Post Carbon Humboldt County, CA

Biophysical Research for Humboldt Outpost Group

By: Sarah Hall
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Problem Background and Statement

It is generally accepted that in the next decade the world oil extraction is going to peak and every year after there will be less and less oil extracted. There are a group of people in Humboldt County who feel our federal government is not taking enough action now to prepare for a future with less oil dependency. They are called an Outpost and they are one of many forming around the country. An Outpost is a group of community members who work together to learn how about their biophysical resources and political resources and try to find a way for their community to survive, intact and thriving when the time comes that oil and gas are not so easily available. They are figuring out ways their specific community can produce resources and sell food locally without depending or ~~on~~ any outside sources for energy, production or capital. The Humboldt Outpost has just recently formed and we have taken on the job of compiling all the biophysical data we can on Humboldt County.

Our problem, we have realized in starting this project, is not having all the information on Humboldt County's biophysical resources in a centralized area. There is no large folder which contains all the necessary reports, books, media articles and a list of local producers, growers and manufacturers who offer the products in Humboldt County. We are compiling the research and creating a single, cohesive document that the Humboldt Oupost can refer to for information. The information will be used by the outpost to help Humboldt County transition from a carbon to a post-carbon society. The biophysical resource information breaks down into the following categories: soil, water, hydrology, space heating, and energy (fuels and electricity). Using the Outpost Manual, we have decided to use their list of questions to find all the information as well as add on a few energy resources we felt should be considered in Humboldt County. The following

the list of questions we tried answering in the documents we have included:

Soil Analysis
What is the composition of your soil?
How fertile is it?
How well is it drained?
Where is it and how is it positioned?
Does the municipality or local government own any significant fertile land?
How expensive is the land with fertile soil?
Is it likely to be available?
Is the fertile land capable of being dry farmed, or will it require irrigation?

Water Analysis
What is the annual average precipitation?
What are the annual precipitation patterns?
Most importantly, when does most of the rain fall – in the winter or in the summer?
If mostly in the winter, as is common in many parts of the world, then great attention will have to be given to the hydrological system and where and how to collect and store water.

Hydrology
What are the nature, extent and flow of local rivers, if there are any?
What state are the rivers in?
Are there or were there underground rivers?
If the latter, have they been culverted, or simply filled in and built on?
What is the extent of ground water, is it regularly recharged by normal precipitation or is it so-called "fossil water" and effectively non-renewable?

Space Heating
What's the cost of geo-exchange heating systems?
Is there ground source or air exchange?
Is there a local manufacturer and/or a local installer?

Energy-fuels
What are the benefits and drawbacks of biodiesel?
What role should biodiesel play in your locale?
Do you have a local producer of biodiesel?
How much biomass and land will it take to provide feedstock for production of biodiesel?
Does it make sense to build a biodiesel production plant?
Are there suitable locations and feedstock for small-scale biogas digesters?

Energy-Electricity
Is your electricity system publicly or privately owned?
Are you allowed to sell electricity back to the grid?

What is your average insolation and what is the pattern of it throughout the year?
What local solar device manufacturers do you have in your locale or region?
What about for water heating and/or photovoltaics?
If neither of the above, how close is the nearest producer of any of these things?
Where are the nearest (reasonably) good sites for wind?
Where are the nearest wind turbines made?
What are the problems of instability when wind production makes up 15%-20% of the electricity production?
Do you have any good sites for micro-hydro installations?
What are the main ways electricity consumption can be reduced for households, communities, manufacturers and commerce?
How possible is wave energy?
How soon into the future will it be feasible?
What information is there on biomass?
How about wood gasification?

Goals and Objectives

Goals:

1) Compile all the data on Humboldt County's energy, water and soils.
2) Process the data and write a paper that summarizes the information found and what it all means.
3) Give a presentation and present the summaries we wrote.

Alternatives Section

Our semester long project is researching Humboldt County's current status in terms of its soils, water and energy. At first we had a difficult time coming up with an alternatives section. Our project was already outlined for us and the solution we were supposed to find was stated from the beginning. However, after speaking with Professor Hansis, we determined that for our alternatives section, we would come up with a list of items that would fine-tune the Outpost manual. We also have listed items that makes the Outpost questions more specific to Humboldt County and we have raised issues about things that might not have any relevance outside of Humboldt County.

Alternatives/Suggestions

- Receive grant $ to give stipends to the researchers and compilers of the data.
- For energy, find information on conversion kits for straight vegetable oil.
- For energy again, make it more site specific instead of county specific. Humboldt County is large and has a variety of geographical regions, therefore county average insolation is not as much use as region average insolation.
- Energy components should be broken down into the different regions instead of looking at county average as well.
- We tossed around the idea that perhaps we should research what a post-carbon Humboldt County would look like if the lower counties could no longer afford to divert and siphon off so much of our lumber and water.
- We should stockpile photovoltaics starting now because we do not have a manufacturer in the county, just installers.
- Ground source heating systems also have no local manufacturers.
- The soil survey is 30 years old and the current one they are working on will not be available until 2008.
- Research wave energy possibilities and best sites in Humboldt County.

Implementation Strategies

Our assignment is researching and compiling the soils, water and energy information of Humboldt County for the Outpost group. We divided the research up as follows:

1) Energy-fuels
   - Contact Andy in February about making an appointment.
   - Get any information he can give us about his own personal experiences with biodiesel.
   - Meet with Andy by the end of March.
   - Visit Footprint Recycling in April.
   - Read Sarah's Biodiesel book by end of March to re-familiarize ourselves with how biodiesel works.
   - Kelli to summarize bio-fuels information from her research by April.
2) Energy-electricity
   - Have Kelli read Sarah's notes from her Engineering class on solar energy by spring break.
   - Kelli to research as much as possible on energy section of project by February.
   - Sarah to go to Shatz Energy Lab and talk to Jim Zoellick about Energy Element of General plan in March.
   - Sarah to give relevant reports from Jim Z. at SERC to Kelli for summarizing.
   - Kelli read and summarize reports relevant for project by April.
   - Sarah to research reports prepared for Humboldt Board of Supervisors in Humboldt Room, referred by Jim Z. at SERC in March.
   - Make a stop at CCAT in April to see what information they may have.
   - Visit Real Goods, design and information center for renewable energy technolgogy and get all the quantitative information during spring break.
   - Sarah brings her Source Book to class for background information.
   - Sarah to go to Six Rivers solar for manufacturing and installer information for passive and active solar by beginning of April.
   - Read copy of Humboldt's energy report written by Schatz lab.
   - Research wood gasification in April
   - Sarah to research in Humboldt Room, inventories on wind and micro-hydroelectric sites in Humboldt County by beginning of April.
   - Sarah to meet with Michael Winkler on ground source heat pump information and summarize information by April.
   - Sarah to research energy conservation in Humboldt County by March.
   - Sarah to summarized Michael Winkler's model household energy conservation reports and Schatz report on energy conservation for residence in Humboldt by April.
   -
3) Soils

- Sarah to meet with RCD to get soil survey and information on work in progress survey by end of February.
- Sarah to read and summarize soil survey for Humboldt County in February.
- Sarah to research other soil reports and summarize by March.

4) Hydrology/Water analysis
    - Sarah to get read relevant section of Humboldt General County Plan update for analysis on hydrology.
    - Sarah to research as much as possible on watersheds in Humboldt county by end of February.
    - Find out about millponds and their purpose and if Humboldt County has any during the month of February and March.
    - Sarah to summarize watershed information by April.
    - Kelli to research relevant water analysis; amount of rainfall, etc. by April
    - Kelli to summarize her research by May.

Kelli Reddy
Project Hours

Environmental Science Practicum

Date	Time/Activity
Monday 1/31	**2 hrs** Researched biophysical resources and found outpost articles, printed them out.
Wednesday 2/2	**3 hrs** Read the Outpost manual Professor Hansen e-mailed.
Wednesday 2/9	**2 hrs** Worked with Sarah on our goals and objectives
Tuesday 3/1	**2 hrs** Wrote the Background and Statement assignment
Wednesday 3/2	**2 hrs** Read Sarah's book on Biodiesel
Tuesday 3/9	**2 hrs** Wrote the Goals and Objectives
Monday 3/21	**2 hrs** Read Sarah's book on solar energy and solar sources.
Wednesday 3/23	**1 hr** Worked with Sarah on our alternatives and the Professor gave us some advice.
Monday 3/28	**2 hrs** Worked with Sarah on organizing our information we have collected so far.
Tuesday 3/29	**2 hrs** Wrote alternatives section
Wednesday 4/6	**3 hrs** Wrote summary for biodiesel section
Wednesday 4/6	**2 hrs** Worked on including Professor's comments on alternatives, goals and objectives, and background statement.
Monday 4/11	**2 hrs** Researched and found information on wave energy, including a device being implemented in Trinidad.
Wednesday 4/13	**2 hrs** Wrote the implementation strategies (sorry, late!)
Monday 4/18	**2 hrs** Sarah and I brought all the information we have collected so far, organized it, and split up the reports to write summaries for them.
Sunday 4/24	**2 hrs** Wrote the summary for wave energy and solar energy
Monday 4/25	**5 hrs** Edited biodiesel summary, wave energy and solar energy and I wrote the anaerobic digestion summary

Wednesday 4/27	**3 hrs**	Went to the library with Sarah to go over each other's summaries so far and come up with a checklist of items we still need to do.
Thursday 4/28	**2 hrs**	Wrote the wind summary
Saturday 4/30	**5 hrs**	Wrote a summary for the upcoming General County plan, energy report subsection (we have the table of contents to show), old Humboldt County plan to accelerate economic development of local energy resources, Draft energy report from Schatz lab and wood gasification summary
Saturday 4/30	**2 hrs**	Printed out all the summaries (9 of them) as well as the assignments, read Sarah's summaries and gave suggestions, and came up with checklist's for things we both still need to do.
Tuesday 5/3	**3 hrs**	Bought the binder and put together all the reports with Sarah in the library. Researched and found the climatography report for California. Organized the binder, wrote the table of contents and reference section.
Wednesday 5/4	**2 hrs**	Wrote the water summary and did a final edit of the rest of my summaries.

Total Hours: 53 hours

Sarah Hall
Environmental Science practicum

Date	Time/Activity
Thursday 2/2/05	**2 hrs** – initial soil research
Sunday 2/6/05	**1 hr** – Post Carbon manual reading chp1-3 (pg 19)
Monday 2/7/05	**2 hr** – soil research online and watershed research from general plan.
Wed 2/9	**2 hr**. worked with Kelli on goals and objectives
Monday 2/14	**3** research energy information/watershed/soil
Wed 2/23	**1** hr phone & email request for meetings and information -called Jim Zoelick for energy report -called Michael Winkler ground source heat pump information -called Andy/regarding Biodiesel **1hr**. met with RCD to get soil analysis
Friday 2/25	**1hr** at Schatz Lab met with Michael Winkler
Wed 3/2	**2 hr** Read watershed info/research more on soil
Monday	**2hr.** Began research on dry farming. Contact South Hum. Comm. Park to get info. / Emailed Michael again requesting information.
Thursday 3/17	**1hr.** reading soil survey
Monday 3/21	**1hr**. reading outpost manual pg.43
Wed 3/23	**2hr**. research ground source heating stuff **.5** Discussing alternatives with Kelli
Saturday 3/26	**1 hr** responding to email regarding dry farming and requesting more information/reading soil survey grades and rating of Ag.soils. Emailed Jim Z for energy information for Humboldt County.
Monday 3/28	2 hrs. Worked with Kelli organizing information, and worked on summarizing hydrology information
Weds 3/30	**2** hrs meeting at SERC with Jim Z.
Saturday 4/2	**2hrs**. reading over reports from SERC
Monday 4/4	**3hrs**. Reading and summarizing watershed info

San Francisco Bay Area Independent Media Center

Original article is at http://www.indybay.org/news/2004/11/1706287.php Print comments.

Creating the Post Carbon City
by Fault Lines Article - David Room *Saturday, Nov. 20, 2004 at 12:18 PM*

Creating the Post Carbon City

By David Room, Post Carbon Institute

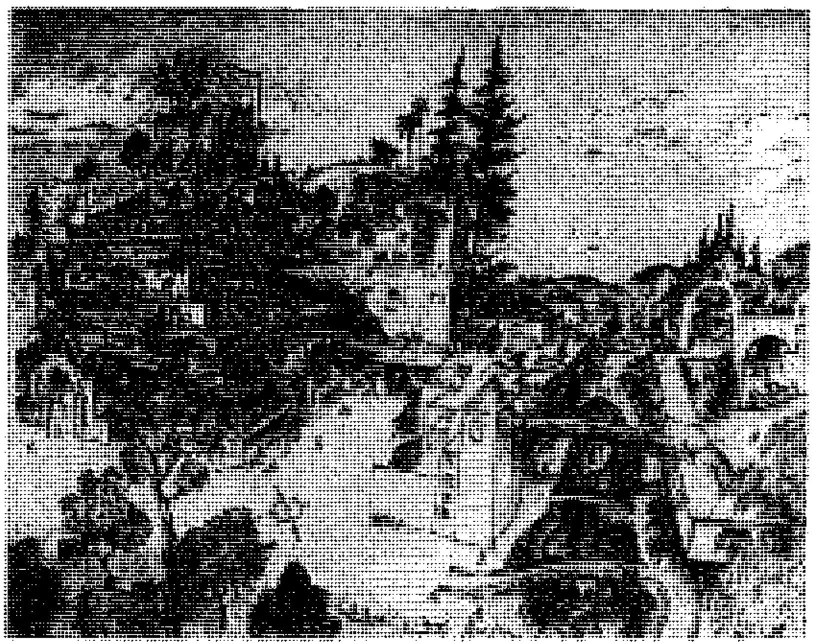

Illustration of a downtown transformed from car-city to the ecological pedestrian city from www.ecocitybuilders.org.

In the modern tradition many cities have become obsessed with growth. Some find themselves using new development to finance the services required for previous development patterns rely on ready access to cheap energy supplies. These supplies, however, are now coming into question in a way that is far more serious than the energy shocks of the 1970s; geology as opposed to geopolitics is driving a process that heralds permanent energy scarcity. If energy realists are right, cities will need to refocus drastically from energy-intensive development towards using much less energy, not only in the built environment, but also in the whole city infrastructure.

A Stressed Biosphere

Energy-subsidized human activity is causing severe biosphere destruction that threatens all life on the planet. Headlines regularly highlight rapid species extinction, fisheries depletion, and other disturbing trends. Most troubling, there is now widespread scientific agreement that human-induced global warming, primarily from the burning of fossil fuels, is causing increasingly harmful climate disruption. Atmospheric greenhouse gases are at levels 30 percent higher than Earth has experienced during the last 400,000 years and they continue to rise inexorably. There are already clear signs of what may become uncontrollable and irreparable impacts. Though obvious to many that urgent and dramatic action is needed, civilization is clearly headed in the wrong direction.

Although human activity has always tended to disrupt ecosystems, climate and other environmental problems have been exacerbated in the last century. Soon for the first time, more people will live in cities than rural areas. City dwellers lead relatively energy intensive lives, even those that live in poverty. As a result, energy consumption scales closely with our explosive urban population growth. The primary enablers of the population run-up and the energy intensive urban lifestyle have been cheap oil and natural gas. After one hundred and fifty years of extraordinary growth, these fuel sources are reaching their limits.

Oil and Gas Peak

Oil and gas do not sit in underground caverns. They are trapped in gaps in certain types of rocks. This is a critical point, because it means that oil and gas fields do not simply drain out as from a tank, but generally follow a bell-shaped pattern of rising to a peak of production and then falling away. The US peaked in 1970. Peak oil makes nonsense of recent claims by BP that we have enough oil for forty years. Oil will still be pumping in a hundred and forty years--just not very much.

Alarm bells sounded in the 1970s with various oil and gas shocks, and there was talk of 'running out.' But the urgency was subsequently quelled by significant discoveries in Alaska and the North Sea; extraction was a matter of engineering--very difficult, but possible. Times are different. Unlike the 1970s, we have found no new huge provinces--in fact the North Sea was the last such find. Worse still, following a declining trend, in 2003 for the first time in many years no major fields were discovered, and world oil production rate is now six times the current discovery rate. To underline how different times are now, Matthew Simmons, chairman of the world's largest private energy bank and writer of a forthcoming book on Saudi oil, believes that Saudi Arabia--the world's largest oil exporter--has reached a plateau and that decline is imminent. The whole Middle East may also be on a plateau.

When global oil peak will occur is debatable, and can only be known for certain in retrospect. Princeton geologist Kenneth Deffeyes and others believe we have passed the peak for conventional oil that is easily and economically extractable using known techniques. Colin Campbell of the Association for the Study of Peak Oil and Gas energy supply. Prudence requires that those involved in urban planning begin considering the possibility that oil is peaking now, since revamping an infrastructure takes decades.
Impetus for Change

The imminent peaking of global oil and gas production could be the catalyst for positive transformation of industrial society, and perhaps avert catastrophic climate change. It could also be disastrous. Essential systems such as food, electricity, health care, and transportation that form the foundation of industrial civilization depend on unfettered access to cheap oil and natural gas. Industrial agriculture relies upon natural gas derived fertilizers, oil-based pesticides, oil-intensive transport, and plastic packaging. In fact, fuel accounts for virtually 100% of the work that's done in industrial society.

Once supply begins to drop and is no longer able to meet demand, less work will be done--which means less economic activity. Alternative energies, conservation, and new energy carriers such as hydrogen will undoubtedly play a role in future energy systems, yet collectively they will not be enough to preserve industrial society as we know it. A largely positive outcome could result from unusual planning, action, and enduring behavior change. Cities must prepare for a serious decrease in net energy availability in their twenty year time horizon or else accept "the cyanide solution of much more coal and nuclear" says Julian Darley, author of High Noon for Natural Gas.

The burden of cities

Most future initiatives to stave off an energy meltdown will be led from the local level--where most energy consumption actually occurs. Every city and community will have different portfolios of solutions tailored to their circumstances and culture. Solutions for Toronto suburbs will be different than those of Johannesburg. Cities--backed by governments providing appropriate support by ending fossil fuel subsidies, developing renewables, and considering carbon taxes – must begin experiments to discover what works and what does not in a given locale.

This knowledge must be gained before the coming energy crisis--experiments that don't work now may be considered useful information. If experiments fail in crisis conditions, people are likely to suffer grievously as Cubans and North Koreans found out in the 1990s when they suddenly lost their cheap Soviet oil. In fact, their experiences will likely prove instructive as the rest of the world grapples with energy scarcity. To save precious time and resources, communities and cities will need to learn from existing models, share experiments, outcomes, and lessons learned; the term sister city will soon have a whole new meaning.

Cities need to prepare themselves to do less materially with much less energy and fewer natural resources, with the ultimate goal of living sustainably within the confines of their bioregion. "We need to reinvent the city," says Richard Heinberg author of The Party's Over and Powerdown. "To not do so will be suicide." One famous example of energy and natural resource collapse occurred on Easter Island, whose complex society unraveled into cannibalism.

Key building blocks of the solution

Relocalization is the process by which communities localize their economies and essential systems, such as food and energy production, water, monetary, governance, and media. To even out local difficulties relocalization will need some degree of regional integration. Cities need to support and collaborate with community groups on relocalization experiments, since cities are the information hubs and the final destination of most production and resources. The benefit will be adaptable communities and cities that collectively operate within the means of their bioregion, using locally produced food and fuel. As the author of The Geography of Nowhere, James Howard Kunstler, puts it, "the 3000 mile Caesar salad will be much less palatable when oil is $100 a barrel." Many regions will also have to experiment with local currencies, as there may be great difficulties with present financial systems.

"The city is radically out of sync with healthy life systems on earth, and is functioning in nearly complete disregard of its long-term sustenance", says Richard Register of Eco City Builders. "We need to move beyond New Urbanism to rebuild cities for people instead of cars and regain a human balance with nature". To roll back sprawl, Register suggests ecological city design as the framework for rebuilding cities around high density, mixed use centers with pedestrian plazas, solar greenhouses, rooftop gardens, ecologically informed architecture, and natural features like creeks. In Register's 'eco-city' concept, centers are interspersed with natural open space, parks, and farming, linking to other city centers and regional centers via appropriate transit.

Sound municipal governance for the transition into the Post Carbon Age requires:
· Nimble government that rapidly reconfigures for energy scarcity
· Active support for relocalization, worker-owned cooperatives, locally owned businesses, and ecological city design
· Innovative municipal tools to affect land and energy use such as zoning ordinances, transfer development rights, tenancy agreements, and community benefit agreements

· A contingency plan (or "Plan B") that addresses how essential systems will work with less energy
· Pressure on national leaders for support of local efforts, including demands for a global carbon tax to support local initiatives and experiments.

At first some of these suggestions will meet great resistance. As the evidence mounts, it will become easier to make the case for serious change. Because so much time has been wasted since the 1970s Oil Shocks were shrugged off, it is essential that cities begin preparations now. We have waited long enough. "The starting is very important", says Jaime Lerner, the driving force behind Curitiba's (Brazil) emergence as the world's most ecological city. "If you wait until you have all the answers, you will never start."

Post carbon links:

ASPO - http://www.peakoil.net
Global Public Media - http://www.globalpublicmedia.com
Post Carbon Institute - http://urban.postcarbon.org
Museletter - http://www.museletter.com
Eco City Builders - http://www.ecocitybuilders.org Illichville http://www.roadkillbill.com/I-Map.html
Community Solution - http://www.communitysolution.org

Soil Analysis

Note: In addition to the reports attached here, Resource Conservation District of Humboldt County is currently working on a Humboldt/Del Norte Soil Survey to be completed by 2008. Their soil survey will be extremely important in furthering determining current conditions of Humboldt County's soils.

Soils of Western Humboldt County California

The information provided came from the document Soils of Western Humboldt County California, from 1965. Provided is a short summary of what the 1965 soil survey offers. The summary illustrates the type of analysis found in the soil survey. The purpose for the document is to provide key information to farmers or any interested party on soil characteristics in Western Humboldt County. Section titled *Descriptions of Mapping Units* provides information of 16 different types of soils in the western region of the county. Each soil type has an agriculture rating given to it. The soils are rated according to the Storie Index method; this method represents numerically, "the relative degree of suitability of the soil for general intensive agriculture" (17). The soil characteristics are solely what the soil rating are based on. Other factors such as water availability for irrigation, climate, and economic factors that determine the desirability of growing certain crops in various locations not looked at in this survey (17). The characteristics are providing information to determine the most sustainable methods to produce crops for Humboldt County in a post-carbon situation. The factors used to determine the proper index rating are as follows;

A –Soil profile characteristics and soil depth

B –The surface soils texture

C – Slope

X- Other factors such as "drainage, alkali, nutrient level, acidity, erosion, and micro-relief.

The soils are evaluated on the above factors and given a percent rating. A good rating is 100% indicating the soil is "most favorable or ideal conditions", lower percentage indicates that the particular soil is "less favorable for plant growth". Each of the four factors are evaluated and multiplied to give a final rating. The soils are categorized in grades from the percentage ratings. The grades are 1 through 6, and grade 1 is the best soils to be used for intensive agriculture and range in the index percentage from 80-100%.

Arcata soils - "Dark brown, well drained young alluvial soils developed in softly consolidated sedimentary alluvium derived from the Hookton formation" (18). Texture varies from loam to fine sandy loam.

•Arcata fine sandy loam, 0-3 percent slope, medium texture and good drainage. The soil is located on primarily a level terrace to a gentle sloping terrace that faces the Pacific Ocean.

Surface soil- "0 to 23 inches, fine sandy loam, dark brown when moist, medium sub angular blocky structure, abundant animal burrows and medium acid in reaction (19).

Subsoil – "23 to 47 inches, fine sandy loam, dark yellowish brown when moist; massive structure, friable, and medium acid in reaction. Few roots are present except in animal burrows where they are abundant" (19).

This soil is rated as a Grade 1 soil with Index rating of 80%.

Arcata soils have seven mapping units with varying in slope, drainage, and nutrient content. The Arcata soils are grade 1 and Grade 2 soils. This means that they range from being excellent soils for agriculture purposes to moderately well suit for intensive agriculture. This is an example of 1 of the 16 mapped units for the western region of Humboldt County.

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SOILS OF WESTERN HUMBOLDT COUNTY CALIFORNIA

Report by
JAMES McLAUGHLIN
and
FRANK HARRADINE

UNIVERSITY OF CALIFORNIA, DAVIS

NOVEMBER 1965

Cooperative project between the
DEPARTMENT OF SOILS AND PLANT NUTRITION,
UNIVERSITY OF CALIFORNIA, DAVIS,
and the
COUNTY OF HUMBOLDT, CALIFORNIA

ACKNOWLEDGEMENTS

The soil survey of Western Humboldt County was a cooperative project between the Department of Soils and Plant Nutrition, University of California, Davis, and the County of Humboldt.

The field work was started in April of 1962, with James C. McLaughlin in charge, and was completed in November of 1964. Fred W. Herbert, Jr., assisted from January 1963, and Edmund Wagner during the summer of 1964.

Laboratory and greenhouse samples were analyzed by William Allardice. Cartographic work was done by Carl Shauger. Robert Elford of the U.S. Weather Bureau, Department of Commerce, made a detailed analysis of the climate. John Lenz, Humboldt County Agricultural Director, provided office space and advisory assistance during the progress of the soil survey. Dr. Frank Harradine supervised all field, laboratory, and cartographic aspects of the project, and edited the comprehensive report.

Soils in the forested and range lands of Humboldt were surveyed during a Cooperative Soil-Vegetation Project conducted by James DeLapp, Ben Smith, et. al., under the direction of William L. Colwell, Pacific Southwest Forest and Range Experiment Station, United States Department of Agriculture, Forest Service. A portion of the soils mapped during this survey have been delineated on the map sheets of the present agricultural soil survey.

CONTENTS

CONTENTS (continued)

SOILS OF WESTERN HUMBOLDT COUNTY

INTRODUCTION

The purpose of this survey is to provide basic information to the farmers and others interested in the use and potentialities of soils in Western Humboldt County. The report embraces six general categories of information.

At the beginning is information concerning the general nature of the area, which includes the location and extent, climate, physiography, and geology. Following this is a discussion of irrigation practices and the nature of available water for irrigation. Also presented, are comments on the prevailing cultural practices and a review of the dominant crops under cultivation. Then, six diagrammatic sketch views of land forms and soil relationships for various parts of the County are illustrated and analyzed. Preceding and following this section are brief discussions on how soils are formed and how an agricultural rating of soils is obtained. The next major category comprises a presentation of the individual mapping unit descriptions. This includes an account of the general nature and limiting characteristics of the soils and their agricultural ratings. The designating symbols in the description headings refêr to the mapping unit symbols as they appear on the map sheets. In an appendix, four important features of the soils are presented. They are: (1) a detailed description of the agricultural soil series; (II) physical and chemical data; (III) fertility analyses; and (IV) some characteristics of the soil-vegetation project soils that are shown on the map sheets.

The last section contains 36 map sheets arranged numerically from north to south with an index showing their areal locations. When the desired map is found, it will be seen that the soil areas are outlined by a solid red line, and that each soil mapping unit is designated with a red symbol. Suppose, for example, an area located on a map sheet has the symbol Fe2. The legend for the map sheet shows that this symbol identifies a Ferndale silt loam, 0 to 3 percent slopes mapping unit. All of the agricultural soil types are described in the section, "Descriptions of Mapping Units".

Areas overwashed during the 1964 flood are indicated by four patterns of shading and identified in the map sheet legend.

The Soil-Vegetation Project soils are delineated by a dashed red line and identified with a red symbol. They are briefly summarized in Appendix table IV.

Most of the area surveyed was included in a previous soil survey by E. B. Watson et.al., in 1925. It was made on a small scale base map and without the aid of aerial photographs. Also, the soils were classified according to more broadly defined mapping units.

The present survey contains more detail than the earlier work. It has the advantage of many more field observations, improved and larger scale base maps, aerial photographs, improved implements and mapping techniques, and modern methods of soil classification. New areas were mapped. Most of the former groupings have been divided into several series and types. Eight new series have been introduced and the older series are more clearly defined.

GENERAL NATURE OF THE AREA

<u>Location and Extent</u>

Humboldt County is situated in the northwest corner of California, the center of which is about 85 miles south of the Oregon border (fig. 1). The County from north to south is approximately 100 miles long and 45 miles wide at its maximum. The present survey covers

Figure 1. Location of the Western Humboldt County soil survey area.

alluvial and terrace lands on the many drainageways within the County. The entire County, excluding the Humboldt Bay area, is quite steep. Alluvial and terrace land forms occupying drainageways inland from Humboldt Bay are long and narrow. The only large alluvial body in the County is located in the Humboldt Bay area where the mountains become low hills and the rivers slow down and widen before reaching the ocean. The survey area includes about 125,000 acres, while the entire County with all of its mountains contains more than 2,000,000 acres. Most of the nearly level lands are within 10 miles of Humboldt Bay.

Eureka, the County seat, with a population of 28,000 is the largest city in the County and is located on the east central shore of Humboldt Bay. It is served by the Western Pacific Railroad. Air transportation to San Francisco, Sacramento, or Portland, is provided by Pacific Air Lines.

Climate

The climate of Humboldt County is moderate in temperature with considerable precipitation (figs 2 and 3).

Temperature along the coast varies only 10°F. from summer to winter although a greater range is found over inland areas. Temperatures of 32°F., or lower, are experienced nearly every winter throughout the area and colder temperatures are common in the eastern mountain regions. Maximum readings seldom exceed 80°F., on the coast, while 100°F., readings are common in the mountain valleys. Fog and low clouds near the coast limit sunshine, while inland areas are relatively unaffected by fog.

Rainfall is light to nonexistant in the summer months and quite heavy in the winter (fig. 4). Snowfall is light and infrequent near the coast but varies from 50 to perhaps 150 inches in the interior mountains.

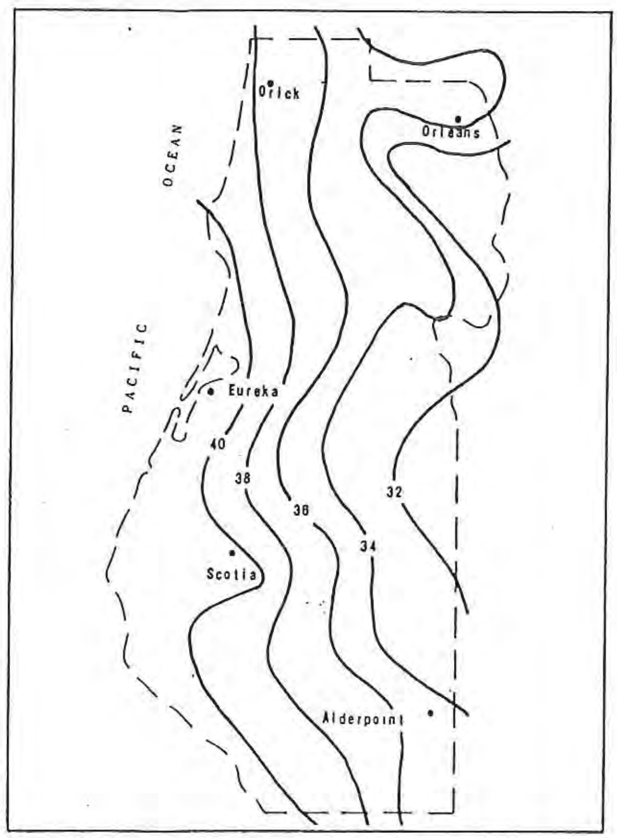

Figure 2. January mean minimum temperature (°F).

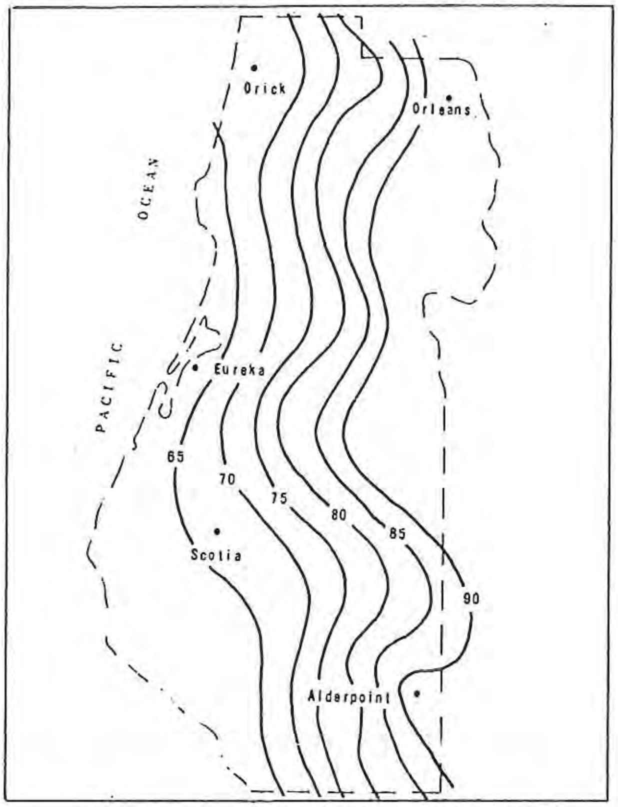

Figure 3. July mean maximum temperature (°F).

Freezing Periods

Temperatures of 32°F., or colder occur over most of the area every year. The average date of the last freezing temperature in the spring ranges from late January near Eureka to early May in Larabee Valley in the eastern mountains (figs. 5 and 6). Most of the coastal section experiences freezing temperatures into February or early March during an average year. Fall temperatures drop to 32°F., by late September in the high mountains, early December in the lower river valleys, and late December along the central and southern coast. This provides a frost free growing season of about 150 days in the high mountain valleys and more than 300 days along the coast.

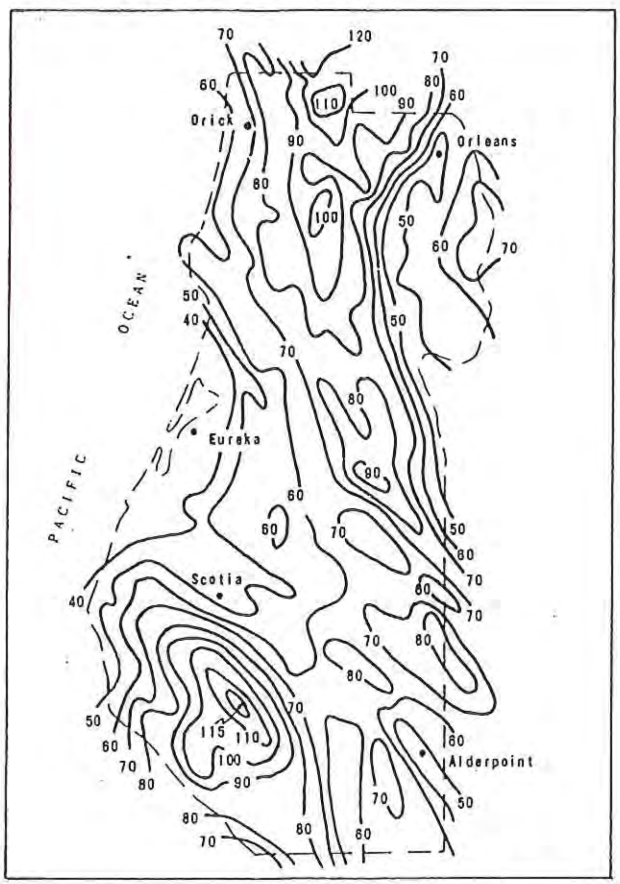

Figure 4. Average annual precipitation, (Inches)

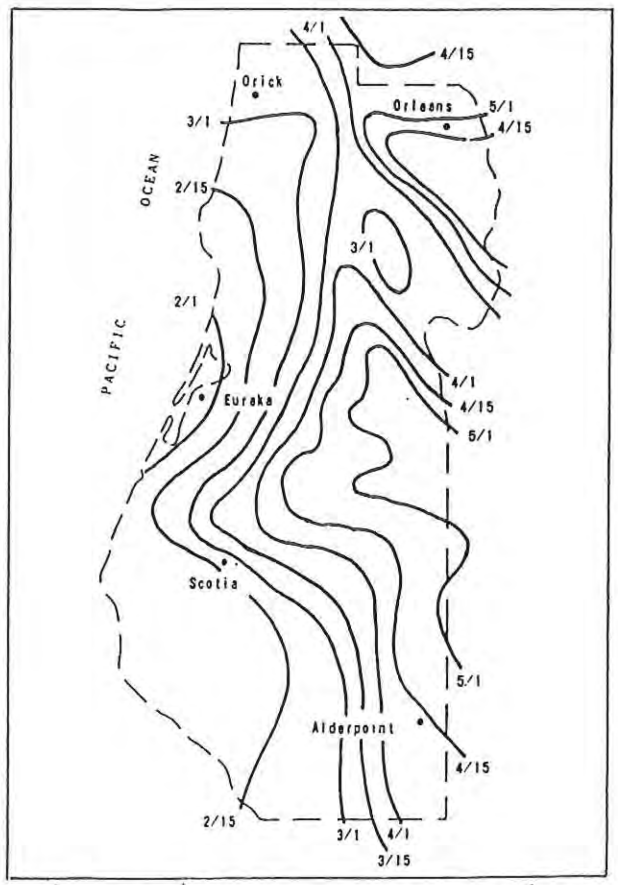

Figure 5. Average date of last 32°F freeze in spring.

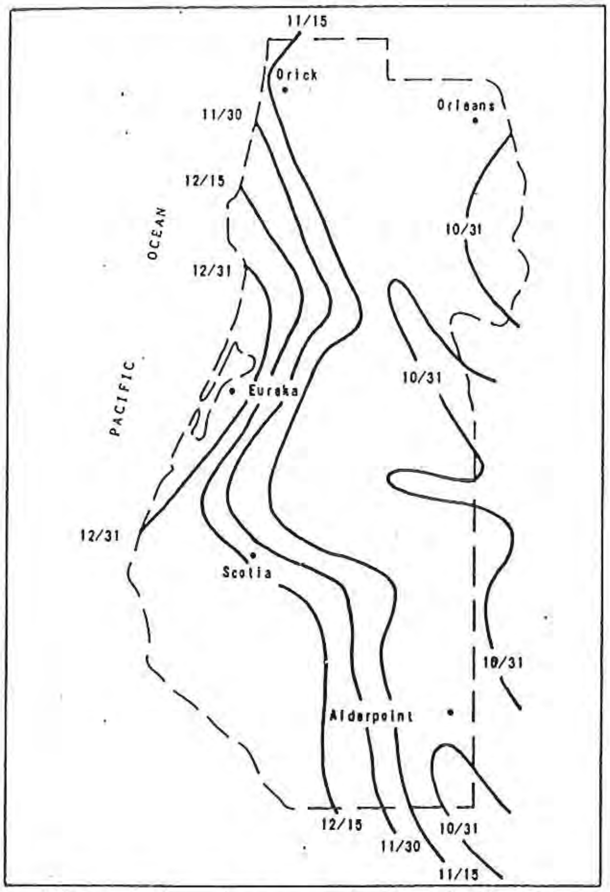

Figure 6. Average date of first 32°F. freeze in fall.

Flooding

Along with the high annual precipitation in Humboldt County there are times when a considerable amount of rain can fall in a very short period. In such cases, rivers or streams might overflow their banks and floods will occur. About 63 percent of the soil survey area has been affected by floods of various magnitudes and frequencies.

The 1964 December flood was considered to be the most severe in more than 100 years of Humboldt County history. A vast sea of flood waters covered the southern and western portions of the County. Entire towns along the Eel River were destroyed. Property damage to roads, bridges, homes, farm equipment, and animal stock was disastrous. Silty and sandy sediments varying from less than a foot to four feet in depth were deposited by turbulent waters on about 20,000 acres of productive agricultural land. On an alluvial flat just north of Rio Dell, the Eel River changed its course by cutting a straight line across a dozen farms, leaving its former channel filled with gravel deposits.

Estimates on the ecomomic rerovery of the devastated areas range from five to fifteen years. Recurrence of such a flood of similar magnitude is estimated to be once in 1,000 years. A previous flood in 1955, however, was also considered to be quite severe. It is estimated that a flood of this magnitude can occur once in 100 years.

Statistics on the amount of water passing through gaging stations on the Eel and Mad rivers, and Redwood Creek are shown in table 1 with respect to the peak flow during periods of flooding. Column 1 shows the height of water in the channel when flooding began. Column 2 shows the height of water during 1955 flood and column 3 shows the height of water during the 1964 flood.

TABLE 1. Gaging station records.

	Stage in Feet			Discharge Cu. Ft. Per Second	
Gaging Station	Flooding Begins	Dec. 1955	Dec. 1964	Dec. 1955	Dec. 1964
Eel R. (Scotia)	51	61.9	70	541,000	700,000
Eel R. (Fernbridge)	19	28	29.5	600,000	780,000
Mad R. (Hwy 299)		21.3	23.4	78,000	100,000
Redwood Ck. (Orick)	21	24	25	50,000	60,000

Physiography

Humboldt County landscape is conditioned by the steep Coast Range Mountains which rise to elevations of 6,000 feet or more. They are dissected by many drainage systems running in a northwesterly direction. Low lying alluvial valleys and tidal plains are at the mouths of principal streams which empty into the Pacific Ocean. Adjacent to the valleys along the coast are some high terraces of limited extent. Fragments of these may be found in any upstream course. Stringers of alluvial flood plains extend up the narrow stream channels of the mountains. A few high elevation valleys have formed in the eastern portion. Low river terraces are found on the Eel, Van Duzen, and Mattole drainages. The alluvial fans that exist between the mountains and flood plains around Humboldt Bay are depositions from scattered freshet troughs or perennial streams from the mountains.

Geology

The geologic rock types within the soil survey area can be placed into four groups as shown in figure 7.

1. The Kerr Ranch schists.

2. The Franciscan and Yager hardrock formations.

3. The softly consolidated sediments of the Wildcat and Hookton formations.

4. The young alluvial deposits

The oldest rocks are those of of the Kerr Ranch schists which occur in the northern part of the County. The age and formational affiliation is somewhat obscure, but recent work indicates there is a middle to late Jurassic age and relationship to the Galace formation which extends into Del Norte County. The schist is dark gray and thinly foliated The folia consist principally of alternate layers of sericite and an aggregates of quartz and plagioclase. It also contains metaconglomerates, metacherts, and glaucophane schists. The dark gray color and abundance of micaceous minerals are prominent in the Kerr soils which were derived from the schists.

The Franciscan and Yager formations are the principal hardrock formations of Humboldt County and occupy more than 60 percent of the area. They are of similar mineral composition and have similar resistance to erosion. In general they have a fault block structure which is tilted northeast. Streams dissect these hard rocks in a northwesterly direction, leaving channels and steep high mountains. The Franciscan formation is principally of graywhacke but contains small bodies of greenstone, chert, and metamorphosed volcanic rock, with some larger inclusions of sandstone and conglomerate. The Yager formation is predominately shale but also contains large bodies of conglomerate and graywhacke. In a line from Garberville to slightly west of Bridgeville, the rock composition of both formations contains a much higher percentage of potassium feldspar than does the main body of Franciscan formation which lies east of that line.

The softly consolidated sediments of the Coast Range are components of the Wildcat and Hookton formations. They were laid down during the upper Miocene through the mid-pliestocene epochs and have a wide range of textures which are strongly stratified. They have been exposed to folding and faulting on both regional and local scales. Together they represent several thousand feet of deposition on the perimeter of Humboldt Bay and are in fault contact with the Yager and Franciscan formations. Rock composition may be softly consolidated to slightly indurated mudstone, siltstone, claystone, sandstone, and conglomerate. The Hookton formation, which is of similar composition to the Wildcat group, caps most of the Wildcat formation on seaward slopes

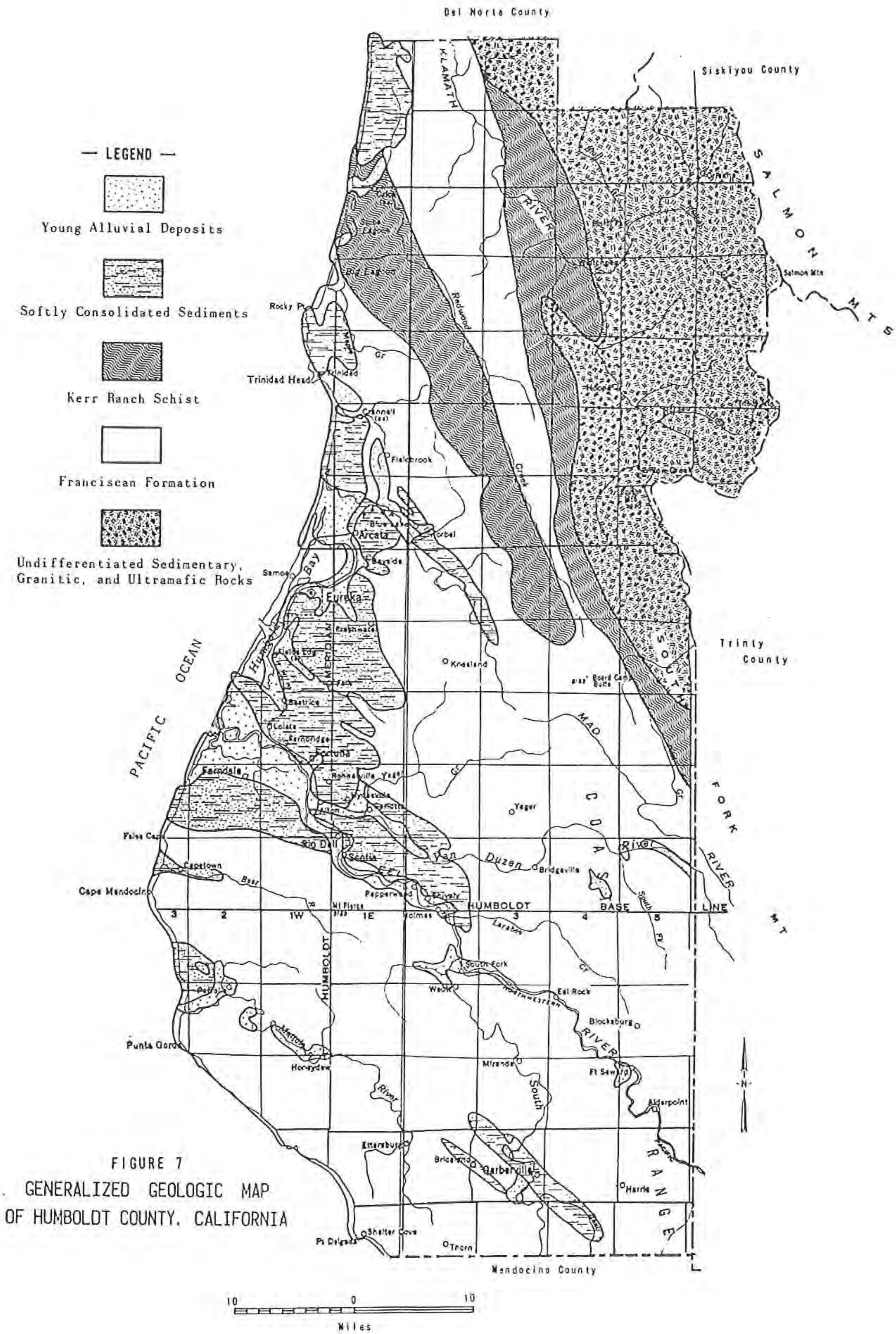

FIGURE 7

GENERALIZED GEOLOGIC MAP OF HUMBOLDT COUNTY, CALIFORNIA from the Van Duzen River to the valley of Little River. The Hookton formation is usually warped and folded more gently than the Wildcat formation.. Beds that dip more than 30 degrees are the exception, whereas gently dipping, flat lying beds are the rule.

The young alluvial deposits comprise parent materials for the Bayside, Ferndale, Kerr, and Loleta soils in this area. They are mostly young alluvial sediments of the Kerr Ranch, Franicscan, Yager, Wildcat, and Hookton formations and occupy the flood plains, basins, and alluvial fans of all drainage areas.

IRRIGATION

Practices

Precipitation provides ample water to maintain the soil at field capacity during the months of October through May, but during the following five dry months there is a deficiency of moisture for crops. Therefore, from June until late September or October, irrigation is necessary. Figure 8 represents an accounting system for the natural supply and characteristic demand of water for crop plants in the Eureka area in an average year and for a medium soil texture.

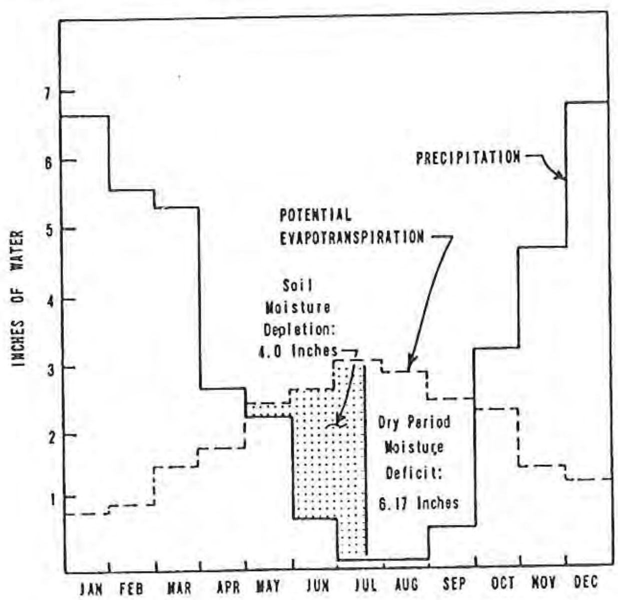

Figure 8. Monthly rainfall and potential evapo-transpiration at Eureka.

Figure 8 shows a moisture deficit of 6.17 inches of soil water for the average dry season. Under ideal circumstances, farmers should supply 6.17 inches of irrigation water to crops at carefully selected times during the summer in order to sustain a maximum growth. When allowances are made for the inherent inefficiency of irrigation systems, runoff from high areas, and for the variability in soil textures, a more practical figure for the requirement of irrigation water is likely to be nearly twice that of the normal moisture deficit, or about 12 acre inches per irrigation season. Irrigation rates for different parts of the County must be varied in accordance to evapotranspiration and rainfall of the area. Cloud cover, amount of sunlight hours, relative humidity, and temperature are important variables that determine the amount of water a crop uses. Thus it is indicated that in the

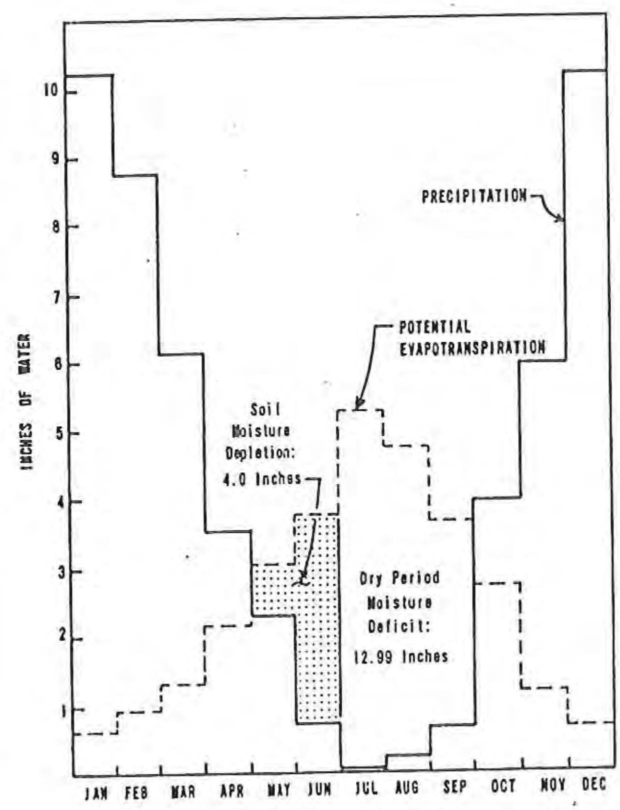

Figure 9. Monthly rainfall and potential evapo-transpiration at Alderpoint.

coastal area, plants need on an average of 6.17 inches of irrigation water in addition to the annual rainfall. At Alderpoint in the eastern portion of the County, because of less cloud cover, more sunlight hours, and higher temperatures, crops require an average of nearly 13 inches of supplemental water (fig. 9).

Ground Water

Unconsolidated clay, silt, and gravel 3,000 to 4,000 feet in total thickness make up the dune sand, alluvium, and terrace deposits. These formations range in age from Pliocene to Pleistocene and contain essentially all of the ground water used for irrigation in the Humboldt Bay area. Confined or artisian water exists in deposits of Pliocene to Pleistocene age in the Eel River valley and in the Pleistocene deposits around the northern end of Humboldt Bay. Most of the water pumped is derived from unconfined alluvial deposits of recent age, and from terrace deposits of Pleistocene age.

Irrigation is distributed principally through various types of sprinkler systems. About 250 irrigation wells supply water to nearly 12,000 acres which is used almost entirely as permanent pasture. In 1952, estimated pumpage from ground water for irrigation, industry, public supply, and domestic use totaled 15,000 acre feet. The total ground water discharge, both natural and pumped, from alluvial deposits in 1952 was about 25,000 acre feet. This is based on the estimated net change in the amount of ground water storage in 1952.

The estimated gross ground water storage capacity of the alluvium and terrace deposits in the Eel and Mad River valleys (figs. 10 and 11), is about 150,000 acre feet. Annual depletion in these areas is about 25,000 acre feet which is replenished to full capacity in the winter and spring.

Alluvial areas for which no storage estimates were made include (a) small areas in which few or no wells are located; (b) areas in which most of the sediments are fine grained, such as the small stream valley mouths, and areas adjacent to the bay on tidal sloughs; and (c) areas where the chemical quality of the water is poor.

Quality of Water

Ground water in the Eureka area is generally good except near the mouths of rivers and in the tidal flats where salts from ocean water penetrate the surface into ground water aquifers. The areas surrounding Humboldt Bay, the Loleta Bottom, and the western side of the Mad River valley are noted for poor quality ground water, as partially indicated in figures 10 and 11.

CULTURAL PRACTICES AND CROPS

Agriculture is one of the major industries in Humboldt County with a total value of nearly $13,000,000 according to the 1960 production census. Dairying accounts for more than one half of that income and ranks an easy first in farm economy. Livestock raising, nursery stock, truck crops, and poultry follow dairying in order of importance. Scattered orchards of apples, peaches, and chestnuts, are found in the inland valleys.

Agricultural census reports during the past 15 years show a decreased interest in poultry and a considerable increased interest in truck crops.

While the coastal climate prevents a wide variety of crops to be grown, it does provide ideal climatic conditions for the production of winter vegetable crops.

An abundance of good quality irrigation water is available in shallow aquifers along the coastal plain.

The first creamery in the state of California was located near the town of Ferndale in 1888. The oldest continuous cow testing as-

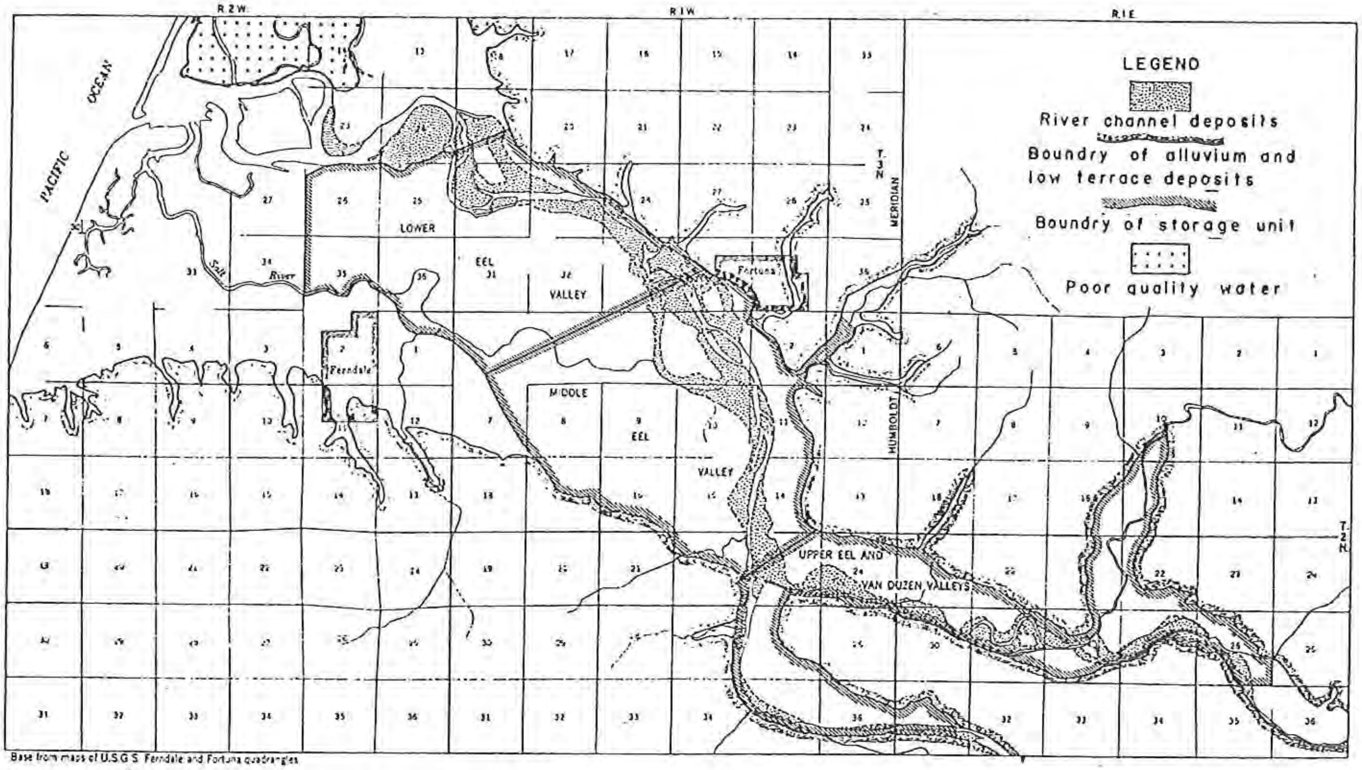

Figure 10. Ground-water storage units in the Eel River valley.

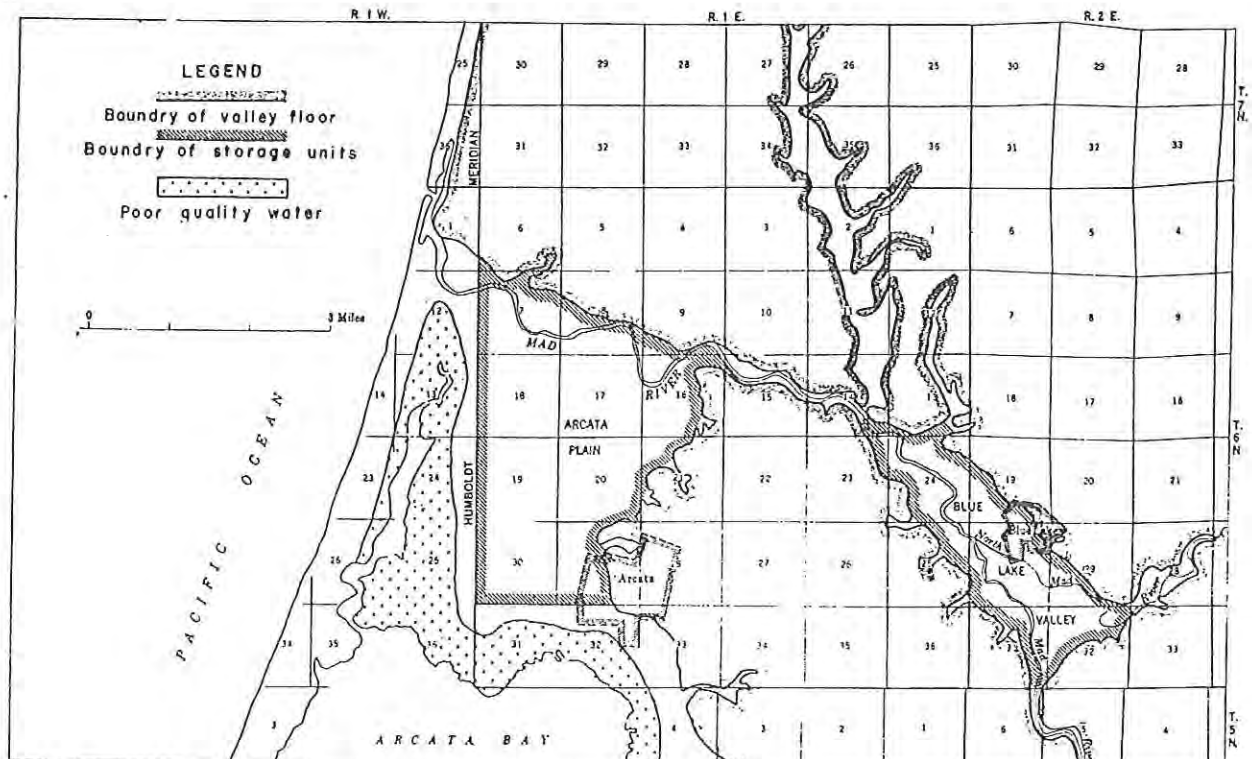

Figure 11. Ground-water storage units in the Mad River valley.

sociation was established in Humboldt County in 1909. With dairying as the principal agricultural industry, the rich agricultural lands have been used principally for the pasturing of dairy stock. Today more than 90 percent of the arable land in the County is devoted to pasture crop production.

Irrigated Pasture

More than 17,000 acres on the coastal plain between Crannell and Scotia are under irrigation. The Ferndale soils on the Eel and Mad river flood plains, under which the best aquifers in the County exist, are the principal areas irrigated. The old rye grass and ladino clover pasture mix which has served so well for years is gradually giving way to salina clover and orchard grass mixtures. These new plants, because of their deeper rooting habit and higher yields, are outproducing their predecessors. Recommended applications of 100 pounds per acre of P_2O_5 as super phosphate has proven a worthy investment in irrigated pastures. Application of nitrogenous fertilizers have been recommended in connection with bloat problems. The control of Canada thistle is the major weed problem in the pastures but it can be controlled by clipping before the plant goes to seed.

High Terrace Pasture

Nearly 10,000 acres of high terrace land around Humboldt Bay is devoted to annual pastures of subterranean clover and rye grass. The deep permeable Rohnerville soils on the flatter portions of these terraces such as Hydesville and Table Bluff, produce the best of pastures. However, the shallow Hookton soils on the side slopes of the same terraces do quite well considering their depth. Both soils have a high organic content in the surface and can hold a good amount of moisture and nutrients. The subterranean clover usually germinates after the first rain in the fall and puts on a fast lush growth during the first warm weather of spring It continues to produce until the dry season sets in about June. It is therefore the first, and an excellent source of protein in the spring.

Both phosphate and nitrogen fertilizer applications have proved profitable. Poverty oat grass is especially hard to manage and it is an unpalatable, rough perennial that can take over entire pastures if left unattended. By plowing and seeding every 5 or 6 years, it can be held in check. The seed is easily transported by sheep in their wool. Cattle transport it at a much slower rate. By pasturing cattle in preference to sheep, it can be more easily isolated.

Reclaimed Tidal Marsh Pasture

Before the turn of the century, large bodies of land on the coastal plain, adjacent to the ocean or to Humboldt Bay, were subject to salt water submergence during high tide. By constructing dikes and installing tide gates, residents of the county have converted some 13,000 additional acres into pasture production. The salt affected land was subsequently reclaimed simply by allowing rain water to wash salts out of the soil and back to the ocean at low tide through tidal gates. At high tide, salt water is kept out by the same tidal gates. While much of the low lying lands behind the levees were consequently converted to pasture production, it is obvious that poor subsoil drainage will limit any attempt at more intensive agriculture. Some of the land has been overwashed by flooding and is spotted with various depths of silt. Most of the land, which is designated as Bayside soil, is clay in texture and characteristically poorly drained.

Good quality irrigation water is not available in shallow aquifers And while good quality deep water may be present, it is quite expensive to develop. Tidal gates are not 100 percent efficient in keeping out salt water. Poor subsoil drainage slows water penetration so that only water tolerant plants may be grown, and water tolerant, or weedy species, are difficult to control. With all of these limitations on reclaimed land, it is not surprising that native species are utilized for pasture.

The dominant native grasses are bent and meadow foxtail. Pastures of this composition often support 1 to 1½ cows per acre from May until August. Trefoil and salina clover are presently being recommended as legume crops and they are doing well in seeded areas. In the exceptionally low lying areas, which may be ponded part of the year, reed canary grass will provide more tons per acre than any other crop. Silverleaf is the most important weed in the area and can be managed with a 2-4D spray in late summer, followed by a fall seeding of some desirable grass species.

Lily Bulbs

Easter lily bulbs provide the highest income per acre of any crop grown along the north coast. In 1960 and 1961, growers netted more than 1,000 dollars per acre. The investment per acre, and the risks involved, discourages many from growing bulbs in spite of the high returns.

The Arcata soils on Dows Prairie, have been the center of lily bulb production since the second World War. Experience has shown a necessity to apply complete fertilizers and lime to bulb crops. Pasture crops on the same soils require only phosphatic and nitrogenous fertilizers. The Farm Advisor's office should be consulted for specific recommendations on fertilizers.

Truck Crops

Corn, tomatoes, cucumbers, and other summer vegetable crops are produced on the Ferndale soils along the Eel River south from Stafford. These vegetables are noted for their excellent quality. The acreage available to produce summer crops is quite limited. Winter vegetable crops on the other hand, have ideal growing conditions on the wide coastal plain. And when it becomes economically feasible, they could supply an abundance of produce to the County. Some experimental plots of artichokes in 1964, demonstrated that an excellent production of quality artichokes can be attained. Quality carrots have been produced for years in sufficient quantities to feed cattle. Cabbage, lettuce, cauliflower, chard, garlic, peas, onions, and beans are raised in abundance in back yard gardens, especially on the Bayside and Ferndale soils.

The potato chip people have found that the Ferndale, Russ, and occasionally the Loleta soils are excellent for the production of potatoes. Silt loam soils seem to be more productive than the coarser textured soils.

Potatoes have a high inherent potassium requirement. And although the soils on which they are raised usually contain an adequate amount of potassium for most crops, they still must be supplemented with potassium to produce the best quality of potatoes.

Potato scab, a virus effecting the tuber, is a serious problem in fields where potatoes are grown for more than one year. The virus causes the product to be unmarketable. Consequently, an annual rotation is advisable for a maximum production.

HOW SOILS ARE FORMED

Soil is the product of the action of climate and living organisms upon the parent material, as conditioned by time and relief. The interrelationships among the factors of soil formation are complex, and the effect of any one factor cannot be isolated and identified with certainty.

Although all five factors influence the formation of any given soil, they do not necessarily play equal roles. In some cases, one or two will determine most of the characteristics of the soil. Pronounced differences in any of the factors result in noticeable differences in soil characteristics. Consequently, soils can vary considerably within short distances on the landscape.

Development of soil horizons results from four basic changes: additions, removals, transfers, and transformations of organic matter, soluble salts, carbonates, sequioxides, and silicate clay minerals. All of these processes have been active, although not all to the same degree, in the development of each soil in Humboldt County.

LAND FORMS

Perhaps the most important asset of the soil surveyor in the classification of alluvial lands is a knowledge of land forms. They reflect the geologic age of alluvial deposits and consequently suggest the degree of weathering involved.

Land forms are often easily seen and often have distinct physiographic limits or boundaries. Soils that are mapped on various land forms are usually bounded by those limits. With all other factors being equal as to their relative soil forming influence, a land form will contain one particular soil series or a particular small group of soil series.

For ease in understanding the field relationship of alluvial soils in Humboldt County, diagrammatic sections have been prepared that show some three dimensional illustrations of land forms. On each land form, excluding upland areas, the dominant soil series is indicated.

At the confluence of the Eel and Van Duzen Rivers there are four important land forms upon which four different soils occur as shown in figure 12 The Ferndale series slope toward the flood plains of both rivers Fairly slow moving water has deposited silts on the surface. Gravels and sands are more prominent on the river banks or near stream edges.

The Bayside series is found toward the ocean where tidal influence was prominent before dikes were built. The fine silts and clays of this soil series are a result of very slow water depositations of the Eel River estuaries, and some chemical weathering after the soil was laid down. A high terrace on which the Rohnerville airport is located can be seen on the west side of the Eel River. Soils located on this terrace are also found at Fortuna which is the base of the Eel River geologic syncline. The Rohnerville terrace is continuous from the center of Fortuna to the south edge of the Rohnerville airport. The Hookton dissected high terrace appears above the Rohnerville terrace which was laid down nearly a million years ago. It has been uplifted, faulted, warped, and eroded. The formation extends to Table Bluff, and Humboldt and Pine Hills. Hookton soils are extensively mapped on the slopes of these terraces.

A series of small streams which dissect the Wildcat formation south of Ferndale have deposited a series of alluvial fans as illustrated in figure 13. They extend from Coffee Creek to the ocean at Centerville Beach, and are cut off to the north by Salt River. Looking east or west from Ferndale, these fans appear to be a group of low humps with a stream on top of each. Rushes, or water loving plants are growing in the lowest areas between the humps.

On the banks of the small stream channels is a narrow flood plain. In the swales or lowest areas between the humps is a basin. The Russ soils are found on the flood plains, the Bayside soils are prominent in the basins, and the Loleta soils, with a medium texture and weak development, are found between flood plains and basins

The three soils can be described as a drainage catena The Russ soils

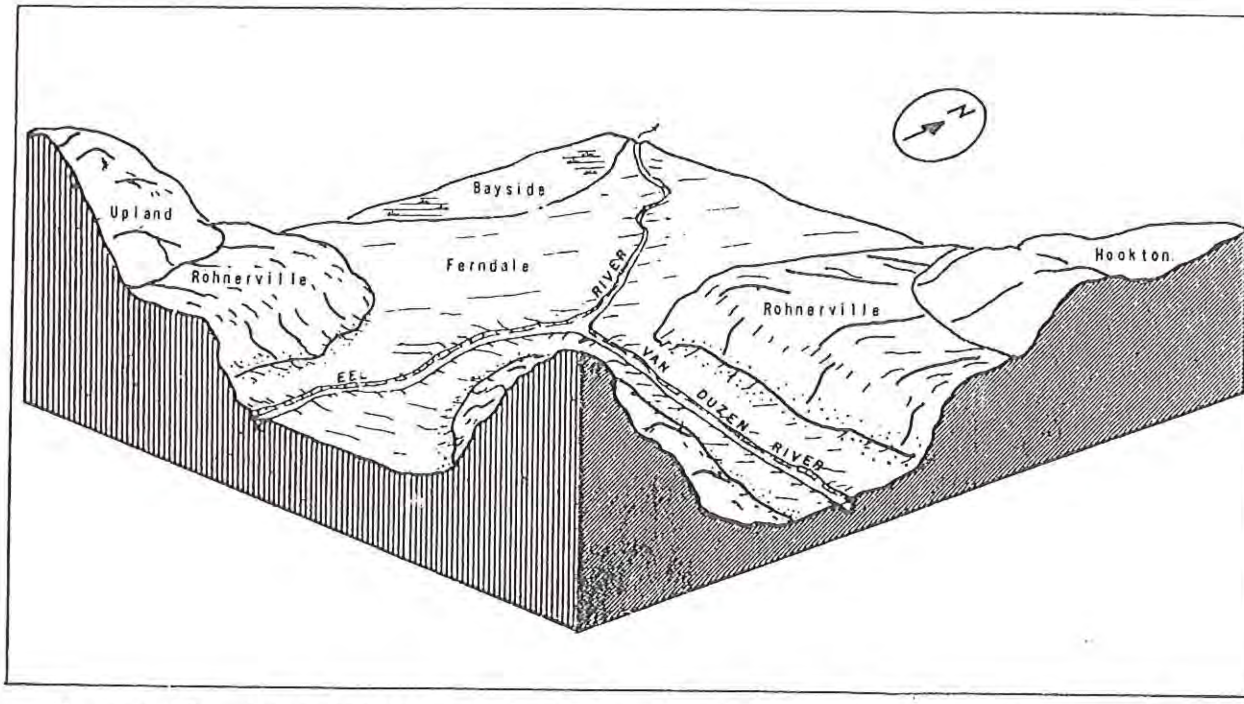

Figure 12. Relationship of land forms and soils at the confluence of the Eel and Van Duzen Rivers.

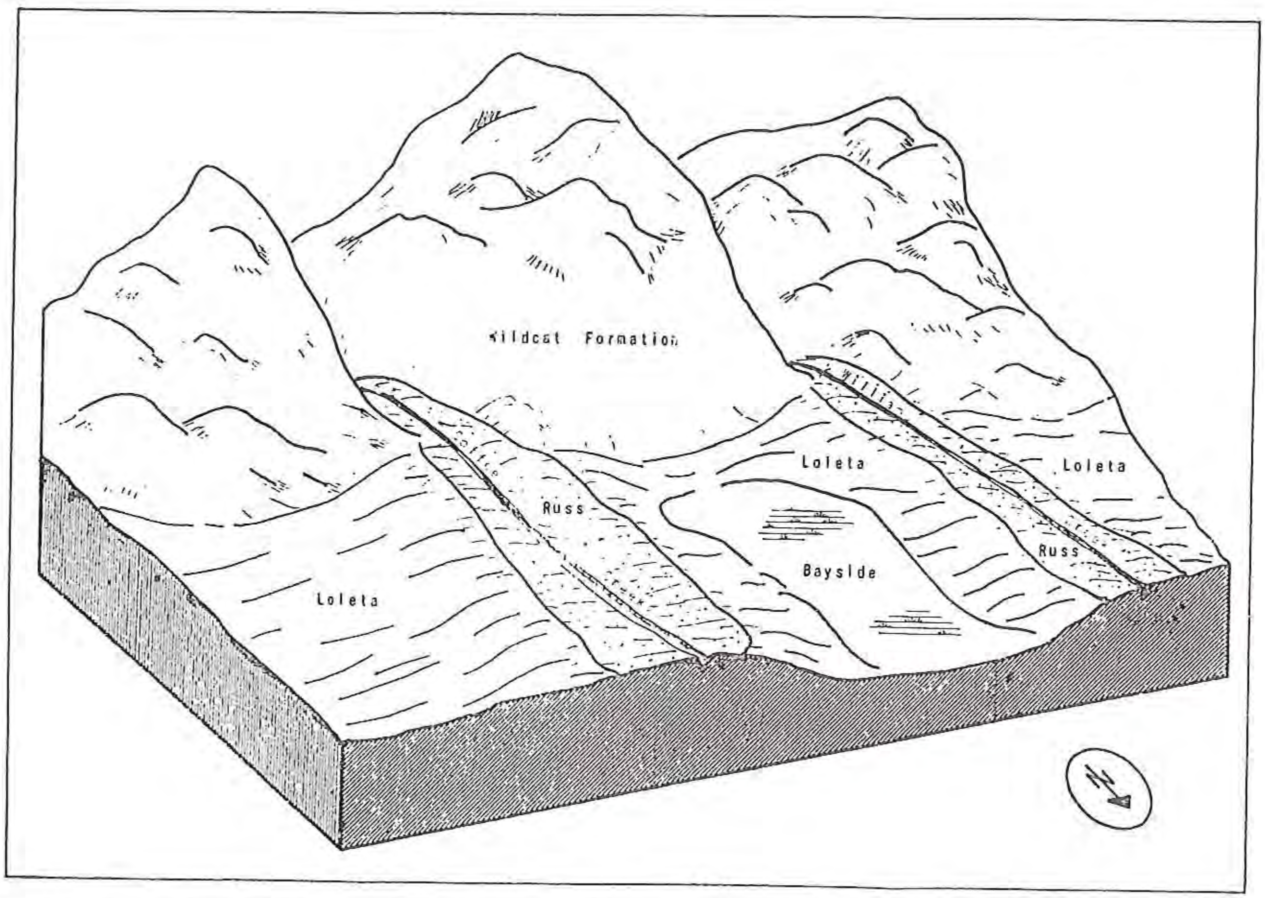

Figure 13. Relationship of land forms and soils along Coffee Creek and Williams Creek south of Ferndale.

are well to moderately well drained. The Loleta soils are moderately well to imperfectly drained, and the Bayside soils are imperfectly to poorly drained. Textural development, color, and vegetational differences also point up the drainage pattern.

Looking east from the Pacific Ocean at the mouth of Mad River toward the mountains behind Blue Lake, four land forms can be seen in figure 14. The first is the McKinleyville high terrace, followed by a low range of forested hills. Behind these, the flood plain of Lindsey Creek stretches from the Mad River to near Little River. Beyond the flood plain is another high terrace upon which is the road to Fieldbrook. And past the second high terrace is a steep forested upland of the Franciscan formation.

The McKinleyville high terrace, which was probably wind deposited and of sand dune origin, dips gently westward. The Arcata soils found on this terrace contain a high proportion of sand. They were formed in the main under thin stands of spruce, some of which are still standing. The Hely and Empire soils, which were mapped during the Soil-Vegetation survey in the low lying hills, have the same high content of sands suggesting sand dune origin. These soils have formed under rather dense stands of redwood and are more acid than their high terrace counterparts. Along Lindsey Creek, which drains areas similar to the Eel and Mad rivers, are the Ferndale soils on the flood plain. In low lying swampy areas where fine sediments have accumulated, the Bayside soils are located. The high terrace to the east of Lindsey Creek was deposited in the Pliocene geologic epoch, probably during an early course of Little River. The Timmons soil on this terrace is more strongly developed and is more acid than the other soils in this group. It was formed under a canopy of old, and quite large redwoods.

In the upper Mattole River valley, where some of the highest rainfall in California is recorded, two terraces are in evidence as shown in figure 15. The first one is a low terrace where the Ettersberg soils were formed. The second one is a high terrace where a variant of the Wilder series was formed. Because of fast moving water and a downcutting stream, these two terrace levels are not always prominent. One may blend into the other where the stream has retained its grade for a considerable time.

Both of these soils have been leached so strongly that their fertility levels are low. The Wilder variant soils are so low in nutrients that they are considered to be economically unfit for any intensified agriculture. The Ettersberg soils are as acid as the Wilder variant but being younger, they are more amenable to fertility treatment and can be managed.

Ferndale soil material has been laid down on the floodplain adjacent to the Mattole River. Time has not permitted sufficient leaching of this material to render it infertile.

From Bridgeville to Carlotta along the Van Duzen river, very few remnants of stream deposition are in evidence as illustrated in figure 16. Only in quite recent geologic history has the river deposited sediments along its banks. Consequently, the only two alluvial land forms to be seen comprise a narrow low terrace and a narrow flood plain.

The Carlotta soils, which were formed on the low terrace, support some of the best redwood groves in the world. In some areas however, gravels have made these soils droughty and only madrone, tan oak, and California laurel have survived.

The Ferndale soils occupy flood plains of the Van Duzen. And like the Carlotta soils, they support some excellent redwood groves. The river has deposited much gravelly and coarse textured material on this flood plain.

The alluvial flood plain around Orick is shown in figure 17, and it is the only land form on that drain-

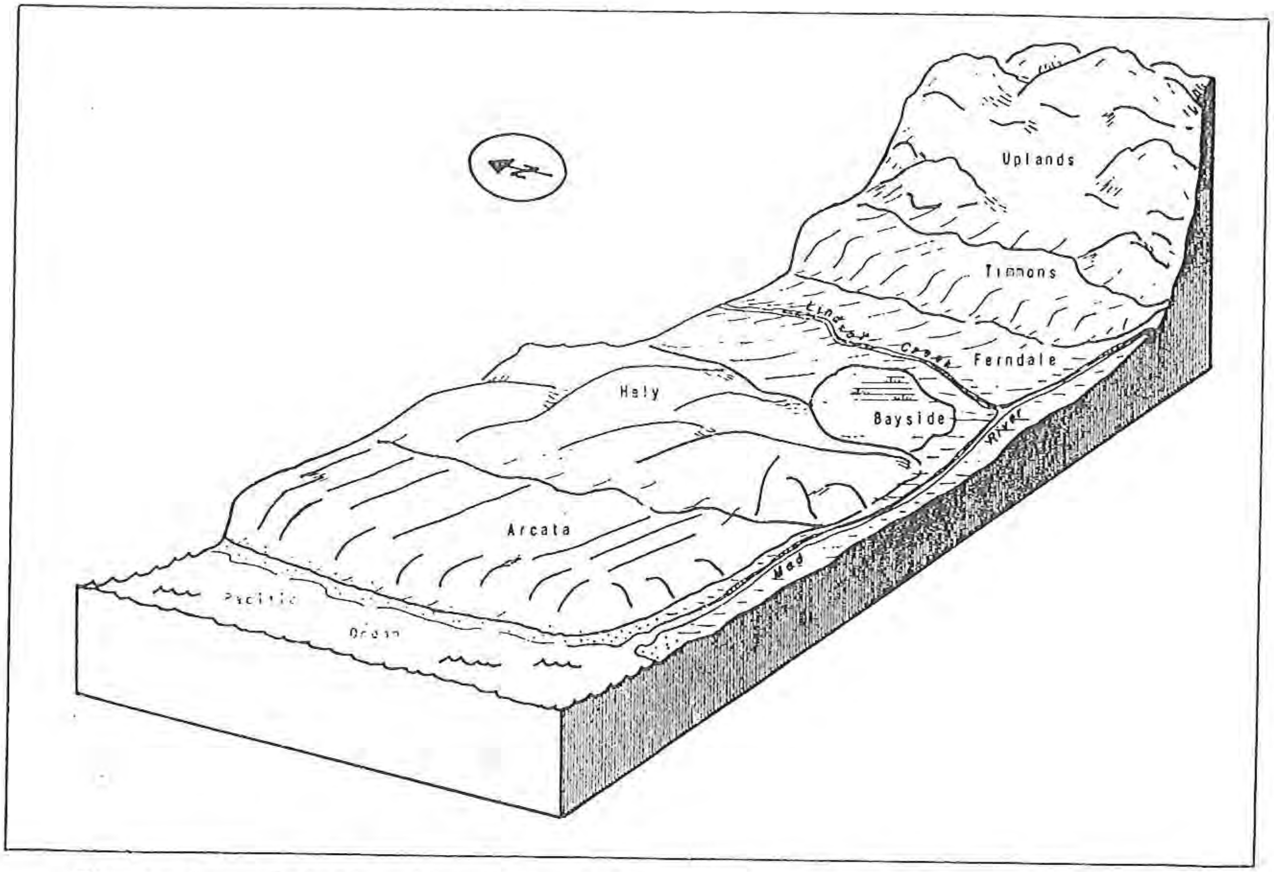

Figure 14. Relationship of land forms and soils along the Mad River.

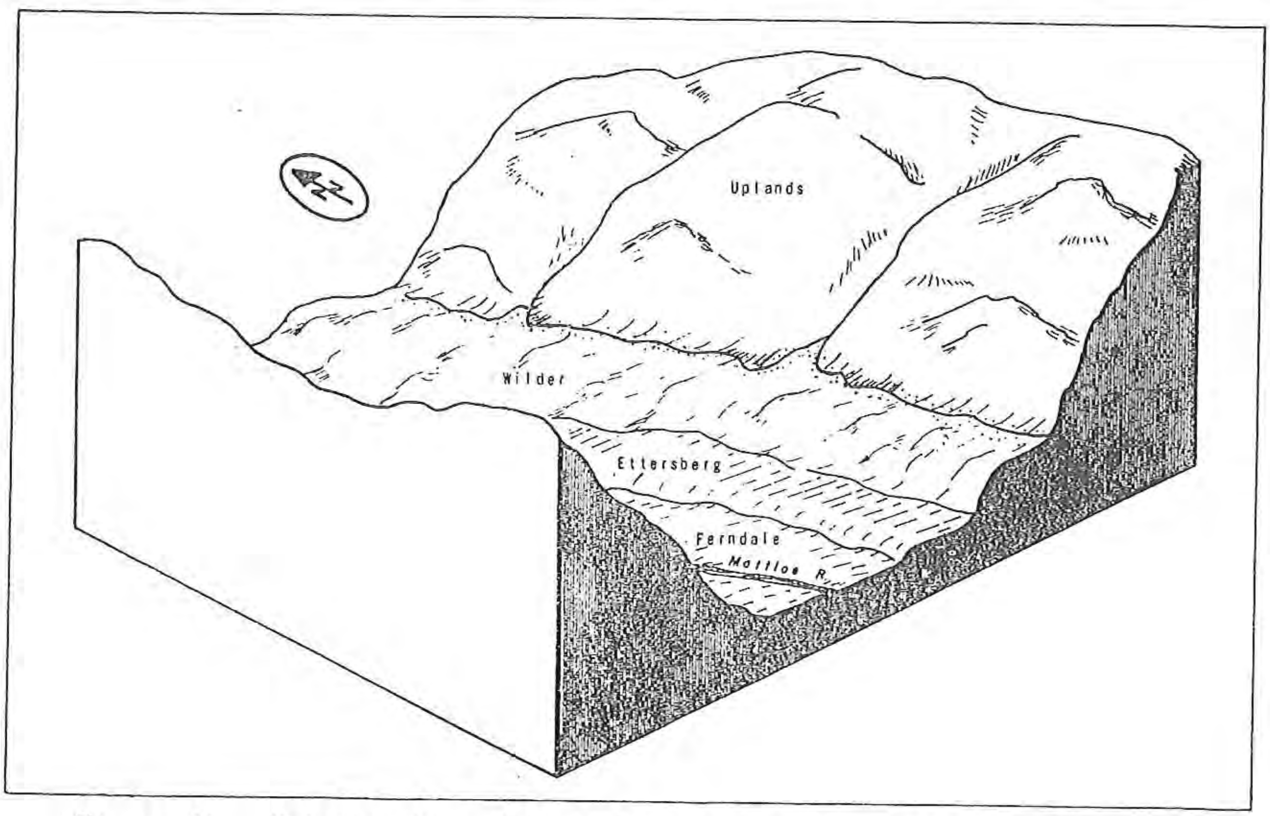

Figure 15. Relationship of land forms and soils in the upper Mattole River valley.

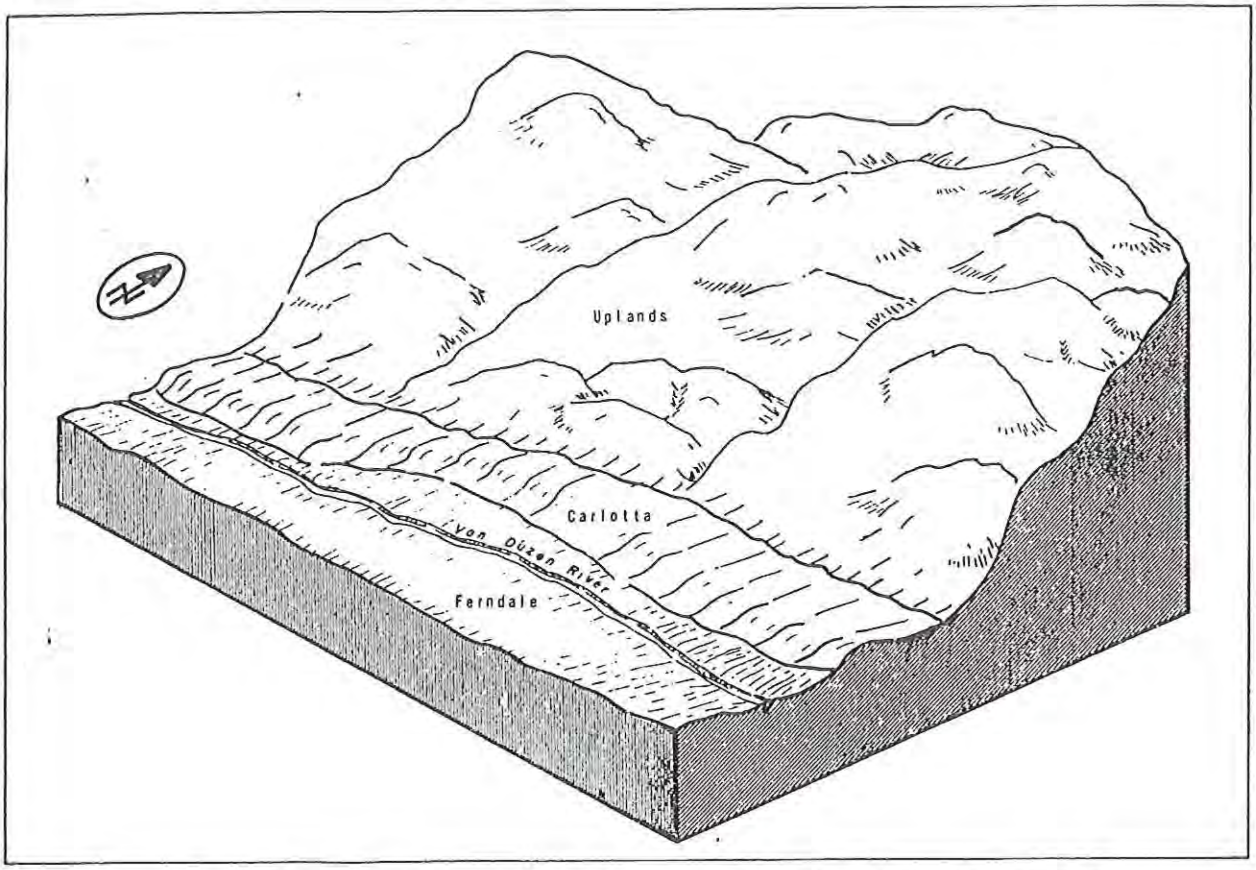

Figure 16. Relationship of land forms and soils along the Van Duzen River from Bridgeville to Carlotta.

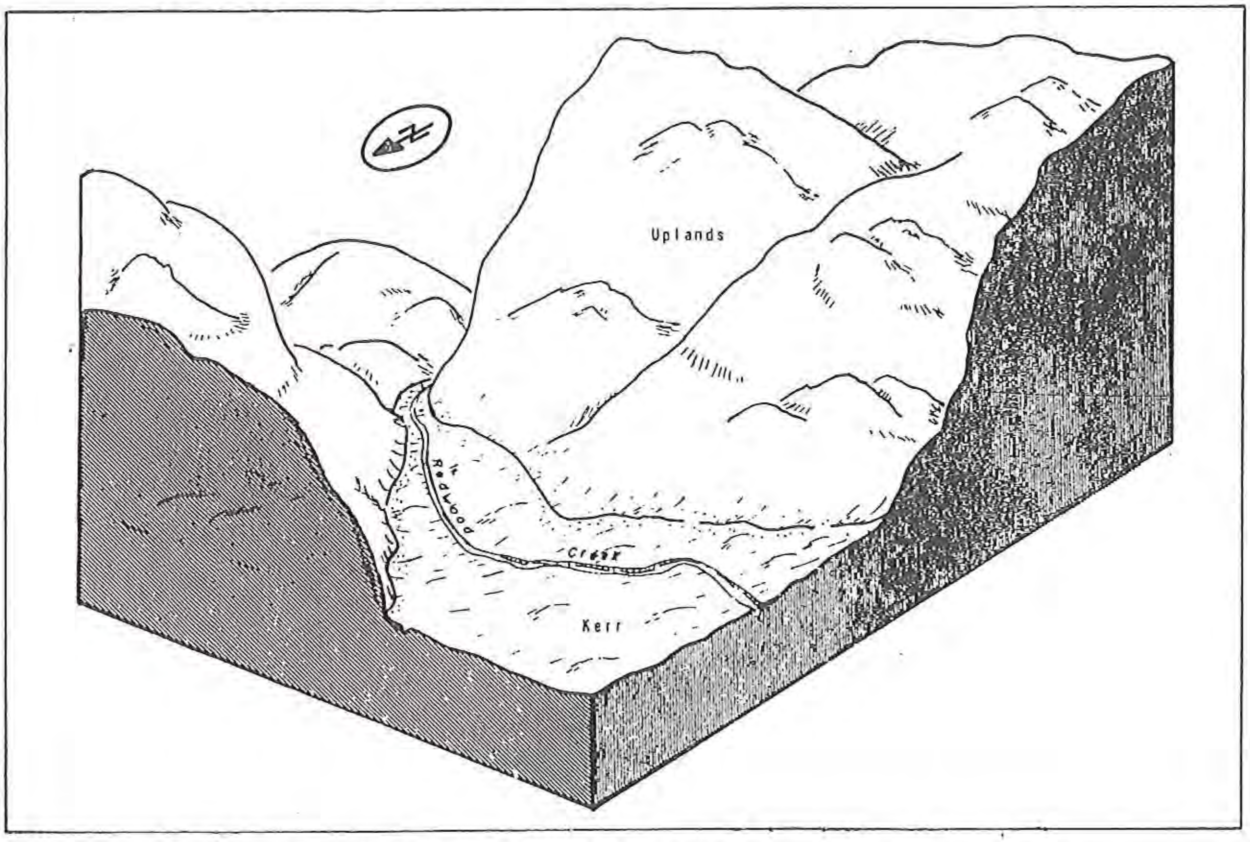

Figure 17. Relationship of land forms and soils at Orick

age that has been deposited by the Redwood Creek. Upstream from the Orick bottom, mountains are too steep, and water moves too fast to leave anything behind. The Kerr soils, containing a high percent of micaceous minerals from the Kerr Ranch schist parent materials, are young alluvial soils on the flood plain.

