendocino
41015	RODEO VALLEY	4	5	39.667	-123.320	2425	45	Mendocino
41017	MCGUIRES	4	5	39.336	-123.601	520	45	Mendocino
41019	LAYTONVILLE	2	1	39.698	-123.453	1838	45	Mendocino

NWS ID	RAWS Name	Type	Agency	Latitude	Longitude	Elevation	FP_	County
44003	LOS BANOS	4	5	37.053	-121.049	350	47	Merced
40303	CANBY	4	1	41.434	-120.868	4312	49	Modoc
40308	JUNIPER CREEK	4	2	41.332	-120.473	4372	49	Modoc
40309	DEVIL'S GARDEN	4	5	41.522	-120.668	5000	49	Modoc
40312	RUSH CREEK	4	1	41.284	-120.853	4720	49	Modoc
43707	WALKER	2	1	38.565	-119.459	5440	51	Mono
43708	BENTON	4	1	37.836	-118.484	5377	51	Mono
43709	CRESTVIEW	4	1	37.735	-119.000	7518	51	Mono
43710	ROCK CREEK	4	1	37.551	-118.667	7040	51	Mono
44318	CAHOON	4	5	36.333	-121.500	2240	53	Monterey
44319	HASTINGS	4	5	36.384	-121.551	1824	53	Monterey
44301	ARROYO SECO	4	1	36.236	-121.481	800	53	Monterey
44302	BIG SUR	2	1	36.236	-121.785	450	53	Monterey
44310	PARKFIELD	4	5	35.883	-120.417	1535	53	Monterey
41804	STAMPEDE	4	1	39.483	-120.075	6600	57	Nevada
41806	WHITECLOUD	4	1	39.317	-120.838	4320	57	Nevada
41807	DORRIS RANCH	4	5	39.329	-121.108	2025	57	Nevada
41808	SECRET TOWN	4	5	39.185	-120.883	2720	57	Nevada
41907	LINCOLN	4	5	38.882	-121.268	200	61	Placer
40904	CHESTER	4	1	40.290	-121.087	4530	63	Plumas
40910	QUINCY	4	1	39.975	-120.942	3500	63	Plumas
40915	PIERCE	4	1	40.250	-120.650	5800	63	Plumas
45604	KEENWILD	4	1	33.713	-116.713	4800	65	Riverside
45611	TEMESCAL (CNF)	2	1	33.763	-117.483	1125	65	Riverside
45614	LOST HORSE	4	3	34.002	-116.184	4100	65	Riverside
45616	ANZA	4	5	33.560	-116.670	3980	65	Riverside
45619	EL CARISO FIRE STATION	4	1	33.652	-117.407	3038	65	Riverside
45620	RICE VALLEY	4	2	34.063	-114.707	820	65	Riverside
45623	SANTA ROSA PLATEAU	4	5	33.500	-117.253	1980	65	Riverside
45624	CLARK	4	5	33.826	-117.303	1720	65	Riverside
44408	SANTA RITA	4	2	36.348	-120.598	5000	69	San Benito
44409	HERNANDEZ	4	5	36.368	-120.851	3752	69	San Benito

NWS ID	RAWS Name	Type	Agency	Latitude	Longitude	Elevation	FP_	County
45101	FAWNSKIN	4	1	34.251	-116.900	6850	71	San Bernardino
45105	CONVERSE	4	1	34.184	-116.917	5618	71	San Bernardino
45109	MILL CREEK (BDF)	2	1	34.084	-117.035	2950	71	San Bernardino
45112	YUCCA	4	5	34.123	-116.409	3300	71	San Bernardino
45113	DEVORE	4	5	34.333	-117.667	2070	71	San Bernardino
45114	MORMON ROCKS	2	1	34.317	-117.502	3300	71	San Bernardino
45122	MOJAVE RIVER SINK	4	2	35.058	-116.083	950	71	San Bernardino
45124	GRANITE MOUNTAIN	4	2	34.536	-117.026	4720	71	San Bernardino
45125	BURNS CANYON	4	2	34.208	-116.621	6000	71	San Bernardino
45127	OPAL MOUNTAIN	4	2	35.157	-117.177	3240	71	San Bernardino
45128	MID HILLS	4	2	35.166	-115.415	5413	71	San Bernardino
45129	HORSE THIEF SPRING	4	2	35.771	-115.909	5000	71	San Bernardino
45704	CAMERON FIRE STATION	4	1	32.721	-116.463	3443	73	San Diego
45707	DESCANSO	2	1	32.857	-116.622	3480	73	San Diego
45708	JULIAN	4	5	33.070	-116.590	4220	73	San Diego
45710	OAK GROVE FIRE STATION	4	1	33.393	-116.795	2752	73	San Diego
45729	RANCHITA	4	5	33.212	-116.505	4180	73	San Diego
45730	POTRERO	4	5	32.606	-116.608	2350	73	San Diego
45731	CASE SPRINGS	4	8	33.450	-117.430	2320	73	San Diego
45732	TARGET RANGE (ROBLAR)	4	8	33.380	-117.360	918	73	San Diego
45733	FLORES	4	8	33.290	-117.450	100	73	San Diego
45734	VALLEY CENTER	4	5	33.226	-116.992	1370	73	San Diego
45735	BELL CANYON	4	6	33.552	-117.573	750	73	San Diego
45736	FREMONT CANYON	4	6	33.811	-117.708	1750	73	San Diego
45738	AMMO DUMP	2	1	33.381	-117.286	1068	73	San Diego
45739	TALEGA	2	1	33.478	-117.486	1203	73	San Diego
44901	BRANCH MOUNTAIN	4	1	35.184	-120.083	3773	79	San Luis Obispo
44904	LAS TABLAS	4	5	35.390	-120.549	1300	79	San Luis Obispo
44914	LA PANZA	4	5	35.230	-120.100	1650	79	San Luis Obispo
44915	ARROYO GRANDE	4	5	35.183	-120.398	750	79	San Luis Obispo
44916	CARRIZO	4	2	35.096	-119.773	2490	79	San Luis Obispo
43304	LA HONDA	4	5	37.200	-122.100	440	81	San Mateo
43308	SPRING VALLEY	4	5	37.562	-122.436	1075	81	San Mateo
43309	PULGAS	4	5	37.475	-122.286	644	81	San Mateo
45203	LOS PRIETOS	2	1	34.536	-119.783	1020	83	Santa Barbara
45216	SANTA CRUZ ISLAND	4	3	34.022	-119.784	1325	83	Santa Barbara
45217	SANTA ROSA ISLAND	4	3	33.978	-120.078	1298	83	Santa Barbara
45218	MONTECITO	4	1	34.452	-119.635	1500	83	Santa Barbara
43912	LOS ALTOS	4	6	37.356	-122.142	645	85	Santa Clara
43913	LOS GATOS	4	6	37.203	-121.943	800	85	Santa Clara
43914	POVERTY	4	5	37.443	-121.771	2067	85	Santa Clara

NWS ID	RAWS Name	Type	Agency	Latitude	Longitude	Elevation	FP_	County
43802	CORRALITOS	4	5	36.994	-121.811	300	87	Santa Cruz
43809	BEN LOMOND	4	5	37.131	-122.171	2630	87	Santa Cruz
40609	MANZINITA LAKE	4	1	40.540	-121.580	5871	89	Shasta
40614	SUGARLOAF (SHF)	2	1	40.917	-122.438	4200	89	Shasta
40615	WHITMORE	4	5	40.620	-121.904	2450	89	Shasta
40618	SIMS	4	1	41.073	-122.373	2580	89	Shasta
40630	SOLDIER MTN	4	5	40.913	-121.570	3760	89	Shasta
40632	ARBUCKLE BASIN	4	5	40.442	-122.832	2300	89	Shasta
40633	HAT MOUNTAIN (SUMMIT)	4	3	40.502	-121.423	8000	89	Shasta
40635	OAK MOUNTAIN	4	1	41.012	-121.983	1700	89	Shasta
41302	DOG VALLEY	2	1	39.562	-120.048	5976	91	Sierra
41304	SADDLEBACK	2	1	39.638	-120.865	6670	91	Sierra
40204	CALLAHAN GS	4	1	41.315	-122.800	3136	93	Siskiyou
40218	OAK KNOLL	4	1	41.838	-122.850	1700	93	Siskiyou
40221	ROUND MOUNTAIN	4	5	41.420	-121.458	5258	93	Siskiyou
40222	SAWYERS BAR	4	1	41.300	-123.100	2192	93	Siskiyou
40225	SLATER	4	1	41.858	-123.352	4670	93	Siskiyou
40228	WEED	4	5	41.479	-122.458	2930	93	Siskiyou
40231	SOMES BAR	4	1	41.378	-123.478	920	93	Siskiyou
40233	INDIAN WELL	4	3	41.735	-121.534	4770	93	Siskiyou
40237	COLLINS BALDY LOOKOUT	4	1	41.776	-122.947	5493	93	Siskiyou
40239	QUARTZ HILL	4	5	41.588	-122.923	4229	93	Siskiyou
40240	JUANITA	4	1	41.800	-122.106	5400	93	Siskiyou
40242	BRAZZI RANCH	4	5	41.689	-122.594	3000	93	Siskiyou
40243	VAN BREMMER	4	1	41.634	-121.784	5310	93	Siskiyou
40244	ASH CREEK	2	1	41.278	-121.977	3200	93	Siskiyou
42009	SANTA ROSA	4	5	38.470	-122.703	600	97	Sonoma
42010	HAWKEYE	4	5	38.735	-122.835	2000	97	Sonoma
43502	DIABLO GRANDE	4	5	37.325	-121.283	1900	99	Stanislaus
40802	EAGLE PEAK	2	1	39.928	-122.657	3713	103	Tehama
40812	PATTYMOCCUS LOOKOUT	4	1	40.300	-122.900	4020	103	Tehama
40814	CORNING	4	5	39.939	-122.170	294	103	Tehama
40815	LASSEN LODGE	4	5	40.343	-121.704	4000	103	Tehama
40816	THOMES CREEK	4	5	39.855	-122.610	1040	103	Tehama



NWS ID	RAWS Name	Type	Agency	Latitude	Longitude	Elevation	FP_	County
40501	BIG BAR	4	1	40.743	-123.250	1500	105	Trinity
40503	HAYFORK	4	1	40.548	-123.165	2340	105	Trinity
40507	MAD RIVER	2	1	40.463	-123.524	2775	105	Trinity
40510	WEAVERVILLE	2	1	40.735	-122.524	2100	105	Trinity
40511	YOLLA BOLLA	4	1	40.338	-123.065	4786	105	Trinity
40512	FRIEND MOUNTAIN	2	1	40.505	-123.342	4000	105	Trinity
40516	TRINITY CAMP	4	5	40.790	-122.798	3350	105	Trinity
40517	SCORPION	2	1	41.112	-122.697	4400	105	Trinity
40518	BACKBONE	2	1	40.889	-123.142	4700	105	Trinity
44707	JOHNSONDALE	2	1	35.972	-118.545	4700	107	Tulare
44708	MILO	2	5	36.232	-118.891	2002	107	Tulare
44712	UHL/HOT SPRINGS	4	1	35.890	-118.647	3775	107	Tulare
44713	PARK RIDGE	4	3	36.724	-118.943	7540	107	Tulare
44717	OAK OPENING	4	1	36.176	-118.708	3240	107	Tulare
44718	MILK RANCH	7	3	36.487	-118.780	6225	107	Tulare
44719	CEDAR GROVE	2	3	36.788	-118.656	4720	107	Tulare
44722	BLACKROCK	2	1	36.093	-118.261	8200	107	Tulare
44724	SHADE QUARTER	4	5	36.567	-118.956	4069	107	Tulare
44728	RATTLESNAKE	4	3	36.412	-118.425	8600	107	Tulare
44729	SUGARLOAF	4	3	36.727	-118.675	8120	107	Tulare
44731	FOUNTAIN SPRINGS	4	5	35.892	-118.917	791	107	Tulare
44732	WOLVERTON	4	3	36.440	-118.702	5240	107	Tulare
44799	BEAR PEAK	8	1	35.883	-118.058	8228	107	Tulare
43603	BUCK MEADOWS (GRVLND)	4	1	37.803	-120.055	3200	109	Tuolumne
43605	MT ELIZ	4	1	38.070	-120.248	4938	109	Tuolumne
43611	TUOLME	4	3	37.867	-119.300	9200	109	Tuolumne
43612	WWOLF	4	3	37.850	-119.650	8000	109	Tuolumne
43613	GREEN SPRING	4	5	37.834	-120.502	1000	109	Tuolumne
45302	CHUCHUPATE	2	1	34.808	-119.013	4900	111	Ventura
45303	OZENA	2	1	34.682	-119.354	3670	111	Ventura
45307	TEMESCAL (LPF)	2	1	34.468	-118.751	1130	111	Ventura
45313	CHEESEBORO	4	3	34.185	-118.717	1650	111	Ventura
45314	ROSE VALLEY II	4	1	34.536	-119.184	3331	111	Ventura
45315	OJAI	2	1	34.448	-119.230	765	111	Ventura
42202	BROOKS	4	5	38.718	-122.135	360	113	Yolo
41701	PIKE COUNTY	4	1	39.467	-121.183	3714	115	Yuba

Appendix 2. Additional station metadata.