AGRICULTURAL RATING OF SOILS

The agricultural rating of soils according to the Storie Index method, expresses numerically, the relative degree of suitability of a soil for general intensive agriculture.

This rating is based on soil characteristics only and is obtained by evaluating such factors as depth and texture of the surface soil, density of subsoil, drainage, alkali content, nutrient level, acidity, erosion, and relief. Other factors, such as availability of water for irrigation, climate, and distance from markets, that might determine the desirability of growing certain plants in a given locality, are not considered. The index is based fundamentally upon soil factors rather than economic aspects.

Four general factors are considered in the index rating. These are: A, the character of the soil profile and soil depth; B, the texture of the surface soil; C, slope, and X, other factors such as drainage, alkali, nutrient level, acidity, erosion, and microrelief. Each of the four general factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable or ideal condition, and lower percentage ratings are given for conditions that are less favorable to plant growth. The index rating for a soil is obtained by multiplying the four factors, A, B, C, and X; thus any one factor can dominate or control the final rating. As an example, a soil might have an excellent profile condition giving a rating of 100 percent for factor A, excellent surface soil conditions giving 100 percent for factor B, smooth nearly level surface giving 100 percent for C, but a seasonal poor drainage condition of the subsoil would justify a rating of 50 percent for factor X. Multiplying these four factors together gives a rating of 50 percent for this soil. The seasonal poor drainage condition dominates the general agricultural suitability and this deficiency is specified by the 50 percent rating in the X factor.

On the basis of the Storie Index ratings, the soils are placed in six grades. The soil grade and the index rating refer to the degree of physical suitability of the soil for general intensive agriculture.

Grade 1 soils are excellent soils well suited to general intensive agriculture and range in index rating from 80 to 100. They are easily worked, productivity is relatively easy to maintain or improve, irrigation can be carried on simply and efficiently, and no special erosion control practices are required.

Grade 2 soils are moderately well suited to general intensive agriculture and range in rating from 60 to 80. Irrigation can be carried on simply and efficiently, and no special erosion control practices are required. The ranges for crops and yields are somewhat less than for Grade 1 soils.

Grade 3 soils are only fairly well suited, and range in rating from 40 to 60. The ranges for crops and yields are less than Grade 2 soils, and the productivity is more difficult to improve.

Grade 4 soils are poorly suited to crops and range in rating from 20 to 40.

Grade 5 soils are very poorly suited and range in rating from 10 to 20. Grade 4 and 5 soils have a narrow range for crops and produce low yields; they are generally marginal land.

Grade 6 consists of nonagricultural soils and land types that have ratings less than 10.

An agricultural rating of each soil type is presented in the following alphabetically arranged descriptions of the mapping units.

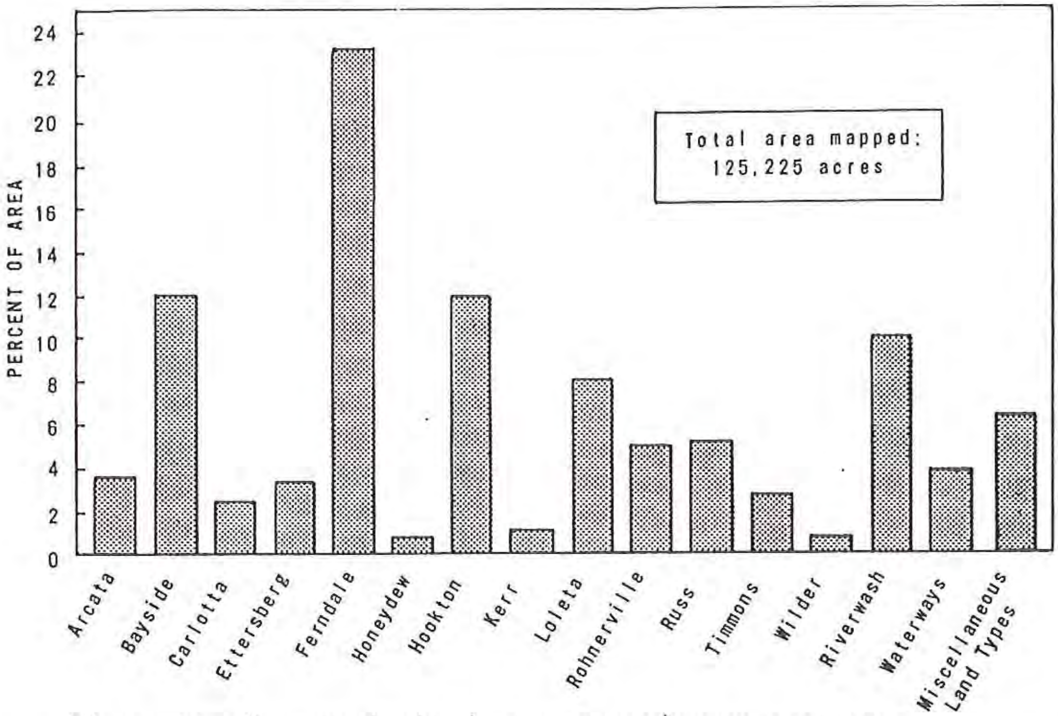

Figure 18. Bar graph showing comparative percentage of soil series and miscellaneous mapping units.

Descriptions of Mapping Units

ARCATA SOILS - Ar

The Arcata series includes dark brown, well drained young alluvial soils developed in softly consolidated sedimentary alluvium derived from the Hookton formation. Arcata soils vary in texture from loam to fine sandy loam, and exhibit slight to no development. They occur on low terraces of marine or sand dune origin, presently 100 to 200 feet above sea level. These terraces are essentially flat and smooth with a gentle westward dip. Native vegetation is essentially spruce and alder, as well as native grass and bracken fern in a few small open areas. Arcata soils are developed under 40 to 60 inches of rainfall; winters are mild and wet; and summers are dry with frequent fogs. Average annual temperature is 52°F., with an average in July of 56°F., and 47°F., in January. Frost free growing season is more than 300 days.

Associated with the Arcata soils are the Hookton and Hely series. The Hookton on flat ground is quite shallow and imperfectly to poorly drained. The Hely is an upland soil under coniferous forest and has a redder surface than the Hookton soil.

The dominant crops grown on the Arcata soils are flower bulbs and permanent pasture. When the soils are fertilized and managed well they produce excellent pasture and yields of bulbs. However, when unfertilized and unirrigated these soils produce low quantity and a poor quality of feed. Bulb crops must be rotated after one cropping if the soil is to retain a low pathogenic level.

Arcata fine sandy loam,
0 to 3 percent slopes (Ar2)

This soil is on a nearly level to gently sloping low terrace which faces the Pacific Ocean. Its medium texture and good drainage makes it an excellent agricultural soil.

Surface soil -

0 to 23 inches, fine sandy loam, dark brown when moist, medium subangular blocky structure, abundant animal burrows and medium acid in reaction.

Subsoil -

23 to 47 inches, fine sandy loam, dark yellowish brown when moist; massive structure, friable, and medium acid in reaction. Few roots are present except in animal burrows where they are abundant.

47 to 70 inches plus, fine sandy loam, yellowish brown with many distinct light gray and strong brown mottles, massive structure which is firm when moist, and strongly acid in reaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	80	80	1

Factor X indicates nutrient level.

Arcata fine sandy loam,
3 to 8 percent slopes (Ar3)

This soil is on gently to moderately sloping terrace breaks. Drainage is good, runoff is medium, and permeability is moderately rapid. In areas where the surface is scarified, there may be a local erosion hazard from a heavy rain.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	80	80	1

Factor X indicates nutrient level.

Arcata loam,
0 to 3 percent slopes (Ar4)

This soil is finer textured than the fine sandy loam, and contains a higher percentage of organic matter in the surface. It has a higher percentage of available moisture and is higher in nutrients. Caution in time of spring plowing is important because of the higher water holding capacity. Spring application of nitrogenous fertilizers will not be readily leached.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	80	80	1

Factor X indicates nutrient level.

Arcata loam, moderately well drained, 0 to 3 percent slopes (Ar5)

This soil is wet for a significant period of time due to strong compaction in the substratum and because of its closeness to steep slopes where runoff is rapid. The surface is often darker than its well drained fine sandy loam counterpart. Artificial drainage may be necessary for deep rooted crops. Aside from the drainage restriction and consequent darker surface, the profile is similar to the Arcata loam.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	64	64	2

Factor X indicates drainage condition and nutrient level.

Arcata loam,
3 to 8 percent slopes (Ar6)

This soil is higher in clay content, organic matter, available moisture, and nutrient capacity than is the fine sandy loam. Slopes are gentle to moderate. They occur essentially on terrace breaks and terrace dissections, and if mismanaged, there is a slight erosion hazard.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	95	80	76	2

Factor X indicates nutrient level.

Arcata loam, dark,
0 to 3 percent slopes (Ar7)

This soil has a much deeper and dark colored surface than the fine sandy loam. It also has a slight clay accumulation in the subsoil. Available moisture in the crop rooting zone is high because of the subsoil organic matter content and loam texture. Nutrient capacity is also quite high. Although this soil type is quite limited in extent, it seems to have very desirable croping characteristics. It occurs on flat, smooth topography.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	80	80	1

Factor X indicates nutrient level.

Arcata loam, dark,
3 to 8 percent slopes (Ar8)

This soil has all the desirable characteristics listed in the description above but is formed on gentle to moderate slopes. Erosion hazard is slight.

Soil Rating Factors

A x	B x	C x	X.	Index	Grade
100	100	95	80	76	2

Factor X indicates nutrient level.

BAYSIDE SOILS - Ba

The Bayside series are imperfectly to poorly drained, fine textured basin soils, developed in sedimentary alluvium from the Franciscan and Wildcat formations in the North Coast Range Mountains. They occur in a basin position with small streams and in a broader area of reclaimed tidal marsh flats near Humboldt Bay. Native vegetation in the stream basin is willow, spruce, and rush, whereas in the tidal marsh areas there is silverweed, pickelweed, and rush. Much of the land has been diked and partially drained with a system of open ditches. Except for the few scattered areas, still affected by salt water, the Bayside soils support an abundance of permanent pasture.

Bayside soils are genetically related to the Ferndale, Russ, and Loleta soils. The Ferndale and Russ are young alluvial flood plain soils and both are better drained, coarser textured, and younger than the Bayside. The Russ is more strongly acid and lighter in color than either the Bayside or Ferndale. The Loleta series occurs on a fan or low terrace position, has a dark surface, is moderately well to imperfectly drained, and medium textured. When the Bayside is in a basin position, the Russ, Loleta, and Bayside soils form a drainage catena.

Bayside soils occur at elevations from sea level to above 50 feet within about a 10 mile perimeter of Humboldt Bay. Mean annual percipitations is about 40 inches, but additional subterranean water is accumulated from adjacent mountain slopes and from ocean water intrusion. Average temperatures vary from 56°F., in July to 47°F., in January. Winters are mild and wet, summers are foggy and cool but with almost no rainfall. Mean annual temperature is 52°F., with a growing season upwards of 300 days.

Bayside soils are devoted almost exclusively to the production of nonirrigated forage. In the overwashed areas, occasional crops of carrots, cow beets, or barley are raised for supplemental dairy feed. Introduced species include birdsfoot trefoil, salina clover, meadow foxtail, alta fescue and in the poorly to very poorly drained areas, reed canary grass. Meadow foxtail is the best suited crop for these marshy areas. Pastures that remain uncultivated for several years are usually dominated by mixtures of meadow foxtail and bull rush, with small quantities of silver leaf, a weedy forb, and what ever legume is introduced. Such a pasture mixture will usually support one animal unit for 6 to 8 months of the year.

Bayside silty clay loam,
poorly drained,
0 to 3 percent slopes (Ba2)

This soil is the most extensive of the Bayside series and occupies the bulk of reclaimed tidal marsh around Humboldt Bay.

A representative profile observed under rush, silverweed and bent grass about a mile from the Pacific Ocean near Centerville Beach is characterized by a:

Surface soil -

0 to 4 inches, silty clay loam, very dark gray, hard, very firm, nonsticky and slightly plastic; strong medium prismatic structure; many very fine roots; many thin clay films on ped faces and in pores; and a slightly acid reaction.

4 to 6 inches, an intermittent muck layer which is medium acid in reaction.

Subsoil -

6 to 30 inches dark gray clay, hard, very firm, sticky and slightly plastic; plentiful fine and very fine roots; many thick clay films on ped faces and in pores; fine prominent mottles; and a mildly alkaline reaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	45	36	4

Factor X indicates drainage condition.

Bayside silty clay loam,
imperfectly drained,
0 to 3 percent slopes (Ba3)

This soil is better drained than its poorly drained counterpart. Soil discoloration is obvious a few inches under the surface indicating there is an excess of water for a short period during the year. The soil is quite dense and puddled from 30 to 40 inches where a blueish gleyed color begins. Fine subangular blocky structure in the surface and nearly three feet of top soil above the water table provides a smooth even pasture of good quality. Vegetational changes on the poorly drained and imperfectly drained areas are quite noticeable. Care must be taken as to the time of plowing if soil compaction is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	60	49	3

Factor X indicates drainage condition.

Bayside silty clay loam,
imperfectly drained, deep overwash,
0 to 3 percent slopes (Ba4)

This soil, being close to the streams or rivers that are subject to annual flooding, has received from 18 to 36 inches of very recent deposits. The predominant texture of these deposits is silt loam and occasionally sandy loam. The structure of this soil is very weak, to nonexistent, and surface organic matter content is lower than the nonoverwashed silty clay loam soil type. High production rates of pasture crops on these soils indicate a high fertility, although deep rooted crops are nearly out of the question because of imperfect drainage. Care must be taken as to time of plowing in order to avoid compaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	60	48	4

Factor X indicates drainage condition.

Bayside silty clay loam,
poorly drained, shallow overwash,
0 to 3 percent slopes (Ba5)

This soil supports the same type of weedy vegetation as does the poorly drained Bayside silty clay loam. It is a transitional Bayside soil type occuring between deeply overwashed and nonoverwashed areas. Extreme caution must be taken in choosing the time to plow these areas if compaction is to be avoided. Vegetation species are grouped in accordance with microrelief. Evidence of puddling with consequent drainage restrictions can be observed at depths from 20 to 30 inches where much of the soil mass is gleyed.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	45	36	4

Factor X indicates drainage condition.

Bayside silty clay loam,
very poorly drained,
0 to 3 percent slopes (Ba6)

This soil is formed in very low lying areas of the Bayside poorly drained soils. It is often affected by salts and the surface horizon is frequently puddled. Discoloration is pronounced at the surface, indicating that water has stood for a matter of a week or more. This soil supports pickleweed, saltgrass, and silverweed. Pasture value is low. Improvement of these small areas would be very difficult because of their position near salt water.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	20	16	5

Factor X indicates drainage condition.

Bayside silty clay loam,
imperfectly to poorly drained,
0 to 3 percent slopes (Ba7)

This soil occurs in the reclaimed tidal marsh lands around Humboldt Bay and has a gently undulating microrelief. The drainage is varied because the subsurface water occurs on a level surface beneath the undulation. Differences in the drainage pattern frequently occurred within a short distance. Therefore it was considered impractical to make a multiple soil type separation. Extreme caution must be used in selecting the proper time to plow this complex if compaction is to be avoided. Vegetation in these areas is an expression of the drainage condition. The higher portions support an even and quite dense stand of bent grass whereas the lower, poorly drained portions, support silverweed and cow clover.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	50	40	3

Factor X indicates drainage condition.

Bayside silty clay loam,
poorly to very poorly drained,
0 to 3 percent slopes (Ba8)

This soil is best described by its drainage pattern and condition. It is a mixture of small bodies of the poorly and very poorly drained areas. Each body is too small to be a practical management unit. They were, therefore, mapped as a complex. Pasture value is quite low, and it is unlikely that this soil type can be improved economically. Plowing can only be done in late summer or after a long drought without danger of compaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	25	20	4

Factor X indicates drainage condition.

CARLOTTA SOILS - Ca

The Carlotta series consists of moderately well drained, medium textured soils developed on sedimentary alluvium derived from soft and hard sediments of the North Coast Range Mountains. The parent material is usually high in quartz or quartzites. These soils occur on low river terraces having smooth, flat relief. Native vegetation is essentially redwood.

Associated geographically with the Carlotta soils are soils of the Larabee and Ferndale series. Larabee is an upland soil developed from softly consolidated sediments and is of medial development. Ferndale is a young alluvial flood plain soil with no profile development.

Carlotta soils occur at elevations from 50 to 500 feet in a subhumid climate. Summers are foggy and cool but rainless. Winters are mild and wet. Mean annual precipitation is from 40 to 60 inches, and mean annual temperature is 54°F. Average July temperature is near 58°F., and an average January temperature is near 47°F. Frost free season is nearly 300 days.

Thick strata of river gravels or cobbles may be found at any depth in the profile. Occasionally these cobbles restrict tree growth because of droughtiness. The Carlotta soil is usually moderately well drained but poorly drained conditions exist on terrace positions to the mountains.

Native vegetation is dominatly redwood but may be madrone and tan oak or sparse stands of Douglas fir in the gravelly areas.

The Carlotta soils are used to a very limited extent for pasture production. Nearly 90 percent of the area mapped Carlotta is in timber. Pastures that are fertilized are irrigated do well. Poorly drained areas are less productive than their better drained counterparts.

Carlotta loam,
0 to 3 percent slopes (Ca2)

This soil occurs on a low terrace under a grove of large second growth redwoods.

Representative profile:

Surface soil -

> 0 to 14 inches, loam, very dark grayish brown; strong, fine subangular blocky structure; friable; plentiful fine, medium, and coarse roots; and slightly acid reaction.

Subsoil -

> 14 to 32 inches, loam, dark grayish brown when moist, brown when dry; weak fine subangular blocky; slightly hard and friable; many fine, medium and coarse roots; and very strongly acid in reaction.

Deep subsoil -

> 32 to 52 inches, loam, gray when moist with many medium distinct yellowish brown mottles; massive structure; hard when dry; few fine roots; and very strongly acid in reaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	100	95	90	1

Factor X indicates nutrient level.

Carlotta loam, shallow,
0 to 3 percent slopes (Ca3)

This soil may be found on any of the Carlotta terraces and in nearly any position on the terrace. They occur more frequently near the present stream channels. It differs from the Carlotta 3 to 8 percent slope type in having only 18 to 36 inches of soil over gravel or cobbles. The gravels or cobbles in these areas do not include enough soil in their matrix to hold any water. Roots are consequently restricted because of drought. The Carlotta loam, shallow, which usually supports a good stand of redwood may only produce madrone, tan oak, and brush, mainly because of the gravelly subsoil.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
60	100	100	95	57	3

Factor X indicates nutrient level.

Carlotta loam, poorly drained,
0 to 3 percent slopes (Ca4)

This soil is found on most Carlotta terraces against the adjacent mountains. They receive a good deal of seep and runoff from these mountains and are usually wet until late spring. The surface of these soils is usually darker in color than the Carlotta loam, 0 to 3 percent slopes, and the reaction is not so acid in the subsoils. The extent of these poorly drained areas is very limited. Each terrace might have a quarter of an acre to perhaps 2 acres of this type.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	100	40	38	4

Factor X indicates drainage condition.

Carlotta loam,
3 to 8 percent slopes (Ca5)

This soil occurs on very short alluvial fans and some shallow terrace breaks. They are quite similar to the Carlotta loam, 0 to 3 percent slope type, except for a slightly larger percentage of gravels on the surface. On slopes more than 4 percent, the soils are subject to some erosion after cultivation.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	95	95	86	1

Factor X indicates nutrient level.

Carlotta gravelly loam,
0 to 3 percent slopes (Ca6)

This soil differs from Carlotta loam, 0 to 3 percent slopes, in having sufficiently abundant surface gravels to cause difficulty in plowing or cultivating.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	60	100	95	51	3

Factor X indicates nutrient level.

Carlotta gravelly loam, shallow,
0 to 3 percent slopes (Ca7)

This soil is both gravelly in the surface and subsoil, and has a limited rooting zone. There is only from 18 to 36 inches of soil overlying gravels containing very little soil material. It is not only difficult to plow because of the surface gravels, but very droughty due to low moisture holding capacity. Nutrient content also is correspondingly low.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
60	60	100	95	34	4

Factor X indicates nutrient level.

Carlotta gravelly loam,
3 to 8 percent slopes (Ca8)

This soil is found on short fans and small terrace breaks. There are sufficient gravels in the surface to cause difficulty in plowing. These areas are quite limited in extent.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	60	95	95	49	3

Factor X indicates nutrient level.

Carlotta gravelly loam,
16 to 30 percent slopes (Ca9)

This soil is found on a few moderately steep alluvial fans. It characteristically has more gravels and cobbles in the surface than the more gently sloping counterparts. Tillage practices are greatly restricted by both the surface gravels and steepness of the slopes. Erosion hazard is high.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	60	75	95	39	4

Factor X indicates nutrient level.

ETTERSBERG SOILS - Et

The Ettersberg series comprises well drained soils developed from graywhacke gravels and river sediments of the Franciscan and Yager formations. The parent material is rich in quartz and shale particles. The soils occur on low river terraces having smooth to nearly flat relief. Vegetation consists of thin Douglas fir stands and open areas of annual grasses and bracken fern.

Ettersberg soils characteristically have deep, dark-grayish brown or grayish-brown loam surface horizons. Subsoils are light gray loams or sandy clay loams. Reaction is strongly to very strongly acid throughout.

The Ettersberg soils are associated with soils of the Wilder, Timmons, and Hookton series. Wilder soils are darker in color and have no distinct horizons. The Timmons soils are less acid, with shallower A horizons and brownish subsoils. The Hookton soils are quite shallow, over a clay substratum and are more poorly drained than the Ettersberg.

The Ettersberg soils occur at elevations from 100 to 2500 feet. Summers are hot and dry; winters are mild and wet. Mean annual precipitation is between 60 and 120 inches.

Ettersberg soils are used for unirrigated pasture and some timber production. The quality and quantity of forage is quite poor in most areas. In a few isolated cases, fertilizer or irrigation practices have improved yields greatly. Apple, chestnut, and peach orchards which are of minor importance on these soils are thrifty when managed well. Subterranean clover and rye grass do well in fertilized areas. Tree crops will not do well in the poorly drained areas.

Ettersberg loam,
0 to 3 percent slopes (Et2)

This soil type is the most extensive of the Ettersberg series. It is prominent in the high rainfall and warm dry summer portions of the area. In several areas it has been found to react quite favorably to sulfur applications.

The depth of the A horizon may vary from 15 to 30 inches. There is an increase of organic matter in the surface when there is a slight increase of clay in the subsoil. The reaction of the surface is normally medium acid but as a result of fertilization, it is presently very strongly acid.

Representative profile, observed on low terrace position under pasture formerly cleared of Douglas fir:

Surface soil -

0 to 22 inches, loam, grayish brown and slightly hard when dry, very dark grayish brown and very friable moist; very weak, very fine granular structure; plentiful very fine and medium roots; and very strongly acid in reaction.

Subsoil -

22 to 49 inches, clay loam, light gray and hard when dry, dark grayish brown and firm moist; strong, fine subangular blocky structure; slightly sticky and slightly plastic when wet; few very fine roots; common thin clay films on ped faces and in pores and bridges; and very strongly acid in reaction.

Substratum -

49 inches plus river rocks of sandstone and graywhacke.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
95		100		100		64	61	2

Factor X indicates degree of acidity and nutrient level.

Ettersberg loam, shallow,
0 to 3 percent slopes (Et3)

This soil occurs in some broad areas on fairly recent, low terraces. It is underlain from 18 to 36 inches with very coarse gravels or cobbles that are droughty to crop roots any time of the year. Trees in these areas do very poorly. If this soil is ever irrigated, the duration and interval of water applications in relation to conservation of water and nutrient content should be investigated.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
60		100		100		64	38	4

Factor X indicates degree of acidity and nutrient level.

Ettersberg loam, poorly drained,
3 to 8 percent slopes (Et4)

This soil occurs to a very limited extent on the edges of low terraces along annual stream channels and where small springs are seeping. Reaction of these seep areas is higher than the normal basin. Extreme caution should be used in time of plowing if compaction is to be avoided. Hydrophytic plant growth is difficult to control.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	95	30	27	4

Factor X indicates degree of acidity and nutrient level.

Ettersberg loam,
3 to 8 percent slopes (Et5)

This soil occurs on gently sloping alluvial fans just above the low terraces. These fans usually contain an entrenched annual stream channel so that it is presently unaffected by overwash.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	95	64	58	3

Factor X indicates degree of acidity and nutrient level.

Ettersberg loam,
8 to 16 percent slopes (Et6)

This soil occurs on strongly sloping alluvial fans where winter freshets have deposited annual loads of soil material. Most of these fans contain downcut stream channels so that they are not presently affected by overwash. Caution should be used in time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	85	64	52	3

Factor X indicates degree of acidity and nutrient level.

Ettersberg gravelly loam,
0 to 3 percent slopes (Et7)

This soil occurs throughout the usual Ettersberg areas where the soil material was laid down by fast moving waters. It contains a sufficient amount of gravels and cobbles in the surface to make it difficult to plow. In all other respects it resembles the Ettersberg loam, 0 to 3 percent slopes soil type.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
85	70	100	64	38	4

Factor X indicates degree of acidity and nutrient level.

Ettersberg gravelly loam, shallow,
0 to 3 percent slopes (Et8)

This soil occurs on the Ettersberg terraces near old stream or river channels. There is sufficient gravel in the surface to make plowing difficult. And from 18 to 36 inches below the surface there are gravels in abundance and they cause a very droughty condition.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
60	70	100	64	27	4

Factor X indicates degree of acidity and nutrient level.

Ettersberg gravelly loam,
3 to 8 percent slopes (Et9)

This soil occurs on gently sloping alluvial fans above the low terraces. There is usually an entrenched stream channel cut through the fan so that it is currently unaffected by overwash. Sufficient gravels are present in the surface to make plowing difficult.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
85	90	95	64	47	3

Factor X indicates degree of acidity and nutrient level.

Ettersberg gravelly loam,
8 to 16 percent slopes (Et10)

This soil occurs on strongly sloping alluvial fans where winter freshets have deposited annual loads of soil material. Most of these fans contain deep stream channels so that they are not presently affected by overwash. Sufficient gravels and cobbles exist in the surface which causes difficulty in plowing.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
85	70	85	64	32	4

Factor X indicates degree of acidity and nutrient level.

FERNDALE SOILS - Fe

The Ferndale series consists of medium textured very dark grayish brown soils of recent alluvial origin. The sediments are derived from graywhacke, shale, and sandstone of the Franciscan formation in the North Coast Range Mountains. They occur under a rainfall of from 40 to 60 inches; winters are mild and wet; summers are relatively dry with frequent fog. Average annual temperature is 52°F., average in July being 56°F., and 47°F., in January. The growing season is approximately 300 days.

Ferndale soils occur at elevations from near sea level to about 100 feet. Drainage is generally good.

They are associated with the Loleta, Bayside, and Russ series. The Loleta soils occur on gently sloping alluvial fans and on some of the low terraces. They differ from Ferndale in having finer textured subsoils indicating a more advanced stage of development. Bayside is an imperfectly to poorly drained fine textured soil occuring in reclaimed tidal marsh lands and in some of the small stream basin areas. It differs from Ferndale in being finer textured and having a more strongly developed structure throughout the profile. The Russ soils are also young alluvials, and medium textured, but differ from the Ferndale in that they are more strongly acid, lighter in color, and are derived from the Wildcat formation.

The main variation in the Ferndale series is in texture which ranges from fine sandy loam to silty clay loam. Most profiles have textural stratification and can have either a coarser or finer texture in the surface horizon. In small local areas, drainage may be impeded, and only in rare instances is the slope of the Ferndale soils greater than 3 percent.

Mixtures of permanent pasture have been produced on the Ferndale soils since the turn of the century. Excellent yields of high quality feed have marked them as the best soils in the County. Mixtures of ladino clover and rye grass, or salina clover, and orchard grass are prominent. Alsike, red and white dutch clovers, and tall fescue have been used effectively. In small local areas where drainage is restricted, reed canary grass has proven worthwhile and highly productive. Some carrots and field corn are raised as supplemental cattle feed. Potatoes are planted occasionally.

Ferndale silt loam, 0 to 3 percent slopes (Fe2)

This soil is the most extensive agricultural soil in the survey area. Nutrient capacity is high. Moisture holding capacity is favorable and it occupies flood plains of the Eel, Van Duzen, and Mad Rivers.

Representative profile observed under permanent pasture:

Surface soil -

0 to 21 inches, very dark grayish brown when moist, silt loam; massive to weak very fine subangular blocky structure; neutral in reaction.

Subsoil -

21 to 80 inches plus, silt loam, very dark grayish-brown when moist; massive in structure; neutral to mildly alkaline in reaction. There are 5 different textural strata in the subsoil all of which are within the limits of a silt loam. Bulk density will vary somewhat with textural changes.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	100	100	1

Ferndale fine sandy loam,
0 to 3 percent slopes (Fe3)

This soil generally occurs near large stream channels and was deposited by fast moving flood water. It retains from 1 to 1½ inches of available water per foot of soil and dries out more rapidly than the silt loam. Irrigation water should be applied frequently, about every 14 days in mid summer, and for a short duration, or enough time to supply 2½ inches. Chances for alfalfa to survive are better on the well drained, well aerated, fine sandy loam types. Small bodies of loamy fine sand adjacent to streams and rivers are included in this mapping unit.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	100	100	1

Ferndale fine sandy loam, shallow,
0 to 3 percent slopes (Fe4)

This soil generally occurs near large stream channels and is deposited by fast moving flood water. It is subject to annual or biannual flooding. Effective depth of the soil is only 18 to 36 inches where it rests on sand or gravel. The soil dries out quite early in the spring and must be managed quite carefully for efficient irrigation. Available moisture, above sandy and gravelly substratum, is between 1 and 1½ inches per foot of soil. Small bodies of loamy, fine sand adjacent to streams and rivers are included in this mapping unit.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
70	100	100	100	70	2

Ferndale fine sandy loam,
imperfectly drained,
0 to 3 percent slopes (Fe5)

This soil generally occurs near large stream channels and is deposited by fast moving flood waters. Acreage is quite limited. Due to a dense substratum, this soil is imperfectly drained internally. It should not be plowed until late spring if compaction is to be avoided. These areas support fair permanent pasture although hydrophytic weeds are difficult to control.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	65	65	2

Factor X indicates drainage condition.

Ferndale silt loam, shallow,
0 to 3 percent slopes (Fe6)

This soil is from 18 to 36 inches deep, overlying sandy or gravel strata. The silt loam part of the profile has a rather high available moisture content of about 3 inches per foot of soil. Irrigation water should be carefully managed on these shallow areas so as not to waste water by deep percolation into the sandy or gravelly substratum.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
70	100	100	100	70	2

Ferndale silt loam,
imperfectly drained,
0 to 3 percent slopes (Fe7)

This soil is of limited extent. It occurs in low areas on gently undulating flood plains as well as in ancient channels of stream meanderings. Because of a high water table for part of the year, or of standing water for more than a day, crops that are sensitive to poor aeration should not be grown. Hydrophytic weeds are difficult to keep out. Care must be taken as to the time of plowing if compaction is to be avoided. Permeability is moderate in these areas, but during periods of high rainfall or continued rains, water accumulates in the low spots. Water cannot permeate the soil rapidly enough to drain the added water and it remains on or near the surface for significant periods.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	65	65	2

Factor X indicates drainage condition.

Ferndale silt loam, poorly drained, 0 to 3 percent slopes (Fe8)

This soil occurs in low areas of gently undulating flood plains as well as in ancient channels of stream meanderings. Because of substratum restriction, water remains on or near the surface for prolonged periods. Extreme caution should be used as to time of plowing if compaction is to be avoided. Hydrophytic weeds are quite difficult to control. Crops are restricted to a few water loving plants unless artificial drainage is provided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	55	55	3

Factor X indicates drainage condition.

Ferndale silty clay loam, 0 to 3 percent slopes (Fe9)

This soil can be found on the broad flood plains some distance from the present stream or river channels It is a well drained, fertile soil, that is high in available moisture. Its finer texture is attributed to the low velocity water from which these sediments settled while the river was in high flood stage. A study of available moisture showed that the Ferndale silty clay loams hold more than 3 inches of water per foot of soil. In spite of the good drainage, aeration restriction might occur in this soil. Because of moderate permeability, deep rooted crops such as alfalfa have not been able to survive. The subsoil dampness apparently promotes the growth of root killing fungus so that deep roots cannot survive the winter.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	90	100	100	90	1

Ferndale silty clay loam, imperfectly drained, 0 to 3 percent slopes (Fe10)

This soil may be found on the broad flood plains some distance from the present stream or river channels, in low lying areas. Because of a high water table, or standing water, crops that are sensitive to poor aeration should not be grown. Artificial drainage might alleviate the situation. Care must be taken as to the time of plowing if compaction is to be avoided. Hydrophytic weeds are difficult to control.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	90	100	65	58	3

Factor X indicates drainage condition.

Ferndale silty clay loam, poorly drained, 0 to 3 percent slopes (Fe12)

This soil occurs on broad flood plains in low areas away from the present stream or river channels. Because of a drainage restriction, accumulated water will remain on or near the surface for prolonged periods. Extreme caution should be used in time of plowing if compaction is to be avoided. Hydrophytic weeds are quite difficult to control. Crops are restricted to a few water loving plants unless artificial drainage is provided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	90	100	55	49	3

Factor X indicates drainage condition.

Ferndale mixed fine and coarse soil material 0 to 3 percent slopes (Fe13)

This soil exists near stream and river channels and is of mixed textural composition. Most of these areas are subject to frequent annual flooding and are consequently undesirable for cropping. They usually contain varying amounts of soil material which ranges from deep to shallow, and normally quite hummocky or channeled. They are separated from riverwash because of their agricultural potential where flooding can be controlled.

Soil Rating Factors

A x B x C x X		Index Grade
1-5' lfs-fsl	100	variable

Factor X indicates channelling

HONEYDEW SOILS (Hd)

The Honeydew series consists of well drained alluvial soils developed from Franciscan graywhacke alluvium. They occur on very gently sloping alluvial fans in narrow valleys along the northern California coast under grass vegetation. Characteristically, they have very dark gray brown medium acid surface horizons which grade into dark grayish brown, slightly acid lower subsoil horizons. The structure, being moderate very fine granular from top to bottom, causes the soil to be well drained and very porous.

The Honeydew soils occur at elevations from 200 to 700 feet in a subhumid climate with a mean annual precipitation of from 80 to 103 inches; most of which falls from October through May. Summers are hot and dry and the winters are mild and wet. Average January temperature is 45°F., and an average July is 54°F., with the mean annual temperature being 52°F. The average frost free season is about 300 days.

The Honeydew soils occur in the same general area as the Ettersberg, Hookton, and Wilder series. The Ettersberg is more developed, has a lighter colored subsoil, and ranges from strongly acid to very strongly acid in reaction throughout the profile. The Hookton is much shallower, and has an abrupt boundary with the substratum. The Wilder has very weak structure, is darker than the Honeydew, and is very strongly acid in reaction.

The texture throughout the Honeydew profile varies from loam to clay loam. Color varies in hue from 2.5Y to 10YR. Surface color ranges in value from dark grayish brown to very dark grayish brown. Permeability is moderately rapid due to its very fine granular structure.

Honeydew soils are quite limited in extent. In areas where they are intensively managed, they produce high quantities of excellent forage. One neglected apple orchard exists on this soil. It appears that it might have been productive if managed properly.

Honeydew loam,
0 to 3 percent slopes (Hd2)

This soil occurs on young agrading alluvial fans. The fine granular structure throughout the profile provides an excellent medium for crop growth. However, where this soil type occurs on alluvial fans that face the ocean, strong winds are detrimental to optimum plant growth.

Representative profile under annual range on a 2 percent south facing slope and 700 feet in elevation:

Surface soil -

0 to 25 inches, gravelly loam, very dark grayish brown and friable when moist, grayish brown and loose when dry; moderate fine granular structure; nonsticky and nonplastic when wet; micro and plentiful very fine roots. Few thin clay films on ped faces, and in pores toward the bottom of this layer; and medium acid in reaction.

Subsoil -

25 to 72 inches plus, gravelly olive brown and friable when moist, light gray and loose when dry; very fine granular structure; nonsticky and nonplastic when wet, few to very few very fine roots; few thin clay films on ped faces and in pores; and slightly acid in reaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	100	100	1

Honeydew loam,
3 to 8 percent slopes (Hd3)

This soil occurs on gently sloping alluvial fans. It has a very fine granular structure that provides an ideal medium for plant growth.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	95	100	95	1

Honeydew gravelly loam,
0 to 3 percent slopes (Hd4)

This soil occurs on agrading alluvial fans. There are sufficient gravels and cobbles in the surface to make plowing difficult. The fine granular structure of the soil provides an ideal medium for plant growth.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	80	100	100	80	1

Honeydew gravelly loam,
3 to 8 percent slopes (Hd5)

This soil occurs on gently sloping portions of young agrading alluvial fans. There are sufficient gravels and cobbles in the surface to make plowing difficult. The fine granular structure of the soil provides an ideal medium for plant growth.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	80	95	100	76	2

Honeydew clay loam,
0 to 3 percent slopes (Hd6)

This soil occurs on young agrading alluvial fans. Nutrient level of this soil type is somewhat higher than that of the Honeydew loam. Granulation is not so pronounced as in the Honeydew loam and surface compaction is more prevalent.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	85	100	100	85	1

Honeydew clay loam, imperfectly drained, 0 to 3 percent slopes (Hd7)

This soil occurs on young agrading alluvial fans. Due to local springs, this soil is wet for significant periods of time. Hydrophytic weeds are difficult to control Caution should be used as to time of plowing if compaction is to be avoided. Artificial drainage of these areas is recommended where economically feasible.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	85	100	65	55	3

Factor X indicates drainage condition.

Honeydew clay loam,
3 to 8 percent slopes (Hd8)

This soil occurs on young agrading alluvial fans. The granular structure is rather weak and tendency for compaction is greater than that in the Honeydew loam soil type.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	85	95	100	81	1

HOOKTON SOILS - Hk

The Hookton series consists of moderately deep prairie regosols of medium texture. They are found on softly consolidated sedimentary alluvium originating in the Hookton formation. The surface is characteristically black, fairly high in organic matter, and varies from 17 to 36 inches in depth, with a medium acid reaction. There is an abrupt boundary between the surface and the substratum. The substratum exhibits heavy compaction, strong mottling, and a strongly acid reaction.

The Hookton series is genetically associated with the Rohnerville and Loleta soil series. The Rohnerville is a deeper and more developed soil found on flat terrain. It is also better drained and has a brown subsoil. The Loleta soils are found on fans and low terraces below the Hookton soils. They are less acid, deeper, and have less organic matter in the surface horizon than the Hookton.

The Hookton soils occur at elevations from 50 to 600 feet, in a cool humid climate having a mean annual precipitation of from 40 to 80 inches, and a mean annual temperature near 52°F. Winters are wet and mild and summers are dry but foggy; the average January temperature is 47°F., and the average July temperature is 56°F.

The depth of the solum varies from 18 to 36 inches under non-eroded conditions and may be as shallow as 6 inches on slopes greater than 10 percent where it has been eroded. Surface textures range from silty clay loam to silt loam and in color from black to very dark gray. The texture of the substratum varies from gravelly loam to clay and is always quite compacted and mottled.

The Hookton formation is an uplifted, folded, and dissected terrace of late Pliestocene. The Hookton soils occur on most of this dissected terrace. On relatively flat portions of the terrace, some poorly drained Rohnerville soils have been included with the Hookton series. The bulk of the flat, well drained, and undissected portion of the terrace comprises the Rohnerville series.

Drainage conditions of the Hookton soils are dependent upon the density of the substratum. Where gravelly loams persist, the soil is usually well drained. If the substratum is a fine textured clay, the soil may be poorly drained.

Most of the Hookton soils have produced hay crops for more than 50 consecutive years. Crop yields have declined slowly from excellent to fair or poor. Soil is easily eroded from slopes that are plowed before a rain. In the last two decades, essentially all of the Hookton soils have been converted to annual clovers and grasses. The most important of these are subterranean clover and rye grass. The sod has stabilized the slopes and the yields have increased appreciably. Native perennials are sparse but widespread and increasing.

Hookton silty clay loam,
0 to 3 percent slopes (Hk2)

This soil occurs on a few nearly flat portions of the uplifted, folded, and dissected terraces of the softly consolidated Hookton formation. The Rohnerville soils occur in a similar position. But where the Hookton formation is very dense, the overlying soils were delineated as the Hookton series.

Representative profile observed under perennial range:

Surface soil -

0 to 19 inches, silty clay loam, very dark brown and very friable when moist, moderate fine granular structure; slightly sticky and slightly plastic when wet; and medium acid in reaction.

Subsoil -

19 to 28 inches, silty clay loam, brown, and loose when moist, weak, fine subangular blocky structure; slightly sticky and slightly plastic when wet; and medium acid in reaction.

Substratum -

Silty clay loam, yellowish brown with many distinct brown mottles; firm when moist, and strongly acid in reaction.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
80		90		100		100	72	2

Hookton silty clay loam,
imperfectly drained
0 to 3 percent slopes (Hk3)

This soil occurs on some nearly flat portions of the uplifted, folded, and dissected terraces of the softly consolidated Hookton formation. It is wet for significant periods of time due to local springs or artisian water. Hydrophytic weeds are difficult to control.

Caution should be used in time of plowing if compaction is to be avoided. High yields of subterranean clover and tall fescue are common on this soil.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	90	100	45	32	4

Factor X indicates degree of erosion and drainage condition.

Hookton silty clay loam,
3 to 8 percent slopes (Hk4)

This soil occurs on gently sloping, dissected areas of the Hookton formation. Its dark surface is from 18 to 36 inches deep and the solum is well drained. Caution should be used as to time of plowing if erosion is to be avoided. High yields of subterranean clover and tall fescue are common.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	90	95	100	68	2

Hookton silty clay loam, eroded,
3 to 8 percent slopes (Hk5)

This soil occurs on the gently sloping dissections of the Hookton formation. There is from 4 to 17 inches of surface soil. Because of heavy use for grain cropping during the past 100 years, and some unwise timing of plowing, from 1 to 30 inches of the original surface has been lost by erosion. The present surface soil is often quite rough. When cattle are allowed to heavily graze these areas in the winter, their hoofs often cut trails down to the dense substratum. Where erosion is only slight, high yields of subterranean clover are obtained. The more eroded Hookton soils dry out earlier in the summer and the growth of grass is restarted.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	90	95	70	48	3

Factor X indicates degree of erosion.

Hookton silty clay loam,
imperfectly drained,
3 to 8 percent slopes (Hk6)

This soil occurs on gently sloping dissected portions of the Hookton formation. It is wet for significant periods of time because of local springs or artisian water. Caution should be used as to time of plowing if compaction or erosion is to be avoided. Hydrophytic weeds are difficult to control. High yields of subterranean clover and tall fescue are common on this soil.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	90	95	45	31	4

Factor X indicates degree of erosion and drainage condition.

Hookton silty clay loam, eroded,
imperfectly drained,
3 to 8 percent slopes (Hk7)

This soil occurs on gently sloping dissected areas of the Hookton formation where spring or artisian water has seeped out of the mountains. Because of some unwise timing of plowing, from 1 to 30 inches of top soil has been removed by erosion. From 4 to 17 inches of top soil is all that remains. When cattle are allowed to pasture these areas heavily in the winter, their hoofs frequently cut trails down to the dense substratum. The eroded Hookton soils dry out earlier in the summer than their deeper soil type counterparts

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	90	95	45	31	4

Factor X indicates degree of erosion and drainage condition.

Hookton silty clay loam,
8 to 16 percent slopes (Hk8)

This soil occurs on strongly sloping dissected areas of the Hookton formation. Caution must be used as to time and direction of plowing if erosion is to be avoided. High yields of subterranean clover and tall fescue are common on this soil.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	90	85	100	61	2

Hookton silty clay loam, eroded, 8 to 16 percent slopes (Hk9)

This soil occurs on strongly sloping, dissected areas of the Hookton formation. Because of heavy grain cropping for the past 100 years, and because of some unwise timing of plowing, from 1 to 30 inches of top soil has been removed by erosion. When cattle are allowed to pasture these areas heavily in the winter, their hoofs often cut paths down to the dense substratum. The eroded Hookton soils dry out earlier in the summer than their deeper soil type counterparts.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
80		90		85		70	43	3

Factor X indicates degree of erosion.

Hookton silty clay loam, eroded, 16 to 30 percent slopes (Hk10)

This soil occurs on moderately steep, and dissected areas of the Hookton formation. Because of unfortunate timing of plowing, and because of being heavily cropped for the past 100 years, from 1 to 30 inches of top soil has been removed by erosion. When cattle are allowed to pasture these areas heavily in the winter, their hoofs usually cut paths down to the dense substratum. The eroded Hookton soils dry out earlier in the summer than their deeper soil type counterparts. Toward the bottom of slopes greater than 16 percent, colluvium is prominent and often quite deep.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
80		90		75		70	38	4

Factor X indicates degree of erosion.

Hookton silty clay loam, eroded, imperfectly drained, 16 to 30 percent slopes (Hk12)

This soil occurs on moderately steep, and dissected portions of the Hookton formation near springs or seep areas of artisian water. Rather large bodies of soil accumulations were found on this landscape where the top soil had moved down slope over a dense, excessively wet substratum. Largely because of unwise timing of plowing, from 10 to 30 inches of top soil has been removed by erosion. When cattle are allowed to pasture these areas heavily in the winter, their hoofs frequently cut paths down to the dense substratum. The eroded Hookton soils dry out earlier in the summer than their deeper soil type counterparts. Toward the bottom of slopes greater than 16 percent, colluvium is prominent and may be quite deep.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
80		90		75		45	24	4

Factor X indicates degree of erosion and drainage condition.

Hookton silty clay loam, eroded, 30 to 50 percent slopes (Hk13)

This soil occurs on steep slopes of the dissected Hookton formation and on high terrace breaks. Soil material on these slopes is essentially colluvial, quite shallow at the top of the slope, and much deeper at the bottom. From 10 to 30 inches of top soil has been removed as a result of erosion. When cattle are allowed to pasture these areas heavily in the winter, their hoofs often cut paths down to the dense substratum. The eroded Hookton soils dry out earlier in the summer than their deeper soil type counterparts. Also, south exposures of steep slopes dry out earlier than north exposures. Early spring feed is excellent on the south exposures mainly because of warm soil temperatures while moisture is still plentiful.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
80		90		40		70	20	4

Factor X indicates degree of erosion.

Hookton loam, eroded, 50 to 70 percent slopes (Hk14)

This soil occurs on the very steep and dissected areas of the

Hookton formation. Soil material on these slopes is essentially colluvium and is shallow at the top of the slope and deeper at the bottom. From 10 to 30 inches of top soil has been removed as a result of erosion. When cattle are allowed to pasture these areas heavily in the winter, their hoofs usually cut deep paths down to the dense substratum. The eroded Hookton soils dry out earlier in the summer than their deeper soil type counterparts. South exposure of the very steep Hookton soils produce earlier feed than similar soils on north exposures because of warmer soil temperatures combined with the early spring moisture that is still adequate.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
80		100		30		70	17	5

Factor X indicates degree of erosion.

KERR SOILS - Kr

The Kerr series consists of well to moderately well drained, medium textured, young alluvial soils developed from sedimentary alluvium derived from the Kerr Ranch schist, and Franciscan formations. These soils occur on flood plains of Redwood Creek in northern Humboldt County. Native vegetation is essentially willows, alders, spruce, and firs.

Kerr soils characteristically have dark olive gray silt loam surface horizons with single grain structure and a strongly acid reaction. They are underlain by a dark olive gray, texturally stratified, medium acid subsoil horizon.

Associated with the Kerr soils are the poorly drained soils of the Bayside series. They are finer in texture and are highly mottled as a result of poor drainage conditions. The Orick series is also associated with the Kerr soils. Orick soils are brown, moderately acid, well drained, upland soils, developing on Kerr Ranch schists.

Kerr soils occur at elevations from 0 to 70 feet in a humid climate. Summers are dry but foggy and winters are wet and mild. Mean annual precipitation is about 70 inches and mean annual temperature is near 52°F. Average July temperature is 56°F., and an average January temperature is 52°F. Growing season is nearly 300 days.

Surface texture varies from fine sandy loam to silt loam. Some areas near stream channels are quite sandy but of limited extent. The surface 10 inches of the Kerr soil is characteristically quite mottled. The mottling is apparently due to reduced permeability caused by heavy animal grazing during the wet season which tends to puddle the soil.

The Kerr soils are devoted exclusively to pasture production. Ladino clover, rye grass, tall fescue, orchard grass and salina clover all seem to do well. In the areas where drainage conditions exist, salina clover and birdsfoot trefoil are preferred. Kerr soils are good producers of quality forage if they are fertilized and managed well.

Kerr silt loam, moderately well drained, 0 to 3 percent slopes (Kr2)

This soil is the most extensive of the Kerr soils and occurs on flat, smooth, flood plains of areas draining the Kerr Ranch schist. It is quite high in mica giving the soil a silky feeling. The Kerr silt loam is deep, dark olive gray in color, and has a capacity to store available water.

Representative profile observed in a pasture:

Surface soil -

0 to 25 inches, silt loam, very dark olive gray and friable when moist, with few faint gray mottles; a massive and somewhat compacted and mottled surface 10 inches; weak very fine granular structure; slightly sticky and slightly plastic when wet; few very fine roots; and strongly acid in reaction.

Subsoil -

25 to 58 inches, stratified textures from fine sandy loam to silt loam, dark olive gray and friable when moist, single grain structure; few very fine roots; and medium acid in reaction. The upper 2 inches of the surface exhibits a moderate coarse platy structure, and contains abundant fine and very fine roots.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	90	90	1

Factor X indicates drainage condition.

Kerr fine sandy loam,
0 to 3 percent slopes (Kr3)

This soil occurs in areas where there has been recent and rapid moving waters. The sands in the fine sandy loam soil type are a mixture of quartz and glaucophane schists. The silty soil types contain a high percentage of mica. The moisture holding capacity of the fine sandy loam is appreciably less than the silt loam and consequently should be irrigated more frequently but for a shorter duration.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	100	100	1

Kerr fine sandy loam,
moderately well drained,
0 to 3 percent slopes (Kr4)

This soil occurs to a very limited extent near stream channels which have a quite recent overwash. There are some drainage restrictions when the lower subsoil is wet for lengthy periods of time. Mottling is observed within 36 inches of the surface.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	90	90	1

Factor X indicates drainage condition.

Kerr silt loam,
0 to 3 percent slopes (Kr5)

This soil is free of the characteristic surface drainage restriction. It occurs on the flood plains not far from present stream channels and on very slightly raised portions of the flood plain. It has a high moisture and nutrient holding capacity, and should produce high yields of any crop that is climatically adapted.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	100	100	1

Kerr silt loam, poorly drained,
0 to 3 percent slopes (Kr6)

This soil occurs in a basin position which is normally some distance from the present stream channel. The soil remains wet much of the year because of a water table near the surface. Artificial drainage is recommended before agricultural development can be economically feasible. Hydrophytic weeds are difficult to control. Extreme caution should be used as to time of plowing if compaction is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	65	65	2

Factor X indicates drainage condition.

LOLETA SOILS - Lo

The Loleta series comprise moderately well to imperfectly drained, medium textured, soils developed from sedimentary alluvium from the Wildcat formation. They occur on nearly level to moderately sloping alluvial fans and low terraces. Surface soils are loam, dark grayish brown to very dark brown, medium acid; and subsoils are silt loam in texture and mottled. The Loleta soils are genetically related to the Russ, Bayside, and Rohnerville series. The Russ is an undifferentiated alluvial soil occuring on stream banks draining the Wildcat formation. It has a lighter colored surface, weaker structure, and is less developed than the Loleta soils. The Bayside soils are found in a basin position below the Loleta soils or in reclaimed tidal marsh areas. It is more poorly drained and finer textured than the Loleta series. The three soil series of Russ, Loleta, and Bayside represent a drainage catena.

The Loleta soils occur at elevations of less than 100 feet in a humid, mesothermal climate, having a mean annual precipitation of from 40 to 60 inches with cool, and dry but foggy summers with mild, wet winters. Average temperatures are 47°F., in January and 56°F., in July. The mean annual temperature is 52°F. An average frost free season is about 300 days.

The surface soils vary widely in color from a very dark brown to brown. This variation can be attributed to a periodic high water table and to overwash. The same situation causes a variability in clay eluviation. Texture varies from loam to clay loam. Because of the proximity of the Loleta soils to the mountains, and because of high rainfall in the area, some poor drainage sites will occur on nearly every fan. However, the bulk of the soils are moderately well to imperfectly drained. Reaction of the profile may be either constant with depth or increasing with depth. It is usually about pH 6.0 at the surface

Due to the restricted drainage conditions on most of the Loleta soils, crops that can withstand wetness are more productive. Essentially all of the Loleta soils are devoted to pasture crop production. Annual rye, ladino clover, orchard grass, tall fescue, salina clover, and trefoil constitute the dominant species grown for forage Bull rush is often a problem.

Loleta loam, moderately well
to imperfectly drained,
0 to 3 percent slopes (Lo2)

This soil is on a gently sloping alluvial fan between the uplands and the flood plain. The subsoil is usually mottled. The surface is dark colored.

Representative profile observed under permanent pasture:

Surface soil -

0 to 11 inches, loam, very dark gray and friable when moist, moderate, very fine subangular blocky structure; and medium in reaction.

Subsoil -

11 to 22 inches, clay loam, grayish brown in color with common, distinct, medium strong brown mottles; friable when moist; weak fine, subangular blocky structure; nonplastic and slightly sticky when moist; medium acid in reaction.

22 to 34 inches, clay loam, light gray to gray in color, with many prominent medium, strong brown mottles; firm when moist; slightly sticky and slightly plastic wet; weak fine subangular blocky structure; and neutral in reaction.

34 to 64 inches, clay loam, light gray to gray with many prominent yellowish red mottles; massive structure; nonsticky and nonplastic wet; and neutral in reaction.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
95		100		100		80	76	2

Factor X indicates drainage condition.

Loleta loam, poorly drained,
0 to 3 percent slopes (Lo3)

This soil occurs in low lying areas or in areas adjacent to the Bayside series. The poorly drained soil types of the Loleta series resemble the Bayside soils in drainage but have been separated because of surface structure differences and textures. Extreme caution should be used as to time of plowing if compaction is to be avoided. Hydrophytic weeds are difficult to control. Crops are restricted to water tolerant plants unless artificial drainage is provided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	100	55	52	3

Factor X indicates drainage condition.

Loleta loam, moderately well to imperfectly drained, 3 to 8 percent slopes (Lo4)

This soil occurs on gently sloping alluvial fans between the upland areas and the flood plains. It receives a large amount of subterranean water until late spring. Restricted drainage is spotty because of the hummocky microrelief. The lowest areas are imperfectly drained while the higher spots are moderately well drained. Caution should be used as to time of plowing if compaction is to be avoided. The gentle slope of the area provides an opportunity to install efficient artificial drainage.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	95	80	72	2

Factor X indicates drainage condition.

Loleta loam, moderately well to imperfectly drained, 8 to 16 percent slopes (Lo5)

This soil occurs on strongly sloping alluvial fans where winter freshets pour out from small water sheds and deposit soil materials or gravel. It also receives an appreciable amount of subterranean water until late spring. Restricted drainage is spotty, and occurs wherever the substratum confines water near to the surface. However, these steep fans in general tend to be better drained than their gently sloping soil type counterparts. Caution should be used as to time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	100	85	80	65	2

Factor X indicates drainage condition.

Loleta clay loam, moderately well to imperfectly drained, 0 to 3 percent slopes (Lo6)

This soil occurs on nearly level alluvial fans or low terraces and is finer textured than the normal Loleta soils. A dark surface is prominent in this soil and it is usually an inch or so thicker than the loam soil type. If cattle are continually pastured on these soils during the winter the surface horizon becomes puddled and ultimately it will be compacted. Also, extreme caution should be taken as to time of plowing if compaction is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	80	65	2

Factor X indicates drainage condition.

Loleta clay loam, poorly drained, 0 to 3 percent slopes (Lo7)

This soil occurs in low lying areas of nearly level to level alluvial fans and low terraces. It is of limited extent, usually occupying one tenth or less of the entire fan. It receives an excessive amount of subterranean water until late spring. Extreme caution should be used as to time of plowing if compaction is to be avoided. Hydrophytic plants are difficult to control. Crops are restricted to water tolerant plants unless artificial drainage is provided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	100	55	44	3

Factor X indicates drainage condition.

Loleta clay loam, moderately well to imperfectly drained, 3 to 8 percent slopes (Lo8)

This soil occurs on gently sloping alluvial fans between the uplands and the flood plain. It receives an appreciable amount of subterranean water until late in the spring. The dark surface is prominent and usually an inch or so deeper than the loam soil type. Cattle continually pastured on these soils during the winter can cause a compact, puddled, and rough surface. Caution should be used as to time of plowing if compaction is to be avoided. The gentle slope of this soil type provides an opportunity to install effective artificial drainage.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
95	85	95	80	61	2

Factor X indicates drainage condition.

Man Altered (MA)

This miscellaneous land type consists of areas where man has altered the surface soil and caused the soil profile to be unrecognizable as a genetic soil type. It includes highways, right of ways and their footings, and areas that have been leveled and filled with imported materials.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
-	-	-	-	variable	

Peat Bog (PB)

This mapping unit consists of some small and poorly to very poorly drained low lying areas that have accumulated organic remains in excess of mineral matter. These areas are usually adjacent to reclaimed tidal marsh lands but can also be found in the center of a high terrace such as that of the old goose lake bed near Hydesville. The depth of the peat layers usually do not exceed three feet and they might be as shallow as eight or ten inches.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
-	-	-	-	< 19	5

Riverwash (RW)

This mapping unit consists of assorted textures from silt to cobbles that are found along the banks of streams and rivers They are usually gently undulating or strongly channeled. Annual high water from the streams might rechannel or deposit a load on any area of riverwash. The dominant vegetation is willow and cottonwood, although some portions support thin strands of grass and clover.

Attempts have been made to clear, level, and seed the best of this land after the waters recede in the spring. The result of such ventures has often been the loss of more acres to the river. Where the willows have partially protected the main body of riverwash lands from the eroding waters of the river, the clearing of trees has often initiated severe erosion.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
-	-	-	-	< 5	6

ROHNERVILLE SOILS - Ro

The Rohnerville series consists of moderately well drained soils developed from softly consolidated sedimentary alluvium originating in the Hookton and Rohnerville formations. They occur on high terraces under permanent pastures. Characteristically the Rohnerville soils have a black surface horizon with a silty clay loam texture and a moderate, medium, subangular blocky structure. This grades into a brown, clay textured horizon with a strong, medium, subangular blocky structure. The soils under proper management are good producers of permanent pasture.

The Rohnerville series occur at elevations from 300 to 1,000 feet in a cool, mesothermal climate having a mean annual precipitation of from 40 to 60 inches, falling between September and June. Mean annual temperature is 52°F. Average July temperature is 56°F., and an average January temperature is 47°F.

The Rohnerville series are genetically related to the Hookton and Loleta series and are geographically associated with the Larabee and Empire series. The Hookton series has a similar dark horizon, and the same kind of structure but is a lithosol over softly consolidated sedimentary alluvium. The Loleta series occurs on a low terrace or alluvial fan and is less developed and less acid than the Rohnerville. The Larabee is an upland or residual soil under conifers, with a shallow surface horizon and a more mottled yellowish subsoil. The Empire is an upland or residual soil under a coniferous forest, and it has a more developed subsoil.

The surface horizon of the Rohnerville series ranges in color from black to dark grayish brown and in texture from silty clay loam to loam. The depth of the A horizon can very from 18 to 36 inches. Under heavy cultivation, even gentle slopes are eroded somewhat.

Rohnerville soils are devoted to pasture and hay crop production. They will produce good to excellent yields if properly managed.

Rohnerville silty clay loam,
0 to 3 percent slopes (Ro2)

This soil, in spite of having been cropped in hay and grain for the last 100 years, has retained an excellent structure and a high content of organic matter. The surface horizon is quite permeable and is characteristically 30 inches deep or more. It has a high moisture holding capacity and a high nutrient level.

Representative profile under permanent pasture on a smooth, flat, high terrace:

Surface soil -

0 to 28 inches, silty clay loam, black in color, and friable when moist; moderate, fine subangular blocky structure; nonsticky and slightly plastic when wet; and medium acid in reaction.

Subsoil -

28 to 58 inches, silty clay; brown, and very firm when moist; strong, medium subangular blocky structure; sticky and plastic when wet; and strongly acid in reaction.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
90		90		100		100	81	1

Rohnerville loam,
0 to 3 percent slopes (Ro3)

This soil occurs on a flat high terrace position and normally on the seaward side of the terrace. It is limited in areal extent. There is an appreciable amount of quartz in the surface horizons, which indicates that there has been some mixing of sand dune materials in the profile. Because of their seaward position, these soils tend to be more wind swept. Native vegetation is perennial grass.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
90		100		100		100	90	1

Rohnerville loam,
3 to 8 percent slopes (Ro4)

This soil occurs on gently sloping high terraces of the Rohnerville and Hookton formations. Because of the excellent permeability, good drainage, and a high organic matter content, erosion hazard is very slight to none. It is of limited extent, occuring on the edges of high terraces facing the ocean. There is a large amount of quartz in the surface horizons, which indicates that there has been some mixing of sand dune materials in the profile.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
90		100		95		100	86	1

Rohnerville silty clay loam,
moderately well drained,
0 to 3 percent slopes (Ro5)

This soil occurs on high, flat terraces of the Hookton and Rohnerville formations. The black surface soil varies from 18 to 36 inches in depth and has a moderate, fine subangular blocky structure. The profile is wet for a short but significant period of time during the winter. Deep rooted crops would be difficult to maintain.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	100	100	90	81	1

Factor X indicates drainage condition.

Rohnerville silty clay loam, 3 to 8 percent slopes (Ro6)

This soil occurs on gently sloping high terraces of the Hookton and Rohnerville formations. The black surface soil varies from 18 to 36 inches in depth and has a moderate, fine subangular blocky structure. It is well drained and has a high moisture holding capacity and a high nutrient level. Erosion hazard is slight, yet caution should be used as to time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	90	95	100	77	2

Rohnerville silty clay loam, eroded, 3 to 8 percent slopes (Ro7)

This soil occurs on gently sloping dissected portions of the Hookton formation and on gently sloping folds of the Rohnerville formation. The black surface horizon is only from 6 to 18 inches deep as a result of erosion. Caution should be used as to time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	90	95	80	62	2

Factor X indicates degree of erosion.

Rohnerville silty clay loam, eroded, moderately well drained, 3 to 8 percent slopes (Ro8)

This soil occurs on gently sloping dissected areas of the Hookton formation and gently sloping folds of the Rohnerville formation. The black surface horizon is only from 6 to 18 inches deep as a result of erosion. Because of the prevailing high rainfall, and some subsoil drainage restrictions, this soil is wet for short but significant periods of time. Deep rooted crops would be difficult to maintain. Caution should be used in time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	90	95	90	69	2

Factor X indicates drainage condition.

Rohnerville silty clay loam, 8 to 16 percent slopes (Ro9)

This soil occurs on moderately to strongly sloping dissected areas of the Hookton formation. The surface horizons are from 18 to 36 inches deep. Rohnerville soils have been cropped heavily for the last 100 years. Those with more than 5 percent slopes have been eroded. So it is surprising to find that this soil type on 8 to 16 percent slopes has suffered little or no erosion. This soil is deep, well drained, and very friable. Caution should be used, however, as to time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	90	85	100	69	2

Rohnerville silty clay loam, eroded, 8 to 16 percent slopes (Ro10)

This soil occurs on moderately to steeply sloping dissected portions of the Hookton formation. The surface horizons are only from 6 to 18 inches deep as a result of erosion. Caution should be used as to time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	90	85	80	55	3

Factor X indicates degree of erosion.

Rohnerville silty clay loam, eroded, moderately well drained,
8 to 16 percent slopes (Ro12)

This soil occurs on moderately to steeply sloping dissected areas of the Hookton formation. The surface horizons are only from 6 to 18 inches deep as a consequence of erosion. Because of subsoil restrictions and high rainfall, the soil is wet for short but significant periods of time. Caution should be used as to time and direction of plowing if erosion is to be avoided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
90	90	85	72	49	3

Factor X indicates degree of erosion and drainage condition.

RUSS SOILS - Ru

The Russ series consists of well to moderately well drained soils developed from sedimentary alluvium originating in the Wildcat formation. They occur along small streams which drain the Wildcat formation and exhibit no profile development. Native vegetation is willow, alder, and brush species. Essentially all of the area surveyed has been cleared.

Characteristically, the Russ soils have a dark grayish brown silt loam surface which is moderately to slightly acid in reaction. The surface color and texture remains rather constant with depth, but the reaction becomes neutral in the subsoil.

Russ soils are genetically related to the Loleta and Bayside series and are geographically associated with the Ferndale series. The Loleta soils are a little more developed, have a darker colored surface, and usually imperfectly drained. The Bayside soils also are more developed, have a finer texture, and are poorly drained. They occur in basin positions. The Ferndale soils are less acid in the surface and usually darker colored than the Russ soils. The Ferndale soils are developing on mixed materials from the Franciscan and Wildcat formations. The Russ, Loleta, and Bayside soils form a drainage catena.

The Russ soils occur at elevations from 15 to 150 feet in a subhumid climate, with a mean annual precipitation of about 40 inches. Summers are cool and somewhat foggy, and winters are mild and wet. Average July temperature is 56°F., and an average January temperature is 47°F. Mean annual temperature is 52°F., with an average frost free season of 300 days. The Russ series occur in the north coast range mountain area, adjacent to alluvial valleys and drainages from the Wildcat formation.

The surface color varies from brown to very dark grayish brown. Textural stratification throughout the profile is normal, and it will vary from silty clay loam to fine sandy loam. Reaction of the surface in some cases, especially toward the bottom of the fan, can be neutral rather than slightly acid. Surface runoff is medium to slow, and permeability is moderately rapid.

The Russ soils are used for pasture and to a very minor extent for carrots or cow beets which are used as supplementary dairy feed. Pasture crops include ladino, salina, red clovers, rye grass, and orchard grass. Occasionally alsike, white dutch clover, or tall fescue is included in pasture mixtures. Pastures produce good to excellent yields as do fields devoted to supplementary feeds if they are well managed. Imperfectly drained Russ soils produce higher yields of the more water tolerant species. The shallower and coarser textured areas of Russ soil produce highest yields with shallow rooted crops.

Russ silt loam,
0 to 3 percent slopes (Ru2)

This soil occurs on nearly level to gently sloping flood plains of small streams draining the Wildcat formation. It is well drained, deep, and permeable. When properly managed, it is one of the most productive soils in Humboldt County.

Representative profile observed in a pasture:

Surface soil-

0 to 8 inches, silt loam, very dark grayish brown, and firm when moist; weak, very fine subangular blocky structure; nonsticky and nonplastic when moist; and slightly acid in reaction.

Subsoil-

8 to 53 inches, silt loam that is stratified with layers of loam, and fine, sandy loam, brown in color, and friable when moist; single grain structure; nonsticky and nonplastic when wet; and medium acid in reaction.

53 to 70 inches plus, silt loam, mottled light gray and yellowish red; mottles are many, medium, and prominent; massive structure; and neutral in reaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	95	95	1

Factor X indicates drainage condition.

Russ sandy loam,
0 to 3 percent slopes (Ru3)

This soil occurs to a very limited extent along stream channels where fast moving flood water has carried away the fine soil particles. The soil has a low moisture holding capacity and a low nutrient level. Because of its good aeration characteristics, it will warm up earlier in the spring than the adjacent finer textured soils. It therefore will have the earliest feed but will also very soon be dry. Irrigation management is difficult on these small areas.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	70	100	95	67	2

Factor X indicates drainage condition.

Russ sandy loam, imperfectly drained, 0 to 3 percent slopes (Ru4)

This soil occurs to a very limited extent in old basin positions where fast moving floods have deposited an abundance of sandy loam on top of a fine textured soil. These areas usually occur very near the mountains in depressions or land locked areas. The soil is wet for a rather long period of time. Caution should be used as to the time of plowing if compaction is to be avoided. Hydrophytic weeds are difficult to control. Deep rooted crops can be grown only if artificial drainage is provided.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	70	100	65	46	3

Factor X indicates drainage condition.

Russ fine sandy loam,
0 to 3 percent slopes (Ru5)

This soil occurs near small stream channels where the stream gradient is relatively low, but where flood waters are still rather fast. It is deep, permeable, and well drained. In some cases, this soil may only be differentiated from the Ferndale fine sandy loam type because it is slightly to medium acid in reaction. Most crops should do well on this soil.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	95	95	1

Factor X indicates drainage condition.

Russ fine sandy loam, shallow,
0 to 3 percent slopes (Ru6)

This soil occurs near small stream channels where the stream gradient is low, but where flood waters still move rather fast. The depth of the effective profile is from 18 to 36 inches, over a deposit of coarse sand or gravel. Caution must be used in the frequency and duration of irrigation applications in order to avoid waste of water. Good pasture crops may be grown with proper management.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
70	100	100	95	66	2

Factor X indicates drainage condition.

Russ fine sandy loam,
imperfectly drained,
0 to 3 percent slopes (Ru7)

This soil occurs in low lying areas adjacent to stream channels where flood waters move fairly fast. A compacted clay substratum layer, deep in the profile, gives rise to an imperfectly drained soil condition. The soil is wet for significant periods of time. Caution should be used as to the time of plowing if compaction is to be avoided. Hydrophytic weeds are difficult to control.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	65	65	2

Factor X indicates drainage condition.

Russ fine sandy loam,
3 to 8 percent slopes (Ru8)

This soil occurs to a limited extent where stream meanders have cut into the flood plain leaving a gentle slope between the stream and the existing flood plain. Water tends to run off at a medium rate so that when heavy applications of irrigation water are applied, in a short period of time, there is a reduction in penetration. Consequently, these soils become dry by early spring. This problem can be solved by applying irrigation water at slower rates.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	95	95	90	1

Factor X indicates drainage condition.

Russ silt loam, shallow,
0 to 3 percent slopes (Ru9)

This soil occurs near streams with a low gradient where flood waters move fairly slowly. The silt loam surface is from 18 to 36 inches in depth over sandy or gravel deposits. Caution must be used in the frequency and duration of irrigation in order to avoid waste of water.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
70	100	100	95	67	2

Factor X indicates drainage condition.

Russ silt loam, imperfectly
drained, 0 to 3 percent slopes (Ru10)

This soil occurs in areas where stream seepage combined with a deep impermeable substratum has caused an imperfect drainage condition. The soil is wet for significant periods of time. Caution should be used in time of plowing if compaction is to be avoided. Hydrophytic plants are difficult to control.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	100	65	65	2

Factor X indicates drainage condition.

Russ silt loam,
3 to 8 percent slopes (Ru12)

This soil occurs to a limited extent where stream meanders have cut into the flood plain leaving a gentle slope between the stream and existing flood plain. Water tends to run off these soils at a medium rate when heavy applications of irrigation waters are applied within a short period of time. This problem can be solved by applying irrigation water at slower rates.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
100	100	95	95	90	1

Factor X indicates drainage condition.

Stabilized Sand Dunes (SD)

Stabilized sand dunes consist of sand dunes which are not presently moving with the wind. Depending on their elevation above sea level, they maintain either a lupine and grass, or a pine and huckleberry vegetative association. A commercial agricultural use of this land type does not seem feasible.

Included with this mapping unit is a limited acreage of alluvial fans facing the ocean They are of very recent origin. Originally they were deposited as sand dunes and later uplifted two or three hundred feet above the ocean. They are presently being washed out of the mountains and deposited on the coastal plain. Vegetation is essentially lupine with some subterranean grasses and clovers. Agricultural value is questionable because of the inherent low fertility and droughtiness.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
-		-		-		-	<19	5

Swamp

This mapping unit is self explanatory. It consists of areas that are inundated for at least nine months of the year. Only Hydrophytic plants can survive in this environment. Some of these areas can be drained and farmed, but the expense involved usually makes it prohibitive.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
-		-		-		-	< 5	6

Terrace Escarpment (TE)

This mapping unit consists of lands with greater than 70 percent slopes between high terraces and alluvial bottoms. The surface soil may be very shallow, usually less than one foot deep, or dominantly rock outcrop. Vegetation consists of brush and some grasses. Because of its steepness, the grass is usually inaccessible to livestock.

Soil Rating Factors

A	x	B	x	C	x	X	Index	Grade
-		-		-		-	< 5	6

TIMMONS SOILS - Ti

The Timmons series consists of well drained soils developing on medium textured alluvium from the Hookton formation. The parent material is high in quartz and clay minerals. The soils occur on smooth, slightly dissected, high terraces with a predominately flat relief. The vegetation is essentially coniferous forest.

Timmons soils characteristically have brown to strong brown loam surface horizons over compact, but porous, clay loam textured subsoils. The reaction is slightly to moderately acid throughout the profile.

The Timmons series is associated with the Mendocino and Hely series. Mendocino soils are very similar but occur in an upland residual position. They have very strongly acid subsoils and are sometimes quite red in color. Hely soils are also residual. They are coarser in texture than the Timmons and exhibit only a slight degree of profile development Timmons soils occur at elevations from 100 to 300 feet. The climate is cool and humid with mean annual precipitation around 45 inches. Summers are cool and dry with some fog, and winters are mild but wet. Mean annual temperature is 52°F., with a July average of 56°F., and a January average of 47°F.

The reaction of the subsoil varies from medium to very strongly acid. The texture of the surface horizon ranges from clay to sandy clay. In small depressed areas, drainage is imperfect to poor, and the organic matter content is high. The normal reddish color of the profile is mottled with yellow and grayish streaks. A gravel strata is often found at any depth and it is of variable thickness.

The Timmons soils are primarily devoted to timber production and produce good yields. Those areas that have been cleared and converted to grass produce poor yields.

Timmons clay loam,
0 to 3 percent slopes (Ti2)

This soil type occupies most of the area mapped Timmons.

Representative profile observed where grass has been seeded in a cut over redwood area:

Surface soil -

0 to 36 inches, clay loam dark grayish brown to dark brown, and friable when moist; moder-

ate, fine subangular blocky structure; slightly sticky and nonplastic; abundant very fine roots; and medium to slightly acid in reaction.

Subsoil -

36 to 49 inches, clay, dark brown to brown with many medium faint, pale brown and yellowish brown mottles below 35 inches; friable when moist; moderate, medium subangular blocky structure; few fine roots; and strong to medium acid in reaction.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	85	100	70	48	3

Factor X indicates degree of acidity and nutrient level.

Timmons clay loam,
imperfectly drained,
0 to 3 percent slopes (Ti3)

This soil occurs in low lying areas on the Timmons terraces where the soil is wet for significant periods of time. Alder and spruce occur as native vegetation in these small areas, most of which has not been cleared.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	85	100	65	44	3

Factor X indicates drainage condition.

Timmons clay loam,
3 to 8 percent slopes (Ti4)

This soil occurs on gently sloping high terraces either adjacent to steep sloping uplands or on gentle terrace breaks. The soil is deep, well drained, and slightly more gravelly than the flat Timmons clay loam type. Surface gravels and cobbles do not normally present tillage problems. Excellent stands of native redwood are growing on this soil type.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	85	95	70	45	3

Factor X indicates degree of acidity and nutrient level.

Timmons clay loam,
8 to 16 percent slopes (Ti5)

This soil occurs on moderately to strongly sloping terrace breaks, none of which has as yet been converted from timber to grass. Erosion is not presently in evidence but could be a problem along deeply cut roads in logging operations. The soil is deep, well drained, and supports good stands of cut over redwood.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	85	85	70	40	3

Factor X indicates degree of acidity and nutrient level.

Urban and Industrial (UI)

This miscellaneous land type delineates areas on the flood plains and terraces which would normally have an agricultural potential, but are covered by houses or industrial buildings. Soil boundaries were extended through such areas if it was practical to do so. Otherwise thin dashed lines were used to indicate the boundaries of this land type.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
-	-	-	-	variable	

WILDER VARIANT SOILS - Wv

The Wilder variant series consists of well drained medium textured soils, which are shallow to moderately deep, and are riddled with small angular fragments of Franciscan graywhacke. They vary from the Wilder series in that their parent material has been transported and laid down by stream deposition, rather than formed in place. Wilder soils are strongly acid in the surface while the variant may be anywhere from strongly to medium acid in the surface.

Wilder variant soils characteristically have very dark gray, massive loam to silt loam surfaces. The subsoils are grayish brown clay loams with a very weak, fine subangular blocky structure. Reaction varies from very strongly to medium acid and there is normally a slight increase in reaction with depth.

The Wilder variant series is associated with the Ettersberg, Hookton, and Timmons series. The Ettersberg series has a shallow surface horizon and a distinct, compact subsoil. The Hookton series is a more poorly drained terrace soil, having a compact, strongly mottled substratum. The Timmons series is less acid, and developed under a coniferous vegetation.

The Wilder variant series occurs at elevations from 500 to 3,000 feet in a subhumid mesothermal climate, having a mean annual precipitation from 60 to 130 inches. Summers are hot and dry; winters are cold and quite wet. The average frost free season is variable.

The surface reaction is the most striking variable going from pH 4.5 to pH 6.0 in one field. The thickness of the dark surface varies from 18 to 30 inches and the depth to gravel varies from 18 to 40 inches. The permeability is moderately rapid to rapid. Native vegetation is usually club grass, bracken fern, and sheep sorral.

Pasture crops are poor to very poor in yields. A wide variety of both crops and fertilizers have been tried to improve the yields. At the present time, only two crops have become established and those with quite limited success. Highland bent grass shows some promise of fair production in the deeper portions of Wilder variant. Subterranean clover is difficult to establish and produces only fair yields. At the present time, no combinations of fertilizers that have been tried show much promise of increasing yields economically.

Wilder variant loam,
0 to 3 percent slopes (Wv2)

This soil is the most extensive of the variant. It occurs on smooth, nearly flat and very high terraces in a high winter rainfall belt with dry, hot summers and a variable frost free season.

Representative profile observed under club grass, bracken fern, and sheep sorral:

Surface soil -

0 to 9 inches, gravelly loam, dark gray, or very dark gray and friable when moist; single grain structure; abundant very fine and medium roots; and very strongly acid in reaction.

Subsoil -

9 to 34 inches, gravelly clay loam, gray, or very dark gray and friable when moist; weak, fine subangular blocky structure, nonsticky and slightly plastic; abundant very fine and medium roots; very strongly acid in reaction.

34 to 41 inches, gravelly clay loam, grayish brown, or dark grayish brown and friable when moist; massive, nonsticky and slightly plastic when wet; common very fine, and abundant medium roots; and strongly acid in reaction.

41 to 55 inches, gravelly loam, light gray to dark brownish gray and friable when moist; weak, very fine, subangular blocky; nonsticky and nonplastic when wet; and medium acid in reaction. This lower subsoil horizon contains 68 percent gravels.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	100	100	24	19	5

Factor X indicates degree of acidity and nutrient level.

Wilder variant loam, shallow,
0 to 3 percent slopes (Wv3)

This soil occurs on the edges of high terraces in a high winter rainfall belt with dry, hot summers and a variable frost free season. The effective depth of the soil is from 18 to 36 inches where gravels become so prominent as to cause a droughty condition to plants. Fertility levels and moisture holding capacities are very low as in the Wilder variant loam, 0 to 3 percent slopes.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
48	100	100	24	12	5

Factor X indicates degree of acidity and nutrient level.

Wilder variant loam,
3 to 8 percent slopes (Wv4)

This soil occurs on gently sloping terrace breaks and dissections in a high rainfall belt with hot, dry summers and a variable frost free season. Graywhacke fragments are more prominent in the sloping soils than in those on smoother terrain. Due to the highly permeable surface and subsoil drainage, erosion is no problem.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	100	95	24	18	5

Factor X indicates degree of acidity and nutrient level.

Wilder variant loam,
8 to 16 percent slopes (Wv5)

This soil occurs on moderately sloping to strongly sloping dissections of terrace breaks. Graywhacke fragments are more prominent on these slopes than on gentler relief. Erosion hazard is only slight because of the high permeability of the surface and subsoil.

Soil Rating Factors

A x	B x	C x	X	Index	Grade
80	100	85	24	16	5

Factor X indicates degree of acidity and nutrient level.

APPENDIX I: Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series ARCATA - Ar (Type Location) Location NW 1/4 of SE 1/4, Sec. 30 T7N R1E HBM

Sample No. 63-Calif-12-7

Lab. No. 301 County Humboldt

Date Sampled 10/25/63

Date Reported Sept. 1964

Analyst WRA, CL, et.al.

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2]: % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50µ-2µ	% Clay <2µ	% Clay <1µ [3]	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5]: % Moisture Retained, Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
A11	0	10	-	0.3	4.1	9.0	46.8	12.0	72.7	11.5	15.8	14.4	fsl	1.1		28.9	11.4	17.5	
A12	10	23	-	0.2	1.1	5.6	55.7	7.0	69.6	13.0	17.4	15.7	fsl	1.3		22.2	9.6	12.6	
AC	23	47	-	0.3	1.0	3.7	54.4	8.0	72.4	10.7	16.9	15.2	fsl	1.4		20.2	7.2	13.0	
C	47	60	-	0	1.0	12.1	66.4	4.5	84.0	8.0	8.0	7.4	lfs	1.5		10.4	4.2	6.2	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	EXTRACTABLE CATIONS (me./100 grams soil) [7]: H	Ca	Mg	Na	K	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	ORGANIC MATTER: % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) [9]: Ca	Mg	Na	K	EC x 10^3 (mmhos/cm)	% Na Saturation
A11	5.5		1.7		2.7	0.3	.2	.2	22.0	15.4	3.84	.226	17						
A12	5.3		1.4		1.0	0	.2	<.1	19.2	6.8	2.51	.134	19						
AC	5.4		1.8		0.6	0	.2	<.1	12.2	7.4	1.08	.065	17						
C	5.5		1.4		0.8	0.2	.2	<.1	4.8	27.1	.193	.015	13						

Analyses by Soil Morphology Laboratory, University of California, Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series BAYSIDE - Ba (Type Location) Location SE Cor. NE 1/4 Date Sampled 8/19/64

Sample No. 64-Calif-12-8 Sec. 32 T3N R2W HBM Date Reported 11/18/64

Lab. No. 373 County Humboldt Analyst WRA, CL, IR

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2]: % Sand (mm.) VCS 2.0mm. to 1.0mm.	CS 1.0mm. to 0.5mm.	MS 0.5mm. to 0.25mm.	FS 0.25mm. to 0.10mm.	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50μ −2μ	% Clay <2μ	% Clay [3] <1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5]: % Moisture Retained Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture of Saturation
A11	0	4	0						7.4	38.4	54.2	38.2	c-sic	1.6		54.0	33.7	20.3	
A12	4	6	0	insufficient soil					-	-	37.4	27.8	-	<1.0		77.9	59.6	18.3	
B2	6	19	0						5.2	40.0	54.8	41.3	c	1.7		44.6	23.8	20.8	
B3	19	26	0						30.9	36.2	32.9	23.8	cl	1.6		28.6	12.0	16.6	
IIC1	26	50+	0						44.3	37.4	18.3	13.3	l	1.5		21.7	7.1	14.6	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm. Phosphorus in the soil [6]	EXTRACTABLE CATIONS (me./100 grams soil) [7] H	Ca	Mg	Na	K	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) [9] Ca	Mg	Na	K	EC x 10^3 (mmhos/cm)	% Na Saturation
A11	5.8	-	5.7		10.4	12.9	1.6	0.5	40.0	63.5	6.81	.562	12						
A12	6.2	-	1.1	insufficient soil					-	-	14.90	1.28	12						
B2	6.6	-	3.6		9.1	14.3	2.3	0.6	32.0	82.2	2.58	.219	12						
B3	7.5	0	1.4		6.2	7.5	2.3	0.2	17.5	92.6	.718	.058	12						
IIC1	7.6	0	3.2		5.3	4.2	1.6	0.1	12.5	89.6	.316	.030	11						

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 1N AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory University of California, Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series CARLOTTA - Ca (Type Location) Location SE Cor. NE 1/4 Sec. 36 T2N R1E HBM
Sample No. 64-Calif-12-5
Lab. No. 375 County Humboldt

Date Sampled 9/4/64
Date Reported 11/18/64
Analyst WRA, CL, LR

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION % Sand (mm.) VCS 2.0mm. to 1.0mm.	CS 1.0mm. to 0.5mm	MS 0.5mm. to 0.25mm	FS 0.25mm. to 0.10mm.	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50µ -2µ	% Clay <2µ	% Clay <1µ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
A11	0	7	4						39.4	35.6	25.0	15.8	l	-		32.6	15.8	16.8	
A12	7	14	7						40.0	33.3	26.7	19.8	l-cl	1.5		26.4	11.4	15.0	
B1	14	32	2						40.9	36.5	22.6	17.6	l	1.5		22.2	9.3	12.9	
B2	32	52	1						48.0	31.5	20.5	15.6	l	1.6		20.1	8.4	11.7	
IIC1	52	+	gravel not sampled																

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	EXTRACTABLE CATIONS (me./100 grams soil) H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
A11	5.8	-	3.0		13.1	2.2	0.1	0.7	30.0	53.7	5.38	.255	21						
A12	5.6	-	2.0		7.7	1.4	0.1	0.4	21.5	44.6	2.61	.132	20						
B1	4.9	-	16.7		2.7	0.2	0.1	0.1	18.0	17.2	1.05	.062	17						
B2	4.6	-	17.7		2.4	2.3	0.2	0.1	19.0	26.3	.425	.041	10						
IIC1			gravel not sampled																

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

REMARKS: *Charcoal present A1 and A3

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series ETTERSBERG - Et (Type Location) Location Honeydew area: SW Cor. NW 1/4, Sec. 28 T2S R1W HBM
Sample No. 64-Calif-12-1
Lab. No. 330 County Humboldt
Date Sampled 1964
Date Reported Sept. 1964
Analyst WRA, CL, et.al.

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL[1]	VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay <2μ	% Clay <1μ[3]	TEXTURE Lab.[2]	Bulk Density g/cc.[4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.[5]	% Moisture at Saturation
Ap1	0	8	<1						43.6	31.7	24.7	18.5	l	1.4		28.4	10.6	17.8	
A12	8	22	1						45.6	38.0	16.4	21.5	l	1.3		24.2	10.1	14.1	
C1	22	36	3	0.7	2.4	10.9	28.0	13.8	55.8	27.8	16.4	11.2	sl	1.8		18.7	7.9	10.8	
C2	36	49	11						49.4	31.1	19.5	13.3	l	1.9		18.1	10.0	8.1	
IIC3	49+		River gravels not sampled																

(PARTICLE SIZE DISTRIBUTION: % Sand (mm.); MOISTURE RETENTION DATA: % Moisture Retained)

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil[6]	H	Ca	Mg	Na	K[7]	Cation Exchange Capacity (me./100 grams soil)[8]	% Base Saturation	% Organic Carbon	% Organic Nitrogen	C/N	Ca	Mg	Na	K	EC x 10^3 (mmhos/cm)[9]	% Na Saturation
Ap1	4.7	0	22.6		0.7	0	0.2	0.4	20.2	6.4	2.65	.189	14						
A12	4.7	0	10.5		0.8	0	0.2	0.4	20.0	7.0	1.61	.123	13						
C1	5.0	0	6.2		3.6	1.1	0.2	0.1	15.0	33.3	.404	.047	9						
C2	5.0	0	9.6		6.0	1.6	0.2	0.2	16.5	48.5	.295	.020	15						
IIC3			River gravels not sampled																

(EXTRACTABLE CATIONS (me./100 grams soil): H, Ca, Mg, Na, K; ORGANIC MATTER; WATER SOLUBLE CATIONS (me./liter): Ca, Mg, Na, K, EC)

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory, University of California, Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series FERNDALE - Fe (Type Location) Location Center NW 1/4 Date Sampled 11/6/62

Sample No. 62-Calif-12-13 Sec. 4 T2N R1W HBM Date Reported 1/63 - 6/63

Lab. No. 233 County Humboldt Analyst WRA, LD

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL[1]	PARTICLE SIZE DISTRIBUTION[2] % Sand (mm.) VCS 2.0mm. to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm. to 0.25mm	FS 0.25mm. to 0.10mm	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50μ -2μ	% Clay[3] <2μ	% Clay <1μ	TEXTURE Lab.	Bulk Density g/cc.[4]	MOISTURE RETENTION DATA[5] % Moisture Retained Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
Ap1	0	7							10.7	68.5	20.8	15.1	sil	1.5		33.7	11.3	22.4	
A12	7	13							12.7	66.8	20.5	14.8	sil	2.0		28.0	9.8	18.2	
A13	13	21							4.5	75.3	20.2	14.7	sil	1.7		32.4	9.8	22.6	
	21	29							1.8	76.7	21.5	16.1	sil	1.7		34.1	10.0	24.1	
C1	29	37							3.1	84.1	12.8	8.5	sil	1.5		33.6	7.2	26.4	
	37	45							1.1	74.1	24.8	16.9	sil	1.5		36.6	10.5	26.1	
C2	45	61							28.4	61.7	9.9	8.3	sil	1.8		20.8	5.2	15.6	
C3	61	80+		0	0.1	0.2	65.1	18.3	83.7	6.6	9.7	8.4	fsl	1.6		7.5	3.8	3.7	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil[6]	EXTRACTABLE CATIONS[7] (me./100 grams soil) H	Ca	Mg	Na	K	Cation Exchange Capacity (me./100grams soil)[8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS[9] (me./liter) Ca	Mg	Na	K	EC x 10^3 (mmhos/cm)	% Na Saturation
Ap1	5.8		3.3		11.2	4.2	0.2	0.3	21.0	75.8	2.14	.178	12					0.47	
A12	6.2		0.8		10.0	4.2	0.2	0.5	18.0	82.8	1.31	.114	11					0.33	
A13	6.4		0.2		9.4	7.1	0.2	0.2	20.3	83.3	1.14	.089	13					0.31	
	6.5		0.2		11.6	4.8	0.2	0.2	21.0	80.0	1.17	.091	13					0.28	
C1	6.6		0.8		9.7	4.1	0.3	0.2	17.3	82.7	.75	.058	13					0.31	
	6.6		0.2		12.2	4.7	0.3	0.2	21.5	81.0	1.15	.091	13					0.29	
C2	6.7		0.2		7.4	3.2	0.2	0.1	13.0	83.9	.56	.043	13					0.24	
C3	6.7		0.6		5.2	2.1	0.2	0.1	8.0	95.0	.33	.024	14					0.23	

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 1N AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory, University of California, Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series HONEYDEW - Hd (Type Location) Location SE Cor. NE 1/4, NE 1/4 Sec. 6 T3S R1E HBM
Date Sampled 1964
Sample No. 64-Calif-12-3
Date Reported Sept. 1964
Lab. No. 331 County Humboldt
Analyst WRA, CL, et.al.