NWS ID	Station Name	Start Date	End Date	Total Hours
45438	ACTON	Jan-95	Dec-01	61344
40423	ALDER POINT	Jul-91	Dec-01	88416
41101	ALDER SPRINGS	Apr-94	Dec-01	67944
45738	AMMO DUMP	Jun-01	Dec-01	5136
45616	ANZA	Jan-95	Dec-01	61344
40632	ARBUCKLE BASIN	Jan-95	Dec-01	61344
44915	ARROYO GRANDE	Feb-97	Dec-01	26256
44301	ARROYO SECO	May-96	Dec-01	49704
40244	ASH CREEK	Nov-89	Dec-01	89976
40726	ASH VALLEY	Oct-91	Dec-01	89832
40518	BACKBONE	Oct-00	Dec-01	8832
42603	BALD MOUNTAIN	Jan-89	Dec-01	108864
41201	BANGOR RAWES	May-90	Dec-01	93504
42308	BARNABE	Jan-97	Dec-01	43824
44201	BATTERSON	Sep-99	Dec-01	20472
44799	BEAR PEAK	Oct-91	Dec-01	88368
42703	BEAVER	Feb-92	Dec-01	73080
45735	BELL CANYON	Apr-93	Dec-01	76704
42612	BEN BOLT	May-90	Dec-01	102264
43809	BEN LOMOND	Jun-98	Dec-01	31440
43708	BENTON	May-94	Dec-01	67224
45442	BEVERLY HILLS	Nov-97	Sep-01	34320
40501	BIG BAR	Nov-89	Dec-01	101544
40402	BIG HILL	Mar-97	Dec-01	42408
44302	BIG SUR	Jul-01	Dec-01	4416
43008	BLACK DIAMOND	Apr-94	Dec-01	67200
44722	BLACKROCK	Jul-99	Dec-01	21960
40725	BLUE DOOR	Oct-91	Dec-01	89832
40703	BOGARD	Jul-92	Dec-01	80448
41001	BOONVILLE	May-90	Dec-01	102264
44901	BRANCH MOUNTAIN	May-96	Dec-01	49704
40242	BRAZZI RANCH	Jun-90	Dec-01	100056
43010	BRIONES	Apr-94	Dec-01	67944
42202	BROOKS	May-90	Dec-01	102264
43603	BUCK MEADOWS	May-99	Dec-99	5880
40728	BULL FLAT	Oct-91	Dec-01	89832
45125	BURNS CANYON	Sep-91	Dec-01	89832
44318	CAHOON	May-90	Apr-97	56904
43405	CALAVERAS ROAD	May-97	Dec-01	40944
40204	CALLAHAN GS	Dec-88	Dec-01	113976
45704	CAMERON FIRE STATION	Oct-94	Dec-01	63552
45441	CAMP 9	Sep-95	Dec-01	55512
40303	CANBY	May-94	Dec-01	67224
41213	CARPENTERS RIDGE	Jun-00	Dec-01	13896
44916	CARRIZO	Oct-91	Dec-01	89832

NWS ID	Station Name	Start Date	End Date	Total Hours
45731	CASE SPRINGS	Oct-92	Dec-01	79584
44114	CATHEY'S VALLEY	Jan-99	Dec-01	23400
44719	CEDAR GROVE	Sep-99	Dec-01	20472
45313	CHEESEBORO	Sep-95	Dec-01	55512
40904	CHESTER	Oct-89	Dec-01	105216
41210	CHICO	May-90	Dec-01	102264
45436	CHILAO	Feb-86	Dec-01	129264
45302	CHUCHUPATE	Feb-99	Dec-01	25560
45443	CLAREMONT	Jul-98	Dec-01	29256
45624	CLARK	May-00	Dec-01	14640
41211	COHASSET	May-90	Dec-01	102264
40237	COLLINS BALDY LOOKOUT	Jul-91	Dec-01	92040
45105	CONVERSE	Jun-97	Dec-99	22656
40422	COOSKIE MOUNTAIN	May-85	Dec-01	146064
40814	CORNING	Oct-98	Dec-01	28512
43802	CORRALITOS	May-90	Nov-01	101520
41410	COUNTY LINE	Oct-94	Dec-01	63552
40106	CRAZY PEAK	Jan-85	Dec-99	147480
43709	CRESTVIEW	Nov-93	Dec-01	71568
45445	DEL VALLE	Nov-98	Dec-01	27768
45707	DESCANSO	Nov-97	Dec-01	36528
40309	DEVILS GARDEN	Sep-91	Dec-01	90552
44208	DEVILS POSTPILE	Nov-93	Dec-01	67944
45113	DEVORE	Nov-90	Dec-01	88416
43502	DIABLO GRANDE	Aug-98	Dec-01	29976
41302	DOG VALLEY	Apr-01	Dec-01	6600
41807	DORRIS RANCH	May-90	Dec-01	102264
40724	DOYLE	Jun-87	Dec-01	117600
40802	EAGLE PEAK	Oct-99	Dec-01	18336
41005	EEL RIVER	May-92	Dec-01	84744
40421	EEL RIVER CAMP	Jul-01	Dec-01	4416
45619	EL CARISO FIRE STATION	Apr-95	Dec-01	59184
43208	ESPERANZA	May-90	Dec-01	100080
44516	FANCHER CREEK	May-90	Dec-01	100800
45101	FAWNSKIN	May-95	Dec-01	58464
44503	FENCEMDW	Jun-99	Dec-01	22680
45802	FISH CREEK MOUNTAIN	Mar-88	Dec-01	121248
45733	FLORES	Oct-92	Dec-01	78120
44731	FOUNTAIN SPRINGS	May-90	Dec-01	102264
45736	FREMONT CANYON	Jul-91	Dec-01	92040
40512	FRIEND MOUNTAIN	Sep-90	Dec-99	57096
40102	GASQUET	Nov-93	Dec-01	27024
45124	GRANITE MOUNTAIN	Sep-91	Dec-01	90552
40721	GRASSHOPPER	May-90	Dec-01	102264
43613	GREEN SPRING	May-90	Dec-01	100776
44319	HASTINGS	Apr-97	Dec-01	41664