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	% Sand VCS 2.0mm. to 1.0mm.	% Sand CS 1.0mm. to 0.5mm.	% Sand MS 0.5mm. to 0.25mm.	% Sand FS 0.25mm. to 0.10mm.	% Sand VFS 0.10mm. to 0.05mm.	% Sand TOTAL 2.0mm. to 0.05mm.	% Silt 50μ-2μ	% Clay <2μ	% Clay <1μ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
Ap1	0	6	-						43.2	31.1	25.7	19.5	1	1.7		19.8	9.4	10.4	
A12	6	25	23						38.8	36.6	24.6	18.5	1	1.6		19.7	10.6	9.1	
C1	25	38	25						39.6	33.7	26.7	20.5	1	1.6		19.7	9.7	10.0	
C2	38	56	-						39.6	38.5	21.5	16.4	1	1.6		17.8	8.2	9.6	
C3	56	72+	23						39.2	37.2	23.6	17.4	1	1.9		17.3	8.1	9.2	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm. Phosphorus in the soil [6]	Extractable Cations (me./100 grams soil) H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100grams soil) [8]	% Base Saturation	% Organic Carbon	% Organic Nitrogen	C/N	Water Soluble Cations (me./liter) Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
Ap1	5.0		15.1		5.0	0.8	0.2	0.4	15.5	41.3	1.64	.169	10						
A12	5.0		13.9		6.4	0.8	0.2	0.3	16.2	47.6	1.05	.123	8						
C1	5.1		11.7		6.8	1.1	0.2	0.3	13.8	60.7	.742	.099	7						
C2	5.0		10.0		7.0	1.2	0.2	0.3	11.8	73.7	.455	.078	6						
C3	5.2		9.6		8.2	1.4	0.2	0.3	11.1	91.0	.369	.077	5						

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory, University of California, Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series HOOKTON - Hk (Type Location) Location Center Sec. 18 T2N R1E HBM

Sample No. 63-Calif-12-4

Lab. No. 238 County Humboldt

Date Sampled 1/17/63

Date Reported 1/63 - 6/63

Analyst WRA, LD

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	% Sand (mm.) VCS 2.0 mm. to 1.0 mm	CS 1.0 mm. to 0.5 mm	MS 0.5 mm. to 0.25 mm.	FS 0.25 mm. to 0.10 mm.	VFS 0.10 mm. to 0.05 mm.	TOTAL 2.0 mm. to 0.05 mm.	% Silt 50µ–2µ	% Clay <2µ	% Clay <1µ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
A11	0	11	-						16.0	56	28	20	sicl-	1.3		35.9	16.1	19.8	
A12	11	19	-						14.0	57	29	21	sicl-	1.2		31.5	14.3	17.2	
AC	19	28	-						14.0	56	30	23	sicl	1.7		26.2	11.5	14.7	
C1	28	56	-						15.0	52	33	27	sicl	-		25.9	12.4	13.5	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Extractable Cations (me./100 grams soil) H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	Organic Matter % Organic Carbon	% Organic Nitrogen	C/N	Water Soluble Cations (me./liter) Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
A11	5.5		62.8		4.8	1.9	0.2	0.9	20.8	37.5	5.26	.392	13						
A12	5.2		21.4		3.4	1.2	0.2	0.5	28.5	18.6	3.58	.272	13						
AC	5.3		40.2		1.6	1.0	0.2	<0.1	16.5	17.6	1.04	.103	10						
C1	5.0		17.8		1.5	2.4	0.2	0.1	15.0	28.0	0.49	.072	7						

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series KERR - Kr (Type Location) Location NE Cor. of SW 1/4 Sec. 34 T11N R1E HBM

Sample No. 63-Calif-12-17

Lab. No. 328 County Humboldt

Date Sampled 1963

Date Reported Sept. 1964

Analyst WRA, CL, et.al.

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	VCS 2.0mm. to 1.0mm	CS 1.0mm. to 0.5mm	MS 0.5mm. to 0.25mm	FS 0.25mm. to 0.10mm.	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50μ - 2μ	% Clay < 2μ	% Clay [3] < 1μ	TEXTURE [2] Lab.	Bulk Density g/cc. [4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
Ap1	0	11							46.0	39.8	14.2	8.1	l	1.6		28.0	5.5	22.5	
A12	11	25							15.7	67.0	17.3	12.2	sil	-		34.6	6.9	27.7	
IIC1	25	44		0.2	3.3	11.1	39.4	20.5	74.5	22.5	3.0	2.0	lfs	1.8		9.4	2.8	6.6	
IIC2	44	50							26.3	62.5	11.2	8.1	sil	1.6		34.0	5.5	28.5	
IVC3	50	58+		0.2	0.3	0.3	15.2	37.1	53.1	37.8	9.1	6.1	lvfs	1.4		23.9	3.9	20.0	

Particle Size Distribution: % Sand (mm.); Moisture Retention Data: % Moisture Retained

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	% Organic Carbon	% Organic Nitrogen	C/N	Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
Ap1	4.6		6.4		1.9	0.1	0.1	0.1	10.0	22.0	1.51	.159	10						
A12	4.8		16.2		1.9	0.7	0.1	0.1	12.5	22.4	.911	.106	9						
IIC1	5.0		7.2		1.5	0.9	0.1	< .1	4.5	5.8	.385	.064	9						
IIC2	5.2		8.4		3.6	0.8	0.2	< .1	11.0	42.7	.585	.085	7						
IVC3	5.3		11.4		3.0	0.7	0.2	< .1	10.0	40.0	.504	.073	7						

Extractable Cations (me./100 grams soil); Organic Matter; Water Soluble Cations (me./liter)

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 1N AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory, University of California, Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series LOLETA - Lo (Type Location) Location SE Cor. NE 1/4 Sec. 3 T2N R2W HBM

Sample No. 62-Calif-12-3

Lab. No. 223 County Humboldt

Date Sampled 9/18/62

Date Reported 1/63 - 6/63

Analyst WRA, LD

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay <2μ	% Clay <1μ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
A	0	11							46.2	34.9	18.9	13.5	l	1.6		25.9	18.5	7.4	
B1	11	22							38.6	46.3	15.1	10.8	l	1.6		19.7	12.1	7.6	
B2	22	34							25.5	49.6	24.9	17.7	l	1.6		29.3	19.8	9.5	
B3	34	50							49.4	36.1	14.5	10.6	l	1.7		21.9	12.3	9.6	
C1	50	60							40.8	41.6	17.6	12.3	l	1.7		24.2	13.6	10.6	
IIC2	60	74		0	0	7.6	50.9	28.6	87.1	6.2	6.7	5.2	lfs	1.6		7.6	5.4	2.2	
IIIC3	74	82+							40.1	43.4	16.5	12.6	l	1.7		27.1	13.3	13.8	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100grams soil) [8]	% Base Saturation	% Organic Carbon	% Organic Nitrogen	C/N	Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
A	5.4		16.9		3.3	3.2	0.2	0.2	17.8	38.8	2.44	.209	12						
B1	6.5		18.8		3.4	4.6	0.2	0.2	11.5	73.0	0.47	.092	5						
B2	5.8		13.2		5.0	8.4	0.4	0.2	18.8	74.5	0.56	.061	9						
B3	6.5		12.8		3.3	7.0	0.4	0.1	13.0	83.1	0.32	.047	7						
C1	6.5		13.8		3.4	8.1	0.4	0.2	14.8	81.8	0.44	.035	13						
IIC2	6.5		-		1.4	3.8	0.2	0.1	7.3	75.3	0.18	.018	10						
IIIC3	6.2		17.3		3.0	7.0	0.3	0.2	12.8	82.0	0.80*	.019	-						

Extractable cations in me./100 grams soil; Organic Matter columns: % Organic Carbon, % Organic Nitrogen, C/N; Water Soluble Cations in me./liter.

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: *Pieces of wood or charcoal present

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series ROHNERVILLE - Ro (Type Location) Location NE Cor. SE 1/4, NW 1/4

Sample No. 62-Calif-12-14 Sec. 20 T2N R1E HBM

Lab. No. 234 County Humboldt

Date Sampled 12/62/62

Date Reported 1/63 - 6/63

Analyst WRA, LD

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	VCS 2.0mm. to 1.0mm.	CS 1.0mm. to 0.5mm	MS 0.5mm. to 0.25mm.	FS 0.25mm. to 0.10mm.	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50μ -2μ	% Clay <2μ	% Clay <1μ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
			*																
A11	0	9							15.2	53.1	31.7	23.2	sicl	1.6		30.4	13.7	16.7	
A12	9	18							14.3	52.2	33.5	25.0	sicl	1.5		30.2	13.2	17.0	
A3	18	28							14.3	51.5	34.2	27.6	sicl	1.4		25.4	13.0	12.4	
B2	28	48							16.8	43.4	39.8	33.5	sic	-		24.7	14.8	9.9	
B3	48	58							+	+	+	+	-	-		23.0	14.4	8.6	
C1	58	65+							24.8	42.8	32.4	27.0	cl	-		27.6	13.3	14.3	

(Particle size distribution: % Sand (mm.) VCS–VFS, TOTAL; Moisture retention data: % Moisture Retained — Moisture Equivalent, 1/3 Atm., 15 Atms.)

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm. Phosphorus in the soil [6]	H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100grams soil) [8]	% Base Saturation	% Organic Carbon	% Organic Nitrogen	C/N	Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
A11	5.4		38.1		4.7	2.9	0.3	0.1	30.5	26.2	3.92	0.153	26						
A12	5.4		17.7		3.0	2.2	0.3	0.1	28.0	20.0	2.85	0.109	26						
A3	5.3		32.5		1.7	1.5	0.2	0.1	21.0	16.7	1.41	0.064	22						
B2	5.5		86.5		2.6	4.9	0.2	0.1	18.0	43.3	0.47	0.048	10						
B3	5.7		+		3.5	5.7	0.3	0.1	+	-	0.42	+	-						
C1	5.8		-		2.0	3.8	0.3	0.1	18.8	33.0	0.40	0.051	8						

(Extractable cations (me./100 grams soil): H, Ca, Mg, Na, K; Organic matter: % Organic Carbon, % Organic Nitrogen, C/N; Water soluble cations (me./liter): Ca, Mg, Na, K, EC)

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: + Out of soil
* % Gravel - not determined

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series RUSS - Ru (Type Location) Location NE Cor., SW 1/4, SW 1/4 Date Sampled 11/3/63

Sample No. 62-Calif-12-11 Sec. 1 T2N R2W HBM Date Reported 1/63 - 6/63

Lab. No. 231 County Humboldt Analyst WRA, LD

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	% Sand (mm.) VCS 2.0mm. to 1.0mm	CS 1.0mm. to 0.5mm	MS 0.5mm. to 0.25mm	FS 0.25mm. to 0.10mm	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50μ -2μ	% Clay <2μ	% Clay <1μ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	% Moisture Retained: Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
A1	0	8							32.3	50.3	17.4	13.7	1	1.7		25.6	9.5	16.1	48.6
C1	8	53							42.4	43.6	14.0	8.6	1	1.4		17.9	5.7	12.2	47.6
C2	53	70							38.6	45.6	15.8	11.6	1	1.6		25.3	7.4	17.9	42.3

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Extractable Cations (me./100 grams soil) [7] H	Ca	Mg	Na	K	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	Organic Matter % Organic Carbon	% Organic Nitrogen	C/N	Water Soluble Cations (me./liter) [9] Ca	Mg	Na	K	EC x 10^3 (mmhos/cm)	% Na Saturation
A1	5.2		32.6		6.1	3.9	0.2	0.7	18.0	60.6	2.15	.132	16					.64	
C1	5.0		4.3		4.9	5.4	0.2	0.4	10.8	x101.0	0.34	.077	4					.98	
C2	5.7		4.2		5.5	5.9	0.3	0.2	13.8	86.2	0.45*	.039	*					.23	

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: * Contains charcoal

x %Base Saturation is calculated from the extractable cations and will therefore show a high value when the soluble salts are high.

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series TIMMONS - Ti (Type Location) Location Center NE 1/4, SE 1/4 Sec. 2 T6N R1E HBM
Sample No. 63-Calif-12-10
Lab. No. 304 County Humboldt
Date Sampled 1963
Date Reported Sept. 1964
Analyst WRA, CL, et.al.

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	% Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50µ -2µ	% Clay <2µ	% Clay <1µ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	Moisture Equivalent	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
A11	0	10	14						26.6	39.6	33.8	26.6	cl	1.41		34.6	16.1	18.5	
A3	10	26	13						25.9	37.0	37.1	29.9	cl	1.25		30.9	14.6	16.3	
B1	26	35	13						25.6	33.4	41.0	32.8	c	1.60		26.2	14.9	11.3	
B2	35	49	11						26.3	30.6	43.1	35.9	c	1.65		26.8	15.3	11.5	
B3	49	59	12						31.6	32.6	35.8	28.3	cl	-		30.2	13.8	16.4	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Extractable Cations (me./100 grams soil) H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100 grams soil) [8]	% Base Saturation	% Organic Carbon	% Organic Nitrogen	C/N	Water Soluble Cations (me./liter) Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
A11	5.5		4.9		3.6	0.6	.2	.3	26.0	18.1	4.98	.281	18						
A3	5.4		12.3		1.9	0	.2	.2	22.4	10.3	2.50	.140	18						
B1	5.1		15.6		1.0	0	.1	.1	16.0	7.5	.616	.077	8						
B2	4.9		28.4		1.0	0	.1	.1	17.0	7.1	.478	.082	6						
B3	5.0		41.6		0.5	0	.1	.1	19.0	3.7	.639	.089	7						

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 1N AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory, University of California, Davis

REMARKS:

Table 2.- PHYSICAL AND CHEMICAL SOIL ANALYSES - Continued

Soil Series WILDER VARIANT - Wv (Type Location) Location NE Cor., SE 1/4, SE 1/4 Sec. 16 T1S R2W HBM
Sample No. 63-Calif-12-16
Lab. No. 329 County Humboldt
Date Sampled 1963
Date Reported Sept. 1964
Analyst WRA, CL, et.al

HORIZON SYMBOL	DEPTH (in.) From	DEPTH (in.) To	% GRAVEL [1]	% Sand (mm.) VCS 2.0mm. to 1.0mm	CS 1.0mm. to 0.5mm	MS 0.5mm. to 0.25mm	FS 0.25mm. to 0.10mm	VFS 0.10mm. to 0.05mm.	TOTAL 2.0mm. to 0.05mm.	% Silt 50µ -2µ	% Clay <2µ	% Clay <1µ [3]	TEXTURE Lab. [2]	Bulk Density g/cc. [4]	Moisture Equivalent	% Moisture Retained 1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms. [5]	% Moisture at Saturation
A11	0	9	22						39.4	34.4	26.2	21.0	l	1.4		35.5	19.3	16.2	
A12	9	34	33						37.0	32.8	30.2	22.9	cl	1.4		36.5	13.7	22.8	
C1	34	41	23						34.1	35.9	30.0	22.7	cl	1.5		28.8	12.1	16.7	
C2	41	55	68	Insufficient soil					-	-	-	-	-	2.0		22.0	10.8	11.2	

HORIZON SYMBOL	pH Glass electrode (saturated paste)	% Carbonates	ppm. Phosphorus in the soil [6]	Extractable Cations (me./100 grams soil) H	Ca	Mg	Na	K [7]	Cation Exchange Capacity (me./100grams soil) [8]	% Base Saturation	Organic Matter % Organic Carbon	% Organic Nitrogen	C/N	Water Soluble Cations (me./liter) Ca	Mg	Na	K	EC x 10^3 (mmhos/cm) [9]	% Na Saturation
A11	4.7		19.8		0.9	1.0	0.3	1.2	34.5	9.9	6.42	.489	13						
A12	5.6		7.2		<.1	<.1	0.2	0.5	28.2	3.2	3.79	.315	12						
C1	4.7		4.3		<.1	<.1	0.2	0.3	19.2	3.6	2.09	.195	11						
C2	4.6		11.4		<.1	<.1	0.2	0.1	13.0	3.8	.773	.100	8						

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL < 2 MM.
3 HYDROMETER METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE

Analyses by Soil Morphology Laboratory, University of California, Davis

REMARKS:

APPENDIX II: FERTILITY ANALYSES

The technique of determining the fertility level of soils by use of greenhouse pot tests[1] has been employed by the University of California, College of Agriculture for many years. This tool is helpful in determining (1) the fertilizer requirements of soils and (2) the need for further investigation under field conditions.

Soil samples collected in Humboldt County were brought into the greenhouse for testing. The soils were prepared by air drying and sieving through a ¼ inch screen to remove the gravels larger than ¼ inch. 1600 grams of the air dry soil were placed in 6 inch clay pots. The pots were painted on the outside with aluminum paint and the interior was lined with a plastic bag with the bottom cut to provide drainage, then twisted to prevent loss of soil.

Soils were tested for their degree of acidity or alkalinity. Those soils with an acidity of pH 4.5 or less received the equivalent of 3 tons of lime per acre 6 inches; soils with a pH of 5.0 to 4.5 received 2 tons of lime. Chemically pure lime ($CaCO_3$) was mixed thoroughly with the soil prior to potting. After planting the seeds, nutrients were added in liquid form. The soils were irrigated with distilled water whenever necessary during the growing period.

As a means of determining the nutrient supplying capabilities of the soil, a series of six treatments was used. The check, which contained no added nutrients; the complete, which contained nitrogen, phosphorus, potassium, and sulfur; minus nitrogen; minus phosphorus; minus potassium; and minus sulfur. Further tests are performed when nutrient deficiency symptoms are observed on the leaves of the "complete treatment".

The following salts, in chemically pure form, were used as fertilizers: for nitrogen, ammonium nitrate; phosphorus, mono calcium phosphate; potassium, potassium chloride, and for sulfur sodium sulfate.

The indicator crops used in these experiments included barely, oats, and tomatoes. Five seedlings of grain or 3 seedlings of tomatoes were left in each pot after thinning. They were grown for a period of 42 days from the time of planting. The plants were then harvested and dried at 70° centigrade, then weighed. The dry weight of the complete treatment was considered as 100 percent growth. The oven dry weight of the other treatments was compared with the complete treatment to determine the percent relative yield for each treatment.

Fourteen agricultural soils from Humboldt County were selected for fertility investigations. Of these, 12 were found to be acutely deficient in phosphorus, 3 were low in nitrogen, 4 were low in sulfur. Response to potassium fertilization was insignificant.

The response to fertilization in the greenhouse is more pronounced than one generally obtains in the field. For this reason it is a good practice to establish a field plot after observation of deficiencies in the greenhouse in order to determine more accurately the need and rate of the fertilizers to be applied under field conditions.

Field response to applications of phosphorus are possible on those soils which indicated a very low nutrient level of phosphorus, and responses to nitrogen are likely on the soils which indicated a low level of nitrogen. Although the nutrient level of sulfur is low, it is suggested that field plots be established before extensive appli-

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[1] Greenhouse Assay of Fertility of California Soils, H. Jenny et.al., Hilgardia Vol. 20, Number 1, May 1950

cation of a sulfur containing fertilizer is undertaken.

Of the 14 soils tested, 4 were sufficiently low in pH to require liming. Wilder received an equivalent of 3 tons per acre 6 inch of lime and the response was significant. Russ also responded with an application of 2 tons of lime. There were only moderate responses on the Loleta and Rohnerville soils when treated with 2 tons of lime.

Table 3 summarizes the nutrient levels obtained from our studies. It is an average value considering both barely and tomatoes. The oat crop was grown to confirm a potential micro nutrient deficiency of copper observed on barley plants grown on the Rohnerville soil. However, further testing is needed before field recommendations can be made.

Additional experiments on the Wilder variant soil showed that a magnesium induced calcium deficiency could result when the equivalent of 1 ton of magnesium carbonate was applied.

Table 3. Nutrient levels

Soil Series	pH	Nitrogen	Phosphorus	Potassium	Sulfur
Arcata	5.4	low	very low	very high	low
Arcata	5.6	medium	very low	very high	low
Bayside	5.6	high	very low	high	high
Ettersberg*	5.1	high	very low	high	high
Ferndale	7.0	high	high	very high	very high
Ferndale	8.0	low	very low	very high	very high
Ferndale	5.0	medium	very low	very high	very high
Hookton	5.4	medium	very low	high	medium
Kerr	5.6	high	low	very high	very high
Loleta*	5.2	medium	very low	high	low
Rohnerville*	5.1	very high	very low	very high	very high
Russ	5.9	high	very low	very high	very high
Timmons	5.5	medium	very low	very high	low
Wilder*	4.5	low	very low	medium	medium

*$CaCO_3$ added to treatments

APPENDIX III: DETAILED SOIL SERIES DESCRIPTIONS

ARCATA SERIES - Ar

The ARCATA series consists of deep, coarse to medium textured, dark brown, well drained, brunizemic alluvial soils developing on high marine terraces. They are medium acid in the solum and exhibit very little profile development. The ARCATA soils are associated with the Hely and Empire soils, and are similar to the Ettersberg, Hookton, and Wilder soils. The Ettersberg soils are very strongly acid throughout and have a dense, hard subsoil. The Hookton soils are formed on gently sloping to steep slopes of similar marine terraces. They are shallower and finer textured than the Arcata soils. The Wilder soils are formed on gently sloping to steep, hard sandstone under bracken fern. They are very strongly acid throughout and of low fertility. The ARCATA soils occur on smooth, nearly level marine terraces from 50 to 200 feet in elevation in a humid mesothermal climate, having a mean annual temperature of 52°F., an average July temperature of 56°F., and an average January temperature of 47°F. The mean summer temperature differs from the mean winter temperature by less than 9°F. Mean annual precipitation is from 45 to 55 inches which falls mainly between September and May. The summers are usually rainless but quite foggy and the winters are mild and wet. Frost free season is more than 300 days.

Soil Profile: Arcata fine sandy loam.

On smooth, flat, high marine terrace about 1½ miles from the Pacific Ocean.

A11 0-10" Brown to dark brown (10 YR 4/3), fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; abundant fine and very fine and few medium roots; many krotovinas; slightly acid (pH 6.1); gradual, irregular boundary. 8 to 15 inches thick.

A12 10-23" Brown (10YR 5/3), fine sandy loam, dark brown (10YR 3/3) when moist; weak, coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; abundant very fine and few medium roots; many krotovinas; medium acid (pH 6.0); gradual, irregular boundary. 8 to 18 inches thick.

AC 23-47" Very pale brown (10YR 7/4), fine sandy loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine and very fine roots in the matrix, abundant fine and very fine roots in the krotovinas; medium acid (pH 6.0); abrupt, smooth boundary. 20 to 30 inches thick.

C 47-60"+ Pale yellow (2.5Y 7/4), fine sandy loam, yellowish brown (10YR 5/6) with light gray (10YR 7/1) and strong brown (7.5YR 5/8) mottles; massive; slightly hard, firm nonsticky and nonplastic; strongly acid (pH 5.5).

Range in Characteristics:

Dominant texture is fine sandy loam, but ranges to loam. Color in the A horizons range from 10YR to perhaps 1 or even 2 units redder. Moist values range from 2 to 3 and dry values from 5 to 6. Chromas range from 1 to 2. The C horizon hues range from 10YR to 7.5YR, dry values range from 6 to 7, wet values range from 4 to 5 and chromas range from 1 to 8 if mottled and 4 to 6 not mottled.

Topography:
Nearly level high marine terraces. Slopes are usually less than 4 percent.

Drainage and Permeability:
Well drained. Runoff is medium, permeability is moderately rapid.

Present Vegetation:
Spruce, sweet vernal grass, wild oats, annual fescues, huckleberry and salal.

Use:
Predominately pasture and some flower bulb production.

Distribution:
High marine terraces along the north coast of California.

Type Location:
McKinleyville area, Humboldt County, California. NW ¼, SE ¼, Sec. 30, T.7N., R1E., HBM.

Series Proposed:
Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Town in central Humboldt County on the coast.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Alluvial
New System of Soil Classification: Entic Cumulic Haplumbrept, coarse loamy, nonacid, mixed, isomesic.

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BAYSIDE SERIES - Ba

The BAYSIDE series consists of deep, poorly drained, moderately fine textured low humic gley soils formed in sedimentary rock alluvium. The sedimentary rock is principally graywhacke and sandstone. The profile is characteristically slightly acid to medium acid in the surface horizon and mildly to moderately alkaline in the subsoil. BAYSIDE soils are associated with the Ferndale, Russ, and Loleta soils. The Russ, Loleta, and BAYSIDE soils form a drainage catena on alluvial fans. The Russ is a young alluvial soil, well to moderately well drained. The Loleta is a Humic Gley soil that is moderately well to imperfectly drained. BAYSIDE soils occur at elevations from sea level to about 50 feet in a humid mesothermal climate having a mean annual temperature of about 53°F., with an average January temperature of 47°F., and an average July temperature near 56°F. Mean summer and winter temperatures differ less than 9°F. Mean annual precipitation is from 35 to 50 inches most of which falls from September to May. Winters are cool and wet and summers are foggy but rainless.

Soil Profile: Bayside silty clay.
A smooth, flat basin about 1 mile from the Pacific Ocean under bent grass and rush.

A11 0-4" Gray (10YR 5/1) silty clay with few fine prominent reddish brown (5YR 4/4) mottles, very dark gray (7.5YR 3/0) with brown (7.5YR 4/4) mottles when moist; strong medium prismatic structure; hard, very firm, sticky and slightly plastic; many very fine and few medium roots; common fine interstitial pores; slightly acid (pH 6.2); gradual wavy boundary 3 to 7 inches thick.

A12 4-6" Very dark gray (10YR 3/1) wet or dry, muck layer; medium acid (pH 5.8) gradual wavy boundary. ½ to 3 inches thick.

B2 6-19" Light gray (7.5YR 7/0) clay with many fine prominent strong brown (7.5YR 5/8) mottles, dark gray (2.5Y 4/0) with strong brown (7.5YR 5/6) mottles when moist; strong coarse prismatic structure; hard, very firm, sticky and slightly plastic; plentiful fine and very fine roots; common very fine and many micro tubular pores; common moderately thick clay films on ped faces and many thick clay films in tubular pores; neutral (pH 7.0); gradual, irregular boundary. 12 to 20 inches thick.

B3 19-26" Gray to light gray (10 YR 6/1) clay loam with many fine prominent strong brown (7.5YR 5/6) mottles; gray (2.5 Y 5/0) with yellowish brown (10YR 5/6) mottles when moist; strong, coarse, prismatic structure; hard, very firm, slightly sticky and slightly plastic; few fine roots; common very fine and many micro tubular pores; common moderately thick clay films on ped faces and many moderately thick clay films in tubular pores; mildly alkaline (pH 7.4); gradual, irregular boundary. 4 to 11 inches thick.

IIC1 26-50"+ Gray to light gray (5Y 6/1) loam with many medium, distinct, brownish yellow (10YR 6/6) mottles, gray (2.5Y 5/0) with yellowish brown (10 YR 5/8) when moist; massive; soft, friable, nonsticky and nonplastic; many micro tubular pores; moderately alkaline (pH 8.0).

Range in Characteristics:

Surface textures range from silty clay to silty clay loam. Colors in the All range in hue from 10YR to 2.5Y; values range from 5 to 6 when dry and 3 to 4 when moist; chromas range from 0 to 1. Structure in the All ranges from strong medium prismatic to massive. Reaction in the A horizons ranges from medium acid to slightly acid. Colors are essentially neutral grays in the matrix while mottles range from 5YR to 10YR in hue. Values range from 4 to 6 when wet and 5 to 6 when dry. Chromas are usually 0 in the matrix but are occasionally 1. Chromas range from 5 to 8 in the mottles. The depth of the profile varies from 20 to 40 inches but is usually from 22 to 30 inches deep.

Topography:

Depressed areas between small streams and in reclaimed tidal marsh areas. Flat and smooth.

Drainage and Permeability:

Drainage is poor and runoff is slow, permeability is moderately slow to slow.

Present Vegetation:

Silverweed, bent grass and bull rush in the reclaimed tidal marsh areas. Domestic ladino or salina clover, and orchard or rye grass in areas between small streams.

Use:

Permanent unirrigated pasture and grass hay crops of considerable quantity.

Distribution:

Basins and reclaimed tidal marsh areas along the north coast of California.

Type Location:

On reclaimed tidal marsh near Russ Creek drainage approximately 1 mile from the ocean and about ½ mile north of Centerville Beach road. SE corner NE ¼, Sec. 32, T.3N., R.2-W., HBM.

Series Revised:

Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Low Humic Gley
New System of Soil Classification:
Aquic Dystric Eutrochrept or Tropepts, fine mixed, nonacid, isomesic.

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CARLOTTA SERIES - Ca

The CARLOTTA series consists of deep, moderately well drained, medium textured, minimal podzolic soils developing in sedimentary rock alluvium. The parent material is high in quartz or quartzite and graywhacke or shale. The A horizons are usually slightly to medium acid and the deep B horizons are usually strongly acid. CARLOTTA soils are associated with Ferndale soils and they are similar to the Ettersberg soils. The Ferndale soils are less acid, lack a B2 horizon, and occur in a flood plain position. The Ettersberg soils are somewhat darker in the A horizon, lack a B2 horizon, are very strongly acid throughout and are better drained. CARLOTTA soils occur at elevations of 50 to 500 feet in a humid mesothermal climate. Summers are cool and foggy but rainless. Winters are wet and mild. The mean annual temperature is from 54 to 57°F., with an average January temperature of about 45°F., and an average July temperature of about 64°F. Mean annual precipitation ranges from 50 to 70 inches, most of which falls from September to May.

Soil Profile: Carlotta loam.
Under dense redwood canopy.

A11 0-7" Grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; strong very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; plentiful fine and medium coarse roots; common very fine interstitial pores; slightly acid (pH 6.2); clear, smooth boundary. 6 to 10 inches thick.

A12 7-14" Brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) when moist; strong fine subangular blocky structure; slightly hard, friable nonsticky and nonplastic; abundant fine, medium, and coarse roots; common very fine interstitial and few very fine vesicular pores; medium acid (pH 5.8); clear, smooth boundary. 10 to 16 inches thick.

B1 14-32" Light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak fine subangular structure; hard, firm, nonsticky and nonplastic; abundant fine, medium, and coarse roots; very strongly acid (pH 5.0); clear, smooth boundary. 16 to 20 inches thick.

B2 32-52" Light brownish gray (2.5Y 6/2) loam with many fine to medium distinct light brown (7.5YR 6/4) mottles, gray to light gray (10YR 6/1) with yellowish brown (10YR 5/8) mottles when moist; massive; hard and firm, nonsticky and nonplastic; few fine roots; few fine and very fine vesicular pores; very strongly acid (pH 4.5); abrupt, smooth boundary. 18 to 22 inches thick.

IIC1 52"+ Fine gravel.

Range in Characteristics:
Depth of the A horizons ranges from 8 to 20 inches, color in the B horizons ranges from 7.5YR to 10YR in hue and from 6 to 7 in value when dry and from 4 to 6 moist. Chromas in the B horizons range from 1 to 3. Strata of gravels or cobbles can be found at any depth in the profile.

Topography:
On smooth fairly flat, low terraces of less than 5 percent slope.

Drainage and Permeability:
Moderately well drained. Runoff is medium, permeability moderately rapid in the A horizons and moderate to moderately slow in the B horizon.

Vegetation:
Dominately Redwood, Madrone, tan oak and sparse stands of Douglas fir in gravelly or cobbly areas.

Use:
Timber production and sparse permanent pasture.

Distribution:
North Coast Range Mountains of California on low terrace deposits.

Type Location:
On California State Highway 36 approximately 1 mile southeast of Cuddyback school, south of the highway, 50 feet. SE corner NE¼, Sec. 36, T.2N., R.1E., HBM.

Series Proposed:
Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Town in central Humboldt County on the Van Duzen River.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Podzolic
New System of Soil Classification:
Typic Haplumbrept, fine loamy, mixed, nonacid, mesic.

JCM
3/10/65 National Cooperative Soil Survey USA

ETTERSBERG SERIES - Et

The ETTERSBERG series consists of deep, well drained, medium textured, minimal podzolic soils formed from alluvium of graywhacke and sandstone origin. The parent material is rich in quartz, chert, and shale gravels and cobbles. The soil is very strongly acid. ETTERSBERG soil is associated with Wilder and Honeydew soils. Wilder soils occur on gently sloping to steep slopes of sandstone under bracken fern. They are less fertile than the Ettersberg series. The Honeydew soils are young alluvial soils on fans. They have hues of 2.5Y and have a moderate, very fine granular structure throughout. The ETTERSBERG soils are similar to the Arcata, Hookton, and Wilder soils. The Arcata soils are less acid and have a less dense subsoil. The Hookton soils occur on gently sloping to steep portions of old uplifted dissected marine terraces. They are less acid, higher in organic matter content, and are shallower. ETTERSBERG soils occur at elevations from 100 to 700 feet in a humid, mesothermal climate. Summers are warm and dry; winters are cool and wet. Mean annual temperature is near 57°F., with an average January temperature of 43°F., and an average July temperature of about 71°F. Mean annual precipitation may range from 60 to 120 inches, most of which falls from September to May. Average frost free season is from 200 to 300 days. The soils are used for dryland pasture and a few orchards.

Soil Profile: Ettersberg loam (grass forb pasture).

Ap1 0-8" Grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, very fine granular structure; slightly hard, friable, nonsticky and nonplastic; plentiful medium and abundant very fine roots; very strongly acid (pH 4.8); clear, smooth boundary. 6 to 10 inches thick.

A12 8-22" Grayish brown (10YR 5/2) loam, very dark brown (10YR 3/2) when moist; very weak, very fine granular structure; soft very friable, nonsticky and nonplastic; plentiful very fine and medium roots; very strongly acid (pH 4.8); gradual, wavy boundary. 11 to 17 inches thick.

C1 22-36" Light gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak fine subangular blocky structure; slightly hard, firm, nonsticky and slightly plastic; very few fine roots; very strongly acid (pH 4.8); clear, smooth boundary. 12 to 16 inches thick.

C2 36-49" Light gray (2.5Y 7/2) heavy loam, very dark grayish brown (10YR 4/2) when moist; strong fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; very few fine roots; very strongly acid (pH 4.6); abrupt, smooth boundary. 11 to 15 inches thick.

IIC3 49"+ River gravels of graywhacke, sandstone and chert.

Range in Characteristics:
The thickness of the A horizons will range from 18 to 30 inches, the modal being about 25 inches deep. The structure of the A1 might be massive or weak, very fine granular. The reaction in the A horizon varies from medium acid to very strongly acid. Reactions in the C horizons are always very strongly acid. Structure varies from strong, fine subangular blocky to massive in the C horizons.

Topography:
On smooth fairly flat low terraces less than 5 percent slope.

Drainage and Permeability:
Well drained. Runoff is medium. Permeability is moderately rapid in the A horizon and moderate in the C.

Vegetation:
Rather thin stands of Douglas fir are native, but some areas may have been covered by annual grasses and bracken fern.

Use:
Permanent dryland pasture with a few orchards.

Distribution:
On terraces of the Mattole and Eel Rivers in southern Humboldt County, California.

Type Location:
Honeydew area: SW corner, NW ¼, SW ¼, Sec. 28, T.2S., R.1W, HBM.

Series Proposed:
Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Town in Southern Humboldt, California.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Podzolic
New System of Soil Classification:
Cumulic Entic Haplumbrept, fine loamy, mixed, acid, mesic.

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FERNDALE SERIES - Fe

The FERNDALE series consists of deep, well drained, medium textured alluvial soils on recent flood plains below the coast range sedimentary geologic formations. Parent material for the soil is mixed since the coast range includes sandstones, graywhackes and some ultrabasic intrusive rocks. The entire profile is neutral in reaction. The FERNDALE soils are associated with the Russ and Bayside soils, and are similar to the Russ soils. The Russ soils are more acid throughout and have less organic matter. FERNDALE soils occur at elevations near sea level to about 100 feet in a humid mesothermal coastal climate having a mean annual temperature of 52°F. Average July temperature is 56°F., and an average January temperature is 47°F. The difference between mean winter and mean summer temperatures is less than 9°F. Mean annual precipitation is from about 35 to 45 inches, most of which falls between September and May. The frost free season is 300 days or more. The soils are extensive and important to the agriculture of the area.

Soil Profile: Ferndale silt loam (permanent pasture).

Ap1 0-7" Light brownish gray (10 YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, firm, nonsticky and nonplastic; abundant fine and very fine roots; neutral (pH 7.0) clear, smooth boundary. 5 to 9 inches thick.

A12 7-13" Gray to light gray (10 YR 6/1) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine subangular blocky; soft, friable, nonsticky and nonplastic; abundant fine and very fine roots; neutral (pH 7.2) diffuse, wavy boundary. 5 to 12 inches thick.

A13 13-21" Light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist, very fine subangular blocky; soft, friable, nonsticky and nonplastic; plentiful fine and very fine roots; mildly alkaline (pH 7.5) diffuse, wavy boundary. 6 to 12 inches thick.

C1 21-45" Light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; very fine subangular blocky toward the top and massive with depth; soft, friable, slightly sticky and slightly plastic; plentiful fine and very fine roots; moderately alkaline (pH 7.8); diffuse, wavy boundary. 20 to 28 inches thick.

C2 45-61" Gray to light gray (10 YR 6/1) silt loam, very dark grayish brown (10YR 3/2) when moist; massive; loose friable, nonsticky and nonplastic; few fine and very fine roots; mildly alkaline (pH 8.0); clear, smooth boundary. 13 to 19 inches thick.

C3 61-80"+ Gray (10YR 5/1) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose, nonsticky and nonplastic; mildly alkaline (pH 8.0).

Range in Characteristics:

Silt loam is the dominant type although silty clay loam is also prevalent. Color will vary throughout the profile in hue from 10YR to 2.5Y; in chroma from 1 to 2 dry or moist, and in value from 3 to 4 when moist. Dry values center near 6. The structure of the surface soil can be either massive due to compaction or it can be weak fine to very fine subangular blocky. The silty clay loams are slightly sticky and might be nonplastic or slightly plastic when wet. The reaction is sometimes slightly acid throughout and therefore varies from slightly acid to mildly alkaline. Surface reaction is seldom more basic than neutral. Occasional small bodies of Russ soils are included in the Ferndale mapping units where they occur adjacent to one another.

Topography:

Flood plains that are flat and very gently undulating.

Drainage and Permeability:

Well drained. Runoff is medium. Permeability is moderate.

Present Vegetation:

Permanent pasture.

Use:

Permanent pasture, some vegetables.

Distribution:
Flood plains of the north coast of California and Oregon in stream or river valleys which drain the Coast Ranges.

Type Location:
Eel River bottom near Pleasant Point. Center NW ¼, Sec. 4, T.2N., R.1W., HBM.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Alluvial
New System of Soil Classification: Cumulic Haplorthent, fine silty, mixed, nonacid, isomesic.

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3/9/65 National Cooperative Soil Survey USA

HONEYDEW SERIES - Hd

The HONEYDEW series consists of deep, well drained, medium textured alluvial soils forming from sedimentary rock alluvium of graywhacke and shale composition. They are characteristically medium to strongly acid in the surface and slightly acid in the deep C horizons. HONEYDEW soils are associated with the Wilder soils and are similar to the Kerr soils. The Kerr soils are flood plain soils that are high in micaceous minerals; are quite dense, and have hues from 2.5Y to 5Y.

HONEYDEW soils occur at elevations from 200 to 700 feet in a subhumid, mesothermal climate with warm, dry summers and extremely wet, cool winters. Mean annual temperature is about 57°F, with an average January temperature of about 43°F., and an average July temperature of about 71°F. Mean annual precipitation, most of which falls from September to May is from 80 to 100 inches. Average frost free season is about 300 days. The soils are quite limited in extent.

Soil Profile: Honeydew loam.
On a south facing 1 percent slope of an alluvial fan at 700 feet elevation under annual grasses.

Ap1 0-6" Light brownish gray (2.5Y 6/2) loam, dark gray (10 YR 4/1) when moist; moderate, very fine granular structure; slightly hard, firm, slightly sticky and nonplastic; abundant micro and very fine roots; many fine interstitial pores; medium acid (pH 5.6); clear, smooth boundary. Approximately 10 percent gravels. 4 to 8 inches thick.

A12 6-25" Grayish brown (2.5Y 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, very fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; abundant micro and plentiful very fine roots; many fine interstitial pores; medium acid (pH 5.8); diffuse, irregular boundary. 16 to 23 inches thick. Approximately 10 percent gravels.

C1 25-38" Light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; moderate, very fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; many fine interstitial pores; medium acid (pH 6.0); clear, smooth boundary. 11 to 15 inches thick. Approximately 10 percent gravels.

C2 38-56" Light gray (2.5Y 7/2) loam, olive brown (2.5Y 4/3) when moist; moderate very fine granular structure; slightly hard, friable, slightly sticky and nonplastic; very few very fine roots; many fine interstitial pores; slightly acid (pH 6.1); clear, smooth boundary. 16 to 20 inches thick. Approximately 10 percent gravels.

C3 56-72"+ Light gray (2.5Y 7/2) loam, olive brown (2.5Y 4/3) when moist; moderate, very fine granular structure; hard, firm, nonsticky and nonplastic; very few very fine roots; many fine interstitial pores; slightly acid (pH 6.2).

Range in Characteristics:
Loam is the dominant surface texture but it might range to a clay loam. Color varies in hue from 2.5Y to 10YR throughout the profile. Color values range in the A horizons from 5 to 6 dry and from 3 to 4 moist. Chromas in the A horizons range from 1 to 2 and in the C horizon from 2 to 3. Wet consistence of the clay loams ranges from slightly sticky and slightly plastic to sticky. Dry consistence ranges from slightly hard to hard. Reaction in the A1 ranges from medium acid to slightly acid and in the C horizons from medium acid to neutral.

Topography:
On short alluvial fans only, varying from 1 to 12 percent slopes.

Drainage and Permeability:
Well drained. Runoff is medium, permeability is rapid.

Vegetation:
Annual and some perennial grasses.

Use:
Pasture and some orchards.

Distribution:
In high rainfall belts along the north coast of California.

Type Location:
SE corner NE ¼, NE ¼, T.3S., R.1E., HBM. 150 yds. NE of Hay Barn, Hindly Ranch, Honeydew, California.

Series Proposed:
Western Humboldt County Soil Survey, Humboldt County, California, July 1964. Source of name: Town in southern Humboldt County, California on Mattole River.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Alluvial
New System of Soil Classification: Cumulic Haplorthent, fine loamy, mixed, nonacid, mesic.

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3/10/65 National Cooperative Soil Survey USA

HOOKTON SERIES - Hk

The HOOKTON series consists of moderately deep, moderately well drained brunizemic regosol soils of fine silty texture. They are formed in residium of softly consolidated, strongly dissected, warped and uplifted old marine terraces. These soft terraces vary in texture from conglomerate to clay, silt, and mud stone. Reaction of the soil is medium acid in the surface and strongly acid in the C horizons. The HOOKTON soils are associated with the Arcata and Rhonerville series. They are similar to Arcata, Ettersberg, and Wilder soils. The Arcata soils are formed on smooth flat high marine terraces. They are of lighter texture and are deeper than the HOOKTON. The Ettersberg soils are formed on low alluvial terraces under very high rainfall. They are very strongly acid throughout, are lower in surface organic matter and lighter in value. The Wilder soils are formed on sandstone, and are coarser in texture, and exhibit like characteristics. They are also more strongly acid and less fertile than the Hookton soils. The HOOKTON soils occur at elevations from 50 to 600 feet along the northern coast of California in a cool, humid, isomesic climate, having a mean annual precipitation from 40 to 60 inches and a mean annual temperature near 52°F. Winters are cool and moist, and summers are dry but foggy. Average January temperature is 47°F., and an average July temperature is 56°F. The frost free season is from 300 to 350 days. The soils are used for permanent dryland pasture.

Soil Profile: Hookton light silty clay loam (grass forb range).

A11 0-11" Grayish brown (10YR 5/2) silty clay loam, and very dark gray (10YR 3/1) when moist; moderate, medium granular structure; soft, friable, nonsticky and nonplastic; abundant fine and very fine roots; medium acid (pH 6.0); gradual, wavy boundary. 8 to 15 inches thick.

A12 11-19" Dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, fine granular structure; soft, very friable, slightly sticky and slightly plastic; abundant fine and very fine roots; medium acid (pH 5.8); gradual, wavy boundary. 6 to 10 inches thick.

AC 19-28" Pale brown (10YR 6/3) silty clay loam, brown to dark brown (10YR 4/3) when moist; massive, soft, loose, slightly sticky and slightly plastic; few and very fine roots; strongly acid (pH 5.5); gradual boundary. 6 to 12 inches thick.

C1 28-56" Light gray (10YR 7/2) silty clay loam, with many medium distinct light yellowish brown (10YR 6/4) mottles; yellowish brown (10YR 5/4) with brown (7.5YR 5/4) mottles when moist; strong medium angular blocky structure; hard, very firm, slightly sticky and slightly plastic; very few very fine roots; a few large iron and manganese stains tending toward concretions; strongly acid (pH 5.0).

Range in Characteristics:

The depth of the solum varies from 18 to 36 inches under noneroded conditions and can be as shallow as 6 inches on slopes greater than 10 percent where it has been eroded. Color of the A11 varies in value from 3 to 2 and in chroma from 1 to 2. Texture of the A horizons varies from silty clay loam to loam. The texture of the C horizons varies widely from softly consolidated conglomerate to softly consolidated silt stone, clay stone, and mud stone. The angular blocky structure of the C listed in the modal description varies with the texture. Mottling of the C ranges from 10YR to 5YR in hue, from 5 to 8 in value and from 1 to 8 in chroma. Reaction of the C horizon varies from strongly acid to very strongly acid. Small bodies of silty clay loam soils that are shallow, usually over clay and poorly drained, are included with the Hookton soils. These areas occur on flatter topography than the Hookton in the Doros Prairie and Garberville areas.

Topography:

Uplifted, folded, and dissected marine terraces. Slopes vary from gently rolling to steep.

Drainage and Permeability:

The Hookton soils are well drained with occasional spring and seep areas of artisian water. Permeability is moderate and runoff is medium to rapid.

Present Vegetation:

Annual and some perennial grasses and forbs. Subterranean clover is prominent.

Use:

This soil has been cropped in hay for almost 100 years. In the last 10 years most of it has been converted to unirrigated pasture.

Distribution:

Old dissected marine terraces on the north coast of California.

Type Location:

Rohnerville area, center Sec. 18, T. 2N., R1E., HBM.

Series Proposed:

Western Humboldt County Soil

Survey Area, Humboldt County, California, July 1964.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Brunizemic regosol
New System of Soil Classification: Entic Haplumbrept, fine silty, mixed, nonacid, isomesic.

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3/5/64 National Cooperative Soil Survey USA

KERR SERIES - Kr

The Kerr series consists of deep, well to moderately well drained, medium textured, recent alluvial soils derived from mixed micaceous schists and sandstones and other sedimentary rocks. The profile is very strongly acid on the surface and grades slowly to medium acid in the subsoil. KERR soils are associated with the Orick soils and are similar to the Loleta soils. The Loleta soils are less acid, and more poorly drained. KERR soils occur at elevations from 20 to 80 feet in a humid, mesothermal, coastal climate. Mean annual temperature is 52°F., with an average January temperature of 44°F., and an average July temperature of 57°F. Mean annual precipitation is from 50 to 70 inches, most of which falls between September and May. The frost free season is near 250 days. The soils are used for permanent pasture and are quite limited in extent.

Soil Profile: Kerr loam (permanent pasture).

Ap1 0-11" Gray to light gray (5Y 6/1) loam with common, fine, distinct strong brown (7.5YR 5/6) mottles; dark olive gray (5Y 3/2) with dark yellowish brown (10YR 4/4) mottles when moist; weak medium subangular blocky structure; slightly hard, firm, nonsticky and slightly plastic; few fine and very fine roots; very strongly acid (pH 5.0); clear, smooth boundary. 8 to 14 inches thick.

A12 11-25" Light brownish gray (2.5Y 6/1) silt loam, very dark grayish brown (2.5Y 3/2) when moist; weak very fine granular structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; strongly acid (pH 5.2); abrupt, smooth boundary. 10 to 18 inches thick.

IIC1 25-44" Gray (5Y 5/1) loamy fine sand, dark olive gray (5Y 3/2) when moist; single grain; soft, loose, nonsticky and nonplastic; very few fine roots; strongly acid (pH 5.5); gradual, smooth boundary. 16 to 23 inches thick.

IIC2 44-50" Gray near light grayish brown (2.5Y 6/1) silt loam, dark grayish brown (2.5Y 3/2) when moist; massive, slightly hard, slightly sticky and slightly plastic; very few, very fine roots; medium acid (pH 6.0); gradual, smooth boundary. 4 to 8 inches thick.

IVC3 50-58"+ Gray (5Y 5/1) loamy very fine sand, olive gray (5Y 4/2) when moist; single grain; soft, loose, nonsticky and nonplastic; no roots; medium acid (pH 5.8).

Range in Characteristics:
The surface color will range from 5Y to 2.5Y in hue; from 0 to 2 in chroma, and from 5 to 6 in value. Structure can be nearly platy in the top two inches of the Ap horizon due to compaction and a high micaceous silt content. Texture of the A horizons will vary from loam to silty clay loam. The surface varies in wet consistence from nonsticky to slightly sticky. There can be abundant roots in the surface two

inches, but they seldom penetrate far in abundance. The stratification of the profile is characteristic. Sandy layers can be deep or shallow and variable in thickness or absent.

Topography:
Flood plain with very gentle hummocks. Essentially flat and smooth.

Drainage and Permeability:
Well drained. In spite of the moist dark colors throughout, and mottles in the surface, the soil appears to be well drained. The pit for the modal sample was dug on the 12th of December, two days after a rain storm and the profile was at field capacity. Surface mottling is believed to be a phenomenon of compaction. Runoff is slow. Permeability of the surface is moderately slow to moderate below the zone of compaction.

Present Vegetation:
Permanent pasture.

Use:
Forage.

Distribution:
Limited in distribution to the north coastal area of California on river flood plains whose parent material is derived from rocks similar to those of the Kerr Ranch schists.

Type Location:
Orick area; NE corner, SW ¼, Sec. 34, T.11N., R.1E., HBM.

Series Proposed:
Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Kerr Ranch.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Alluvial
New System of Soil Classification: Cumulic Haplorthent, coarse, silty, nonacid, mesic.

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LOLETA SERIES - Lo

The LOLETA series consists of deep, moderately well to imperfectly drained, medium textured, minimal humic gley soils formed in sedimentary rock alluvium. They have grayish brown to very dark brown, medium acid, loam surfaces, with mottled, neutral, loam subsoils. LOLETA soils are associated with Russ, Ferndale, and Bayside soils. The Russ soils are alluvial fan soils with lighter colored surfaces and are moderately well drained. The Bayside soils are clayey, and poorly drained soils occuring in a lower position than the Loleta. The LOLETA soils occur at elevations of less than 100 feet in a humid, mesothermal climate with a mean annual temperature of about 52°F. Average January temperature is about 47°F., and an average July temperature is about 56°F. Mean annual precipitation is about 50 inches, most of which occurs between September and May. The average frost free season is more than 300 days.

Soil Profile: Loleta loam.
On a north facing 3 percent slope at 30 feet elevation under permanent pasture and rush.

A 0-11" Grayish brown (10YR 5/2) loam, very dark gray (10 YR 3/1) when moist; moderate very fine subangular blocky; slightly hard, friable, nonsticky and nonplastic; abundant fine and very fine roots; medium acid (pH 5.6); clear, smooth boundary. 9 to 13 inches thick.

B1 11-22" Light gray (2.5Y 7/1) loam, with common, distinct, medium reddish yellow (7.5YR 6/6) mottles, grayish brown

(2.5Y 5/2) with strong brown (7.5YR 5/6) mottles when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonplastic and slightly sticky; few fine and very fine roots; medium acid (pH 6.0); gradual, wavy boundary. 9 to 13 inches thick.

B2 22-34" Light gray (10YR 7/1) heavy loam, many prominent medium reddish yellow (7.5YR 6/6) mottles, gray to light gray (10YR 6/1) with strong brown (7.5YR 5/6) mottles when moist; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; very few fine and very fine roots; neutral (pH 7.0); gradual wavy boundary. 10 to 15 inches thick.

B3 34-50" Light gray (7.5YR 7/0) loam with many prominent medium reddish yellow (7.5YR 6/8) mottles, gray to light gray (10YR 6/1) with yellowish red (5YR 4/6) mottles when moist; slightly hard, friable, nonsticky and nonplastic; massive; very few fine and very fine roots; neutral (pH 7.3); gradual wavy boundary. 12 to 20 inches thick.

C1 50-60" Light gray (7.5YR 7/0) loam with many prominent medium strong brown (7.5YR 5/6) mottles gray to light gray (10YR 6/1) with yellowish red (5YR 4/6) mottles when moist; slightly hard, firm, slightly sticky and nonplastic; massive; neutral (pH 7.3); clear, abrupt boundary. 8 to 12 inches thick.

IIC2 60-74" Light gray (7.5YR 7/0) loamy fine sand, with many prominent coarse, strong brown (7.5YR 5/6) mottles, gray to light gray (10YR 6/1) with strong brown (7.5YR 5/6) mottles when moist; massive; loose, nonsticky and nonplastic; neutral (pH 7.3); clear, abrupt boundary. 12 to 16 inches thick.

IIIC3 74-82"+ Gray to light brownish gray (2.5Y 6/1) loam with common prominent coarse reddish yellow (7.5YR 6/8) mottles, gray to light gray (2.5Y 6/0) with dark reddish brown (5YR 5/4) mottles when moist; soft, friable, nonsticky and nonplastic; neutral (pH 7.0).

Range in Characteristics:

The surface varies widely in color from (10YR 2/2) to (10YR 4/3). This variation may be attributed to the periodic overwash and consequent inability of the profile to stabilize. The same situation causes a variability in clay eluviation although normal eluviation is slight. Where the soil has not been overwashed for a long period of time, the surface is darker and a little deeper. There is more evidence of clay migration. Surface texture varies from loam to a light clay loam. The B2 ranges in texture from loam to clay loam. When dry, color hues range from 10YR to 7.5YR; chromas range from 0 to 1 and values range from 5YR to 10YR. When wet, chromas range from 5 to 6 and values range from 4 to 6 wet or dry. Wet consistence in the clay loams are slightly sticky and slightly plastic and dry consistence is hard to slightly hard. Reaction of the profile can be uniformly medium acid, or increasingly more basic with depth. It is usually near pH 6.0 in the surface.

Topography:

Nearly level to gently sloping alluvial fans.

Drainage and Permeability:

Moderately well to imperfectly drained. Runoff is medium. Permeability is slow.

Vegetation:

Permanent pasture and rush. Native vegetation was spruce, willow and rush.

Use:

Nonirrigated permanent pasture and hay.

Distribution:

North coastal region of California.

Type Location:

Adrain Chapin Dairy, off Meridian road near Ferndale. SE corner NE ¼, Sec. 3, T.2N., R.2W., HBM.

Series Proposed:

Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Town in central Humboldt County, California.

Remarks:

This soil is classified as follows:
USDA Yearbook 1938: Humic Gley
New System of Soil Classification: Typic Umbraquept, fine loamy, mixed, nonacid, isomesic.

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ROHNERVILLE SERIES - Ro

The ROHNERVILLE series consists of deep, moderately well drained, medium to fine textured, brunizem soils formed from sedimentary rock alluvium. The rock alluvium is principally of graywhacke and sandstone composition. The entire profile is medium acid. ROHNERVILLE soils are associated with the Hookton soils and are similar to the Hookton and Arcata series. The Hookton soils occur on rolling to steep topography, and are shallower than the ROHNERVILLE soils. They overlie various textured soft marine sediments that are strongly mottled. The Arcata soils are a bit coarser textured and lack a B horizon development. ROHNERVILLE soils occur at elevations from 300 to 1,000 feet in a cool, humid, mesothermal climate having a mean annual temperature near 52°F. Average January temperature is about 47°F., and average July temperature is about 56°F. Mean annual precipitation is from 40 to 50 inches. The average frost free season is greater than 300 days.

Soil Profile: Rohnerville silty clay loam.

On a flat high river terrace under annual rye, orchard grasses, and subterranean clover.

A11 0-9" Grayish brown (10YR 5/2) silty clay loam, black (10YR 2/2) when moist; moderate; medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; abundant fine and very fine roots; many fine interstitial pores; medium acid (pH 5.7); clear smooth boundary. 7 to 11 inches thick.

A12 9-18" Grayish brown (10YR 5/2) silty clay loam, black (10YR 2/2) when moist; weak, fine subangular blocky structure; soft, very friable; nonsticky and nonplastic; abundant fine and very fine interstitial pores; medium acid (pH 6.0); clear smooth boundary. 8 to 12 inches thick.

A3 18-28" Brown (10YR 5/3) silty clay loam, black (10YR 2/2) when moist; moderate, coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; abundant fine and plentiful very fine roots; common fine interstitial, and many micro tubular pores; medium acid (pH 5.6); gradual wavy boundary. 9 to 14 inches thick.

B2 28-48" Light yellowish brown (10YR 6/4) silty clay loam, brown (7.5YR 5/4) when moist; strong medium subangular blocky structure; hard, very firm, sticky and plastic; few fine and very fine roots; common tubular pores; medium acid (pH 5.6); gradual irregular boundary. 16 to 25 inches thick.

B3 48-58" Light yellowish brown (10YR 6/4) silty clay loam, brown (7.5YR 5/4) when moist; strong medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; few fine tubular pores; medium acid (pH 5.7); gradual irregular boundary. 8 to 14 inches thick.

C1 58-65"+ Light yellowish brown (10YR 6/4) silty clay loam, brown (7.5YR 5/4) when moist; massive structure; hard, firm, slightly sticky and slightly plastic; few fine tubular pores; medium acid (pH 6.0).

Range in Characteristics:
Silty clay loam is the dominant type. Surface texture ranges from silty clay loam to loam. Color values vary from 2 to 3 in the A horizons when moist and from 4 to 5 when dry. Chroma varies in the A horizons from 1 to 3 wet or dry. The strength of surface structure ranges from weak to strong with a moderate structure being dominant. The texture of the B2 ranges from silty clay to clay loam. The color ranges from 7.5YR to 10YR in hue; values range from 4 to 6 wet or dry. Consistence ranges from slightly sticky and slightly plastic to sticky and plastic when wet. Reaction of the B2 ranges from medium acid to strongly acid.

Topography:
High river and marine terraces with slopes from 0 to 10 percent. Predominantely flat.

Drainage and Permeability:
Well drained. Runoff is medium. Permeability is moderately rapid in the A horizons and moderate in the B.

Vegetation:
Annual grasses and legumes, especially rye and subterranean clover. Sweet Vernal grass and Poverty Oat grass are abundant perennials.

Use:
Dryland range and permanent pasture.

Distribution:
On high alluvial and marine terraces on the north coast of California.

Type Location:
Hydesville area ½ mile south of Highway 36 directly across from the old Hydesville School. NE corner SE ¼, NW ¼, Sec. 20, T.2N., R.1E., HBM.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Brunizem
New System of Soil Classification: Humic Normudult, fine silty, mixed, isomesic.

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RUSS SERIES - Ru

The RUSS series consists of deep, moderately well to imperfectly drained coarse silty, alluvial soils developed on small flood plains of streams draining soft sandstone, siltstone, claystone, and conglomerate. The entire profile is from slightly acid to medium acid in reaction. RUSS soils are associated with the Loleta and Bayside soils, and they are similar to the Ferndale soils. The Ferndale soils have darker, more organic surfaces and are less acid. The RUSS soils occur at elevations between 50 and 150 feet in a humid, isomesic coastal climate having a mean annual temperature of 52°F., with an average January temperature of 47°F., and an average July temperature of 56°F. The mean annual precipitation is from 30 to 50 inches. Most of the rainfall comes in the months of September through May. The frost free season is about 300 days. These soils are used for permanent pasture; They are limited in extent.

Soil Profile: Russ loam (under permanent pasture).

A1 0-8" Light brownish gray (10 YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, very fine subangular blocky structure; soft, firm, nonsticky and nonplastic; abundant fine and very fine roots; slightly acid (pH 6.5); gradual wavy boundary. 6 to 12 inches deep.

C1 8-53" Light brownish gray (2.5Y 6/2) loam, olive brown (2.5Y 4/3) when moist; massive; loose; friable, nonsticky and nonplastic; plentiful fine and very fine roots; medium acid (pH 5.9); clear, smooth boundary. 43 to 50 inches thick.

C2 53-70"+ Light gray (10YR 7/1) loam, with many medium, prominent strong brown (7.5YR 5/6) mottles; gray near light gray (10YR 6/1) with dark brown (7.5YR 4/4) mottles when moist; massive; slightly hard, friable, nonsticky and nonplastic; very fine and micro roots; neutral reaction (pH 7.0).

Range in Characteristics:
The color throughout the profile will range in hue from 2.5Y to 10YR. Chroma in the A horizons will range from 4 to 2. Values in the A horizons will vary from 5 to 6 when dry and from 3 to 4 when moist. Texture varies throughout the profile from loam to light silty clay loam. The light silty clay loams are slightly sticky and slightly plastic when wet. Occasional small bodies of Ferndale soils are included in the Russ mapping units where they occur adjacent to one another.

Topography:
Gently sloping to flat, smooth flood plains on broad alluvial fans.

Drainage and Permeability:
Moderately well to imperfectly drained. Runoff is medium. Permeability is moderately rapid in the upper portion and moderate to moderately slow at depth.

Present Vegetation:
Permanent pasture with some bull rush, buttercup, and other hydrophytes in the imperfectly drained areas.

Use:
Pasture.

Distribution:
On small flood plains of alluvial fans occuring below softly consolidated rock material on the north coast of California.

Type Location:
Ferndale Area near Williams Creek, NE corner, SW ¼, SW ¼, Sec. 1, T.2N., R.2W., HBM.

Series Proposed:
Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Russ Creek near Ferndale, Humboldt County.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Alluvial
New System of Soil Classification: Typic Haplorthent, coarse silty, mixed, nonacid, isomesic.

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TIMMONS SERIES - Ti

The TIMMONS series consists of deep, well drained, fine textured, minimal red yellow podzolic soils developing from sedimentary rock alluvium. The rock alluvium is from diverse softly consolidated and hard rock materials including large quantities of quartzite gravels, and silt or clay stones. Characteristically, the profile is medium acid in the A horizons and strongly acid in the subsoil. TIMMONS soils are associated with the Mendocino and Larabee soils, both of which occur on steep to moderately steep terrain and have well defined illuvial B horizons. The TIMMONS soils are similar to the Carlotta soils but have a lighter colored surface soil and are redder in hue and finer textured in the subsoil. TIMMONS soils occur at elevations between 100 and 300 feet in a cool, humid, mesothermal climate. Mean annual temperature is about 52°F., with an average January temperature near 45°F., and an average July temperature between 59 and 64°F. Mean annual precipitation varies from 45 to 60 inches, nearly all of which falls during the winter and spring months. Frost free season is from 260 to 300 days.

Soil Profile: Timmons clay loam.

On a high river terrace, 200 feet in elevation about 6 miles from the Pacific Ocean. Relief is flat and smooth.

A11 0-10" Brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; moderate fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; abundant fine and very fine roots; many fine pores; medium acid (pH 6.0); clear, smooth boundary. 8 to 12 inches thick.

A3 10-26" Brown (10YR 5/3) clay loam; dark brown (10YR 3/3) when moist; weak, medium, subangular blocky, weak, fine, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; abundant very fine roots; many very fine pores; medium acid (pH 6.0); gradual, wavy boundary. 12 to 20 inches thick.

B1 26-35" Light brown (7.5YR 6/4) clay, strong brown (7.5YR 5/6) when moist; moderate, medium subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many fine and very fine vesicular pores; common thin clay films on ped faces; strongly acid (pH 5.5); gradual wavy boundary. 7 to 13 inches thick.

B2 35-49" Light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) when moist; moderate, fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common, moderately thick clay films on ped faces and in pores; many fine and very fine vesicular pores; strongly acid (pH 5.5); gradual wavy boundary. 12 to 18 inches thick.

B3 49-59" Very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) when moist; massive structure; hard very firm, sticky and slightly plastic; no roots; common thin clay films in pores; many fine and very fine vesicular pores; medium acid (pH 5.8). 8 to 14 inches thick.

Range in Characteristics:

Clay loam is the dominant type. Surface texture ranges from loam to clay loam. Subsoil textures range from clay to clay loam. Clay migration is not pronounced. Increase of clay with depth is gradual. Color in the A horizons range from 10YR to 7.4YR in hue and from 3 to 4 in chroma. Values range from 3 to 4 moist and from 5 to 6 dry. Subsoil colors range in hue from 7.5YR to 10YR, in chroma from 4 to 6. Subsoil values range from 5 to 7 dry and from 5 to 6 moist. Wet consistence ranges from slightly sticky and slightly plastic to sticky and plastic in the B horizons. Abundant roots of medium and course size are often present in the A horizons. Gravels and cobbles are sometimes plentiful in the B horizons although they are often partly disintegrated.

Topography:
Smooth, nearly flat, high river terraces.

Drainage and Permeability:
Well drained. Permeability is moderate to moderately slow in the B2 horizons and moderate to moderately rapid above and below. Runoff is medium.

Vegetation:
Redwood and some Douglas fir.

Use:
Timber production. Some areas have been cleared for pasture and support poor stands of annual and perennial grass, and fair subterranean clover.

Distribution:
High terraces in river valleys of the north coastal area of California.

Type Location:
Timmons Ranch 150 yds. west of Fieldbrook Road, Center NE ¼, SE ¼, Sec. 2, T.6N., R.1E., HBM.

Series Proposed:
Western Humboldt County Soil Survey Area, Humboldt County, California, July 1964.
Source of name: Timmons Ranch near Fieldbrook, Humboldt County, California.

Remarks:
This soil is classified as follows:
USDA Yearbook 1938: Red Yellow Podzolic
New System of Soil Classification: Typic Dystochrept, fine, mixed, mesic.

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WILDER VARIANT SERIES - Wv

The WILDER VARIANT soils are moderately deep, well drained, moderately fine, and medium textured brunizem soils developed from sandstone and graywhacke sedimentary rock alluvium. Gravels of the sandstone and graywhacke remain dispersed throughout the profile. The entire profile is strongly to very strongly acid. WILDER VARIANT soils are associated with the Kneeland and Ettersberg soils, and are similar to Ettersberg and Arcata soils. The Ettersberg soils have less organic matter in the surface and have a dense, slowly permeable subsoil. The Arcata soils have coarser textures and are less acid than the WILDER VARIANT soils. The Wilder soils occur typically on gently sloping to very steep topography whereas the WILDER VARIANT occurs on flat, smooth, high alluvial terraces. The WILDER VARIANT is usually finer textured and contains less sands than the Wilder. WILDER VARIANT soils occur at elevations from 500 to 3,000 feet in a subhumid, mesothermal climate having a mean annual temperature of from 53 to 57°F. Average January temperatures are from 42 to 47°F., and average July temperatures are from 56 to 71°F. Mean annual precipitation ranges from 60 to 100 inches, most of which falls during the winter and spring. Average frost free season is from 200 to 300 days.

Soil Profile: Wilder variant loam.
On a high river terrace about

1,000 feet in elevation, five miles from the Pacific Ocean under bracken fern and sheep sorrel.

A11 0-9" Dark gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, fine granular structure; loose, very friable nonsticky and nonplastic; few medium and abundant fine, very fine, and micro roots; many interstitial and tubular pores; very strongly acid; (pH 4.5); clear smooth boundary. 8 to 12 inches thick.

A12 9-34" Dark gray (10YR 4/1) light clay loam; black (10YR 2/1) when moist; massive structure; soft, very friable, nonsticky and nonplastic; abundant medium, fine, very fine, and micro roots; many tubular pores; very strongly acid (pH 4.8); clear smooth boundary. 20 to 30 inches thick.

C1 34-41" Light brownish gray (2.5Y 6/2) light clay loam, very dark grayish brown (10YR 3/2) when moist; massive structure; soft, friable, nonsticky and nonplastic; plentiful micro roots; common micro tubular pores; strongly acid (pH 5.5); clear smooth boundary. 5 to 15 inches thick.

C2 41-55"+ Light gray (2.5Y 7/2) gravelly loam, dark brownish gray (10YR 4/2) when moist; moderate, very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few micro roots; few micro pores; medium acid (pH 5.8).

Range in Characteristics:

Loam is the dominant type. Near the edges of terraces, gravelly loam is a common surface texture. Reaction can vary in the surface from 4.5 to 5.8. Thickness of the A horizons will range from 20 to 40 inches. The texture, color, structure, and consistence of the C horizons do not vary appreciably. The reaction of the C horizons range from medium to strongly acid.

Topography:

Flat, smooth, high alluvial terraces.

Drainage and Permeability:

Moderate to well drained and permeable.

Vegetation:

Annual grasses, bracken fern, and sheep sorrell. Occasional stands of Douglas fir.

Use:

Range.

Distribution:

On high river terraces in southern and eastern Humboldt County.

Type Location:

Petrolia area, Joel flat. NE corner, SE ¼, SE ¼, Sec. 16, T.1S., R.2W., HBM.

Remarks:

This soil is classified as follows:
USDA Yearbook 1938: Brunizem
New System of Soil Classification: Cumulic Entic Haplumbrept, fine loamy, mixed, nonacid, mesic.

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APPENDIX IV: Table 4. CHARACTERISTICS OF SOIL-VEGETATION PROJECT SOILS [1]

Map Symbol	Soil Series Name	Depth Range [2]	Color of Surface/Subsoil	Reaction of Surface/Subsoil	Texture of Surface/Subsoil	Parent Material	Estimated Suitability: Timber Production [3]	Estimated Suitability: Extensive Range Use [4]
711B	Boomer	26-60	Reddish brown/ reddish brown	Slightly acid/ moderately acid	Gravelly loam/ gravelly clay loam	Metamorphosed basic igneous rocks	Medium to high	Medium
72X	Unnamed	30-60	Brown/ yellowish red	Moderately acid/ strongly acid	Loam/ fine sandy clay loam	Basic igneous rock	High	Medium
723	Comptche	30-60	Reddish brown/ weak red	Slightly acid/ moderately acid	Gravelly clay loam/ gravelly clay loam	Metamorphosed basic igneous rock	Medium to high	Medium to low
726	Dubakella	18-36	Reddish brown/ strong brown	Neutral/ mildly alkaline	Stony loam/ gravelly loam	Serpentine	Medium	Low to very low
726V	Dubakella (variant)	30-45	Reddish brown/ brown	Neutral/ mildly alkaline	Loam/ clay loam	Ultrabasic igneous rocks	Medium to high	Medium to low
732	Montara	6-18	Dark grayish brown/ dark grayish brown	Neutral/ alkaline	Stony clay loam/ stony clay loam	Serpentine rock	Unsuited	Medium to very low
752	Yorkville	30-60	Grayish brown/ gray	Slightly acid/ alkaline	Clay loam/ clay	Metamorphosed rocks	Unsuited	Medium to very high
752V2	Yorkville (variant 2)	48-70	Very dark gray/ dark gray	Moderately acid/ alkaline	Loam/ clay	Sheared sedimentary rocks	Unsuited	Medium to very high
81Y	Unnamed	30-60	Grayish brown/ gray	Slightly acid/ mildly alkaline	Clay loam/ clay	Metamorphosed sedimentary rocks	Medium to high	Medium
812	Hugo	30-60	Grayish brown/ pale brown	Slightly acid/ strongly acid	Gravelly loam/ stony clay loam	Sandstone & shale	Moderate to very high	Medium to low
812m	Hugo (schist)	30-60	Grayish brown/ pale brown	Slightly acid/ strongly acid	Gravelly loam/ gravelly clay loam	Metamorphosed sedimentary rocks	Medium to high	Medium to low
812V2	Hugo (variant 2)	30-60	Grayish brown/ light yellowish brown	Moderately acid/ strongly acid	Loam/ clay loam	Sandstone & shale	Variable	Medium
813	Orick	40-70	Brown/ strong brown	Moderately acid/ strongly acid	Loam/ clay loam	Schistose sedimentary rocks	Medium to very high	Medium
813V	Orick (variant)	40-60	Very dark gray/ strong brown	Moderately acid/ strongly acid	Organic loam/ clay loam	Schistose sedimentary rock	Medium to high	Medium
814	Melbourne	30-60	Brown/ strong brown	Moderately acid/ strongly acid	Loam/ clay loam	Sandstone & shale	High to very high	Medium
814V	Melbourne (variant)	30-60	Brown/ strong brown	Strongly acid/ strongly acid	Loam/ clay loam	Sandstone & shale	Very high	Medium
815	Josephine	30-60	Brown/ reddish yellow	Slightly acid/ moderately acid	Loam/ clay loam	Sandstone & shale	High to very high	Medium
816	Sites	30-60	Reddish brown/ red	Moderately acid/ strongly acid	Clay loam/ clay	Schistose sedimentary rocks	Variable	Medium
818	Usal	30-60	Dark grayish brown/ light yellowish brown	Slightly acid/ strongly acid	Loam/ clay loam	Sandstone & shale	High	Medium to high
818V	Usal (variant)	40-60	Dark grayish brown/ yellowish brown	Moderately acid/ strongly acid	Loam/ silty clay loam	Sandstone	High	Medium to high
819	Tatu	30-60	Dark brown/ brown	Moderately acid/ moderately acid	Loam/ loam	Sandstone	Variable	Medium to low
819V2	Tatu (variant 2)	24-60	Dark reddish brown/ reddish brown	Slightly acid/ moderately acid	Very gravelly loam/ very gravelly loam	Shaly chert	Medium to high	Medium to low
82X	Unnamed	40-80	Gray brown/ light yellowish brown	Moderately acid/ strongly acid	Gravelly clay loam/ gravelly clay loam	Sedimentary colluvium	High	Medium
82Y	Unnamed	12-24	Dark reddish brown/ dark brown	Slightly acid/neutral to mildly alkaline	Loam/ stony clay loam	Limestone	Questionable	Low to medium
820	Sheetiron	20-40	Grayish brown/ pale brown	Moderately acid/ strongly acid	Gravelly loam/ gravelly loam	Schistose rock	Medium to high	Medium - low
821	Masterson	30-60	Brown/ light yellowish brown	Moderately acid/ strongly acid	Loam/ gravelly loam	Schistose sedimentary rock	Medium to very high	Medium - low
821V2	Masterson (variant 2)	36-60	Very dark gray/ light yellowish brown	Strongly acid/ strongly acid	Organic loam/ gravelly clay loam	Schistose sedimentary rock	Variable	Medium - low
822	Hoover	30-60	Dark grayish brown/ pale brown	Slightly acid/ strongly acid	Gravelly loam/ gravelly loam	Sandstone	Medium to high	Medium - low
823	Atwell	36-72	Dark grayish brown/ pale brown	Slightly acid/ strongly acid	Loam/ gravelly clay loam	Sheared sedimentary rocks	High to very high	Medium
823m	Atwell (schist)	36-72	Brown/ light yellowish brown	Slightly acid/ strongly acid	Loam/ gravelly clay loam	Sheared schist	Variable	Medium
834	Hulls	20-40	Gray/ gray	Moderately acid/ moderately acid	Clay loam/ gravelly clay loam	Schistose sedimentary rock	Unsuited	Medium
835	Kneeland	18-40	Dark grayish brown/ pale brown	Strongly acid/ strongly acid	Clay loam/ clay loam	Sandstone & shale	Unsuited	High
835V [5]	Kinman	36-72	Gray/ brown	Moderately acid/ strongly acid	Loam/ clay	Sandstone & shale	Unsuited	High
839	McMahon	30-60	Dark gray/ dark grayish brown	Slightly acid/ neutral	Clay loam/ clay	Sandstone	Unsuited	High to very high

Table 4. CHARACTERISTICS OF SOIL-VEGETATION PROJECT SOILS 1/ - Continued

Map Symbol	Soil Series Name	Depth Range 2/	Color of Surface/Subsoil	Reaction of Surface/Subsoil	Texture of Surface/Subsoil	Parent Material	Estimated Suitability: Timber Production 3/	Estimated Suitability: Extensive Range Use 4/
840	Wilder	26-50	Very dark grayish brown/ light yellowish brown	Very strongly acid/ very strongly acid	Sandy loam/ gravelly sandy loam	Sandstone	Variable	Low to very low
840m	Wilder (schist)	26-50	Very dark grayish brown/ light yellowish brown	Very strongly acid/ very strongly acid	Sandy loam/ gravelly sandy loam	Schistose sedimentary rocks	Variable	Low to very low
842	Contra Costa	15-45	Brown/ reddish brown	Neutral/ neutral	Clay loam/ clay	Sandstone & shale	Unsuited	Moderate to high
847	Laughlin	16-36	Pale brown/ light yellowish brown	Slightly acid/ slightly acid	Loam/ loam	Sandstone & shale	Unsuited	Medium to low
849	Tyson	18-48	Dark grayish brown/ pale brown	Slightly acid/ moderately acid	Gravelly loam/ very gravelly loam	Sandstone & shale	Medium to low	Medium to very low
850	Sutherlin	30-50+	Pale brown/ gray	Slightly acid/ moderately acid	Loam/ clay	Sandstone, hard	Unsuited	Medium to possibly high
852	Zanone	36-72	Dark gray/ grayish brown	Strongly acid/ moderately acid	Clay loam/ clay	Sandstone & shale mostly calcareous	Unsuited	Very high
855	Kinman	40-72	Dark grayish brown/ yellowish brown	Strongly acid/ strongly acid	Clay loam/ clay	Sandstone & shale	Unsuited	High
855V	Kinman (variant)	40-72	Dark grayish brown/ yellowish brown	Strongly acid strongly acid	Clay loam/ clay	Sandstone & shale	Unsuited	High
871	Los Gatos	12-36	Brown/brown (near reddish brown)	Slightly acid/ slightly acid	Gravelly clay loam/ gravelly clay loam	Sandstone & shale	Unsuited	Very low
872	Maymen	4-16	Pale brown/ pale brown	Slightly acid/ slightly acid	Gravelly loam/ gravelly loam	Sandstone & shale	Unsuited	Very low
877	Cahto	6-25	Very dark grayish brown/ dark brown	Slightly acid/ moderately acid	Loam/loam with rock fragments	Sandstone, hard	Unsuited	Low to medium
91X	Unnamed	40-50	Very dark grayish brown/ pale brown	Moderately acid/ slightly acid	Loam/ silt loam	Mudstone	High to very high	Medium
914	Larabee	40-70	Grayish brown/ strong brown	Slightly acid/ strongly acid	Loam/ clay loam	Soft sedimentary rock	High to very high	Medium
914g	Larabee (conglomerate)	40-70	Grayish brown/ strong brown	Slightly acid/ strongly acid	Gravelly loam/ gravelly clay loam	Soft conglomerate	High to very high	Medium
915	Mendocino	40-90	Brown/ reddish yellow	Slightly acid/ strongly acid	Loam/ clay	Soft sedimentary rocks	High	Medium
15g	Mendocino (conglomerate)	60+	Brown/ reddish brown	Moderately acid/ strongly acid	Loam/ clay loam	Soft sedimentary rocks	Variable	Medium
915V	Mendocino (variant)	40-70	Dark reddish brown/ reddish brown	Slightly acid/ strongly acid	Silt loam/ clay	Soft sedimentary rocks	Very high	Medium
915m	Mendocino (schist)	60+	Brown/ reddish brown	Slightly to moderately acid/strongly acid	Loam/ clay	Schistose sedimentary rock	Medium	Medium
920	Empire	40-70	Brown/ yellowish brown	Moderately acid/ strongly acid	Loam/ clay loam	Soft sedimentary rock	High to very high	Medium
920g	Empire (conglomerate)	50+	Dark reddish brown/ reddish brown	Moderately acid/ strongly acid	Loam/ silt loam	Weakly consolidated conglomerate	High to very high	Low
920V	Empire (Variant)	40-70	Dark brown/ reddish yellow	Moderately acid/ strongly acid	Loam/ silty clay loam	Soft sedimentary rocks	High to very high	Medium
921	Hely	40-70	Dark brown/ brown	Slightly acid/ strongly acid	Loam/ fine sandy loam	Soft sedimentary rock	Very high	Medium
922	Tonini	20-40	Dark grayish brown/ pale brown	Moderately acid/ strongly acid	Fine sandy loam/ loamy fine sand	Soft sandstone	Medium to high	Medium to very low
934	Rio Dell	22-50	Very dark grayish brown/ light yellowish brown	Moderately acid/ strongly acid	Silt loam/ clay loam	Soft sedimentary rock	Variable	Medium to high
952	Mattole	38-60	Dark gray/mottled light brownish gray and brownish yellow	Moderately acid/ neutral	Silty clay loam/ clay	Soft sedimentary rock	Unsuited	Very high
97X	Unnamed	8-20	Grayish brown/ pale brown	Moderately acid/ moderately acid	Loamy fine sand/ fine sand	Soft sandstone	Unsuited	Unsuited

1/ These are some of the more typical characteristics of each soil series. Variations must be expected in any of the characteristics listed.

2/ Characteristics effective depth range of soil in inches.

3/ Estimated suitability for timber production is based on predominant site index determinations in relation to soil and climatic characteristics. Suitability is not necessarily based on nor indicative of existing vegetation in an area at the time of mapping. Relative terms used on a State-wide basis are: Unsuited = nontimberland; low = sites I, 2, 3, V; medium = sites 4, IV; high = sites 5, III; very high = sites 6, II; extremely high = site I; questionable = conclusive evidence of suitability for growth of commercial stands of timber is lacking.

4/ Estimated suitability for extensive range use is based on observations of natural forage production and use experiences over wide areas in relation to soil and climatic characteristics. Estimates apply to open areas, either natural or cleared, under extensive management (without seeding or fertilizing) and in average condition of herbaceous cover relative to kind of soil. Consideration is also given to such factors as rockiness, topography and erosion hazard. Suitability is not necessarily based on nor indicative of existing vegetation in an area at the time of mapping. Suitability terms used are: Very low, low, medium, high, very high. These terms are relative and are used by this survey on a State-wide basis. Unless otherwise indicated, they apply to soils of slope class 2 (30 to 50%). They should not be interpreted as necessarily applying to suitability of soils for forage production under more intensive management involving seeding, fertilizing, or irrigation.

5/ This new soil series was formerly mapped as a variant of Kneeland, symbol 835V. It is now tentatively correlated as the Kinman series, symbol 855, and has not been appraised as yet by the State Correlation Committee.

Report and General Soil Map Humboldt County, California, prepared by United States Department of Agriculture Soil Conservation Service.

The Report and General Soil Map give general information on soil characteristics. This report is appropriate only for general planning purposes. It is not suitable for applications that require a detailed soil survey. "General soil maps are prepared through orderly abstraction of detailed surveys" (3). The General Soil Map is useful for providing information about overall soil resources for communities. It can provide information on large areas of "prime" agriculture soils, large areas where there strict restrictions for various applications occur, and places where soil offer problems in building foundation or for constructing roads.

The information found in this report come from more detailed soil maps expanded by field observations and earlier published soil survey maps. The organization of the Report and General Soil Map in the county is separated in 23 different mapping units. The name given to the mapping unit is the major soil series found in the unit's location. "A soil series is a group of soils that have about the same kind of profile or sequence of layers" (4). Within the soil series all the soils have similar thickness of horizon layers and other key characteristics, but the surface texture may differ within a series. "The 23 mapping units for Humboldt County are organized into 7 major groups based on soil characteristics and qualities, including slope" (4).

The General Soil Map report can provide very useful in gaining an understanding soil features of large areas within the county. Following is an example of the organization in the report.

Group 1 – Areas dominated by deep and very deep, nearly level, well to poorly drained soils.

Bk-LC-AC Bayside-Loleta association, 0-9 percent slopes. A description of the soil is provided. Information of how the soil originated, the fertility, potential erosions hazards, and typical use of the soil, color, acidity, and drainage of soil also discussed.

The map that accompanies the General Soil report provides the specific location of the mapping units.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

REPORT AND

GENERAL SOIL MAP

HUMBOLDT COUNTY, CALIFORNIA

By Personnel of Soil Conservation Service
Ukiah, California
April 1967

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PURPOSES AND METHODS

The General Soil Map is a small scale map delineating different geographic areas and showing the general patterns of soils that occur within each area. Each area is made up of one or more extensive soils similar in general soil characteristics, and includes minor areas of soil that may or may not be like the dominant soils within the area. Each area on the map is called a soil association and is named for the major soil series it contains.

Soil associations differ from one another by having contrasting soil properties or differing in potentialities. For example, one association may be dominated by sandy soils while another would be mostly clayey soils.

General soil maps are suitable only for general program planning. They are no substitute for detailed surveys but have a very useful purpose when available at the proper time in the planning process. General soil maps are prepared through orderly abstraction of detailed surveys. The interpretations made from these soil maps are suitable only for general planning. The same interpretations and others can be made from detailed surveys and are suitable for operational planning on individual farms, ranches, subdivisions and for other uses of land.

The General Soil Map is useful for providing information about the soil resources of communities, whole counties or parts of counties. This information can be used for preliminary planning for agricultural, urban, engineering, watershed, recreation and wildlife uses. For example, the General Soil Map can show large areas of "prime" agricultural land, extensive areas where most soils may have severe restrictions for septic tank filter fields, or places in a county where clay soils would be a problem in constructing roads or for building foundations.

The General Soil Map for Humboldt County has been compiled from more detailed soil maps (2) (3) supplemented by field observations and earlier published soil survey maps (4).

The soils of parts of urbanized areas have been altered by much cutting and reshaping of the landscape. These areas are shown on the General Soil Map as the soil pattern was presumed to be before these changes were made. Some general predictions can be made for these reshaped areas from the General Soil Map. However, detailed soil maps are needed to delineate their extent and determine more precisely their characteristics and qualities.

DESCRIPTION OF THE SOILS

There are 23 different mapping units on the General Soil Map for Humboldt County. These are named for the major soil series that occur within each unit. A soil series is a group of soils that have about the same kind of profile or sequence of layers. Except for a difference in surface texture, all members of a soil series have major horizons or layers that are similar in thickness, arrangement and other important characteristics. Some soil areas on the General Soil Map have the same soil series for which they are named, but differ by properties or qualities of major importance to use and management. These are separated (or phased) by indicating differences such as slope, surface texture, or depth of soil.

The soil series names are tentative and may be changed when the soils of the Humboldt Area are correlated into the National Soil Classification System. Any changes in names will not affect the usefulness of the map because the soil properties and qualities do not change and the names are only a means of identifying the map unit.

The 23 mapping units for Humboldt County are organized into 7 major groups based on soil characteristics and qualities, including slope. The seven major groups and the mapping units within each group are described below.

Group 1 - Areas dominated by deep and very deep, nearly level, well to poorly drained soils.

Bk-LC-AC Bayside-Loleta association, 0 to 9 percent slopes.

These soils occur on nearly level to moderately sloping valley floors and alluvial fans. They are developed in alluvium from sedimentary rocks. They are very deep with low fertility. The erosion hazard is slight. Both soils are subject to flooding and may have deposits of overwash material. The soils are used for pasture and other forage crops. The association comprises about 1.5 percent of the area on the maps.

The Bayside soils have dark gray and brown, mottled, slightly acid silty clay loam surface layers. Their subsoils are gray and yellowish brown, mottled, mildly alkaline clay loam. They are poorly drained and the permeability is slow.

The Loleta soils have very dark gray, medium acid loam surface layers. Their subsoils are grayish brown and brown, mottled, medium acid loam. They are moderately well to somewhat poorly drained and the permeability is slow.

Bayside soils comprise about 50 percent and Loleta soils about 30 percent of this association. The remaining 20 percent is composed of inclusions of marsh land, river wash, small peat bog areas and poorly drained, brown loam soils.

Cn-Eo-AB Carlotta-Ettersburg association, 0 to 5 percent slopes.

The soils of this association occur on nearly level to gently sloping, low, river terraces. The soils are deep to very deep with moderate subsoil permeability. They are used for pasture and Carlotta soils have conifers as natural vegetation. The erosion hazard is slight. This association comprises about 0.6 percent of the area on the maps.

The Carlotta soils have dark grayish brown, slightly acid loam surface layers. Their subsoils are dark grayish brown, strongly acid loam. They are moderately well drained.

The Ettersburg soils have grayish brown, very strongly acid loam surface layers. Their subsoils are grayish brown, very strongly acid clay loam. The underlying material is gravel. They are well drained.

Carlotta soils comprise about 35 percent and Ettersburg soils about 35 percent of this association. The remaining 30 percent is composed of inclusions of a brown clay loam terrace soil with a clay subsoil, areas of Wilder soils and terrace escarpments.

Fh-Ru-AC Ferndale-Russ association, 0 to 9 percent slopes.

These soils occur on nearly level to moderately sloping flood plains. They are developed from recent stream deposits. They are very deep with moderate fertility. The erosion hazard is slight. Recent floods have deposited other materials on many of the soil areas. These soils are used for field and forage crops. The association comprises about 2.5 percent of the area on the maps.

The Ferndale soils have dark grayish brown, neutral silt loam surface layers. Their subsoils are thick layers of dark grayish brown, neutral silt loam. The underlying materials are strata of sand, gravel and loam. The soils are well drained. Permeability is moderately rapid.

The Russ soils have grayish brown, slightly acid loam surface layers. Their subsoils are thick layers of olive brown, medium acid loam. The soils are moderately well drained with moderate permeability.

Ferndale soils comprise 60 percent and Russ soils 15 percent of this association. The remaining 25 percent is composed of deep well drained gravelly loam soils and deep moderately well drained silt loam soils.

Group 2 - Areas dominated by shallow to deep, gently sloping to steep, well to moderately well drained silty soils.

Hk-Rs-AD Hookton-Rohnerville association, 0 to 15 percent slopes.

These soils occur on nearly level to strongly sloping terraces. They are developed from old massive sediments and sedimentary rock. The erosion hazard is moderate. The soils are used for forage crops and urban areas. This association comprises about 0.8 percent of the area on the maps.

The Hookton soils have dark gray, medium acid silty clay loam surface layers. Their subsoils are brown, strongly acid silty clay loam. They are moderately deep, moderately well drained and the permeability is moderate.

The Rohnerville soils have black, medium acid silty clay loam surface layers. Their subsoils are black medium acid silty clay loam. They are deep, well to moderately well drained and the permeability is moderate.

Hookton soils comprise about 50 percent and the Rohnerville soils 20 percent of this association. The remaining 30 percent is composed of inclusions of dark brown, medium acid sandy loam terrace soils and terrace escarpments of the three soils.

Hx-Rs-BF-2 Hookton-Rohnerville association, 3 to 50 percent slopes, eroded.

The soils of this association occur on gently sloping to steep terraces. They are developed from old marine sediments and sedimentary rock. The erosion hazard is high. From 6 to 30 inches of the soil has been lost or moved down hill from erosion. The fertility is lower than on the uneroded phases. The soils are used for forage crops and urban areas. This association comprises about 0.7 percent of the area on the maps.

The Hookton soils have dark gray, medium acid silty clay loam surface layers. Their subsoils are brown, strongly acid silty clay loam. They are shallow to moderately deep, moderately well drained and the permeability is moderate.

The Rohnerville soils have black, medium acid silty clay loam surface layers. Their subsoils are black, medium acid silty clay loam. They are moderately deep to deep and well to moderately well drained. The subsoil permeability is moderate.

Hookton soils comprise about 45 percent and the Rohnerville soils 45 percent of this association. The remaining 10 percent is composed of inclusions of non-eroded phases of Hookton-Rohnerville soils.

Group 3 - Areas dominated by deep to very deep, gently sloping to very steep, well to moderately well drained, medium to strongly acid soils.

AI-DE Atwell association, 10 to 30 percent slopes.

These soils occur on moderately sloping to moderately steep uplands. They are moderately deep to deep and moderately well drained. The erosion hazard is high. Slips and slides are common. The natural vegetation is conifer and broad leaf trees. The association comprises about 0.5 percent of the area on the maps.

Atwell soils have grayish brown, strongly acid clay loam surface layers. Their subsoils are brown, strongly acid clay. The underlying material is gray, neutral clay.

The Atwell soils occupy 90 percent of the association. The remaining 10 percent is composed of Hugo soils and a brown soil with clay loam surface layers and clay loam subsoils.

AI-F Atwell association, 30 to 50 percent slopes.

These soils occur on steep uplands. They are moderately deep to deep and moderately well drained. The erosion hazard is high and landslips are common. The natural vegetation is conifer and broad leaf trees. The association comprises about 0.7 percent of the area on the maps.

Atwell soils have grayish brown, strongly acid clay loam surface layers. Their subsoils are brown, strongly acid clay. The underlying material is gray, neutral clay.

The Atwell soils occupy 90 percent of the association. The remaining 10 percent is composed of Hugo and Masterson soils.

Kr-DF Kneeland association, 10 to 50 percent slopes.

These soils occur on strongly sloping to steep uplands, and are developed from sandstone or shale rock. They are moderately deep and well drained. The erosion hazard is moderate. About 7 percent of the soil area is moderately eroded. Kneeland soils are used for range. This association comprises about 1 percent of the area on the maps.

Kneeland soils have dark grayish brown, strongly acid clay loam surface layers. The subsoils are pale brown, strongly acid clay loam. The permeability is slow.

Kneeland soils comprise 90 percent of this association. The remaining 10 percent is composed of a soil with gray clay loam surface and subsoils and a dark gray silty clay loam soil with dark grayish brown silty clay loam subsoils.

Kr-G Kneeland association, 50 to 75 percent slopes.

These soils occur on very steep uplands and are developed from sandstone or shale rock. They are moderately deep and well drained. The erosion hazard is moderate to high. About 45 percent of the soil area is severely eroded. Runoff is very rapid. The soils are used for range. The association comprises about 0.7 percent of the area on the maps.

Kneeland soils have dark grayish brown, strongly acid clay loam surface layers. The subsoils are pale brown, strongly acid clay loam. The permeability is slow.

Kneeland soils comprise 90 percent of this association. The remaining 10 percent is composed of Yorkville soils and a gray clay loam soil with gray gravelly clay loam subsoils.

Lg-Mz-AE Larabee-Mendocino association, 0 to 30 percent slopes.

The soils of this association occur on nearly level to moderately steep uplands. They are developed from soft sedimentary rock. The soils are deep to very deep. The erosion hazard is slight to moderate. The native vegetation is redwood and Douglas fir forest. This association comprises about 1.5 percent of the area on the maps.

The Larabee soils have grayish brown, slightly acid loam surface layers. Their subsoils are brown, strongly acid clay loam. They are well drained and the permeability is moderate to moderately slow.

The Mendocino soils have dark grayish brown, medium acid loam surface layers. Their subsoils are yellowish red, medium acid clay. They are moderately well drained and the permeability is moderate to moderately slow.

Larabee soils comprise about 35 percent and Mendocino soils 25 percent of this association. The remaining 40 percent is composed of inclusions of a brown sandy loam soil and a dark brown loam soil with sandy loam subsoils.

Lg-Mz-F Larabee-Mendocino association, 30 to 50 percent slopes.

The soils of this association occur on steep uplands. They are developed from soft sedimentary rock. The soils are deep to very deep. The erosion hazard is moderate to high. The native vegetation is redwood and Douglas fir forest. This association comprises about 6.5 percent of the area on the maps.

The Larabee soils have grayish brown, slightly acid loam surface layers. Their subsoils are brown, strongly acid clay loam. They are well drained and the permeability is moderate to moderately slow.

The Mendocino soils have dark grayish brown, medium acid loam surface layers. Their subsoils are yellowish red, medium acid clay. They are moderately well drained and the permeability is moderate to moderately slow.

Larabee soils comprise about 30 percent and Mendocino soils 25 percent of the association. The remaining 45 percent is composed of inclusions of a brown sandy loam soil; a dark brown loam soil with sandy loam subsoils and a grayish brown strongly acid sandy loam soil with yellowish brown clay subsoils.

Wi-EF   Wilder association, 15 to 50 percent slopes.

These soils occur on moderately steep to steep uplands. They are developed on sandstone rock and are moderately deep to deep. The erosion hazard is high. The soils are subject to both wind and water erosion on high ridges or knolls. The vegetation is bracken fern and thin stands of annual grasses. The association comprises 0.5 percent of the area on the maps.

The Wilder soils have dark grayish brown, strongly acid sandy loam surface layers. Their subsoils are light yellowish brown, very strongly acid gravelly sandy loam.

Wilder soils comprise 90 percent of the association. The remaining 10 percent is composed of inclusions of Hugo and Kneeland soils.

Group 4 - Areas dominated by moderately deep to deep, well drained, gently sloping to very steep soils.

HF-Jp-AE   Hugo-Josephine association, 0 to 30 percent slopes.

These soils occur on nearly level to moderately steep uplands. They are developed from sandstone rock. They are moderately deep to deep and well drained. The erosion hazard is slight to moderate. The natural vegetation is Douglas fir and redwood forest. This association occupies 2 percent of the area on the maps.

The Hugo soils have brown, medium acid loam or gravelly loam surface layers. The subsoils are yellowish brown, strongly acid loam or silt loam. Permeability is moderate.

The Josephine soils have brown, medium acid silt loam or loam surface layers. The subsoils are yellowish red, strongly acid clay loam. Permeability is moderate to moderately slow.

The Hugo soils comprise 70 percent and Josephine soils 15 percent of this association. The remaining 15 percent is composed of areas of Mendocino and Larabee soils. Also included are soils with brown loam surface layers and yellowish brown, strongly acid subsoils.

HF-Jp-F Hugo-Josephine association, 30 to 50 percent slopes.

These soils occur on steep uplands. They are moderately deep to deep and well drained. The erosion hazard is moderate to high. The association occupies 30 percent of the area on the maps.

The Hugo soils have brown, medium acid loam or gravelly loam surface layers. The subsoils are yellowish brown, strongly acid loam or silt loam. Permeability is moderate.

The Josephine soils have brown, medium acid silt loam or loam surface layers. The subsoils are yellowish red, strongly acid clay loam. Permeability is moderate to moderately slow.

The Hugo soils occupy 70 percent and Josephine soils 10 percent of this association. The remaining 20 percent is composed of Mendocino soils and a brown loam soil with brown strongly acid clay loam subsoils.

HF-Jp-G Hugo-Josephine association, 50 to 75 percent slopes.

These soils occur on very steep uplands. They are moderately deep to deep and well drained. The erosion hazard is high. About 6 percent of the soil area is moderately eroded. Gravelly surface layers are common. The association comprises 24 percent of the area on the maps.

The Hugo soils have brown, medium acid loam or gravelly loam surface layers. The subsoils are yellowish brown, strongly acid loam or silt loam. Permeability is moderate.

The Josephine soils have brown, medium acid silt loam or loam surface layers. The subsoils are yellowish red, strongly acid clay loam. Permeability is moderate to moderately slow.

The Hugo soils occupy 75 percent and the Josephine soils 5 percent of this association. The remaining 20 percent is composed of areas of a brown loam soil with brown strongly acid clay loam subsoils and areas of shallow gravelly clay loam soils.

SF-Mm-F-2 Sheetiron-Masterson association, 30 to 50 percent slopes, eroded.

These soils occur on steep uplands. They are developed from sedimentary rock. They are moderately deep to deep. The erosion hazard is high. The soils are used for growing timber. The association comprises about 2 percent of the soils of the area on the maps.

The Sheetiron soils have dark grayish brown or black, medium acid gravelly loam surface layers. The subsoils are brown, strongly acid gravelly loam. The drainage is somewhat excessive and permeability is moderate.

The Masterson soils have dark brown, strongly acid gravelly loam surface layers. The subsoils are dark brown, strongly acid gravelly loam. The soils are well drained and permeabilities are moderately rapid or rapid.

The Sheetiron soils comprise 90 percent and the Masterson soils 5 percent of this association. The remaining 5 percent is composed of inclusions of Hugo-Josephine soils.

Group 5 - Areas dominated by shallow to moderately deep, well drained, sloping to very steep soils.

Lm-F Laughlin association, 30 to 50 percent slopes.

These soils occur on steep uplands. They are moderately deep and well drained. The erosion hazard is moderate. About 20 percent of the soil area is moderately eroded. The subsoil permeability is moderately rapid and runoff is medium. The natural vegetation is grass and oak. The association comprises about 3 percent of the area on the maps.

Laughlin soils have grayish brown, medium acid loam surface layers. The subsoils are grayish brown, medium acid loam.

The Laughlin soils comprise 85 percent of this association. The remaining 15 percent is composed of Yorkville and Hugo-Josephine soils. Also included are areas of Laughlin soils on less sloping and very steep slopes.

Mq-LE-EG Maymen-Los Gatos association, 15 to 75 percent slopes.

These soils occur on moderately steep to very steep uplands. They are developed on sandstone rock and are very shallow to moderately deep. The erosion hazard is moderate to high. About 20 percent of the soil area is severely eroded. The vegetation consists of chamise and other brush with very low usability for grazing. The association comprises about 1 percent of the area on the maps.

The Maymen soils have brown, medium acid gravelly loam surface layers. Their subsoils are yellowish brown, strongly acid gravelly loam. The soils are somewhat excessively drained and moderately rapidly permeable.

The Los Gatos soils have brown, slightly acid clay loam or gravelly loam surface layers. Their subsoils are reddish brown, medium acid gravelly clay loam. The soils are well drained and moderately slowly permeable.

Maymen soils comprise 40 percent and Los Gatos soils 20 percent of this association. The remaining 40 percent is composed of shallow, rocky, dark grayish brown soils that occur near the coast.

Group 6 - Areas dominated by shallow to deep, gently sloping to steep, well to moderately well drained soils on serpentine or other unstable rock formations.

Dv-We-DF Dubakella-Weitchpec association, 10 to 50 percent slopes.

These soils occur on strongly sloping to steep uplands. They are shallow to moderately deep and well to excessively drained. The erosion hazard is moderate. The shallower soils have watershed and wildlife value. The deeper soils are used for limited timber production. The association comprises about 0.5 percent of the area on the maps.

The Dubakella soils have reddish brown, neutral stony loam surface layers. Their subsoils are brown, mildly alkaline gravelly loam. The underlying rock is serpentine.

The Weitchpec soils have pale brown, medium acid very gravelly loam surface layers. Their subsoils are yellowish brown, slightly acid very gravelly loam. The underlying rock is igneous.

Dubakella soils comprise 80 percent and Weitchpec soils 10 percent of the association. The remaining 10 percent is composed of other shallow rocky soils and small areas of Hugo-Josephine soils.

Yr-EF Yorkville association, 15 to 50 percent slopes.

These soils occur on moderately steep to steep uplands and are developed from metamorphosed basic rock. They are shallow to moderately deep and somewhat poorly to moderately well drained. The erosion hazard is moderate to high. About 40 percent of the soil area is moderately and severely eroded. Landslips and gullies are common. Subsoil permeability is slow. The natural vegetation is annual grasses with a few scattered trees. The association comprises about 5 percent of the area on the maps.

The Yorkville soils have grayish brown, neutral clay loam surface layers. Their subsoils are dark gray, mildly alkaline clay that is several feet thick.

Yorkville soils comprise 70 percent of this association. The remaining 30 percent is composed of inclusions of Laughlin soils.

Group 7 - Areas dominated by miscellaneous land types.

cy-DG Colluvial land association, 10 to 75 percent slopes.

This association occurs on strongly sloping to very steep uplands. It consists of areas of sedimentary rock material without soil or with very thin soil layers. The land areas are bare or have oak, madrone and laurel vegetation. The association comprises about 0.7 percent of the area on the maps.

Colluvial land comprises 90 percent of the association. The remaining 10 percent is composed of rock out crops and inclusions of Maymen-Los Gatos soils.

DL-ba Dune land-Beaches association.

These miscellaneous land types occur on sections of the coast line without rocky bluffs. They both consist of coarse sands, usually deep, excessively drained, with very low fertility. The erosion hazard is high and fertility very low. Beaches are bare and wave washed. Dune lands may have a sparse growth of beach grass or shrubs. Wind action constantly moves the sand from the beaches to the dunes and within the dune areas. The association comprises about 0.6 percent of the soils of the County.

Dune land occupies 45 percent of the association and Beaches 45 percent. The remaining 10 percent is composed of Riverwash, organic soils and rocky escarpments.

RW Riverwash association.

These soils occur on nearly level streambeds, are stream deposits with little or no development. The material consists of coarse sand and gravel stratified and variable in thickness. The areas are frequently flooded, have a high erosion hazard and are of low fertility. They are not used for agriculture. The association comprises about 0.7 percent of the area on the maps.

Riverwash comprises 85 percent of this association. The remaining 15 percent is composed of inclusions of Ferndale-Russ soils.

Dry Farming

Mishka Straka provided the following information on dry farming in Humboldt County. This information is via e-mail.

Not all soils are dry farmable with all crops. Some soils are dry farmable with many crops, some soils might only grow trees without water while others might not grow anything with or without water. There are lots of variables. Basically Ferndale soils which are floodplain alluvial are likely dry farmable. Also most agricultural soils around here can grow crops in the winter without irrigation, though dry farm I know means summer to most people. Summer Crops you could dry farm include tomatoes, melons, potatoes, sunflowers, winter squash, corn, other grains, flowers, herbs, and things that are regarded as drought tolerant. Most soils in the county can't be dry farmed unless we are talking about the aforementioned winter cropping but those crops are limited too.

Information from the Report and General Soil Map, Soil of Western Humboldt County, and the maps of Northern, Central, and Southern Humboldt illustrating prime agriculture soils give data to determine where dry farming can occur.

Climatography of the United States

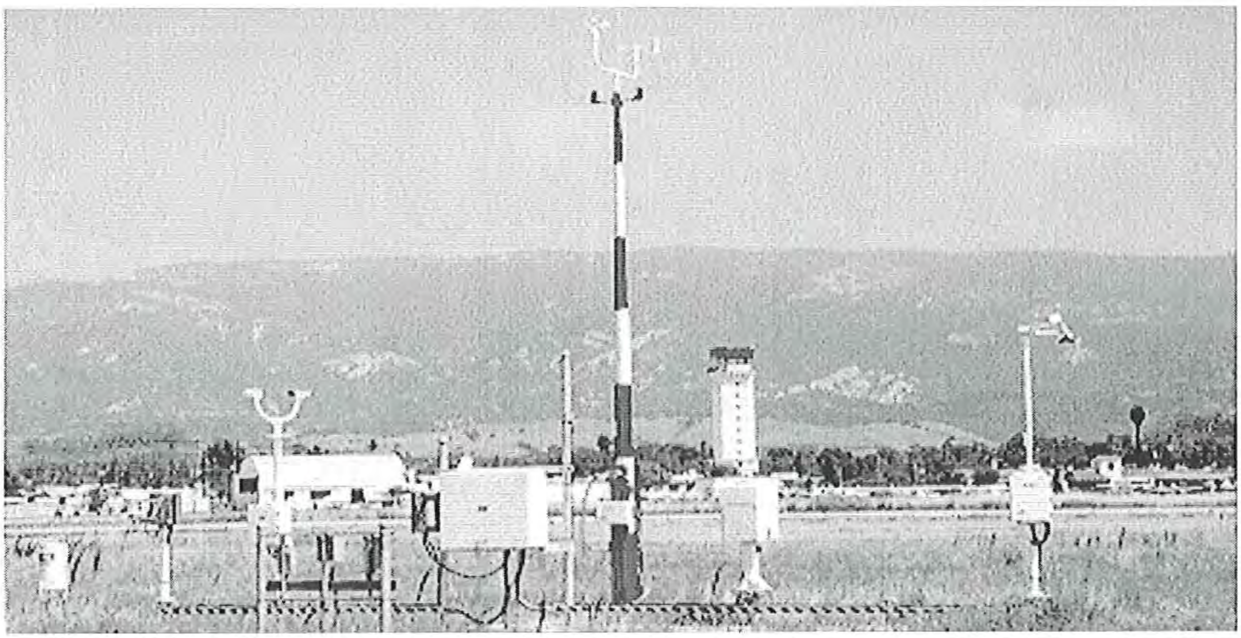
Water Analysis Questions

What is the annual average precipitation?
What are the annual precipitation patterns?
Most importantly, when does most of the rain fall – in the winter or in the summer?

The climatography report is for 1971-2000. It has all the data for monthly and annual maximum, minimum and mean temperature. It also has the monthly and annual total precipitation, heating and cooling degree days. The stations are all over the state and include the National Weather Service Cooperative Network and Principal Observation. The closest weather station to us is in Eureka. Eureka's annual average temperature is 52.9 degrees with a maximum of 59.3 and a minimum of 46.4 degrees Fahrenheit. Eureka's average annual precipitation is 38.10 inches. Eureka receives a monthly high of precipitation in December, January, March and February all of which are around 5 to 6 inches a month. Eureka receives the least amount of precipitation in July, August and September all around ½ an inch. This report has information on hundreds of sites, and is the most accurate information on weather patterns in the county. There are also weather stations found in Shelter Cove, Trinity River, CopCo 1 & 2 dams and Willow Creek.

CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971 - 2000



04 CALIFORNIA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER
ASHEVILLE, NC

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NOTES

Product Description:
This Climatography includes 1971-2000 normals of monthly and annual maximum, minimum, and mean temperature (degrees F), monthly and annual total precipitation (inches), and heating and cooling degree days (base 65 degrees F). Normals stations include both National Weather Service Cooperative Network and Principal Observation (First-Order) locations in the 50 states, Puerto Rico, the Virgin Islands, and Pacific Islands.

Abbreviations:
No. = Station Number in State Map
COOP ID = Cooperative Network ID (1:2=State ID, 3:6=Station Index)
WBAN ID = Weather Bureau Army Navy ID, if assigned
Elements = Input Elements (X=Maximum Temperature, N=Minimum Temperature, P=Precipitation)
Call = 3-Letter Station Call Sign, if assigned
MAX = Normal Maximum Temperature (degrees Fahrenheit)
MEAN = Average of MAX and MIN (degrees Fahrenheit)
MIN = Normal Minimum Temperature (degrees Fahrenheit)
HDD = Total Heating Degree Days (base 65 degrees Fahrenheit)
CDD = Total Cooling Degree Days (base 65 degrees Fahrenheit)

Latitude = Latitude in degrees, minutes, and hemisphere (N=North, S=South)
Longitude = Longitude in degrees, minutes, and hemisphere (W=West, E=East)
Elev = Elevation in feet above mean sea level
Flag 1 = * if a published *Local Climatological Data* station
Flag 2 = + if WMO Fully Qualified (see *Note* below)

HIGHEST MEAN/YEAR = Maximum Mean Monthly Value/Year, 1971-2000
MEDIAN = Median Mean Monthly Value/Year, 1971-2000
LOWEST MEAN/YEAR = Minimum Mean Monthly Value/Year, 1971-2000
MAX OBS TIME ADJUSTMENT = Add to MAX to Get Midnight Obs. Schedule
MIN OBS TIME ADJUSTMENT = Add to MIN to Get Midnight Obs. Schedule

Note: In 1989, the World Meteorological Organization (WMO) prescribed standards of data completeness for the 1961-1990 WMO Standard Normals. For full qualification, no more than three consecutive year-month values can be missing for a given month or no more than five overall values can be missing for a given month (out of 30 values). Stations meeting these standards are indicated with a '+' sign in Flag 2. Otherwise, stations are included in the normals if they have at least 10 year-month values for each month and have been active since January 1999 or were a previous normals station.

Map Legend: Numbers correspond to 'No.' in Station Inventory; Shaded Circles indicate Temperature and Precipitation Stations, Triangles (Point Up) indicate Precipitation-Only Stations, Triangles (Point Down) indicate Temperature-Only Stations, and Hexagons indicate stations with Flag 1 = *.

Computational Procedures:
A climate normal is defined, by convention, as the arithmetic mean of a climatological element computed over three consecutive decades (WMO,1989). Ideally, the data record for such a 30-year period should be free of any inconsistencies in observational practices (*e.g.*, changes in station location, instrumentation, time of observation, *etc.*) and be serially complete (*i.e.*, no missing values). When present, inconsistencies can lead to a non-climatic bias in one period of a station's record relative to another, yielding an "inhomogeneous" data record. Adjustments and estimations can make a climate record "homogeneous" and serially complete, and allow a climate normal to be calculated simply as the average of the 30 monthly values.

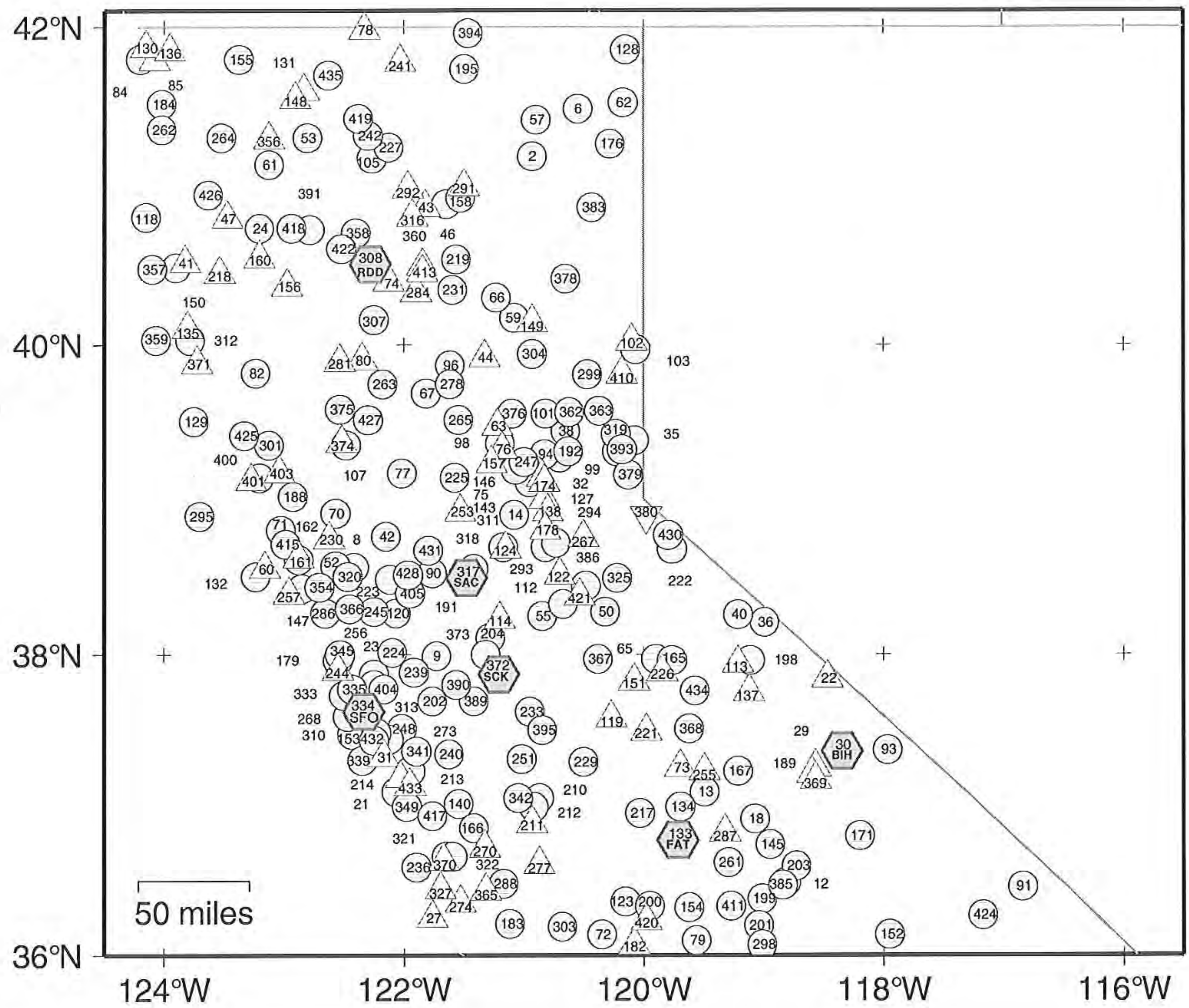
The methodology employed to generate the 1971-2000 normals is not the same as in previous normals, as it addresses inhomogeneity and missing data value problems using several steps. The technique developed by Karl *et al.* (1986) is used to adjust monthly maximum and minimum temperature observations of conterminous U.S. stations to a consistent midnight-to-midnight schedule. All monthly temperature averages and precipitation totals are cross-checked against archived daily observations to ensure internal consistency. Each monthly observation is evaluated using a modified quality control procedure (Peterson *et al.*,1998), where station observation departures are computed, compared with neighboring stations, and then flagged and estimated where large differences with neighboring values exist. Missing or discarded temperature and precipitation observations are replaced using a weighting function derived from the observed relationship between a candidate's monthly observations and those of up to 20 neighboring stations whose observations are most strongly correlated with the candidate site. For temperature estimates, neighboring stations were selected from the U.S. Historical Climatology Network (USHCN; Karl *et al.* 1990). For precipitation estimates, all available stations were potential neighbors, maximizing station density for estimating the more spatially variable precipitation values.

Peterson and Easterling (1994) and Easterling and Peterson (1995) outline the method for adjusting temperature inhomogeneities. This technique involves comparing the record of the candidate station with a reference series generated from neighboring data. The reference series is reconstructed using a weighted average of first difference observations (the difference from one year to the next) for neighboring stations with the highest correlation with the candidate. The underlying assumption behind this methodology is that temperatures over a region have similar tendencies in variation. If this assumption is violated, the potential discontinuity is evaluated for statistical significance. Where significant discontinuities are detected, the difference in average annual temperatures before and after the inhomogeneity is applied to adjust the mean of the earlier block with the mean of the latter block of data. Such an evaluation requires a minimum of five years between discontinuities. Consequently, if multiple changes occur within five years or if a change occurs very near the end of the normals period (*e.g.,* after 1995), the discontinuity may not be detectable using this methodology.

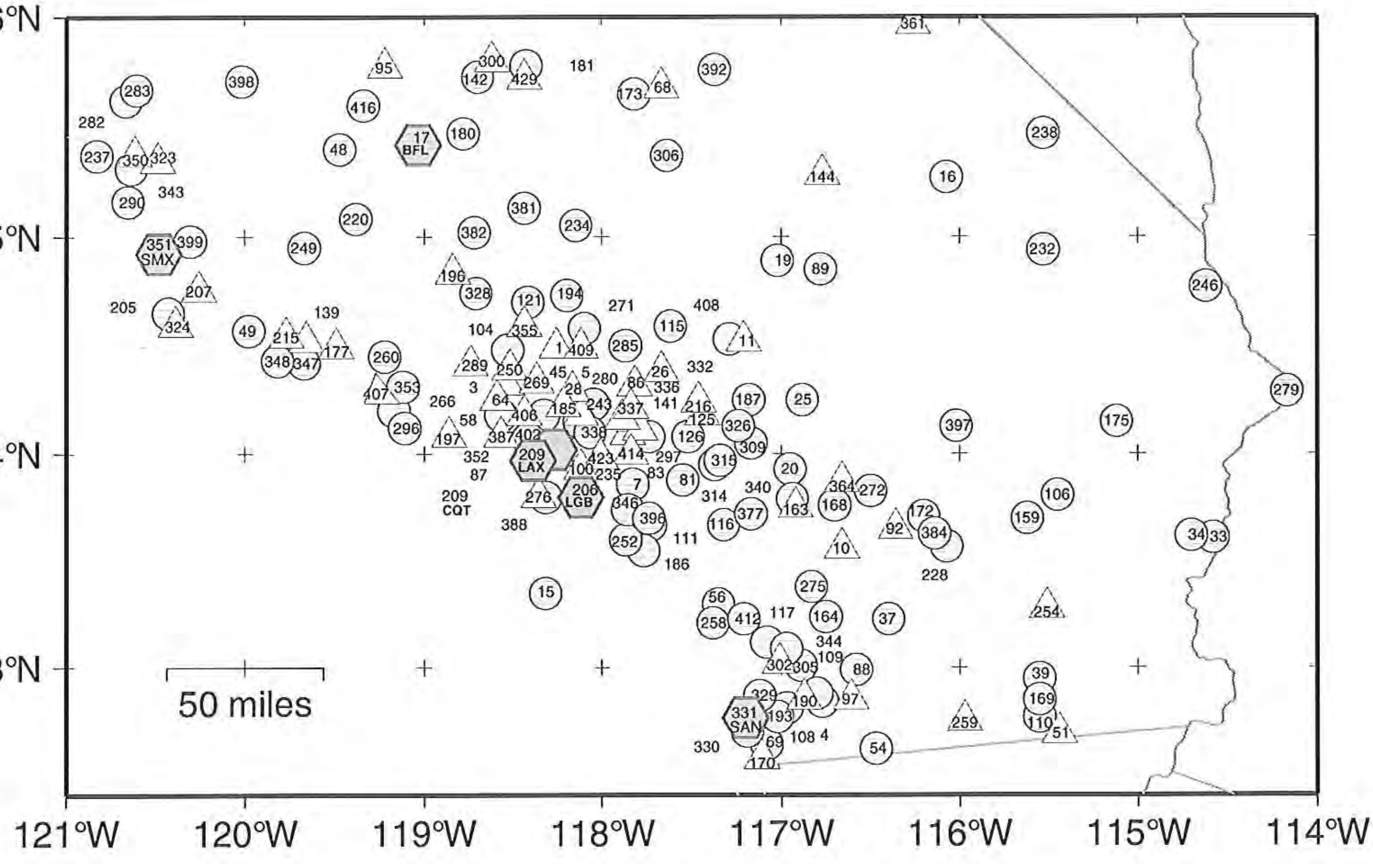
The monthly normals for maximum and minimum temperature and precipitation are computed simply by averaging the appropriate 30 values from the 1971-2000 record. The monthly average temperature normals are computed by averaging the corresponding monthly maximum and minimum normals. The annual temperature normals are calculated by taking the average of the 12 monthly normals. The annual precipitation and degree day normals are the sum of the 12 monthly normals. Trace precipitation totals are shown as zero. Precipitation totals include rain and the liquid equivalent of frozen and freezing precipitation (*e.g.*, snow, sleet, freezing rain, and hail). For many NWS locations, indicated with an '*' next to 'HDD' and 'CDD' in the degree day table, degree day normals are computed directly from daily values for the 1971-2000 period. For all other stations, estimated degree day totals are based on a modification of the rational conversion formula developed by Thom (1966), using daily spline-fit means and standard deviations of average temperature as inputs.

References:
Easterling, D.R, and T.C. Peterson, 1995: A new method for detecting and adjusting for undocumented discontinuities in climatological time series. *Intl. J. Clim.*, **15**, 369-377.
Karl, T.R., C.N. Williams, Jr., P.J. Young, and W.M. Wendland,1986: A model to estimate the time of observation bias associated with monthly mean maximum, minimum, and mean temperatures for the United States, *J. Clim. Appl. Met.*, **25**, 145-160.
Peterson, T.C., and D.R. Easterling, 1994: Creation of homogeneous composite climatological reference series. *Intl. J. Clim.*, **14**, 671-679.
Peterson,T.C., R. Vose, R. Schmoyer, and V. Razuvaev, 1998: Global Historical Climatology Network (GHCN) quality control of monthly temperature data. *Intl. J. Clim.*, **18**, 1169-1179.
Thom, H.C.S., 1966: Normal degree days above any base by the universal truncation coefficient, *Month. Wea. Rev.*, **94**, 461-465.
World Meteorological Organization, 1989: Calculation of Monthly and Annual 30-Year Standard Normals, WCDP-No. 10, WMO-TD/No. 341, Geneva: World Meteorological Organization.

04 - CALIFORNIA (NORTHERN)



04 - CALIFORNIA (SOUTHERN)



STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
1	040014		P	ACTON ESCONDIDO FC261		34 30 N	118 16 W	2970		
2	040029		XNP	ADIN RS		41 12 N	120 57 W	4195		+
3	040115		P	ALISO CANYON OAT MTN		34 19 N	118 33 W	2367		
4	040136		XNP	ALPINE		32 50 N	116 47 W	1735		+
5	040144		P	ALTADENA		34 11 N	118 08 W	1127		+
6	040161		XNP	ALTURAS		41 30 N	120 33 W	4400		+
7	040192		XNP	ANAHEIM		33 52 N	117 51 W	335		
8	040212		XNP	ANGWIN PAC UNION COL		38 34 N	122 26 W	1715		+
9	040232		XNP	ANTIOCH PUMP PLANT #3		37 59 N	121 45 W	60		+
10	040235		P	ANZA		33 33 N	116 41 W	3915		+
11	040244		P	APPLE VALLEY		34 31 N	117 13 W	2935		
12	040343		XNP	ASH MOUNTAIN		36 29 N	118 50 W	1708		+
13	040379		XNP	AUBERRY 2 NW		37 06 N	119 31 W	2090		+
14	040383		XNP	AUBURN		38 54 N	121 05 W	1292		+
15	040395	23107	XNP	AVALON PLEASURE PIER	AUX	33 21 N	118 19 W	25		
16	040436		XNP	BAKER		35 16 N	116 04 W	940		
17	040442	23155	XNP	BAKERSFIELD KERN CO AP	BFL	35 26 N	119 03 W	489	*	+
18	040449		XNP	BALCH POWER HOUSE		36 55 N	119 05 W	1720		+
19	040521		XNP	BARSTOW FIRE STATION		34 53 N	117 01 W	2320		
20	040609	23156	XNP	BEAUMONT 1 E	BUO	33 56 N	116 58 W	2600		+
21	040673		XNP	BEN LOMOND NO 4		37 05 N	122 05 W	420		+
22	040684		P	BENTON INSPECTION STN		37 51 N	118 29 W	5460		+
23	040693		XNP	BERKELEY		37 52 N	122 16 W	310		
24	040738		XNP	BIG BAR 4 E		40 44 N	123 12 W	1250		
25	040741		XNP	BIG BEAR LAKE		34 15 N	116 53 W	6790		+
26	040779		P	BIG PINES PARK FC83B		34 23 N	117 41 W	6845		
27	040790		P	BIG SUR STATION		36 15 N	121 47 W	200		+
28	040798		P	BIG TUJUNGA DAM FC46DE		34 18 N	118 11 W	2317		+
29	040819		P	BISHOP CREEK INTAKE 2		37 15 N	118 35 W	8154		+
30	040822	23157	XNP	BISHOP AP	BIH	37 22 N	118 21 W	4102	*	+
31	040850		P	BLACK MOUNTAIN 2 WSW		37 19 N	122 10 W	2120		
32	040897	23225	XNP	BLUE CANYON	BLU	39 17 N	120 43 W	5280		
33	040924		XNP	BLYTHE		33 37 N	114 36 W	268		+
34	040927	23158	XNP	BLYTHE AP	BLH	33 37 N	114 43 W	395		+
35	040931		XNP	BOCA		39 23 N	120 06 W	5575		+
36	040943		XNP	BODIE		38 13 N	119 01 W	8370		+
37	040983		XNP	BORREGO DESERT PARK		33 14 N	116 25 W	805		+
38	041018		XNP	BOWMAN DAM		39 27 N	120 39 W	5383		+
39	041048		XNP	BRAWLEY 2 SW		32 57 N	115 33 W	-100		+
40	041072		XNP	BRIDGEPORT		38 15 N	119 14 W	6470		+
41	041080		P	BRIDGEVILLE 4 NNW		40 31 N	123 49 W	2100		
42	041112		XNP	BROOKS FARNHAM RANCH		38 46 N	122 09 W	294		
43	041149		P	BUCKHORN		40 52 N	121 51 W	3800		+
44	041159		P	BUCKS CREEK P H		39 55 N	121 20 W	1759		+
45	041194		XNP	BURBANK VALLEY PUMP PLNT	BUR	34 11 N	118 20 W	655		+
46	041214	24212	XNP	BURNEY		40 53 N	121 39 W	3198		
47	041215		P	BURNT RANCH 1 S		40 48 N	123 28 W	2150		
48	041244		XNP	BUTTONWILLOW		35 24 N	119 28 W	269		+
49	041253		XNP	CACHUMA LAKE		34 34 N	119 59 W	781		+
50	041277		XNP	CALAVERAS BIG TREES		38 17 N	120 19 W	4694		+
51	041288		P	CALEXICO 2 NE		32 41 N	115 28 W	12		+
52	041312		XNP	CALISTOGA		38 35 N	122 34 W	370		+
53	041316		XNP	CALLAHAN		41 19 N	122 48 W	3185		+
54	041424		XNP	CAMPO	CZZ	32 37 N	116 28 W	2630		+
55	041428		XNP	CAMP PARDEE		38 15 N	120 52 W	658		+
56	803154	03154	XNP	CAMP PENDLETON MCAS		33 18 N	117 21 W	75		
57	041476		XNP	CANBY 3 SW		41 25 N	120 54 W	4310		
58	041484		XNP	CANOGA PARK PIERCE COLLG		34 11 N	118 34 W	790		+
59	041497		XNP	CANYON DAM		40 10 N	121 05 W	4560		+
60	041603		P	CAZADERO 5 NW		38 34 N	123 10 W	1420		
61	041606		XNP	CECILVILLE		41 08 N	123 08 W	2330		
62	041614		XNP	CEDARVILLE		41 32 N	120 10 W	4670		+
63	041653		P	CHALLENGE R S		39 29 N	121 13 W	2570		
64	041680		P	CHATSWORTH FC 24 F		34 15 N	118 36 W	950		
65	041697		XNP	CHERRY VALLEY DAM		37 58 N	119 55 W	4765		+
66	041700		XNP	CHESTER		40 18 N	121 14 W	4525		+
67	041715		XNP	CHICO UNIVERSITY FARM		39 41 N	121 49 W	185		+
68	041733	93104	P	CHINA LAKE ARMITAGE		35 41 N	117 41 W	2220		
69	041758		XNP	CHULA VISTA		32 38 N	117 05 W	56		+
70	041806		XNP	CLEARLAKE 4 SE		38 55 N	122 34 W	1349		+

STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
71	041838		XNP	CLOVERDALE		38 48 N	123 01 W	333		
72	041864	23252	XNP	COALINGA		36 08 N	120 22 W	670		+
73	041878		P	COARSEGOLD 1 SW		37 15 N	119 42 W	2230		
74	041907		P	COLEMAN FISHERIES STA		40 24 N	122 09 W	420		+
75	041912		XNP	COLFAX		39 07 N	120 57 W	2400		+
76	041916		P	COLGATE P H		39 20 N	121 12 W	595		+
77	041948		XNP	COLUSA 2 SSW		39 11 N	122 02 W	50		+
78	041990		P	COPCO NO 1 DAM		41 59 N	122 20 W	2703		+
79	042012		XNP	CORCORAN IRRIG DIST		36 06 N	119 35 W	200		+
80	042027		P	CORNING HOUGHTON RANCH		39 54 N	122 21 W	487		
81	042031		XNP	CORONA		33 53 N	117 33 W	610		
82	042081		XNP	COVELO		39 49 N	123 15 W	1410		+
83	042090		P	COVINA CITY YRD FC387B		34 06 N	117 53 W	583		+
84	042147		XNP	CRESCENT CITY 3 NNW	CEC	41 48 N	124 13 W	40		+
85	042148		P	CRESCENT CITY 7 ENE		41 48 N	124 05 W	120		+
86	042198		P	CRYSTAL LAKE FC 283 C		34 19 N	117 50 W	5370		
87	042214		XNP	CULVER CITY		34 00 N	118 25 W	55		
88	042239		XNP	CUYAMACA		32 59 N	116 35 W	4640		+
89	042257	23161	XNP	DAGGETT BARSTOW AP	DAG	34 51 N	116 47 W	1917		+
90	042294		XNP	DAVIS 2 WSW EXP FARM		38 32 N	121 47 W	60		+
91	042319		XNP	DEATH VALLEY		36 28 N	116 52 W	-194		+
92	042327		P	DEEP CANYON LABORATORY		33 39 N	116 23 W	1200		+
93	042331		XNP	DEEP SPRINGS COLLEGE		37 22 N	117 59 W	5225		
94	042338		XNP	DEER CREEK FOREBAY		39 18 N	120 50 W	4455		
95	042346		P	DELANO		35 46 N	119 14 W	323		+
96	042402		XNP	DE SABLA		39 52 N	121 37 W	2710		+
97	042406		P	DESCANSO RANGER STN		32 51 N	116 37 W	3500		
98	042456		XNP	DOBBINS 1 S		39 22 N	121 12 W	1640		
99	042467		XNP	DONNER MEMORIAL ST PK		39 19 N	120 14 W	5937		+
100	042494		P	DOWNEY FIRE STN FC107C		33 56 N	118 09 W	110		+
101	042500		XNP	DOWNIEVILLE		39 34 N	120 49 W	2914		
102	042504		P	DOYLE		40 01 N	120 06 W	4240		+
103	042506		XNP	DOYLE 4 SSE		39 58 N	120 05 W	4390		+
104	042516		XNP	DRY CANYON RESERVOIR		34 29 N	118 32 W	1455		
105	042574		XNP	DUNSMUIR TREATMENT PLANT		41 11 N	122 16 W	2170		
106	042598		XNP	EAGLE MOUNTAIN		33 49 N	115 27 W	973		+
107	042640		XNP	EAST PARK RESERVOIR		39 22 N	122 31 W	1205		+
108	042706		XNP	EL CAJON		32 49 N	116 59 W	405		
109	042709		XNP	EL CAPITAN DAM		32 53 N	116 49 W	600		+
110	042713		XNP	EL CENTRO 2 SSW		32 46 N	115 34 W	-30		+
111	893101	93101	XNP	EL TORO MCAS		33 40 N	117 44 W	381		+
112	042728		XNP	ELECTRA P H		38 20 N	120 40 W	715		
113	042756		P	ELLERY LAKE		37 56 N	119 14 W	9645		+
114	042760		P	ELLIOTT		38 14 N	121 12 W	92		
115	042771		XNP	EL MIRAGE		34 35 N	117 38 W	2950		+
116	042805		XNP	ELSINORE		33 40 N	117 20 W	1285		+
117	042863		XNP	ESCONDIDO NO 2		33 07 N	117 06 W	600		
118	042910	24213	XNP	EUREKA WFO WOODLEY IS	EKA	40 49 N	124 10 W	20		+
119	042920		P	EXCHEQUER DAM		37 35 N	120 16 W	442		+
120	042934		XNP	FAIRFIELD		38 16 N	122 04 W	40		+
121	042941		XNP	FAIRMONT		34 42 N	118 26 W	3060		+
122	043038		P	FIDDLETOWN DEXTER RANCH		38 31 N	120 42 W	2160		+
123	043083		XNP	FIVE POINTS 5 SSW		36 22 N	120 09 W	285		
124	043113		XNP	FOLSOM DAM		38 42 N	121 10 W	350		
125	043118		P	FONTANA 5 N		34 11 N	117 27 W	1972		
126	043120		XNP	FONTANA KAISER (ONTARIO)	ONT	34 05 N	117 31 W	1102		
127	043134		P	FORESTHILL RANGER STN		39 01 N	120 51 W	3015		+
128	043157		XNP	FORT BIDWELL		41 52 N	120 09 W	4500		+
129	043161		XNP	FORT BRAGG 5 N		39 31 N	123 46 W	120		+
130	043173		P	FORT DICK		41 52 N	124 09 W	46		
131	043182		P	FORT JONES RANGER STN		41 36 N	122 51 W	2725		
132	043191		XNP	FORT ROSS		38 31 N	123 15 W	112		+
133	043257	93193	XNP	FRESNO YOSEMITE INTL	FAT	36 47 N	119 43 W	333	*	+
134	043261		XNP	FRIANT GOVERNMENT CAMP		37 00 N	119 43 W	410		+
135	043320		P	GARBERVILLE		40 06 N	123 48 W	340		
136	043357		P	GASQUET RS		41 51 N	123 58 W	384		+
137	043369		P	GEM LAKE		37 45 N	119 08 W	8970		+
138	043384		P	GEORGETOWN R S		38 56 N	120 48 W	3001		
139	043402		P	GIBRALTAR DAM 2		34 31 N	119 41 W	1550		+
140	043417		XNP	GILROY		37 00 N	121 34 W	194		+

STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
141	043452		P	GLENDORA FC 287B		34 09 N	117 51 W	920		+
142	043463		XNP	GLENNVILLE		35 44 N	118 42 W	3140		+
143	043491		P	GOLD RUN 2 SW		39 09 N	120 51 W	3320		+
144	043498		P	GOLDSTONE ECHO NO 2		35 17 N	116 47 W	2950		+
145	043551		XNP	GRANT GROVE		36 44 N	118 58 W	6600		+
146	043573		XNP	GRASS VALLEY NO 2		39 12 N	121 04 W	2400		+
147	043578		XNP	GRATON		38 26 N	122 52 W	200		+
148	043614		P	GREENVIEW		41 33 N	122 54 W	2820		
149	043621		P	GREENVILLE R S		40 08 N	120 57 W	3560		
150	043647		XNP	GRIZZLY CREEK STATE PARK		40 29 N	123 55 W	410		
151	043672		P	GROVELAND R S		37 49 N	120 06 W	3144		+
152	043710		XNP	HAIWEE		36 08 N	117 57 W	3825		+
153	043714		XNP	HALF MOON BAY		37 28 N	122 27 W	16		+
154	043747		XNP	HANFORD 1 S		36 19 N	119 38 W	245		+
155	043761		XNP	HAPPY CAMP RANGER STN		41 48 N	123 23 W	1120		
156	043791		P	HARRISON GULCH R S		40 22 N	122 58 W	2749		
157	043800		P	HARRY ENGLEBRIGHT DAM		39 14 N	121 16 W	800		+
158	043824		XNP	HAT CREEK		40 56 N	121 33 W	3015		+
159	043855		XNP	HAYFIELD PUMPING PLANT		33 42 N	115 38 W	1370		+
160	043859		P	HAYFORK 2 W		40 33 N	123 13 W	2300		
161	043875		XNP	HEALDSBURG		38 37 N	122 52 W	108		+
162	043878		P	HEALDSBURG NO 2		38 38 N	122 52 W	150		+
163	043896		P	HEMET		33 45 N	116 56 W	1655		+
164	043914		XNP	HENSHAW DAM		33 14 N	116 46 W	2700		+
165	043939		XNP	HETCH HETCHY		37 58 N	119 47 W	3870		+
166	044025		XNP	HOLLISTER 2		36 51 N	121 25 W	275		
167	044176		XNP	HUNTINGTON LAKE		37 14 N	119 13 W	7020		
168	044211		XNP	IDYLLWILD FIRE DEPT		33 45 N	116 42 W	5380		+
169	044223		XNP	IMPERIAL	IPL	32 51 N	115 34 W	-64		+
170	893115	93115	P	IMPERIAL BEACH REAM NAS		32 34 N	117 07 W	20		
171	044232		XNP	INDEPENDENCE		36 48 N	118 12 W	3950		+
172	044259		XNP	INDIO FIRE STATION		33 43 N	116 13 W	-21		
173	044278		XNP	INYOKERN		35 39 N	117 49 W	2440		+
174	044288		P	IOWA HILL		39 07 N	120 50 W	3100		+
175	044297		XNP	IRON MOUNTAIN		34 09 N	115 07 W	922		+
176	044374		XNP	JESS VALLEY		41 16 N	120 18 W	5400		+
177	044422		P	JUNCAL DAM		34 29 N	119 30 W	2227		+
178	044484		P	KELSEY 1 N		38 49 N	120 49 W	2000		
179	044500		XNP	KENTFIELD		37 57 N	122 34 W	128		+
180	044520		XNP	KERN RIVER PH 1		35 28 N	118 47 W	970		
181	044523		XNP	KERN RIVER PH 3		35 47 N	118 26 W	2703		+
182	044536		P	KETTLEMAN STATION		36 04 N	120 05 W	508		+
183	044555		XNP	KING CITY		36 12 N	121 07 W	320		+
184	044577		XNP	KLAMATH		41 31 N	124 02 W	25		+
185	044628		P	LA CRESCENTA FC 251C		34 13 N	118 15 W	1565		+
186	044647		XNP	LAGUNA BEACH		33 33 N	117 47 W	35		+
187	044671		XNP	LAKE ARROWHEAD		34 15 N	117 11 W	5205		+
188	044701		XNP	LAKEPORT		39 02 N	122 55 W	1315		
189	044705		P	LAKE SABRINA		37 13 N	118 37 W	9065		
190	044710		P	LAKESIDE 2 E		32 51 N	116 54 W	690		+
191	044712		XNP	LAKE SOLANO		38 29 N	122 00 W	190		
192	044713		XNP	LAKE SPAULDING		39 19 N	120 38 W	5155		+
193	044735		XNP	LA MESA		32 46 N	117 01 W	530		+
194	044749	03159	XNP	LANCASTER ATC	WJF	34 44 N	118 12 W	2338		+
195	044838		XNP	LAVA BEDS NAT MONUMENT		41 44 N	121 30 W	4770		+
196	044863		P	LEBEC		34 50 N	118 52 W	3585		+
197	044867		P	LECHUZA PTRL ST FC352B		34 05 N	118 53 W	1600		+
198	044881		XNP	LEE VINING		37 57 N	119 07 W	6797		
199	044890		XNP	LEMON COVE		36 23 N	119 02 W	513		+
200	823110	23110	XNP	LEMOORE REEVES NAS		36 20 N	119 57 W	240		+
201	044957		XNP	LINDSAY		36 12 N	119 03 W	420		+
202	044997		XNP	LIVERMORE		37 42 N	121 47 W	480		+
203	045026		XNP	LODGEPOLE		36 36 N	118 44 W	6735		+
204	045032		XNP	LODI		38 06 N	121 17 W	40		+
205	045064		XNP	LOMPOC		34 39 N	120 27 W	95		+
206	045085	23129	XNP	LONG BEACH AP	LGB	33 49 N	118 09 W	25	*	+
207	045107		P	LOS ALAMOS		34 45 N	120 17 W	565		
208	045114	23174	XNP	LOS ANGELES INTL AP	LAX	33 56 N	118 24 W	100	*	+
209	045115	93134	XNP	LOS ANGELES DOWNTOWN USC	CQT	34 02 N	118 18 W	185	*	+
210	045118		XNP	LOS BANOS		37 03 N	120 52 W	120		+

STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
211	045119		P	LOS BANOS ARBURUA RANCH		36 53 N	120 57 W	860		+
212	045120		XNP	LOS BANOS DET RESV		36 59 N	120 56 W	407		+
213	045123		XNP	LOS GATOS		37 14 N	121 58 W	365		+
214	045125		P	LOS GATOS 4 SW		37 11 N	122 02 W	2415		
215	045147		P	LOS PRIETOS RANGER STN		34 33 N	119 47 W	1024		+
216	045218		P	LYTLE CREEK R S		34 14 N	117 28 W	2730		+
217	045233		XNP	MADERA		36 57 N	120 02 W	270		+
218	045244		P	MAD RIVER RANGER STN		40 27 N	123 32 W	2675		
219	045311		XNP	MANZANITA LAKE		40 33 N	121 35 W	5750		+
220	045338		XNP	MARICOPA		35 05 N	119 23 W	675		
221	045352		P	MARIPOSA R S		37 30 N	119 59 W	2100		
222	045356		XNP	MARKLEEVILLE		38 42 N	119 47 W	5530		
223	045360		XNP	MARKLEY COVE		38 30 N	122 08 W	480		+
224	045378		XNP	MARTINEZ WATER PLANT		38 01 N	122 07 W	40		+
225	045385		XNP	MARYSVILLE		39 09 N	121 35 W	57		+
226	045400		P	MATHER		37 53 N	119 51 W	4510		+
227	045449		XNP	MC CLOUD		41 15 N	122 08 W	3280		+
228	045502		XNP	MECCA FIRE STATION		33 34 N	116 05 W	-180		+
229	045532		XNP	MERCED		37 17 N	120 31 W	153		+
230	045598		P	MIDDLETOWN		38 45 N	122 37 W	1130		
231	045679		XNP	MINERAL		40 21 N	121 37 W	4874		+
232	045721		XNP	MITCHELL CAVERNS		34 57 N	115 33 W	4350		+
233	045738		XNP	MODESTO CITY-COUNTY AP	MOD	37 37 N	120 57 W	73		+
234	045756		XNP	MOJAVE		35 03 N	118 10 W	2735		+
235	045790		XNP	MONTEBELLO		34 01 N	118 06 W	240		
236	045795		XNP	MONTEREY	MRY	36 35 N	121 55 W	385		+
237	045866		XNP	MORRO BAY FIRE DEPT	87Q	35 22 N	120 51 W	115		+
238	045890		XNP	MOUNTAIN PASS		35 28 N	115 33 W	4730		
239	045915		XNP	MOUNT DIABLO JUNCTION		37 53 N	121 56 W	2170		+
240	045933	23261	XNP	MOUNT HAMILTON		37 21 N	121 39 W	4206		+
241	045941		P	MOUNT HEBRON RNG STN		41 47 N	122 02 W	4250		
242	045983	24215	XNP	MOUNT SHASTA	MHS	41 19 N	122 18 W	3590		
243	046006		XNP	MT WILSON NO 2		34 14 N	118 04 W	5709		+
244	046027		P	MUIR WOODS		37 53 N	122 34 W	220		+
245	046074		XNP	NAPA STATE HOSPITAL		38 17 N	122 16 W	35		+
246	046118	23179	XNP	NEEDLES AP	EED	34 46 N	114 37 W	887		+
247	046136		XNP	NEVADA CITY		39 15 N	121 00 W	2781		+
248	046144		XNP	NEWARK (OAKLAND)	OAK	37 31 N	122 02 W	10		+
249	046154		XNP	NEW CUYAMA FIRE STN		34 57 N	119 41 W	2160		
250	046162		P	NEWHALL S FC32CE		34 23 N	118 32 W	1243		
251	046168		XNP	NEWMAN		37 19 N	121 01 W	90		
252	046175	03107	XNP	NEWPORT BEACH HARBOR	3L3	33 36 N	117 53 W	10		+
253	046194		P	NICOLAUS 2		38 56 N	121 33 W	43		+
254	046197		P	NILAND		33 17 N	115 31 W	-60		+
255	046252		P	NORTH FORK R S		37 14 N	119 30 W	2630		
256	046336		XNP	OAKLAND MUSEUM		37 48 N	122 16 W	30		+
257	046370		P	OCCIDENTAL		38 23 N	122 58 W	865		+
258	046377		XNP	OCEANSIDE MARINA	L34	33 13 N	117 24 W	10		+
259	046390		P	OCOTILLO 2		32 45 N	116 00 W	410		+
260	046399		XNP	OJAI		34 27 N	119 14 W	750		+
261	046476		XNP	ORANGE COVE		36 37 N	119 18 W	430		
262	046498		XNP	ORICK PRAIRIE CREEK PARK		41 22 N	124 01 W	160		+
263	046506		XNP	ORLAND		39 45 N	122 12 W	254		+
264	046508		XNP	ORLEANS		41 18 N	123 32 W	400		+
265	046521		XNP	OROVILLE		39 31 N	121 33 W	171		
266	046569		XNP	OXNARD (CAMARILLO)	CMA	34 12 N	119 11 W	49		+
267	046597		P	PACIFIC HOUSE		38 45 N	120 30 W	3440		+
268	046599		XNP	PACIFICA 4 SSE		37 36 N	122 28 W	475		
269	046602		P	PACOIMA DAM FC 33 A-E		34 20 N	118 24 W	1500		+
270	046610		P	PAICINES 4 W		36 43 N	121 21 W	905		+
271	046624		XNP	PALMDALE (LANCASTER)	WJF	34 35 N	118 06 W	2596		+
272	046635	93138	XNP	PALM SPRINGS	PSP	33 50 N	116 31 W	425		+
273	046646		XNP	PALO ALTO		37 27 N	122 08 W	25		+
274	046650		P	PALOMA		36 21 N	121 32 W	1775		+
275	046657		XNP	PALOMAR MOUNTAIN OBS		33 23 N	116 50 W	5550		+
276	046663		P	PALOS VERDES EST FC43D		33 48 N	118 23 W	216		+
277	046675		P	PANOCHE 2 W		36 36 N	120 53 W	1320		+
278	046685		XNP	PARADISE		39 45 N	121 37 W	1750		+
279	046699		XNP	PARKER RESERVOIR		34 17 N	114 10 W	738		+
280	046719		XNP	PASADENA		34 09 N	118 09 W	864		+

STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
281	046726		P	PASKENTA RANGER STN		39 53 N	122 33 W	755		+
282	046730		XNP	PASO ROBLES		35 37 N	120 41 W	700		+
283	046742	93209	XNP	PASO ROBLES MUNICIPAL AP	PRB	35 40 N	120 38 W	810		+
284	046761		P	PAYNES CREEK		40 20 N	121 54 W	1841		
285	046773		XNP	PEARBLOSSOM		34 30 N	117 54 W	3050		
286	046826		XNP	PETALUMA FIRE STA 2		38 16 N	122 39 W	31		+
287	046896		P	PINE FLAT DAM		36 49 N	119 20 W	610		+
288	046926		XNP	PINNACLES NATL MONUMENT		36 29 N	121 11 W	1307		+
289	046940		P	PIRU 2 ESE		34 24 N	118 45 W	730		+
290	046943		XNP	PISMO BEACH		35 10 N	120 41 W	39		+
291	046944		P	PIT RIVER P H 1		41 00 N	121 30 W	2880		
292	046946		P	PIT RIVER P H 5		40 59 N	121 59 W	1458		+
293	046960		XNP	PLACERVILLE		38 42 N	120 49 W	1850		+
294	046962		XNP	PLACERVILLE IFG		38 44 N	120 44 W	2755		
295	047009		XNP	POINT ARENA		38 54 N	123 42 W	100		
296	893111	93111	XNP	POINT MUGU NF		34 07 N	119 07 W	10		+
297	047050		XNP	POMONA FAIRPLEX		34 05 N	117 46 W	1040		
298	047077		XNP	PORTERVILLE		36 04 N	119 01 W	393		+
299	047085		XNP	PORTOLA		39 48 N	120 28 W	4850		
300	047096		P	POSEY 3 E		35 48 N	118 38 W	4960		
301	047109		XNP	POTTER VALLEY P H		39 22 N	123 08 W	1015		+
302	047111		P	POWAY VALLEY		33 01 N	117 02 W	648		+
303	047150		XNP	PRIEST VALLEY		36 11 N	120 42 W	2300		+
304	047195		XNP	QUINCY		39 56 N	120 57 W	3420		
305	047228		XNP	RAMONA FIRE DEPT		33 01 N	116 55 W	1470		
306	047253		XNP	RANDSBURG		35 22 N	117 39 W	3570		+
307	047292	24216	XNP	RED BLUFF AP	RBL	40 09 N	122 15 W	349		
308	047304	24257	XNP	REDDING MUNICIPAL AP	RDD	40 31 N	122 18 W	497	*	
309	047306		XNP	REDLANDS		34 03 N	117 11 W	1318		+
310	047339		XNP	REDWOOD CITY		37 29 N	122 14 W	31		+
311	047370		P	REPRESA		38 42 N	121 10 W	295		+
312	047404		XNP	RICHARDSON GR ST PK		40 02 N	123 48 W	500		+
313	047414		XNP	RICHMOND		37 37 N	122 22 W	20		+
314	047470		XNP	RIVERSIDE FIRE STA 3		33 57 N	117 23 W	840		+
315	047473		XNP	RIVERSIDE CITRUS EXP STN		33 58 N	117 21 W	986		+
316	047581		P	ROUND MOUNTAIN PG & E		40 48 N	121 56 W	2100		
317	047630	23232	XNP	SACRAMENTO AP	SAC	38 30 N	121 30 W	15	*	+
318	047633	23271	XNP	SACRAMENTO 5 ESE		38 33 N	121 25 W	38		+
319	047641		XNP	SAGEHEN CREEK		39 26 N	120 14 W	6337		+
320	047643		XNP	SAINT HELENA		38 30 N	122 28 W	225		+
321	047668		XNP	SALINAS NO 2		36 40 N	121 40 W	45		+
322	047669	23233	XNP	SALINAS AP	SNS	36 40 N	121 36 W	74		+
323	047672		P	SALINAS DAM		35 20 N	120 30 W	1245		+
324	047681		P	SALSIPUEDES GAGING STN		34 35 N	120 24 W	250		+
325	047689		XNP	SALT SPRINGS PWR HOUSE		38 30 N	120 13 W	3700		
326	047723		XNP	SAN BERNARDINO F S 226		34 08 N	117 15 W	1140		+
327	047731		P	SAN CLEMENTE DAM		36 26 N	121 43 W	600		+
328	047735	23187	XNP	SANDBERG	SDB	34 45 N	118 43 W	4510		
329	893107	93107	XNP	SAN DIEGO MIRAMAR NAS		32 52 N	117 08 W	459		+
330	893112	93112	XNP	SAN DIEGO N ISLAND NAS		32 42 N	117 12 W	49		+
331	047740	23188	XNP	SAN DIEGO LINDBERGH AP	SAN	32 44 N	117 10 W	13	*	+
332	047749		P	SAN DIMAS FIRE FC95		34 06 N	117 48 W	955		+
333	047767		XNP	SAN FRANCISCO OCEANSIDE		37 44 N	122 30 W	8		
334	047769	23234	XNP	SAN FRANCISCO INTL AP	SFO	37 37 N	122 24 W	8	*	+
335	047772	23272	XNP	SAN FRANCISCO DOWNTOWN		37 46 N	122 26 W	175		+
336	047776		P	SAN GABRIEL CANYON P H		34 09 N	117 54 W	744		+
337	047779		P	SAN GABRIEL DAM FC425B		34 12 N	117 52 W	1481		+
338	047785		XNP	SAN GABRIEL FIRE DEPT		34 06 N	118 06 W	450		+
339	047807		XNP	SAN GREGORIO 2 SE		37 18 N	122 22 W	275		+
340	047813		XNP	SAN JACINTO R S		33 47 N	116 58 W	1560		
341	047821	23293	XNP	SAN JOSE		37 22 N	121 54 W	67		+
342	047846		XNP	SAN LUIS DAM		37 03 N	121 03 W	277		+
343	047851		XNP	SAN LUIS OBISPO POLYTECH		35 18 N	120 40 W	315		+
344	047874		XNP	SAN PASQUAL ANIMAL PK		33 06 N	117 00 W	420		
345	047880		XNP	SAN RAFAEL CIVIC CENTER		38 00 N	122 32 W	120		
346	047888		XNP	SANTA ANA FIRE STATION		33 45 N	117 52 W	135		+
347	047902		XNP	SANTA BARBARA		34 25 N	119 41 W	5		
348	047905	23190	XNP	SANTA BARBARA MNCPL AP	SBA	34 26 N	119 51 W	9		
349	047916		XNP	SANTA CRUZ		36 59 N	121 59 W	130		+
350	047933		P	SANTA MARGARITA BOOST		35 22 N	120 38 W	1100		+

STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
351	047946	23273	XNP	SANTA MARIA AP	SMX	34 55 N	120 28 W	254	*	+
352	047953		XNP	SANTA MONICA PIER		34 00 N	118 30 W	14		+
353	047957		XNP	SANTA PAULA		34 19 N	119 08 W	237		+
354	047965		XNP	SANTA ROSA		38 27 N	122 43 W	167		+
355	048014		P	SAUGUS POWER PLANT 1		34 35 N	118 27 W	2105		+
356	048025		P	SAWYERS BAR RS		41 18 N	123 08 W	2169		
357	048045		XNP	SCOTIA		40 29 N	124 06 W	133		+
358	048135		XNP	SHASTA DAM		40 43 N	122 25 W	1075		+
359	048163	94262	XNP	SHELTER COVE AV	O87	40 02 N	124 04 W	246		
360	048175		P	SHINGLETOWN 2 E		40 30 N	121 51 W	3556		
361	048200		P	SHOSHONE		35 58 N	116 16 W	1570		+
362	048207		XNP	SIERRA CITY		39 34 N	120 37 W	4240		
363	048218		XNP	SIERRAVILLE R S		39 35 N	120 22 W	4975		
364	048317		P	SNOW CREEK UPPER		33 52 N	116 41 W	1940		+
365	048338		P	SOLEDAD		36 26 N	121 19 W	210		
366	048351		XNP	SONOMA		38 18 N	122 28 W	97		+
367	048353		XNP	SONORA RS		37 58 N	120 23 W	1675		
368	048380		XNP	SOUTH ENTR YOSEMITE NP		37 30 N	119 39 W	5120		+
369	048406		P	SOUTH LAKE		37 10 N	118 34 W	9580		
370	048446		P	SPRECKELS HWY BRIDGE		36 38 N	121 40 W	21		
371	048490		P	STANDISH HICKEY ST PK		39 53 N	123 44 W	850		
372	048558	23237	XNP	STOCKTON AP	SCK	37 54 N	121 14 W	22	*	+
373	048560		XNP	STOCKTON FIRE STN # 4		38 00 N	121 19 W	12		+
374	048580		P	STONYFORD		39 23 N	122 33 W	1170		+
375	048587		XNP	STONY GORGE RESERVOIR		39 35 N	122 32 W	800		+
376	048606		XNP	STRAWBERRY VALLEY		39 34 N	121 06 W	3808		+
377	048655		XNP	SUN CITY		33 43 N	117 11 W	1420		+
378	048702	24258	XNP	SUSANVILLE 2 SW	SVE	40 25 N	120 40 W	4184		
379	048758		XNP	TAHOE CITY		39 10 N	120 09 W	6230		+
380	048762	93230	XN	TAHOE VALLEY AP	TVL	38 54 N	120 00 W	6254		+
381	048826		XNP	TEHACHAPI		35 08 N	118 27 W	4017		+
382	048839	03108	XNP	TEJON RANCHO		35 01 N	118 45 W	1425		+
383	048873		XNP	TERMO 1 E		40 52 N	120 26 W	5300		+
384	048892	03104	XNP	THERMAL RGNL AP	TRM	33 38 N	116 10 W	-112		+
385	048917		XNP	THREE RIVERS EDISON PH 1		36 28 N	118 52 W	1140		+
386	048928		XNP	TIGER CREEK PH		38 27 N	120 30 W	2355		+
387	048967		P	TOPANGA PATROL STN FC6		34 05 N	118 36 W	745		+
388	048973	03122	XNP	TORRANCE	TOA	33 48 N	118 20 W	110		+
389	048999		XNP	TRACY CARBONA		37 42 N	121 26 W	140		+
390	049001		XNP	TRACY PUMPING PLANT		37 48 N	121 35 W	61		+
391	049026		XNP	TRINITY RIVER HATCHERY		40 44 N	122 48 W	1860		+
392	049035		XNP	TRONA		35 46 N	117 23 W	1695		+
393	049043		XNP	TRUCKEE RS		39 20 N	120 11 W	6020		+
394	049053		XNP	TULELAKE		41 57 N	121 28 W	4035		+
395	049073		XNP	TURLOCK #2		37 30 N	120 51 W	115		+
396	049087		XNP	TUSTIN IRVINE RANCH		33 42 N	117 45 W	235		+
397	049099		XNP	TWENTYNINE PALMS		34 08 N	116 02 W	1975		+
398	049105		XNP	TWIN LAKES		38 43 N	120 02 W	8000		+
399	049111		XNP	TWITCHELL DAM		34 59 N	120 19 W	582		
400	049122		XNP	UKIAH	UKI	39 09 N	123 13 W	633		+
401	049124		P	UKIAH 4 WSW		39 08 N	123 16 W	1820		+
402	049152		XNP	U C L A		34 04 N	118 27 W	430		+
403	049167		P	UPPER LAKE 7 W		39 11 N	123 02 W	1564		
404	049185		XNP	UPPER SAN LEANDRO FLTR		37 46 N	122 10 W	394		+
405	049200		XNP	VACAVILLE		38 24 N	121 58 W	110		+
406	049260		P	VAN NUYS FC15A		34 11 N	118 27 W	695		
407	049285		P	VENTURA		34 17 N	119 18 W	105		
408	049325		XNP	VICTORVILLE PUMP PLANT		34 32 N	117 18 W	2858		+
409	049345		P	VINCENT FS FC 120		34 29 N	118 08 W	3135		+
410	049351		P	VINTON		39 48 N	120 11 W	4950		+
411	049367		XNP	VISALIA		36 20 N	119 18 W	325		+
412	049378		XNP	VISTA 2 NNE		33 14 N	117 14 W	510		+
413	049390		P	VOLTA POWER HOUSE		40 27 N	121 52 W	2220		+
414	049431		P	WALNUT NI FC102C		34 00 N	117 52 W	488		+
415	049440		XNP	WARM SPRINGS DAM		38 43 N	123 00 W	224		
416	049452		XNP	WASCO		35 36 N	119 21 W	345		+
417	049473		XNP	WATSONVILLE WATERWORKS	WVI	36 56 N	121 46 W	95		+
418	049490		XNP	WEAVERVILLE		40 44 N	122 56 W	2040		
419	049499		XNP	WEED FIRE DEPT		41 26 N	122 23 W	3589		
420	049560		P	WESTHAVEN		36 14 N	120 00 W	285		+

STATION INVENTORY

No.	COOP ID	WBAN ID	Elements	Station Name	Call	Latitude	Longitude	Elev	Flag 1	Flag 2
421	049582		P	WEST POINT		38 23 N	120 33 W	2775		+
422	049621		XNP	WHISKEYTOWN RESERVOIR		40 37 N	122 32 W	1295		+
423	049660		P	WHITTIER CITY YD FC106C		33 59 N	118 01 W	420		+
424	049671		XNP	WILDROSE R S		36 16 N	117 11 W	4100		+
425	049684		XNP	WILLITS 1 NE		39 25 N	123 21 W	1350		+
426	049694		XNP	WILLOW CREEK 1 NW		40 57 N	123 38 W	461		
427	049699		XNP	WILLOWS 6 W		39 31 N	122 18 W	233		+
428	049742		XNP	WINTERS		38 31 N	121 58 W	135		+
429	049754		P	WOFFORD HEIGHTS KERNVILL		35 43 N	118 27 W	2733		
430	049775		XNP	WOODFORDS		38 47 N	119 48 W	5650		
431	049781		XNP	WOODLAND 1 WNW		38 41 N	121 48 W	69		
432	049792		XNP	WOODSIDE FIRE STN 1		37 26 N	122 15 W	380		
433	049814		P	WRIGHTS		37 08 N	121 57 W	1600		
434	049855		XNP	YOSEMITE PARK HDQTRS		37 45 N	119 35 W	3966		+
435	049866		XNP	YREKA SISKIYOU CO	SIY	41 42 N	122 38 W	2625		+

No. Station Name	Element	TEMPERATURE NORMALS (Degrees Fahrenheit) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
002 ADIN RS	MAX	43.1	47.2	52.5	59.3	67.8	76.4	84.9	84.3	77.8	66.6	51.8	42.7	62.9
	MEAN	33.2	37.1	41.4	46.5	53.4	60.5	67.4	66.7	60.8	51.6	40.9	33.0	49.4
	MIN	23.3	26.9	30.3	33.7	38.9	44.6	49.8	49.1	43.7	36.5	30.0	23.3	35.8
004 ALPINE	MAX	65.0	66.2	66.8	71.9	75.1	83.0	88.6	89.4	86.4	79.4	71.2	65.4	75.7
	MEAN	54.1	55.2	55.8	59.5	62.9	69.3	74.7	75.9	73.5	66.8	59.0	54.3	63.4
	MIN	43.1	44.1	44.7	47.1	50.7	55.6	60.7	62.3	60.6	54.2	46.8	43.1	51.1
006 ALTURAS	MAX	43.2	47.4	52.7	59.8	68.8	78.6	88.1	87.6	79.5	67.3	51.0	43.1	63.9
	MEAN	30.7	34.4	39.0	44.0	51.5	59.2	66.0	64.8	57.7	47.7	37.2	30.4	46.9
	MIN	18.1	21.4	25.3	28.2	34.1	39.8	43.8	42.0	35.8	28.1	23.3	17.7	29.8
007 ANAHEIM	MAX	68.6	69.1	69.6	72.5	75.3	79.0	84.0	85.6	84.6	80.2	74.1	69.6	76.0
	MEAN	56.9	57.9	59.0	62.0	65.5	69.4	73.2	74.5	73.2	68.3	62.3	57.8	65.0
	MIN	45.2	46.6	48.4	51.4	55.7	59.8	62.4	63.4	61.7	56.3	50.5	45.9	53.9
008 ANGWIN PAC UNION COL	MAX	53.2	56.0	59.1	65.8	72.9	80.4	85.6	85.0	80.8	72.3	59.1	53.0	68.6
	MEAN	46.3	48.0	49.9	54.4	59.9	65.9	70.3	69.7	67.1	61.0	50.6	45.7	57.4
	MIN	39.3	39.9	40.6	42.9	46.8	51.3	55.0	54.3	53.4	49.6	42.0	38.3	46.1
009 ANTIOCH PUMP PLANT #3	MAX	53.5	59.9	64.6	71.1	78.5	85.6	90.7	89.8	85.9	77.5	63.9	54.3	72.9
	MEAN	45.7	50.6	54.5	59.2	65.2	71.1	74.4	73.7	71.0	64.3	53.8	45.7	60.8
	MIN	37.8	41.3	44.3	47.2	51.9	56.5	58.1	57.6	56.0	51.1	43.6	37.1	48.5
012 ASH MOUNTAIN	MAX	58.1	61.7	64.6	70.4	79.7	90.0	97.2	96.6	90.6	80.3	65.9	58.8	76.2
	MEAN	47.1	50.4	53.1	57.8	65.9	75.2	81.7	81.2	75.2	65.8	53.6	47.4	62.9
	MIN	36.0	39.0	41.6	45.2	52.1	60.3	66.2	65.7	59.7	51.2	41.3	35.9	49.5
013 AUBERRY 2 NW	MAX	56.7	59.8	62.7	69.9	79.5	89.4	95.9	94.8	88.7	77.9	63.7	56.7	74.6
	MEAN	46.8	49.6	52.0	57.6	65.7	74.7	81.5	80.6	75.1	65.3	52.8	46.7	62.4
	MIN	36.8	39.3	41.3	45.2	51.9	60.0	67.1	66.3	61.5	52.6	41.8	36.6	50.0
014 AUBURN	MAX	54.2	58.2	61.6	67.7	75.9	84.6	91.3	90.7	85.2	75.6	61.4	54.6	71.8
	MEAN	45.9	49.4	52.0	56.6	63.4	70.9	77.0	76.4	72.0	64.0	52.3	46.2	60.5
	MIN	37.6	40.5	42.4	45.4	50.8	57.1	62.7	62.0	58.8	52.3	43.2	37.7	49.2
015 AVALON PLEASURE PIER	MAX	64.6	64.2	65.3	67.6	69.2	71.1	74.0	75.4	75.0	72.7	68.2	64.7	69.3
	MEAN	57.0	57.3	58.6	60.8	63.0	65.3	68.1	69.8	69.1	65.9	60.6	57.0	62.7
	MIN	49.3	50.3	51.8	53.9	56.8	59.5	62.2	64.1	63.1	59.1	53.0	49.3	56.0
016 BAKER	MAX	61.3	68.0	74.6	82.9	92.3	102.4	108.0	105.8	98.6	86.0	70.9	60.6	84.3
	MEAN	47.9	53.9	60.3	67.7	76.6	86.2	92.0	90.6	83.2	70.1	56.4	46.8	69.3
	MIN	34.5	39.8	46.0	52.5	60.9	69.9	76.0	75.3	67.7	54.2	41.8	33.0	54.3
017 BAKERSFIELD KERN CO AP	MAX	56.3	63.5	68.3	75.7	83.8	91.6	96.9	95.4	89.4	79.5	65.3	56.1	76.8
	MEAN	47.8	53.3	57.3	62.7	70.3	77.7	83.1	81.9	76.7	67.2	54.8	47.2	65.0
	MIN	39.3	43.0	46.2	49.6	56.8	63.7	69.2	68.4	63.9	54.9	44.2	38.2	53.1
018 BALCH POWER HOUSE	MAX	52.5	58.1	63.2	69.8	77.6	86.2	93.2	93.3	88.0	77.3	60.0	52.1	72.6
	MEAN	45.0	48.9	52.7	57.7	65.0	72.8	79.8	80.0	75.0	65.2	51.6	44.9	61.6
	MIN	37.4	39.6	42.1	45.6	52.4	59.3	66.3	66.6	61.9	53.1	43.2	37.6	50.4
019 BARSTOW FIRE STATION	MAX	61.7	66.3	71.4	78.9	87.2	97.3	102.7	101.4	94.8	83.7	69.8	61.6	81.4
	MEAN	47.9	52.2	56.8	63.2	70.8	79.8	85.6	84.3	78.1	67.4	55.0	47.4	65.7
	MIN	34.0	38.1	42.1	47.4	54.3	62.2	68.5	67.1	61.3	51.1	40.2	33.2	50.0
020 BEAUMONT 1 E	MAX	63.7	66.2	68.3	74.0	80.2	89.5	96.3	96.6	91.4	82.3	71.6	64.7	78.7
	MEAN	51.8	53.2	54.7	58.8	64.4	71.6	77.6	78.1	74.1	66.2	57.3	52.1	63.3
	MIN	39.8	40.2	41.1	43.6	48.6	53.7	58.8	59.5	56.7	50.0	43.0	39.4	47.9
021 BEN LOMOND NO 4	MAX	61.4	63.9	66.3	72.2	76.5	82.1	85.4	85.7	84.1	78.1	67.3	61.5	73.7
	MEAN	48.9	51.3	53.2	56.7	60.6	64.8	67.5	67.7	66.1	60.9	52.8	48.2	58.2
	MIN	36.3	38.6	40.1	41.1	44.6	47.5	49.5	49.6	48.1	43.6	38.3	34.9	42.7
023 BERKELEY	MAX	56.4	59.3	60.9	64.0	66.6	69.5	70.4	70.6	71.7	70.0	62.3	56.6	64.9
	MEAN	50.0	52.7	54.2	56.3	59.0	61.6	62.8	63.2	63.8	61.8	55.1	50.2	57.6
	MIN	43.6	46.1	47.4	48.6	51.3	53.6	55.1	55.7	55.9	53.5	47.9	43.7	50.2
024 BIG BAR 4 E	MAX	50.0	56.9	63.2	71.1	79.8	88.5	96.8	96.7	90.0	76.4	56.2	48.5	72.8
	MEAN	41.7	45.6	49.7	54.5	61.3	68.3	74.3	74.1	68.7	58.5	46.7	41.1	57.0
	MIN	33.4	34.2	36.2	37.8	42.8	48.1	51.8	51.4	47.3	40.6	37.1	33.7	41.2
025 BIG BEAR LAKE	MAX	47.1	48.0	51.1	58.0	66.1	75.6	80.7	79.1	73.6	64.4	54.3	47.9	62.2
	MEAN	33.9	35.1	37.8	43.2	50.3	58.4	63.9	62.7	57.1	48.3	39.8	34.5	47.1
	MIN	20.7	22.1	24.5	28.3	34.4	41.1	47.1	46.3	40.6	32.1	25.3	21.1	32.0
030 BISHOP AP	MAX	53.6	58.4	64.3	72.1	81.2	91.5	97.9	95.8	87.6	76.0	62.4	54.3	74.6
	MEAN	38.0	42.4	47.7	54.1	62.5	71.1	76.8	74.8	67.3	56.6	44.8	38.0	56.2
	MIN	22.4	26.4	31.0	36.0	43.7	50.7	55.7	53.7	46.9	37.1	27.1	21.6	37.7
032 BLUE CANYON	MAX	44.7	44.9	46.4	52.5	61.0	69.7	76.9	76.8	71.4	62.3	49.4	45.6	58.5
	MEAN	38.8	38.8	39.7	44.5	52.7	60.9	67.6	67.3	62.3	54.1	42.8	39.1	50.7
	MIN	32.9	32.7	33.0	36.5	44.3	52.0	58.3	57.8	53.1	45.9	36.2	32.6	42.9
033 BLYTHE	MAX	67.2	72.8	79.0	87.1	95.4	104.8	108.5	106.8	101.2	89.4	75.4	66.5	87.8
	MEAN	53.5	58.2	63.6	70.5	78.6	87.1	92.8	91.6	85.3	73.3	60.4	52.9	72.3
	MIN	39.8	43.5	48.1	53.8	61.7	69.3	77.1	76.4	69.4	57.2	45.3	39.2	56.7
034 BLYTHE AP	MAX	66.6	72.0	77.6	85.7	93.9	104.1	107.2	105.4	99.6	88.0	74.7	66.0	86.7
	MEAN	54.2	58.9	63.9	71.0	78.9	88.4	93.7	92.5	86.0	74.0	61.1	53.5	73.0
	MIN	41.7	45.7	50.2	56.2	63.9	72.6	80.2	79.5	72.4	60.0	47.4	40.9	59.2

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			TEMPERATURE NORMALS (Degrees Fahrenheit)												
035	BOCA	MAX	41.4	44.4	49.4	56.5	65.1	74.8	83.1	82.9	76.1	65.7	51.1	42.6	61.1
		MEAN	26.3	29.3	34.6	40.0	47.3	54.4	60.3	59.5	53.6	45.4	35.4	28.0	42.8
		MIN	11.2	14.1	19.7	23.5	29.5	33.9	37.4	36.0	31.0	25.0	19.7	13.3	24.5
036	BODIE	MAX	40.0	41.6	44.3	50.8	60.0	69.6	76.9	76.3	69.8	59.7	48.1	41.1	56.5
		MEAN	22.9	24.6	28.3	34.4	42.5	50.2	55.9	54.9	48.4	39.6	30.2	23.6	38.0
		MIN	5.8	7.5	12.2	18.0	24.9	30.7	34.8	33.5	27.0	19.5	12.3	6.0	19.4
037	BORREGO DESERT PARK	MAX	69.1	72.8	77.5	84.9	92.6	102.7	107.2	105.9	100.5	89.9	77.6	69.4	87.5
		MEAN	56.1	59.4	63.1	69.1	76.2	85.4	91.1	90.5	85.1	75.3	63.6	56.3	72.6
		MIN	43.1	45.9	48.7	53.2	59.8	68.1	75.0	75.1	69.7	60.6	49.6	43.2	57.7
038	BOWMAN DAM	MAX	45.0	45.8	47.5	53.8	62.3	72.1	79.4	79.6	73.9	64.3	51.2	45.5	60.0
		MEAN	35.7	35.9	37.7	42.7	50.3	59.0	65.6	66.0	60.9	52.5	41.3	36.1	48.6
		MIN	26.4	25.9	27.8	31.6	38.2	45.8	51.8	52.3	47.9	40.6	31.4	26.7	37.2
039	BRAWLEY 2 SW	MAX	70.4	74.7	79.5	86.1	93.8	103.3	107.0	106.2	101.7	91.4	78.9	70.3	88.6
		MEAN	54.8	58.7	63.2	69.1	76.3	84.6	90.4	90.5	85.4	74.5	62.1	54.5	72.0
		MIN	39.2	42.7	46.9	52.1	58.7	65.9	73.7	74.8	69.0	57.6	45.2	38.7	55.4
040	BRIDGEPORT	MAX	40.5	43.6	48.9	56.2	63.7	73.0	81.4	80.4	73.8	64.6	51.3	42.1	60.0
		MEAN	24.3	27.5	33.8	39.7	46.8	54.7	60.9	59.7	52.6	43.7	33.7	25.8	41.9
		MIN	8.1	11.4	18.7	23.1	29.8	36.4	40.3	38.9	31.3	22.7	16.1	9.4	23.9
042	BROOKS FARNHAM RANCH	MAX	56.5	61.7	65.9	72.9	81.9	90.9	96.4	96.0	91.1	81.1	65.6	57.6	76.5
		MEAN	45.8	49.8	53.0	57.9	65.2	72.9	77.0	76.5	72.1	64.2	52.4	45.9	61.1
		MIN	35.1	37.9	40.1	42.9	48.5	54.9	57.6	56.9	53.1	47.2	39.1	34.2	45.6
045	BURBANK VALLEY PUMP PLN	MAX	67.5	69.5	70.6	74.9	77.5	83.2	88.9	89.9	87.1	81.5	73.5	67.9	77.7
		MEAN	54.8	56.9	58.4	62.2	65.9	70.8	75.5	76.2	73.5	67.6	59.5	54.6	64.7
		MIN	42.0	44.3	46.2	49.5	54.2	58.3	62.1	62.4	59.9	53.6	45.4	41.3	51.6
046	BURNEY	MAX	45.5	51.2	56.6	63.0	71.7	80.3	88.6	88.2	81.7	69.8	52.8	44.8	66.2
		MEAN	31.9	36.7	40.8	45.6	52.7	59.8	65.6	64.0	57.7	48.3	37.8	31.6	47.7
		MIN	18.3	22.2	24.9	28.1	33.6	39.2	42.6	39.8	33.6	26.8	22.8	18.4	29.2
048	BUTTONWILLOW	MAX	54.7	62.4	67.9	75.4	83.8	91.2	95.8	94.5	89.4	80.4	65.7	55.2	76.4
		MEAN	45.3	51.2	56.0	61.3	68.9	75.7	80.4	79.0	73.9	64.6	52.4	44.3	62.8
		MIN	35.8	40.0	44.0	47.1	53.9	60.2	65.0	63.4	58.3	48.8	39.1	33.4	49.1
049	CACHUMA LAKE	MAX	66.0	67.5	69.0	74.1	78.7	85.6	91.2	92.5	89.2	83.2	74.0	67.5	78.2
		MEAN	52.8	54.4	55.9	59.1	63.2	68.0	72.0	72.9	70.7	65.8	58.4	53.2	62.2
		MIN	39.6	41.2	42.7	44.0	47.7	50.3	52.7	53.3	52.2	48.3	42.8	38.8	46.1
050	CALAVERAS BIG TREES	MAX	44.3	45.9	48.7	55.3	64.1	74.1	81.2	80.8	74.0	63.7	50.5	44.7	60.6
		MEAN	36.2	37.2	39.4	44.3	51.8	60.4	66.7	66.3	60.7	52.0	41.3	36.5	49.4
		MIN	28.0	28.5	30.1	33.3	39.5	46.6	52.1	51.7	47.3	40.2	32.1	28.2	38.1
052	CALISTOGA	MAX	59.0	62.9	66.5	71.5	78.7	86.5	91.7	91.0	87.3	79.5	66.0	59.2	75.0
		MEAN	47.2	50.6	53.3	56.6	62.5	68.5	72.2	71.8	69.0	62.7	52.7	47.2	59.5
		MIN	35.4	38.2	40.0	41.6	46.3	50.4	52.7	52.5	50.7	45.9	39.4	35.2	44.0
053	CALLAHAN	MAX	45.1	51.0	56.2	62.9	71.1	79.2	86.7	86.3	79.6	68.3	52.0	44.6	65.3
		MEAN	35.6	39.9	43.6	48.3	54.9	61.6	68.1	67.3	61.2	52.2	41.2	35.4	50.8
		MIN	26.0	28.8	30.9	33.6	38.7	44.0	49.4	48.3	42.8	36.1	30.3	26.2	36.3
054	CAMPO	MAX	62.2	64.2	66.0	72.1	78.1	87.3	93.5	93.6	88.8	79.4	69.3	63.0	76.5
		MEAN	48.2	49.3	50.9	54.7	59.7	66.0	72.3	73.0	68.8	60.6	52.3	47.8	58.6
		MIN	34.1	34.3	35.8	37.3	41.3	44.7	51.0	52.3	48.7	41.8	35.3	32.5	40.8
055	CAMP PARDEE	MAX	53.8	59.6	63.6	70.6	79.6	88.7	94.7	93.6	88.4	78.1	63.2	54.3	74.0
		MEAN	45.8	50.3	53.5	58.2	65.2	72.6	78.0	77.3	73.3	65.2	53.7	46.2	61.6
		MIN	37.8	41.0	43.3	45.8	50.8	56.5	61.2	60.9	58.2	52.3	44.2	38.0	49.2
056	CAMP PENDLETON MCAS	MAX	68.5	68.6	68.2	71.4	73.1	76.5	81.2	82.4	82.1	78.3	74.3	70.4	74.6
		MEAN	55.1	56.0	56.8	59.6	63.3	66.7	70.5	71.9	70.6	65.5	59.1	55.2	62.5
		MIN	41.6	43.3	45.4	47.8	53.4	56.9	59.7	61.3	59.1	52.6	43.8	40.0	50.4
057	CANBY 3 SW	MAX	40.7	45.9	51.1	57.8	67.1	76.4	85.6	85.1	77.2	66.2	49.4	41.5	62.0
		MEAN	30.5	34.2	39.1	44.1	51.6	59.4	66.1	64.8	57.2	47.7	36.3	30.1	46.8
		MIN	20.2	22.4	27.0	30.4	36.1	42.4	46.6	44.4	37.1	29.2	23.1	18.7	31.5
058	CANOGA PARK PIERCE COLL	MAX	67.9	69.9	72.0	77.7	81.3	88.8	95.0	96.0	91.7	84.4	74.7	68.8	80.7
		MEAN	53.7	55.4	57.2	61.3	65.2	71.0	76.0	76.8	73.5	66.8	58.2	53.6	64.1
		MIN	39.5	40.9	42.3	44.8	49.1	53.2	56.9	57.6	55.2	49.2	41.7	38.3	47.4
059	CANYON DAM	MAX	40.0	43.8	49.5	57.6	67.1	76.2	84.0	83.4	76.1	64.1	48.2	40.4	60.9
		MEAN	31.5	34.4	38.6	44.2	52.0	59.6	66.0	65.1	59.0	49.5	38.4	32.0	47.5
		MIN	23.0	24.9	27.6	30.7	36.8	43.0	48.0	46.7	41.8	34.9	28.6	23.6	34.1
061	CECILVILLE	MAX	46.8	52.0	57.0	64.1	73.2	81.8	90.2	90.7	83.0	70.7	53.0	44.4	67.2
		MEAN	37.9	41.2	44.6	49.7	56.8	63.8	70.2	69.9	63.9	54.2	42.7	36.6	52.6
		MIN	28.9	30.4	32.2	35.2	40.3	45.7	50.2	49.1	44.8	37.6	32.4	28.8	38.0
062	CEDARVILLE	MAX	40.0	44.7	50.5	56.9	65.5	75.7	85.5	84.9	76.6	64.6	48.3	40.5	61.1
		MEAN	30.0	34.2	39.3	44.7	52.4	61.2	69.5	68.4	60.0	49.5	37.3	30.3	48.1
		MIN	20.0	23.6	28.0	32.5	39.2	46.6	53.4	51.8	43.4	34.3	26.2	20.1	34.9
065	CHERRY VALLEY DAM	MAX	48.5	50.7	53.7	60.4	68.8	78.6	86.5	86.2	78.9	68.2	54.9	48.8	65.4
		MEAN	39.2	40.3	42.6	48.0	55.8	64.3	71.2	70.9	64.7	55.5	44.6	39.6	53.1
		MIN	29.8	29.8	31.5	35.6	42.7	49.9	55.9	55.6	50.5	42.7	34.3	30.3	40.7