NWS ID	Station Name	Start Date	End Date	Total Hours
40633	HAT MOUNTAIN SUMMIT	Sep-95	Mar-99	24816
42010	HAWKEYE	Sep-93	Dec-01	73032
40503	HAYFORK	Apr-97	Dec-99	23376
42608	HELL HOLE	Jun-89	Dec-01	93504
44409	HERNANDEZ	May-90	Dec-01	102264
41402	HIGH GLADE LOOKOUT	May-97	Nov-01	39480
44520	HIGH SIERRA	Jul-01	Dec-01	4416
40408	HOOPA	Apr-97	Dec-01	41664
40727	HORSE LAKE	Oct-91	Dec-01	89832
45129	HORSE THIEF SPRING	Sep-91	Dec-01	90552
44517	HURLEY	Jan-95	Dec-01	60600
40233	INDIAN WELLS	May-97	Dec-01	32952
45013	JAWBONE	Sep-91	Dec-01	90552
44707	JOHNSONDALE	Jun-98	Dec-01	30696
40240	JUANITA	Dec-88	Dec-01	111024
45708	JULIAN	Mar-93	Dec-01	77448
40308	JUNIPER CREEK	Apr-88	Dec-01	120504
45604	KEENWILD	May-90	Dec-01	102264
45005	KERNVILLE	Jan-99	Dec-01	26304
44602	KETTLEMAN HILLS	Feb-88	Dec-01	121920
41409	KNOXVILLE CREEK	May-85	Dec-01	146064
41411	KONOCTI	Mar-95	Dec-01	59928
43304	LA HONDA	May-90	Dec-01	102264
44914	LA PANZA	May-90	Dec-01	102264
40723	LADDER BUTTE	Apr-88	Dec-01	114768
44904	LAS TABLAS	May-90	Dec-01	102264
43009	LAS TRAMPAS	Apr-94	Dec-01	65064
40815	LASSEN LODGE	May-90	Dec-01	74568
40709	LAUFMAN	Feb-98	Dec-01	34320
41019	LAYTONVILLE	Jul-01	Nov-01	3672
45447	LEO CARRILO	Jul-99	Dec-01	21960
41907	LINCOLN	Aug-91	Dec-01	91296
43406	LIVERMORE	May-90	Nov-01	100776
43912	LOS ALTOS	Feb-98	Dec-01	34320
44003	LOS BANOS	May-90	Dec-01	101520
43913	LOS GATOS	May-97	Dec-01	40200
45203	LOS PRIETOS	Oct-97	Dec-01	37272
45614	LOST HORSE	Sep-91	Dec-01	90552
41408	LYONS VALLEY	Mar-88	Dec-01	121248
40507	MAD RIVER	Oct-99	Dec-01	19752
45433	MALIBU	Jan-95	Dec-01	59184
43011	MALLORY RIDGE	Oct-98	Dec-01	28512
40609	MANZANITA LAKE	Jun-90	Dec-01	75984
40424	MAPLE CREEK	Jan-95	Dec-01	61344
44106	MARIPOSA	May-90	Dec-01	91296
44113	MARIPOSA GROVE	Sep-88	Dec-01	91320

NWS ID	Station Name	Start Date	End Date	Total Hours
42802	MARKLEEVILLE	Apr-98	Dec-01	32904
41017	MCGUIRES	May-90	Dec-01	73032
44209	METCALF GAP	May-90	Dec-01	100056
42607	MEYERS	Jul-98	Dec-01	30720
45128	MID HILLS	Sep-91	Dec-01	90552
44718	MILK RANCH	Aug-97	Aug-99	18264
45435	MILL CREEK (ANF)	Apr-89	Dec-01	105192
45109	MILL CREEK (BDF)	Feb-98	Dec-01	34320
44708	MILO	Jul-01	Dec-01	4416
45122	MOJAVE RIVER SINK	Mar-88	Dec-01	120504
45218	MONTECITO	Sep-96	Dec-01	46752
45114	MORMON ROCKS	Oct-99	Dec-01	19752
44505	MT REST	Apr-99	Dec-01	24144
44511	MT TOM	Aug-99	Dec-01	21216
43012	MT. DIABLO	Jul-00	Dec-01	13176
43605	MT ELIZ	Jul-99	Dec-99	4416
44204	NORTHFORK	Aug-98	Dec-01	29976
44804	OAK CREEK	Oct-94	Dec-01	62808
45710	OAK GROVE FIRE STATION	Mar-95	Dec-01	59928
40218	OAK KNOLL	Dec-88	Dec-01	114648
40635	OAK MOUNTAIN	Aug-91	Jun-01	43944
44717	OAK OPENING	Feb-96	Dec-01	49632
43402	OAKLAND NORTH	Jun-92	Dec-01	84000
43403	OAKLAND SOUTH	Aug-92	Dec-01	82536
45315	OJAI	Jun-00	Dec-01	13896
45127	OPAL MOUNTAIN	Sep-91	Dec-01	88368
42611	OWENS CAMP	Sep-89	Dec-01	101592
44803	OWENS VALLEY	Sep-92	Dec-01	81792
45303	OZENA	Aug-01	Dec-01	3672
44806	PANAMINT	Mar-88	Dec-01	121248
44514	PANOCH	May-90	Feb-01	94176
44713	PARK RIDGE	Jul-97	Dec-01	24960
44310	PARKFIELD	May-90	Dec-01	102264
40812	PATTY MOCUS LOOKOUT	Oct-90	Dec-01	68736
40915	PIERCE	Jul-86	Nov-01	100368
41701	PIKE COUNTY	May-85	Dec-01	122760
42609	PILOT HILL	Apr-93	Dec-01	76704
44508	PINEHURST	Apr-01	Dec-01	6600
45440	POPPY PARK	Sep-95	Dec-01	43872
45730	POTRERO	May-90	Dec-01	75984
43914	POVERTY	Oct-98	Jul-99	7296
43309	PULGAS	May-97	Dec-01	40944
40239	QUARTZ HILL	May-90	Nov-01	101520
40910	QUINCY	Oct-88	Dec-01	107328
45729	RANCHITA	Jan-95	Dec-01	61344
44728	RATTLESNAKE	Jul-92	Oct-01	34512