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
		TEMPERATURE NORMALS (Degrees Fahrenheit)												
066 CHESTER	MAX	41.8	45.7	51.1	58.5	67.5	76.4	84.4	83.8	77.3	66.0	49.8	42.0	62.0
	MEAN	31.0	34.2	38.6	43.9	51.4	59.0	65.1	64.0	58.2	49.1	38.0	31.4	47.0
	MIN	20.1	22.7	26.1	29.3	35.2	41.5	45.8	44.1	39.0	32.2	26.1	20.7	31.9
067 CHICO UNIVERSITY FARM	MAX	53.7	60.0	64.9	71.9	80.1	87.8	93.0	92.2	88.4	78.7	63.0	54.4	74.0
	MEAN	44.5	49.3	53.2	58.4	65.7	72.4	76.9	75.4	71.5	63.0	51.6	44.6	60.5
	MIN	35.2	38.6	41.5	44.9	51.3	57.0	60.7	58.6	54.6	47.3	40.2	34.8	47.1
069 CHULA VISTA	MAX	68.5	68.8	68.4	70.2	70.3	72.6	76.1	78.3	78.7	76.4	72.2	68.8	72.4
	MEAN	57.3	58.3	59.2	61.5	63.7	66.5	70.1	71.8	71.2	67.1	61.0	57.2	63.7
	MIN	46.1	47.7	50.0	52.8	57.1	60.3	64.0	65.3	63.7	57.7	49.8	45.5	55.0
070 CLEARLAKE 4 SE	MAX	55.2	57.7	60.6	66.5	74.3	83.3	90.4	89.6	84.0	74.4	61.3	55.1	71.0
	MEAN	43.5	46.0	48.6	52.8	59.5	67.3	72.9	71.9	66.7	58.4	48.4	43.2	56.6
	MIN	31.8	34.3	36.5	39.1	44.7	51.3	55.4	54.1	49.3	42.4	35.4	31.2	42.1
071 CLOVERDALE	MAX	56.3	60.5	64.9	72.4	80.7	88.7	93.4	91.9	87.1	77.8	63.5	55.9	74.4
	MEAN	47.6	51.0	54.1	59.2	65.2	71.1	74.0	72.9	70.4	63.7	53.5	47.0	60.8
	MIN	38.9	41.5	43.2	45.9	49.7	53.5	54.6	53.9	53.7	49.5	43.5	38.1	47.2
072 COALINGA	MAX	58.4	64.9	70.3	77.8	86.4	94.2	99.0	97.7	92.5	82.9	68.1	59.0	79.3
	MEAN	48.2	53.0	57.1	62.6	70.2	77.5	82.6	81.4	76.3	67.2	55.0	47.5	64.9
	MIN	37.9	41.1	43.9	47.4	54.0	60.8	66.1	65.1	60.0	51.4	41.8	35.9	50.5
075 COLFAX	MAX	55.6	58.1	60.4	66.3	73.9	82.8	89.6	89.2	84.2	74.6	60.7	55.4	70.9
	MEAN	45.4	47.5	49.4	54.1	61.0	69.1	75.2	74.2	69.5	60.9	49.7	44.9	58.4
	MIN	35.2	36.9	38.4	41.8	48.0	55.3	60.7	59.1	54.7	47.1	38.6	34.3	45.8
077 COLUSA 2 SSW	MAX	53.5	59.8	64.8	72.4	80.7	88.4	93.2	92.1	88.0	78.6	62.9	54.0	74.0
	MEAN	45.6	50.6	54.6	59.6	67.5	73.7	76.9	75.4	71.5	63.8	52.2	45.5	61.4
	MIN	37.6	41.3	44.4	46.8	54.3	58.9	60.5	58.7	55.0	49.0	41.5	37.0	48.8
079 CORCORAN IRRIG DIST	MAX	54.1	62.1	68.0	76.3	85.2	93.0	97.7	96.3	91.1	81.3	65.2	54.3	77.1
	MEAN	46.1	51.6	56.1	61.7	69.1	76.0	80.4	79.4	74.9	66.1	53.3	45.3	63.3
	MIN	38.0	41.0	44.2	47.0	53.0	58.9	63.0	62.5	58.6	50.8	41.4	36.2	49.6
081 CORONA	MAX	67.8	69.8	71.4	76.6	80.5	86.6	92.0	92.9	89.6	82.8	74.1	68.4	79.4
	MEAN	54.7	56.5	58.1	62.1	66.4	71.3	75.9	77.1	74.1	67.6	59.4	54.5	64.8
	MIN	41.5	43.1	44.8	47.5	52.2	56.0	59.7	61.2	58.6	52.4	44.6	40.5	50.2
082 COVELO	MAX	53.7	58.1	62.3	68.7	76.3	85.1	92.8	92.6	87.8	76.4	59.7	52.6	72.2
	MEAN	42.5	46.0	49.1	53.2	59.2	66.3	72.2	71.4	66.7	57.9	47.1	41.7	56.1
	MIN	31.3	33.8	35.8	37.7	42.1	47.5	51.5	50.1	45.6	39.3	34.4	30.7	40.0
084 CRESCENT CITY 3 NNW	MAX	53.6	54.4	54.6	56.6	59.6	62.7	65.4	66.0	66.0	63.0	56.7	54.0	59.4
	MEAN	46.6	47.8	48.2	50.0	52.8	55.6	57.9	58.4	57.4	54.2	49.4	46.5	52.1
	MIN	39.6	41.2	41.8	43.3	46.0	48.4	50.4	50.8	48.7	45.4	42.0	38.9	44.7
087 CULVER CITY	MAX	67.3	68.6	69.3	72.6	73.5	77.1	80.0	81.1	80.2	77.0	71.6	67.7	73.8
	MEAN	56.7	57.9	59.2	62.3	64.6	68.0	70.8	71.7	70.8	67.1	61.2	57.0	63.9
	MIN	46.1	47.2	49.1	52.0	55.7	58.8	61.5	62.2	61.3	57.2	50.8	46.3	54.0
088 CUYAMACA	MAX	51.1	52.9	55.0	60.4	67.0	76.6	83.4	83.6	78.9	69.0	58.7	52.2	65.7
	MEAN	39.9	41.4	43.5	47.8	53.7	62.3	69.0	68.7	63.3	53.8	45.3	39.9	52.4
	MIN	28.7	29.9	32.0	35.2	40.4	48.0	54.6	53.7	47.7	38.5	31.9	27.6	39.0
089 DAGGETT BARSTOW AP	MAX	61.0	66.2	71.4	79.1	88.1	98.7	104.5	102.3	94.7	83.0	69.5	60.9	81.6
	MEAN	48.0	52.7	57.6	64.3	72.8	82.0	87.9	86.4	79.4	68.1	55.3	47.4	66.8
	MIN	34.9	39.1	43.8	49.4	57.4	65.3	71.3	70.4	64.1	53.1	41.1	33.9	52.0
090 DAVIS 2 WSW EXP FARM	MAX	53.3	59.8	64.7	72.0	80.3	88.2	92.7	91.7	88.0	78.9	63.6	53.9	73.9
	MEAN	45.2	49.8	53.6	58.6	65.2	71.4	74.3	73.4	70.7	63.5	52.2	45.0	60.2
	MIN	37.1	39.8	42.4	45.1	50.0	54.5	55.9	55.0	53.3	48.0	40.8	36.1	46.5
091 DEATH VALLEY	MAX	65.5	73.2	80.5	89.3	98.7	108.8	114.9	113.2	105.3	92.2	75.8	65.1	90.2
	MEAN	52.1	59.4	67.1	75.5	84.8	94.5	100.6	98.8	90.1	76.5	61.3	51.3	76.0
	MIN	38.7	45.5	53.7	61.6	70.9	80.1	86.3	84.3	74.9	60.7	46.8	37.5	61.8
093 DEEP SPRINGS COLLEGE	MAX	47.4	51.7	57.8	65.8	74.6	85.1	91.3	88.8	80.6	69.0	55.0	47.2	67.9
	MEAN	33.2	38.2	44.0	50.8	59.4	68.8	75.0	72.5	64.7	53.2	40.4	32.9	52.8
	MIN	19.0	24.6	30.1	35.8	44.1	52.4	58.6	56.2	48.8	37.4	25.7	18.5	37.6
094 DEER CREEK FOREBAY	MAX	49.9	50.5	53.0	59.7	67.9	76.6	83.7	84.1	78.2	67.7	54.9	50.4	64.7
	MEAN	41.0	41.4	43.0	48.4	56.0	63.8	70.7	71.0	65.6	56.6	45.7	41.3	53.7
	MIN	32.1	32.2	33.0	37.1	44.0	50.9	57.7	57.8	53.0	45.5	36.5	32.2	42.7
096 DE SABLA	MAX	53.3	55.8	59.1	65.6	74.1	83.4	90.3	90.2	84.6	74.1	58.9	52.9	70.2
	MEAN	42.6	44.7	47.1	52.0	59.1	66.9	72.6	72.1	67.4	59.1	47.3	42.3	56.1
	MIN	31.8	33.5	35.0	38.3	44.0	50.3	54.9	54.0	50.1	44.0	35.7	31.7	41.9
098 DOBBINS 1 S	MAX	56.7	59.9	62.3	68.5	76.4	86.1	93.4	92.9	87.4	77.0	62.7	56.8	73.3
	MEAN	45.1	47.7	50.0	54.4	61.2	68.8	74.6	73.5	69.0	60.4	49.6	44.7	58.3
	MIN	33.5	35.5	37.7	40.2	45.9	51.5	55.7	54.1	50.5	43.8	36.5	32.5	43.1
099 DONNER MEMORIAL ST PK	MAX	39.6	42.1	45.1	51.7	60.8	71.1	79.3	79.2	72.2	61.6	47.4	39.7	57.5
	MEAN	27.0	29.3	33.2	38.6	46.0	54.0	60.2	59.9	53.6	44.9	34.4	27.5	42.4
	MIN	14.4	16.5	21.2	25.4	31.2	36.9	41.1	40.5	35.0	28.1	21.4	15.3	27.3
101 DOWNIEVILLE	MAX	48.6	53.1	58.2	65.0	72.8	82.0	88.7	88.8	83.1	72.6	56.0	48.2	68.1
	MEAN	39.1	42.1	45.5	50.0	56.6	63.7	69.0	68.6	63.8	55.4	44.3	38.7	53.1
	MIN	29.5	31.0	32.8	35.0	40.4	45.4	49.2	48.3	44.5	38.1	32.5	29.1	38.0

United States Climate Normals 1971-2000

CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days

1971-2000

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
103	DOYLE 4 SSE	MAX	42.3	48.0	54.4	61.1	69.6	78.7	86.6	85.6	78.0	66.5	51.4	42.6	63.7
		MEAN	32.5	37.3	42.3	47.0	54.2	61.6	67.9	66.8	60.2	50.5	39.4	32.3	49.3
		MIN	22.7	26.6	30.1	32.9	38.8	44.4	49.2	47.9	42.3	34.4	27.4	22.0	34.9
104	DRY CANYON RESERVOIR	MAX	64.4	65.5	68.4	74.1	79.5	87.9	94.2	95.4	90.7	82.1	71.8	65.4	78.3
		MEAN	50.3	51.2	53.2	57.6	62.5	69.0	74.1	75.2	71.4	64.1	55.6	50.6	61.2
		MIN	36.1	36.9	37.9	41.0	45.5	50.1	54.0	54.9	52.0	46.0	39.4	35.8	44.1
105	DUNSMUIR TREATMENT PLAN	MAX	50.1	53.7	58.0	65.2	73.9	82.2	89.7	89.3	83.3	72.9	56.6	50.5	68.8
		MEAN	39.2	41.6	44.7	50.2	57.6	64.8	70.5	69.2	63.9	55.5	44.4	39.6	53.4
		MIN	28.3	29.4	31.3	35.1	41.3	47.4	51.3	49.1	44.5	38.0	32.2	28.6	38.0
106	EAGLE MOUNTAIN	MAX	64.8	69.4	74.9	82.4	90.3	100.2	104.1	102.8	97.2	86.1	73.3	65.1	84.2
		MEAN	55.1	59.3	64.2	71.3	79.2	88.7	93.4	92.0	86.2	75.2	63.0	55.3	73.6
		MIN	45.4	49.1	53.5	60.1	68.0	77.1	82.6	81.1	75.2	64.2	52.6	45.5	62.9
107	EAST PARK RESERVOIR	MAX	55.4	58.6	62.1	68.6	77.3	86.3	92.9	92.1	87.0	77.1	62.9	56.1	73.0
		MEAN	43.5	46.7	49.7	54.5	61.9	70.0	76.0	74.6	69.4	60.5	49.7	43.6	58.3
		MIN	31.6	34.7	37.3	40.3	46.5	53.6	59.0	57.0	51.7	43.9	36.5	31.1	43.6
108	EL CAJON	MAX	68.2	69.3	70.1	74.1	76.4	82.0	87.0	88.1	86.5	80.2	73.5	68.3	77.0
		MEAN	54.9	56.7	58.3	62.1	65.6	70.3	74.7	76.0	73.9	67.4	59.4	54.3	64.5
		MIN	41.6	44.0	46.5	50.1	54.7	58.5	62.4	63.8	61.3	54.6	45.2	40.3	51.9
109	EL CAPITAN DAM	MAX	70.2	71.7	72.1	77.4	80.9	89.2	95.9	97.0	93.7	86.6	77.8	71.4	82.0
		MEAN	55.9	57.3	58.4	62.2	66.0	71.7	76.6	78.1	75.6	69.6	61.6	56.5	65.8
		MIN	41.6	42.8	44.6	47.0	51.0	54.1	57.2	59.2	57.5	52.6	45.4	41.5	49.5
110	EL CENTRO 2 SSW	MAX	70.2	74.5	79.3	86.1	94.0	103.4	107.0	105.7	101.1	90.9	78.1	69.7	88.3
		MEAN	55.8	59.7	64.0	69.8	77.3	85.9	91.4	91.2	85.9	75.1	62.7	55.1	72.8
		MIN	41.3	44.9	48.7	53.5	60.6	68.4	75.8	76.6	70.6	59.2	47.3	40.5	57.3
111	EL TORO MCAS	MAX	66.2	67.4	67.7	71.8	73.2	77.9	82.3	83.4	82.1	77.6	71.7	66.9	74.0
		MEAN	56.7	57.6	58.2	61.5	64.2	68.3	72.4	73.4	72.1	67.5	61.5	57.0	64.2
		MIN	47.2	47.7	48.7	51.2	55.2	58.7	62.4	63.4	62.1	57.3	51.2	47.1	54.4
112	ELECTRA P H	MAX	58.3	62.7	65.9	72.3	81.1	90.2	96.6	95.5	90.5	80.6	66.1	58.3	76.5
		MEAN	46.3	49.8	52.7	57.1	64.1	71.0	76.3	75.1	71.2	63.3	52.7	46.2	60.5
		MIN	34.3	36.9	39.4	41.8	47.0	51.7	56.0	54.7	51.9	46.0	39.2	34.0	44.4
115	EL MIRAGE	MAX	55.9	60.0	64.2	71.7	80.4	90.5	96.9	95.5	88.4	77.1	64.5	56.3	75.1
		MEAN	42.2	45.8	49.9	55.7	63.7	72.3	77.8	76.9	70.6	60.1	48.8	41.7	58.8
		MIN	28.5	31.6	35.5	39.7	47.0	54.0	58.7	58.2	52.7	43.1	33.1	27.1	42.4
116	ELSINORE	MAX	66.1	68.2	71.1	77.4	82.6	91.3	98.1	98.3	92.9	83.7	73.1	66.8	80.8
		MEAN	52.2	54.2	57.0	61.6	67.0	73.6	79.6	80.2	75.7	67.3	57.7	52.1	64.9
		MIN	38.3	40.2	42.8	45.7	51.3	55.8	61.0	62.0	58.4	50.8	42.2	37.3	48.8
117	ESCONDIDO NO 2	MAX	68.5	69.4	70.4	74.8	77.5	83.6	88.6	89.1	86.9	81.0	73.9	69.2	77.7
		MEAN	55.5	57.0	58.6	62.3	66.0	70.8	75.1	76.2	74.0	68.0	60.1	55.4	64.9
		MIN	42.5	44.5	46.8	49.8	54.4	57.9	61.5	63.2	61.1	54.9	46.3	41.6	52.0
118	EUREKA WFO WOODLEY IS	MAX	55.0	55.9	56.1	57.4	59.6	61.8	63.3	63.9	63.6	61.3	58.0	55.1	59.3
		MEAN	47.9	48.9	49.2	50.7	53.6	56.3	58.1	58.7	57.4	54.5	51.0	47.9	52.9
		MIN	40.8	41.8	42.2	44.0	47.6	50.7	52.8	53.4	51.2	47.7	43.9	40.6	46.4
120	FAIRFIELD	MAX	54.7	61.2	65.6	71.4	78.1	84.7	88.8	88.7	86.3	78.3	64.8	55.6	73.2
		MEAN	46.1	51.1	54.8	58.9	64.4	69.4	72.6	72.6	70.4	64.1	53.9	46.3	60.4
		MIN	37.5	40.9	43.9	46.3	50.6	54.1	56.4	56.5	54.5	49.9	42.9	36.9	47.5
121	FAIRMONT	MAX	54.4	57.5	61.1	67.3	74.7	84.1	90.6	90.9	85.8	75.5	62.8	55.1	71.7
		MEAN	45.4	48.1	51.1	56.0	63.1	71.9	78.2	78.3	73.3	63.6	52.6	45.8	60.6
		MIN	36.3	38.6	41.0	44.7	51.4	59.6	65.8	65.6	60.8	51.6	42.3	36.5	49.5
123	FIVE POINTS 5 SSW	MAX	55.1	62.9	68.0	75.6	84.8	91.7	95.9	94.0	89.4	80.3	65.0	55.4	76.5
		MEAN	47.3	52.2	56.1	61.2	69.0	75.0	79.4	78.1	74.1	65.7	53.6	46.3	63.2
		MIN	39.4	41.4	44.2	46.8	53.1	58.3	62.9	62.1	58.8	51.0	42.2	37.1	49.8
124	FOLSOM DAM	MAX	54.5	60.8	65.1	71.5	80.2	88.5	94.8	93.6	88.6	78.6	63.7	55.2	74.6
		MEAN	46.9	51.5	55.0	59.4	66.0	72.7	77.7	76.8	73.4	65.9	54.4	47.1	62.2
		MIN	39.2	42.2	44.8	47.3	51.8	56.8	60.6	59.9	58.1	53.1	45.0	38.9	49.8
126	FONTANA KAISER (ONTARIO	MAX	67.9	70.0	70.9	76.1	80.3	88.4	95.0	95.0	90.8	83.0	73.7	68.5	80.0
		MEAN	56.6	58.5	59.0	62.5	66.7	72.9	78.3	79.0	76.2	69.5	61.3	56.4	66.4
		MIN	45.3	46.9	47.1	48.9	53.1	57.3	61.5	63.0	61.5	55.9	48.9	44.3	52.8
128	FORT BIDWELL	MAX	38.3	43.8	50.6	58.0	66.4	74.9	83.7	83.2	75.8	64.1	47.3	38.5	60.4
		MEAN	29.5	34.2	39.8	45.4	52.6	59.8	67.1	66.3	59.1	49.3	37.1	29.7	47.5
		MIN	20.7	24.6	29.0	32.8	38.7	44.7	50.4	49.4	42.4	34.4	26.9	20.8	34.6
129	FORT BRAGG 5 N	MAX	55.9	57.0	58.4	60.7	62.4	64.8	66.6	66.7	67.0	64.1	59.2	55.4	61.5
		MEAN	48.4	49.3	50.3	52.0	53.9	56.4	58.1	58.4	58.2	55.3	51.2	47.7	53.3
		MIN	40.8	41.5	42.1	43.2	45.4	48.0	49.5	50.0	49.3	46.4	43.1	39.9	44.9
132	FORT ROSS	MAX	56.7	58.3	59.1	60.6	62.6	65.2	66.0	67.2	67.7	65.9	61.2	57.3	62.3
		MEAN	48.6	50.2	50.6	51.4	53.4	55.8	57.0	58.0	57.9	56.0	52.2	48.9	53.3
		MIN	40.5	42.0	42.1	42.2	44.2	46.4	47.9	48.8	48.1	46.0	43.2	40.4	44.3
133	FRESNO YOSEMITE INTL	MAX	53.6	61.3	66.1	74.0	82.7	90.9	96.6	94.8	88.8	78.1	63.0	53.4	75.3
		MEAN	46.0	51.4	55.5	61.2	68.8	76.1	81.4	79.9	74.6	65.0	52.7	45.2	63.2
		MIN	38.4	41.4	44.9	48.4	54.9	61.2	66.1	64.9	60.4	51.9	42.3	37.0	51.0

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			TEMPERATURE NORMALS (Degrees Fahrenheit)												
134	FRIANT GOVERNMENT CAMP	MAX	54.7	61.0	65.4	73.3	83.5	92.4	98.6	97.4	91.2	80.7	65.1	55.4	76.6
		MEAN	46.4	51.2	54.2	58.7	66.5	74.0	79.7	78.7	74.0	65.3	53.3	46.0	62.3
		MIN	38.1	41.3	43.0	44.1	49.4	55.6	60.7	59.9	56.7	49.8	41.4	36.5	48.0
140	GILROY	MAX	59.9	64.0	67.2	73.0	78.2	84.2	88.3	87.9	85.8	79.0	67.2	60.2	74.6
		MEAN	49.7	53.3	56.1	59.8	64.4	69.1	72.0	71.9	70.1	64.3	55.2	49.2	61.3
		MIN	39.4	42.5	44.9	46.6	50.6	54.0	55.7	55.8	54.3	49.5	43.2	38.2	47.9
142	GLENNVILLE	MAX	55.7	57.4	59.1	65.1	73.3	82.7	88.8	87.9	82.3	72.7	61.2	56.0	70.2
		MEAN	41.8	43.9	45.8	49.7	56.1	63.4	69.2	68.5	63.9	55.4	46.1	41.5	53.8
		MIN	27.9	30.4	32.5	34.3	38.9	44.0	49.5	49.0	45.4	38.0	30.9	26.9	37.3
145	GRANT GROVE	MAX	42.3	42.6	43.4	48.0	55.6	66.4	74.0	73.6	67.7	58.2	48.1	43.4	55.3
		MEAN	34.7	34.7	35.6	39.8	46.9	56.5	63.2	62.9	57.6	49.2	40.1	35.7	46.4
		MIN	27.1	26.8	27.8	31.5	38.2	46.5	52.4	52.1	47.5	40.1	32.1	28.0	37.5
146	GRASS VALLEY NO 2	MAX	52.9	55.0	56.9	62.6	70.3	79.3	86.6	86.4	81.0	71.5	58.1	53.1	67.8
		MEAN	42.2	44.2	46.4	50.8	57.6	65.1	70.9	70.3	65.4	57.1	46.7	42.1	54.9
		MIN	31.4	33.3	35.9	39.0	44.9	50.8	55.2	54.2	49.7	42.7	35.3	31.0	42.0
147	GRATON	MAX	57.0	61.7	64.9	70.2	75.8	81.2	83.6	83.8	82.4	77.0	65.5	57.5	71.7
		MEAN	46.4	49.9	52.5	55.8	60.2	64.4	66.5	66.4	65.1	60.1	51.8	45.9	57.1
		MIN	35.7	38.1	40.1	41.4	44.5	47.6	49.3	49.0	47.7	43.1	38.0	34.3	42.4
150	GRIZZLY CREEK STATE PAR	MAX	48.8	51.5	54.3	58.9	64.3	68.8	73.3	73.0	70.2	63.3	53.2	48.5	60.7
		MEAN	43.0	45.2	47.3	50.4	55.4	59.3	63.0	62.9	59.8	53.9	46.6	42.6	52.5
		MIN	37.2	38.8	40.2	41.8	46.5	49.8	52.6	52.8	49.4	44.5	39.9	36.6	44.2
152	HAIWEE	MAX	52.5	57.6	63.3	70.7	79.7	89.9	95.8	94.2	87.0	76.0	62.3	53.1	73.5
		MEAN	40.5	44.9	49.8	55.9	63.9	72.9	78.7	77.4	70.5	59.9	47.8	40.4	58.6
		MIN	28.5	32.1	36.3	41.0	48.0	55.9	61.6	60.5	53.9	43.7	33.2	27.6	43.5
153	HALF MOON BAY	MAX	58.0	58.8	59.1	60.7	61.3	63.4	64.6	65.6	66.5	65.0	61.6	58.2	61.9
		MEAN	50.7	51.6	51.9	52.8	54.4	56.7	58.3	59.4	59.3	56.9	53.7	50.8	54.7
		MIN	43.4	44.3	44.6	44.8	47.5	49.9	52.0	53.2	52.0	48.8	45.7	43.4	47.5
154	HANFORD 1 S	MAX	53.7	61.4	66.7	74.4	83.1	90.7	95.9	94.7	89.3	80.2	65.1	54.2	75.8
		MEAN	44.7	50.2	55.0	60.6	68.3	75.0	79.6	78.4	73.3	64.5	52.4	44.1	62.2
		MIN	35.7	38.9	43.2	46.8	53.4	59.2	63.2	62.0	57.3	48.7	39.6	33.9	48.5
155	HAPPY CAMP RANGER STN	MAX	50.2	54.9	61.2	67.8	76.2	84.1	92.4	92.4	86.0	73.5	57.0	49.1	70.4
		MEAN	40.7	43.9	47.9	52.2	58.8	65.7	72.0	71.8	65.8	56.4	46.4	40.2	55.2
		MIN	31.2	32.9	34.5	36.5	41.3	47.3	51.5	51.1	45.5	39.3	35.7	31.3	39.8
158	HAT CREEK	MAX	47.0	52.2	57.1	64.0	72.7	81.0	89.1	88.9	82.5	70.8	54.3	46.2	67.2
		MEAN	34.5	38.8	43.0	48.1	55.4	62.4	68.1	66.6	60.5	51.1	40.4	34.1	50.3
		MIN	22.0	25.4	28.9	32.2	38.0	43.7	47.0	44.3	38.4	31.3	26.4	21.9	33.3
159	HAYFIELD PUMPING PLANT	MAX	65.6	69.8	74.6	81.8	89.8	99.7	104.2	102.8	97.5	86.7	74.1	66.2	84.4
		MEAN	52.3	56.1	60.5	66.8	74.3	82.8	88.6	87.5	81.5	70.6	59.1	52.2	69.4
		MIN	38.9	42.3	46.3	51.7	58.8	65.8	73.0	72.2	65.5	54.5	44.0	38.2	54.3
161	HEALDSBURG	MAX	57.3	62.2	65.9	72.5	79.8	86.6	90.1	88.4	84.1	76.4	64.1	57.3	73.7
		MEAN	48.3	52.2	54.9	59.2	64.8	69.9	72.2	71.2	68.6	62.6	53.7	48.0	60.5
		MIN	39.3	42.1	43.8	45.9	49.7	53.2	54.3	54.0	53.0	48.8	43.2	38.6	47.2
164	HENSHAW DAM	MAX	60.3	62.4	64.2	69.1	74.9	85.0	92.2	92.6	87.6	78.5	67.9	61.2	74.7
		MEAN	45.2	47.2	49.5	53.4	58.7	65.7	72.0	72.6	67.7	58.8	49.9	44.7	57.1
		MIN	30.0	31.9	34.7	37.7	42.4	46.3	51.8	52.6	47.8	39.0	31.8	28.1	39.5
165	HETCH HETCHY	MAX	48.0	52.5	56.1	62.1	69.2	77.8	84.6	84.7	79.3	70.2	55.9	47.9	65.7
		MEAN	39.2	42.0	44.9	50.0	56.6	64.2	70.4	70.4	65.3	56.7	45.3	39.1	53.7
		MIN	30.3	31.4	33.7	37.8	44.0	50.6	56.2	56.0	51.2	43.1	34.6	30.2	41.6
166	HOLLISTER 2	MAX	61.1	63.7	66.1	70.9	73.8	78.7	80.9	81.8	81.8	78.2	67.9	61.1	72.2
		MEAN	49.5	51.9	53.9	57.0	60.2	64.4	66.6	67.4	66.7	62.6	54.6	48.8	58.6
		MIN	37.8	40.1	41.7	43.1	46.6	50.1	52.2	52.9	51.6	47.0	41.2	36.5	45.1
167	HUNTINGTON LAKE	MAX	45.9	46.1	47.1	51.2	57.3	66.3	73.6	73.3	67.4	58.9	50.2	45.8	56.9
		MEAN	36.0	35.7	36.7	40.3	46.2	54.1	60.7	60.6	55.5	48.0	40.2	36.2	45.9
		MIN	26.0	25.3	26.3	29.3	35.1	41.8	47.8	47.9	43.6	37.0	30.2	26.6	34.7
168	IDYLLWILD FIRE DEPT	MAX	53.7	55.0	56.8	62.4	69.1	77.8	83.0	82.5	78.3	69.6	60.2	54.6	66.9
		MEAN	40.3	41.1	42.5	47.0	52.9	60.8	66.9	67.0	62.7	54.3	45.5	40.8	51.8
		MIN	26.8	27.2	28.2	31.5	36.7	43.7	50.7	51.4	47.1	39.0	30.7	26.9	36.7
169	IMPERIAL	MAX	69.0	73.4	77.8	84.8	92.4	101.8	105.3	104.3	99.6	89.1	77.0	68.7	86.9
		MEAN	55.2	59.4	63.6	69.6	76.6	85.0	90.3	90.2	85.2	74.4	62.3	54.7	72.2
		MIN	41.4	45.3	49.4	54.4	60.7	68.2	75.2	76.0	70.7	59.7	47.6	40.7	57.4
171	INDEPENDENCE	MAX	54.5	59.5	65.9	74.1	83.6	93.9	99.7	97.4	89.6	77.6	63.8	55.3	76.2
		MEAN	40.9	45.0	50.4	57.3	66.5	76.2	81.7	79.4	72.4	61.1	48.8	41.4	60.1
		MIN	27.3	30.4	34.9	40.4	49.4	58.4	63.6	61.3	55.2	44.5	33.7	27.5	43.9
172	INDIO FIRE STATION	MAX	71.5	75.9	80.5	87.1	94.2	103.2	107.1	106.0	101.6	92.0	79.5	71.7	89.2
		MEAN	56.8	61.3	66.5	72.9	79.9	88.1	92.8	92.0	86.8	76.8	63.8	56.4	74.5
		MIN	42.0	46.6	52.4	58.7	65.5	72.9	78.4	78.0	72.0	61.5	48.1	41.0	59.8
173	INYOKERN	MAX	60.3	65.9	71.1	78.6	87.1	97.0	102.9	101.1	94.1	83.2	69.2	60.5	80.9
		MEAN	45.7	50.5	55.2	61.6	70.1	78.7	84.5	83.0	76.2	65.7	53.1	45.5	64.2
		MIN	31.1	35.1	39.3	44.6	53.0	60.3	66.0	64.8	58.3	48.2	36.9	30.4	47.3

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
175	IRON MOUNTAIN	MAX	65.9	71.4	77.4	85.5	94.4	104.4	109.0	107.3	101.0	89.2	75.0	65.9	87.2
		MEAN	54.7	59.4	64.6	71.9	80.4	90.0	95.0	93.4	87.0	75.2	62.5	54.5	74.1
		MIN	43.5	47.3	51.7	58.2	66.4	75.6	81.0	79.4	73.0	61.1	49.9	43.1	60.9
176	JESS VALLEY	MAX	41.0	43.5	47.3	54.2	62.8	72.2	81.3	80.8	73.8	62.8	47.6	41.3	59.1
		MEAN	29.6	32.1	35.4	40.6	47.9	56.2	63.1	62.6	55.9	46.8	35.6	29.8	44.6
		MIN	18.2	20.7	23.4	27.0	32.9	40.2	44.9	44.3	37.9	30.8	23.6	18.2	30.2
179	KENTFIELD	MAX	56.2	61.4	65.3	70.6	76.0	81.8	85.0	84.4	82.1	75.4	63.4	56.3	71.5
		MEAN	48.5	52.2	54.7	58.2	62.5	66.9	69.2	69.0	67.3	62.5	54.2	48.5	59.5
		MIN	40.7	43.0	44.1	45.8	48.9	52.0	53.4	53.6	52.5	49.6	45.0	40.6	47.4
180	KERN RIVER PH 1	MAX	59.9	66.3	71.1	79.1	87.7	95.8	100.7	98.9	94.0	84.2	69.1	59.2	80.5
		MEAN	51.2	56.9	60.4	66.6	74.3	82.5	87.7	86.4	82.0	72.9	59.6	51.3	69.3
		MIN	42.5	47.5	49.6	54.0	60.9	69.1	74.7	73.8	69.9	61.6	50.1	43.3	58.1
181	KERN RIVER PH 3	MAX	59.3	62.5	65.6	71.9	80.2	89.8	96.8	96.3	89.8	79.7	66.6	60.0	76.5
		MEAN	45.4	48.4	51.5	56.8	64.5	73.0	79.4	78.8	72.7	62.8	50.9	45.3	60.8
		MIN	31.5	34.3	37.4	41.7	48.8	56.2	62.0	61.3	55.6	45.9	35.1	30.5	45.0
183	KING CITY	MAX	63.2	66.2	68.9	74.8	78.4	83.0	85.1	85.2	85.0	79.9	69.4	63.2	75.2
		MEAN	50.2	53.3	55.5	59.0	62.7	66.6	69.0	69.2	68.1	63.2	54.8	49.7	60.1
		MIN	37.2	40.3	42.1	43.1	46.9	50.2	52.9	53.1	51.2	46.5	40.1	36.1	45.0
184	KLAMATH	MAX	55.1	56.3	57.2	59.0	61.9	64.8	66.7	66.7	67.1	64.2	58.1	54.8	61.0
		MEAN	46.4	47.9	48.7	50.5	53.7	56.9	59.1	59.2	58.1	54.5	49.5	46.1	52.6
		MIN	37.7	39.5	40.2	41.9	45.4	48.9	51.5	51.7	49.0	44.8	40.9	37.3	44.1
186	LAGUNA BEACH	MAX	66.9	67.4	67.7	70.5	71.2	74.2	77.3	78.8	78.8	75.9	71.3	67.3	72.3
		MEAN	55.4	56.0	57.0	59.7	62.5	65.6	68.7	69.3	69.2	65.4	59.6	55.5	62.0
		MIN	43.9	44.5	46.3	48.8	53.8	56.9	60.1	59.8	59.5	54.9	47.8	43.6	51.7
187	LAKE ARROWHEAD	MAX	44.5	47.2	52.7	60.2	67.2	76.1	81.3	81.1	76.0	64.5	52.1	45.1	62.3
		MEAN	36.9	38.8	42.3	47.8	54.2	62.4	68.4	68.3	63.2	53.0	42.9	37.3	51.3
		MIN	29.3	30.3	31.8	35.3	41.1	48.7	55.4	55.5	50.3	41.5	33.6	29.4	40.2
188	LAKEPORT	MAX	53.7	57.2	61.9	67.8	76.5	84.8	92.2	91.9	85.7	74.9	60.0	53.5	71.7
		MEAN	43.2	46.3	49.6	53.6	60.3	67.4	73.1	72.4	67.4	59.1	48.3	43.2	57.0
		MIN	32.7	35.4	37.3	39.3	44.1	49.9	54.0	52.9	49.0	43.3	36.6	32.8	42.3
191	LAKE SOLANO	MAX	55.1	61.1	65.9	72.7	81.2	89.9	95.7	94.6	89.8	80.0	64.9	56.1	75.6
		MEAN	45.5	50.1	54.1	59.1	66.1	73.1	76.9	75.8	72.2	64.6	53.4	46.0	61.4
		MIN	35.8	39.0	42.2	45.5	50.9	56.3	58.1	56.9	54.6	49.2	41.9	35.9	47.2
192	LAKE SPAULDING	MAX	44.7	46.5	49.4	55.3	63.7	73.5	80.7	80.6	74.9	64.3	50.1	44.1	60.7
		MEAN	35.4	36.6	38.8	43.0	50.3	58.5	64.2	64.0	59.5	50.7	39.8	34.7	48.0
		MIN	26.1	26.6	28.1	30.7	36.8	43.4	47.6	47.4	44.0	37.0	29.5	25.3	35.2
193	LA MESA	MAX	68.5	69.5	69.8	73.1	74.3	78.9	83.6	85.5	84.1	79.6	73.4	68.8	75.8
		MEAN	57.1	58.2	59.2	62.3	64.8	68.8	73.0	74.7	73.2	68.2	61.5	57.1	64.8
		MIN	45.7	46.9	48.6	51.4	55.3	58.7	62.3	63.8	62.2	56.8	49.6	45.3	53.9
194	LANCASTER ATC	MAX	56.8	60.6	64.6	71.4	79.3	89.1	95.5	94.8	88.4	77.7	65.1	56.9	75.0
		MEAN	43.9	47.6	51.9	58.0	66.1	74.8	80.8	79.5	72.6	61.8	50.0	42.8	60.8
		MIN	31.0	34.6	39.2	44.5	52.8	60.4	66.0	64.1	56.8	45.8	34.9	28.7	46.6
195	LAVA BEDS NAT MONUMENT	MAX	41.6	45.4	50.1	57.3	66.4	75.8	84.8	85.0	77.2	65.9	49.5	41.6	61.7
		MEAN	32.0	35.3	39.0	44.6	52.2	60.2	67.9	67.8	60.8	51.2	38.7	32.1	48.5
		MIN	22.4	25.2	27.9	31.8	38.0	44.5	51.0	50.6	44.4	36.5	27.8	22.5	35.2
198	LEE VINING	MAX	40.3	43.9	49.7	57.9	66.0	75.4	83.1	82.3	74.7	65.3	52.5	41.7	61.1
		MEAN	29.7	32.8	38.1	44.6	52.5	61.0	67.9	66.9	59.6	50.3	39.9	30.9	47.9
		MIN	19.1	21.7	26.4	31.3	39.0	46.6	52.7	51.5	44.4	35.3	27.3	20.1	34.6
199	LEMON COVE	MAX	57.1	64.2	69.3	76.6	85.3	93.6	98.7	97.3	91.7	81.8	67.0	57.5	78.3
		MEAN	47.3	52.7	56.9	61.9	69.1	76.0	80.9	79.6	74.8	66.2	54.2	46.9	63.9
		MIN	37.4	41.1	44.4	47.2	52.8	58.4	63.0	61.9	57.9	50.6	41.4	36.3	49.4
200	LEMOORE REEVES NAS	MAX	55.8	63.6	69.0	76.7	85.3	93.1	97.8	96.2	91.3	81.7	66.8	55.9	77.8
		MEAN	45.9	51.5	55.5	60.7	68.0	74.7	78.7	77.4	73.1	64.7	52.5	44.8	62.3
		MIN	36.0	39.3	42.0	44.6	50.6	56.3	59.5	58.5	54.9	47.6	38.2	33.7	46.8
201	LINDSAY	MAX	57.8	64.8	69.7	77.3	85.2	92.9	97.6	96.3	91.2	81.3	66.8	57.8	78.2
		MEAN	47.1	51.9	56.0	61.2	68.0	74.9	79.5	78.1	73.2	64.3	52.9	46.1	62.8
		MIN	36.4	38.9	42.2	45.0	50.8	56.8	61.4	59.9	55.2	47.3	39.0	34.4	47.3
202	LIVERMORE	MAX	56.9	61.8	65.3	71.2	77.0	84.0	89.1	88.7	85.9	77.9	64.8	57.0	73.3
		MEAN	47.2	51.1	53.8	57.7	62.8	68.3	72.0	71.9	69.6	63.2	53.2	47.0	59.8
		MIN	37.4	40.3	42.3	44.2	48.5	52.5	54.9	55.0	53.2	48.4	41.5	36.9	46.3
203	LODGEPOLE	MAX	39.1	42.1	44.4	49.9	57.9	68.2	75.6	75.0	68.3	58.2	45.6	38.7	55.3
		MEAN	27.2	29.4	32.5	37.5	44.8	53.4	59.8	59.0	53.0	44.1	33.7	27.3	41.8
		MIN	15.3	16.7	20.6	25.0	31.7	38.6	43.9	43.0	37.7	29.9	21.8	15.9	28.3
204	LODI	MAX	54.7	61.9	66.9	73.7	80.7	87.3	91.1	90.0	87.2	78.7	64.1	54.9	74.3
		MEAN	46.1	51.1	54.7	59.5	65.2	70.6	73.8	73.0	70.3	63.2	52.4	45.5	60.5
		MIN	37.5	40.3	42.5	45.2	49.7	53.9	56.5	55.9	53.4	47.6	40.7	36.0	46.6
205	LOMPOC	MAX	66.0	67.3	68.2	70.9	71.2	73.7	75.4	76.7	77.8	76.4	71.1	66.7	71.8
		MEAN	53.7	55.3	56.4	58.3	60.0	62.6	64.5	65.6	65.7	63.0	57.6	53.5	59.7
		MIN	41.4	43.3	44.5	45.6	48.7	51.5	53.5	54.5	53.6	49.6	44.0	40.2	47.5

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
206	LONG BEACH AP	MAX	68.0	68.5	68.9	72.7	74.0	78.3	82.9	84.6	83.1	78.9	73.4	68.8	75.2
		MEAN	57.0	58.3	59.7	63.0	65.9	69.8	73.8	75.1	73.4	68.6	61.8	57.1	65.3
		MIN	46.0	48.1	50.4	53.2	57.8	61.3	64.6	65.6	63.7	58.3	50.1	45.3	55.4
208	LOS ANGELES INTL AP	MAX	65.6	65.8	65.3	68.0	69.3	72.6	75.3	76.8	76.5	74.3	70.4	66.7	70.6
		MEAN	57.1	58.0	58.3	60.8	63.1	66.4	69.3	70.7	70.1	66.9	61.6	57.6	63.3
		MIN	48.6	50.1	51.3	53.6	56.9	60.1	63.3	64.5	63.6	59.4	52.7	48.5	56.1
209	LOS ANGELES DOWNTOWN US	MAX	68.1	69.6	69.8	73.1	74.5	79.5	83.8	84.8	83.3	79.0	73.2	68.7	75.6
		MEAN	58.3	60.0	60.7	63.8	66.2	70.5	74.2	75.2	74.0	69.5	62.9	58.5	66.2
		MIN	48.5	50.3	51.6	54.4	57.9	61.4	64.6	65.6	64.6	59.9	52.6	48.3	56.6
210	LOS BANOS	MAX	54.9	62.4	67.5	74.1	81.6	89.0	94.6	93.5	88.8	79.6	65.3	55.1	75.5
		MEAN	45.9	51.5	55.7	60.6	67.2	73.4	78.1	77.1	73.1	65.1	53.4	45.3	62.2
		MIN	36.8	40.5	43.9	47.0	52.7	57.7	61.5	60.6	57.3	50.6	41.4	35.4	48.8
212	LOS BANOS DET RESV	MAX	53.7	60.5	65.4	72.3	79.9	88.0	94.2	93.1	87.8	78.3	64.2	54.5	74.3
		MEAN	46.2	51.6	55.7	60.8	67.2	74.1	79.0	78.1	74.2	66.3	54.8	46.4	62.9
		MIN	38.7	42.7	45.9	49.2	54.5	60.1	63.8	63.1	60.5	54.3	45.3	38.3	51.4
213	LOS GATOS	MAX	58.5	62.4	65.5	70.7	75.9	81.8	85.4	84.9	82.5	75.6	64.7	58.2	72.2
		MEAN	48.7	51.8	54.2	57.6	62.1	66.9	70.3	69.9	67.9	62.1	53.6	48.2	59.4
		MIN	38.8	41.1	42.9	44.4	48.2	52.0	55.1	54.8	53.3	48.6	42.4	38.1	46.6
217	MADERA	MAX	54.1	61.5	66.8	74.3	83.1	91.0	96.5	95.3	89.8	79.9	64.9	54.3	76.0
		MEAN	45.7	50.8	55.3	60.5	67.8	74.8	79.6	78.6	73.4	64.2	52.4	44.7	62.3
		MIN	37.2	40.0	43.7	46.6	52.5	58.5	62.7	61.8	57.0	48.5	39.9	35.1	48.6
219	MANZANITA LAKE	MAX	41.9	42.9	45.7	51.5	60.8	70.2	78.3	77.8	71.7	60.6	46.4	41.7	57.5
		MEAN	31.5	32.2	34.9	39.6	47.4	55.3	61.5	60.8	55.8	47.0	36.1	31.8	44.5
		MIN	21.1	21.4	24.0	27.7	34.0	40.4	44.7	43.7	39.9	33.3	25.8	21.8	31.5
220	MARICOPA	MAX	56.9	63.8	68.6	75.9	83.9	92.2	96.9	95.8	90.0	80.5	66.1	57.2	77.3
		MEAN	47.8	53.4	57.2	62.7	70.3	78.1	83.4	82.3	77.4	68.6	55.7	47.6	65.4
		MIN	38.6	42.9	45.7	49.4	56.6	63.9	69.8	68.7	64.7	56.6	45.3	38.0	53.4
222	MARKLEEVILLE	MAX	44.3	46.9	51.0	57.1	65.6	75.2	83.2	82.2	75.3	65.1	52.7	44.5	61.9
		MEAN	31.1	33.6	37.6	42.5	49.8	57.5	63.7	62.8	56.0	46.9	37.4	30.7	45.8
		MIN	17.8	20.3	24.1	27.9	33.9	39.8	44.2	43.4	36.6	28.6	22.1	16.8	29.6
223	MARKLEY COVE	MAX	54.8	59.6	63.8	70.1	78.2	86.4	92.8	92.1	87.5	77.8	63.4	55.7	73.5
		MEAN	45.4	48.9	52.2	56.6	63.2	70.0	75.0	74.3	70.8	63.1	52.3	45.9	59.8
		MIN	35.9	38.2	40.5	43.0	48.2	53.6	57.1	56.5	54.1	48.4	41.1	36.0	46.1
224	MARTINEZ WATER PLANT	MAX	53.7	59.5	64.3	70.9	77.7	83.9	87.4	86.6	83.3	75.5	62.7	54.5	71.7
		MEAN	46.3	50.7	54.3	58.5	63.7	68.9	71.2	70.8	68.6	62.5	53.0	46.5	59.6
		MIN	38.8	41.8	44.3	46.1	49.7	53.8	54.9	55.0	53.8	49.5	43.3	38.5	47.5
225	MARYSVILLE	MAX	54.8	61.7	66.8	74.2	82.7	90.7	96.3	95.0	89.7	80.0	64.5	55.3	76.0
		MEAN	46.3	51.7	56.0	61.3	68.5	74.9	78.9	77.4	73.2	65.2	53.5	46.2	62.8
		MIN	37.8	41.7	45.1	48.4	54.3	59.0	61.4	59.8	56.6	50.4	42.5	37.1	49.5
227	MC CLOUD	MAX	47.1	49.5	53.8	61.0	70.5	79.3	87.4	87.2	81.0	69.8	53.8	47.4	65.7
		MEAN	35.8	38.2	41.6	46.8	54.5	62.2	68.3	67.2	61.5	52.4	41.3	36.1	50.5
		MIN	24.4	26.8	29.3	32.6	38.5	45.0	49.2	47.2	42.0	34.9	28.7	24.8	35.3
228	MECCA FIRE STATION	MAX	70.9	75.9	81.6	89.3	96.2	104.9	108.6	107.4	102.7	92.4	78.9	70.8	90.0
		MEAN	54.8	59.5	65.1	71.6	78.6	86.2	91.2	90.7	85.2	74.5	61.4	54.1	72.7
		MIN	38.7	43.1	48.6	53.9	60.9	67.5	73.7	73.9	67.6	56.5	43.9	37.3	55.5
229	MERCED	MAX	55.1	62.5	67.6	75.3	83.7	91.5	96.5	95.1	90.5	81.1	65.5	55.1	76.6
		MEAN	46.3	51.2	55.0	60.0	67.2	73.9	78.6	77.4	73.2	64.7	53.1	45.5	62.2
		MIN	37.5	39.9	42.3	44.6	50.6	56.3	60.6	59.7	55.8	48.2	40.7	35.8	47.7
231	MINERAL	MAX	41.6	43.4	46.5	53.1	62.1	71.4	80.0	80.1	73.2	62.1	47.3	41.8	58.6
		MEAN	31.7	33.3	36.0	40.8	47.7	55.2	61.2	60.5	55.2	46.7	36.7	32.1	44.8
		MIN	21.8	23.1	25.5	28.4	33.3	38.9	42.4	40.9	37.1	31.3	26.1	22.4	30.9
232	MITCHELL CAVERNS	MAX	54.4	57.6	61.6	69.5	78.4	89.1	94.0	92.1	86.0	75.1	63.1	55.1	73.0
		MEAN	45.7	48.6	51.8	58.9	67.1	77.3	82.6	80.9	74.9	64.8	53.4	46.2	62.7
		MIN	36.9	39.5	42.0	48.2	55.7	65.4	71.1	69.6	63.7	54.4	43.6	37.3	52.3
233	MODESTO CITY-COUNTY AP	MAX	54.3	62.2	67.5	74.1	81.5	88.7	93.6	92.3	87.9	78.4	64.1	54.3	74.9
		MEAN	47.2	52.9	56.9	61.7	67.7	73.7	77.7	76.7	73.1	65.3	54.2	46.6	62.8
		MIN	40.1	43.6	46.2	49.2	53.8	58.7	61.7	61.1	58.2	52.1	44.2	38.9	50.7
234	MOJAVE	MAX	58.1	62.0	65.8	72.3	80.8	90.5	97.1	96.1	89.5	78.7	65.7	58.4	76.3
		MEAN	46.1	49.6	53.3	59.0	67.3	76.4	82.2	81.0	74.4	63.9	52.4	45.8	62.6
		MIN	34.1	37.1	40.8	45.6	53.7	62.2	67.3	65.8	59.3	49.0	39.1	33.1	48.9
235	MONTEBELLO	MAX	69.7	71.3	72.6	77.4	79.2	84.2	88.9	89.4	87.5	82.2	75.2	70.7	79.0
		MEAN	58.8	60.0	61.6	65.3	68.1	72.6	76.6	77.4	75.7	70.3	63.6	59.0	67.4
		MIN	47.9	48.7	50.5	53.1	56.9	60.9	64.3	65.4	63.8	58.4	52.0	47.3	55.8
236	MONTEREY	MAX	59.8	61.4	61.9	64.1	64.6	66.9	68.1	69.5	71.4	69.9	64.2	59.7	65.1
		MEAN	51.6	53.1	53.8	55.4	56.6	58.7	60.2	61.4	62.3	60.4	55.5	51.5	56.7
		MIN	43.4	44.7	45.7	46.6	48.5	50.4	52.3	53.2	53.1	50.9	46.7	43.2	48.2
237	MORRO BAY FIRE DEPT	MAX	61.9	62.4	62.4	63.4	62.8	64.3	65.2	66.0	67.7	68.6	66.1	62.3	64.4
		MEAN	52.0	53.1	53.4	54.2	55.2	57.3	58.8	59.7	60.2	59.3	55.9	52.1	55.9
		MIN	42.0	43.8	44.4	45.0	47.5	50.2	52.3	53.3	52.6	49.9	45.6	41.8	47.4

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
238	MOUNTAIN PASS	MAX	50.3	53.9	59.7	67.0	75.7	86.6	92.5	90.7	84.4	72.4	58.1	50.7	70.2
		MEAN	39.4	42.6	47.2	54.0	62.5	73.7	79.5	77.6	70.5	59.1	47.4	39.9	57.8
		MIN	28.5	31.3	34.7	40.9	49.3	60.8	66.5	64.5	56.5	45.7	36.6	29.1	45.4
239	MOUNT DIABLO JUNCTION	MAX	55.6	57.2	59.2	64.8	70.8	78.7	85.2	85.1	82.2	74.4	61.9	56.2	69.3
		MEAN	47.5	49.0	50.0	54.1	59.1	66.0	72.4	72.3	69.9	63.1	52.8	48.0	58.7
		MIN	39.3	40.7	40.7	43.3	47.4	53.2	59.6	59.5	57.5	51.8	43.7	39.7	48.0
240	MOUNT HAMILTON	MAX	49.4	49.6	50.4	55.8	63.4	72.0	78.2	77.9	73.8	65.3	53.9	49.9	61.6
		MEAN	43.5	43.3	43.7	47.9	55.1	63.7	70.7	70.4	66.0	58.1	47.5	43.6	54.5
		MIN	37.5	36.9	37.0	40.0	46.8	55.3	63.1	62.8	58.2	50.8	41.0	37.3	47.2
242	MOUNT SHASTA	MAX	44.2	47.6	52.1	59.2	67.3	75.5	83.2	82.6	76.0	64.4	49.9	43.8	62.2
		MEAN	35.3	38.2	41.2	46.3	53.2	60.2	66.1	65.1	59.5	50.5	39.9	34.8	49.2
		MIN	26.4	28.7	30.3	33.3	39.0	44.9	48.9	47.5	42.9	36.6	29.9	25.8	36.2
243	MT WILSON NO 2	MAX	52.9	53.4	55.0	60.7	67.9	77.0	82.1	81.6	77.0	68.5	59.5	53.8	65.8
		MEAN	44.4	44.7	45.7	50.7	57.6	66.9	72.7	72.3	67.7	59.6	50.5	45.3	56.5
		MIN	35.9	35.9	36.3	40.6	47.3	56.7	63.2	63.0	58.4	50.6	41.4	36.7	47.2
245	NAPA STATE HOSPITAL	MAX	56.6	61.8	65.4	70.5	75.4	80.5	82.6	82.4	81.8	76.4	64.1	56.8	71.2
		MEAN	47.9	51.8	54.3	57.6	62.1	66.6	68.6	68.5	67.5	62.7	53.5	47.7	59.1
		MIN	39.2	41.8	43.1	44.7	48.8	52.6	54.5	54.5	53.1	49.0	42.9	38.6	46.9
246	NEEDLES AP	MAX	65.2	71.2	77.8	86.0	94.6	104.8	109.1	107.1	100.8	88.8	74.1	65.0	87.0
		MEAN	54.0	58.7	64.1	71.5	80.4	90.3	96.1	94.4	87.5	75.3	62.0	54.0	74.0
		MIN	42.8	46.2	50.4	56.9	66.2	75.8	83.0	81.6	74.1	61.7	49.9	43.0	61.0
247	NEVADA CITY	MAX	50.1	52.7	55.6	61.9	69.6	78.5	85.6	85.3	79.7	69.9	55.8	49.7	66.2
		MEAN	41.1	43.0	45.5	50.2	57.0	64.7	70.8	70.3	65.3	57.1	46.1	41.0	54.3
		MIN	32.1	33.3	35.3	38.4	44.4	50.9	56.0	55.2	50.8	44.2	36.4	32.3	42.4
248	NEWARK (OAKLAND)	MAX	57.6	61.4	64.3	68.1	71.5	75.9	78.3	78.6	78.0	73.5	64.4	57.7	69.1
		MEAN	49.8	53.3	55.8	59.0	62.2	65.9	68.0	68.5	67.8	63.7	55.8	49.7	60.0
		MIN	42.0	45.1	47.3	49.8	52.9	55.9	57.7	58.4	57.5	53.8	47.1	41.7	50.8
249	NEW CUYAMA FIRE STN	MAX	60.3	62.3	64.6	71.2	79.5	88.5	94.2	93.2	87.0	77.5	66.1	60.8	75.4
		MEAN	46.2	48.3	50.4	54.7	61.6	69.2	74.7	73.6	68.6	59.9	50.2	45.8	58.6
		MIN	32.0	34.3	36.2	38.2	43.6	49.8	55.1	54.0	50.1	42.3	34.3	30.8	41.7
251	NEWMAN	MAX	54.2	61.8	67.0	74.5	82.7	90.5	94.6	92.6	88.6	79.8	65.1	55.1	75.5
		MEAN	45.6	50.9	54.8	59.8	66.8	73.2	77.1	75.8	72.3	64.5	53.0	45.3	61.6
		MIN	37.0	40.0	42.6	45.1	50.8	55.9	59.6	58.9	55.9	49.2	40.9	35.5	47.6
252	NEWPORT BEACH HARBOR	MAX	63.6	63.8	63.6	65.5	66.1	68.4	71.4	73.0	72.9	71.2	67.7	64.2	67.6
		MEAN	55.9	56.7	57.4	59.5	61.7	64.3	67.3	68.7	68.1	65.1	60.0	56.1	61.7
		MIN	48.2	49.6	51.2	53.5	57.3	60.2	63.1	64.4	63.2	59.0	52.2	48.0	55.8
256	OAKLAND MUSEUM	MAX	57.1	61.2	63.2	66.4	68.9	71.6	72.7	73.5	74.6	72.1	63.9	57.6	66.9
		MEAN	50.9	54.4	56.1	58.5	61.1	63.7	64.9	65.9	66.4	63.7	56.7	51.2	59.5
		MIN	44.7	47.6	49.0	50.6	53.3	55.7	57.0	58.3	58.2	55.2	49.4	44.8	52.0
258	OCEANSIDE MARINA	MAX	64.0	63.9	64.0	65.3	66.5	68.8	72.1	73.6	73.4	71.4	68.1	64.9	68.0
		MEAN	54.7	55.2	56.2	58.2	61.2	64.2	67.6	68.6	67.4	63.8	58.4	54.9	60.9
		MIN	45.4	46.5	48.4	51.0	55.9	59.6	63.0	63.6	61.4	56.1	48.6	44.8	53.7
260	OJAI	MAX	68.1	69.2	70.2	75.0	77.5	83.5	88.9	90.1	87.2	81.9	74.3	69.3	77.9
		MEAN	52.5	54.4	56.0	59.5	63.0	68.0	72.3	73.0	70.4	64.6	57.1	52.6	62.0
		MIN	36.9	39.6	41.7	44.0	48.4	52.4	55.7	55.9	53.6	47.3	39.9	35.8	45.9
261	ORANGE COVE	MAX	55.5	62.5	68.2	75.7	84.8	93.2	98.6	97.6	91.5	81.5	66.1	56.2	77.6
		MEAN	46.1	51.1	55.8	60.8	68.4	75.8	80.5	79.3	74.5	65.4	53.6	45.9	63.1
		MIN	36.6	39.7	43.3	45.8	52.0	58.4	62.3	61.0	57.4	49.3	41.1	35.5	48.5
262	ORICK PRAIRIE CREEK PAR	MAX	52.4	55.2	56.9	58.9	62.5	65.9	68.6	69.6	70.6	65.6	56.6	51.4	61.2
		MEAN	43.9	46.2	47.3	48.7	52.0	55.6	58.3	59.0	58.2	53.7	47.8	43.7	51.2
		MIN	35.4	37.1	37.6	38.4	41.5	45.2	48.0	48.4	45.7	41.8	38.9	35.9	41.2
263	ORLAND	MAX	55.6	61.2	65.6	72.4	80.5	88.3	93.9	93.1	89.2	79.2	64.0	55.7	74.9
		MEAN	46.5	50.9	54.5	59.3	66.7	73.7	78.1	77.0	73.6	65.2	53.4	46.4	62.1
		MIN	37.4	40.5	43.3	46.2	52.8	59.0	62.3	60.8	57.9	51.1	42.7	37.0	49.3
264	ORLEANS	MAX	52.4	57.6	63.8	70.6	77.3	84.8	92.1	92.0	87.6	74.2	57.5	50.9	71.7
		MEAN	44.1	47.8	51.9	56.2	61.6	67.7	73.2	72.8	68.7	59.4	49.0	43.3	58.0
		MIN	35.7	38.0	40.0	41.8	45.9	50.5	54.2	53.5	49.7	44.5	40.5	35.6	44.2
265	OROVILLE	MAX	54.2	60.4	64.6	71.3	80.2	89.0	94.7	93.1	87.0	77.6	63.0	54.6	74.1
		MEAN	45.3	50.3	54.0	58.7	66.1	73.5	78.1	76.1	71.0	63.1	52.0	45.6	61.2
		MIN	36.3	40.1	43.3	46.1	51.9	58.0	61.5	59.1	54.9	48.6	41.0	36.6	48.1
266	OXNARD (CAMARILLO)	MAX	65.6	65.8	65.5	67.5	67.7	70.2	72.7	73.9	73.8	72.8	69.7	66.4	69.3
		MEAN	55.6	56.2	56.7	58.6	60.5	63.3	65.9	67.0	66.3	63.7	59.3	55.9	60.8
		MIN	45.5	46.6	47.9	49.6	53.2	56.4	59.1	60.0	58.7	54.5	48.9	45.3	52.1
268	PACIFICA 4 SSE	MAX	55.5	58.3	59.7	62.8	65.2	68.8	70.4	70.1	70.9	67.7	59.9	55.7	63.8
		MEAN	50.2	52.1	52.7	54.5	56.7	59.4	61.2	61.2	62.0	59.9	54.2	50.5	56.2
		MIN	44.8	45.9	45.7	46.1	48.1	50.0	51.9	52.3	53.0	52.0	48.4	45.2	48.6
271	PALMDALE (LANCASTER)	MAX	58.8	63.2	67.8	74.8	82.5	91.6	97.5	97.0	91.1	80.4	67.0	58.6	77.5
		MEAN	46.6	50.3	54.2	59.9	67.5	75.7	81.7	81.0	75.2	65.0	53.2	46.0	63.0
		MIN	34.3	37.3	40.5	45.0	52.5	59.8	65.9	65.0	59.2	49.5	39.3	33.3	48.5

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
272	PALM SPRINGS	MAX	70.4	74.8	79.7	87.5	94.6	104.0	108.2	106.9	101.3	90.9	78.2	70.0	88.9
		MEAN	57.3	61.0	65.2	71.8	78.7	86.8	92.1	91.5	85.9	76.0	64.0	56.7	73.9
		MIN	44.2	47.2	50.7	56.0	62.8	69.6	76.0	76.0	70.5	61.1	49.7	43.4	58.9
273	PALO ALTO	MAX	57.6	61.6	64.3	69.0	73.5	77.4	78.8	78.7	77.8	73.0	64.1	58.2	69.5
		MEAN	49.0	52.4	55.0	58.2	62.4	66.2	68.0	68.0	66.4	61.5	54.0	48.7	59.2
		MIN	40.4	43.2	45.6	47.4	51.2	55.0	57.1	57.2	55.0	50.0	43.9	39.2	48.8
275	PALOMAR MOUNTAIN OBS	MAX	51.5	52.5	56.1	62.2	69.3	79.3	84.9	84.1	79.3	68.8	57.9	51.8	66.5
		MEAN	43.3	44.1	46.3	51.2	57.6	67.3	73.1	73.1	68.2	59.0	49.1	43.7	56.3
		MIN	35.0	35.6	36.5	40.1	45.9	55.3	61.3	62.1	57.1	49.1	40.2	35.6	46.2
278	PARADISE	MAX	53.7	56.4	60.0	66.7	75.5	84.9	91.7	90.8	85.2	74.3	59.9	53.9	71.1
		MEAN	45.7	48.3	51.0	56.2	63.5	71.7	77.8	76.9	72.3	63.3	51.4	45.9	60.3
		MIN	37.7	40.1	42.0	45.7	51.4	58.4	63.9	63.0	59.4	52.3	42.9	37.9	49.6
279	PARKER RESERVOIR	MAX	64.8	70.5	76.4	84.5	93.1	103.4	107.5	106.0	100.1	88.3	73.9	65.0	86.1
		MEAN	53.9	58.8	64.4	71.8	80.4	90.1	95.2	93.7	87.7	75.8	62.1	53.9	74.0
		MIN	42.9	47.0	52.3	59.0	67.6	76.8	82.8	81.3	75.2	63.3	50.3	42.8	61.8
280	PASADENA	MAX	67.8	70.3	71.3	76.0	78.2	84.0	89.4	90.6	88.5	82.5	73.8	68.0	78.4
		MEAN	56.1	58.1	59.3	63.0	65.9	70.7	75.3	76.3	74.6	68.9	61.0	56.1	65.4
		MIN	44.3	45.9	47.2	50.0	53.5	57.4	61.1	62.0	60.6	55.2	48.1	44.1	52.5
282	PASO ROBLES	MAX	61.4	64.5	67.4	73.0	79.8	86.5	91.3	92.0	88.0	80.7	68.2	61.7	76.2
		MEAN	47.3	50.6	53.4	56.6	62.3	67.6	71.6	71.8	68.2	61.5	51.9	46.3	59.1
		MIN	33.1	36.6	39.3	40.1	44.8	48.7	51.8	51.6	48.4	42.3	35.6	30.9	41.9
283	PASO ROBLES MUNICIPAL A	MAX	60.3	63.4	66.4	73.6	81.1	88.8	93.9	93.7	89.1	80.5	67.8	60.8	76.6
		MEAN	48.0	51.1	53.5	57.3	63.3	69.4	73.8	73.7	70.0	62.5	52.7	47.1	60.2
		MIN	35.6	38.7	40.5	41.0	45.4	50.0	53.7	53.7	50.8	44.4	37.5	33.3	43.7
285	PEARBLOSSOM	MAX	56.7	60.1	65.2	72.4	80.6	91.0	96.0	95.1	87.9	77.7	64.9	56.5	75.3
		MEAN	45.9	48.8	52.5	58.2	65.8	74.6	80.6	80.1	73.2	64.6	52.9	45.7	61.9
		MIN	35.1	37.5	39.8	44.0	51.0	58.2	65.2	65.0	58.4	51.4	40.9	34.8	48.4
286	PETALUMA FIRE STA 2	MAX	57.9	62.6	65.3	69.8	73.9	79.3	82.7	82.8	82.2	77.1	65.9	58.1	71.5
		MEAN	48.4	51.9	53.9	57.0	60.4	64.8	67.3	67.5	66.9	62.3	54.1	47.9	58.5
		MIN	38.9	41.2	42.5	44.2	46.9	50.2	51.8	52.1	51.5	47.5	42.2	37.7	45.6
288	PINNACLES NATL MONUMENT	MAX	62.7	64.7	66.6	72.6	79.6	88.1	94.4	94.5	90.3	81.9	69.9	63.4	77.4
		MEAN	48.2	50.3	52.1	56.0	61.3	67.5	72.6	72.4	69.3	62.2	53.3	48.0	59.4
		MIN	33.6	35.8	37.6	39.3	42.9	46.8	50.7	50.3	48.3	42.5	36.6	32.5	41.4
290	PISMO BEACH	MAX	64.6	65.8	66.6	69.3	69.6	71.1	71.2	72.3	73.0	72.6	68.9	65.5	69.2
		MEAN	53.6	55.0	55.6	57.6	58.5	60.8	61.9	62.8	63.1	61.7	57.4	54.0	58.5
		MIN	42.6	44.1	44.6	45.9	47.3	50.5	52.5	53.3	53.1	50.7	45.9	42.4	47.7
293	PLACERVILLE	MAX	57.7	60.8	63.1	68.9	76.8	86.2	93.2	93.0	87.5	77.1	63.3	57.4	73.8
		MEAN	45.5	48.3	50.8	55.1	61.7	69.3	75.3	75.1	70.4	61.5	50.4	45.2	59.1
		MIN	33.3	35.8	38.4	41.3	46.5	52.4	57.4	57.2	53.2	45.9	37.5	32.9	44.3
294	PLACERVILLE IFG	MAX	54.0	56.4	59.0	65.1	73.7	83.7	91.2	90.8	84.9	74.3	59.2	54.0	70.5
		MEAN	46.5	48.2	49.7	54.6	62.2	70.8	77.9	77.2	72.5	63.5	50.9	46.3	60.0
		MIN	39.0	39.9	40.4	44.0	50.7	57.9	64.5	63.6	60.0	52.6	42.6	38.5	49.5
295	POINT ARENA	MAX	56.7	57.6	58.7	60.0	61.7	64.2	66.2	67.4	67.9	65.8	60.6	57.1	62.0
		MEAN	47.7	49.1	50.1	51.2	53.6	56.1	57.8	58.9	58.5	55.3	50.7	47.7	53.1
		MIN	38.7	40.5	41.4	42.3	45.5	47.9	49.4	50.3	49.1	44.8	40.8	38.2	44.1
296	POINT MUGU NF	MAX	66.0	66.1	66.0	68.1	68.9	71.5	74.0	75.1	74.9	73.5	70.1	66.8	70.1
		MEAN	55.7	56.1	56.5	58.2	60.3	63.3	66.0	67.1	66.8	63.7	58.9	55.4	60.7
		MIN	45.3	46.0	46.9	48.2	51.7	55.0	57.9	59.1	58.6	53.9	47.7	44.0	51.2
297	POMONA FAIRPLEX	MAX	67.6	69.0	69.1	74.1	76.7	82.3	88.7	89.2	86.7	80.2	73.1	68.3	77.1
		MEAN	54.6	56.3	56.9	60.5	64.1	68.7	73.8	74.2	72.4	66.4	59.3	54.7	63.5
		MIN	41.5	43.5	44.6	46.9	51.5	55.1	58.8	59.2	58.0	52.6	45.4	41.0	49.8
298	PORTERVILLE	MAX	57.9	64.9	69.8	76.9	85.3	93.2	98.1	96.8	91.8	82.5	67.9	58.3	78.6
		MEAN	48.7	54.1	58.4	63.6	70.9	77.8	82.8	81.5	76.5	67.7	55.7	48.3	65.5
		MIN	39.4	43.3	46.9	50.3	56.4	62.4	67.4	66.1	61.2	52.9	43.5	38.2	52.3
299	PORTOLA	MAX	40.5	44.5	49.5	56.5	65.7	75.6	84.4	83.6	76.4	65.3	49.7	41.6	61.1
		MEAN	29.2	32.7	37.6	42.6	49.7	57.2	63.1	61.9	55.8	46.9	36.2	29.9	45.2
		MIN	17.8	20.9	25.6	28.6	33.6	38.7	41.8	40.2	35.2	28.5	22.7	18.2	29.3
301	POTTER VALLEY P H	MAX	56.5	59.7	63.1	68.9	76.3	84.6	92.2	91.3	87.0	76.8	62.1	55.8	72.9
		MEAN	45.3	48.2	50.8	54.5	60.2	66.9	72.6	71.5	67.6	59.7	49.6	44.5	57.6
		MIN	34.1	36.7	38.5	40.1	44.1	49.2	53.0	51.7	48.1	42.5	37.1	33.1	42.4
303	PRIEST VALLEY	MAX	56.7	59.0	62.1	69.1	77.5	87.0	93.4	92.9	87.7	77.5	63.7	57.1	73.6
		MEAN	43.3	45.6	48.0	52.0	58.7	66.0	71.5	71.1	66.6	58.1	47.7	42.6	55.9
		MIN	29.8	32.2	33.9	34.9	39.8	44.9	49.6	49.2	45.5	38.6	31.7	28.1	38.2
304	QUINCY	MAX	47.4	53.3	58.8	65.2	74.6	83.4	91.1	90.5	84.3	73.3	56.5	46.6	68.8
		MEAN	35.8	40.0	44.1	48.2	55.7	62.6	67.7	66.5	60.9	52.3	42.4	35.1	50.9
		MIN	24.1	26.6	29.3	31.2	36.7	41.7	44.2	42.4	37.5	31.2	28.2	23.5	33.1
305	RAMONA FIRE DEPT	MAX	66.5	67.8	68.0	72.8	76.4	84.4	90.2	90.8	87.7	80.9	73.0	67.5	77.2
		MEAN	52.4	53.6	54.5	57.9	62.2	67.9	73.0	73.9	71.5	64.3	57.4	52.3	61.7
		MIN	38.3	39.4	40.9	42.9	47.9	51.4	55.8	57.0	55.2	47.7	41.8	37.0	46.3

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
306	RANDSBURG	MAX	54.2	58.6	63.8	71.9	81.3	91.4	97.7	96.0	88.3	76.2	62.4	54.3	74.7
		MEAN	44.3	47.9	51.6	58.2	66.7	76.2	82.1	80.7	74.1	63.4	51.4	44.4	61.8
		MIN	34.4	37.1	39.3	44.4	52.1	60.9	66.5	65.4	59.9	50.6	40.3	34.5	48.8
307	RED BLUFF AP	MAX	55.7	60.9	64.8	71.9	81.8	90.7	97.6	96.0	90.5	79.1	63.1	55.4	75.6
		MEAN	46.7	50.9	54.3	59.5	68.0	76.1	81.6	79.7	74.9	65.1	52.7	46.3	63.0
		MIN	37.7	40.8	43.7	47.0	54.1	61.4	65.5	63.4	59.3	51.1	42.3	37.1	50.3
308	REDDING MUNICIPAL AP	MAX	55.4	60.1	63.9	70.6	80.7	90.7	98.5	96.9	90.2	78.4	62.4	55.6	75.3
		MEAN	45.5	49.1	52.5	57.8	66.2	75.2	81.3	78.9	73.4	63.2	51.1	45.3	61.6
		MIN	35.5	38.1	41.1	44.9	51.6	59.6	64.1	60.8	56.5	48.0	39.8	35.0	47.9
309	REDLANDS	MAX	65.4	67.3	68.6	74.9	79.2	87.7	94.4	94.7	89.8	81.5	72.9	66.5	78.6
		MEAN	52.9	54.9	56.6	61.3	65.9	72.2	78.0	78.4	74.6	66.9	58.6	53.2	64.5
		MIN	40.4	42.5	44.5	47.6	52.5	56.7	61.5	62.1	59.4	52.3	44.2	39.8	50.3
310	REDWOOD CITY	MAX	57.7	61.7	65.1	69.9	74.0	78.7	80.8	80.5	78.5	73.0	63.2	57.4	70.0
		MEAN	48.4	51.7	54.4	57.6	61.5	65.7	68.0	67.8	65.9	60.9	53.1	48.0	58.6
		MIN	39.1	41.7	43.6	45.2	48.9	52.7	55.2	55.0	53.2	48.7	42.9	38.6	47.1
312	RICHARDSON GR ST PK	MAX	50.0	54.3	59.2	64.7	71.1	78.2	85.5	86.5	82.8	70.3	55.4	49.1	67.3
		MEAN	44.1	46.7	49.7	53.1	58.5	64.3	69.7	70.2	66.6	58.1	48.5	43.6	56.1
		MIN	38.2	39.0	40.1	41.4	45.9	50.4	53.8	53.8	50.4	45.8	41.6	38.1	44.9
313	RICHMOND	MAX	57.1	60.9	63.2	66.3	68.3	70.7	70.5	71.0	73.4	71.8	63.6	57.3	66.2
		MEAN	50.0	53.2	55.0	57.4	59.6	62.2	62.7	63.5	64.8	62.5	55.6	50.2	58.1
		MIN	42.9	45.4	46.8	48.4	50.9	53.6	54.9	55.9	56.1	53.1	47.6	43.0	49.9
314	RIVERSIDE FIRE STA 3	MAX	67.9	69.6	71.0	76.2	80.2	87.8	94.1	95.0	90.8	83.0	74.1	68.6	79.9
		MEAN	55.3	57.0	58.6	62.8	67.3	73.3	78.7	79.6	76.1	68.7	60.0	55.2	66.1
		MIN	42.7	44.3	46.2	49.3	54.4	58.7	63.3	64.1	61.4	54.3	45.9	41.7	52.2
315	RIVERSIDE CITRUS EXP ST	MAX	66.4	68.2	69.6	75.5	79.6	87.3	93.5	94.4	90.6	82.9	73.9	67.9	79.2
		MEAN	54.2	55.9	57.5	61.8	66.3	72.1	77.4	78.2	75.1	68.0	59.5	54.5	65.0
		MIN	42.0	43.6	45.4	48.1	52.9	56.9	61.2	62.0	59.6	53.0	45.0	41.1	50.9
317	SACRAMENTO AP	MAX	53.8	60.5	64.7	71.4	80.0	87.4	92.4	91.4	87.5	78.2	63.7	53.9	73.7
		MEAN	46.3	51.2	54.5	58.9	65.5	71.5	75.4	74.8	71.7	64.4	53.3	45.8	61.1
		MIN	38.8	41.9	44.2	46.3	50.9	55.5	58.3	58.1	55.8	50.6	42.8	37.7	48.4
318	SACRAMENTO 5 ESE	MAX	55.1	62.2	67.0	73.9	81.6	88.8	93.8	92.5	88.6	79.2	64.2	55.0	75.2
		MEAN	48.2	53.5	57.1	61.7	67.9	73.6	77.4	76.7	73.8	66.4	55.1	47.7	63.3
		MIN	41.3	44.7	47.1	49.5	54.1	58.4	60.9	60.8	59.0	53.6	45.9	40.4	51.3
319	SAGEHEN CREEK	MAX	38.8	41.5	46.0	52.4	61.0	70.4	78.2	77.5	70.9	59.8	45.5	38.8	56.7
		MEAN	26.5	28.7	33.2	38.2	45.1	52.3	57.6	57.1	51.5	43.0	32.9	26.3	41.0
		MIN	14.1	15.9	20.3	23.9	29.2	34.1	36.9	36.7	32.1	26.1	20.2	13.8	25.3
320	SAINT HELENA	MAX	58.0	62.5	66.3	73.0	79.2	85.5	89.3	88.3	85.6	77.7	65.1	58.4	74.1
		MEAN	47.9	51.4	54.1	58.6	63.6	68.8	71.6	71.0	68.6	62.5	53.4	47.6	59.9
		MIN	37.8	40.3	41.8	44.2	48.0	52.1	53.9	53.6	51.6	47.2	41.6	36.7	45.7
321	SALINAS NO 2	MAX	62.7	64.4	65.2	67.6	68.3	70.7	71.4	72.7	74.6	73.5	67.5	62.9	68.5
		MEAN	51.7	53.5	54.5	56.2	58.1	60.7	62.3	63.3	63.5	60.8	55.2	51.2	57.6
		MIN	40.6	42.6	43.7	44.7	47.9	50.6	53.1	53.8	52.3	48.0	42.8	39.4	46.6
322	SALINAS AP	MAX	61.0	62.7	63.8	67.0	68.0	70.5	71.3	72.5	74.5	73.0	66.6	61.4	67.7
		MEAN	51.2	53.0	54.2	56.6	59.1	61.7	63.2	64.1	64.5	61.6	55.5	50.7	58.0
		MIN	41.3	43.3	44.6	46.1	50.1	52.8	55.0	55.7	54.4	50.1	44.3	40.0	48.1
325	SALT SPRINGS PWR HOUSE	MAX	53.1	56.0	59.2	64.9	72.7	81.3	88.3	88.3	82.7	72.9	59.4	52.9	69.3
		MEAN	44.0	45.5	47.7	52.4	59.6	67.3	74.1	73.8	69.0	60.3	49.3	44.0	57.3
		MIN	34.8	35.0	36.1	39.8	46.4	53.2	59.8	59.3	55.3	47.7	39.1	35.0	45.1
326	SAN BERNARDINO F S 226	MAX	67.0	68.8	70.7	76.6	81.3	89.5	96.0	96.2	91.4	83.0	73.4	67.7	80.1
		MEAN	54.4	56.2	58.0	62.7	67.5	73.8	79.6	80.1	76.3	68.4	59.4	54.5	65.9
		MIN	41.8	43.5	45.3	48.7	53.6	58.1	63.1	64.0	61.1	53.7	45.4	41.2	51.6
328	SANDBERG	MAX	48.8	50.9	53.3	59.1	67.1	77.7	84.7	84.4	79.0	68.3	56.3	49.1	64.9
		MEAN	43.0	44.5	45.8	50.4	57.4	67.0	73.8	73.8	69.3	59.9	49.2	42.5	56.4
		MIN	37.1	38.1	38.2	41.6	47.7	56.3	62.8	63.2	59.5	51.4	42.0	35.9	47.8
329	SAN DIEGO MIRAMAR NAS	MAX	67.0	67.3	66.8	70.1	71.8	76.2	80.8	82.1	80.9	77.1	71.9	67.7	73.3
		MEAN	55.3	56.0	56.5	59.5	62.6	66.6	70.9	72.3	70.8	66.2	59.9	55.5	62.7
		MIN	43.5	44.6	46.1	48.9	53.3	57.0	60.9	62.4	60.7	55.3	47.8	43.3	52.0
330	SAN DIEGO N ISLAND NAS	MAX	64.5	64.7	64.7	67.2	67.8	70.0	73.1	74.8	74.6	72.1	68.2	64.9	68.9
		MEAN	56.9	57.8	58.9	61.6	63.5	65.9	69.1	70.8	70.0	66.3	60.8	56.9	63.2
		MIN	49.3	50.8	53.1	55.9	59.2	61.8	65.1	66.7	65.4	60.5	53.4	48.9	57.5
331	SAN DIEGO LINDBERGH AP	MAX	65.8	66.3	66.3	68.7	69.3	72.2	75.8	77.5	77.0	74.0	69.9	66.3	70.8
		MEAN	57.8	58.9	60.0	62.6	64.6	67.4	70.9	72.5	71.6	67.6	61.8	57.6	64.4
		MIN	49.7	51.5	53.6	56.4	59.8	62.6	65.9	67.4	66.1	61.2	53.6	48.9	58.1
333	SAN FRANCISCO OCEANSIDE	MAX	56.5	58.7	58.9	59.0	58.8	60.1	61.1	62.5	64.3	64.5	60.7	56.7	60.2
		MEAN	50.6	52.6	53.2	53.5	54.3	55.8	57.3	58.7	59.5	58.9	54.7	51.0	55.0
		MIN	44.6	46.4	47.4	48.0	49.7	51.5	53.5	54.8	54.6	53.3	48.7	45.2	49.8
334	SAN FRANCISCO INTL AP	MAX	55.9	59.3	61.2	64.3	66.8	69.9	71.1	71.7	72.7	69.7	62.0	56.1	65.1
		MEAN	49.4	52.4	54.0	56.2	58.7	61.4	62.8	63.6	63.9	61.0	54.7	49.5	57.3
		MIN	42.9	45.5	46.8	48.1	50.5	52.9	54.5	55.5	55.1	52.4	47.5	43.0	49.6

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			TEMPERATURE NORMALS (Degrees Fahrenheit)												
335	SAN FRANCISCO DOWNTOWN	MAX	58.1	61.4	62.5	64.5	65.4	67.7	68.2	69.2	71.3	70.4	64.1	58.6	65.1
		MEAN	52.3	55.0	55.9	57.3	58.4	60.5	61.3	62.4	63.7	62.5	57.5	52.7	58.3
		MIN	46.4	48.5	49.2	50.1	51.4	53.2	54.4	55.6	56.1	54.6	50.8	46.7	51.4
338	SAN GABRIEL FIRE DEPT	MAX	69.9	71.5	72.3	76.8	78.7	84.3	89.0	90.2	88.3	83.1	75.6	70.8	79.2
		MEAN	56.3	58.2	59.8	63.4	66.7	71.5	75.6	76.6	74.7	68.9	61.0	56.4	65.8
		MIN	42.6	44.8	47.3	50.0	54.7	58.6	62.2	62.9	61.0	54.7	46.4	41.9	52.3
339	SAN GREGORIO 2 SE	MAX	60.1	60.3	60.2	62.1	63.8	67.1	69.9	71.1	72.5	70.2	64.8	60.7	65.2
		MEAN	50.2	51.0	51.2	52.4	54.9	57.7	60.3	61.1	60.9	57.8	53.3	49.9	55.1
		MIN	40.3	41.6	42.2	42.6	46.0	48.2	50.6	51.1	49.3	45.4	41.7	39.1	44.8
340	SAN JACINTO R S	MAX	66.4	68.5	70.0	77.0	82.5	91.8	97.8	98.4	92.9	84.1	73.5	67.8	80.9
		MEAN	52.4	54.5	56.3	61.5	67.1	74.0	79.9	80.4	75.6	67.3	57.7	52.6	64.9
		MIN	38.4	40.4	42.5	46.0	51.7	56.1	61.9	62.3	58.3	50.5	41.9	37.3	48.9
341	SAN JOSE	MAX	59.3	63.4	67.0	72.1	76.7	81.8	84.3	84.0	82.2	75.9	65.3	58.9	72.6
		MEAN	50.5	54.0	56.7	60.2	64.3	68.6	70.9	70.9	69.5	64.1	55.5	50.0	61.3
		MIN	41.7	44.6	46.4	48.3	51.8	55.4	57.5	57.7	56.7	52.3	45.6	41.0	49.9
342	SAN LUIS DAM	MAX	54.1	60.5	65.3	71.6	78.4	85.6	91.2	90.5	86.6	78.0	64.3	54.8	73.4
		MEAN	45.3	50.6	55.4	60.4	66.3	72.3	77.2	76.7	73.2	65.4	53.9	45.4	61.8
		MIN	36.4	40.7	45.4	49.2	54.2	58.9	63.2	62.9	59.8	52.7	43.5	35.9	50.2
343	SAN LUIS OBISPO POLYTEC	MAX	64.6	65.9	66.8	70.8	73.2	77.6	80.3	81.7	81.8	78.7	72.0	66.4	73.3
		MEAN	53.3	54.8	55.7	58.1	60.4	64.1	66.5	67.5	67.3	64.3	58.8	54.0	60.4
		MIN	41.9	43.6	44.5	45.4	47.5	50.6	52.7	53.3	52.8	49.8	45.5	41.6	47.4
344	SAN PASQUAL ANIMAL PK	MAX	69.9	71.1	71.5	75.8	78.8	85.1	90.4	91.7	89.8	83.4	76.2	71.1	79.6
		MEAN	54.4	56.0	57.3	60.7	64.8	69.9	74.3	75.6	73.5	66.9	58.8	54.0	63.9
		MIN	38.8	40.9	43.1	45.5	50.7	54.6	58.2	59.5	57.2	50.4	41.3	36.9	48.1
345	SAN RAFAEL CIVIC CENTER	MAX	56.2	61.0	64.2	68.5	72.5	77.6	80.9	81.2	79.7	74.4	63.6	56.5	69.7
		MEAN	48.8	52.4	54.7	57.7	61.1	65.3	67.7	68.0	66.8	62.5	54.6	48.9	59.0
		MIN	41.3	43.8	45.2	46.8	49.6	53.0	54.5	54.8	53.9	50.6	45.6	41.3	48.4
346	SANTA ANA FIRE STATION	MAX	69.4	70.1	70.7	73.6	74.9	78.7	82.7	84.2	83.4	79.7	74.2	69.7	75.9
		MEAN	58.0	59.1	60.2	63.0	65.7	69.3	72.9	74.3	73.2	68.9	62.4	57.9	65.4
		MIN	46.6	48.0	49.6	52.4	56.4	59.9	63.1	64.3	62.9	58.0	50.5	46.0	54.8
347	SANTA BARBARA	MAX	64.5	65.4	66.1	69.2	69.6	72.1	75.1	76.7	75.2	73.3	68.9	65.3	70.1
		MEAN	54.6	56.1	57.2	59.7	61.3	64.0	66.9	68.1	66.9	64.1	59.0	55.0	61.1
		MIN	44.7	46.7	48.3	50.1	53.0	55.8	58.6	59.5	58.5	54.9	49.0	44.7	52.0
348	SANTA BARBARA MNCPL AP	MAX	65.4	66.3	67.4	70.1	71.2	74.4	76.7	78.7	78.2	75.4	71.0	66.4	71.8
		MEAN	53.1	55.2	56.7	58.9	60.9	64.2	67.0	68.6	67.4	63.5	57.5	53.2	60.5
		MIN	40.8	44.0	46.0	47.6	50.5	53.9	57.3	58.4	56.6	51.6	44.0	39.9	49.2
349	SANTA CRUZ	MAX	61.0	62.9	64.6	68.8	71.0	74.0	74.8	75.5	75.6	72.5	65.3	60.8	68.9
		MEAN	50.6	52.6	54.0	56.6	59.1	62.2	63.7	64.3	63.9	60.4	54.4	50.2	57.7
		MIN	40.2	42.3	43.3	44.4	47.2	50.4	52.6	53.0	52.1	48.3	43.4	39.6	46.4
351	SANTA MARIA AP	MAX	63.9	64.8	64.8	67.6	68.6	71.4	73.5	74.2	74.9	74.0	69.2	64.9	69.3
		MEAN	51.6	53.1	53.8	55.5	57.8	60.9	63.5	64.2	63.9	61.1	55.5	51.6	57.7
		MIN	39.3	41.4	42.7	43.4	46.9	50.4	53.5	54.2	52.9	48.2	41.8	38.2	46.1
352	SANTA MONICA PIER	MAX	63.7	63.4	62.1	63.4	63.6	65.9	68.8	70.3	70.5	69.6	67.3	64.8	66.1
		MEAN	57.0	57.4	57.1	58.7	60.1	62.7	65.5	66.7	66.6	64.5	60.8	57.7	61.2
		MIN	50.2	51.3	52.1	53.9	56.5	59.4	62.1	63.1	62.6	59.4	54.3	50.5	56.3
353	SANTA PAULA	MAX	68.1	69.1	69.8	73.6	74.3	77.5	80.7	81.9	81.0	78.2	73.0	68.8	74.7
		MEAN	54.7	55.8	56.7	59.6	61.9	65.3	68.3	69.2	68.0	64.0	58.3	54.7	61.4
		MIN	41.2	42.4	43.5	45.5	49.5	53.0	55.9	56.5	54.9	49.7	43.5	40.6	48.0
354	SANTA ROSA	MAX	57.8	62.0	64.8	69.6	74.2	79.9	82.2	82.3	81.8	76.9	65.3	58.1	71.2
		MEAN	48.7	52.3	54.5	57.6	61.5	66.0	67.6	67.8	67.2	62.8	54.2	48.5	59.1
		MIN	39.5	42.5	44.2	45.6	48.7	52.1	53.0	53.2	52.5	48.7	43.0	38.8	46.8
357	SCOTIA	MAX	56.8	58.3	59.4	61.9	64.2	67.0	69.8	71.1	71.8	68.2	60.6	56.3	63.8
		MEAN	48.4	49.8	50.6	52.7	55.4	58.4	60.9	61.8	60.9	57.3	51.6	47.7	54.6
		MIN	40.0	41.2	41.8	43.5	46.6	49.8	52.0	52.4	49.9	46.3	42.5	39.1	45.4
358	SHASTA DAM	MAX	53.2	56.8	61.4	68.3	77.4	86.5	94.5	93.7	87.1	75.6	59.9	53.3	72.3
		MEAN	46.3	49.1	52.4	57.9	66.1	74.4	81.2	80.1	74.5	65.1	52.4	46.6	62.2
		MIN	39.4	41.4	43.3	47.5	54.7	62.2	67.9	66.4	61.9	54.5	44.9	39.8	52.0
359	SHELTER COVE AV	MAX	57.4	58.2	59.4	61.6	66.0	68.9	69.4	69.5	70.1	67.2	61.4	57.7	63.9
		MEAN	51.3	51.9	52.6	53.9	57.1	59.5	60.3	60.8	61.1	59.3	54.9	51.7	56.2
		MIN	45.1	45.6	45.7	46.1	48.2	50.0	51.2	52.0	52.1	51.3	48.3	45.7	48.4
362	SIERRA CITY	MAX	48.0	50.4	53.7	60.4	68.8	77.7	85.2	85.3	79.5	69.2	54.1	48.0	65.0
		MEAN	38.6	40.1	42.8	47.8	54.8	62.6	69.0	68.6	63.7	55.2	43.5	38.7	52.1
		MIN	29.1	29.8	31.8	35.1	40.7	47.4	52.7	51.9	47.9	41.1	32.8	29.4	39.1
363	SIERRAVILLE R S	MAX	41.6	46.7	52.0	58.9	66.9	75.8	83.7	83.8	77.3	67.0	51.9	43.9	62.5
		MEAN	29.2	33.6	39.1	44.0	51.2	58.6	64.2	63.3	57.2	48.3	37.7	30.5	46.4
		MIN	16.7	20.5	26.1	29.0	35.5	41.3	44.6	42.8	37.1	29.6	23.5	17.1	30.3
366	SONOMA	MAX	58.4	63.6	67.0	72.1	78.2	85.5	89.8	89.4	87.1	80.1	66.5	58.6	74.7
		MEAN	47.9	51.8	54.2	57.6	62.3	67.9	70.9	70.6	68.7	63.2	53.6	47.6	59.7
		MIN	37.3	39.9	41.4	43.0	46.4	50.3	51.9	51.8	50.3	46.3	40.7	36.5	44.7

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
367	SONORA RS	MAX	55.6	59.2	61.9	68.0	76.8	86.8	94.1	93.5	87.8	77.7	63.0	56.1	73.4
		MEAN	43.8	46.5	49.2	53.9	61.0	68.8	75.2	74.3	69.0	60.0	49.1	43.6	57.9
		MIN	32.0	33.7	36.4	39.8	45.1	50.8	56.2	55.0	50.2	42.2	35.2	31.1	42.3
368	SOUTH ENTR YOSEMITE NP	MAX	44.8	46.4	48.3	54.3	62.4	71.0	77.6	77.1	71.4	62.5	51.0	46.1	59.4
		MEAN	35.1	36.2	37.8	42.3	49.5	57.2	63.2	62.8	57.8	49.6	40.0	35.7	47.3
		MIN	25.4	25.9	27.3	30.3	36.6	43.3	48.7	48.5	44.2	36.6	29.0	25.3	35.1
372	STOCKTON AP	MAX	53.8	61.2	66.1	73.3	81.3	88.9	93.8	92.6	88.2	78.6	64.0	53.8	74.6
		MEAN	46.0	51.1	54.9	60.0	66.7	73.2	77.3	76.5	72.8	64.6	53.1	45.3	61.8
		MIN	38.1	41.0	43.6	46.7	52.1	57.5	60.8	60.3	57.4	50.5	42.1	36.7	48.9
373	STOCKTON FIRE STN # 4	MAX	54.9	62.3	67.0	73.6	81.0	88.0	92.3	91.8	88.4	79.7	65.3	55.7	75.0
		MEAN	45.7	51.1	54.9	59.5	65.7	71.4	74.8	74.3	71.3	63.9	53.0	45.5	60.9
		MIN	36.4	39.8	42.7	45.4	50.4	54.7	57.2	56.8	54.1	48.0	40.6	35.3	46.8
375	STONY GORGE RESERVOIR	MAX	55.5	59.3	63.1	70.1	79.4	88.7	95.3	94.1	88.9	78.5	63.3	55.9	74.3
		MEAN	44.4	47.7	50.8	55.9	63.8	72.1	77.9	76.4	71.4	62.3	50.3	44.2	59.8
		MIN	33.2	36.1	38.5	41.7	48.1	55.5	60.4	58.7	53.8	46.1	37.2	32.4	45.1
376	STRAWBERRY VALLEY	MAX	49.0	49.9	52.7	58.8	66.8	75.0	82.2	82.2	77.2	68.0	54.4	49.4	63.8
		MEAN	39.0	39.8	42.1	46.7	53.5	60.8	66.5	66.2	61.9	54.2	43.6	39.4	51.1
		MIN	29.0	29.7	31.5	34.5	40.2	46.5	50.8	50.1	46.5	40.3	32.8	29.3	38.4
377	SUN CITY	MAX	66.2	68.4	69.7	76.7	82.7	91.6	97.8	98.1	92.6	84.2	74.2	67.5	80.8
		MEAN	51.2	53.3	55.5	60.4	66.3	72.8	78.3	78.9	74.8	66.6	57.1	51.0	63.9
		MIN	36.1	38.2	41.2	44.1	49.8	53.9	58.7	59.7	56.9	49.0	40.0	34.4	46.8
378	SUSANVILLE 2 SW	MAX	40.8	46.5	53.5	61.1	70.1	79.7	88.4	87.3	78.4	65.9	50.7	41.8	63.7
		MEAN	30.8	36.0	41.4	47.0	54.4	62.7	69.1	68.0	60.1	49.8	38.8	31.3	49.1
		MIN	20.8	25.5	29.2	32.9	38.7	45.7	49.8	48.7	41.8	33.7	26.9	20.7	34.5
379	TAHOE CITY	MAX	40.5	42.0	45.1	51.4	60.1	69.2	77.5	77.0	70.1	60.0	47.9	41.4	56.9
		MEAN	30.3	31.7	34.7	39.6	46.8	54.4	61.1	60.9	54.9	46.2	36.7	31.0	44.0
		MIN	20.1	21.3	24.3	27.7	33.5	39.6	44.7	44.8	39.6	32.3	25.5	20.6	31.2
380	TAHOE VALLEY AP	MAX	41.0	42.4	45.6	52.7	61.1	70.4	78.6	78.7	72.0	61.8	48.8	41.8	57.9
		MEAN	28.1	29.7	34.1	39.6	46.5	53.6	59.2	58.6	52.3	43.8	34.3	28.0	42.3
		MIN	15.1	17.0	22.5	26.4	31.9	36.8	39.8	38.5	32.5	25.8	19.7	14.1	26.7
381	TEHACHAPI	MAX	52.1	54.5	56.8	62.6	70.5	79.5	86.2	85.8	80.3	70.8	58.6	52.3	67.5
		MEAN	41.8	43.6	45.9	50.4	57.7	66.0	72.4	71.4	65.7	56.6	47.1	41.7	55.0
		MIN	31.5	32.7	35.0	38.2	44.9	52.5	58.6	56.9	51.0	42.3	35.5	31.1	42.5
382	TEJON RANCHO	MAX	58.5	63.3	67.2	74.3	82.7	91.3	96.6	95.3	89.9	80.6	66.4	58.4	77.0
		MEAN	46.9	51.3	54.9	60.5	68.1	75.9	81.5	79.7	74.8	66.3	53.5	46.5	63.3
		MIN	35.3	39.3	42.6	46.6	53.4	60.5	66.3	64.1	59.7	52.0	40.6	34.5	49.6
383	TERMO 1 E	MAX	38.4	42.7	48.7	56.6	65.5	75.3	84.7	83.7	75.3	63.2	47.3	38.8	60.0
		MEAN	26.6	31.3	36.6	41.7	49.1	56.9	63.9	62.4	55.1	45.1	34.0	26.8	44.1
		MIN	14.8	19.8	24.5	26.8	32.7	38.4	43.1	41.0	34.8	27.0	20.6	14.8	28.2
384	THERMAL RGNL AP	MAX	71.2	75.9	81.1	88.4	95.3	104.3	107.5	105.6	100.6	90.5	78.4	70.6	89.1
		MEAN	55.0	59.6	64.8	71.6	78.8	86.7	91.2	90.1	84.5	73.5	61.0	53.9	72.6
		MIN	38.8	43.2	48.4	54.8	62.3	69.1	74.9	74.5	68.3	56.5	43.5	37.2	56.0
385	THREE RIVERS EDISON PH	MAX	58.7	63.4	67.1	74.7	84.2	93.7	99.7	98.3	92.2	81.5	66.6	58.6	78.2
		MEAN	47.1	50.8	54.2	59.6	67.6	75.9	82.1	81.1	75.2	65.2	53.2	46.6	63.2
		MIN	35.5	38.2	41.2	44.5	50.9	58.1	64.5	63.8	58.1	48.9	39.8	34.6	48.2
386	TIGER CREEK PH	MAX	51.2	57.4	60.7	66.8	74.5	83.5	90.6	90.0	85.0	75.0	59.1	49.5	70.3
		MEAN	41.4	45.3	47.9	52.5	59.1	66.4	72.5	72.2	67.9	59.3	47.4	40.4	56.0
		MIN	31.5	33.1	35.1	38.1	43.6	49.3	54.4	54.3	50.7	43.5	35.7	31.3	41.7
388	TORRANCE	MAX	66.4	67.2	67.7	70.6	71.7	74.7	77.6	78.7	77.9	75.3	70.5	66.8	72.1
		MEAN	56.3	57.4	58.3	60.9	63.2	66.3	69.4	70.4	69.5	66.0	60.3	56.4	62.9
		MIN	46.2	47.5	48.8	51.1	54.7	57.8	61.1	62.0	61.1	56.7	50.1	46.0	53.6
389	TRACY CARBONA	MAX	54.7	61.7	66.5	73.3	80.9	88.1	93.1	92.1	87.8	78.9	65.1	55.4	74.8
		MEAN	44.9	49.8	53.7	58.6	64.7	70.6	74.0	73.1	70.0	63.2	52.5	44.8	60.0
		MIN	35.0	37.8	40.9	43.8	48.5	53.0	54.9	54.0	52.1	47.4	39.8	34.1	45.1
390	TRACY PUMPING PLANT	MAX	55.6	62.4	67.2	73.5	80.0	87.3	92.5	91.8	88.0	79.2	65.1	55.6	74.9
		MEAN	47.1	51.9	56.0	60.9	66.8	72.4	76.4	75.9	73.2	66.0	55.0	47.0	62.4
		MIN	38.5	41.3	44.8	48.2	53.5	57.4	60.2	59.9	58.3	52.8	44.9	38.4	49.9
391	TRINITY RIVER HATCHERY	MAX	47.2	53.3	58.6	65.6	74.8	83.9	91.9	91.3	84.9	73.2	54.6	46.7	68.8
		MEAN	39.3	43.0	46.6	51.2	58.5	65.9	72.1	71.0	64.8	55.9	44.8	39.0	54.3
		MIN	31.3	32.6	34.5	36.7	42.1	47.8	52.2	50.6	44.7	38.6	34.9	31.2	39.8
392	TRONA	MAX	56.0	63.7	68.7	76.9	85.1	94.4	99.8	98.0	91.1	79.6	65.5	55.6	77.9
		MEAN	45.9	52.4	57.4	64.5	72.7	81.7	87.2	86.0	79.4	67.5	53.8	44.8	66.1
		MIN	35.7	41.0	46.1	52.0	60.3	69.0	74.5	74.0	67.6	55.4	42.1	33.9	54.3
393	TRUCKEE RS	MAX	40.9	44.6	48.7	55.3	64.4	74.0	82.7	82.2	75.1	64.0	48.9	41.2	60.2
		MEAN	28.6	31.6	35.9	41.0	48.4	56.1	62.6	62.1	55.8	46.6	35.7	28.9	44.4
		MIN	16.3	18.5	23.0	26.7	32.4	38.2	42.4	41.9	36.4	29.1	22.4	16.6	28.7
394	TULELAKE	MAX	39.1	45.3	51.9	59.4	67.7	75.8	83.5	83.1	76.2	64.7	47.0	38.7	61.0
		MEAN	29.3	34.2	38.9	44.5	52.1	59.2	64.7	63.2	56.5	47.2	35.7	29.0	46.2
		MIN	19.5	23.0	25.8	29.5	36.4	42.5	45.8	43.3	36.8	29.6	24.3	19.2	31.3

			TEMPERATURE NORMALS (Degrees Fahrenheit)												
No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
395	TURLOCK #2	MAX	53.7	61.4	66.2	72.7	80.7	88.0	93.3	91.8	87.1	77.6	63.5	53.3	74.1
		MEAN	46.4	52.2	56.1	60.7	67.1	73.3	77.6	76.5	72.7	64.7	53.5	45.6	62.2
		MIN	39.0	42.9	45.9	48.7	53.4	58.5	61.8	61.2	58.2	51.8	43.5	37.9	50.2
396	TUSTIN IRVINE RANCH	MAX	67.6	68.6	69.2	73.4	74.9	79.3	83.8	85.4	84.0	79.1	73.3	68.2	75.6
		MEAN	54.5	55.9	57.3	60.9	64.2	68.1	72.1	73.1	71.4	66.1	59.1	54.3	63.1
		MIN	41.4	43.2	45.4	48.4	53.5	56.8	60.4	60.8	58.8	53.1	44.8	40.4	50.6
397	TWENTYNINE PALMS	MAX	63.9	68.8	74.7	82.7	91.4	101.3	105.8	103.6	97.3	85.8	71.9	63.6	84.2
		MEAN	50.0	54.0	59.1	66.0	74.3	83.2	88.4	86.9	80.4	69.0	56.4	49.5	68.1
		MIN	36.1	39.2	43.4	49.3	57.1	65.1	71.0	70.1	63.5	52.2	40.9	35.4	51.9
398	TWIN LAKES	MAX	38.2	38.9	41.4	46.2	54.3	62.6	70.7	70.3	64.6	55.3	43.9	39.0	52.1
		MEAN	28.0	28.1	30.6	34.9	42.3	50.2	57.2	57.3	51.8	43.3	33.3	28.8	40.5
		MIN	17.8	17.3	19.8	23.5	30.2	37.8	43.7	44.3	39.0	31.2	22.7	18.5	28.8
399	TWITCHELL DAM	MAX	65.8	66.4	67.3	71.4	72.8	77.5	79.9	81.2	80.9	78.2	71.5	66.6	73.3
		MEAN	53.2	54.6	55.5	58.2	60.3	64.2	66.5	67.4	67.0	63.9	58.2	53.5	60.2
		MIN	40.5	42.8	43.7	44.9	47.8	50.8	53.1	53.6	53.1	49.5	44.9	40.3	47.1
400	UKIAH	MAX	56.2	59.7	63.6	69.2	75.8	83.4	90.6	90.2	86.1	76.3	61.8	55.6	72.4
		MEAN	46.6	49.6	52.2	55.9	61.4	67.7	73.0	72.5	68.9	61.2	51.1	45.9	58.8
		MIN	37.0	39.5	40.8	42.6	47.0	51.9	55.3	54.7	51.7	46.1	40.4	36.2	45.3
402	U C L A	MAX	66.3	66.9	66.7	69.2	69.6	73.2	76.9	78.2	77.9	75.2	70.7	67.0	71.5
		MEAN	57.9	58.4	58.7	61.3	62.9	66.3	69.5	70.7	70.2	67.1	62.3	58.6	63.7
		MIN	49.4	49.9	50.7	53.3	56.1	59.3	62.1	63.1	62.4	58.9	53.9	50.1	55.8
404	UPPER SAN LEANDRO FLTR	MAX	57.7	61.2	62.9	66.5	69.0	72.8	75.2	76.0	76.3	73.4	64.8	58.9	67.9
		MEAN	49.7	52.3	53.6	56.3	58.9	62.4	64.6	65.3	65.4	62.5	55.1	50.1	58.0
		MIN	41.7	43.3	44.3	46.0	48.8	51.9	53.9	54.6	54.5	51.6	45.3	41.2	48.1
405	VACAVILLE	MAX	55.6	62.1	66.9	74.1	82.3	90.5	95.8	94.8	90.4	80.5	65.3	56.2	76.2
		MEAN	47.2	52.1	55.9	60.8	67.1	73.5	77.3	76.3	73.0	65.4	54.1	47.0	62.5
		MIN	38.8	42.1	44.9	47.4	51.9	56.4	58.8	57.8	55.5	50.3	42.8	37.7	48.7
408	VICTORVILLE PUMP PLANT	MAX	59.5	63.4	68.0	75.3	83.7	93.4	99.1	98.4	92.1	81.2	68.4	60.1	78.6
		MEAN	45.5	49.0	52.9	58.7	66.2	74.2	80.0	79.6	73.8	63.2	51.9	45.1	61.7
		MIN	31.4	34.5	37.8	42.1	48.6	55.0	60.8	60.7	55.4	45.2	35.4	30.1	44.8
411	VISALIA	MAX	54.2	61.7	66.8	73.7	81.6	89.2	93.8	92.2	86.9	78.0	63.7	54.2	74.7
		MEAN	45.8	51.4	55.9	60.9	67.8	74.7	79.3	77.9	73.1	64.9	53.0	45.2	62.5
		MIN	37.4	41.1	44.9	48.1	54.0	60.1	64.8	63.6	59.3	51.8	42.2	36.2	50.3
412	VISTA 2 NNE	MAX	67.7	68.2	68.4	72.0	73.4	77.8	82.2	83.7	82.6	78.7	73.0	68.2	74.7
		MEAN	56.4	57.0	57.9	61.0	63.9	67.6	71.6	73.0	71.7	67.2	60.9	56.6	63.7
		MIN	45.1	45.7	47.3	49.9	54.3	57.4	60.9	62.2	60.8	55.7	48.8	44.9	52.8
415	WARM SPRINGS DAM	MAX	57.0	61.4	65.0	70.4	77.4	84.5	89.3	89.0	85.3	77.8	65.1	57.3	73.3
		MEAN	46.4	50.0	52.7	56.7	62.3	67.6	70.3	69.7	67.3	61.6	52.3	46.2	58.6
		MIN	35.7	38.6	40.3	42.9	47.1	50.7	51.3	50.4	49.2	45.3	39.5	35.1	43.8
416	WASCO	MAX	56.6	64.5	70.2	78.4	86.6	94.3	99.0	97.6	92.2	82.2	66.9	56.6	78.8
		MEAN	46.6	52.3	56.9	62.6	69.8	76.5	81.1	79.7	75.0	65.7	53.3	45.5	63.8
		MIN	36.5	40.0	43.5	46.7	52.9	58.7	63.2	61.8	57.7	49.1	39.7	34.4	48.7
417	WATSONVILLE WATERWORKS	MAX	60.6	62.6	63.8	67.6	68.9	71.3	72.0	72.7	73.7	72.0	65.9	60.9	67.7
		MEAN	49.7	51.9	53.4	56.2	58.5	61.1	62.4	63.0	63.0	60.1	54.1	49.5	56.9
		MIN	38.7	41.1	43.0	44.7	48.0	50.8	52.7	53.2	52.3	48.2	42.3	38.1	46.1
418	WEAVERVILLE	MAX	49.0	54.6	59.8	67.4	76.9	85.8	94.2	94.3	87.8	75.4	55.8	47.0	70.7
		MEAN	38.4	41.9	45.7	50.4	58.3	65.7	72.1	71.4	65.1	55.5	44.2	37.3	53.8
		MIN	27.7	29.2	31.5	33.4	39.7	45.6	49.9	48.4	42.4	35.5	32.6	27.6	37.0
419	WEED FIRE DEPT	MAX	43.8	49.0	53.9	59.9	68.2	76.6	84.7	84.9	77.7	66.0	50.5	43.5	63.2
		MEAN	33.8	38.3	41.8	46.6	53.1	60.4	66.8	66.4	59.4	50.2	39.7	34.0	49.2
		MIN	23.8	27.6	29.6	33.2	37.9	44.1	48.8	47.8	41.0	34.4	28.9	24.5	35.1
422	WHISKEYTOWN RESERVOIR	MAX	53.4	56.9	61.8	69.0	78.3	87.7	96.1	95.9	89.0	76.8	60.3	53.5	73.2
		MEAN	44.5	47.3	51.1	56.7	64.9	72.9	79.5	78.6	72.9	63.1	50.4	44.6	60.5
		MIN	35.6	37.6	40.4	44.3	51.5	58.1	62.9	61.2	56.7	49.3	40.5	35.6	47.8
424	WILDROSE R S	MAX	52.8	56.6	62.5	71.0	80.2	90.5	96.1	94.0	86.6	74.4	60.9	53.4	73.3
		MEAN	41.6	44.8	49.3	56.1	64.8	74.2	80.1	78.5	71.9	60.9	48.5	41.6	59.4
		MIN	30.4	33.0	36.1	41.2	49.4	57.8	64.0	62.9	57.1	47.3	36.1	29.7	45.4
425	WILLITS 1 NE	MAX	54.7	57.7	60.1	64.3	70.7	77.8	84.5	84.6	81.9	74.0	60.4	54.7	68.8
		MEAN	43.4	46.2	48.0	50.6	55.5	61.1	66.0	65.4	62.2	56.0	47.5	43.0	53.7
		MIN	32.1	34.6	35.9	36.8	40.2	44.3	47.4	46.1	42.5	37.9	34.5	31.2	38.6
426	WILLOW CREEK 1 NW	MAX	52.2	57.1	62.7	69.9	78.0	86.9	94.7	94.4	87.6	74.4	58.3	50.6	72.2
		MEAN	43.4	47.0	50.6	55.2	61.3	68.1	74.1	73.4	67.8	58.7	49.0	43.0	57.6
		MIN	34.5	36.8	38.4	40.4	44.5	49.3	53.5	52.4	47.9	43.0	39.7	35.4	43.0
427	WILLOWS 6 W	MAX	55.1	60.6	65.1	72.1	80.2	87.6	92.7	91.5	88.0	79.1	63.9	55.6	74.3
		MEAN	45.3	49.6	53.2	58.2	65.7	72.5	76.6	75.1	71.9	64.2	52.1	45.4	60.8
		MIN	35.5	38.6	41.2	44.2	51.1	57.3	60.4	58.6	55.8	49.3	40.2	35.2	47.3
428	WINTERS	MAX	54.8	61.3	66.6	74.4	82.9	90.9	95.8	94.3	89.8	80.3	65.0	55.6	76.0
		MEAN	46.2	51.2	55.4	61.2	68.2	74.6	77.9	76.7	73.3	65.5	53.8	46.3	62.5
		MIN	37.6	41.1	44.2	47.9	53.4	58.2	60.0	59.1	56.8	50.7	42.6	37.0	49.1

TEMPERATURE NORMALS (Degrees Fahrenheit)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
430	WOODFORDS	MAX	45.0	48.2	53.2	59.7	68.2	77.2	85.1	84.1	76.7	65.6	52.0	45.2	63.4
		MEAN	33.8	36.7	40.8	45.6	53.2	61.3	68.3	67.4	60.3	50.7	39.8	34.1	49.3
		MIN	22.5	25.2	28.3	31.4	38.2	45.3	51.5	50.7	43.8	35.8	27.5	22.9	35.3
431	WOODLAND 1 WNW	MAX	53.7	60.3	65.5	72.6	80.9	89.0	94.0	93.2	88.6	78.7	63.5	54.1	74.5
		MEAN	45.7	50.6	54.9	59.9	66.7	73.0	76.4	75.5	72.2	64.5	53.0	45.6	61.5
		MIN	37.6	40.9	44.2	47.2	52.4	57.0	58.7	57.8	55.8	50.3	42.5	37.0	48.5
432	WOODSIDE FIRE STN 1	MAX	59.8	63.8	66.9	72.5	77.9	84.2	88.2	88.0	85.4	78.7	66.4	59.9	74.3
		MEAN	48.1	51.4	53.8	57.2	61.5	66.3	69.7	69.4	67.4	61.9	53.0	47.8	59.0
		MIN	36.4	39.0	40.7	41.8	45.0	48.4	51.1	50.8	49.3	45.1	39.6	35.6	43.6
434	YOSEMITE PARK HDQTRS	MAX	47.5	52.8	57.4	64.7	72.1	81.6	89.9	90.6	84.2	73.2	57.2	47.9	68.3
		MEAN	37.7	41.3	45.3	51.1	57.7	65.7	72.7	72.6	66.8	57.2	44.5	37.6	54.2
		MIN	27.8	29.8	33.1	37.4	43.2	49.8	55.4	54.6	49.4	41.1	31.8	27.2	40.1
435	YREKA SISKIYOU CO	MAX	45.1	51.3	56.9	63.5	72.6	81.5	90.5	90.2	82.3	69.9	52.5	44.5	66.7
		MEAN	34.1	38.7	43.1	48.5	56.0	63.8	70.8	70.2	63.0	52.5	40.4	34.0	51.3
		MIN	23.1	26.0	29.2	33.5	39.4	46.0	51.1	50.1	43.6	35.1	28.3	23.5	35.7

PRECIPITATION NORMALS (Total in Inches)

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
001	ACTON ESCONDIDO FC261	2.42	2.51	2.42	.59	.23	.05	.01	.12	.25	.43	.83	1.40	11.26
002	ADIN RS	1.97	1.84	1.90	1.22	1.58	1.00	.37	.43	.87	1.16	1.82	1.72	15.88
003	ALISO CANYON OAT MTN	5.05	4.50	4.38	.90	.28	.05	.01	.22	.35	.65	1.99	2.65	21.03
004	ALPINE	3.49	3.44	3.92	1.26	.47	.20	.16	.27	.42	.85	1.72	1.99	18.19
005	ALTADENA	4.58	4.99	4.48	1.47	.60	.22	.06	.19	.57	.67	1.73	2.48	22.04
006	ALTURAS	1.32	1.28	1.55	1.11	1.32	.79	.30	.37	.66	.73	1.47	1.23	12.13
007	ANAHEIM	2.47	2.86	2.55	.66	.13	.09	.03	.01	.06	.26	.82	1.29	11.23
008	ANGWIN PAC UNION COL	8.47	7.75	6.21	2.27	1.14	.26	.05	.10	.62	2.17	5.48	6.15	40.67
009	ANTIOCH PUMP PLANT #3	2.72	2.51	2.16	.73	.47	.09	.03	.03	.24	.76	1.70	1.89	13.33
010	ANZA	2.37	2.65	2.37	.79	.52	.07	.46	.58	.66	.47	1.08	1.40	13.42
011	APPLE VALLEY	.77	.80	1.06	.21	.17	.01	.07	.18	.21	.13	.32	.51	4.44
012	ASH MOUNTAIN	4.97	4.72	4.95	2.14	1.06	.42	.10	.11	.67	1.42	2.79	3.15	26.50
013	AUBERRY 2 NW	5.32	4.75	4.83	1.86	.84	.31	.08	.05	.52	1.43	2.73	3.41	26.13
014	AUBURN	6.68	6.28	6.16	2.50	1.30	.37	.14	.14	.77	1.93	4.89	5.35	36.51
015	AVALON PLEASURE PIER	2.76	2.51	2.36	.61	.12	.01	.00	.09	.28	.22	1.10	1.82	11.88
016	BAKER	.53	.55	.66	.18	.13	.07	.19	.48	.25	.18	.24	.25	3.71
017	BAKERSFIELD KERN CO AP	1.18	1.21	1.41	.45	.24	.12	.00	.08	.15	.30	.59	.76	6.49
018	BALCH POWER HOUSE	6.10	5.69	5.38	2.36	1.17	.48	.17	.05	.94	1.59	3.22	3.83	30.98
019	BARSTOW FIRE STATION	.92	.82	.61	.14	.07	.05	.23	.22	.25	.18	.37	.47	4.33
020	BEAUMONT 1 E	4.18	4.07	3.72	1.10	.73	.21	.27	.23	.63	.72	1.44	2.00	19.30
021	BEN LOMOND NO 4	10.29	9.74	7.51	2.77	1.04	.23	.11	.15	.48	2.17	6.13	7.06	47.68
022	BENTON INSPECTION STN	.98	1.22	1.07	.35	.48	.37	.40	.47	.37	.36	.53	.81	7.41
023	BERKELEY	5.13	4.75	4.08	1.63	.61	.14	.07	.10	.36	1.37	3.62	3.54	25.40
024	BIG BAR 4 E	6.82	6.06	5.45	2.20	1.36	.52	.21	.38	.95	2.25	5.39	6.33	37.92
025	BIG BEAR LAKE	4.10	4.60	3.55	.95	.51	.18	.75	.98	.53	.78	1.55	2.67	21.15
026	BIG PINES PARK FC83B	5.22	5.91	4.84	1.38	.56	.18	.17	.39	.63	.82	1.79	3.51	25.40
027	BIG SUR STATION	9.13	8.24	7.30	2.79	.86	.20	.09	.14	.54	1.94	5.37	6.60	43.20
028	BIG TUJUNGA DAM FC46DE	5.25	6.31	5.87	1.53	.73	.15	.05	.14	.50	.82	1.91	3.21	26.47
029	BISHOP CREEK INTAKE 2	2.04	2.03	1.81	.82	.65	.42	.42	.50	.74	.61	1.32	1.58	12.94
030	BISHOP AP	.88	.97	.62	.24	.26	.21	.17	.13	.28	.20	.44	.62	5.02
031	BLACK MOUNTAIN 2 WSW	7.18	7.24	5.81	2.47	.97	.30	.06	.14	.39	2.23	4.53	5.51	36.83
032	BLUE CANYON	11.72	11.57	10.50	4.98	2.93	.88	.37	.43	1.44	3.86	8.97	8.71	66.36
033	BLYTHE	.51	.57	.34	.11	.07	.03	.18	.65	.55	.25	.22	.50	3.98
034	BLYTHE AP	.46	.55	.45	.14	.03	.01	.32	.66	.50	.23	.19	.48	4.02
035	BOCA	3.76	3.70	3.00	1.08	1.12	.57	.57	.50	.85	1.38	2.72	3.04	22.29
036	BODIE	1.69	1.89	1.69	.89	.80	.80	.87	.53	.61	.67	1.19	1.30	12.93
037	BORREGO DESERT PARK	1.43	1.41	.94	.19	.10	.02	.33	.59	.50	.21	.44	.75	6.91
038	BOWMAN DAM	12.04	11.04	10.34	4.49	3.35	1.22	.37	.57	1.56	4.22	9.04	9.73	67.97
039	BRAWLEY 2 SW	.50	.45	.39	.09	.05	.01	.07	.42	.26	.26	.19	.42	3.11
040	BRIDGEPORT	1.29	1.46	1.07	.40	.54	.58	.45	.50	.50	.35	.86	1.01	9.01
041	BRIDGEVILLE 4 NNW	11.25	10.44	9.81	5.14	2.79	.86	.13	.65	1.40	4.39	9.96	11.27	68.09
042	BROOKS FARNHAM RANCH	3.82	3.45	2.63	.93	.35	.10	.03	.04	.20	.92	2.56	2.83	17.86
043	BUCKHORN	10.58	9.75	9.43	5.38	3.69	1.54	.32	.63	2.14	4.27	9.15	9.14	66.02
044	BUCKS CREEK P H	12.41	11.50	11.08	5.19	2.97	1.22	.15	.32	1.47	3.81	9.03	10.32	69.47
045	BURBANK VALLEY PUMP PLN	3.56	4.29	3.88	1.02	.37	.12	.02	.18	.30	.55	1.05	2.15	17.49
046	BURNEY	4.40	4.06	3.83	1.95	1.64	.76	.20	.37	.87	1.69	3.36	3.76	26.89
047	BURNT RANCH 1 S	7.84	7.68	6.54	3.31	1.51	.51	.15	.48	.97	3.14	6.73	7.83	46.69
048	BUTTONWILLOW	1.31	1.19	1.39	.47	.23	.07	.01	.04	.20	.28	.55	.70	6.44
049	CACHUMA LAKE	4.34	5.47	4.76	1.26	.39	.04	.01	.03	.30	.76	1.58	2.92	21.86
050	CALAVERAS BIG TREES	10.77	9.94	9.02	4.14	2.18	.74	.28	.22	1.07	3.14	6.47	7.45	55.42
051	CALEXICO 2 NE	.45	.32	.28	.05	.03	.00	.13	.42	.31	.31	.12	.45	2.87
052	CALISTOGA	7.74	7.85	5.98	2.22	.95	.22	.10	.11	.46	1.96	5.13	5.79	38.51
053	CALLAHAN	3.72	2.94	2.44	1.34	1.15	.82	.46	.35	.64	1.39	2.95	3.10	21.30
054	CAMPO	3.30	3.04	3.02	.94	.26	.09	.29	.55	.40	.65	1.24	1.80	15.58
055	CAMP PARDEE	4.19	3.87	3.98	1.77	.97	.27	.10	.10	.52	1.34	2.87	3.01	22.99
056	CAMP PENDLETON MCAS	3.00	2.91	2.67	.81	.32	.14	.08	.02	.14	.46	.93	1.73	13.21
057	CANBY 3 SW	1.85	1.95	2.19	1.46	1.48	.84	.26	.40	.77	1.08	2.11	2.06	16.45
058	CANOGA PARK PIERCE COLL	3.83	4.40	3.60	.88	.32	.07	.01	.15	.24	.62	1.29	2.38	17.79
059	CANYON DAM	6.68	6.72	5.71	2.44	1.64	.76	.25	.35	.93	2.18	4.71	5.43	37.80
060	CAZADERO 5 NW	14.34	12.74	10.30	4.07	1.77	.34	.14	.24	1.10	3.65	10.33	11.61	70.63
061	CECILVILLE	6.45	5.24	4.78	2.32	1.65	.79	.45	.56	.86	2.37	5.22	5.91	36.60
062	CEDARVILLE	1.84	1.42	1.58	1.16	1.16	.67	.29	.38	.61	.86	1.65	1.54	13.16
063	CHALLENGE R S	12.58	11.83	10.10	4.56	2.19	.83	.17	.25	1.19	3.58	8.96	10.05	66.29
064	CHATSWORTH FC 24 F	3.97	3.46	3.38	.64	.21	.02	.01	.18	.28	.34	1.69	1.95	16.13
065	CHERRY VALLEY DAM	9.44	8.40	7.38	3.41	1.75	.79	.18	.21	1.08	2.72	5.89	6.21	47.46
066	CHESTER	5.91	5.62	4.90	2.04	1.59	.79	.37	.39	.90	2.00	3.84	4.62	32.97
067	CHICO UNIVERSITY FARM	5.17	4.50	4.32	1.59	.91	.47	.05	.16	.59	1.34	3.50	3.63	26.23
068	CHINA LAKE ARMITAGE	.76	.68	.71	.12	.12	.02	.08	.26	.21	.09	.27	.37	3.69
069	CHULA VISTA	1.99	1.99	2.07	.69	.14	.08	.03	.08	.20	.39	1.11	1.18	9.95

PRECIPITATION NORMALS (Total in Inches)

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
070	CLEARLAKE 4 SE	6.01	5.37	4.37	1.39	.94	.22	.06	.08	.45	1.41	3.42	4.27	27.99
071	CLOVERDALE	8.65	7.89	6.52	2.36	1.13	.12	.06	.15	.60	2.20	5.79	6.59	42.06
072	COALINGA	1.78	1.75	1.55	.46	.24	.06	.01	.04	.32	.38	.64	1.07	8.30
073	COARSEGOLD 1 SW	5.30	5.09	5.03	1.81	.75	.23	.07	.06	.34	1.29	3.19	3.50	26.66
074	COLEMAN FISHERIES STA	5.50	4.37	4.25	2.10	1.77	.57	.22	.29	1.16	1.74	3.51	4.30	29.78
075	COLFAX	8.77	8.43	7.70	3.19	1.70	.59	.19	.23	1.08	2.58	6.44	7.02	47.92
076	COLGATE P H	7.62	6.82	6.52	2.84	1.53	.55	.13	.16	.84	2.31	5.77	6.23	41.32
077	COLUSA 2 SSW	3.65	3.07	2.71	.77	.65	.20	.04	.04	.34	.94	2.15	2.34	16.90
078	COPCO NO 1 DAM	3.01	2.32	2.27	1.47	1.48	.96	.41	.60	.78	1.29	2.94	3.06	20.59
079	CORCORAN IRRIG DIST	1.51	1.55	1.43	.52	.24	.06	.00	.01	.24	.38	.74	.95	7.63
080	CORNING HOUGHTON RANCH	3.99	4.09	3.23	1.29	.56	.25	.12	.11	.33	1.10	2.44	3.13	20.64
081	CORONA	2.72	2.88	2.31	.68	.16	.02	.02	.12	.23	.36	1.03	1.47	12.00
082	COVELO	8.32	7.49	6.31	2.50	1.44	.36	.07	.21	.68	2.35	5.72	6.78	42.23
083	COVINA CITY YRD FC387B	4.33	4.37	3.70	.96	.40	.13	.04	.17	.37	.65	1.49	2.39	19.00
084	CRESCENT CITY 3 NNW	10.15	9.18	9.22	5.13	3.13	1.57	.40	.74	1.67	4.56	9.84	11.23	66.82
085	CRESCENT CITY 7 ENE	12.98	12.01	11.63	6.72	4.11	1.76	.41	.76	2.13	5.39	12.20	13.96	84.06
086	CRYSTAL LAKE FC 283 C	7.55	8.48	7.15	1.88	.75	.23	.10	.35	.76	1.36	2.23	4.47	35.31
087	CULVER CITY	3.19	3.25	2.66	.58	.26	.04	.02	.07	.08	.33	.94	1.90	13.32
088	CUYAMACA	6.34	6.62	7.02	2.58	1.12	.27	.43	.93	1.04	1.64	3.45	4.39	35.83
089	DAGGETT BARSTOW AP	.67	.60	.55	.18	.08	.11	.45	.39	.33	.17	.18	.46	4.17
090	DAVIS 2 WSW EXP FARM	4.04	3.76	3.03	.97	.55	.18	.03	.04	.30	.90	2.44	2.81	19.05
091	DEATH VALLEY	.35	.42	.42	.12	.10	.05	.11	.14	.19	.13	.12	.18	2.33
092	DEEP CANYON LABORATORY	1.10	1.03	.73	.15	.10	.03	.54	.78	.71	.20	.35	.58	6.30
093	DEEP SPRINGS COLLEGE	.58	.83	.81	.52	.47	.25	.65	.57	.49	.28	.37	.45	6.27
094	DEER CREEK FOREBAY	12.90	13.31	11.17	5.00	2.94	.96	.26	.34	1.46	3.53	9.29	9.42	70.58
095	DELANO	1.35	1.47	1.55	.55	.34	.05	.00	.02	.22	.38	.75	.87	7.55
096	DE SABLA	12.18	11.54	10.41	4.63	2.46	.91	.16	.32	1.46	3.58	8.48	9.72	65.85
097	DESCANSO RANGER STN	5.05	5.03	5.24	1.73	.60	.17	.28	.55	.50	1.14	2.07	2.81	25.17
098	DOBBINS 1 S	9.23	8.29	8.05	3.43	1.96	.50	.15	.17	1.02	2.75	7.21	7.34	50.10
099	DONNER MEMORIAL ST PK	6.89	6.72	5.83	2.50	1.55	.76	.47	.59	1.11	2.18	4.92	5.48	39.00
100	DOWNEY FIRE STN FC107C	3.37	3.75	2.89	.78	.22	.09	.03	.14	.28	.40	1.21	1.91	15.07
101	DOWNIEVILLE	11.07	10.69	9.84	4.56	2.92	.93	.32	.34	1.51	3.63	8.04	8.79	62.64
102	DOYLE	1.85	1.66	1.45	.61	.80	.60	.36	.24	.53	.68	1.49	1.53	11.80
103	DOYLE 4 SSE	2.50	2.57	2.22	.88	1.15	.73	.48	.40	.76	1.07	2.34	2.20	17.30
104	DRY CANYON RESERVOIR	2.99	3.50	3.03	.63	.22	.01	.01	.11	.27	.36	1.22	1.61	13.96
105	DUNSMUIR TREATMENT PLAN	11.39	10.38	9.50	4.14	2.55	.99	.34	.36	1.35	3.22	7.90	9.16	61.28
106	EAGLE MOUNTAIN	.58	.53	.50	.08	.08	.06	.44	.82	.47	.24	.18	.43	4.41
107	EAST PARK RESERVOIR	4.88	4.28	3.21	.99	.69	.28	.06	.10	.28	1.06	2.61	3.26	21.70
108	EL CAJON	2.47	2.57	2.66	.79	.16	.06	.04	.06	.15	.46	1.18	1.36	11.96
109	EL CAPITAN DAM	3.19	3.35	3.67	1.21	.44	.15	.08	.13	.35	.81	1.49	2.01	16.88
110	EL CENTRO 2 SSW	.51	.36	.31	.05	.03	.01	.06	.32	.36	.35	.17	.43	2.96
111	EL TORO MCAS	2.95	3.38	2.85	.85	.26	.14	.03	.15	.30	.32	1.05	1.75	14.03
112	ELECTRA P H	5.85	5.33	5.41	2.33	.94	.35	.16	.13	.63	1.72	3.89	4.20	30.94
113	ELLERY LAKE	4.41	3.88	3.29	1.39	1.04	.60	.82	.66	.82	1.41	3.14	3.16	24.62
114	ELLIOTT	3.81	3.54	3.32	1.54	.54	.17	.07	.06	.35	.98	2.55	2.60	19.53
115	EL MIRAGE	1.21	1.00	1.01	.24	.25	.08	.14	.39	.32	.18	.28	.68	5.78
116	ELSINORE	2.80	2.96	2.29	.56	.22	.02	.10	.12	.30	.36	.78	1.58	12.09
117	ESCONDIDO NO 2	3.37	3.16	3.30	1.04	.27	.11	.07	.02	.22	.44	1.32	1.78	15.10
118	EUREKA WFO WOODLEY IS	5.97	5.51	5.55	2.91	1.62	.65	.16	.38	.86	2.36	5.78	6.35	38.10
119	EXCHEQUER DAM	3.76	3.66	3.61	1.53	.52	.20	.05	.06	.35	1.12	2.26	2.63	19.75
120	FAIRFIELD	5.04	4.57	3.59	1.12	.64	.16	.03	.05	.30	1.24	3.08	3.64	23.46
121	FAIRMONT	3.41	3.99	2.96	.89	.43	.08	.07	.15	.33	.49	1.19	2.32	16.31
122	FIDDLETOWN DEXTER RANCH	6.78	6.33	6.19	2.76	1.60	.48	.17	.15	.79	2.08	4.61	5.08	37.02
123	FIVE POINTS 5 SSW	1.57	1.41	1.43	.44	.26	.13	.01	.03	.28	.43	.63	.78	7.40
124	FOLSOM DAM	4.46	4.34	4.30	1.84	.52	.31	.11	.10	.45	1.32	3.47	3.39	24.61
125	FONTANA 5 N	5.18	5.13	5.89	1.28	.61	.16	.02	.20	.38	.68	1.99	2.97	24.49
126	FONTANA KAISER (ONTARIO	3.50	3.42	3.49	.63	.19	.01	.00	.11	.26	.27	1.26	1.63	14.77
127	FORESTHILL RANGER STN	9.75	8.57	7.81	3.65	2.22	.69	.19	.27	1.25	2.92	6.96	7.66	51.94
128	FORT BIDWELL	2.59	2.22	2.13	1.47	1.36	.86	.40	.46	.70	1.08	2.39	2.59	18.25
129	FORT BRAGG 5 N	7.32	6.78	6.48	2.86	1.59	.42	.14	.34	.74	2.57	5.42	6.34	41.00
130	FORT DICK	11.15	10.17	10.02	5.57	3.43	1.53	.40	.73	1.93	5.16	11.62	11.59	73.30
131	FORT JONES RANGER STN	3.72	2.95	2.43	1.34	.95	.67	.42	.58	.74	1.22	3.26	3.52	21.80
132	FORT ROSS	7.21	6.21	5.59	2.41	1.05	.33	.14	.26	.64	2.22	5.35	5.67	37.08
133	FRESNO YOSEMITE INTL	2.16	2.12	2.20	.76	.39	.23	.01	.01	.26	.65	1.10	1.34	11.23
134	FRIANT GOVERNMENT CAMP	2.78	2.73	2.86	1.04	.42	.21	.02	.02	.27	.84	1.60	1.92	14.71
135	GARBERVILLE	10.83	9.94	8.33	3.71	1.29	.34	.05	.36	.85	3.00	8.25	8.90	55.85
136	GASQUET RS	14.68	13.70	12.72	7.12	4.10	1.69	.39	.79	2.25	5.55	13.69	15.35	92.03
137	GEM LAKE	3.33	3.24	3.19	1.32	.75	.52	.54	.57	.90	1.10	2.09	2.80	20.35
138	GEORGETOWN R S	10.00	8.92	8.49	3.90	1.85	.71	.22	.20	1.09	2.86	7.21	7.93	53.38

PRECIPITATION NORMALS (Total in Inches)

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
139	GIBRALTAR DAM 2	5.88	7.22	5.54	1.22	.54	.02	.01	.02	.29	.74	1.60	3.77	26.85
140	GILROY	4.30	4.10	3.64	1.16	.41	.10	.06	.05	.33	.93	2.52	3.00	20.60
141	GLENDORA FC 287B	4.77	5.26	4.31	1.19	.63	.24	.04	.17	.58	.70	1.68	2.59	22.16
142	GLENNVILLE	3.88	3.54	3.72	1.62	.73	.14	.05	.16	.53	.92	2.13	2.51	19.93
143	GOLD RUN 2 SW	9.74	9.35	8.78	3.89	2.35	.73	.23	.30	1.26	3.08	7.25	8.16	55.12
144	GOLDSTONE ECHO NO 2	1.00	1.09	.86	.20	.17	.03	.31	.55	.35	.14	.24	.56	5.50
145	GRANT GROVE	8.23	7.58	7.44	3.07	1.50	.57	.23	.11	1.25	2.23	4.31	5.55	42.07
146	GRASS VALLEY NO 2	9.86	9.21	8.52	3.69	1.97	.62	.18	.23	1.10	2.72	7.08	7.89	53.07
147	GRATON	8.65	7.64	6.15	2.25	1.03	.25	.08	.11	.52	2.01	5.85	6.29	40.83
148	GREENVIEW	4.79	4.28	2.65	1.36	.95	.40	.33	.27	.52	1.44	3.79	3.83	24.61
149	GREENVILLE R S	6.91	7.02	6.18	2.65	1.71	.79	.29	.30	.99	2.29	5.07	5.53	39.73
150	GRIZZLY CREEK STATE PAR	8.88	8.42	8.51	4.07	2.21	.64	.11	.43	.99	3.06	7.44	9.34	54.10
151	GROVELAND R S	7.21	7.16	6.30	2.84	1.09	.40	.12	.09	.67	1.76	4.33	5.20	37.17
152	HAIWEE	1.22	1.48	1.34	.31	.34	.08	.35	.36	.39	.15	.48	.87	7.37
153	HALF MOON BAY	5.55	4.91	4.36	1.77	.79	.26	.16	.27	.44	1.82	3.53	4.10	27.96
154	HANFORD 1 S	1.66	1.60	1.76	.63	.26	.08	.01	.01	.25	.44	.82	1.06	8.58
155	HAPPY CAMP RANGER STN	9.16	8.28	6.90	3.04	1.55	.66	.31	.54	1.24	3.11	7.86	8.79	51.44
156	HARRISON GULCH R S	6.77	6.59	6.15	2.18	1.45	.45	.10	.29	.85	2.02	5.13	5.45	37.43
157	HARRY ENGLEBRIGHT DAM	6.25	6.16	5.84	2.43	1.20	.40	.05	.11	.72	1.81	4.83	5.07	34.87
158	HAT CREEK	2.96	2.89	2.82	1.44	1.36	.73	.21	.36	.79	1.34	2.33	2.55	19.78
159	HAYFIELD PUMPING PLANT	.74	.67	.61	.11	.11	.01	.23	.70	.35	.29	.25	.43	4.50
160	HAYFORK 2 W	6.50	5.70	5.25	1.86	1.17	.62	.27	.34	.99	2.11	5.07	5.74	35.62
161	HEALDSBURG	8.65	8.08	6.54	2.24	1.06	.17	.07	.13	.55	2.12	6.04	6.50	42.15
162	HEALDSBURG NO 2	8.85	8.12	6.74	2.30	.86	.15	.07	.12	.57	2.17	5.77	6.96	42.68
163	HEMET	2.73	2.59	2.28	.75	.47	.11	.18	.38	.41	.48	.87	1.23	12.48
164	HENSHAW DAM	5.74	5.56	5.85	1.78	.65	.16	.40	.65	.67	.90	2.36	3.19	27.91
165	HETCH HETCHY	6.38	6.10	5.82	2.99	1.77	.82	.28	.21	.95	2.20	4.44	4.63	36.59
166	HOLLISTER 2	2.86	2.71	2.37	.79	.36	.05	.04	.06	.21	.64	1.87	1.65	13.61
167	HUNTINGTON LAKE	8.51	8.29	7.54	3.37	1.87	.68	.37	.22	1.24	2.44	4.91	5.81	45.25
168	IDYLLWILD FIRE DEPT	5.52	5.23	5.00	1.76	.77	.23	.78	.95	1.02	1.10	2.28	3.16	27.80
169	IMPERIAL	.48	.39	.34	.08	.04	.00	.13	.32	.36	.28	.19	.41	3.02
170	IMPERIAL BEACH REAM NAS	1.55	1.38	1.70	.46	.13	.07	.02	.09	.16	.30	1.04	1.07	7.97
171	INDEPENDENCE	.99	1.13	.73	.21	.19	.18	.13	.12	.26	.18	.49	.59	5.20
172	INDIO FIRE STATION	.78	.68	.47	.06	.06	.01	.10	.20	.21	.12	.18	.28	3.15
173	INYOKERN	.89	1.11	.81	.19	.10	.02	.12	.34	.25	.07	.28	.55	4.73
174	IOWA HILL	10.01	9.12	8.17	3.79	2.33	.70	.22	.29	1.14	2.87	7.27	7.90	53.81
175	IRON MOUNTAIN	.58	.47	.51	.11	.11	.05	.28	.41	.29	.30	.21	.46	3.78
176	JESS VALLEY	1.91	1.70	2.14	1.97	2.37	1.48	.52	.64	.96	1.30	2.08	1.99	19.06
177	JUNCAL DAM	6.52	8.42	6.24	1.50	.68	.08	.04	.03	.41	.95	2.19	4.09	31.15
178	KELSEY 1 N	7.33	6.00	5.63	2.80	1.66	.46	.17	.15	.80	2.16	4.92	5.33	37.41
179	KENTFIELD	9.60	9.10	7.05	2.56	1.20	.24	.01	.12	.50	2.33	7.47	7.29	47.47
180	KERN RIVER PH 1	1.91	1.77	2.37	.86	.35	.07	.00	.09	.26	.55	1.12	1.37	10.72
181	KERN RIVER PH 3	2.88	2.74	2.35	.61	.31	.13	.13	.19	.40	.49	1.26	1.75	13.24
182	KETTLEMAN STATION	1.54	1.51	1.37	.54	.27	.07	.00	.02	.29	.35	.55	.80	7.31
183	KING CITY	2.35	2.65	2.49	.74	.24	.07	.01	.05	.25	.55	1.23	1.67	12.30
184	KLAMATH	12.24	11.20	10.99	5.89	3.70	1.70	.37	.75	1.99	5.25	11.65	13.40	79.13
185	LA CRESCENTA FC 251C	4.72	5.75	5.13	1.44	.57	.19	.05	.23	.55	.77	1.75	2.67	23.82
186	LAGUNA BEACH	2.75	2.96	2.58	.84	.25	.13	.04	.12	.35	.47	1.23	1.84	13.56
187	LAKE ARROWHEAD	8.39	8.99	8.03	2.53	1.32	.28	.10	.33	1.07	2.01	3.45	5.16	41.66
188	LAKEPORT	6.74	5.93	4.75	1.70	.85	.22	.05	.09	.48	1.48	4.30	4.81	31.40
189	LAKE SABRINA	2.60	2.59	2.42	1.09	.70	.49	.51	.48	1.01	.77	1.60	1.97	16.23
190	LAKESIDE 2 E	3.06	3.31	3.61	1.12	.40	.16	.06	.11	.35	.70	1.43	1.90	16.21
191	LAKE SOLANO	5.61	5.03	3.98	1.16	.62	.12	.06	.04	.25	1.06	3.01	3.75	24.69
192	LAKE SPAULDING	12.96	12.39	11.44	5.48	3.45	1.20	.39	.51	1.73	3.99	9.44	11.00	73.98
193	LA MESA	2.89	2.52	2.98	1.05	.33	.11	.06	.10	.29	.58	1.32	1.52	13.75
194	LANCASTER ATC	1.60	1.62	1.44	.32	.12	.05	.10	.14	.20	.30	.50	1.01	7.40
195	LAVA BEDS NAT MONUMENT	1.75	1.81	2.02	1.12	1.25	.94	.62	.51	.60	1.14	1.39	1.66	14.81
196	LEBEC	2.40	2.97	2.83	.94	.52	.08	.04	.13	.30	.55	1.06	1.67	13.49
197	LECHUZA PTRL ST FC352B	4.93	4.92	3.95	.89	.32	.06	.03	.11	.43	.63	1.82	2.96	21.05
198	LEE VINING	2.31	2.70	1.56	.39	.33	.27	.52	.49	.53	.61	1.68	1.62	13.01
199	LEMON COVE	2.80	2.53	2.98	1.10	.54	.16	.01	.04	.33	.76	1.56	1.75	14.56
200	LEMOORE REEVES NAS	1.53	1.47	1.63	.56	.32	.06	.00	.02	.30	.46	.62	.92	7.89
201	LINDSAY	2.44	2.25	2.57	.90	.41	.13	.01	.02	.34	.67	1.33	1.50	12.57
202	LIVERMORE	2.99	2.77	2.47	.96	.43	.09	.03	.08	.24	.84	1.88	2.04	14.82
203	LODGEPOLE	8.60	8.71	7.66	3.06	1.34	.66	.47	.34	1.51	2.02	4.38	5.99	44.74
204	LODI	3.56	3.29	2.99	1.16	.61	.13	.06	.08	.34	1.05	2.35	2.60	18.22
205	LOMPOC	3.20	3.64	3.38	.93	.31	.04	.01	.05	.24	.48	1.34	2.23	15.85
206	LONG BEACH AP	2.95	3.01	2.43	.60	.23	.08	.02	.10	.24	.40	1.12	1.76	12.94

PRECIPITATION NORMALS (Total in Inches)

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
207	LOS ALAMOS	3.15	3.89	3.70	1.08	.35	.07	.01	.04	.36	.59	1.38	2.30	16.92
208	LOS ANGELES INTL AP	2.98	3.11	2.40	.63	.24	.08	.03	.14	.26	.36	1.13	1.79	13.15
209	LOS ANGELES DOWNTOWN US	3.33	3.68	3.14	.83	.31	.06	.01	.13	.32	.37	1.05	1.91	15.14
210	LOS BANOS	1.93	1.97	1.65	.63	.44	.07	.04	.05	.28	.56	1.11	1.22	9.95
211	LOS BANOS ARBURUA RANCH	1.75	1.80	1.49	.49	.37	.06	.05	.07	.35	.46	1.02	1.04	8.95
212	LOS BANOS DET RESV	1.67	1.69	1.40	.46	.32	.05	.03	.03	.28	.44	.94	1.08	8.39
213	LOS GATOS	5.11	4.77	3.93	1.19	.46	.10	.04	.08	.24	1.02	2.47	3.23	22.64
214	LOS GATOS 4 SW	9.45	9.33	8.41	2.90	.65	.24	.10	.11	.44	2.46	5.57	6.76	46.42
215	LOS PRIETOS RANGER STN	4.84	5.91	4.91	1.26	.48	.04	.01	.07	.24	.87	1.75	3.27	23.65
216	LYTLE CREEK R S	8.47	8.96	8.21	2.06	.96	.12	.06	.19	.65	1.25	2.78	4.91	38.62
217	MADERA	2.19	2.22	2.29	1.00	.43	.11	.01	.02	.23	.74	1.24	1.46	11.94
218	MAD RIVER RANGER STN	10.52	9.93	8.46	4.01	1.64	.44	.08	.46	1.18	3.64	8.70	10.05	59.11
219	MANZANITA LAKE	5.84	5.59	5.86	3.44	2.84	1.60	.48	.69	1.57	3.07	5.31	5.08	41.37
220	MARICOPA	1.16	1.13	1.40	.51	.21	.04	.00	.07	.26	.20	.63	.71	6.32
221	MARIPOSA R S	6.20	6.06	5.66	2.14	.60	.23	.03	.00	.42	1.26	3.62	3.96	30.18
222	MARKLEEVILLE	3.39	2.92	2.76	.78	.93	.55	.54	.52	.75	1.22	2.02	2.32	18.70
223	MARKLEY COVE	5.85	5.83	4.68	1.42	.78	.13	.03	.07	.34	1.34	3.22	4.25	27.94
224	MARTINEZ WATER PLANT	4.25	3.81	3.24	1.04	.46	.12	.02	.08	.24	.94	2.59	2.79	19.58
225	MARYSVILLE	4.26	3.89	3.54	1.43	.76	.25	.07	.08	.40	1.23	2.80	3.36	22.07
226	MATHER	6.35	5.95	5.74	2.86	1.58	.60	.19	.12	.79	1.99	3.96	4.58	34.71
227	MC CLOUD	8.82	8.28	7.64	3.28	2.33	.97	.28	.42	1.15	2.78	6.13	6.98	49.06
228	MECCA FIRE STATION	.69	.62	.38	.08	.02	.01	.13	.23	.42	.24	.20	.31	3.33
229	MERCED	2.43	2.43	2.23	.89	.45	.09	.03	.02	.19	.73	1.41	1.60	12.50
230	MIDDLETOWN	9.51	8.40	6.48	2.43	1.08	.22	.04	.09	.56	2.02	5.55	6.92	43.30
231	MINERAL	9.45	8.77	8.40	4.14	2.97	1.49	.33	.47	1.53	3.73	7.17	7.86	56.31
232	MITCHELL CAVERNS	1.54	1.73	1.74	.53	.27	.13	.90	1.80	.90	.73	.58	.97	11.82
233	MODESTO CITY-COUNTY AP	2.56	2.38	2.30	.91	.55	.13	.05	.06	.27	.75	1.48	1.68	13.12
234	MOJAVE	1.34	1.51	1.13	.22	.15	.05	.16	.27	.28	.28	.43	.81	6.63
235	MONTEBELLO	3.53	3.60	2.94	.90	.23	.06	.01	.02	.17	.31	1.00	1.67	14.44
236	MONTEREY	4.19	3.75	3.53	1.48	.50	.20	.09	.11	.28	1.06	2.43	2.73	20.35
237	MORRO BAY FIRE DEPT	3.49	3.69	3.66	1.12	.34	.07	.03	.09	.37	.70	1.54	2.51	17.61
238	MOUNTAIN PASS	1.04	1.17	1.12	.41	.33	.25	.97	1.19	.69	.45	.65	.71	8.98
239	MOUNT DIABLO JUNCTION	4.76	4.49	3.83	1.46	.85	.15	.05	.08	.36	1.31	3.27	3.35	23.96
240	MOUNT HAMILTON	4.42	4.02	3.90	1.77	.95	.24	.05	.09	.44	1.51	3.23	3.11	23.73
241	MOUNT HEBRON RNG STN	1.63	1.18	1.34	.72	1.04	.88	.39	.53	.63	.93	1.60	1.64	12.51
242	MOUNT SHASTA	7.06	6.45	5.81	2.65	1.87	.99	.39	.43	.87	2.21	5.08	5.35	39.16
243	MT WILSON NO 2	7.96	9.53	8.38	2.34	.97	.26	.08	.29	1.01	1.54	3.23	4.78	40.37
244	MUIR WOODS	7.32	6.85	5.63	2.18	1.11	.30	.12	.17	.46	2.07	5.78	5.60	37.59
245	NAPA STATE HOSPITAL	5.35	5.03	4.09	1.45	.78	.16	.05	.11	.41	1.43	3.72	3.88	26.46
246	NEEDLES AP	.74	.63	.65	.22	.11	.04	.32	.70	.60	.31	.35	.44	5.11
247	NEVADA CITY	11.16	10.63	9.46	4.12	2.25	.69	.19	.28	1.20	2.89	7.74	8.69	59.30
248	NEWARK (OAKLAND)	2.97	2.89	2.39	.94	.42	.12	.03	.07	.20	.90	1.84	2.08	14.85
249	NEW CUYAMA FIRE STN	1.43	1.75	1.71	.43	.26	.05	.07	.10	.33	.30	.66	1.01	8.10
250	NEWHALL S FC32CE	4.23	4.32	3.54	.83	.27	.06	.02	.12	.27	.61	1.24	2.45	17.96
251	NEWMAN	2.55	2.18	2.00	.63	.39	.04	.02	.02	.27	.61	1.23	1.51	11.45
252	NEWPORT BEACH HARBOR	2.60	2.54	2.25	.70	.18	.08	.02	.09	.30	.28	1.02	1.59	11.65
253	NICOLAUS 2	3.89	3.45	3.19	1.26	.59	.25	.06	.05	.44	1.12	2.57	2.90	19.77
254	NILAND	.48	.45	.46	.08	.02	.04	.25	.34	.30	.29	.17	.35	3.23
255	NORTH FORK R S	6.78	6.42	6.17	2.41	1.31	.47	.10	.08	.74	1.66	3.60	4.35	34.09
256	OAKLAND MUSEUM	4.85	4.27	3.56	1.38	.57	.11	.07	.10	.33	1.33	3.14	3.23	22.94
257	OCCIDENTAL	11.69	10.28	8.14	3.35	1.61	.33	.11	.25	.69	3.21	8.06	8.15	55.87
258	OCEANSIDE MARINA	2.42	2.23	2.11	.92	.23	.09	.02	.13	.29	.43	.92	1.34	11.13
259	OCOTILLO 2	.72	.57	.31	.06	.07	.08	.33	.47	.32	.25	.23	.65	4.06
260	OJAI	4.81	5.68	4.36	1.04	.48	.08	.03	.08	.41	.57	1.46	2.79	21.79
261	ORANGE COVE	2.69	2.22	2.41	.82	.43	.06	.01	.02	.18	.66	1.37	1.40	12.27
262	ORICK PRAIRIE CREEK PAR	9.75	9.72	9.24	5.28	3.18	1.30	.31	.52	1.58	4.33	9.90	10.92	66.03
263	ORLAND	4.37	3.85	3.51	1.14	.96	.40	.08	.15	.40	1.17	2.77	3.03	21.83
264	ORLEANS	8.77	7.98	7.12	3.36	2.09	.75	.18	.47	1.23	3.68	8.08	9.07	52.78
265	OROVILLE	5.52	5.20	4.70	1.84	.99	.31	.07	.16	.46	1.59	3.74	4.17	28.75
266	OXNARD (CAMARILLO)	3.41	3.90	3.04	.72	.21	.05	.02	.07	.36	.36	1.37	2.11	15.62
267	PACIFIC HOUSE	9.58	8.62	8.03	4.01	2.31	.81	.28	.26	1.20	2.95	6.48	7.34	51.87
268	PACIFICA 4 SSE	6.34	5.57	4.42	1.93	.85	.22	.03	.12	.41	1.43	3.84	4.34	29.50
269	PACOIMA DAM FC 33 A-E	4.13	4.82	4.17	1.18	.61	.17	.04	.27	.42	.80	1.48	2.43	20.52
270	PAICINES 4 W	3.25	3.20	2.93	.94	.29	.07	.06	.06	.30	.73	1.90	2.23	15.96
271	PALMDALE (LANCASTER)	1.56	1.69	1.39	.33	.16	.06	.06	.13	.22	.24	.43	1.09	7.36
272	PALM SPRINGS	1.27	1.15	.63	.08	.06	.05	.19	.40	.39	.11	.29	.61	5.23
273	PALO ALTO	3.24	3.18	2.65	.89	.35	.11	.03	.08	.19	.85	1.83	2.31	15.71
274	PALOMA	5.35	5.82	4.53	1.62	.61	.13	.10	.08	.28	1.02	2.68	4.01	26.23
275	PALOMAR MOUNTAIN OBS	5.77	6.29	6.13	1.76	.71	.18	.42	.91	.73	.99	2.60	3.47	29.96

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
						PRECIPITATION NORMALS (Total in Inches)								
276	PALOS VERDES EST FC43D	3.09	2.88	2.61	.65	.27	.07	.02	.17	.27	.36	1.09	1.69	13.17
277	PANOCHE 2 W	2.04	2.28	1.86	.61	.33	.08	.02	.05	.39	.50	.97	1.43	10.56
278	PARADISE	10.64	9.60	9.33	3.85	1.94	.71	.12	.26	1.12	2.91	7.43	8.29	56.20
279	PARKER RESERVOIR	1.06	.90	.86	.21	.12	.05	.41	.67	.55	.43	.40	.59	6.25
280	PASADENA	4.48	5.00	4.38	1.22	.45	.21	.05	.21	.48	.65	1.50	2.46	21.09
281	PASKENTA RANGER STN	4.79	4.30	4.10	1.55	1.09	.47	.10	.07	.57	1.24	2.97	3.40	24.65
282	PASO ROBLES	3.23	3.29	2.88	.80	.24	.03	.02	.06	.34	.59	1.29	1.94	14.71
283	PASO ROBLES MUNICIPAL A	2.83	2.87	2.66	.68	.23	.02	.01	.06	.36	.51	1.12	1.73	13.08
284	PAYNES CREEK	5.33	4.79	4.89	2.76	1.01	.42	.10	.24	.76	1.81	3.87	4.74	30.72
285	PEARBLOSSOM	1.30	1.20	1.10	.25	.07	.03	.04	.12	.09	.14	.26	.74	5.34
286	PETALUMA FIRE STA 2	5.41	5.31	3.85	1.40	.62	.15	.05	.08	.29	1.37	3.52	3.80	25.85
287	PINE FLAT DAM	4.10	3.76	3.87	1.40	.60	.25	.03	.01	.35	1.09	2.12	2.55	20.13
288	PINNACLES NATL MONUMENT	3.32	3.45	3.47	1.09	.48	.08	.04	.09	.32	.90	1.72	2.39	17.35
289	PIRU 2 ESE	4.07	4.66	3.56	.87	.34	.03	.02	.14	.26	.55	1.43	2.46	18.39
290	PISMO BEACH	3.59	3.87	3.46	1.13	.41	.07	.03	.02	.32	.62	1.70	2.57	17.79
291	PIT RIVER P H 1	2.73	2.73	2.67	1.43	1.41	.71	.15	.32	.79	1.41	2.20	2.33	18.88
292	PIT RIVER P H 5	13.11	12.92	11.79	5.25	3.30	1.25	.39	.51	2.25	4.31	9.65	10.97	75.70
293	PLACERVILLE	7.47	6.62	6.03	2.84	1.56	.45	.18	.15	.94	2.12	4.91	5.48	38.75
294	PLACERVILLE IFG	7.45	7.22	6.36	3.19	1.27	.54	.21	.16	.86	2.34	5.59	5.58	40.77
295	POINT ARENA	7.99	6.89	6.42	3.01	1.07	.26	.14	.34	.74	2.36	5.80	6.83	41.85
296	POINT MUGU NF	3.00	3.27	2.55	.65	.18	.05	.01	.09	.40	.31	1.14	1.96	13.61
297	POMONA FAIRPLEX	4.02	4.05	3.45	.73	.25	.05	.00	.13	.29	.66	1.29	2.04	16.96
298	PORTERVILLE	2.17	1.99	2.33	.87	.42	.11	.01	.02	.35	.65	1.14	1.43	11.49
299	PORTOLA	4.17	3.87	3.61	1.23	1.12	.54	.34	.43	.78	1.22	2.50	3.28	23.09
300	POSEY 3 E	5.63	5.11	5.40	2.46	.85	.20	.00	.18	.47	1.24	2.87	4.30	28.71
301	POTTER VALLEY P H	8.83	7.87	6.88	2.80	1.63	.36	.08	.18	.89	2.60	6.33	6.87	45.32
302	POWAY VALLEY	3.17	2.79	3.06	1.11	.35	.09	.02	.11	.28	.49	1.37	1.70	14.54
303	PRIEST VALLEY	4.37	4.07	4.00	1.32	.49	.10	.06	.09	.46	1.08	2.00	2.96	21.00
304	QUINCY	6.77	6.75	5.59	2.53	1.53	.71	.24	.27	.84	2.55	4.90	5.64	38.32
305	RAMONA FIRE DEPT	3.40	3.42	3.56	1.15	.39	.08	.12	.20	.36	.55	1.42	1.78	16.43
306	RANDSBURG	1.36	1.56	1.24	.31	.15	.04	.12	.23	.27	.33	.45	.80	6.86
307	RED BLUFF AP	4.82	4.01	3.66	1.39	1.09	.44	.10	.14	.68	1.35	2.92	3.47	24.07
308	REDDING MUNICIPAL AP	6.50	5.49	5.15	2.40	1.66	.69	.05	.22	.48	2.18	4.03	4.67	33.52
309	REDLANDS	2.98	3.04	2.58	.81	.42	.13	.10	.22	.42	.50	.91	1.51	13.62
310	REDWOOD CITY	4.20	4.04	3.37	1.07	.43	.10	.03	.10	.21	1.06	2.62	2.93	20.16
311	REPRESA	4.08	3.93	3.81	1.55	.81	.26	.10	.12	.45	1.25	2.92	2.93	22.21
312	RICHARDSON GR ST PK	12.90	11.38	10.30	4.46	2.05	.65	.09	.37	1.31	3.93	9.78	11.18	68.40
313	RICHMOND	4.91	4.41	3.52	1.35	.54	.17	.07	.09	.27	1.25	3.47	3.30	23.35
314	RIVERSIDE FIRE STA 3	2.32	2.31	2.11	.58	.20	.10	.03	.17	.24	.31	.74	1.11	10.22
315	RIVERSIDE CITRUS EXP ST	2.47	2.39	2.19	.60	.25	.10	.03	.17	.26	.26	.78	1.17	10.67
316	ROUND MOUNTAIN PG & E	10.86	10.37	9.75	4.94	3.31	1.28	.19	.53	1.70	3.95	8.40	9.33	64.61
317	SACRAMENTO AP	3.84	3.54	2.80	1.02	.53	.20	.05	.06	.36	.89	2.19	2.45	17.93
318	SACRAMENTO 5 ESE	4.18	3.77	3.15	1.17	.60	.18	.05	.05	.37	1.00	2.59	2.76	19.87
319	SAGEHEN CREEK	4.89	5.58	5.15	1.76	1.50	.63	.52	.55	1.15	2.19	4.31	4.40	32.63
320	SAINT HELENA	7.46	7.10	5.31	1.74	.68	.17	.04	.08	.41	1.84	4.83	5.22	34.88
321	SALINAS NO 2	3.00	2.92	2.77	1.00	.34	.09	.04	.07	.18	.74	1.85	2.12	15.12
322	SALINAS AP	2.62	2.48	2.36	.93	.23	.09	.04	.06	.21	.62	1.51	1.76	12.91
323	SALINAS DAM	4.68	4.97	4.48	1.35	.43	.04	.01	.07	.41	.90	1.99	3.29	22.62
324	SALSIPUEDES GAGING STN	3.72	4.49	3.97	1.20	.36	.04	.01	.05	.21	.52	1.50	2.73	18.80
325	SALT SPRINGS PWR HOUSE	7.92	7.96	7.33	3.64	2.17	.93	.31	.28	1.21	2.71	5.82	5.95	46.23
326	SAN BERNARDINO F S 226	3.50	3.70	3.28	.93	.41	.09	.04	.22	.41	.71	1.20	1.94	16.43
327	SAN CLEMENTE DAM	4.54	4.67	3.98	1.41	.43	.12	.05	.06	.24	.93	2.19	3.21	21.83
328	SANDBERG	2.48	3.21	2.29	.60	.28	.07	.02	.09	.25	.32	.82	2.17	12.60
329	SAN DIEGO MIRAMAR NAS	2.52	2.31	2.47	.88	.28	.09	.05	.07	.26	.48	1.17	1.39	11.97
330	SAN DIEGO N ISLAND NAS	1.99	1.89	2.04	.67	.16	.08	.02	.10	.20	.42	.93	1.17	9.67
331	SAN DIEGO LINDBERGH AP	2.28	2.04	2.26	.75	.20	.09	.03	.09	.21	.44	1.07	1.31	10.77
332	SAN DIMAS FIRE FC95	4.12	4.60	3.85	1.07	.28	.09	.02	.13	.38	.67	1.46	2.22	18.89
333	SAN FRANCISCO OCEANSIDE	4.14	3.74	3.23	1.17	.51	.09	.03	.08	.17	1.03	2.61	2.97	19.77
334	SAN FRANCISCO INTL AP	4.45	4.01	3.26	1.18	.38	.11	.03	.07	.20	1.04	2.49	2.89	20.11
335	SAN FRANCISCO DOWNTOWN	4.72	4.15	3.40	1.25	.54	.13	.04	.09	.28	1.19	3.31	3.18	22.28
336	SAN GABRIEL CANYON P H	5.12	5.75	4.73	1.22	.68	.26	.05	.23	.62	.92	1.72	2.83	24.13
337	SAN GABRIEL DAM FC425B	6.45	7.04	5.90	1.66	.89	.23	.03	.31	.64	1.13	2.12	3.63	30.03
338	SAN GABRIEL FIRE DEPT	4.07	4.66	3.76	1.01	.41	.16	.03	.10	.44	.57	1.29	2.06	18.56
339	SAN GREGORIO 2 SE	5.71	5.37	4.60	2.00	.85	.29	.13	.20	.41	1.67	3.93	4.36	29.52
340	SAN JACINTO R S	2.68	2.80	2.34	.64	.44	.09	.14	.25	.36	.49	.93	1.39	12.55
341	SAN JOSE	3.03	2.84	2.69	1.02	.44	.10	.06	.07	.23	.87	1.73	2.00	15.08
342	SAN LUIS DAM	2.10	2.11	1.74	.55	.49	.05	.03	.10	.23	.54	1.25	1.33	10.52
343	SAN LUIS OBISPO POLYTEC	5.28	5.41	4.48	1.31	.47	.09	.03	.08	.44	.99	2.17	3.61	24.36
344	SAN PASQUAL ANIMAL PK	3.10	2.82	2.97	1.02	.31	.09	.13	.05	.21	.49	1.21	1.68	14.08

PRECIPITATION NORMALS (Total in Inches)

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
345	SAN RAFAEL CIVIC CENTER	7.38	7.14	4.89	1.75	.70	.12	.06	.08	.34	1.65	4.86	5.32	34.29
346	SANTA ANA FIRE STATION	3.18	3.05	2.78	.67	.25	.11	.02	.12	.34	.36	1.17	1.79	13.84
347	SANTA BARBARA	4.14	4.68	3.59	.77	.35	.09	.01	.03	.29	.52	1.48	2.63	18.58
348	SANTA BARBARA MNCPL AP	3.57	4.28	3.51	.63	.23	.05	.03	.11	.42	.52	1.32	2.26	16.93
349	SANTA CRUZ	6.49	6.15	4.78	1.97	.70	.18	.14	.11	.41	1.44	4.08	4.22	30.67
350	SANTA MARGARITA BOOST	6.98	6.88	5.97	1.83	.56	.10	.03	.10	.49	1.57	3.17	4.49	32.17
351	SANTA MARIA AP	2.64	3.23	2.94	.91	.32	.05	.03	.05	.31	.45	1.24	1.84	14.01
352	SANTA MONICA PIER	3.06	3.29	2.56	.53	.25	.04	.01	.13	.17	.36	1.02	1.85	13.27
353	SANTA PAULA	4.18	4.65	3.57	.80	.30	.05	.01	.08	.32	.52	1.45	2.48	18.41
354	SANTA ROSA	6.25	6.08	4.71	1.67	.83	.19	.06	.11	.49	1.81	4.31	4.50	31.01
355	SAUGUS POWER PLANT 1	3.76	4.33	3.57	1.20	.53	.12	.03	.19	.36	.61	1.53	2.40	18.63
356	SAWYERS BAR RS	7.06	6.41	5.23	2.37	1.37	.75	.16	.58	1.02	3.07	7.16	7.22	42.40
357	SCOTIA	8.45	7.70	7.40	3.38	1.73	.55	.11	.34	.82	2.81	6.87	8.31	48.47
358	SHASTA DAM	11.47	10.76	10.79	4.18	2.80	1.25	.26	.42	1.63	2.97	7.86	9.01	63.40
359	SHELTER COVE AV	10.29	9.35	8.78	4.16	2.62	1.00	.18	.60	1.39	4.14	8.55	10.41	61.47
360	SHINGLETOWN 2 E	7.05	7.05	7.76	3.81	2.75	1.10	.23	.46	1.32	3.02	5.77	6.32	46.64
361	SHOSHONE	.73	.89	.84	.24	.30	.04	.19	.35	.24	.16	.34	.48	4.80
362	SIERRA CITY	11.49	12.00	10.11	4.41	3.18	1.00	.39	.55	1.65	3.99	8.54	8.98	66.29
363	SIERRAVILLE R S	4.59	4.38	3.80	1.33	1.08	.45	.29	.42	.77	1.65	3.68	3.90	26.34
364	SNOW CREEK UPPER	2.76	3.09	2.41	.53	.24	.07	.21	.50	.74	.39	.85	1.80	13.59
365	SOLEDAD	2.11	1.97	2.16	.61	.09	.05	.04	.06	.21	.48	1.13	1.42	10.33
366	SONOMA	6.52	6.10	4.64	1.55	.79	.18	.05	.12	.33	1.68	4.22	4.46	30.64
367	SONORA RS	6.39	5.76	5.65	2.49	1.22	.26	.07	.14	.57	1.84	3.83	4.26	32.48
368	SOUTH ENTR YOSEMITE NP	8.34	8.02	7.26	3.09	1.64	.70	.17	.09	.86	2.20	4.39	5.27	42.03
369	SOUTH LAKE	3.17	3.33	2.84	1.33	.80	.53	.64	.54	1.20	.87	1.81	2.24	19.30
370	SPRECKELS HWY BRIDGE	2.81	2.32	2.93	1.17	.19	.10	.06	.07	.23	.77	1.80	1.92	14.37
371	STANDISH HICKEY ST PK	13.70	12.30	10.64	4.71	2.38	.68	.20	.44	1.30	4.44	9.97	11.46	72.22
372	STOCKTON AP	2.71	2.46	2.28	.96	.50	.09	.05	.05	.33	.82	1.77	1.82	13.84
373	STOCKTON FIRE STN # 4	3.34	3.12	2.66	1.17	.53	.10	.05	.05	.34	.97	2.01	2.26	16.60
374	STONYFORD	5.03	4.30	3.48	1.00	.72	.30	.06	.11	.27	1.00	2.74	3.27	22.28
375	STONY GORGE RESERVOIR	4.50	3.86	3.24	1.11	.86	.45	.11	.22	.30	1.18	2.41	3.07	21.31
376	STRAWBERRY VALLEY	14.81	13.86	12.66	5.73	3.31	1.02	.28	.32	1.64	4.41	10.42	12.16	80.62
377	SUN CITY	2.62	2.86	2.34	.63	.33	.04	.04	.25	.18	.26	.76	1.09	11.40
378	SUSANVILLE 2 SW	2.36	2.06	1.53	.57	.88	.45	.28	.19	.49	1.00	1.65	1.98	13.44
379	TAHOE CITY	6.01	5.71	4.57	1.82	1.21	.77	.33	.46	.90	1.95	4.25	4.68	32.66
381	TEHACHAPI	2.14	1.94	2.36	.71	.46	.12	.08	.28	.22	.55	1.19	1.46	11.51
382	TEJON RANCHO	2.12	1.78	2.60	1.10	.51	.15	.05	.10	.31	.60	1.42	1.27	12.01
383	TERMO 1 E	1.03	1.05	1.16	.75	1.21	.88	.40	.28	.59	.80	1.11	1.15	10.41
384	THERMAL RGNL AP	.72	.63	.43	.06	.06	.02	.19	.37	.41	.14	.21	.29	3.53
385	THREE RIVERS EDISON PH	4.74	4.29	4.77	1.80	.79	.33	.10	.06	.66	1.15	2.67	3.00	24.36
386	TIGER CREEK PH	8.90	7.89	7.67	3.46	1.87	.54	.19	.19	.92	2.59	5.90	6.31	46.43
387	TOPANGA PATROL STN FC6	5.76	5.48	4.66	1.06	.39	.07	.02	.12	.29	.69	1.83	3.26	23.63
388	TORRANCE	3.60	3.22	2.79	.73	.26	.08	.04	.13	.23	.48	1.24	1.99	14.79
389	TRACY CARBONA	1.97	1.92	1.71	.70	.59	.08	.04	.06	.26	.65	1.19	1.41	10.58
390	TRACY PUMPING PLANT	2.61	2.31	1.97	.73	.45	.10	.04	.06	.25	.72	1.61	1.66	12.51
391	TRINITY RIVER HATCHERY	5.94	5.26	4.93	2.04	1.42	.63	.21	.25	.84	1.91	4.44	4.96	32.83
392	TRONA	.89	.87	.62	.13	.12	.10	.08	.26	.25	.12	.25	.42	4.11
393	TRUCKEE RS	5.35	5.30	4.43	1.93	1.33	.66	.41	.52	1.00	1.75	3.83	4.34	30.85
394	TULELAKE	1.35	1.18	1.26	.90	.97	.79	.35	.53	.60	.87	1.27	1.28	11.35
395	TURLOCK #2	2.43	2.34	2.13	.89	.47	.06	.03	.04	.27	.70	1.40	1.67	12.43
396	TUSTIN IRVINE RANCH	2.96	3.07	2.79	.77	.28	.10	.01	.14	.34	.40	1.22	1.79	13.87
397	TWENTYNINE PALMS	.56	.52	.49	.14	.12	.01	.64	.76	.55	.17	.21	.40	4.57
398	TWIN LAKES	7.89	7.52	6.67	3.30	2.30	1.20	.63	.61	1.40	2.84	5.84	6.25	46.45
399	TWITCHELL DAM	3.66	3.80	3.80	1.10	.28	.05	.04	.05	.39	.77	1.52	2.38	17.84
400	UKIAH	7.96	7.05	5.92	2.19	1.20	.28	.05	.14	.67	2.07	5.40	5.97	38.90
401	UKIAH 4 WSW	9.88	8.87	7.52	3.36	1.56	.36	.09	.19	.77	2.80	6.85	7.64	49.89
402	U C L A	4.09	4.93	3.54	.86	.34	.11	.02	.16	.32	.57	1.35	2.39	18.68
403	UPPER LAKE 7 W	8.74	8.75	7.00	3.00	.97	.12	.04	.15	.62	2.19	5.95	6.56	44.09
404	UPPER SAN LEANDRO FLTR	5.20	4.64	4.27	1.72	.71	.15	.06	.11	.36	1.55	3.69	3.84	26.30
405	VACAVILLE	5.47	5.03	3.74	1.13	.60	.09	.05	.03	.29	1.19	3.27	3.66	24.55
406	VAN NUYS FC15A	4.31	4.37	3.45	.67	.23	.05	.01	.17	.24	.43	1.05	1.94	16.92
407	VENTURA	3.23	3.82	3.22	.72	.18	.02	.01	.06	.37	.40	1.21	2.11	15.35
408	VICTORVILLE PUMP PLANT	1.11	1.18	1.14	.31	.23	.06	.16	.25	.33	.26	.36	.81	6.20
409	VINCENT FS FC 120	1.75	1.86	1.92	.49	.22	.07	.03	.15	.28	.36	.52	1.14	8.79
410	VINTON	2.24	2.04	1.78	.74	1.00	.60	.38	.43	.66	.94	1.62	1.75	14.18
411	VISALIA	2.03	1.95	2.15	.80	.37	.14	.01	.02	.25	.65	1.17	1.49	11.03
412	VISTA 2 NNE	3.13	2.66	2.83	.94	.27	.13	.05	.11	.31	.45	1.28	1.53	13.69
413	VOLTA POWER HOUSE	5.66	4.99	5.00	2.90	2.24	1.11	.20	.40	1.27	2.58	4.22	4.72	35.29
414	WALNUT NI FC102C	3.86	3.95	3.30	.85	.33	.12	.01	.23	.32	.53	1.33	2.15	16.98

PRECIPITATION NORMALS (Total in Inches)

No.	Station Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
415	WARM SPRINGS DAM	9.02	8.25	6.91	2.43	1.03	.18	.05	.13	.60	2.21	5.70	6.88	43.39
416	WASCO	1.34	1.37	1.60	.58	.24	.13	.01	.03	.18	.34	.64	.88	7.34
417	WATSONVILLE WATERWORKS	4.72	4.45	3.92	1.62	.51	.12	.08	.07	.29	1.06	3.00	3.41	23.25
418	WEAVERVILLE	7.08	6.05	5.49	2.25	1.31	.58	.23	.27	1.05	2.34	5.47	6.29	38.41
419	WEED FIRE DEPT	3.68	3.30	3.54	1.88	1.36	.82	.32	.42	.49	1.36	3.11	3.36	23.64
420	WESTHAVEN	1.54	1.49	1.64	.47	.33	.01	.00	.02	.29	.42	.60	.90	7.71
421	WEST POINT	6.93	6.20	5.85	2.73	1.60	.44	.17	.16	.80	2.08	4.56	5.00	36.52
422	WHISKEYTOWN RESERVOIR	11.26	10.69	11.14	4.22	2.76	1.07	.41	.24	1.56	2.95	8.15	8.79	63.24
423	WHITTIER CITY YD FC106C	3.25	3.62	2.91	.74	.27	.09	.02	.13	.34	.44	1.17	1.72	14.70
424	WILDROSE R S	1.02	1.05	1.13	.33	.44	.13	.32	.63	.48	.31	.36	.55	6.75
425	WILLITS 1 NE	9.91	8.78	7.40	3.08	1.61	.32	.10	.21	.87	2.77	6.89	7.83	49.77
426	WILLOW CREEK 1 NW	9.33	8.83	7.84	3.43	2.04	.64	.15	.42	1.14	3.19	8.10	9.38	54.49
427	WILLOWS 6 W	3.89	3.59	2.94	.98	.79	.29	.06	.09	.34	.98	2.43	2.65	19.03
428	WINTERS	5.10	4.67	3.60	1.03	.64	.12	.03	.05	.26	1.00	2.87	3.45	22.82
429	WOFFORD HEIGHTS KERNVIL	2.67	2.41	1.80	.48	.23	.03	.06	.09	.30	.28	.82	1.55	10.72
430	WOODFORDS	3.51	3.78	2.47	.88	.82	.61	.45	.53	.67	1.48	2.86	2.95	21.01
431	WOODLAND 1 WNW	4.51	4.13	3.28	1.10	.57	.15	.03	.05	.41	1.07	2.50	2.98	20.78
432	WOODSIDE FIRE STN 1	6.16	5.79	4.57	1.64	.64	.13	.04	.14	.26	1.27	3.86	4.21	28.71
433	WRIGHTS	9.27	8.40	7.41	2.98	.70	.20	.11	.11	.47	1.81	5.55	6.36	43.37
434	YOSEMITE PARK HDQTRS	6.73	6.92	5.80	2.57	1.58	.79	.51	.21	.92	2.27	4.66	4.77	37.73
435	YREKA SISKIYOU CO	3.19	2.27	2.04	1.20	1.15	.95	.49	.54	.75	1.11	2.80	3.17	19.66

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			DEGREE DAYS (Total)												
002	ADIN RS	HDD	986	782	732	556	366	175	39	48	165	423	723	993	5988
		CDD	0	0	0	0	5	39	113	99	37	7	0	0	300
004	ALPINE	HDD	344	285	283	200	140	46	8	5	21	67	206	342	1947
		CDD	0	4	12	35	76	174	306	341	276	123	26	9	1382
006	ALTURAS	HDD	1066	856	806	630	423	203	74	73	232	537	835	1073	6808
		CDD	0	0	0	0	2	29	102	68	11	0	0	0	212
007	ANAHEIM	HDD	256	206	202	137	74	22	1	1	7	30	117	233	1286
		CDD	5	6	17	45	91	155	256	296	251	130	34	8	1294
008	ANGWIN PAC UNION COL	HDD	582	478	470	326	203	73	13	16	55	173	438	599	3426
		CDD	0	0	0	7	43	99	177	160	119	48	6	0	659
009	ANTIOCH PUMP PLANT #3	HDD	600	404	332	206	99	18	4	1	10	99	344	597	2714
		CDD	0	0	4	30	106	200	296	270	190	77	6	0	1179
012	ASH MOUNTAIN	HDD	557	410	377	251	117	10	0	0	12	107	353	547	2741
		CDD	0	0	8	35	145	313	518	500	316	130	11	0	1976
013	AUBERRY 2 NW	HDD	566	434	409	259	123	12	0	0	13	109	375	568	2868
		CDD	0	0	5	35	145	304	511	482	316	117	7	0	1922
014	AUBURN	HDD	593	437	405	269	142	27	1	1	21	126	386	584	2992
		CDD	0	0	3	16	90	203	372	352	232	93	5	0	1366
015	AVALON PLEASURE PIER	HDD	257	221	211	155	127	79	29	16	31	53	156	254	1589
		CDD	0	4	12	28	63	89	124	164	153	81	25	6	749
016	BAKER	HDD	530	312	187	81	13	0	0	0	0	51	274	563	2011
		CDD	0	1	41	163	372	634	836	791	544	210	15	0	3607
017	BAKERSFIELD KERN CO AP	HDD*	521	324	236	119	31	3	0	0	2	55	293	536	2120
		CDD*	0	1	7	56	205	392	577	540	368	138	2	0	2286
018	BALCH POWER HOUSE	HDD	621	453	389	255	134	35	2	0	11	114	406	625	3045
		CDD	0	0	6	35	133	267	459	463	309	119	3	0	1794
019	BARSTOW FIRE STATION	HDD	531	360	278	148	44	1	0	0	2	73	311	546	2294
		CDD	0	1	21	92	223	443	639	597	392	147	11	0	2566
020	BEAUMONT 1 E	HDD	412	332	317	218	127	22	0	0	8	71	247	407	2161
		CDD	0	1	12	31	109	219	390	404	279	106	16	5	1572
021	BEN LOMOND NO 4	HDD	501	386	367	257	167	67	23	13	54	148	368	520	2871
		CDD	0	0	1	6	29	62	99	96	86	20	1	0	400
023	BERKELEY	HDD	466	344	337	263	198	123	85	80	82	119	300	460	2857
		CDD	0	0	0	1	11	18	22	23	46	18	3	0	142
024	BIG BAR 4 E	HDD	723	544	474	327	163	42	6	1	38	221	550	742	3831
		CDD	0	0	0	9	47	142	293	281	147	20	0	0	939
025	BIG BEAR LAKE	HDD	965	839	828	657	461	208	73	105	241	519	756	946	6598
		CDD	0	0	0	0	3	10	39	33	4	0	0	0	89
030	BISHOP AP	HDD*	843	643	545	344	138	21	1	1	46	276	609	847	4314
		CDD*	0	0	0	3	45	191	357	293	106	8	0	0	1003
032	BLUE CANYON	HDD	813	733	769	617	397	165	48	54	166	367	667	803	5599
		CDD	0	0	0	1	15	41	129	125	84	28	0	0	423
033	BLYTHE	HDD	358	202	126	44	5	0	0	0	0	14	168	378	1295
		CDD	0	10	81	207	424	662	861	825	609	270	27	1	3977
034	BLYTHE AP	HDD	343	184	108	40	7	0	0	0	0	17	164	363	1226
		CDD	7	13	72	217	438	701	890	851	631	296	45	5	4166
035	BOCA	HDD	1199	1001	944	751	548	324	168	183	344	608	888	1149	8107
		CDD	0	0	0	0	0	4	20	10	1	0	0	0	35
036	BODIE	HDD	1305	1132	1124	919	700	445	287	315	499	788	1043	1285	9842
		CDD	0	0	0	0	0	0	3	1	0	0	0	0	4
037	BORREGO DESERT PARK	HDD	285	181	151	73	19	0	0	0	0	16	122	283	1130
		CDD	10	23	92	195	366	612	810	791	603	333	79	14	3928
038	BOWMAN DAM	HDD	909	816	831	669	465	209	85	76	176	404	711	896	6247
		CDD	0	0	0	0	7	28	103	105	53	15	0	0	311
039	BRAWLEY 2 SW	HDD	322	186	122	46	5	0	0	0	0	10	136	328	1155
		CDD	5	10	64	169	353	588	787	790	610	305	49	3	3733
040	BRIDGEPORT	HDD	1262	1050	966	761	567	311	148	181	374	662	940	1217	8439
		CDD	0	0	0	0	0	3	18	15	1	0	0	0	37
042	BROOKS FARNHAM RANCH	HDD	595	426	373	230	98	6	0	0	10	103	381	593	2815
		CDD	0	0	1	17	105	244	372	355	222	75	2	0	1393
045	BURBANK VALLEY PUMP PLN	HDD	320	232	221	132	77	28	2	0	12	38	187	326	1575
		CDD	1	5	15	49	104	200	327	347	266	117	20	4	1455
046	BURNEY	HDD	1026	792	753	584	386	180	78	91	236	518	815	1036	6495
		CDD	0	0	0	0	3	23	97	59	14	0	0	0	196
048	BUTTONWILLOW	HDD	612	387	295	169	59	2	0	0	10	110	382	642	2668
		CDD	0	0	14	56	178	322	478	432	276	98	3	0	1857
049	CACHUMA LAKE	HDD	379	299	295	202	116	33	4	1	18	58	218	371	1994
		CDD	0	1	10	24	61	121	220	246	183	81	20	3	970