NWS ID	Station Name	Start Date	End Date	Total Hours
40714	RAVENDALE	Jun-99	Dec-01	22680
45620	RICE VALLEY	Mar-88	Dec-01	121248
43710	ROCK CREEK	Jun-99	Dec-01	22680
41015	RODEO VALLEY	Jul-93	Dec-01	73032
43404	ROSE PEAK	Jan-95	Dec-01	61344
45314	ROSE VALLEY II	Nov-93	Dec-01	71568
40221	ROUND MOUNTAIN	Mar-91	Dec-01	93552
40312	RUSH CREEK	Sep-97	Dec-01	21960
41102	SACRAMENTO	Jul-01	Dec-01	4416
41304	SADDLEBACK	Jun-01	Dec-01	5136
45444	SADDLEBACK BUTTE	Jul-98	Dec-01	29976
45216	SANTA CRUZ ISLAND	Apr-90	Dec-01	92088
45437	SANTA FE	Jun-93	Jul-01	61368
44408	SANTA RITA	Oct-91	Nov-01	89088
42009	SANTA ROSA	Mar-91	Dec-01	94968
45217	SANTA ROSA ISLAND	Apr-90	Dec-01	101544
45623	SANTA ROSA PLATEAU	Apr-93	Dec-01	76704
45412	SAUGUS	Sep-94	Dec-01	63552
40222	SAWYERS BAR	Dec-88	Dec-01	112512
40517	SCORPION	Oct-90	Dec-01	73152
41808	SECRET TOWN	May-92	Dec-01	84744
44724	SHADEQUARTER	May-90	Dec-01	91296
44522	SHAVER	Apr-95	Dec-01	59184
40618	SIMS	Nov-89	Dec-01	75312
40225	SLATER	Dec-88	Nov-01	109560
41406	SODA CREEK	May-92	Dec-01	78960
40630	SOLDIER MTN	May-90	Dec-01	100776
40231	SOMES BAR	Dec-88	Dec-01	114648
43308	SPRING VALLEY	Oct-98	Dec-01	28512
41804	STAMPEDE	Jul-91	Dec-01	89160
41503	STONYFORD	Jul-94	Dec-01	65760
44729	SUGARLOAF	Jul-92	Oct-01	36696
40614	SUGARLOAF (SHF)	Nov-99	Dec-99	1464
45739	TALEGA	May-01	Dec-01	5880
45421	TANBARK	Feb-86	Dec-01	139440
45732	TARGET RANGE	Oct-92	Dec-01	80328
45611	TEMESCAL	Jan-00	Dec-01	17544
45307	TEMESCAL (LPF)	Jan-85	Sep-91	55416
40816	THOMAS CREEK	May-90	Dec-01	102264
44510	TRIMMER	Jun-99	Dec-01	5136
40516	TRINITY CAMP	Apr-96	Dec-01	49680
43611	TUOLUMNE	Aug-88	Dec-01	89112
44712	UHL/HOT SPRINGS	Mar-96	Dec-01	46800
45734	VALLEY CENTER	May-90	Oct-01	74520
40243	VAN BREMMER	Jun-93	Dec-01	74496
43707	WALKER	Apr-02	Dec-01	6600

NWS ID	Station Name	Start Date	End Date	Total Hours
45014	WALKER PASS	Oct-91	Dec-01	89832
45426	WARM SPRINGS LOOKOUT	Apr-86	Dec-01	105960
40510	WEAVERVILLE	Jul-98	Dec-01	30720
40228	WEED	May-90	Dec-01	102264
40719	WESTWOOD	May-90	Dec-01	97944
41806	WHITE CLOUD	Feb-93	Dec-01	66456
40615	WHITMORE	May-90	Dec-01	102264
45446	WHITTIER HILLS	May-99	Dec-01	23424
44732	WOLVERTON	Jun-96	Dec-01	48960
43612	WWOLF	Aug-88	Dec-01	84792
40511	YOLLA BOLLA	Sep-90	Dec-01	45408
45112	YUCCA	May-90	Dec-01	102264
42701	ZION	May-90	Dec-01	102264

Appendix 3. QC analysis statistics (see text for description). Values given in percent.

Station Name	Estimated Values	Impossible Values	Scenario 1	Scenario 2	Changed to missing
ACTON	0.75%	0.00%	0.00%	0.12%	0.12%
ALDER POINT	1.39%	0.01%	0.00%	0.00%	0.01%
ALDER SPRINGS	0.93%	0.02%	0.00%	0.39%	0.41%
AMMO DUMP	0.21%	0.00%	0.00%	0.00%	0.00%
ANZA	0.92%	0.00%	0.00%	0.35%	0.35%
ARBUCKLE BASIN	0.62%	0.00%	0.00%	0.52%	0.52%
ARROYO GRANDE	0.64%	0.00%	0.00%	0.05%	0.05%
ARROYO SECO	0.33%	0.00%	0.00%	0.00%	0.00%
ASH CREEK	0.87%	0.00%	0.00%	0.08%	0.08%
ASH VALLEY	0.50%	0.00%	0.00%	0.00%	0.00%
BACKBONE	0.62%	0.03%	0.00%	0.02%	0.06%
BALD MOUNTAIN	0.72%	0.05%	0.04%	0.07%	0.16%
BANGOR	1.10%	0.00%	0.00%	0.01%	0.02%
BARNABE	0.57%	0.01%	0.00%	0.47%	0.48%
BATTERSON	0.50%	0.00%	0.00%	0.00%	0.00%
BEAR PEAK	0.67%	0.00%	0.00%	0.01%	0.01%
BEAVER	0.57%	0.00%	0.00%	0.01%	0.01%
BELL CANYON	0.64%	0.01%	0.00%	0.03%	0.04%
BEN BOLT	1.28%	0.00%	0.00%	0.08%	0.09%
BEN LOMOND	0.62%	0.20%	0.00%	0.84%	1.04%
BENTON	0.66%	0.00%	0.00%	0.00%	0.00%
BEVERLY HILLS	0.11%	0.00%	0.00%	0.00%	0.00%
BIG BAR	0.87%	0.00%	0.56%	0.21%	0.77%
BIG HILL	0.37%	0.07%	0.01%	0.09%	0.17%
BIG SUR	0.19%	0.00%	0.00%	0.00%	0.00%
BLACK DIAMOND	0.38%	0.00%	0.00%	0.00%	0.00%
BLACKROCK	0.96%	0.00%	0.00%	0.61%	0.61%
BLUE DOOR	0.54%	0.00%	0.00%	0.00%	0.00%
BOGARD	1.63%	0.00%	0.29%	0.07%	0.35%
BOONVILLE	1.32%	0.01%	0.00%	0.10%	0.12%
BRANCH MOUNTAIN	0.37%	0.00%	0.00%	9.60%	9.60%
BRAZZI RANCH	1.40%	0.00%	0.00%	0.02%	0.02%
BRIONES	0.37%	0.00%	0.00%	0.15%	0.15%
BROOKS	1.14%	0.03%	0.00%	0.01%	0.04%
BUCK MEADOWS	0.18%	0.00%	0.00%	0.00%	0.00%
BULL FLAT	0.51%	0.00%	0.00%	0.00%	0.00%
BURNS CANYON	0.61%	0.00%	0.00%	0.00%	0.00%
CAHOON	1.61%	0.11%	0.00%	0.02%	0.13%
CALAVERAS ROAD	0.17%	0.03%	0.00%	0.00%	0.03%
CALLAHAN GS	0.88%	0.00%	0.03%	1.63%	1.67%
CAMERON FIRE STATION	0.47%	0.04%	0.00%	0.00%	0.04%
CAMP 9	0.54%	0.01%	0.00%	0.14%	0.15%
CANBY	0.78%	0.00%	0.00%	0.02%	0.03%
CARPENTERS RIDGE	0.34%	0.00%	0.00%	0.02%	0.02%