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			DEGREE DAYS (Total)												
050	CALAVERAS BIG TREES	HDD	893	780	779	622	423	176	55	53	178	417	711	885	5972
		CDD	0	0	0	0	14	37	105	93	47	12	0	0	308
052	CALISTOGA	HDD	551	406	369	270	129	26	2	1	18	116	372	551	2811
		CDD	0	0	4	15	51	130	224	210	138	45	2	0	819
053	CALLAHAN	HDD	912	704	665	503	320	143	37	31	146	399	715	918	5493
		CDD	0	0	0	0	7	42	130	102	32	2	0	0	315
054	CAMPO	HDD	522	440	438	319	198	69	9	10	42	170	381	535	3133
		CDD	0	0	0	10	34	99	234	257	153	33	1	0	821
055	CAMP PARDEE	HDD	595	412	363	227	107	14	0	0	8	102	346	584	2758
		CDD	0	0	5	22	114	242	402	378	256	108	7	0	1534
056	CAMP PENDLETON MCAS	HDD	313	257	251	195	116	47	10	5	13	75	199	310	1791
		CDD	4	4	12	32	62	99	180	216	180	88	21	5	903
057	CANBY 3 SW	HDD	1071	864	805	628	417	193	63	76	245	537	861	1082	6842
		CDD	0	0	0	0	1	24	96	68	10	0	0	0	199
058	CANOGA PARK PIERCE COLL	HDD	349	272	260	163	104	29	1	0	10	55	221	358	1822
		CDD	0	3	16	49	111	208	341	365	263	109	18	2	1485
059	CANYON DAM	HDD	1039	858	820	626	409	188	70	84	209	484	798	1024	6609
		CDD	0	0	0	0	5	27	102	84	27	2	0	0	247
061	CECILVILLE	HDD	843	667	633	471	275	119	46	33	125	355	669	880	5116
		CDD	0	0	0	11	19	82	207	185	91	20	0	0	615
062	CEDARVILLE	HDD	1086	864	798	610	400	167	36	39	192	487	834	1076	6589
		CDD	0	0	0	0	7	52	173	143	41	4	0	0	420
065	CHERRY VALLEY DAM	HDD	802	694	679	515	319	104	13	16	112	324	612	790	4980
		CDD	0	0	0	6	32	81	205	199	104	28	1	0	656
066	CHESTER	HDD	1055	863	819	633	431	210	80	84	218	495	812	1043	6743
		CDD	0	0	0	0	7	28	82	52	14	1	0	0	184
067	CHICO UNIVERSITY FARM	HDD	637	439	368	223	93	8	0	0	12	130	403	632	2945
		CDD	0	0	2	24	114	229	367	323	207	67	1	0	1334
069	CHULA VISTA	HDD	243	194	190	126	91	40	8	4	8	31	138	248	1321
		CDD	4	5	10	20	50	83	165	214	193	95	18	5	862
070	CLEARLAKE 4 SE	HDD	666	533	510	373	205	48	9	5	54	225	500	676	3804
		CDD	0	0	0	7	35	117	253	218	103	20	0	0	753
071	CLOVERDALE	HDD	539	392	348	206	95	12	0	4	20	117	349	557	2639
		CDD	0	0	8	31	102	194	280	249	183	75	5	0	1127
072	COALINGA	HDD	524	337	262	142	48	1	0	0	3	65	308	544	2234
		CDD	0	0	17	71	209	376	544	508	342	130	7	0	2204
075	COLFAX	HDD	607	491	483	341	191	53	11	6	51	190	463	625	3512
		CDD	0	0	1	12	66	174	325	291	184	61	2	0	1116
077	COLUSA 2 SSW	HDD	603	406	329	190	67	4	0	0	8	105	385	605	2702
		CDD	0	0	6	27	145	262	367	322	202	68	2	0	1401
079	CORCORAN IRRIG DIST	HDD	587	377	288	155	50	2	0	0	3	79	354	612	2507
		CDD	0	0	11	55	178	331	476	446	298	111	3	0	1909
081	CORONA	HDD	322	245	229	142	73	14	0	1	8	44	192	329	1599
		CDD	1	5	14	54	113	204	336	375	283	125	22	2	1534
082	COVELO	HDD	697	535	496	358	201	57	16	5	49	247	540	724	3925
		CDD	0	0	0	4	21	96	238	202	99	24	0	0	684
084	CRESCENT CITY 3 NNW	HDD	571	483	506	452	378	284	221	207	234	335	469	576	4716
		CDD	0	0	0	0	0	0	0	3	3	0	0	0	6
087	CULVER CITY	HDD	258	203	192	123	81	28	8	8	17	32	142	252	1344
		CDD	1	4	13	41	68	116	185	213	190	97	27	4	959
088	CUYAMACA	HDD	779	660	652	518	369	140	23	38	121	358	591	778	5027
		CDD	0	0	0	2	18	58	147	152	70	10	0	0	457
089	DAGGETT BARSTOW AP	HDD	528	348	263	134	36	0	0	0	2	69	303	545	2228
		CDD	0	2	33	112	276	510	709	662	434	164	13	0	2915
090	DAVIS 2 WSW EXP FARM	HDD	614	425	358	215	99	11	0	1	15	109	386	620	2853
		CDD	0	0	3	20	104	202	289	261	185	61	2	0	1127
091	DEATH VALLEY	HDD	401	176	73	16	1	0	0	0	0	10	156	424	1257
		CDD	1	17	138	328	615	884	1103	1046	753	366	45	0	5296
093	DEEP SPRINGS COLLEGE	HDD	987	751	652	438	226	43	1	4	80	374	739	998	5293
		CDD	0	0	0	12	50	155	309	237	72	8	0	0	843
094	DEER CREEK FOREBAY	HDD	744	669	667	509	317	105	25	21	106	306	581	736	4786
		CDD	0	0	0	9	35	68	202	207	124	45	2	0	692
096	DE SABLA	HDD	696	570	557	401	222	67	9	9	56	218	531	704	4040
		CDD	0	0	0	9	39	123	246	228	127	34	0	0	806
098	DOBBINS 1 S	HDD	617	485	466	326	176	38	2	1	33	182	462	630	3418
		CDD	0	0	0	6	56	151	298	265	152	41	0	0	969
099	DONNER MEMORIAL ST PK	HDD	1179	1001	987	794	589	335	167	183	344	625	917	1163	8284
		CDD	0	0	0	0	0	4	18	19	3	0	0	0	44

DEGREE DAYS (Total)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
101	DOWNIEVILLE	HDD	804	643	606	452	281	95	19	28	104	312	622	816	4782
		CDD	0	0	0	3	19	56	142	137	67	14	0	0	438
103	DOYLE 4 SSE	HDD	1007	777	705	540	345	150	42	40	175	452	767	1013	6013
		CDD	0	0	0	0	10	48	132	94	29	1	0	0	314
104	DRY CANYON RESERVOIR	HDD	457	385	374	251	142	29	4	2	21	97	293	447	2502
		CDD	0	0	7	27	64	150	286	316	212	67	10	0	1139
105	DUNSMUIR TREATMENT PLAN	HDD	801	657	631	449	248	80	16	16	103	303	618	789	4711
		CDD	0	0	0	2	18	73	186	147	70	7	0	0	503
106	EAGLE MOUNTAIN	HDD	315	178	133	46	7	0	0	0	0	11	129	312	1131
		CDD	7	19	107	234	446	709	879	836	635	326	68	11	4277
107	EAST PARK RESERVOIR	HDD	666	514	474	322	160	25	3	1	29	180	461	663	3498
		CDD	0	0	0	6	64	173	341	297	159	41	1	0	1082
108	EL CAJON	HDD	315	238	222	131	77	13	0	0	7	40	183	334	1560
		CDD	0	4	13	44	94	170	301	340	275	114	13	3	1371
109	EL CAPITAN DAM	HDD	289	227	223	140	81	14	0	0	4	28	137	276	1419
		CDD	6	10	16	56	111	214	357	405	322	171	35	9	1712
110	EL CENTRO 2 SSW	HDD	293	165	120	47	7	0	0	0	0	10	127	311	1080
		CDD	6	16	88	191	388	626	817	810	625	323	58	4	3952
111	EL TORO MCAS	HDD	268	215	210	153	97	37	8	10	16	44	148	259	1465
		CDD	3	6	15	47	73	136	236	270	228	119	41	9	1183
112	ELECTRA P H	HDD	579	427	384	250	112	16	0	0	14	114	372	586	2854
		CDD	0	0	1	12	82	195	350	314	201	62	1	0	1218
115	EL MIRAGE	HDD	707	538	473	304	142	19	0	2	28	195	486	722	3616
		CDD	0	0	3	26	102	236	397	369	194	43	0	0	1370
116	ELSINORE	HDD	398	305	263	163	73	10	0	0	8	63	236	405	1924
		CDD	0	4	13	58	134	267	451	469	327	133	15	3	1874
117	ESCONDIDO NO 2	HDD	294	229	213	129	73	15	1	0	6	35	168	301	1464
		CDD	0	4	13	48	103	186	312	345	274	126	21	4	1436
118	EUREKA WFO WOODLEY IS	HDD	530	451	475	430	354	263	216	198	232	326	423	532	4430
		CDD	0	0	0	0	0	0	0	2	5	0	0	0	7
120	FAIRFIELD	HDD	586	390	321	201	99	18	1	2	14	95	340	582	2649
		CDD	0	0	4	16	78	151	237	239	176	68	6	0	975
121	FAIRMONT	HDD	610	475	441	311	168	32	1	2	25	153	385	596	3199
		CDD	0	0	9	40	108	237	410	413	273	107	11	0	1608
123	FIVE POINTS 5 SSW	HDD	551	360	294	163	49	3	0	0	5	90	349	582	2446
		CDD	0	0	18	48	170	304	446	403	277	110	8	0	1784
124	FOLSOM DAM	HDD	563	377	321	197	86	10	0	0	7	86	328	557	2532
		CDD	0	0	8	30	116	240	392	363	258	113	8	0	1528
126	FONTANA KAISER (ONTARIO	HDD	270	196	203	149	72	16	0	0	4	27	154	273	1364
		CDD	9	13	31	74	125	250	411	435	338	165	43	7	1901
128	FORT BIDWELL	HDD	1101	863	782	589	390	188	53	60	205	489	837	1096	6653
		CDD	0	0	0	0	4	32	115	100	29	1	0	0	281
129	FORT BRAGG 5 N	HDD	516	445	442	392	346	258	217	210	207	302	416	538	4289
		CDD	0	0	0	0	0	0	1	3	2	0	0	0	6
132	FORT ROSS	HDD	509	417	431	409	359	276	249	218	217	281	384	501	4251
		CDD	0	0	0	0	0	0	0	1	4	1	0	0	6
133	FRESNO YOSEMITE INTL	HDD*	578	377	283	140	37	4	0	0	3	73	354	598	2447
		CDD*	0	0	3	40	170	351	524	478	307	89	1	0	1963
134	FRIANT GOVERNMENT CAMP	HDD	576	388	342	219	84	6	0	0	10	97	359	591	2672
		CDD	0	0	6	30	129	277	454	424	278	104	6	0	1708
140	GILROY	HDD	477	329	284	178	95	19	2	1	13	92	298	490	2278
		CDD	0	0	6	22	76	141	218	213	164	69	4	0	913
142	GLENNVILLE	HDD	720	591	580	459	289	99	20	28	103	311	568	730	4498
		CDD	0	0	0	0	13	50	148	136	69	11	0	0	427
145	GRANT GROVE	HDD	940	848	896	757	568	270	108	119	247	501	747	907	6908
		CDD	0	0	0	0	6	13	51	52	24	9	0	0	155
146	GRASS VALLEY NO 2	HDD	708	584	578	429	257	82	18	17	88	265	549	712	4287
		CDD	0	0	0	3	27	83	200	182	97	20	0	0	612
147	GRATON	HDD	579	422	389	278	166	70	25	26	65	169	398	592	3179
		CDD	0	0	0	1	15	52	70	69	65	16	0	0	288
150	GRIZZLY CREEK STATE PAR	HDD	682	555	550	439	298	175	77	77	163	344	554	696	4610
		CDD	0	0	0	0	1	3	14	13	7	0	0	0	38
152	HAIWEE	HDD	760	565	477	302	152	14	0	1	27	204	517	765	3784
		CDD	0	0	5	27	116	251	424	383	190	44	1	0	1441
153	HALF MOON BAY	HDD	443	376	391	368	328	250	210	177	176	254	341	440	3754
		CDD	0	0	0	0	0	0	2	3	4	2	0	0	11
154	HANFORD 1 S	HDD	630	416	324	179	56	3	0	0	6	102	383	650	2749
		CDD	0	0	13	46	157	302	450	413	255	86	2	0	1724

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			DEGREE DAYS (Total)												
155	HAPPY CAMP RANGER STN	HDD	754	590	532	391	222	71	14	8	67	277	559	770	4255
		CDD	0	0	0	4	28	92	230	217	90	10	0	0	671
158	HAT CREEK	HDD	946	734	683	508	307	124	44	42	166	433	739	959	5685
		CDD	0	0	0	0	8	44	139	92	29	2	0	0	314
159	HAYFIELD PUMPING PLANT	HDD	396	258	189	85	20	0	0	0	0	36	205	399	1588
		CDD	0	6	46	138	309	533	731	698	496	210	27	2	3196
161	HEALDSBURG	HDD	517	359	318	193	87	16	0	2	27	110	342	530	2501
		CDD	0	0	4	18	79	163	224	194	134	35	2	0	853
164	HENSHAW DAM	HDD	615	500	484	353	227	73	16	12	62	224	455	630	3651
		CDD	0	0	0	4	30	93	233	253	143	30	0	0	786
165	HETCH HETCHY	HDD	802	646	623	458	292	100	20	20	91	290	593	805	4740
		CDD	0	0	0	7	31	75	188	186	100	31	1	0	619
166	HOLLISTER 2	HDD	482	367	346	251	180	70	35	22	42	111	316	502	2724
		CDD	0	0	2	11	31	52	83	94	93	36	3	0	405
167	HUNTINGTON LAKE	HDD	900	820	862	742	584	339	165	168	302	531	745	893	7051
		CDD	0	0	0	0	0	10	32	31	17	3	0	0	93
168	IDYLLWILD FIRE DEPT	HDD	768	684	682	543	389	162	41	57	124	342	586	751	5129
		CDD	0	0	0	2	15	35	99	117	55	10	0	0	333
169	IMPERIAL	HDD	309	172	116	47	7	0	0	0	0	12	129	323	1115
		CDD	4	13	73	186	365	600	783	780	606	303	48	3	3764
171	INDEPENDENCE	HDD	747	561	464	273	114	8	0	0	13	178	488	733	3579
		CDD	0	0	10	39	160	343	517	444	235	55	1	0	1804
172	INDIO FIRE STATION	HDD	267	135	81	23	4	0	0	0	0	6	109	278	903
		CDD	11	30	125	261	464	692	860	836	655	370	74	10	4388
173	INYOKERN	HDD	599	406	322	175	59	2	0	0	3	94	366	607	2633
		CDD	0	0	18	73	215	412	603	558	339	115	7	0	2340
175	IRON MOUNTAIN	HDD	326	176	118	35	5	0	0	0	0	13	146	337	1156
		CDD	6	18	104	240	481	749	931	880	659	328	69	11	4476
176	JESS VALLEY	HDD	1099	921	919	733	532	279	125	127	299	566	882	1093	7575
		CDD	0	0	0	0	0	14	68	50	24	2	0	0	158
179	KENTFIELD	HDD	513	358	323	215	121	41	9	7	28	112	327	513	2567
		CDD	0	0	3	10	41	98	140	130	98	35	2	0	557
180	KERN RIVER PH 1	HDD	427	233	195	111	27	0	0	0	0	25	197	430	1645
		CDD	0	6	52	157	315	525	702	662	509	270	36	2	3236
181	KERN RIVER PH 3	HDD	607	465	422	277	120	19	0	0	16	140	425	612	3103
		CDD	0	0	4	31	105	259	446	429	247	71	1	0	1593
183	KING CITY	HDD	460	330	301	202	119	40	8	4	27	106	311	476	2384
		CDD	0	0	6	21	46	89	131	132	120	50	3	0	598
184	KLAMATH	HDD	576	494	490	438	352	245	184	181	213	326	465	589	4553
		CDD	0	0	0	0	0	0	0	1	4	0	0	0	5
186	LAGUNA BEACH	HDD	299	257	253	180	120	58	19	19	22	59	174	296	1756
		CDD	0	4	5	20	42	75	132	159	147	72	10	0	666
187	LAKE ARROWHEAD	HDD	871	735	705	525	363	138	35	50	123	381	664	860	5450
		CDD	0	0	0	6	27	60	139	153	67	10	0	0	462
188	LAKEPORT	HDD	677	524	477	349	183	45	7	5	44	210	500	677	3698
		CDD	0	0	0	6	37	116	258	234	114	28	0	0	793
191	LAKE SOLANO	HDD	606	418	345	207	94	7	0	0	10	87	352	590	2716
		CDD	0	0	6	30	128	250	369	333	225	75	4	0	1420
192	LAKE SPAULDING	HDD	918	807	798	660	462	218	88	83	200	450	756	939	6379
		CDD	0	0	0	0	6	20	61	53	34	5	0	0	179
193	LA MESA	HDD	249	195	193	127	87	25	4	2	10	30	138	253	1313
		CDD	3	5	14	45	80	139	251	302	255	128	32	7	1261
194	LANCASTER ATC	HDD	655	487	411	249	112	8	0	0	18	161	451	689	3241
		CDD	0	0	5	38	145	301	488	448	246	61	1	0	1733
195	LAVA BEDS NAT MONUMENT	HDD	1023	832	806	614	404	188	47	53	180	436	790	1022	6395
		CDD	0	0	0	0	8	42	136	139	54	8	0	0	387
198	LEE VINING	HDD	1094	903	835	611	395	156	29	41	181	456	754	1058	6513
		CDD	0	0	0	0	6	37	119	100	18	1	0	0	281
199	LEMON COVE	HDD	550	346	267	149	51	2	0	0	4	78	328	561	2336
		CDD	0	0	14	55	177	332	491	452	298	115	5	0	1939
200	LEMOORE REEVES NAS	HDD	592	380	312	178	77	5	0	0	10	101	379	626	2660
		CDD	0	0	17	47	168	295	423	383	254	90	3	0	1680
201	LINDSAY	HDD	556	368	291	160	58	3	0	0	10	108	365	586	2505
		CDD	0	0	11	44	151	298	450	407	257	86	3	0	1707
202	LIVERMORE	HDD	555	391	349	238	130	34	6	4	19	111	358	560	2755
		CDD	0	0	2	18	60	131	222	216	154	53	2	0	858
203	LODGEPOLE	HDD	1172	997	993	828	626	351	176	197	362	650	939	1169	8460
		CDD	0	0	0	0	0	3	14	12	2	0	0	0	31

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
			DEGREE DAYS (Total)												
204	LODI	HDD	587	388	323	185	92	16	2	2	21	109	379	606	2710
		CDD	0	0	4	18	99	184	274	248	179	50	1	0	1057
205	LOMPOC	HDD	350	272	260	215	170	98	71	48	64	105	237	360	2250
		CDD	0	2	7	12	13	25	54	66	84	44	14	1	322
206	LONG BEACH AP	HDD*	267	205	186	99	39	5	0	0	1	16	128	265	1211
		CDD*	3	5	10	28	55	135	260	302	244	119	20	5	1186
208	LOS ANGELES INTL AP	HDD*	252	205	200	141	78	19	1	0	2	21	121	234	1274
		CDD*	4	6	6	15	19	58	135	175	154	81	22	4	679
209	LOS ANGELES DOWNTOWN US	HDD*	207	149	144	83	36	5	0	0	1	11	91	201	928
		CDD*	15	23	26	58	84	178	295	325	281	164	44	13	1506
210	LOS BANOS	HDD	594	380	298	174	64	6	0	0	4	84	354	612	2570
		CDD	0	0	9	40	130	255	404	373	246	87	3	0	1547
212	LOS BANOS DET RESV	HDD	582	376	299	173	85	12	0	0	3	69	314	577	2490
		CDD	0	0	9	46	153	282	435	407	278	110	6	0	1726
213	LOS GATOS	HDD	506	370	337	231	134	36	8	1	29	122	345	522	2641
		CDD	0	0	1	8	42	93	170	150	117	32	0	0	613
217	MADERA	HDD	599	399	309	175	61	4	0	0	6	107	380	630	2670
		CDD	0	0	7	38	148	296	454	419	259	83	2	0	1706
219	MANZANITA LAKE	HDD	1039	919	919	762	546	300	149	161	289	561	867	1031	7543
		CDD	0	0	0	0	0	8	40	29	12	1	0	0	90
220	MARICOPA	HDD	534	327	259	148	41	2	0	0	3	51	286	539	2190
		CDD	0	0	16	77	203	394	568	535	373	161	7	0	2334
222	MARKLEEVILLE	HDD	1052	879	850	675	474	236	85	108	275	564	827	1066	7091
		CDD	0	0	0	0	0	11	44	39	3	0	0	0	97
223	MARKLEY COVE	HDD	608	452	402	272	132	24	1	0	14	113	383	595	2996
		CDD	0	0	3	18	75	174	310	290	186	54	1	0	1111
224	MARTINEZ WATER PLANT	HDD	582	402	335	212	106	28	4	5	33	115	362	573	2757
		CDD	0	0	2	17	66	143	195	185	139	37	2	0	786
225	MARYSVILLE	HDD	579	372	289	157	57	4	0	0	10	88	350	582	2488
		CDD	0	0	9	45	165	299	430	385	255	94	5	0	1687
227	MC CLOUD	HDD	906	752	727	545	335	131	44	37	157	398	713	896	5641
		CDD	0	0	0	0	11	46	145	106	53	7	0	0	368
228	MECCA FIRE STATION	HDD	321	174	90	25	2	0	0	0	0	14	150	342	1118
		CDD	5	19	93	223	421	637	809	796	604	306	43	2	3958
229	MERCED	HDD	581	387	317	186	67	6	0	0	5	89	359	605	2602
		CDD	0	0	6	34	133	273	420	385	249	77	1	0	1578
231	MINERAL	HDD	1033	890	884	728	536	300	157	167	305	567	848	1021	7436
		CDD	0	0	0	0	0	5	39	28	9	0	0	0	81
232	MITCHELL CAVERNS	HDD	600	460	425	233	96	9	0	0	7	122	364	586	2902
		CDD	0	0	14	48	159	376	544	492	302	114	15	2	2066
233	MODESTO CITY-COUNTY AP	HDD	551	339	267	140	62	6	0	0	7	85	331	570	2358
		CDD	0	0	16	41	145	266	393	362	248	93	6	0	1570
234	MOJAVE	HDD	586	433	376	232	94	4	0	0	10	121	381	598	2835
		CDD	0	0	13	50	163	343	533	494	291	86	3	0	1976
235	MONTEBELLO	HDD	200	152	146	80	45	9	0	0	4	15	97	201	949
		CDD	8	12	39	88	139	235	360	385	322	179	55	15	1837
236	MONTEREY	HDD	416	335	333	290	266	193	156	123	113	157	290	420	3092
		CDD	0	0	0	0	4	6	8	10	30	14	2	0	74
237	MORRO BAY FIRE DEPT	HDD	404	347	345	324	306	233	196	174	174	189	276	401	3369
		CDD	0	0	0	0	0	0	1	8	28	11	2	0	50
238	MOUNTAIN PASS	HDD	795	628	563	365	174	13	0	0	26	231	532	778	4105
		CDD	0	0	11	33	96	275	449	391	190	47	2	0	1494
239	MOUNT DIABLO JUNCTION	HDD	545	451	451	337	237	105	29	12	44	147	379	530	3267
		CDD	0	0	1	8	53	132	259	239	188	89	13	1	983
240	MOUNT HAMILTON	HDD	669	608	645	520	346	130	37	30	112	272	533	664	4566
		CDD	0	0	0	7	39	89	212	196	142	56	6	0	747
242	MOUNT SHASTA	HDD	921	753	738	563	374	175	66	65	196	451	753	936	5991
		CDD	0	0	0	0	7	31	100	66	29	2	0	0	235
243	MT WILSON NO 2	HDD	640	570	594	452	304	79	7	14	76	241	445	617	4039
		CDD	0	0	12	23	74	133	244	240	157	72	10	4	969
245	NAPA STATE HOSPITAL	HDD	529	370	335	231	133	49	9	13	31	105	347	537	2689
		CDD	0	0	2	9	42	94	120	120	105	34	3	0	529
246	NEEDLES AP	HDD	346	192	138	41	5	0	0	0	0	14	146	345	1227
		CDD	5	16	110	235	482	759	963	910	673	331	56	5	4545
247	NEVADA CITY	HDD	741	616	606	454	276	94	22	31	110	300	570	745	4565
		CDD	0	0	0	8	28	86	201	193	117	53	3	0	689
248	NEWARK (OAKLAND)	HDD	471	331	290	197	129	52	19	7	35	82	280	474	2367
		CDD	0	1	6	15	42	79	112	115	118	40	2	0	530

DEGREE DAYS (Total)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
249	NEW CUYAMA FIRE STN	HDD	585	468	455	324	168	35	4	5	37	199	445	596	3321
		CDD	0	0	2	15	61	158	303	271	144	41	1	0	996
251	NEWMAN	HDD	601	395	323	195	79	6	0	0	8	97	365	611	2680
		CDD	0	0	7	39	133	251	376	333	225	81	4	0	1449
252	NEWPORT BEACH HARBOR	HDD	284	236	224	171	128	76	25	30	34	66	167	278	1719
		CDD	3	3	3	5	25	55	95	143	126	68	15	2	543
256	OAKLAND MUSEUM	HDD	438	298	282	202	143	89	60	45	69	89	257	428	2400
		CDD	0	1	6	8	23	49	55	72	110	47	6	0	377
258	OCEANSIDE MARINA	HDD	319	275	275	208	137	84	36	34	44	78	205	314	2009
		CDD	0	1	1	2	18	60	115	145	117	40	6	0	505
260	OJAI	HDD	388	299	289	190	125	46	7	6	24	83	248	387	2092
		CDD	0	1	9	25	63	134	233	253	187	70	12	2	989
261	ORANGE COVE	HDD	589	389	299	170	63	2	0	0	6	82	345	593	2538
		CDD	0	0	12	42	168	327	478	443	289	95	3	0	1857
262	ORICK PRAIRIE CREEK PAR	HDD	654	538	534	491	403	284	207	186	209	350	519	662	5037
		CDD	0	0	0	0	0	0	0	0	3	0	0	0	3
263	ORLAND	HDD	573	395	334	201	88	10	0	0	4	91	355	579	2630
		CDD	0	0	7	30	139	269	406	370	260	96	4	0	1581
264	ORLEANS	HDD	650	483	407	272	147	39	6	2	31	198	480	674	3389
		CDD	0	0	1	8	41	118	259	241	140	23	0	0	831
265	OROVILLE	HDD	612	414	347	212	90	8	0	0	21	121	391	602	2818
		CDD	0	0	4	22	124	263	406	343	198	61	1	0	1422
266	OXNARD (CAMARILLO)	HDD	295	251	246	199	157	88	42	37	58	86	189	288	1936
		CDD	2	4	5	8	16	37	71	98	95	44	19	4	403
268	PACIFICA 4 SSE	HDD	461	371	367	319	262	177	128	128	114	168	327	451	3273
		CDD	0	0	0	4	6	8	8	12	23	9	2	0	72
271	PALMDALE (LANCASTER)	HDD	573	413	353	214	85	6	0	0	7	103	360	590	2704
		CDD	0	0	16	62	163	326	518	496	312	101	4	0	1998
272	PALM SPRINGS	HDD	257	140	111	42	8	0	0	0	0	8	112	273	951
		CDD	18	29	117	243	433	653	840	819	626	349	81	16	4224
273	PALO ALTO	HDD	496	353	312	211	124	46	15	10	53	128	330	506	2584
		CDD	0	0	1	8	41	81	106	101	95	19	0	0	452
275	PALOMAR MOUNTAIN OBS	HDD	674	587	572	433	290	79	10	11	65	230	481	661	4093
		CDD	0	0	8	18	61	149	260	262	161	42	2	0	963
278	PARADISE	HDD	598	470	441	289	149	23	1	2	24	144	413	591	3145
		CDD	0	0	6	25	102	223	398	370	243	91	6	0	1464
279	PARKER RESERVOIR	HDD	352	192	131	41	5	0	0	0	0	13	144	352	1230
		CDD	6	16	109	244	480	753	935	888	679	349	57	7	4523
280	PASADENA	HDD	281	205	200	129	80	20	0	2	8	34	156	283	1398
		CDD	3	11	22	69	106	191	318	352	294	153	33	6	1558
282	PASO ROBLES	HDD	550	404	364	265	135	36	12	4	40	148	394	580	2932
		CDD	0	0	3	12	52	114	215	214	136	39	0	0	785
283	PASO ROBLES MUNICIPAL A	HDD	528	390	363	252	134	25	2	2	28	138	371	556	2789
		CDD	0	0	3	20	78	157	274	271	176	58	1	0	1038
285	PEARBLOSSOM	HDD	593	453	397	243	109	10	0	0	14	120	370	599	2908
		CDD	0	0	10	40	135	297	483	466	259	105	6	0	1801
286	PETALUMA FIRE STA 2	HDD	515	366	345	247	167	65	22	13	32	110	329	530	2741
		CDD	0	0	0	8	23	56	93	88	88	27	2	0	385
288	PINNACLES NATL MONUMENT	HDD	522	413	403	286	167	47	8	5	33	136	358	529	2907
		CDD	0	0	3	14	51	120	242	235	161	50	6	0	882
290	PISMO BEACH	HDD	355	282	280	241	219	137	110	86	108	133	233	347	2531
		CDD	0	0	3	8	10	11	13	18	50	29	5	4	151
293	PLACERVILLE	HDD	605	468	443	312	173	36	10	2	39	179	442	615	3324
		CDD	0	0	1	14	69	165	329	314	199	70	3	0	1164
294	PLACERVILLE IFG	HDD	572	472	460	333	179	31	1	2	33	155	435	583	3256
		CDD	0	0	2	20	91	205	399	379	256	106	11	1	1470
295	POINT ARENA	HDD	536	451	447	416	354	268	224	193	197	300	428	538	4352
		CDD	0	0	0	0	0	0	0	2	2	0	0	0	4
296	POINT MUGU NF	HDD	291	252	250	217	160	89	41	31	47	85	197	301	1961
		CDD	0	0	0	11	14	36	70	96	100	45	14	3	389
297	POMONA FAIRPLEX	HDD	325	252	249	169	101	31	3	2	11	59	198	327	1727
		CDD	1	7	12	33	72	142	273	287	231	103	25	5	1191
298	PORTERVILLE	HDD	507	304	225	118	40	2	0	0	2	50	285	520	2053
		CDD	0	0	19	76	220	386	551	510	346	132	6	0	2246
299	PORTOLA	HDD	1111	905	852	674	477	245	110	133	283	561	864	1088	7303
		CDD	0	0	0	0	0	10	52	37	7	0	0	0	106
301	POTTER VALLEY P H	HDD	612	471	441	319	184	53	8	4	44	193	463	637	3429
		CDD	0	0	0	3	36	111	242	205	121	27	0	0	745

DEGREE DAYS (Total)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
303	PRIEST VALLEY	HDD	674	543	527	391	226	61	10	9	59	233	519	694	3946
		CDD	0	0	0	1	30	90	212	197	107	16	0	0	653
304	QUINCY	HDD	907	702	650	505	308	119	47	65	175	405	679	928	5490
		CDD	0	0	0	1	18	46	129	109	52	9	0	0	364
305	RAMONA FIRE DEPT	HDD	392	320	313	232	141	48	5	5	14	94	242	397	2203
		CDD	0	0	2	17	53	134	253	282	207	73	14	1	1036
306	RANDSBURG	HDD	643	481	430	255	109	7	0	0	11	144	415	639	3134
		CDD	0	0	13	49	162	342	529	486	284	94	6	0	1965
307	RED BLUFF AP	HDD	566	397	340	203	68	5	0	0	11	103	373	581	2647
		CDD	0	0	6	36	158	337	514	456	308	107	4	0	1926
308	REDDING MUNICIPAL AP	HDD	606	445	390	239	99	7	0	0	13	131	420	611	2961
		CDD	0	0	3	22	133	310	504	430	263	74	2	0	1741
309	REDLANDS	HDD	375	287	282	172	102	22	0	0	8	67	219	370	1904
		CDD	0	3	20	59	128	238	400	415	297	126	25	3	1714
310	REDWOOD CITY	HDD	515	371	332	232	145	51	17	12	54	149	358	528	2764
		CDD	0	0	1	8	34	72	109	98	79	21	0	0	422
312	RICHARDSON GR ST PK	HDD	649	513	477	359	216	73	18	5	47	228	495	663	3743
		CDD	0	0	0	0	13	52	163	164	95	13	0	0	500
313	RICHMOND	HDD	464	332	311	234	181	111	93	71	71	107	285	460	2720
		CDD	0	0	1	5	13	26	23	23	63	27	3	0	184
314	RIVERSIDE FIRE STA 3	HDD	305	230	216	129	64	9	0	0	5	34	172	311	1475
		CDD	3	4	17	62	135	256	424	451	337	147	22	5	1863
315	RIVERSIDE CITRUS EXP ST	HDD	339	261	252	148	81	18	0	0	6	46	191	332	1674
		CDD	3	6	20	53	120	230	383	409	308	137	23	5	1697
317	SACRAMENTO AP	HDD	580	387	335	208	97	10	0	0	11	84	359	595	2666
		CDD	0	0	6	24	110	204	320	303	210	66	5	0	1248
318	SACRAMENTO 5 ESE	HDD	521	324	258	136	65	6	0	0	6	66	308	536	2226
		CDD	0	0	11	37	154	263	382	361	270	110	9	0	1597
319	SAGEHEN CREEK	HDD	1195	1016	987	806	616	383	236	247	405	684	966	1200	8741
		CDD	0	0	0	0	0	0	4	2	0	0	0	0	6
320	SAINT HELENA	HDD	531	381	343	216	115	21	5	5	26	116	352	541	2652
		CDD	0	0	3	23	72	134	210	190	134	37	3	0	806
321	SALINAS NO 2	HDD	415	323	310	267	222	143	101	79	88	150	299	430	2827
		CDD	0	0	0	5	7	13	16	24	41	18	4	0	128
322	SALINAS AP	HDD	431	337	326	258	202	119	92	63	75	131	292	444	2770
		CDD	0	0	6	12	18	18	34	35	58	25	4	0	210
325	SALT SPRINGS PWR HOUSE	HDD	653	546	540	393	220	75	10	6	53	202	477	653	3828
		CDD	0	0	1	14	51	142	291	279	175	57	5	0	1015
326	SAN BERNARDINO F S 226	HDD	331	253	236	129	72	10	0	0	6	38	191	333	1599
		CDD	3	5	19	59	146	274	451	468	344	141	21	6	1937
328	SANDBERG	HDD	685	573	587	457	280	73	9	18	85	236	485	698	4186
		CDD	0	0	6	17	44	133	280	290	212	76	8	0	1066
329	SAN DIEGO MIRAMAR NAS	HDD	307	261	260	198	128	60	12	9	23	61	186	303	1808
		CDD	5	8	10	33	53	107	194	234	198	98	31	8	979
330	SAN DIEGO N ISLAND NAS	HDD	256	209	197	136	96	48	20	11	15	50	152	256	1446
		CDD	5	6	9	33	49	75	147	189	166	92	26	4	801
331	SAN DIEGO LINDBERGH AP	HDD*	227	176	160	90	47	10	0	0	1	12	109	231	1063
		CDD*	2	4	5	17	32	81	183	230	199	97	15	1	866
333	SAN FRANCISCO OCEANSIDE	HDD	448	355	352	345	333	277	240	202	174	193	309	437	3665
		CDD	0	0	0	0	0	0	1	4	8	4	0	0	17
334	SAN FRANCISCO INTL AP	HDD*	482	354	339	266	201	120	77	56	62	131	298	476	2862
		CDD*	0	0	0	4	10	21	23	26	38	20	0	0	142
335	SAN FRANCISCO DOWNTOWN	HDD	396	283	271	233	214	150	133	107	95	100	232	383	2597
		CDD	0	2	3	7	9	14	19	26	56	22	5	0	163
338	SAN GABRIEL FIRE DEPT	HDD	273	198	184	110	64	14	0	0	6	26	145	275	1295
		CDD	3	6	23	62	117	207	328	358	295	146	24	6	1575
339	SAN GREGORIO 2 SE	HDD	459	394	413	379	314	220	153	128	136	232	354	468	3650
		CDD	0	0	0	0	0	0	5	7	12	8	0	0	32
340	SAN JACINTO R S	HDD	391	299	286	166	75	13	0	0	5	56	234	389	1914
		CDD	0	3	15	60	139	281	461	474	323	128	16	3	1903
341	SAN JOSE	HDD	450	308	267	170	95	24	4	2	13	82	289	467	2171
		CDD	0	0	9	25	72	131	188	183	146	54	3	0	811
342	SAN LUIS DAM	HDD	613	403	306	175	81	17	1	0	5	78	337	609	2625
		CDD	0	0	6	37	121	234	379	364	251	89	5	0	1486
343	SAN LUIS OBISPO POLYTEC	HDD	364	288	279	220	174	85	34	22	53	65	206	348	2138
		CDD	0	2	6	14	30	58	80	99	120	43	18	6	476
344	SAN PASQUAL ANIMAL PK	HDD	330	255	254	173	98	18	0	1	9	45	200	342	1725
		CDD	0	3	14	43	89	164	289	329	265	104	12	1	1313

United States Climate Normals 1971-2000

CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days

1971-2000

DEGREE DAYS (Total)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
345	SAN RAFAEL CIVIC CENTER	HDD	504	353	319	226	157	65	20	9	46	108	314	500	2621
		CDD	0	0	1	5	35	73	104	102	99	30	2	0	451
346	SANTA ANA FIRE STATION	HDD	222	176	174	110	70	20	1	1	8	22	120	229	1153
		CDD	6	8	23	50	89	149	246	288	253	140	40	7	1299
347	SANTA BARBARA	HDD	324	253	248	172	142	80	26	24	55	73	193	312	1902
		CDD	0	2	6	13	28	48	82	120	111	46	11	3	470
348	SANTA BARBARA MNCPL AP	HDD	369	277	263	193	151	75	22	23	54	92	234	368	2121
		CDD	0	0	5	8	23	50	84	133	125	45	9	0	482
349	SANTA CRUZ	HDD	446	347	343	258	194	101	72	58	85	153	320	459	2836
		CDD	0	0	0	5	11	18	31	35	50	11	1	0	162
351	SANTA MARIA AP	HDD*	419	337	333	291	230	135	68	49	70	141	288	422	2783
		CDD*	0	0	0	4	5	10	23	25	33	18	3	0	121
352	SANTA MONICA PIER	HDD	253	233	233	200	171	105	49	47	56	72	155	236	1810
		CDD	3	4	4	9	18	34	63	98	103	55	29	9	429
353	SANTA PAULA	HDD	323	261	249	182	130	59	19	25	43	79	217	324	1911
		CDD	0	2	8	19	35	68	120	154	131	46	15	4	602
354	SANTA ROSA	HDD	507	356	328	227	144	65	29	36	52	109	328	513	2694
		CDD	0	0	2	5	35	94	110	121	116	41	2	0	526
357	SCOTIA	HDD	514	433	431	368	299	200	134	114	139	246	403	536	3817
		CDD	0	0	0	0	2	3	7	14	16	5	0	0	47
358	SHASTA DAM	HDD	580	445	398	248	113	14	0	0	16	120	387	573	2894
		CDD	0	0	7	36	146	294	502	467	302	121	9	0	1884
359	SHELTER COVE AV	HDD	427	372	369	334	248	174	155	152	152	186	305	412	3286
		CDD	0	0	0	0	3	9	16	21	35	8	0	0	92
362	SIERRA CITY	HDD	820	697	689	523	341	133	30	32	119	335	648	816	5183
		CDD	0	0	0	5	22	60	153	144	78	29	1	0	492
363	SIERRAVILLE R S	HDD	1112	878	804	631	430	206	81	95	242	517	819	1069	6884
		CDD	0	0	0	0	2	12	54	43	8	0	0	0	119
366	SONOMA	HDD	532	370	335	232	132	38	4	2	25	92	344	541	2647
		CDD	0	0	0	8	49	126	186	175	136	36	1	0	717
367	SONORA RS	HDD	656	519	492	345	184	31	4	3	48	195	477	664	3618
		CDD	0	0	0	12	58	146	318	290	167	39	0	0	1030
368	SOUTH ENTR YOSEMITE NP	HDD	927	808	828	681	486	248	112	98	235	484	750	909	6566
		CDD	0	0	0	0	5	13	58	31	19	5	0	0	131
372	STOCKTON AP	HDD*	592	391	313	169	54	6	0	0	5	76	348	609	2563
		CDD*	0	0	0	18	111	254	390	363	247	73	0	0	1456
373	STOCKTON FIRE STN # 4	HDD	600	391	322	186	87	12	2	1	19	98	364	604	2686
		CDD	0	0	7	20	108	203	304	290	206	62	3	0	1203
375	STONY GORGE RESERVOIR	HDD	639	484	441	288	135	18	1	0	18	151	445	648	3268
		CDD	0	0	0	15	97	232	399	354	210	67	2	0	1376
376	STRAWBERRY VALLEY	HDD	806	705	695	552	368	161	52	55	150	356	643	796	5339
		CDD	0	0	0	1	12	34	99	90	56	20	0	0	312
377	SUN CITY	HDD	430	328	303	191	89	16	0	0	8	69	253	436	2123
		CDD	0	0	6	53	128	247	410	430	300	118	17	1	1710
378	SUSANVILLE 2 SW	HDD	1060	813	734	541	339	127	37	39	172	473	787	1046	6168
		CDD	0	0	0	1	10	58	164	132	25	0	0	0	390
379	TAHOE CITY	HDD	1076	934	924	763	565	320	142	148	310	585	849	1055	7671
		CDD	0	0	0	0	0	2	20	21	4	0	0	0	47
380	TAHOE VALLEY AP	HDD	1146	989	960	764	574	342	192	220	387	656	922	1148	8300
		CDD	0	0	0	0	0	0	12	22	4	0	0	0	38
381	TEHACHAPI	HDD	718	600	592	442	252	65	7	10	74	280	539	722	4301
		CDD	0	0	0	3	25	95	236	206	94	18	0	0	677
382	TEJON RANCHO	HDD	562	384	323	180	77	6	0	0	10	88	349	576	2555
		CDD	0	0	10	43	172	332	510	456	304	128	5	0	1960
383	TERMO 1 E	HDD	1191	944	881	699	493	258	108	123	304	617	932	1184	7734
		CDD	0	0	0	0	0	14	74	41	5	0	0	0	134
384	THERMAL RGNL AP	HDD	315	170	100	24	1	0	0	0	0	15	169	347	1141
		CDD	5	16	93	221	429	651	811	777	583	279	48	3	3916
385	THREE RIVERS EDISON PH	HDD	556	399	342	205	74	5	0	0	8	99	358	569	2615
		CDD	0	0	5	43	153	334	529	497	312	106	4	0	1983
386	TIGER CREEK PH	HDD	733	554	532	384	222	63	7	7	48	217	529	762	4058
		CDD	0	0	0	7	37	105	240	229	133	37	0	0	788
388	TORRANCE	HDD	272	218	217	149	100	45	10	15	22	44	163	271	1526
		CDD	1	4	7	23	44	82	143	181	158	75	21	3	742
389	TRACY CARBONA	HDD	625	427	354	214	105	20	2	1	13	113	378	628	2880
		CDD	0	0	3	21	95	188	281	250	162	54	2	0	1056
390	TRACY PUMPING PLANT	HDD	556	368	291	167	84	11	0	0	7	71	307	559	2421
		CDD	0	0	10	42	138	231	352	337	252	101	7	0	1470

DEGREE DAYS (Total)

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
391	TRINITY RIVER HATCHERY	HDD	799	619	572	420	230	69	11	8	87	296	609	807	4527
		CDD	0	0	0	5	25	94	229	193	82	13	0	0	641
392	TRONA	HDD	593	355	275	142	50	2	0	0	7	93	347	628	2492
		CDD	0	6	40	125	288	507	686	651	437	171	11	0	2922
393	TRUCKEE RS	HDD	1130	937	903	720	516	275	123	133	283	572	880	1119	7591
		CDD	0	0	0	0	0	8	46	40	6	0	0	0	100
394	TULELAKE	HDD	1108	864	810	618	405	198	85	99	265	554	880	1117	7003
		CDD	0	0	0	0	4	23	74	43	10	0	0	0	154
395	TURLOCK #2	HDD	579	360	289	174	69	4	0	0	8	87	347	602	2519
		CDD	0	0	10	44	134	252	389	357	238	79	3	0	1506
396	TUSTIN IRVINE RANCH	HDD	331	259	255	156	99	37	6	11	29	71	201	339	1794
		CDD	6	4	15	33	74	129	225	262	220	104	23	7	1102
397	TWENTYNINE PALMS	HDD	465	309	220	94	20	0	0	0	0	50	270	482	1910
		CDD	0	2	36	124	307	545	725	677	462	174	12	0	3064
398	TWIN LAKES	HDD	1148	1034	1051	905	705	446	250	251	398	675	951	1124	8938
		CDD	0	0	0	0	0	2	9	12	2	0	0	0	25
399	TWITCHELL DAM	HDD	368	291	291	216	175	92	37	27	59	86	217	359	2218
		CDD	0	0	10	11	30	67	83	101	119	51	13	2	487
400	UKIAH	HDD	571	431	398	282	157	41	7	1	24	159	419	593	3083
		CDD	0	0	1	10	45	120	253	232	140	41	1	0	843
402	U C L A	HDD	229	199	197	142	113	55	11	18	28	42	126	219	1379
		CDD	8	9	15	30	46	92	150	193	183	105	44	18	893
404	UPPER SAN LEANDRO FLTR	HDD	474	357	353	270	202	105	58	38	63	123	302	465	2810
		CDD	0	0	1	7	13	25	44	48	74	45	4	0	261
405	VACAVILLE	HDD	553	362	287	163	66	5	0	0	6	75	333	560	2410
		CDD	0	0	5	36	133	258	380	350	244	88	4	0	1498
408	VICTORVILLE PUMP PLANT	HDD	606	449	382	229	100	7	0	0	11	133	395	617	2929
		CDD	0	0	7	39	137	284	464	451	273	77	3	0	1735
411	VISALIA	HDD	596	381	295	171	63	2	0	0	8	93	364	615	2588
		CDD	0	0	11	46	149	292	443	400	251	90	3	0	1685
412	VISTA 2 NNE	HDD	271	230	230	154	106	37	9	10	14	39	145	269	1514
		CDD	0	4	9	33	70	114	211	256	216	107	21	6	1047
415	WARM SPRINGS DAM	HDD	578	421	387	262	135	32	3	8	34	136	382	584	2962
		CDD	0	0	2	11	49	111	166	154	100	29	2	0	624
416	WASCO	HDD	571	357	265	143	47	2	0	0	4	86	354	605	2434
		CDD	0	0	14	69	194	347	500	455	302	106	3	0	1990
417	WATSONVILLE WATERWORKS	HDD	477	368	360	272	211	130	101	84	104	165	328	480	3080
		CDD	0	0	0	6	9	11	20	21	43	12	1	0	123
418	WEAVERVILLE	HDD	826	648	599	441	233	79	17	10	79	307	623	859	4721
		CDD	0	0	0	3	25	100	235	207	82	12	0	0	664
419	WEED FIRE DEPT	HDD	967	748	721	553	374	170	53	58	197	462	759	961	6023
		CDD	0	0	0	0	3	30	108	100	27	3	0	0	271
422	WHISKEYTOWN RESERVOIR	HDD	637	497	434	276	122	14	0	0	27	157	442	634	3240
		CDD	0	0	3	24	118	250	450	421	262	96	4	0	1628
424	WILDROSE R S	HDD	726	566	489	300	133	14	0	0	21	189	497	728	3663
		CDD	0	0	3	33	127	287	466	417	228	60	2	0	1623
425	WILLITS 1 NE	HDD	669	529	527	434	301	139	56	44	109	285	525	684	4302
		CDD	0	0	0	0	6	20	84	54	26	3	0	0	193
426	WILLOW CREEK 1 NW	HDD	671	506	450	304	154	49	9	2	36	222	480	683	3566
		CDD	0	0	2	9	37	142	291	262	118	26	0	0	887
427	WILLOWS 6 W	HDD	610	431	372	228	106	16	0	0	12	102	391	606	2874
		CDD	0	0	5	21	126	240	357	312	218	77	2	0	1358
428	WINTERS	HDD	583	386	307	167	63	3	0	0	7	89	342	580	2527
		CDD	0	0	10	50	161	291	399	363	256	103	7	0	1640
430	WOODFORDS	HDD	968	793	752	584	379	158	38	50	171	448	757	961	6059
		CDD	0	0	0	0	13	44	140	125	29	5	0	0	356
431	WOODLAND 1 WNW	HDD	600	403	323	188	78	5	0	0	12	105	367	602	2683
		CDD	0	0	9	37	129	244	351	325	227	89	6	0	1417
432	WOODSIDE FIRE STN 1	HDD	524	381	349	245	149	48	9	9	35	125	360	535	2769
		CDD	0	0	1	10	40	86	152	145	105	30	0	0	569
434	YOSEMITE PARK HDQTRS	HDD	849	664	612	429	266	88	16	13	74	283	614	851	4759
		CDD	0	0	0	11	37	110	254	249	128	39	0	0	828
435	YREKA SISKIYOU CO	HDD	959	739	681	496	293	114	25	22	129	393	737	962	5550
		CDD	0	0	0	2	14	76	204	181	68	5	0	0	550

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
002 ADIN RS	HIGHEST MEAN	39.8	45.8	48.3	53.3	59.4	66.5	70.8	70.4	66.9	57.1	48.9	38.9	70.8
	MEDIAN	33.8	36.9	41.3	46.2	53.4	61.0	67.8	66.4	61.1	51.5	40.9	33.4	49.6
	LOWEST MEAN	23.3	27.5	37.1	38.9	47.3	55.9	62.5	62.1	54.2	42.2	31.0	24.1	23.3
	HIGHEST MEAN YEAR	1986	1991	1978	1987	1973	1977	1996	1986	1975	1978	1976	1995	1996
	LOWEST MEAN YEAR	1977	1989	1977	1975	1998	1980	1993	1985	1986	1984	1994	1990	1977
	MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.6	-0.7	-0.5	-0.6	-0.5	-0.6	-0.7	-0.9	-0.9	-0.8	
	MAX OBS TIME ADJUSTMENT	-1.1	-1.1	-1.4	-1.4	-1.6	-1.7	-1.3	-1.4	-1.7	-1.2	-1.4	-1.2	
004 ALPINE	HIGHEST MEAN	60.3	60.6	60.7	65.2	70.3	74.8	79.0	81.4	80.3	73.4	65.1	58.8	81.4
	MEDIAN	54.0	54.6	56.2	59.5	63.2	69.4	74.8	75.7	73.9	66.5	58.8	54.4	63.5
	LOWEST MEAN	48.7	51.3	48.8	52.0	56.8	62.8	68.8	72.1	66.2	62.0	54.3	46.8	46.8
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1984	1998	1984	1999	1995	1980	1998
	LOWEST MEAN YEAR	1973	1979	1973	1975	1977	1982	1987	1987	1986	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.8	-0.9	-0.9	-0.7	-0.6	-0.6	-0.7	-0.9	-1.1	-0.7	-0.9	
006 ALTURAS	HIGHEST MEAN	40.1	41.3	44.2	49.9	58.6	64.1	70.6	68.7	61.3	53.4	42.9	36.7	70.6
	MEDIAN	31.5	34.5	39.3	43.4	51.2	58.9	65.7	65.2	57.9	47.6	37.5	30.5	46.7
	LOWEST MEAN	15.9	22.9	33.8	35.3	44.4	54.3	59.3	59.5	52.6	42.5	28.2	20.8	15.9
	HIGHEST MEAN YEAR	1986	1991	1986	1990	1992	1992	1988	1971	1991	1987	1995	1981	1988
	LOWEST MEAN YEAR	1977	1989	1977	1975	1977	1980	1993	1976	1986	1984	1985	1990	1977
	MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.7	-0.7	-0.5	-0.5	-0.5	-0.6	-0.7	-0.9	-0.9	-0.8	
	MAX OBS TIME ADJUSTMENT	-1.1	-1.1	-1.2	-1.4	-1.6	-1.3	-1.3	-1.4	-1.7	-1.2	-1.4	-1.1	
007 ANAHEIM	HIGHEST MEAN	61.4	63.3	64.6	66.4	71.6	74.7	77.4	78.1	79.8	73.0	67.1	61.9	79.8
	MEDIAN	57.3	57.7	59.0	62.0	65.7	69.7	73.0	74.1	72.9	68.0	62.1	58.2	65.1
	LOWEST MEAN	53.1	54.2	54.7	55.0	61.3	64.7	70.0	70.1	67.9	64.6	57.5	52.5	52.5
	HIGHEST MEAN YEAR	1986	1995	1997	1992	1984	1981	1984	1992	1984	1999	1976	1977	1984
	LOWEST MEAN YEAR	1973	1979	1973	1975	1971	1982	1987	1976	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.8	-0.6	-0.6	-0.7	-1.1	-1.1	-0.7	-0.9	
008 ANGWIN PAC UN	HIGHEST MEAN	50.1	54.2	55.3	60.0	64.9	72.8	74.7	74.3	71.9	66.2	58.4	50.1	74.7
	MEDIAN	46.3	48.2	49.4	53.9	59.7	65.8	70.3	69.7	67.3	60.6	51.5	46.4	57.4
	LOWEST MEAN	42.1	43.3	45.0	49.0	52.9	59.2	65.3	66.0	59.9	55.0	43.8	38.8	38.8
	HIGHEST MEAN YEAR	1984	1991	1988	1987	1992	1981	1988	1998	1974	1991	1976	1989	1988
	LOWEST MEAN YEAR	1987	1989	1985	1975	1998	1980	1987	1985	1985	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.3	-0.8	-0.8	-0.7	-0.7	-1.1	-0.8	-0.7	-0.4	
009 ANTIOCH PUMP	HIGHEST MEAN	51.4	54.7	58.2	64.2	71.9	77.5	79.8	77.5	75.6	69.2	59.8	51.9	79.8
	MEDIAN	45.9	50.5	54.3	59.3	65.6	71.4	74.6	73.8	71.4	64.4	54.2	45.7	60.8
	LOWEST MEAN	39.1	47.2	50.3	51.8	59.1	65.6	70.4	69.9	67.1	58.6	48.3	40.3	39.1
	HIGHEST MEAN YEAR	1995	1991	1993	1987	1997	1981	1988	1992	1984	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1971	1985	1975	1998	1982	1975	1980	1986	1971	1982	1972	1972
	MIN OBS TIME ADJUSTMENT	0.3	0.4	0.0	0.0	-0.2	-0.2	-0.2	-0.3	-0.2	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
012 ASH MOUNTAIN	HIGHEST MEAN	54.0	58.2	58.9	64.2	73.9	80.3	86.4	84.5	80.5	72.5	61.3	52.4	86.4
	MEDIAN	47.0	50.3	52.5	57.9	66.6	75.0	81.7	80.9	75.3	65.5	53.5	47.6	63.2
	LOWEST MEAN	41.6	46.2	46.9	49.9	57.1	69.2	76.1	72.5	68.7	59.6	46.8	41.3	41.3
	HIGHEST MEAN YEAR	1986	1991	1997	1977	1997	1981	1996	1996	1991	1991	1995	1979	1996
	LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1998	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	-0.1	-0.1	-0.1	0.1	
013 AUBERRY 2 NW	HIGHEST MEAN	53.9	56.8	58.7	64.5	73.0	80.4	85.4	83.8	80.5	71.4	58.6	53.3	85.4
	MEDIAN	46.5	49.6	51.4	57.4	66.0	74.9	82.0	80.7	75.0	64.8	52.5	46.7	62.3
	LOWEST MEAN	43.1	45.2	46.3	50.3	55.4	67.7	76.1	74.3	67.0	60.0	46.3	41.5	41.5
	HIGHEST MEAN YEAR	1986	1991	1972	1977	1992	1981	1984	1971	1991	1991	1995	1980	1984
	LOWEST MEAN YEAR	1982	1989	1973	1975	1998	1998	1987	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.5	-0.4	-0.4	-0.6	-0.6	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.6	-0.9	-1.1	-1.1	-1.2	-0.9	-0.8	-1.2	-0.8	-0.7	-0.6	
014 AUBURN	HIGHEST MEAN	52.3	54.4	57.1	62.3	70.3	77.1	81.4	80.0	76.6	69.6	58.6	50.6	81.4
	MEDIAN	45.9	49.8	52.0	56.2	63.5	70.8	77.3	76.5	72.4	63.6	52.7	46.0	60.5
	LOWEST MEAN	41.9	44.6	46.5	49.6	55.7	65.8	70.7	69.8	64.3	57.9	45.5	40.9	40.9
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1981	1996	1996	1975	1991	1995	1979	1996
	LOWEST MEAN YEAR	1985	1990	1991	1975	1998	1980	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.8	0.8	0.6	0.0	0.0	0.0	-0.1	-0.2	0.4	0.2	0.5	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	
015 AVALON PLEASU	HIGHEST MEAN	60.8	61.4	63.1	65.5	68.4	70.6	72.2	72.9	75.7	69.2	64.2	61.3	75.7
	MEDIAN	57.0	57.2	58.6	61.2	62.8	65.6	68.1	69.8	68.8	66.2	61.0	57.0	62.8
	LOWEST MEAN	51.7	53.5	54.0	54.8	58.1	60.2	64.0	65.8	64.3	62.6	56.2	52.7	51.7
	HIGHEST MEAN YEAR	1980	1981	1978	1989	1997	1979	1980	1998	1984	1983	1976	1977	1984
	LOWEST MEAN YEAR	1971	1975	1985	1975	1971	1971	1987	1975	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.7	-0.6	-0.6	-0.6	-1.0	-1.1	-0.7	-0.9	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
016 BAKER	HIGHEST MEAN	53.4	59.1	65.6	75.6	84.5	90.8	95.5	94.7	88.7	76.2	61.9	51.7	95.5
	MEDIAN	47.3	53.3	60.0	67.3	76.7	85.8	91.9	90.4	83.4	70.1	56.7	46.7	69.2
	LOWEST MEAN	43.1	50.2	54.4	60.9	70.4	81.7	87.5	85.5	75.1	64.2	50.4	42.1	42.1
	HIGHEST MEAN YEAR	1986	1977	1972	1989	1997	2000	1989	1998	1974	1988	1995	1977	1989
	LOWEST MEAN YEAR	1979	1990	1991	1975	1977	1991	1987	1983	1985	1984	1982	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.3	-0.2	-0.2	-0.3	-0.4	-0.6	-0.4	-0.4	0.3	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	-0.2	-0.2	-0.2	0.1	
017 BAKERSFIELD K	HIGHEST MEAN	53.9	57.0	62.8	68.7	76.5	83.7	86.2	85.0	81.8	73.9	61.0	56.0	86.2
	MEDIAN	47.9	54.0	57.2	62.8	70.1	77.5	84.1	81.9	76.5	67.5	55.4	46.7	64.9
	LOWEST MEAN	40.8	49.0	52.4	57.7	61.1	70.6	76.5	77.6	69.6	61.1	48.1	42.4	40.8
	HIGHEST MEAN YEAR	1978	1991	1972	1989	1992	1981	1982	1971	1974	1978	1995	1977	1982
	LOWEST MEAN YEAR	1972	1990	1999	1983	1998	1998	1987	1999	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
018 BALCH POWER H	HIGHEST MEAN	51.3	55.7	59.1	64.6	72.5	78.2	84.7	83.7	81.1	71.7	56.6	49.6	84.7
	MEDIAN	44.9	48.6	52.4	56.9	65.4	73.7	79.3	79.9	75.6	64.5	51.6	45.3	61.5
	LOWEST MEAN	41.5	44.0	47.0	50.8	55.6	62.4	72.7	74.6	67.5	59.7	46.9	40.1	40.1
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1996	1991	1991	1995	1977	1996
	LOWEST MEAN YEAR	1972	1998	1973	1975	1998	1998	1983	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.6	-0.5	-0.6	-0.4	-0.5	-0.4	-0.4	-0.6	-0.7	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.2	-1.5	-1.3	-1.5	-1.1	-1.0	-1.5	-1.2	-1.1	-1.0	
019 BARSTOW FIRE	HIGHEST MEAN	53.2	60.5	62.8	70.7	77.2	84.7	89.2	88.1	81.6	75.0	64.0	53.4	89.2
	MEDIAN	47.4	52.3	56.8	63.2	71.3	80.0	86.1	84.5	78.0	66.7	54.5	47.2	65.6
	LOWEST MEAN	42.5	48.0	50.8	54.8	63.4	75.0	81.5	79.5	71.8	62.3	48.0	41.3	41.3
	HIGHEST MEAN YEAR	1996	1995	1972	1989	1997	1981	1996	1998	1979	1988	1995	1977	1996
	LOWEST MEAN YEAR	1979	1979	1973	1975	1998	1998	1987	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.4	-0.3	-0.3	-0.4	-0.6	-0.6	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.3	-1.1	-0.9	-0.9	-0.9	-1.4	-1.3	-0.8	-1.1	
020 BEAUMONT 1 E	HIGHEST MEAN	58.2	59.2	62.1	64.4	71.5	78.1	81.0	82.5	78.8	70.7	62.7	58.5	82.5
	MEDIAN	51.4	53.0	54.1	59.2	64.9	71.9	77.6	77.7	74.2	65.5	56.7	52.3	63.3
	LOWEST MEAN	46.1	47.9	47.9	52.2	57.5	66.0	72.3	74.4	67.0	62.3	50.3	46.0	46.0
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1998	1984	1978	1995	1980	1998
	LOWEST MEAN YEAR	1979	1998	1973	1975	1998	1982	1993	1976	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.3	-0.3	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	-0.7	
	MAX OBS TIME ADJUSTMENT	-1.0	-0.9	-1.0	-1.0	-1.0	-0.7	-0.9	-0.9	-1.2	-1.2	-0.8	-1.0	
021 BEN LOMOND NO	HIGHEST MEAN	52.0	54.5	57.2	60.6	67.3	70.3	71.1	70.5	70.9	63.6	59.3	52.5	71.1
	MEDIAN	48.8	51.6	53.5	56.5	60.6	64.8	67.7	67.7	66.2	61.3	52.8	48.5	58.3
	LOWEST MEAN	45.5	47.1	48.1	51.6	55.5	60.4	63.2	64.8	60.3	57.2	46.6	43.1	43.1
	HIGHEST MEAN YEAR	1986	1995	1978	1992	1997	1981	1996	1998	1984	1999	1995	1977	1996
	LOWEST MEAN YEAR	1982	1989	1991	1975	1998	1991	1994	1989	1986	1981	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.2	-0.8	-0.7	-0.7	-0.6	-1.0	-0.7	-0.7	-0.5	
023 BERKELEY	HIGHEST MEAN	53.0	56.9	57.5	59.8	64.2	66.7	66.3	66.6	68.5	64.6	59.3	53.8	68.5
	MEDIAN	50.2	53.2	54.3	56.1	58.7	61.7	62.7	63.3	63.6	61.9	55.3	50.6	57.5
	LOWEST MEAN	46.4	48.7	50.2	51.0	55.9	58.2	59.7	60.3	60.5	58.9	50.3	45.8	45.8
	HIGHEST MEAN YEAR	1986	1991	1993	1992	1997	1981	1995	1997	1984	1991	1976	1996	1984
	LOWEST MEAN YEAR	1982	1989	1999	1975	1971	1982	1994	1980	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	-0.1	-0.3	-0.3	-0.3	-0.2	-0.1	-0.2	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	
024 BIG BAR 4 E	HIGHEST MEAN	46.0	50.1	54.8	60.2	68.7	73.4	78.4	78.4	74.2	64.3	53.1	46.1	78.4
	MEDIAN	41.4	45.4	49.7	53.8	61.2	68.3	74.8	73.6	68.6	58.7	46.8	41.0	57.0
	LOWEST MEAN	37.7	41.3	45.4	49.8	55.1	63.4	68.2	70.1	63.5	54.0	39.9	34.9	34.9
	HIGHEST MEAN YEAR	1978	1995	1978	1990	1992	1977	1996	1986	1974	1988	1995	1981	1986
	LOWEST MEAN YEAR	1982	1999	1975	1975	1977	1980	1983	1976	1986	1989	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.7	0.8	0.6	0.7	0.0	0.0	0.0	-0.2	0.3	0.2	0.5	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
025 BIG BEAR LAKE	HIGHEST MEAN	41.8	39.8	44.7	49.7	56.5	62.6	67.1	65.8	60.2	52.7	45.4	40.7	67.1
	MEDIAN	33.7	35.3	37.9	43.1	50.3	58.0	63.9	62.3	57.1	48.0	40.3	34.6	46.9
	LOWEST MEAN	27.6	30.3	30.7	33.6	42.4	54.7	60.5	58.7	51.4	43.6	33.8	29.3	27.6
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1984	1994	1996	1986	1997	1978	1995	1980	1996
	LOWEST MEAN YEAR	1979	1973	1991	1975	1977	1982	1987	1976	1986	1971	1994	1971	1979
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.4	-0.3	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.1	-1.0	-0.8	-0.9	-1.0	-1.3	-1.3	-0.8	-1.0	
030 BISHOP AP	HIGHEST MEAN	42.8	48.3	55.2	60.5	69.4	76.5	79.8	78.7	71.0	61.8	51.1	43.1	79.8
	MEDIAN	38.8	42.7	47.6	53.7	62.8	71.0	77.2	74.8	67.2	56.3	44.7	38.3	56.1
	LOWEST MEAN	29.7	37.7	41.9	47.0	54.1	65.3	72.7	70.8	60.6	52.7	37.2	31.6	29.7
	HIGHEST MEAN YEAR	1984	1995	1972	1989	1984	1981	1994	1971	1974	1988	1995	1981	1994
	LOWEST MEAN YEAR	1974	1994	1991	1975	1998	1995	1987	1976	1986	1998	1994	1990	1974
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
032 BLUE CANYON	HIGHEST MEAN	45.4	45.9	45.5	52.4	59.9	65.9	72.4	71.8	70.3	63.1	52.5	47.8	72.4
	MEDIAN	39.1	38.6	39.4	44.0	53.0	60.7	67.4	67.1	62.6	53.0	43.2	38.3	51.0
	LOWEST MEAN	32.5	34.8	33.8	35.7	42.3	55.1	62.0	60.0	52.6	46.8	34.7	30.5	30.5
	HIGHEST MEAN YEAR	1984	1988	1986	1987	1992	1985	1988	1981	1974	1988	1976	1980	1988
	LOWEST MEAN YEAR	1973	1998	1973	1975	1977	1980	1983	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
033 BLYTHE	HIGHEST MEAN	58.2	63.2	70.3	76.8	85.0	91.5	96.2	95.6	89.2	78.9	65.5	57.9	96.2
	MEDIAN	53.4	58.2	63.8	70.2	78.4	86.9	93.2	91.3	85.1	73.1	60.4	52.7	72.3
	LOWEST MEAN	49.1	54.4	57.1	62.0	71.4	83.6	89.8	87.2	78.5	68.9	56.0	48.2	48.2
	HIGHEST MEAN YEAR	1981	1996	1972	1996	1997	1981	1996	1998	1995	1988	1995	1980	1996
	LOWEST MEAN YEAR	1979	1975	1991	1975	1977	1998	1987	1976	1985	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.5	-0.3	-0.3	-0.2	-0.2	-0.4	-0.5	-0.6	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.1	-0.9	-0.7	-0.7	-1.0	-1.2	-1.4	-1.0	-1.2	
034 BLYTHE AP	HIGHEST MEAN	60.8	64.1	69.2	77.2	86.8	94.3	97.5	96.4	89.8	78.8	66.3	60.1	97.5
	MEDIAN	54.4	59.0	64.1	70.8	79.1	88.0	93.8	92.2	86.4	74.0	61.3	53.4	73.0
	LOWEST MEAN	47.5	55.0	59.2	62.5	72.3	83.1	88.8	88.3	78.6	66.3	55.0	47.6	47.5
	HIGHEST MEAN YEAR	1981	1995	1997	1989	1997	1981	1980	1995	1979	1988	1995	1980	1980
	LOWEST MEAN YEAR	1972	1990	1991	1975	1977	1998	1987	1976	1986	1971	1994	1971	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
035 BOCA	HIGHEST MEAN	34.8	35.8	40.4	45.6	52.9	59.9	64.9	63.9	58.1	50.0	41.2	36.1	64.9
	MEDIAN	26.2	29.5	34.9	39.7	47.2	53.8	60.4	59.2	53.2	45.1	34.9	28.4	42.9
	LOWEST MEAN	17.7	19.0	28.1	30.4	41.3	50.9	54.2	54.5	48.8	41.1	27.1	18.3	17.7
	HIGHEST MEAN YEAR	1981	1991	1978	1987	1973	1977	1996	1971	1975	1987	1995	1981	1996
	LOWEST MEAN YEAR	1993	1990	1977	1975	1977	1991	1983	1976	1986	1984	1994	1990	1993
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.4	-0.4	-0.3	-0.5	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
036 BODIE	HIGHEST MEAN	29.4	30.8	36.5	42.2	48.1	55.2	59.8	58.7	53.2	44.6	38.1	31.0	59.8
	MEDIAN	23.1	24.5	28.3	33.6	42.8	49.9	55.5	54.7	48.9	39.5	30.3	23.8	38.2
	LOWEST MEAN	17.6	19.9	21.4	25.5	34.2	46.3	52.3	49.8	42.6	35.3	22.9	16.4	16.4
	HIGHEST MEAN YEAR	1986	1991	1972	1992	1992	1985	1994	1971	1981	1988	1995	1981	1994
	LOWEST MEAN YEAR	1982	1993	1980	1975	1998	1980	1983	1976	1986	1984	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	-0.4	-0.4	-0.6	-0.6	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.8	-1.0	-1.2	-1.1	-1.2	-0.9	-0.8	-1.2	-0.8	-0.8	-0.7	
037 BORREGO DESER	HIGHEST MEAN	61.4	66.7	71.9	77.7	84.5	90.9	94.3	94.4	89.9	82.2	69.8	62.5	94.4
	MEDIAN	56.2	59.2	62.1	68.6	76.3	85.3	91.2	90.5	85.6	75.1	63.7	56.8	72.5
	LOWEST MEAN	50.1	55.2	57.3	60.7	69.0	79.3	85.8	86.5	78.1	68.7	56.3	51.4	50.1
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1989	1995	1979	1988	1995	1980	1995
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1998	1993	1983	1985	1971	1994	1992	1979
	MIN OBS TIME ADJUSTMENT	0.3	0.0	0.0	-0.2	-0.1	-0.1	-0.2	-0.3	-0.4	-0.3	-0.4	0.2	
	MAX OBS TIME ADJUSTMENT	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	
038 BOWMAN DAM	HIGHEST MEAN	41.2	41.6	43.5	49.9	58.8	64.2	70.2	70.9	66.3	61.9	50.5	43.3	70.9
	MEDIAN	36.1	36.1	37.8	42.0	50.3	58.5	65.8	65.9	61.2	51.4	41.8	36.6	48.7
	LOWEST MEAN	30.5	31.2	29.6	33.9	42.1	53.6	59.4	59.8	52.0	45.6	31.5	29.4	29.4
	HIGHEST MEAN YEAR	1986	1977	1972	1987	1992	1981	1994	1996	1974	1988	1976	1989	1996
	LOWEST MEAN YEAR	1995	1998	1991	1975	1977	1980	1983	1976	1986	1984	1994	1987	1987
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	
039 BRAWLEY 2 SW	HIGHEST MEAN	60.0	64.1	68.3	75.5	82.8	89.6	94.1	94.5	89.3	79.4	67.5	59.5	94.5
	MEDIAN	54.0	58.4	62.8	69.0	76.2	84.4	90.4	90.0	85.5	74.4	62.1	54.4	72.0
	LOWEST MEAN	50.6	54.7	58.1	61.7	70.2	80.7	86.8	86.1	79.7	68.5	57.2	50.4	50.4
	HIGHEST MEAN YEAR	1981	1995	1972	1989	1997	1978	1996	1996	1997	1988	1995	1980	1996
	LOWEST MEAN YEAR	1972	1975	1973	1975	1977	1991	1993	1976	1986	1971	2000	1992	1992
	MIN OBS TIME ADJUSTMENT	-0.1	-0.2	-0.3	-0.2	-0.2	-0.1	-0.2	-0.4	-0.5	-0.6	-0.6	-0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.0	-0.2	-0.2	-0.2	0.0	
040 BRIDGEPORT	HIGHEST MEAN	35.2	35.0	41.2	45.2	52.8	59.0	64.0	63.7	56.3	47.9	40.0	33.2	64.0
	MEDIAN	25.0	26.8	34.0	38.5	46.6	54.8	60.9	59.5	52.9	43.9	33.8	25.7	42.2
	LOWEST MEAN	13.7	20.4	25.4	32.0	40.5	49.2	56.8	54.3	47.2	38.8	26.2	17.8	13.7
	HIGHEST MEAN YEAR	1986	1991	1997	1994	1992	1981	1994	1998	1997	1993	1999	1981	1994
	LOWEST MEAN YEAR	1982	1990	1973	1975	1977	1995	1995	1976	1986	1981	1972	1978	1982
	MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
042 BROOKS FARNHA	HIGHEST MEAN	49.2	53.7	56.4	62.5	71.1	78.3	80.7	79.0	76.6	69.2	57.4	49.9	80.7
	MEDIAN	45.7	50.1	52.9	57.7	65.2	72.8	77.1	76.6	72.4	64.1	52.4	46.0	61.1
	LOWEST MEAN	42.6	45.5	48.5	52.7	58.5	68.2	72.7	71.4	66.6	58.8	46.9	40.8	40.8
	HIGHEST MEAN YEAR	1986	1991	1986	1985	1992	1981	1996	1998	1984	1991	1995	1995	1996
	LOWEST MEAN YEAR	1972	1989	1991	1975	1998	1980	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.2	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
045 BURBANK VALLE	HIGHEST MEAN	59.7	61.3	62.4	67.0	71.6	77.5	79.8	79.9	81.0	71.8	63.8	59.8	81.0
	MEDIAN	55.0	56.3	58.3	62.5	66.4	71.1	75.7	76.3	73.6	67.2	59.6	55.0	64.6
	LOWEST MEAN	51.0	52.8	53.3	56.4	60.6	65.7	70.8	72.7	66.9	64.6	53.5	49.4	49.4
	HIGHEST MEAN YEAR	1986	1977	1972	1989	1984	1981	1984	1994	1984	1999	1976	1980	1984
	LOWEST MEAN YEAR	1979	1998	1973	1975	1998	1998	1987	1989	1986	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.7	0.7	0.5	0.0	0.0	0.1	0.0	-0.1	0.3	0.3	0.2	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
046 BURNEY	HIGHEST MEAN	38.0	42.5	46.3	50.2	60.2	65.5	70.3	68.5	63.7	54.0	43.8	36.8	70.3
	MEDIAN	32.0	36.9	40.5	45.6	52.7	60.0	65.7	63.9	58.0	48.4	38.2	31.4	47.7
	LOWEST MEAN	24.4	27.9	35.9	38.9	47.1	55.6	61.0	59.7	51.3	43.0	31.5	22.6	22.6
	HIGHEST MEAN YEAR	1978	1995	1978	1989	1997	1977	1998	1998	1998	1987	1995	1977	1998
	LOWEST MEAN YEAR	1977	1990	1985	1975	1977	1993	1993	1985	1986	1984	1985	1990	1990
	MIN OBS TIME ADJUSTMENT	0.9	1.0	0.7	0.0	0.0	0.0	-0.1	-0.2	0.4	0.2	0.6	0.7	
	MAX OBS TIME ADJUSTMENT	0.2	0.3	0.2	0.3	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
048 BUTTONWILLOW	HIGHEST MEAN	51.7	56.8	61.0	66.4	75.4	79.8	84.1	81.8	78.9	70.8	58.6	50.4	84.1
	MEDIAN	45.1	51.1	56.0	60.8	68.9	76.0	80.1	79.1	73.8	64.5	52.5	44.4	62.6
	LOWEST MEAN	39.1	45.3	50.5	54.9	61.7	71.3	75.7	73.2	68.8	59.3	48.2	39.5	39.1
	HIGHEST MEAN YEAR	1995	2000	1994	1990	1992	2000	1999	1998	1999	1991	1999	1977	1999
	LOWEST MEAN YEAR	1972	1971	1977	1975	1977	1980	1987	1976	1985	1971	2000	1985	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
049 CACHUMA LAKE	HIGHEST MEAN	57.3	59.8	61.0	64.7	69.5	73.9	75.5	75.7	77.2	68.9	63.9	57.9	77.2
	MEDIAN	52.9	53.9	55.3	59.2	63.1	68.1	72.2	73.0	70.4	65.8	58.4	53.1	62.3
	LOWEST MEAN	48.8	50.8	50.8	53.0	58.5	64.2	68.1	69.9	65.1	62.8	53.0	48.4	48.4
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1984	1971	1984	1987	1976	1977	1984
	LOWEST MEAN YEAR	1973	1979	1991	1975	1998	1991	1987	1989	1986	1998	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.2	-0.1	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.5	-0.3	-0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	-0.1	0.0	0.1	
050 CALAVERAS BIG	HIGHEST MEAN	42.3	44.6	45.3	50.3	58.4	65.9	70.4	69.7	65.9	58.4	48.7	41.8	70.4
	MEDIAN	36.0	37.1	38.8	44.4	52.7	60.5	67.0	66.4	60.9	51.4	41.0	36.0	49.4
	LOWEST MEAN	31.4	32.0	32.9	36.0	42.2	54.9	61.8	60.2	52.2	45.9	32.6	28.4	28.4
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1977	1984	1981	1974	1988	1995	1989	1984
	LOWEST MEAN YEAR	1979	1990	1991	1975	1998	1998	1987	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
052 CALISTOGA	HIGHEST MEAN	51.3	54.8	58.5	62.2	67.5	72.8	76.1	75.0	72.1	66.3	58.2	51.4	76.1
	MEDIAN	47.2	50.6	53.4	56.1	62.7	68.4	72.2	71.9	69.0	63.0	52.9	47.9	59.4
	LOWEST MEAN	43.2	47.0	48.4	50.2	56.6	63.9	68.8	68.3	64.5	59.2	47.4	42.0	42.0
	HIGHEST MEAN YEAR	1986	1995	1986	1985	1987	1981	1988	1998	1979	1987	1995	1977	1988
	LOWEST MEAN YEAR	1972	1989	1982	1975	1998	1982	1987	1976	1986	1981	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	0.0	-0.3	-0.2	-0.3	-0.3	-0.2	-0.3	0.2	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
053 CALLAHAN	HIGHEST MEAN	42.8	45.0	48.1	54.3	61.1	66.6	71.6	71.2	65.1	58.1	47.2	41.4	71.6
	MEDIAN	35.5	39.7	43.3	47.9	54.9	61.1	68.3	66.9	61.0	52.0	41.8	35.0	50.6
	LOWEST MEAN	27.6	34.4	39.8	40.9	48.8	58.1	62.1	63.9	55.8	48.3	34.7	29.2	27.6
	HIGHEST MEAN YEAR	1986	1995	1972	1990	1992	1977	1985	1986	1974	1988	1995	1981	1985
	LOWEST MEAN YEAR	1977	1990	1977	1975	1977	1991	1993	1976	1986	1984	1994	1990	1977
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.5	-0.6	-0.5	-0.5	-0.4	-0.5	-0.6	-0.7	-0.8	-0.6	
	MAX OBS TIME ADJUSTMENT	-1.0	-0.7	-0.9	-1.3	-1.1	-1.1	-0.9	-0.9	-1.1	-0.7	-0.8	-0.9	
054 CAMPO	HIGHEST MEAN	54.7	55.4	55.9	60.0	66.8	72.3	75.5	77.3	73.3	65.4	58.9	52.9	77.3
	MEDIAN	48.1	49.1	50.9	54.8	59.7	65.8	72.4	72.1	68.9	60.5	52.3	47.9	58.7
	LOWEST MEAN	43.1	45.6	45.2	48.1	54.4	61.1	66.4	68.4	62.1	56.5	47.5	43.1	43.1
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1972	1998	1984	1988	1995	1980	1998
	LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1991	1993	1976	1986	1971	2000	1971	1979
	MIN OBS TIME ADJUSTMENT	-0.4	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.5	-0.4	-0.8	-0.7	-0.6	-0.5	-0.5	-0.6	-0.7	-0.8	-0.4	-0.6	
055 CAMP PARDEE	HIGHEST MEAN	51.9	54.8	58.6	63.2	71.5	78.8	83.1	80.7	78.1	70.6	59.5	51.1	83.1
	MEDIAN	45.9	50.3	53.5	58.5	65.1	72.3	77.7	76.9	73.4	64.9	54.1	46.2	61.9
	LOWEST MEAN	39.9	45.9	48.7	50.6	57.7	67.6	73.0	71.9	67.6	59.9	48.3	39.3	39.3
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1997	1981	1984	1996	1984	1991	1995	1995	1984
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1998	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
056 CAMP PENDLETO	HIGHEST MEAN	60.5	60.7	61.6	66.4	69.4	71.3	75.0	76.6	74.5	69.9	63.3	60.0	76.6
	MEDIAN	54.8	55.7	56.6	59.2	63.1	66.9	70.5	72.1	70.4	65.3	58.7	55.3	62.5
	LOWEST MEAN	51.9	51.6	51.7	52.7	57.2	62.4	67.0	67.3	65.7	61.6	53.7	50.6	50.6
	HIGHEST MEAN YEAR	1997	1992	1993	1992	1992	1990	1990	1992	1984	1978	1989	1977	1992
	LOWEST MEAN YEAR	1972	1999	1999	1975	1977	1982	1997	1999	1999	1984	2000	1998	1998
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
057 CANBY 3 SW	HIGHEST MEAN	38.0	41.7	44.5	50.1	58.8	63.8	69.7	68.2	61.2	52.6	43.1	36.4	69.7
	MEDIAN	31.5	34.0	39.3	43.6	51.3	58.8	65.7	64.8	57.4	47.3	36.3	30.6	46.7
	LOWEST MEAN	14.6	23.5	33.3	37.1	45.2	55.0	60.9	58.9	52.0	43.5	27.8	22.1	14.6
	HIGHEST MEAN YEAR	1986	1991	1986	1990	1992	1987	1996	1971	1998	1987	1995	1995	1996
	LOWEST MEAN YEAR	1977	1989	1977	1975	1977	1980	1993	1976	1985	1971	1994	1990	1977
	MIN OBS TIME ADJUSTMENT	0.9	1.0	0.7	0.0	0.0	-0.4	-0.1	-0.2	0.4	0.2	0.7	0.7	
	MAX OBS TIME ADJUSTMENT	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
058 CANOGA PARK P	HIGHEST MEAN	57.7	60.0	63.1	66.7	71.8	78.1	80.0	81.6	78.8	71.5	63.1	57.1	81.6
	MEDIAN	53.7	55.7	57.0	60.9	65.6	71.5	76.3	76.4	73.7	66.7	58.4	54.0	64.2
	LOWEST MEAN	49.2	49.4	52.8	55.1	57.6	63.8	70.8	73.3	67.2	63.3	52.9	48.0	48.0
	HIGHEST MEAN YEAR	1986	1995	1972	1993	1984	1981	1985	1992	1984	1991	1976	1980	1992
	LOWEST MEAN YEAR	1979	1998	1973	1975	1998	1998	1987	1976	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.3	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.1	-0.8	-0.7	-0.7	-0.7	-1.2	-1.3	-0.8	-0.9	
059 CANYON DAM	HIGHEST MEAN	37.4	40.4	43.3	49.6	59.1	64.9	71.6	69.3	63.6	56.1	44.6	36.6	71.6
	MEDIAN	32.2	35.0	38.5	44.2	52.3	59.2	65.8	65.0	59.2	49.1	38.1	31.7	47.7
	LOWEST MEAN	26.0	26.0	33.3	35.7	45.1	54.1	60.9	58.4	52.9	43.1	31.4	25.5	25.5
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1977	1988	1977	1974	1988	1995	1981	1988
	LOWEST MEAN YEAR	1993	1990	1973	1975	1977	1990	1983	1989	1986	1989	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.4	-0.5	-0.7	-0.7	-0.8	-0.8	
	MAX OBS TIME ADJUSTMENT	-1.2	-1.1	-1.3	-1.5	-1.4	-1.5	-1.2	-1.2	-1.6	-1.3	-1.2	-1.1	
061 CECILVILLE	HIGHEST MEAN	42.6	47.0	49.9	57.3	65.5	70.0	76.9	74.9	71.5	61.2	48.9	41.8	76.9
	MEDIAN	37.4	40.6	44.9	49.6	56.5	63.3	69.7	70.1	63.5	54.1	42.8	36.9	52.6
	LOWEST MEAN	32.8	36.6	38.1	42.2	50.1	58.2	62.4	64.3	58.0	47.7	37.2	30.7	30.7
	HIGHEST MEAN YEAR	1986	1995	1992	1990	1992	1987	1994	1992	1991	1987	1976	1995	1994
	LOWEST MEAN YEAR	1972	1990	1975	1975	1977	1980	1983	1976	1971	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.3	-0.4	-0.4	-0.5	-0.4	-0.4	-0.4	-0.5	-0.7	-0.9	-0.7	-0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.0	0.1	0.0	0.0	0.0	-0.2	-0.3	-0.5	-0.2	0.0	
062 CEDARVILLE	HIGHEST MEAN	38.6	41.7	46.1	51.6	60.4	67.7	75.0	72.2	64.7	56.9	44.0	38.2	75.0
	MEDIAN	31.4	34.3	39.5	43.6	51.4	61.4	69.8	68.7	60.5	49.6	37.2	30.4	48.3
	LOWEST MEAN	16.7	24.3	33.6	36.2	45.3	55.8	62.8	61.3	52.8	40.1	28.3	19.8	16.7
	HIGHEST MEAN YEAR	1986	1991	1986	1990	1992	1986	1994	1971	1979	1988	1995	1981	1994
	LOWEST MEAN YEAR	1977	1989	1985	1975	1977	1984	1993	1976	1986	1984	1994	1990	1977
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.4	-0.5	-0.4	-0.6	-0.4	-0.5	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.0	-0.1	-0.1	0.0	0.1	
065 CHERRY VALLEY	HIGHEST MEAN	45.2	47.2	49.9	55.0	63.0	69.9	75.4	74.0	70.4	62.1	52.6	45.7	75.4
	MEDIAN	39.6	40.3	42.3	47.9	56.6	63.9	71.1	70.6	64.6	55.1	45.1	40.1	53.2
	LOWEST MEAN	33.7	35.6	34.8	39.6	46.3	59.3	66.2	63.7	56.7	48.4	35.9	30.2	30.2
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1981	1988	1998	1974	1999	1995	1980	1988
	LOWEST MEAN YEAR	1993	1998	1991	1975	1998	1998	1983	1976	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
066 CHESTER	HIGHEST MEAN	36.3	40.0	43.8	49.5	58.7	64.3	69.2	67.6	62.4	56.0	43.4	36.4	69.2
	MEDIAN	31.0	34.6	39.0	44.4	51.7	58.7	64.8	63.7	58.5	49.3	37.8	31.7	47.1
	LOWEST MEAN	24.8	28.0	33.5	36.4	40.8	53.0	59.3	59.1	52.4	42.9	29.3	23.4	23.4
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1985	1996	1988	1991	1988	1995	1981	1996
	LOWEST MEAN YEAR	1993	1990	1991	1975	1998	1998	1983	1976	1986	1998	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.5	-0.6	-0.7	-0.8	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.7	-1.0	-1.1	-1.1	-1.2	-1.0	-0.9	-1.2	-0.9	-0.8	-0.7	
067 CHICO UNIVERS	HIGHEST MEAN	49.0	53.8	56.9	63.7	72.4	76.5	80.9	78.7	74.5	68.2	57.7	48.9	80.9
	MEDIAN	44.4	49.6	53.2	58.5	65.5	72.3	76.8	75.6	72.1	62.9	51.3	45.0	60.5
	LOWEST MEAN	40.0	45.0	48.7	51.2	58.8	67.8	72.7	70.4	65.9	58.2	45.9	38.9	38.9
	HIGHEST MEAN YEAR	1995	1991	1986	1990	1992	1981	1988	1996	1979	1978	1995	1995	1988
	LOWEST MEAN YEAR	1972	1990	1991	1975	1977	1980	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	-0.3	-0.3	-0.4	-0.4	-0.5	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
069 CHULA VISTA	HIGHEST MEAN	61.2	62.2	63.3	65.9	69.0	71.2	74.2	75.0	75.9	70.4	65.3	62.8	75.9
	MEDIAN	57.2	58.2	59.4	61.2	63.5	66.6	69.8	71.8	70.7	67.1	61.6	57.4	63.9
	LOWEST MEAN	53.4	54.9	55.2	57.3	60.4	63.3	67.0	68.4	66.8	64.6	56.9	53.1	53.1
	HIGHEST MEAN YEAR	1980	1995	1978	1992	1992	1981	1984	1992	1997	1987	1976	1977	1997
	LOWEST MEAN YEAR	1972	1985	1985	1975	1998	1999	1987	1975	1986	1971	1994	1987	1987
	MIN OBS TIME ADJUSTMENT	-0.4	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.8	-0.9	-0.8	-0.7	-0.5	-0.6	-0.5	-0.9	-1.0	-0.6	-0.8	
070 CLEARLAKE 4 S	HIGHEST MEAN	47.2	50.2	52.8	58.5	66.4	71.9	77.5	74.6	70.8	63.6	54.5	48.3	77.5
	MEDIAN	43.6	45.8	48.0	52.4	59.1	67.0	72.9	72.0	66.9	58.5	48.2	43.9	56.6
	LOWEST MEAN	39.5	41.8	44.1	45.5	51.7	61.7	68.1	66.5	61.7	53.2	42.9	36.8	36.8
	HIGHEST MEAN YEAR	1986	1995	1984	1985	1992	1977	1988	1992	1991	1991	1995	1995	1988
	LOWEST MEAN YEAR	1982	1989	1991	1975	1998	1980	1983	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.2	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
071 CLOVERDALE	HIGHEST MEAN	50.8	55.6	59.3	64.4	70.8	75.6	77.3	77.9	75.4	67.8	59.5	50.3	77.9
	MEDIAN	47.9	51.1	53.7	59.2	65.5	71.1	73.6	73.2	70.7	63.9	53.4	47.3	60.9
	LOWEST MEAN	44.5	47.3	49.7	52.4	57.6	66.8	71.8	69.1	64.5	58.2	46.3	41.7	41.7
	HIGHEST MEAN YEAR	1986	1991	1993	1987	1997	1981	1997	1998	1984	1993	1995	1981	1998
	LOWEST MEAN YEAR	1972	1979	1991	1975	1977	1982	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-0.9	-1.4	-1.1	-1.0	-0.9	-0.8	-1.2	-1.1	-1.1	-0.7	
072 COALINGA	HIGHEST MEAN	54.3	58.3	62.3	68.3	77.2	81.3	86.8	85.0	81.7	72.8	61.4	52.2	86.8
	MEDIAN	47.8	53.3	56.8	62.4	70.2	77.3	82.0	81.4	76.9	67.2	55.4	47.2	64.8
	LOWEST MEAN	42.4	49.5	51.9	55.7	62.3	72.3	77.3	75.8	71.0	62.8	50.7	42.3	42.3
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1992	1981	1984	1998	1991	1991	1995	1995	1984
	LOWEST MEAN YEAR	1972	1979	1973	1975	1998	1980	1983	1976	1986	1981	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.3	-0.4	-0.3	-0.4	-0.6	-0.7	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.1	-1.4	-1.1	-1.2	-1.0	-0.9	-1.4	-1.2	-1.1	-0.8	
075 COLFAX	HIGHEST MEAN	50.7	53.9	55.1	61.0	67.9	75.1	81.4	78.6	76.0	66.0	56.4	50.8	81.4
	MEDIAN	45.1	47.3	49.0	53.6	61.2	68.9	75.3	74.4	69.7	61.5	49.7	45.0	58.6
	LOWEST MEAN	42.1	42.6	42.9	46.8	51.2	62.3	70.0	67.6	62.7	55.5	43.1	38.3	38.3
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1972	1972	1971	1974	1988	1976	1980	1972
	LOWEST MEAN YEAR	1982	1998	1991	1975	1998	1998	1983	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.6	-0.6	-0.7	-0.8	-0.7	
	MAX OBS TIME ADJUSTMENT	-1.1	-1.0	-1.3	-1.5	-1.4	-1.6	-1.2	-1.3	-1.5	-1.2	-1.2	-1.0	
077 COLUSA 2 SSW	HIGHEST MEAN	49.9	54.3	59.3	64.5	73.6	79.1	82.3	77.9	74.7	69.6	57.8	49.4	82.3
	MEDIAN	45.3	50.6	54.4	59.6	67.5	73.5	77.0	75.4	71.6	63.8	52.3	45.8	61.4
	LOWEST MEAN	41.3	46.5	49.7	53.2	59.9	69.1	73.2	73.0	66.5	59.9	47.3	39.8	39.8
	HIGHEST MEAN YEAR	1978	1992	1986	1990	1992	1981	1988	1971	1984	1991	1995	1996	1988
	LOWEST MEAN YEAR	1972	1989	1991	1975	1998	1980	1999	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
079 CORCORAN IRRI	HIGHEST MEAN	52.2	55.4	60.1	67.4	75.2	80.1	84.7	83.2	78.8	70.3	58.6	51.8	84.7
	MEDIAN	45.9	51.5	56.0	61.1	69.0	76.3	80.3	79.6	74.5	65.4	53.7	45.1	63.4
	LOWEST MEAN	39.4	46.2	50.0	55.3	62.4	71.0	75.8	75.3	69.9	61.4	49.0	40.6	39.4
	HIGHEST MEAN YEAR	1986	1992	1997	1989	1992	2000	1988	1998	1991	1991	1995	1977	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1980	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.4	-0.5	-0.3	-0.4	-0.6	-0.6	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.8	-1.1	-1.0	-1.1	-0.8	-0.8	-1.2	-0.8	-0.8	-0.6	
081 CORONA	HIGHEST MEAN	60.0	61.3	62.4	67.4	73.2	76.1	80.7	81.9	81.2	71.4	64.3	58.6	81.9
	MEDIAN	54.8	56.1	58.2	61.8	66.3	71.9	75.7	76.3	74.1	67.5	59.2	54.6	64.8
	LOWEST MEAN	48.9	52.6	53.3	54.8	61.5	65.8	71.8	73.1	68.3	63.6	54.1	48.9	48.9
	HIGHEST MEAN YEAR	1986	1991	1997	1989	1997	1981	1984	1998	1984	1999	1995	1980	1998
	LOWEST MEAN YEAR	1973	1975	1973	1975	1977	1982	1993	1974	1986	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.7	-0.8	-0.7	-0.6	-0.5	-0.6	-0.6	-1.0	-0.9	-0.5	-0.6	
082 COVELO	HIGHEST MEAN	47.2	50.6	53.6	59.3	66.0	71.6	76.7	75.1	72.4	63.1	52.5	47.1	76.7
	MEDIAN	42.4	45.9	48.8	53.0	59.1	65.7	72.3	71.0	66.8	57.9	47.2	41.3	56.1
	LOWEST MEAN	38.6	41.5	45.2	47.9	53.5	61.3	67.8	68.3	62.1	52.6	42.1	34.5	34.5
	HIGHEST MEAN YEAR	1986	1991	1993	1990	1992	1977	1984	1986	1991	1991	1995	1981	1984
	LOWEST MEAN YEAR	1982	1990	1991	1975	1998	1980	1999	1975	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.4	-0.5	-0.4	-0.4	-0.3	-0.4	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-1.0	-0.6	-0.7	-1.3	-0.9	-1.0	-0.8	-0.8	-1.1	-0.8	-0.7	-0.5	
084 CRESCENT CITY	HIGHEST MEAN	51.7	52.1	52.5	54.4	57.0	57.9	60.3	61.8	62.3	56.9	52.3	50.4	62.3
	MEDIAN	46.3	47.9	48.2	50.1	52.6	55.4	58.0	58.3	57.1	53.9	49.6	46.7	52.1
	LOWEST MEAN	42.7	41.3	43.4	45.8	50.1	53.4	55.5	55.1	54.5	51.6	43.3	40.5	40.5
	HIGHEST MEAN YEAR	1981	1980	1992	1992	1997	1981	1995	1997	1979	1987	1976	1995	1979
	LOWEST MEAN YEAR	1972	1989	1985	1975	1999	1984	1981	1980	1987	1971	1985	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.3	-0.4	-0.4	-0.7	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.6	-0.5	-1.1	-0.9	-0.7	-0.6	-0.7	-0.9	-0.6	-0.7	-0.7	
087 CULVER CITY	HIGHEST MEAN	60.8	61.7	63.6	68.0	68.8	72.9	74.3	76.4	78.8	71.1	67.0	60.7	78.8
	MEDIAN	56.3	58.1	59.5	62.6	64.8	68.1	70.4	71.2	70.4	67.2	61.1	57.3	64.1
	LOWEST MEAN	53.5	54.6	54.8	57.6	60.7	64.2	67.9	67.7	66.2	63.7	57.3	52.6	52.6
	HIGHEST MEAN YEAR	1986	1980	1984	1992	1984	1981	1985	1983	1984	1983	1976	1980	1984
	LOWEST MEAN YEAR	1973	1989	1991	1975	1971	1975	1978	1975	1999	2000	2000	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.8	-1.0	-0.9	-0.6	-0.5	-0.5	-0.6	-1.0	-1.1	-0.7	-0.9	
088 CUYAMACA	HIGHEST MEAN	45.2	45.7	50.6	55.5	63.3	69.5	73.8	73.3	68.0	60.5	51.5	45.2	73.8
	MEDIAN	40.2	41.3	43.4	48.3	53.9	62.0	69.0	68.0	63.8	53.4	45.5	39.9	52.3
	LOWEST MEAN	34.4	35.6	35.4	38.1	46.1	55.8	63.9	63.3	56.6	47.4	38.7	33.3	33.3
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1995	1997	1988	1995	1977	1996
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1982	1993	1976	1985	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	-0.1	0.0	-0.2	-0.1	0.0	-0.1	-0.3	-0.4	-0.3	-0.3	0.2	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	-0.1	0.1	