Station Name	Estimated Values	Impossible Values	Scenario 1	Scenario 2	Changed to missing
CARRIZO	0.51%	0.00%	0.00%	0.00%	0.00%
CASE SPRINGS	0.71%	0.00%	0.00%	0.00%	0.00%
CATHEY'S VALLEY	0.26%	0.00%	0.00%	0.00%	0.00%
CEDAR GROVE	0.80%	0.00%	0.00%	4.81%	4.81%
CHEESEBORO	0.37%	0.00%	0.00%	0.00%	0.00%
CHESTER	1.21%	0.06%	0.01%	0.44%	0.51%
CHICO	1.08%	0.03%	0.00%	0.29%	0.32%
CHILAO	0.98%	0.00%	0.00%	0.06%	0.06%
CHUCHUPATE	0.27%	0.00%	0.00%	0.00%	0.00%
CLAREMONT	0.09%	0.00%	0.00%	0.00%	0.00%
CLARK	0.25%	0.00%	0.00%	0.00%	0.00%
COHASSET	0.97%	0.00%	0.00%	0.03%	0.03%
COLLINS BALDY LOOKOUT	0.97%	0.02%	0.05%	0.11%	0.17%
CONVERSE	0.57%	0.00%	0.00%	0.04%	0.04%
COOSKIE MOUNTAIN	0.82%	0.25%	0.03%	0.32%	0.59%
CORNING	0.26%	0.01%	0.00%	1.19%	1.20%
CORRALITOS	1.33%	0.00%	0.00%	0.74%	0.74%
COUNTY LINE	0.46%	0.00%	0.00%	0.00%	0.00%
CRAZY PEAK	1.02%	0.00%	0.00%	0.39%	0.39%
CRESTVIEW	0.47%	0.00%	0.82%	0.03%	0.85%
DEL VALLE	0.13%	0.00%	0.00%	0.00%	0.00%
DESCANSO	0.39%	0.01%	0.00%	0.27%	0.28%
DEVILS GARDEN	0.80%	0.01%	0.00%	0.33%	0.34%
DEVILS POSTPILE	1.34%	0.00%	0.18%	1.21%	1.38%
DEVORE	1.36%	0.00%	0.01%	0.01%	0.02%
DIABLO GRANDE	0.22%	0.37%	0.00%	0.00%	0.37%
DOG VALLEY	1.15%	0.00%	0.00%	0.00%	0.00%
DORRIS RANCH	1.26%	0.02%	0.00%	0.01%	0.03%
DOYLE	0.47%	0.00%	0.00%	0.00%	0.00%
EAGLE PEAK	0.51%	0.47%	0.00%	0.49%	0.96%
EEL RIVER	0.64%	0.00%	0.31%	0.52%	0.83%
EEL RIVER CAMP	0.33%	0.01%	0.00%	0.76%	0.77%
EL CARISO FIRE STATION	0.37%	0.00%	0.00%	0.00%	0.00%
ESPERANZA	1.83%	0.01%	0.00%	0.10%	0.10%
FANCHER CREEK	1.08%	0.24%	0.00%	0.26%	0.49%
FAWNSKIN	0.24%	0.00%	0.00%	3.41%	3.41%
FENCEMDW	0.14%	0.03%	0.00%	0.00%	0.03%
FISH CREEK MOUNTAIN	0.57%	0.02%	0.00%	0.07%	0.09%
FLORES	0.94%	0.00%	0.00%	0.05%	0.05%
FOUNTAIN SPRINGS	1.23%	0.38%	0.00%	0.05%	0.42%
FREMONT CANYON	0.96%	0.00%	0.00%	0.48%	0.48%
FRIEND MOUNTAIN	1.54%	0.00%	0.04%	0.09%	0.13%
GASQUET	0.81%	0.00%	0.00%	0.31%	0.31%
GRANITE MOUNTAIN	0.59%	0.00%	0.00%	0.00%	0.00%
GRASSHOPPER	1.23%	0.00%	0.00%	0.05%	0.05%

Station Name	Estimated Values	Impossible Values	Scenario 1	Scenario 2	Changed to missing
GREEN SPRING	1.27%	0.08%	0.00%	0.37%	0.44%
HASTINGS	0.45%	0.00%	0.00%	0.00%	0.00%
HAT MOUNTAIN SUMMIT	1.21%	0.00%	0.00%	0.02%	0.02%
HAWKEYE	0.64%	0.02%	0.00%	0.05%	0.06%
HAYFORK	0.98%	0.00%	0.00%	0.34%	0.34%
HELL HOLE	0.39%	0.49%	0.00%	0.00%	0.50%
HERNANDEZ	1.00%	0.23%	0.00%	0.50%	0.72%
HIGH GLADE LOOKOUT	0.58%	0.00%	0.00%	0.06%	0.06%
HIGH SIERRA	0.23%	0.00%	0.00%	0.01%	0.01%
HOOPA	0.69%	0.00%	0.00%	0.00%	0.00%
HORSE LAKE	0.58%	0.00%	0.00%	0.00%	0.00%
HORSE THIEF SPRING	0.57%	0.00%	0.00%	0.01%	0.01%
HURLEY	1.13%	0.00%	0.00%	0.53%	0.53%
INDIAN WELLS	0.38%	0.01%	0.00%	0.01%	0.02%
JAWBONE	0.72%	0.00%	0.00%	0.23%	0.23%
JOHNSONDALE	0.85%	0.00%	0.00%	0.23%	0.23%
JUANITA	0.65%	0.00%	0.00%	0.11%	0.11%
JULIAN	0.57%	0.37%	0.00%	0.03%	0.40%
JUNIPER CREEK	0.43%	0.03%	0.00%	0.00%	0.03%
KEENWILD	0.44%	0.09%	0.02%	0.84%	0.95%
KERNVILLE	0.78%	0.00%	0.00%	0.16%	0.16%
KETTLEMAN HILLS	0.57%	0.03%	0.00%	0.08%	0.11%
KNOXVILLE CREEK	0.61%	0.00%	0.00%	0.22%	0.22%
KONOCTI	0.55%	0.00%	0.00%	0.99%	0.99%
LA HONDA	0.94%	0.23%	0.00%	0.73%	0.95%
LA PANZA	1.78%	0.00%	0.00%	0.44%	0.44%
LADDER BUTTE	0.60%	0.05%	0.01%	0.16%	0.22%
LAS TABLAS	2.05%	0.00%	0.00%	0.18%	0.18%
LAS TRAMPAS	0.38%	0.00%	0.00%	1.01%	1.01%
LASSEN LODGE	1.48%	0.00%	0.00%	0.83%	0.83%
LAUFMAN	0.77%	0.00%	0.00%	0.01%	0.01%
LAYTONVILLE	0.15%	0.02%	0.00%	0.00%	0.02%
LEO CARRILO	0.10%	0.00%	0.00%	0.00%	0.00%
LINCOLN	0.97%	0.00%	0.00%	0.00%	0.00%
LIVERMORE	0.80%	0.86%	0.00%	0.11%	0.97%
LOS ALTOS	1.02%	0.04%	0.00%	0.83%	0.86%
LOS BANOS	1.03%	0.00%	0.00%	0.31%	0.31%
LOS GATOS	0.54%	0.04%	0.00%	0.15%	0.19%
LOS PRIETOS	0.27%	0.00%	0.00%	0.03%	0.03%
LOST HORSE	0.54%	0.01%	0.01%	0.00%	0.02%
LYONS VALLEY	0.64%	0.09%	0.00%	0.12%	0.21%
MAD RIVER	0.53%	0.00%	0.00%	0.00%	0.00%
MALIBU	1.35%	0.00%	0.00%	0.45%	0.45%
MALLORY RIDGE	0.10%	0.00%	0.00%	0.00%	0.00%
MANZANITA LAKE	1.34%	0.00%	0.00%	0.19%	0.19%

Station Name	Estimated Values	Impossible Values	Scenario 1	Scenario 2	Changed to missing
MAPLE CREEK	0.42%	0.05%	0.00%	1.62%	1.66%
MARIPOSA	1.19%	0.04%	0.00%	0.05%	0.09%
MARIPOSA GROVE	1.23%	0.00%	0.00%	0.23%	0.24%
MARKLEEVILLE	0.28%	0.00%	0.00%	0.01%	0.01%
MCGUIRES	1.54%	0.08%	0.03%	0.78%	0.90%
METCALF GAP	1.26%	0.00%	0.00%	0.09%	0.09%
MEYERS	1.38%	0.00%	0.00%	0.80%	0.80%
MID HILLS	0.53%	0.00%	0.00%	0.01%	0.01%
MILK RANCH	1.46%	0.00%	0.00%	0.36%	0.36%
MILL CREEK (ANF)	1.06%	0.03%	0.00%	0.53%	0.56%
MILL CREEK (BDF)	0.55%	0.00%	0.00%	0.00%	0.00%
MILO	0.79%	0.17%	0.00%	0.00%	0.17%
MOJAVE RIVER SINK	0.73%	0.02%	0.00%	0.04%	0.06%
MONTECITO	1.54%	0.00%	0.00%	0.60%	0.60%
MORMON ROCKS	0.30%	0.00%	0.00%	0.00%	0.00%
MT REST	0.44%	0.00%	0.00%	0.10%	0.10%
MT TOM	0.94%	0.00%	0.00%	0.15%	0.15%
MT. DIABLO	1.16%	0.03%	0.00%	0.00%	0.03%
MT ELIZ	0.31%	0.00%	0.00%	0.00%	0.00%
NORTHFORK	0.65%	0.00%	0.00%	0.19%	0.19%
OAK CREEK	0.52%	0.00%	0.00%	0.00%	0.00%
OAK GROVE FIRE STATION	0.50%	0.38%	0.00%	0.00%	0.38%
OAK KNOLL	0.57%	0.00%	0.07%	0.07%	0.14%
OAK MOUNTAIN	2.11%	0.19%	1.18%	0.86%	2.22%
OAK OPENING	0.98%	0.00%	0.00%	0.52%	0.52%
OAKLAND NORTH	0.48%	0.08%	0.00%	0.00%	0.09%
OAKLAND SOUTH	0.34%	0.00%	0.00%	0.00%	0.00%
OJAI	0.18%	0.00%	0.00%	0.00%	0.00%
OPAL MOUNTAIN	0.77%	0.00%	0.00%	0.00%	0.00%
OWENS CAMP	0.75%	0.05%	0.02%	0.04%	0.11%
OWENS VALLEY	0.76%	0.23%	0.00%	0.14%	0.36%
OZENA	0.32%	0.07%	0.00%	0.00%	0.07%
PANAMINT	0.68%	0.10%	0.01%	0.15%	0.25%
PANOCHÉ	0.97%	0.00%	0.00%	0.79%	0.79%
PARK RIDGE	0.62%	0.00%	0.00%	0.09%	0.09%
PARKFIELD	1.40%	0.24%	0.00%	0.04%	0.28%
PATTY MOCUS LOOKOUT	1.36%	0.01%	0.02%	0.00%	0.02%
PIERCE	0.80%	0.01%	0.03%	0.13%	0.16%
PIKE COUNTY	1.00%	0.25%	0.13%	0.14%	0.52%
PILOT HILL	0.76%	0.00%	0.00%	0.09%	0.10%
PINEHURST	0.18%	0.00%	0.00%	0.00%	0.00%
POPPY PARK	0.39%	0.00%	0.00%	0.00%	0.00%
POTRERO	1.32%	0.01%	0.00%	0.32%	0.33%
POVERTY	0.28%	0.00%	0.00%	0.00%	0.00%
PULGAS	0.24%	0.00%	0.00%	0.01%	0.01%

Station Name	Estimated Values	Impossible Values	Scenario 1	Scenario 2	Changed to missing
QUARTZ HILL	1.90%	0.03%	0.00%	0.15%	0.18%
QUINCY	1.22%	0.03%	0.04%	0.53%	0.60%
RANCHITA	0.85%	0.00%	0.00%	0.06%	0.06%
RATTLESNAKE	0.63%	0.02%	3.34%	1.84%	5.19%
RAVENDALE	0.29%	0.00%	0.00%	0.01%	0.01%
RICE VALLEY	0.50%	0.02%	0.00%	0.00%	0.02%
ROCK CREEK	0.33%	0.00%	0.00%	0.00%	0.00%
RODEO VALLEY	1.06%	0.00%	0.00%	0.41%	0.41%
ROSE PEAK	0.37%	0.03%	0.00%	0.51%	0.54%
ROSE VALLEY II	0.50%	0.00%	0.00%	0.00%	0.00%
ROUND MOUNTAIN	0.85%	0.00%	0.00%	0.01%	0.01%
RUSH CREEK	0.19%	0.00%	0.00%	0.00%	0.00%
SACRAMENTO	0.11%	0.00%	0.00%	0.01%	0.01%
SADDLEBACK	0.82%	0.00%	0.00%	0.21%	0.21%
SADDLEBACK BUTTE	0.19%	0.00%	0.00%	0.00%	0.00%
SANTA CRUZ ISLAND	0.74%	0.00%	0.31%	0.30%	0.60%
SANTA FE	1.03%	0.00%	0.00%	0.23%	0.23%
SANTA RITA	0.70%	0.00%	0.00%	0.18%	0.18%
SANTA ROSA	1.01%	0.00%	0.00%	0.27%	0.27%
SANTA ROSA ISLAND	0.44%	0.01%	0.68%	0.03%	0.72%
SANTA ROSA PLATEAU	1.13%	0.31%	0.00%	0.20%	0.50%
SAUGUS	0.48%	0.00%	0.00%	0.00%	0.00%
SAWYERS BAR	0.70%	0.00%	0.01%	0.11%	0.12%
SCORPION	1.07%	0.34%	0.01%	0.12%	0.46%
SECRET TOWN	1.23%	0.01%	0.00%	0.03%	0.03%
SHADEQUARTER	1.25%	0.00%	0.00%	0.49%	0.49%
SHAVER	0.69%	0.00%	0.00%	0.54%	0.54%
SIMS	0.77%	0.00%	0.01%	0.78%	0.80%
SLATER	0.78%	0.02%	0.02%	0.49%	0.53%
SODA CREEK	1.27%	0.00%	0.62%	0.60%	1.22%
SOLDIER MTN	1.02%	0.03%	0.00%	0.22%	0.25%
SOMES BAR	0.73%	0.00%	0.32%	0.09%	0.41%
SPRING VALLEY	0.33%	0.00%	0.00%	0.00%	0.00%
STAMPEDE	1.21%	0.01%	0.93%	0.06%	1.01%
STONYFORD	0.87%	0.29%	0.00%	0.44%	0.73%
SUGARLOAF	0.81%	0.05%	0.79%	0.01%	0.85%
SUGARLOAF (SHF)	0.03%	0.00%	0.00%	0.00%	0.00%
TALEGA	0.21%	0.00%	0.00%	0.00%	0.00%
TANBARK	0.61%	0.00%	0.00%	0.47%	0.47%
TARGET RANGE	0.96%	0.04%	0.00%	0.02%	0.06%
TEMESCAL	0.64%	0.00%	0.00%	0.13%	0.13%
TEMESCAL (LPF)	1.59%	0.00%	0.00%	0.03%	0.03%
THOMAS CREEK	1.13%	0.01%	0.00%	0.77%	0.78%
TRIMMER	0.17%	0.00%	0.00%	0.00%	0.00%
TRINITY CAMP	0.67%	0.13%	0.00%	0.06%	0.19%

Station Name	Estimated Values	Impossible Values	Scenario 1	Scenario 2	Changed to missing
TUOLUMNE	0.62%	0.07%	0.72%	0.09%	0.88%
UHL/HOT SPRINGS	0.66%	0.00%	0.00%	0.05%	0.05%
VALLEY CENTER	1.36%	0.01%	0.00%	0.24%	0.24%
VAN BREMMER	0.44%	0.14%	0.01%	0.53%	0.68%
WALKER	0.13%	0.00%	0.00%	0.00%	0.00%
WALKER PASS	0.63%	0.00%	0.00%	0.00%	0.00%
WARM SPRINGS LOOKOUT	1.16%	0.00%	0.00%	0.19%	0.19%
WEAVERVILLE	3.68%	0.00%	0.00%	1.92%	1.92%
WEED	0.94%	0.00%	0.00%	0.03%	0.03%
WESTWOOD	1.07%	0.11%	0.01%	0.05%	0.17%
WHITE CLOUD	0.80%	0.00%	0.01%	0.12%	0.13%
WHITMORE	1.05%	0.00%	0.00%	0.03%	0.03%
WHITTIER HILLS	0.15%	0.00%	0.00%	0.38%	0.38%
WOLVERTON	0.33%	0.00%	0.00%	0.01%	0.01%
WWOLF	0.89%	0.05%	0.51%	0.37%	0.93%
YOLLA BOLLA	1.40%	0.07%	0.01%	0.35%	0.43%
YUCCA	1.52%	0.01%	0.00%	0.01%	0.02%
ZION	1.04%	0.06%	0.01%	0.07%	0.14%

AVERAGES      0.77%      0.04%      0.05%      0.28%      0.36%