United States Climate Normals 1971-2000

CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days

1971-2000

CALIFORNIA

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
089 DAGGETT BARST	HIGHEST MEAN	53.4	59.5	64.2	72.5	80.7	87.2	91.9	90.7	84.1	75.1	62.3	52.8	91.9
	MEDIAN	47.6	52.4	57.3	64.2	72.4	81.7	87.8	86.1	79.9	67.6	55.4	47.8	66.6
	LOWEST MEAN	41.8	48.4	51.5	56.8	65.6	77.5	83.3	81.4	73.7	62.2	48.1	41.0	41.0
	HIGHEST MEAN YEAR	2000	1995	1972	1989	1997	1994	1996	1998	1974	1988	1995	1981	1996
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1998	1983	1983	1985	1972	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
090 DAVIS 2 WSW E	HIGHEST MEAN	50.6	53.7	57.6	63.0	71.0	77.4	79.0	76.4	75.0	68.6	58.2	50.0	79.0
	MEDIAN	44.8	50.0	53.1	58.1	65.2	71.3	74.3	73.5	71.0	63.4	52.2	45.1	60.3
	LOWEST MEAN	40.4	45.5	49.4	53.0	58.1	66.8	70.4	69.9	65.5	59.6	46.6	40.5	40.4
	HIGHEST MEAN YEAR	1978	1991	1972	1990	1992	1981	1988	1998	1984	1991	1995	1977	1988
	LOWEST MEAN YEAR	1972	1989	1991	1975	1977	1980	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.5	-0.4	-0.5	-0.2	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
091 DEATH VALLEY	HIGHEST MEAN	56.7	64.5	73.9	83.5	90.7	99.3	104.4	102.7	94.9	83.0	66.2	55.0	104.4
	MEDIAN	51.7	59.1	67.1	74.5	85.4	94.4	100.8	98.8	89.9	76.2	61.0	51.8	75.8
	LOWEST MEAN	48.2	54.4	62.0	69.0	76.4	87.6	96.4	93.9	84.5	71.4	56.3	44.9	44.9
	HIGHEST MEAN YEAR	1980	1995	1972	1989	1997	1981	1994	1994	1974	1988	1995	1977	1994
	LOWEST MEAN YEAR	1991	1998	1991	1975	1998	1998	1987	1976	1985	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.6	0.0	-0.4	-0.3	-0.3	-0.3	-0.4	-0.7	-0.4	-0.5	0.3	
	MAX OBS TIME ADJUSTMENT	0.3	0.3	0.3	0.3	0.3	0.2	0.1	-0.1	-0.2	-0.2	-0.2	0.1	
093 DEEP SPRINGS	HIGHEST MEAN	40.1	44.5	50.3	58.5	65.9	73.9	78.0	75.4	68.8	58.6	47.8	39.4	78.0
	MEDIAN	33.4	37.8	43.5	51.1	59.6	68.8	74.7	72.6	64.8	52.6	40.2	33.4	52.8
	LOWEST MEAN	25.2	32.4	37.4	41.9	51.0	63.1	71.1	66.5	59.6	47.9	32.1	27.5	25.2
	HIGHEST MEAN YEAR	2000	2000	1972	1989	1984	1981	1988	1996	1979	1988	1995	1980	1988
	LOWEST MEAN YEAR	1973	1973	1977	1975	1977	1998	1987	1976	1986	1971	1994	1971	1973
	MIN OBS TIME ADJUSTMENT	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	
094 DEER CREEK FO	HIGHEST MEAN	49.1	50.5	50.0	56.8	64.7	69.4	76.5	75.0	72.1	65.9	55.0	49.8	76.5
	MEDIAN	41.3	41.3	42.3	48.2	56.1	63.8	70.2	71.0	66.5	56.4	45.8	41.1	54.0
	LOWEST MEAN	35.5	35.4	35.7	38.2	44.2	58.8	64.7	62.9	57.7	49.3	38.0	32.3	32.3
	HIGHEST MEAN YEAR	1984	1991	1984	1987	1992	1985	1984	1986	1991	1988	1976	1989	1984
	LOWEST MEAN YEAR	1993	1989	1991	1975	1977	1980	1983	1976	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.4	-0.6	-0.7	-0.8	-0.9	-0.8	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.5	-0.7	-0.9	-0.6	-0.6	-0.5	-0.9	-0.8	-1.0	-0.8	-0.7	
096 DE SABLA	HIGHEST MEAN	48.1	50.8	53.2	58.7	65.0	71.6	77.5	76.8	71.7	65.3	55.2	47.9	77.5
	MEDIAN	42.7	44.5	46.4	51.7	59.3	66.6	73.1	72.2	67.9	58.4	47.4	42.7	56.2
	LOWEST MEAN	36.9	40.0	41.0	45.3	51.0	60.6	67.4	66.6	60.3	53.0	41.4	36.0	36.0
	HIGHEST MEAN YEAR	1986	1988	1997	1987	1997	1977	1996	1996	1975	1987	1976	1980	1996
	LOWEST MEAN YEAR	1982	1989	1991	1975	1998	1980	1987	1976	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.5	-0.6	-0.7	-0.8	-0.6	
	MAX OBS TIME ADJUSTMENT	-1.1	-0.9	-1.2	-1.4	-1.4	-1.5	-1.2	-1.3	-1.5	-1.2	-1.1	-0.9	
098 DOBBINS 1 S	HIGHEST MEAN	49.3	52.3	55.0	59.4	67.5	73.3	78.1	76.7	73.1	64.8	55.7	48.4	78.1
	MEDIAN	44.9	47.9	50.0	53.6	61.3	68.4	74.4	73.8	69.2	60.9	49.9	44.8	58.4
	LOWEST MEAN	42.0	42.5	45.1	47.9	53.4	64.0	70.2	69.6	62.1	54.9	44.0	39.3	39.3
	HIGHEST MEAN YEAR	1986	1991	1972	1990	1992	1977	1984	1971	1975	1978	1995	1977	1984
	LOWEST MEAN YEAR	1972	1999	1991	1975	1998	1998	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.4	-0.5	-0.6	-0.6	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.4	-0.4	-0.6	-0.7	-0.7	-0.9	-0.7	-0.6	-0.8	-0.5	-0.5	-0.4	
099 DONNER MEMORI	HIGHEST MEAN	34.7	36.8	37.6	44.9	52.6	59.1	64.3	63.1	57.3	50.7	41.7	33.8	64.3
	MEDIAN	27.5	28.8	33.6	38.6	46.1	53.9	60.1	60.1	54.3	45.2	34.1	27.4	42.2
	LOWEST MEAN	21.1	22.4	27.2	28.8	39.1	48.9	55.3	54.0	48.8	39.1	26.2	20.7	20.7
	HIGHEST MEAN YEAR	1986	1991	1986	1987	1992	2000	1996	1981	1981	1988	1995	1981	1996
	LOWEST MEAN YEAR	1982	1990	1977	1975	1977	1980	1983	1976	1985	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
101 DOWNIEVILLE	HIGHEST MEAN	43.8	48.0	49.6	55.7	63.6	68.1	72.9	72.1	68.0	61.1	51.6	42.3	72.9
	MEDIAN	39.7	42.1	45.3	50.3	56.4	63.6	68.5	68.7	64.5	55.4	44.5	39.3	53.0
	LOWEST MEAN	34.1	36.2	39.4	41.2	48.6	59.5	65.5	62.3	57.5	50.5	37.5	32.3	32.3
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1981	1984	1981	1991	1988	1995	1989	1984
	LOWEST MEAN YEAR	1972	1990	1991	1975	1977	1980	1983	1976	1986	1975	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.6	-0.6	-0.6	-0.8	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.8	-1.0	-1.1	-1.1	-1.3	-1.0	-1.0	-1.3	-0.9	-0.9	-0.7	
103 DOYLE 4 SSE	HIGHEST MEAN	39.9	43.0	48.6	52.6	60.3	66.4	71.4	69.5	64.0	56.0	47.0	39.4	71.4
	MEDIAN	33.6	37.8	42.3	47.1	54.2	62.0	67.7	66.9	61.2	50.2	39.9	32.4	49.1
	LOWEST MEAN	25.5	27.9	35.8	38.8	47.0	56.5	61.3	61.8	53.8	45.9	31.7	20.7	20.7
	HIGHEST MEAN YEAR	1986	1991	1993	1987	1992	1974	1994	1988	1974	1988	1995	1981	1994
	LOWEST MEAN YEAR	1993	1989	1977	1975	1977	1980	1983	1976	1986	1984	1985	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.5	-0.6	-0.6	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.5	-0.5	-0.6	-0.7	-0.7	-0.8	-0.7	-0.6	-0.8	-0.5	-0.6	-0.5	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
104 DRY CANYON RE	HIGHEST MEAN	55.8	56.1	59.1	64.0	69.1	74.3	79.2	79.4	77.9	68.3	60.9	55.4	79.4
	MEDIAN	50.5	50.9	53.0	57.6	62.6	69.5	74.3	74.8	71.4	63.7	55.3	50.9	61.2
	LOWEST MEAN	45.2	46.7	47.2	48.9	56.2	63.8	68.8	70.5	64.4	59.9	48.9	44.9	44.9
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1984	1998	1984	1991	1995	1977	1998
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1982	1987	1976	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.7	0.7	0.5	0.0	0.0	0.1	0.0	-0.1	0.3	0.3	0.2	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
105 DUNSMUIR TREA	HIGHEST MEAN	43.4	48.3	49.3	55.7	64.2	68.6	74.8	72.3	68.6	61.1	50.3	43.5	74.8
	MEDIAN	39.8	41.6	43.9	50.0	57.7	64.7	70.6	69.3	64.3	55.5	44.2	40.0	53.2
	LOWEST MEAN	34.7	37.2	40.7	43.5	51.3	58.7	65.8	64.0	58.2	51.1	37.5	33.8	33.8
	HIGHEST MEAN YEAR	1986	1995	1986	1990	1992	2000	1994	1998	1991	1988	1995	1989	1994
	LOWEST MEAN YEAR	1993	1989	1991	1975	1977	1980	1983	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.8	0.8	0.7	0.0	0.0	0.0	-0.1	-0.2	0.4	0.2	0.6	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
106 EAGLE MOUNTAI	HIGHEST MEAN	60.5	64.9	72.8	79.8	87.0	93.6	96.3	95.9	89.8	79.7	68.5	62.1	96.3
	MEDIAN	54.4	59.3	63.3	71.3	79.2	88.1	93.4	91.7	86.8	75.1	63.0	55.8	73.5
	LOWEST MEAN	49.2	55.0	57.7	62.3	71.9	83.7	90.2	87.7	79.6	69.4	56.6	50.3	49.2
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1995	1979	1978	1995	1980	1996
	LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1998	1986	1983	1985	1971	1994	1987	1979
	MIN OBS TIME ADJUSTMENT	0.7	0.5	0.6	0.1	0.1	0.1	0.0	-0.2	-0.3	0.1	0.1	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	
107 EAST PARK RES	HIGHEST MEAN	47.8	51.6	54.0	59.3	67.3	75.0	80.9	77.2	73.5	65.7	55.5	48.4	80.9
	MEDIAN	43.6	46.7	49.0	54.3	61.9	69.7	75.8	74.2	69.7	60.2	49.5	44.1	58.3
	LOWEST MEAN	37.9	43.6	44.9	48.3	54.5	64.2	69.8	69.2	63.9	55.8	43.1	37.4	37.4
	HIGHEST MEAN YEAR	1984	1991	1972	1977	1992	1977	1988	1996	1991	1991	1995	1983	1988
	LOWEST MEAN YEAR	1982	1994	1982	1975	1998	1980	1983	1976	1986	1982	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
108 EL CAJON	HIGHEST MEAN	59.3	60.2	62.5	66.9	71.8	73.9	78.7	79.5	79.9	71.4	64.5	59.8	79.9
	MEDIAN	54.9	56.6	58.4	62.3	65.6	70.3	74.5	75.8	73.8	67.4	59.2	54.6	64.3
	LOWEST MEAN	50.4	52.5	53.1	55.3	60.7	66.9	70.0	71.9	67.9	63.5	54.7	49.5	49.5
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1984	1998	1984	1999	1995	1977	1984
	LOWEST MEAN YEAR	1979	1990	1973	1975	1977	1991	1987	1976	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	
	MAX OBS TIME ADJUSTMENT	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	
109 EL CAPITAN DA	HIGHEST MEAN	60.4	62.4	62.8	68.0	72.0	76.2	80.3	81.7	80.9	75.6	65.3	60.8	81.7
	MEDIAN	56.2	56.8	58.2	62.4	66.3	71.4	76.5	78.0	75.9	69.5	61.7	56.7	66.0
	LOWEST MEAN	50.9	52.2	53.3	54.5	60.5	67.4	71.3	73.3	70.0	66.1	57.7	50.2	50.2
	HIGHEST MEAN YEAR	1994	1995	1997	1992	1997	1981	1984	1994	1984	1999	1991	1977	1994
	LOWEST MEAN YEAR	1973	1998	1973	1975	1980	1982	1987	1974	1986	1975	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.6	0.6	0.5	0.0	0.0	0.1	0.0	-0.1	0.3	0.2	0.1	0.5	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
110 EL CENTRO 2 S	HIGHEST MEAN	61.5	64.8	69.6	75.8	84.2	89.8	94.2	94.6	90.1	79.7	69.5	59.0	94.6
	MEDIAN	55.4	59.7	63.9	69.7	77.1	85.9	91.3	90.7	86.0	75.1	62.9	55.5	72.8
	LOWEST MEAN	51.3	56.1	58.0	60.8	69.6	82.0	89.1	87.6	80.4	69.2	57.8	50.6	50.6
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1994	1996	1994	1995	1999	1995	1980	1994
	LOWEST MEAN YEAR	1973	1975	1977	1975	1977	1991	1976	1979	1985	1971	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.4	-0.8	-0.7	-0.6	-0.5	-0.6	-0.7	-0.8	-0.9	-0.5	-0.6	
111 EL TORO MCAS	HIGHEST MEAN	62.3	61.7	62.9	67.5	69.4	74.8	77.0	78.2	79.1	72.6	66.5	60.8	79.1
	MEDIAN	57.0	57.8	58.5	61.8	64.0	68.4	72.3	73.5	72.1	67.1	61.3	56.7	64.4
	LOWEST MEAN	51.5	52.5	53.1	54.4	59.7	63.8	65.6	68.4	66.7	63.4	56.2	50.3	50.3
	HIGHEST MEAN YEAR	1986	1992	1993	1992	1997	1981	1984	1992	1984	1991	1976	1977	1984
	LOWEST MEAN YEAR	1974	1975	1973	1975	1974	1988	1987	1987	1973	1974	1973	1987	1987
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
112 ELECTRA P H	HIGHEST MEAN	51.2	53.1	57.6	62.4	69.3	75.6	80.5	77.9	75.5	67.4	58.3	50.8	80.5
	MEDIAN	45.9	50.5	52.7	56.8	63.9	70.9	76.8	75.3	71.4	63.5	52.3	46.0	60.9
	LOWEST MEAN	42.1	44.7	48.5	50.5	57.6	67.0	71.0	71.6	65.1	59.3	47.1	40.8	40.8
	HIGHEST MEAN YEAR	1986	1991	1978	1987	1997	1981	1988	1971	1984	1978	1995	1977	1988
	LOWEST MEAN YEAR	1985	1990	1991	1975	1998	1998	1987	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.5	-0.4	-0.4	-0.6	-0.6	-0.8	-0.6	
	MAX OBS TIME ADJUSTMENT	-1.0	-0.9	-1.2	-1.4	-1.2	-1.4	-1.1	-1.1	-1.5	-1.1	-1.1	-0.9	
115 EL MIRAGE	HIGHEST MEAN	47.5	50.9	56.1	62.7	72.2	77.2	83.4	81.0	74.1	65.7	54.9	47.8	83.4
	MEDIAN	41.1	46.1	49.4	55.4	63.4	72.1	77.9	76.1	71.0	60.0	48.1	41.7	58.6
	LOWEST MEAN	37.1	41.3	43.3	47.6	56.3	65.7	72.6	70.2	64.3	55.0	42.3	35.8	35.8
	HIGHEST MEAN YEAR	2000	1995	1972	1989	1997	1981	1996	1996	1979	1988	1995	1977	1996
	LOWEST MEAN YEAR	1973	1979	1977	1975	1998	1998	1983	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.2	-0.2	-0.1	-0.2	-0.4	-0.3	-0.4	-0.4	0.3	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
116 ELSINORE	HIGHEST MEAN	57.2	61.4	62.2	66.9	75.1	79.5	84.3	85.1	80.7	71.9	65.0	58.3	85.1
	MEDIAN	52.3	53.7	57.0	61.5	67.0	73.5	79.6	79.5	76.1	67.0	57.1	52.4	65.1
	LOWEST MEAN	48.0	50.4	51.0	52.9	61.4	68.6	74.6	77.0	69.0	60.1	53.3	45.6	45.6
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1984	1994	1984	1995	1995	1977	1994
	LOWEST MEAN YEAR	1973	1975	1973	1975	1977	1982	1987	1989	1986	1971	1973	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.7	-0.8	-0.7	-0.6	-0.5	-0.6	-0.6	-1.0	-0.9	-0.5	-0.6	
117 ESCONDIDO NO	HIGHEST MEAN	60.1	61.6	63.0	67.4	72.2	75.6	79.8	79.8	79.6	71.8	64.0	60.1	79.8
	MEDIAN	55.8	56.6	58.4	62.3	66.3	71.1	74.7	76.2	73.8	67.8	60.3	55.7	65.2
	LOWEST MEAN	52.0	53.8	54.2	55.7	61.4	66.7	70.4	72.9	68.1	64.5	54.7	50.6	50.6
	HIGHEST MEAN YEAR	1986	1995	1972	1992	1997	1981	1984	1998	1984	1991	1995	1977	1998
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1982	1987	1976	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.8	-0.9	-0.9	-0.7	-0.6	-0.6	-0.6	-1.0	-1.1	-0.7	-0.9	
118 EUREKA WFO WO	HIGHEST MEAN	53.2	53.2	53.2	55.2	57.8	58.9	60.4	61.6	62.6	57.4	54.7	52.3	62.6
	MEDIAN	47.4	48.6	49.7	50.8	53.6	56.4	58.3	58.8	56.9	54.4	51.4	47.6	52.7
	LOWEST MEAN	43.8	43.3	45.4	46.7	50.8	52.7	56.1	55.6	54.5	50.6	44.6	40.9	40.9
	HIGHEST MEAN YEAR	1986	1980	1978	1992	1997	1986	1983	1983	1979	1979	1999	1981	1979
	LOWEST MEAN YEAR	1982	1990	1976	1975	1991	1991	1971	1973	1988	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
120 FAIRFIELD	HIGHEST MEAN	50.9	55.2	58.7	62.8	70.3	74.5	76.7	76.3	74.3	68.9	60.1	51.5	76.7
	MEDIAN	46.0	51.1	54.3	58.3	64.4	69.2	72.6	72.8	70.7	63.9	53.7	46.6	60.4
	LOWEST MEAN	39.3	47.2	49.9	53.7	58.2	65.6	68.4	68.6	63.6	60.1	48.7	38.8	38.8
	HIGHEST MEAN YEAR	1995	1991	1978	1992	1997	1981	1996	1998	1984	1991	1995	1995	1996
	LOWEST MEAN YEAR	1985	1989	1985	1975	1998	1980	1987	1980	1986	1984	1994	1985	1985
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.0	
121 FAIRMONT	HIGHEST MEAN	52.0	55.3	58.1	65.8	72.8	78.7	82.7	82.5	78.8	70.7	61.5	52.8	82.7
	MEDIAN	45.4	47.9	50.4	55.9	63.3	72.1	78.8	78.0	73.6	62.5	51.9	46.2	60.6
	LOWEST MEAN	40.3	41.1	44.9	46.3	54.1	64.8	71.9	71.0	64.5	57.4	44.5	38.9	38.9
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1994	1974	1978	1995	1977	1996
	LOWEST MEAN YEAR	1979	1989	1973	1975	1998	1998	1987	1976	1986	1981	1994	1984	1984
	MIN OBS TIME ADJUSTMENT	0.7	0.7	1.0	0.7	0.7	0.7	0.5	0.3	0.6	0.6	0.5	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	
123 FIVE POINTS 5	HIGHEST MEAN	53.0	55.1	63.0	69.7	74.8	79.6	83.2	81.7	78.5	70.1	58.5	51.5	83.2
	MEDIAN	47.1	52.4	55.6	60.4	68.8	74.9	79.6	78.2	74.1	65.4	53.4	45.8	63.3
	LOWEST MEAN	42.5	48.3	50.9	55.5	62.2	71.3	75.6	72.3	68.3	59.1	47.2	39.4	39.4
	HIGHEST MEAN YEAR	2000	1991	1990	1987	1997	1973	1984	1971	1984	1991	1997	1977	1984
	LOWEST MEAN YEAR	1972	1971	1977	1975	1977	1991	1983	1976	1985	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.5	-0.5	-0.4	-0.4	-0.3	-0.4	-0.6	-0.6	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.8	-1.1	-0.9	-1.1	-0.8	-0.7	-1.2	-0.8	-0.8	-0.6	
124 FOLSOM DAM	HIGHEST MEAN	51.5	55.8	59.3	64.8	71.6	78.1	82.4	79.6	77.5	70.9	60.5	51.3	82.4
	MEDIAN	47.2	51.7	54.6	59.1	66.3	72.9	77.5	76.9	73.9	65.7	54.3	47.3	62.3
	LOWEST MEAN	41.9	47.1	50.5	52.8	59.4	67.7	72.4	72.5	67.2	60.6	48.8	40.3	40.3
	HIGHEST MEAN YEAR	1995	1988	1986	1987	1992	1981	1988	1992	1984	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1971	1991	1975	1998	1980	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.3	-0.3	-0.4	-0.4	-0.5	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
126 FONTANA KAISE	HIGHEST MEAN	62.2	64.4	65.9	67.5	73.3	77.4	83.6	85.5	82.0	73.7	65.8	60.5	85.5
	MEDIAN	56.5	58.3	59.8	62.6	66.5	72.8	77.9	78.4	76.6	69.2	61.3	56.5	66.8
	LOWEST MEAN	50.4	54.1	53.4	55.1	60.4	65.2	73.7	74.3	70.6	64.3	55.7	52.4	50.4
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1972	1971	1984	1991	1995	1977	1971
	LOWEST MEAN YEAR	1982	1979	1973	1983	1980	1982	1987	1974	1986	1981	1983	1983	1982
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.5	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.1	-1.0	-0.8	-0.8	-0.8	-1.3	-1.2	-0.8	-1.0	
128 FORT BIDWELL	HIGHEST MEAN	37.7	41.4	45.5	52.0	59.9	65.2	71.4	71.0	63.4	57.3	44.9	36.6	71.4
	MEDIAN	31.5	34.4	40.2	44.5	52.4	59.7	66.7	67.3	59.3	49.1	37.0	29.2	47.5
	LOWEST MEAN	12.5	24.1	34.8	37.4	46.2	55.7	59.9	60.5	53.1	44.1	29.6	21.4	12.5
	HIGHEST MEAN YEAR	1986	1991	1978	1990	1992	1986	1994	1986	1987	1988	1995	1981	1994
	LOWEST MEAN YEAR	1977	1993	1971	1975	1977	1991	1993	1976	1985	1984	1985	1990	1977
	MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.7	-0.6	-0.5	-0.5	-0.5	-0.6	-0.7	-0.8	-0.9	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.8	-0.8	-0.9	-1.2	-0.8	-1.0	-1.1	-1.3	-0.8	-1.0	-0.7	
129 FORT BRAGG 5	HIGHEST MEAN	53.9	53.2	54.7	55.9	58.2	58.5	61.5	61.5	61.5	59.2	55.6	51.5	61.5
	MEDIAN	48.0	49.3	49.9	52.1	53.4	56.5	58.0	58.0	58.3	54.9	51.5	48.0	53.3
	LOWEST MEAN	44.4	43.8	45.9	48.5	50.8	53.2	55.6	55.4	54.7	52.1	46.2	40.1	40.1
	HIGHEST MEAN YEAR	1986	1980	1978	1992	1992	1986	1992	1993	1979	1992	1976	1981	1992
	LOWEST MEAN YEAR	1989	1989	1999	1975	1999	1996	1999	1973	1996	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.4	-0.5	-0.4	-0.4	-0.3	-0.4	-0.4	-0.5	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.5	-0.7	-1.3	-0.9	-0.9	-0.7	-0.7	-0.9	-0.7	-0.7	-0.5	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
132 FORT ROSS	HIGHEST MEAN	53.0	53.2	55.7	54.9	57.1	60.4	59.6	61.6	63.1	58.9	57.0	52.7	63.1
	MEDIAN	48.8	50.4	51.0	51.2	53.4	55.6	56.9	58.0	57.6	56.0	52.5	49.2	53.2
	LOWEST MEAN	44.4	45.6	46.2	46.7	51.2	53.8	54.5	55.1	54.7	52.1	47.5	44.0	44.0
	HIGHEST MEAN YEAR	1998	1996	1978	2000	1997	1981	1992	1997	1997	1995	1997	1995	1997
	LOWEST MEAN YEAR	1987	1989	1976	1975	1974	1975	1994	1973	1985	1971	1994	1985	1985
	MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	-0.1	-0.3	-0.3	-0.3	-0.3	-0.1	-0.2	0.2	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	
133 FRESNO YOSEMI	HIGHEST MEAN	53.0	55.3	60.2	66.6	75.3	82.0	86.2	84.1	80.0	69.5	58.7	50.5	86.2
	MEDIAN	45.9	51.4	56.0	61.0	68.9	76.1	81.2	79.7	74.7	64.6	53.0	44.8	63.3
	LOWEST MEAN	40.0	47.1	49.8	53.3	62.0	71.5	76.2	71.8	70.3	59.8	47.1	40.1	40.0
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1984	1998	1984	1991	1995	1977	1984
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1998	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
134 FRIANT GOVERN	HIGHEST MEAN	52.4	56.2	58.8	64.1	73.6	78.4	84.1	82.1	78.8	70.1	60.3	51.3	84.1
	MEDIAN	46.5	51.3	54.2	58.2	66.3	74.3	79.5	78.8	73.9	65.2	53.3	45.6	62.3
	LOWEST MEAN	39.9	46.8	49.3	51.8	60.2	69.2	74.0	72.9	67.4	59.6	48.1	41.0	39.9
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1981	1988	1996	1991	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1980	1983	1976	1986	1984	1994	1978	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.3	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
140 GILROY	HIGHEST MEAN	53.7	57.7	60.0	64.3	69.9	75.6	74.5	74.4	74.1	67.7	61.6	55.3	75.6
	MEDIAN	49.6	53.7	56.2	59.9	64.8	69.4	72.4	71.8	70.1	64.5	55.1	49.2	61.3
	LOWEST MEAN	45.4	49.6	51.5	54.5	59.6	65.7	68.1	69.6	64.2	58.8	51.1	43.9	43.9
	HIGHEST MEAN YEAR	1995	1991	1978	1992	1997	1981	1996	1992	1984	1991	1995	1977	1981
	LOWEST MEAN YEAR	1972	1990	1973	1975	1998	1991	1987	1987	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.2	-0.1	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	-0.5	-0.5	-0.4	-0.2	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.0	-0.1	0.0	0.0	
142 GLENNVILLE	HIGHEST MEAN	48.2	49.3	51.0	55.6	61.9	67.7	72.8	72.0	68.0	60.0	52.0	46.3	72.8
	MEDIAN	41.5	44.0	45.9	49.4	56.3	63.1	69.1	68.6	63.8	55.5	46.4	42.2	53.8
	LOWEST MEAN	37.4	39.6	39.3	42.8	49.8	58.6	64.7	63.2	57.2	49.8	40.5	35.6	35.6
	HIGHEST MEAN YEAR	1986	1995	1978	1989	1992	2000	1996	1998	1991	1988	1995	1980	1996
	LOWEST MEAN YEAR	1973	1990	1973	1975	1977	1980	1987	1976	1986	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.6	-0.6	-0.5	-0.5	-0.4	-0.4	-0.6	-0.6	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.8	-0.9	-1.2	-1.1	-1.2	-0.9	-0.8	-1.3	-0.9	-0.8	-0.7	
145 GRANT GROVE	HIGHEST MEAN	42.8	42.3	43.2	47.7	54.2	61.4	67.1	67.0	62.9	57.5	49.0	42.6	67.1
	MEDIAN	34.4	34.8	35.9	39.9	47.7	56.4	62.9	62.6	57.9	48.4	39.6	36.1	46.4
	LOWEST MEAN	28.2	29.6	28.0	29.5	36.9	49.4	58.1	55.1	48.7	41.9	31.0	26.8	26.8
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1996	1996	1974	1988	1995	1980	1996
	LOWEST MEAN YEAR	1979	1990	1991	1975	1977	1998	1987	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	0.4	-0.1	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.2	0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.2	0.3	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	
146 GRASS VALLEY	HIGHEST MEAN	46.8	49.6	51.4	56.3	64.7	69.3	75.6	74.2	70.4	62.2	54.0	45.6	75.6
	MEDIAN	42.8	44.2	46.3	50.6	57.7	64.9	70.8	70.5	65.8	57.0	46.7	42.6	54.8
	LOWEST MEAN	36.9	39.0	41.1	43.8	50.4	59.6	64.4	64.3	58.0	50.7	41.2	36.1	36.1
	HIGHEST MEAN YEAR	1986	1995	1972	1987	1992	1977	1996	1996	1975	1991	1995	1989	1996
	LOWEST MEAN YEAR	1982	1990	1991	1975	1977	1980	1983	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.4	-0.3	-0.4	-0.4	-0.5	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
147 GRATON	HIGHEST MEAN	50.1	53.3	56.9	58.5	63.7	71.2	69.5	68.6	69.9	63.3	56.9	50.0	71.2
	MEDIAN	46.0	50.2	52.3	56.1	60.1	64.3	66.5	66.7	64.7	60.1	51.7	46.0	57.0
	LOWEST MEAN	42.8	45.3	48.5	50.2	56.2	61.5	63.5	63.4	60.8	55.8	46.7	41.3	41.3
	HIGHEST MEAN YEAR	1986	1995	1978	1985	1997	1981	1988	1983	1984	1987	1995	1996	1981
	LOWEST MEAN YEAR	1982	1989	1999	1975	1998	1991	2000	1973	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	0.0	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	0.2	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
150 GRIZZLY CREEK	HIGHEST MEAN	48.0	50.6	51.5	54.0	60.7	62.8	66.1	65.2	63.3	56.6	50.6	47.5	66.1
	MEDIAN	42.3	45.1	48.0	50.2	55.2	59.4	63.0	63.1	59.9	53.6	46.6	42.7	52.3
	LOWEST MEAN	39.1	40.3	43.5	44.4	51.5	55.7	60.7	60.7	56.6	49.8	40.9	35.5	35.5
	HIGHEST MEAN YEAR	1995	1995	1992	1989	1997	1986	1990	1971	1979	1988	1995	1995	1990
	LOWEST MEAN YEAR	1982	1990	1977	1975	1977	1976	2000	1980	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.6	0.3	-0.1	0.0	-0.3	-0.2	-0.2	-0.3	-0.2	-0.3	0.2	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1	
152 HAIWEE	HIGHEST MEAN	45.6	51.3	57.1	64.0	71.4	77.6	83.1	82.2	74.1	65.5	56.0	45.7	83.1
	MEDIAN	40.1	45.1	49.8	55.7	64.5	72.5	78.6	77.1	70.8	59.9	47.8	40.2	58.4
	LOWEST MEAN	33.5	39.8	44.0	46.8	53.7	67.7	74.7	70.2	64.6	54.7	42.4	33.7	33.5
	HIGHEST MEAN YEAR	1996	1995	1972	1989	1997	1981	1994	1994	1995	1988	1995	1999	1994
	LOWEST MEAN YEAR	1974	1979	1973	1975	1977	1998	1987	1976	1985	1972	1994	1984	1974
	MIN OBS TIME ADJUSTMENT	0.7	0.9	0.7	0.0	0.1	0.0	0.0	-0.2	0.3	0.2	0.1	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.3	0.1	0.0	-0.1	-0.1	-0.1	0.1	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
153 HALF MOON BAY	HIGHEST MEAN	54.5	56.3	56.5	57.8	58.2	59.5	61.9	62.6	63.4	60.4	59.1	54.3	63.4
	MEDIAN	50.9	51.9	51.7	53.1	54.5	56.9	58.2	59.3	58.9	57.0	53.5	51.2	54.7
	LOWEST MEAN	46.4	46.1	48.2	48.5	50.0	53.3	53.7	56.6	56.2	52.0	49.6	45.8	45.8
	HIGHEST MEAN YEAR	1986	1992	1992	1992	1997	1992	1992	1997	1983	1983	1997	2000	1983
	LOWEST MEAN YEAR	1972	1989	1991	1975	1991	1991	1971	1975	1975	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.5	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.3	-0.8	-0.7	-0.7	-0.6	-1.0	-0.7	-0.7	-0.5	
154 HANFORD 1 S	HIGHEST MEAN	50.4	54.1	59.5	66.2	74.4	79.1	83.4	81.9	77.8	69.7	58.3	49.6	83.4
	MEDIAN	44.4	50.2	55.4	60.4	68.1	75.1	79.5	78.2	73.7	64.3	52.4	43.9	62.3
	LOWEST MEAN	38.7	45.7	47.9	53.8	61.6	71.2	75.3	72.7	69.0	60.2	48.0	39.8	38.7
	HIGHEST MEAN YEAR	1995	1992	1997	1987	1992	1981	1988	1992	1991	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1991	1987	1976	1986	1984	1994	1985	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
155 HAPPY CAMP RA	HIGHEST MEAN	45.2	49.0	52.9	58.1	67.1	70.9	75.6	75.4	69.8	63.0	52.1	45.7	75.6
	MEDIAN	40.6	44.2	47.5	51.6	58.4	65.3	72.4	71.9	65.9	56.0	46.3	39.8	55.2
	LOWEST MEAN	36.7	38.0	43.3	44.0	51.4	62.3	66.0	66.8	60.5	52.6	38.5	33.2	33.2
	HIGHEST MEAN YEAR	1981	1991	1978	1989	1992	1977	1996	1986	1991	1988	1995	1973	1996
	LOWEST MEAN YEAR	1979	1979	1971	1975	1977	1980	1983	1976	1985	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.7	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.2	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
158 HAT CREEK	HIGHEST MEAN	39.9	43.7	47.0	54.3	60.8	67.2	72.2	69.4	66.0	56.6	47.4	38.6	72.2
	MEDIAN	35.1	39.1	42.7	47.1	55.3	62.1	67.6	67.2	60.7	51.4	40.3	34.3	50.1
	LOWEST MEAN	27.9	32.8	38.2	41.3	48.7	56.9	62.7	62.6	55.5	46.1	32.6	27.2	27.2
	HIGHEST MEAN YEAR	1986	1991	1972	1990	1992	1977	1988	1971	1991	1987	1995	1995	1988
	LOWEST MEAN YEAR	1993	1993	1977	1975	1977	1980	1983	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.4	-0.4	-0.4	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
159 HAYFIELD PUMP	HIGHEST MEAN	56.3	61.5	67.9	74.5	82.8	88.0	92.3	92.1	85.7	76.8	63.5	57.7	92.3
	MEDIAN	52.4	56.2	60.7	66.8	74.3	82.1	88.7	86.8	82.1	70.7	59.1	52.3	69.1
	LOWEST MEAN	46.5	50.9	55.2	58.9	67.1	78.5	84.1	82.7	75.0	64.4	53.4	47.2	46.5
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1994	1995	1999	1995	1980	1996
	LOWEST MEAN YEAR	1979	1975	1991	1975	1977	1998	1993	1976	1985	1971	1994	1987	1979
	MIN OBS TIME ADJUSTMENT	-0.1	-0.3	-0.3	-0.3	-0.2	-0.1	-0.2	-0.4	-0.5	-0.6	-0.6	-0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.2	0.2	0.2	0.2	0.1	-0.1	-0.2	-0.2	-0.2	0.0	
161 HEALDSBURG	HIGHEST MEAN	52.3	56.1	58.7	63.0	69.3	76.4	75.4	73.6	74.7	65.9	57.8	51.9	76.4
	MEDIAN	48.5	52.6	55.0	59.2	64.6	69.9	72.2	71.6	68.3	62.7	53.6	48.3	60.4
	LOWEST MEAN	44.6	47.8	51.0	53.4	59.6	65.9	69.9	68.2	63.2	59.6	47.7	42.7	42.7
	HIGHEST MEAN YEAR	1995	1991	1988	1985	1997	1981	1984	1984	1984	1991	1995	1996	1981
	LOWEST MEAN YEAR	1972	1989	1999	1975	1998	1982	1987	1973	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.5	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.3	-0.3	-0.4	-0.9	-0.5	-0.6	-0.5	-0.4	-0.7	-0.4	-0.4	-0.3	
164 HENSHAW DAM	HIGHEST MEAN	49.5	53.6	55.5	58.8	66.1	71.9	77.2	76.9	72.4	64.1	56.3	49.5	77.2
	MEDIAN	45.5	47.1	49.6	53.5	58.2	66.1	72.3	72.7	67.8	58.2	50.1	44.8	57.2
	LOWEST MEAN	41.4	43.6	43.9	46.5	52.3	60.3	65.4	66.6	59.5	54.2	44.6	39.6	39.6
	HIGHEST MEAN YEAR	1986	1995	1972	1992	1997	1981	1996	1980	1979	1978	1995	1977	1996
	LOWEST MEAN YEAR	1973	1998	1973	1975	1977	1982	1987	1976	1986	1998	1994	1987	1987
	MIN OBS TIME ADJUSTMENT	0.6	0.7	0.5	0.0	0.1	0.1	0.0	-0.1	-0.2	0.2	0.1	0.5	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	-0.1	0.1	
165 HETCH HETCHY	HIGHEST MEAN	44.6	49.0	52.3	56.5	64.0	69.7	75.3	73.8	69.7	63.5	53.2	44.3	75.3
	MEDIAN	39.1	42.1	44.7	49.7	56.9	64.2	70.4	70.3	65.6	56.4	45.2	39.8	53.6
	LOWEST MEAN	33.8	35.1	37.6	41.1	47.9	59.1	64.6	63.3	58.4	50.3	36.7	32.0	32.0
	HIGHEST MEAN YEAR	1986	1995	1997	1987	1992	2000	1988	1994	1991	1988	1995	2000	1988
	LOWEST MEAN YEAR	1982	1990	1991	1975	1977	1998	1983	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	0.4	-0.1	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
166 HOLLISTER 2	HIGHEST MEAN	54.4	56.3	58.1	62.1	66.8	69.3	70.0	71.3	72.3	66.3	60.7	53.6	72.3
	MEDIAN	48.9	51.9	53.7	57.0	60.2	64.5	66.4	67.1	66.5	62.6	54.5	49.1	58.5
	LOWEST MEAN	45.5	46.5	49.4	51.1	55.7	60.5	62.9	63.7	62.8	59.2	48.8	43.0	43.0
	HIGHEST MEAN YEAR	1986	1996	1986	1992	1997	1981	1985	1998	1984	1992	1995	2000	1984
	LOWEST MEAN YEAR	1982	1999	1999	1975	1977	1982	1994	1989	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-1.1	-0.9	-1.2	-1.4	-1.1	-1.1	-0.9	-0.9	-1.3	-1.4	-1.2	-1.0	
167 HUNTINGTON LA	HIGHEST MEAN	42.5	44.2	42.6	50.7	53.0	58.9	65.8	64.2	60.4	56.6	46.2	44.8	65.8
	MEDIAN	35.7	35.1	36.0	40.2	46.5	53.8	60.3	60.7	56.5	47.1	41.0	36.9	46.0
	LOWEST MEAN	28.7	29.4	26.9	33.1	37.7	48.0	54.7	54.1	46.9	42.6	34.1	25.6	25.6
	HIGHEST MEAN YEAR	1986	1991	1994	1989	1992	1994	1988	1988	1991	1988	1995	1989	1988
	LOWEST MEAN YEAR	1973	1998	1973	1975	1977	1983	1983	1976	1986	1972	1972	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.6	-0.6	-0.6	-0.4	-0.5	-0.4	-0.4	-0.6	-0.6	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-1.0	-1.2	-1.6	-1.3	-1.5	-1.1	-1.0	-1.5	-1.2	-1.0	-0.9	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
168	IDYLLWILD FIR	HIGHEST MEAN	47.0	48.3	50.5	54.1	61.4	66.1	71.1	71.4	66.1	60.7	53.0	46.7	71.4
		MEDIAN	40.1	41.4	42.5	46.6	52.8	60.6	67.0	66.6	63.2	53.8	45.7	41.4	51.6
		LOWEST MEAN	34.1	37.2	34.2	37.5	43.5	56.4	62.4	61.6	55.0	48.4	39.9	32.4	32.4
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1994	1979	1988	1995	2000	1994
		LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1982	1993	1976	1986	1972	1972	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.3	-0.3	-0.2	-0.3	-0.3	-0.4	-0.5	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.0	-0.9	-0.7	-0.8	-0.9	-1.1	-1.2	-0.7	-1.0	
169	IMPERIAL	HIGHEST MEAN	60.1	64.3	68.8	75.6	82.5	88.7	92.7	94.0	90.3	79.5	68.4	59.4	94.0
		MEDIAN	54.9	58.8	63.3	69.5	76.5	85.3	90.1	89.8	85.6	74.0	62.5	55.0	72.1
		LOWEST MEAN	50.6	55.8	58.7	61.6	70.5	80.6	88.0	86.7	79.7	68.1	56.8	50.4	50.4
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1978	1980	1995	1995	1988	1995	1980	1995
		LOWEST MEAN YEAR	1979	1975	1977	1975	1977	1982	1991	1979	1985	1971	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
171	INDEPENDENCE	HIGHEST MEAN	47.9	53.3	57.9	66.5	73.9	82.5	85.7	83.3	76.3	69.0	56.8	48.3	85.7
		MEDIAN	40.8	45.0	50.1	57.3	67.0	75.8	81.3	79.1	72.6	60.6	48.3	41.5	59.9
		LOWEST MEAN	32.4	39.7	43.4	48.5	57.3	70.1	75.4	73.7	66.9	56.2	43.2	35.0	32.4
		HIGHEST MEAN YEAR	1986	1995	1997	1989	1984	1981	1996	1996	1979	1988	1995	1980	1996
		LOWEST MEAN YEAR	1974	1994	1991	1975	1977	1998	1987	1976	1978	1972	1994	1990	1974
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
172	INDIO FIRE ST	HIGHEST MEAN	62.7	67.0	73.6	78.8	86.9	92.1	96.1	96.4	90.7	82.1	70.6	61.9	96.4
		MEDIAN	56.6	61.2	65.7	73.1	79.8	87.8	92.7	91.9	86.8	76.6	63.7	56.2	74.3
		LOWEST MEAN	51.2	57.3	60.3	65.2	73.2	83.2	89.0	88.9	81.9	70.3	57.9	51.6	51.2
		HIGHEST MEAN YEAR	1986	1995	1972	2000	1997	1994	1996	1995	1995	1991	1995	1980	1995
		LOWEST MEAN YEAR	1979	1975	1991	1975	1977	1991	1993	1976	1985	1971	1994	1978	1979
		MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.3	-0.3	-0.4	-0.6	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.0	-0.9	-0.7	-0.8	-0.8	-1.1	-1.2	-0.8	-1.0	
173	INYOKERN	HIGHEST MEAN	50.5	56.6	61.7	70.0	76.7	83.2	88.0	86.3	79.6	72.1	60.1	50.4	88.0
		MEDIAN	45.0	50.8	54.6	61.4	70.6	78.2	84.5	82.6	76.7	65.3	52.9	46.2	64.1
		LOWEST MEAN	40.8	46.5	49.6	53.2	61.0	73.5	79.6	77.1	70.8	60.5	45.8	39.3	39.3
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1998	1991	1988	1995	1980	1996
		LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1998	1987	1976	1985	1971	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.6	-0.4	-0.4	-0.4	-0.4	-0.6	-0.7	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.8	-0.9	-1.2	-1.1	-1.1	-0.9	-0.8	-1.3	-0.9	-0.5	-0.7	
175	IRON MOUNTAIN	HIGHEST MEAN	60.1	64.3	72.5	80.0	88.9	95.1	98.3	98.0	91.4	81.9	68.9	61.4	98.3
		MEDIAN	54.2	59.8	64.2	71.1	80.5	89.7	95.2	93.3	87.1	74.9	62.9	54.6	74.0
		LOWEST MEAN	47.2	54.2	57.4	64.5	73.4	85.1	90.5	90.1	79.9	68.9	55.5	49.4	47.2
		HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1995	1995	1988	1995	1980	1996
		LOWEST MEAN YEAR	1979	1979	1991	1975	1977	1991	1993	1983	1985	1971	1994	1990	1979
		MIN OBS TIME ADJUSTMENT	0.7	0.5	0.6	0.1	0.1	-0.1	0.0	-0.2	-0.3	0.1	0.1	0.6	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	
176	JESS VALLEY	HIGHEST MEAN	37.1	40.7	41.7	46.6	55.1	61.3	67.4	67.0	61.1	54.3	44.6	37.2	67.4
		MEDIAN	30.5	32.2	35.9	40.1	47.7	56.7	63.2	62.9	56.5	46.9	35.9	30.0	45.3
		LOWEST MEAN	21.4	24.7	29.4	32.9	41.2	51.2	56.0	58.0	46.0	38.0	24.5	23.1	21.4
		HIGHEST MEAN YEAR	1981	1991	1978	1990	1992	1977	1988	1971	1991	1988	1999	1980	1988
		LOWEST MEAN YEAR	1982	1989	1985	1975	1977	1982	1983	1976	1985	1984	1985	1992	1982
		MIN OBS TIME ADJUSTMENT	0.8	0.9	1.2	0.9	0.9	0.0	0.7	0.5	0.9	0.7	0.6	0.7	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.0	-0.1	-0.1	0.0	0.1	
179	KENTFIELD	HIGHEST MEAN	52.5	55.5	58.3	61.7	67.6	73.3	72.9	71.2	71.0	66.1	59.6	53.2	73.3
		MEDIAN	48.5	52.3	54.6	57.9	62.3	66.7	69.3	69.1	67.1	62.7	54.1	48.6	59.3
		LOWEST MEAN	44.2	47.8	51.0	53.2	58.1	63.4	66.2	65.3	63.7	59.0	49.7	43.7	43.7
		HIGHEST MEAN YEAR	1995	1995	1986	1992	1997	1981	1985	1993	1997	1992	1995	1996	1981
		LOWEST MEAN YEAR	1972	1989	1999	1975	1999	1982	1994	1980	1986	1971	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
		MAX OBS TIME ADJUSTMENT	-0.8	-0.7	-0.9	-1.4	-1.0	-0.9	-0.8	-0.7	-1.2	-1.1	-1.0	-0.7	
180	KERN RIVER PH	HIGHEST MEAN	56.3	61.4	65.7	76.1	80.0	89.8	92.8	89.7	86.4	78.5	65.1	57.8	92.8
		MEDIAN	51.3	57.1	59.7	66.3	74.9	82.5	87.4	86.1	82.3	72.9	59.8	50.5	69.4
		LOWEST MEAN	44.5	51.0	52.8	57.7	63.4	77.8	83.6	79.0	75.7	67.8	53.5	45.1	44.5
		HIGHEST MEAN YEAR	1986	1991	1972	1987	1997	1981	1984	1992	1984	1990	1995	1979	1984
		LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1998	1987	1976	1985	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.6	-0.4	-0.4	-0.4	-0.4	-0.7	-0.8	-0.8	-0.7	
		MAX OBS TIME ADJUSTMENT	-1.1	-1.0	-1.4	-1.8	-1.3	-1.4	-1.0	-1.0	-1.7	-1.6	-1.3	-1.2	
181	KERN RIVER PH	HIGHEST MEAN	52.3	54.6	57.9	64.3	69.9	78.3	85.2	83.6	77.4	67.9	56.4	50.9	85.2
		MEDIAN	45.2	48.1	51.1	56.8	64.8	73.0	79.3	78.6	72.8	62.8	50.9	45.6	61.0
		LOWEST MEAN	41.3	43.4	45.4	49.0	56.7	66.3	74.5	74.2	66.3	58.0	45.7	39.5	39.5
		HIGHEST MEAN YEAR	1986	1995	1972	1987	1992	1981	1996	1996	1991	1991	1976	1980	1996
		LOWEST MEAN YEAR	1982	1989	1991	1975	1998	1998	1983	1976	1986	1984	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.2	0.3	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.0	-0.1	-0.1	-0.1	0.1	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
183 KING CITY	HIGHEST MEAN	56.0	58.1	60.5	64.1	67.6	70.9	72.0	71.6	73.2	66.5	59.5	54.4	73.2
	MEDIAN	50.0	52.7	55.6	58.8	62.6	66.5	69.0	69.0	68.1	63.4	55.1	50.0	60.3
	LOWEST MEAN	45.8	50.1	51.3	52.6	58.5	63.8	65.7	66.4	62.8	59.1	49.0	44.4	44.4
	HIGHEST MEAN YEAR	1986	1991	1978	1992	1997	1973	1984	1983	1984	1991	1995	1977	1984
	LOWEST MEAN YEAR	1982	1990	1973	1975	1998	1991	1987	1975	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.3	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-1.5	-1.0	-1.1	-0.9	-0.8	-1.3	-1.1	-1.1	-0.8	
184 KLAMATH	HIGHEST MEAN	51.2	52.1	53.1	54.4	56.8	59.3	61.1	61.4	62.5	57.1	53.7	49.6	62.5
	MEDIAN	46.3	48.2	48.4	50.5	53.3	56.4	59.0	59.0	57.9	54.3	49.7	46.3	52.6
	LOWEST MEAN	43.0	41.9	45.1	45.7	50.8	55.1	57.2	56.3	55.0	50.9	43.5	40.1	40.1
	HIGHEST MEAN YEAR	1986	1980	1978	1989	1997	2000	1990	1999	1979	1979	1999	1995	1979
	LOWEST MEAN YEAR	1972	1989	1999	1975	1999	1976	1973	1973	1993	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.3	-0.4	-0.4	-0.7	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.6	-0.5	-1.1	-0.9	-0.7	-0.6	-0.7	-0.8	-0.6	-0.7	-0.7	
186 LAGUNA BEACH	HIGHEST MEAN	58.8	59.7	60.7	64.0	68.9	70.4	73.0	74.0	75.2	71.0	63.7	58.6	75.2
	MEDIAN	55.5	56.0	57.2	59.9	62.5	65.4	68.5	69.4	69.4	65.2	59.3	55.9	62.0
	LOWEST MEAN	52.4	51.9	53.5	55.0	58.4	61.2	65.5	64.3	65.0	62.1	55.8	51.5	51.5
	HIGHEST MEAN YEAR	1986	1980	1997	1989	1997	1981	1984	1983	1984	1983	1976	1977	1984
	LOWEST MEAN YEAR	1979	1990	1985	1978	1977	1980	1973	1975	1973	1996	2000	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.8	-0.6	-0.7	-0.7	-1.1	-1.1	-0.7	-0.9	
187 LAKE ARROWHEA	HIGHEST MEAN	42.4	44.6	50.6	56.8	62.4	68.1	72.8	74.5	66.7	60.0	51.0	43.7	74.5
	MEDIAN	36.6	38.4	41.3	47.9	54.4	62.3	67.7	67.5	63.8	52.3	42.2	37.5	51.3
	LOWEST MEAN	31.4	34.9	36.3	38.3	45.4	58.1	64.6	62.1	55.8	47.7	36.9	29.9	29.9
	HIGHEST MEAN YEAR	1986	1995	1972	1989	2000	1994	2000	1998	1999	1988	1995	2000	1998
	LOWEST MEAN YEAR	1973	1990	1973	1975	1977	1982	1993	1976	1986	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.3	-0.3	-0.2	-0.3	-0.3	-0.5	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.9	-0.9	-0.8	-0.7	-0.7	-0.7	-1.2	-0.9	-0.5	-0.7	
188 LAKEPORT	HIGHEST MEAN	46.5	50.6	54.3	59.3	66.6	71.9	76.7	75.9	71.9	65.1	54.0	47.3	76.7
	MEDIAN	43.3	46.7	49.3	53.2	60.6	67.1	73.1	72.9	67.9	59.0	48.4	43.7	56.9
	LOWEST MEAN	39.6	41.5	45.1	46.9	53.5	61.8	67.8	67.4	62.6	54.4	42.7	38.2	38.2
	HIGHEST MEAN YEAR	1984	1991	1986	1987	1992	1985	1996	1986	1999	1991	1995	1995	1996
	LOWEST MEAN YEAR	1982	1989	1991	1975	1977	1980	1983	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
191 LAKE SOLANO	HIGHEST MEAN	49.5	54.3	59.4	64.0	73.7	78.3	81.4	79.6	75.9	69.4	59.7	50.9	81.4
	MEDIAN	45.1	50.1	53.6	59.3	66.2	72.9	76.7	76.0	72.8	64.7	53.2	45.8	61.1
	LOWEST MEAN	40.5	46.4	48.8	52.6	59.2	67.8	73.5	71.1	66.7	60.6	48.5	41.0	40.5
	HIGHEST MEAN YEAR	1986	1997	1997	1992	1992	1981	1996	1998	1984	1991	1995	1995	1996
	LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1980	1987	1976	1986	1975	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.2	-0.3	-0.3	-0.4	-0.2	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.0	
192 LAKE SPAULDIN	HIGHEST MEAN	39.8	43.1	43.2	49.2	57.6	66.3	67.6	68.1	65.7	56.5	46.9	40.7	68.1
	MEDIAN	35.1	36.3	38.8	42.9	50.7	57.8	64.4	64.1	59.7	50.2	40.1	34.8	47.7
	LOWEST MEAN	30.8	30.5	33.1	35.4	40.6	54.2	59.7	59.7	51.0	44.8	31.7	28.6	28.6
	HIGHEST MEAN YEAR	1976	1991	1978	1987	1992	1977	1984	1977	1975	1988	1976	1980	1977
	LOWEST MEAN YEAR	1993	1989	1991	1975	1998	1980	1987	1989	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.4	-0.6	-0.6	-0.7	-0.8	-0.8	
	MAX OBS TIME ADJUSTMENT	-1.1	-1.1	-1.4	-1.5	-1.4	-1.6	-1.2	-1.3	-1.5	-1.2	-1.2	-1.1	
193 LA MESA	HIGHEST MEAN	63.1	62.8	63.5	68.1	71.2	73.4	77.8	78.6	79.4	72.9	66.2	61.0	79.4
	MEDIAN	57.2	57.9	59.0	62.1	64.6	69.3	72.6	74.1	73.0	68.0	61.4	57.2	64.8
	LOWEST MEAN	53.6	54.7	55.4	56.8	60.6	64.1	68.8	71.0	67.9	65.1	57.1	51.0	51.0
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1984	1996	1984	1999	1995	1977	1984
	LOWEST MEAN YEAR	1979	1990	1973	1975	1977	1982	1987	1975	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.8	-0.9	-0.8	-0.6	-0.5	-0.6	-0.5	-0.9	-1.0	-0.6	-0.8	
194 LANCASTER ATC	HIGHEST MEAN	48.4	52.6	57.8	65.4	75.2	80.3	85.2	82.9	77.1	67.8	56.6	49.9	85.2
	MEDIAN	43.0	47.8	51.8	57.3	66.2	74.3	80.7	78.9	72.6	61.5	50.0	42.8	60.8
	LOWEST MEAN	40.0	41.8	45.9	50.1	58.2	68.4	75.5	74.3	66.5	57.0	43.7	36.3	36.3
	HIGHEST MEAN YEAR	1980	1995	1972	1989	1997	1981	1996	1994	1979	1991	1995	1977	1996
	LOWEST MEAN YEAR	1973	1979	1977	1975	1998	1998	1987	1976	1986	1971	1994	1984	1984
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
195 LAVA BEDS NAT	HIGHEST MEAN	39.4	43.6	44.8	51.2	61.1	65.5	72.5	72.8	66.5	58.7	46.4	37.3	72.8
	MEDIAN	33.1	35.1	39.0	43.8	52.3	59.7	68.2	68.1	61.4	50.6	38.3	32.7	48.5
	LOWEST MEAN	26.5	26.6	34.0	35.8	44.7	54.9	61.6	61.3	53.7	45.1	30.3	25.3	25.3
	HIGHEST MEAN YEAR	1986	1995	1978	1987	1992	1986	1994	1986	1991	1987	1976	1989	1986
	LOWEST MEAN YEAR	1993	1989	1975	1975	1977	1991	1993	1976	1985	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	-0.1	-0.5	-0.6	-0.5	-0.5	-0.4	-0.6	-0.7	-0.8	-0.5	-0.4	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.1	0.2	0.2	0.1	-0.1	-0.1	-0.2	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
198 LEE VINING	HIGHEST MEAN	36.2	40.3	44.8	51.6	57.8	65.6	71.0	70.2	62.5	55.7	46.9	36.2	71.0
	MEDIAN	29.8	32.9	37.5	44.3	52.9	60.6	68.1	67.2	59.9	50.5	39.9	30.8	47.8
	LOWEST MEAN	24.4	25.9	32.2	37.0	45.0	55.3	63.2	60.9	54.2	45.6	31.5	23.7	23.7
	HIGHEST MEAN YEAR	2000	1991	1997	1992	1992	1981	1994	1971	1995	1988	1995	1996	1994
	LOWEST MEAN YEAR	1992	1993	1977	1975	1977	1998	1983	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.2	-0.1	-0.4	-0.5	-0.4	-0.4	-0.3	-0.5	-0.6	-0.6	-0.4	-0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.2	0.2	0.1	0.2	0.2	0.1	-0.1	-0.1	-0.2	-0.1	0.0	
199 LEMON COVE	HIGHEST MEAN	53.1	56.8	61.3	67.8	74.7	80.6	84.4	82.8	78.4	71.2	59.7	53.2	84.4
	MEDIAN	47.4	52.7	56.9	61.8	69.3	76.0	81.3	79.7	74.8	66.2	54.4	47.0	64.0
	LOWEST MEAN	40.3	47.3	51.8	55.3	61.4	71.9	75.1	74.8	68.9	61.7	48.6	42.4	40.3
	HIGHEST MEAN YEAR	1986	1991	1978	1989	1992	1981	1996	1996	1984	1991	1995	1977	1996
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1998	1987	1976	1986	1981	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
200 LEMOORE REEVE	HIGHEST MEAN	52.3	56.6	60.8	66.6	75.2	80.1	83.0	80.9	78.8	69.7	59.9	50.6	83.0
	MEDIAN	45.6	51.5	55.6	60.7	68.4	74.7	78.8	77.4	73.1	64.8	52.6	44.4	62.0
	LOWEST MEAN	40.3	46.4	49.1	55.0	58.0	69.1	72.0	73.2	67.7	59.7	47.8	40.1	40.1
	HIGHEST MEAN YEAR	1986	1996	1972	1989	1992	1981	1996	1996	1991	1991	1995	1995	1996
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1980	1987	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
201 LINDSAY	HIGHEST MEAN	51.8	55.9	61.4	67.3	74.9	78.8	83.4	82.1	77.5	69.5	57.2	52.4	83.4
	MEDIAN	46.5	52.1	56.7	60.9	67.8	74.5	79.5	78.2	73.3	63.9	52.9	46.0	62.6
	LOWEST MEAN	40.6	47.3	51.0	56.0	61.9	70.8	74.9	74.1	66.2	59.5	46.4	41.3	40.6
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1977	1988	1998	1991	1987	1995	1977	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1980	1983	1976	1986	1984	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.5	-0.5	-0.4	-0.5	-0.3	-0.4	-0.6	-0.6	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.3	-0.5	-0.5	-0.7	-0.7	-0.8	-0.6	-0.5	-0.8	-0.5	-0.5	-0.4	
202 LIVERMORE	HIGHEST MEAN	52.0	54.6	57.7	62.4	68.6	74.7	76.1	76.0	73.8	67.7	59.0	51.9	76.1
	MEDIAN	46.7	51.1	53.9	57.6	62.7	68.4	72.1	71.9	69.9	63.4	53.5	46.9	59.7
	LOWEST MEAN	42.9	47.1	49.2	50.7	56.9	63.5	68.1	68.0	63.8	59.6	48.2	41.9	41.9
	HIGHEST MEAN YEAR	1995	1991	1986	1987	1997	1981	1988	1998	1984	1991	1995	1995	1988
	LOWEST MEAN YEAR	1982	1989	1973	1975	1977	1982	1987	1976	1986	1971	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.5	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.3	-0.3	-0.4	-0.9	-0.5	-0.6	-0.5	-0.5	-0.7	-0.4	-0.4	-0.3	
203 LODGEPOLE	HIGHEST MEAN	34.1	37.0	38.7	44.0	51.8	58.2	62.8	62.2	57.3	49.7	41.6	33.7	62.8
	MEDIAN	27.4	29.7	32.4	37.6	45.3	53.4	59.8	59.2	52.9	43.8	33.6	28.1	41.9
	LOWEST MEAN	21.8	24.0	25.2	27.8	36.4	47.0	55.5	52.9	46.0	38.6	26.4	19.0	19.0
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1992	1981	1996	1971	1974	1988	1995	1977	1996
	LOWEST MEAN YEAR	1973	1990	1973	1975	1998	1998	1987	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	0.5	-0.1	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	-0.1	-0.1	-0.1	0.1	
204 LODI	HIGHEST MEAN	51.9	54.0	58.8	63.8	70.9	75.1	77.8	76.5	74.1	67.5	58.1	51.4	77.8
	MEDIAN	45.9	51.5	54.7	59.3	65.5	70.4	73.8	72.8	70.7	62.7	52.5	45.4	60.3
	LOWEST MEAN	40.8	46.8	50.4	54.4	59.2	65.6	67.5	70.0	63.9	59.7	48.2	39.3	39.3
	HIGHEST MEAN YEAR	1978	1977	1972	1977	1997	1973	1988	1998	1984	1991	1995	1983	1988
	LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1982	1987	1987	1986	1981	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.6	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.6	-0.8	-1.0	-0.9	-1.1	-0.9	-0.8	-1.2	-0.8	-0.7	-0.5	
205 LOMPOC	HIGHEST MEAN	58.5	60.0	60.3	64.1	64.5	65.7	67.4	69.0	72.5	67.5	62.0	57.9	72.5
	MEDIAN	54.2	55.1	56.5	57.9	59.6	62.4	64.6	65.4	65.0	62.7	57.5	53.5	59.8
	LOWEST MEAN	49.2	50.5	51.4	53.7	56.7	59.0	60.5	62.5	62.6	58.2	52.5	48.5	48.5
	HIGHEST MEAN YEAR	1986	1995	1988	1989	1992	1981	1992	1983	1984	1987	1976	1977	1984
	LOWEST MEAN YEAR	1979	1979	1977	1975	1999	1999	1971	1999	1974	1971	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.6	-1.1	-0.9	-0.8	-0.8	-1.2	-1.3	-1.1	-1.0	
206 LONG BEACH AP	HIGHEST MEAN	61.7	61.8	64.6	67.5	71.3	75.9	77.5	80.1	80.0	72.4	66.8	61.7	80.1
	MEDIAN	57.0	57.9	59.6	63.0	66.1	70.1	73.5	74.5	73.9	68.1	61.5	57.2	65.3
	LOWEST MEAN	53.9	55.6	55.4	57.3	62.2	65.9	70.4	70.9	68.5	64.7	56.9	52.9	52.9
	HIGHEST MEAN YEAR	1986	1995	1978	1992	1997	1981	1984	1998	1984	1976	1977	1977	1998
	LOWEST MEAN YEAR	1974	1990	1973	1975	1995	1999	1987	1999	1986	2000	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
208 LOS ANGELES I	HIGHEST MEAN	62.3	61.7	62.5	65.6	67.6	71.9	71.7	74.7	76.5	69.6	65.9	60.9	76.5
	MEDIAN	57.1	58.1	58.2	60.8	62.9	66.2	69.4	70.3	69.7	66.4	61.5	57.9	63.4
	LOWEST MEAN	53.9	54.2	55.0	56.7	60.1	63.6	66.3	67.7	65.8	63.7	57.9	52.7	52.7
	HIGHEST MEAN YEAR	1986	1995	1988	1992	1997	1981	1981	1994	1984	1990	1976	1977	1984
	LOWEST MEAN YEAR	1972	1979	1991	1975	1980	1982	1987	1989	1986	2000	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
209 LOS ANGELES D	HIGHEST MEAN	65.2	65.3	65.1	69.0	72.7	77.0	78.8	80.5	80.9	73.7	67.1	63.1	80.9
	MEDIAN	58.5	59.7	60.8	64.1	65.8	70.9	73.7	75.0	73.6	69.5	63.2	59.1	66.0
	LOWEST MEAN	52.6	54.3	55.1	55.5	61.4	64.9	70.4	71.2	68.4	65.1	57.9	52.2	52.2
	HIGHEST MEAN YEAR	1986	1995	1997	1992	1997	1981	1985	1994	1984	1983	1995	1980	1984
	LOWEST MEAN YEAR	1979	1979	1975	1975	1977	1982	1987	1976	1986	2000	1978	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
210 LOS BANOS	HIGHEST MEAN	51.1	55.0	59.8	65.6	73.2	78.9	82.0	80.3	76.7	69.7	59.1	50.9	82.0
	MEDIAN	45.7	51.6	55.5	60.0	67.2	73.5	78.0	77.4	73.5	65.4	53.6	45.1	62.1
	LOWEST MEAN	39.9	47.1	50.9	54.1	61.2	69.2	73.1	72.6	68.6	60.6	48.2	40.9	39.9
	HIGHEST MEAN YEAR	1986	1992	1993	1987	1997	1981	1996	1998	1984	1991	1995	1983	1996
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1980	1987	1976	1986	1971	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
212 LOS BANOS DET	HIGHEST MEAN	51.1	55.1	61.2	66.7	74.3	80.7	83.6	81.9	78.3	71.2	60.7	51.5	83.6
	MEDIAN	46.2	51.6	55.2	60.4	67.5	74.4	79.2	78.1	74.5	66.7	54.9	46.1	62.8
	LOWEST MEAN	39.7	48.0	51.4	54.2	59.8	68.6	73.8	73.0	69.4	62.4	49.5	40.4	39.7
	HIGHEST MEAN YEAR	2000	1991	1972	1987	1997	1981	1996	1996	1984	1991	1995	1983	1996
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1980	1987	1976	1986	1984	1994	1985	1972
	MIN OBS TIME ADJUSTMENT	-0.2	0.0	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	-0.5	-0.6	-0.4	-0.3	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.1	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.0	
213 LOS GATOS	HIGHEST MEAN	52.6	54.6	58.6	61.5	66.7	71.6	74.7	72.0	73.5	65.1	58.3	52.8	74.7
	MEDIAN	48.5	52.2	54.3	57.1	62.3	66.8	70.1	69.6	67.7	62.7	53.7	48.0	59.4
	LOWEST MEAN	45.2	47.3	50.1	52.9	56.8	63.7	66.1	68.2	62.8	58.4	47.8	42.3	42.3
	HIGHEST MEAN YEAR	1986	1991	1978	1989	1997	1981	1984	1998	1984	1991	1995	1977	1984
	LOWEST MEAN YEAR	1972	1989	1991	1975	1998	1991	1987	1989	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.3	-0.8	-0.9	-0.8	-0.7	-1.1	-0.7	-0.7	-0.5	
217 MADERA	HIGHEST MEAN	51.0	54.0	59.8	66.1	73.1	81.4	83.6	81.3	77.3	69.0	57.9	50.3	83.6
	MEDIAN	45.3	50.7	55.2	60.6	67.8	74.6	79.7	78.9	73.8	64.1	52.6	44.3	62.4
	LOWEST MEAN	40.2	46.8	51.2	54.2	61.4	71.1	75.7	73.1	68.5	59.2	46.9	40.7	40.2
	HIGHEST MEAN YEAR	1986	1986	1972	1987	1997	1981	1988	1980	1984	1987	1995	1977	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1998	1987	1976	1986	1981	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	-0.1	0.1	
219 MANZANITA LAK	HIGHEST MEAN	37.0	39.2	40.5	46.6	54.9	60.3	66.9	64.2	61.6	54.1	44.9	38.0	66.9
	MEDIAN	31.6	32.6	34.8	38.9	48.0	54.9	61.4	60.6	55.6	46.7	35.9	31.5	44.3
	LOWEST MEAN	25.7	26.5	28.5	30.1	38.7	49.3	56.0	54.9	48.0	40.5	26.9	24.7	24.7
	HIGHEST MEAN YEAR	1986	1991	1986	1987	1992	1977	1988	1992	1974	1988	1976	1989	1988
	LOWEST MEAN YEAR	1973	1990	1973	1975	1998	1980	1983	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.3	0.5	-0.1	-0.4	-0.4	-0.4	-0.4	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	
220 MARICOPA	HIGHEST MEAN	55.6	58.4	62.6	68.9	76.4	85.3	87.6	86.3	83.9	75.3	60.5	53.3	87.6
	MEDIAN	47.7	53.5	56.6	62.3	70.6	77.8	83.0	81.8	77.6	68.4	55.9	47.7	65.1
	LOWEST MEAN	40.8	49.0	51.8	55.9	62.5	73.6	77.3	76.0	71.5	64.6	49.9	42.3	40.8
	HIGHEST MEAN YEAR	1986	1991	1986	1989	1992	1981	1988	1984	1991	1991	1995	1977	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1980	1983	1976	1985	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.3	-0.2	-0.2	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
222 MARKLEEVILLE	HIGHEST MEAN	38.2	39.6	43.2	48.6	55.0	61.3	67.1	66.7	59.2	52.3	44.1	36.4	67.1
	MEDIAN	31.5	33.8	37.3	41.9	49.9	57.4	63.7	63.1	56.0	46.5	37.9	30.7	45.7
	LOWEST MEAN	24.2	28.2	31.6	34.8	43.3	53.1	59.7	56.7	50.7	42.2	28.3	23.2	23.2
	HIGHEST MEAN YEAR	1986	1991	1997	1992	1992	1985	1988	1971	1979	1988	1995	1981	1988
	LOWEST MEAN YEAR	1993	1990	1991	1975	1977	1995	1983	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.8	0.9	0.7	0.0	0.0	0.0	0.0	-0.2	0.3	0.2	0.6	0.7	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.2	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
223 MARKLEY COVE	HIGHEST MEAN	49.5	53.1	56.9	61.8	69.7	76.3	79.3	77.5	74.4	68.0	57.8	50.6	79.3
	MEDIAN	45.1	48.8	51.5	56.6	63.2	70.0	74.8	74.6	71.3	62.9	52.3	46.0	59.7
	LOWEST MEAN	41.3	44.4	47.8	49.0	56.5	64.4	70.7	69.5	65.3	59.6	46.9	40.6	40.6
	HIGHEST MEAN YEAR	1995	1997	1997	1992	1992	1981	1988	1996	1991	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1989	1973	1975	1998	1980	1987	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.3	0.4	0.0	0.0	-0.2	-0.3	-0.3	-0.4	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.0	
224 MARTINEZ WATE	HIGHEST MEAN	51.1	54.1	58.4	62.5	70.8	76.2	74.9	74.0	74.0	66.7	58.8	52.3	76.2
	MEDIAN	46.1	50.7	54.3	58.3	63.6	68.9	71.3	70.9	68.7	62.8	52.8	47.0	59.4
	LOWEST MEAN	41.0	47.0	50.1	52.0	58.9	64.7	67.8	68.2	63.5	58.6	48.5	41.6	41.0
	HIGHEST MEAN YEAR	1995	1986	1988	1987	1997	1981	1996	1998	1984	1991	1995	1995	1981
	LOWEST MEAN YEAR	1972	1989	1991	1975	1998	1982	1987	1987	1986	1971	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	0.3	0.4	0.0	0.0	-0.2	-0.2	-0.3	-0.3	-0.2	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.0	-0.1	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
225 MARYSVILLE	HIGHEST MEAN	51.3	55.6	60.0	65.7	74.7	79.6	84.0	81.4	78.2	70.6	60.2	51.9	84.0
	MEDIAN	46.3	51.9	55.8	61.1	68.6	74.9	78.3	77.5	73.7	65.2	53.5	46.3	62.7
	LOWEST MEAN	41.3	46.5	51.5	55.6	61.8	69.3	74.3	71.4	67.4	60.4	49.0	40.8	40.8
	HIGHEST MEAN YEAR	1995	1991	1997	1987	1992	1981	1988	1998	1984	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1980	1987	1976	1986	1981	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.2	-0.1	-0.4	-0.4	-0.4	-0.5	-0.4	-0.5	-0.6	-0.6	-0.4	-0.3	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.0	-0.1	-0.2	-0.1	0.0	
227 MC CLOUD	HIGHEST MEAN	40.5	44.7	47.2	53.3	61.8	68.0	73.1	70.3	66.6	59.4	49.0	41.6	73.1
	MEDIAN	36.3	38.7	41.0	46.4	54.4	61.7	68.6	67.2	62.2	51.8	41.0	36.4	50.6
	LOWEST MEAN	31.0	32.5	36.5	38.2	47.6	57.1	62.9	62.4	54.9	47.1	33.1	29.2	29.2
	HIGHEST MEAN YEAR	1986	1995	1986	1990	1992	1977	1988	1988	1975	1988	1976	1980	1988
	LOWEST MEAN YEAR	1973	1989	1975	1975	1977	1980	1983	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.9	0.5	-0.1	-0.4	-0.4	-0.4	-0.4	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
228 MECCA FIRE ST	HIGHEST MEAN	60.0	65.6	71.1	77.2	84.8	90.3	95.2	94.2	88.9	79.5	66.7	59.0	95.2
	MEDIAN	54.5	59.5	65.2	71.7	78.4	86.4	91.3	90.2	85.2	74.4	61.4	54.2	72.8
	LOWEST MEAN	49.3	54.1	59.8	63.4	72.2	82.5	87.6	87.2	78.7	65.6	56.3	48.0	48.0
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1997	1984	1991	1995	1980	1996
	LOWEST MEAN YEAR	1979	1975	1975	1975	1977	1991	1993	1976	1985	1971	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.4	-0.8	-0.8	-0.7	-0.6	-0.6	-0.7	-0.8	-0.9	-0.5	-0.7	
229 MERCED	HIGHEST MEAN	51.6	55.4	60.7	64.8	73.1	79.5	82.2	80.4	77.8	69.1	59.1	51.2	82.2
	MEDIAN	46.0	51.3	55.2	59.5	66.9	74.0	78.5	77.3	73.4	64.5	53.1	45.1	62.1
	LOWEST MEAN	41.6	47.4	50.3	54.6	60.6	69.2	73.7	73.0	68.9	60.5	49.0	40.5	40.5
	HIGHEST MEAN YEAR	1986	1991	1972	1990	1997	1981	1996	1996	1984	1991	1995	1995	1996
	LOWEST MEAN YEAR	1972	1971	1977	1975	1977	1982	1987	1976	1986	1981	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.6	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.6	-0.8	-1.0	-0.9	-1.0	-0.8	-0.7	-1.1	-0.8	-0.7	-0.6	
231 MINERAL	HIGHEST MEAN	36.7	40.1	40.9	46.4	54.8	59.9	65.6	65.6	60.1	53.7	44.1	37.0	65.6
	MEDIAN	32.3	33.9	35.7	40.2	47.7	54.7	61.1	60.4	55.7	46.3	36.8	32.3	44.7
	LOWEST MEAN	25.5	26.6	31.3	32.5	40.7	49.4	55.6	54.6	46.5	39.5	28.3	25.6	25.5
	HIGHEST MEAN YEAR	1986	1991	1972	1990	1992	2000	1996	1971	1991	1988	1995	1980	1996
	LOWEST MEAN YEAR	1993	1990	1991	1975	1998	1980	1987	1976	1986	1984	1994	1971	1993
	MIN OBS TIME ADJUSTMENT	0.3	0.4	-0.1	-0.4	-0.4	-0.4	-0.3	-0.5	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
232 MITCHELL CAVE	HIGHEST MEAN	52.5	54.5	61.7	65.3	74.6	83.9	86.6	84.4	80.3	72.1	60.5	54.1	86.6
	MEDIAN	45.3	48.6	50.9	58.8	67.2	77.4	83.2	81.1	75.2	64.4	53.1	46.3	62.9
	LOWEST MEAN	38.2	42.0	43.6	51.1	59.5	71.5	78.6	77.3	68.5	58.7	45.0	39.1	38.2
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1974	1972	1995	1979	1988	1995	1980	1972
	LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1998	1993	1989	1985	1972	1994	1971	1979
	MIN OBS TIME ADJUSTMENT	0.3	-0.1	0.0	-0.3	-0.2	-0.2	-0.3	-0.4	-0.6	-0.4	-0.4	0.3	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	-0.1	-0.1	-0.1	0.1	
233 MODESTO CITY-	HIGHEST MEAN	53.0	56.4	61.4	66.7	73.4	79.5	81.8	80.6	78.2	70.4	61.3	52.0	81.8
	MEDIAN	47.3	53.0	56.8	61.6	67.9	73.8	77.4	76.6	73.1	65.4	54.5	46.4	62.8
	LOWEST MEAN	41.7	48.8	51.9	55.5	61.4	69.6	73.9	72.0	67.8	61.1	48.8	42.0	41.7
	HIGHEST MEAN YEAR	1995	1992	1978	1987	1997	1981	1988	1998	1984	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1980	1987	1976	1986	1971	2000	1985	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
234 MOJAVE	HIGHEST MEAN	52.0	54.5	60.5	67.8	74.6	80.5	87.5	85.5	79.0	69.6	59.2	52.1	87.5
	MEDIAN	45.8	49.9	52.3	58.4	67.3	76.1	82.0	80.5	74.6	63.3	52.3	45.7	62.7
	LOWEST MEAN	41.4	44.5	46.9	51.5	58.8	71.3	76.4	74.9	68.1	58.9	45.0	39.6	39.6
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1994	1974	1988	1995	1977	1996
	LOWEST MEAN YEAR	1979	1979	1977	1975	1977	1998	1983	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.2	-1.4	-1.1	-1.0	-0.9	-0.9	-1.4	-1.2	-0.8	-1.0	
235 MONTEBELLO	HIGHEST MEAN	64.6	65.0	66.4	69.9	74.1	77.7	80.1	80.8	82.5	75.0	68.0	63.0	82.5
	MEDIAN	58.9	59.9	61.1	65.7	68.2	73.1	76.8	77.5	75.5	69.9	63.8	59.4	67.6
	LOWEST MEAN	55.4	56.8	56.8	58.6	63.4	67.6	72.4	74.1	69.8	67.5	59.5	54.0	54.0
	HIGHEST MEAN YEAR	1986	1995	1997	1992	1997	1981	1984	1983	1984	1999	1995	1977	1984
	LOWEST MEAN YEAR	1973	1990	1973	1975	1977	1982	1987	1976	1986	1975	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.3	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.1	-0.8	-0.7	-0.7	-0.7	-1.2	-1.2	-0.8	-1.0	
236 MONTEREY	HIGHEST MEAN	55.8	56.1	57.4	59.8	62.3	61.3	63.7	64.6	68.0	64.2	59.5	55.5	68.0
	MEDIAN	51.7	53.4	54.1	55.5	56.3	58.6	60.0	61.4	62.0	60.4	55.7	51.9	56.6
	LOWEST MEAN	48.1	48.2	50.0	50.6	52.8	55.8	57.4	58.1	59.4	56.0	51.2	46.6	46.6
	HIGHEST MEAN YEAR	1986	1992	1978	1992	1997	1981	1995	1983	1984	1983	1995	1980	1984
	LOWEST MEAN YEAR	1972	1989	1999	1975	1999	1999	1971	1973	1975	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.4	-0.3	-0.3	-0.4	-0.5	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.3	-0.4	-0.5	-1.0	-0.6	-0.6	-0.5	-0.4	-0.6	-0.4	-0.5	-0.3	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
237 MORRO BAY FIR	HIGHEST MEAN	55.0	57.8	57.8	58.5	59.6	60.5	61.9	64.0	69.3	64.9	60.0	57.0	69.3
	MEDIAN	52.2	53.6	53.5	54.4	54.9	56.9	58.8	59.3	59.9	59.0	55.5	52.7	55.9
	LOWEST MEAN	48.7	49.1	49.0	49.7	50.5	53.4	56.3	57.2	56.5	56.1	51.9	47.6	47.6
	HIGHEST MEAN YEAR	1986	1995	1978	1996	1997	1985	1983	1997	1984	1983	1997	1977	1984
	LOWEST MEAN YEAR	1987	1990	1977	1975	1991	1991	1975	1989	1989	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	0.4	-0.1	-0.1	-0.3	-0.3	-0.3	-0.3	-0.1	-0.2	0.3	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	
238 MOUNTAIN PASS	HIGHEST MEAN	45.9	48.2	55.3	64.9	70.7	79.0	83.3	81.4	75.0	65.8	53.8	47.0	83.3
	MEDIAN	39.6	43.5	47.3	53.3	63.1	73.6	79.0	77.8	71.0	58.6	47.2	40.7	57.9
	LOWEST MEAN	30.6	35.9	35.8	40.4	54.1	68.7	75.7	70.8	64.3	50.4	37.8	31.6	30.6
	HIGHEST MEAN YEAR	1986	1995	1972	1989	1984	1994	1996	1995	1979	1988	1995	1980	1996
	LOWEST MEAN YEAR	1973	1973	1973	1975	1977	1998	1987	1976	1985	1971	1972	1972	1973
	MIN OBS TIME ADJUSTMENT	0.7	0.5	0.7	0.0	0.1	-0.1	-0.1	-0.2	-0.3	0.2	0.1	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.3	0.1	-0.1	-0.1	-0.1	-0.1	0.1	
239 MOUNT DIABLO	HIGHEST MEAN	53.1	54.8	56.7	60.2	66.4	73.0	78.6	76.8	75.3	70.1	59.8	55.9	78.6
	MEDIAN	47.2	49.5	49.5	53.7	59.4	66.1	72.5	72.4	69.7	62.3	52.9	48.2	58.4
	LOWEST MEAN	43.5	44.4	44.5	47.5	50.2	58.8	66.4	67.7	62.6	58.1	44.9	41.4	41.4
	HIGHEST MEAN YEAR	1976	1977	1972	1977	1997	1981	1996	1998	1975	1978	1976	1976	1996
	LOWEST MEAN YEAR	1982	1998	1991	1975	1998	1980	2000	1991	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	0.0	-0.2	-0.1	-0.2	-0.3	-0.2	-0.3	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.0	
240 MOUNT HAMILTO	HIGHEST MEAN	49.1	51.2	51.6	58.8	62.8	69.1	77.7	75.7	72.6	66.6	56.9	52.2	77.7
	MEDIAN	43.5	42.9	43.3	46.9	55.6	64.1	70.4	70.5	66.0	56.9	47.4	43.4	54.5
	LOWEST MEAN	38.1	36.4	35.5	39.7	45.6	56.5	63.5	63.7	55.4	51.6	37.6	35.4	35.4
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1992	1981	1988	1998	1991	1988	1976	1980	1988
	LOWEST MEAN YEAR	1993	1998	1991	1975	1998	1998	1987	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-1.4	-1.0	-1.0	-0.9	-0.9	-1.4	-1.1	-1.0	-0.7	
242 MOUNT SHASTA	HIGHEST MEAN	41.4	44.4	45.9	52.5	60.8	65.2	70.0	67.8	64.3	57.4	46.5	38.7	70.0
	MEDIAN	35.8	38.8	40.8	45.9	53.4	59.5	65.6	64.8	59.9	50.1	39.5	35.4	49.2
	LOWEST MEAN	30.5	32.7	37.2	39.5	45.9	53.9	60.1	59.9	53.4	45.6	32.8	28.3	28.3
	HIGHEST MEAN YEAR	1986	1995	1986	1987	1992	1986	1988	1971	1991	1987	1995	1980	1988
	LOWEST MEAN YEAR	1993	1989	1991	1975	1977	1980	1983	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.8	-0.6	-0.6	-0.6	-0.5	-0.5	-0.4	-0.5	-0.7	-0.8	-0.8	-0.6	
	MAX OBS TIME ADJUSTMENT	-1.3	-1.0	-1.0	-1.2	-1.4	-1.4	-1.2	-1.2	-1.6	-1.1	-1.2	-0.9	
243 MT WILSON NO	HIGHEST MEAN	51.6	52.0	55.8	59.7	68.6	72.6	76.7	76.9	73.4	68.4	59.7	51.9	76.9
	MEDIAN	44.5	44.8	45.3	50.4	58.1	66.4	73.1	72.1	68.7	58.9	51.0	46.0	56.5
	LOWEST MEAN	36.0	38.0	36.8	38.3	47.2	59.9	67.8	65.2	59.0	49.7	42.4	35.6	35.6
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1994	1996	1998	1979	1978	1995	1980	1998
	LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1998	1987	1976	1985	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.3	-0.3	-0.2	-0.3	-0.3	-0.5	-0.6	-0.7	-0.7	
	MAX OBS TIME ADJUSTMENT	-1.1	-0.9	-1.1	-1.2	-0.9	-0.7	-0.8	-0.8	-1.2	-1.4	-1.1	-1.2	
245 NAPA STATE HO	HIGHEST MEAN	53.0	55.3	58.2	61.7	66.7	72.7	71.5	72.2	71.8	66.0	59.7	53.1	72.7
	MEDIAN	48.0	52.4	54.4	57.3	61.9	66.7	68.5	68.5	67.2	62.9	53.6	47.7	59.0
	LOWEST MEAN	43.4	47.1	50.7	52.3	56.9	61.4	66.1	64.8	64.2	59.3	48.7	42.5	42.5
	HIGHEST MEAN YEAR	1986	1991	1986	1987	1997	1981	1988	1998	1984	1986	1995	1995	1981
	LOWEST MEAN YEAR	1972	1989	1985	1975	1977	1982	1994	1980	1972	1981	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.4	-1.1	-1.1	-1.0	-0.9	-1.3	-1.1	-1.0	-0.7	
246 NEEDLES AP	HIGHEST MEAN	59.2	63.6	71.8	78.9	87.5	94.8	99.1	98.4	91.8	81.7	67.5	59.4	99.1
	MEDIAN	53.7	58.8	63.9	70.4	80.5	90.2	96.4	94.0	87.9	75.3	62.3	54.5	73.8
	LOWEST MEAN	47.2	54.0	56.3	63.5	73.4	86.6	92.9	90.0	80.3	69.8	56.0	49.1	47.2
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1994	1996	1994	1979	1988	1995	1980	1996
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1991	1986	1983	1985	1971	1994	1978	1979
	MIN OBS TIME ADJUSTMENT	-0.7	-0.5	-0.6	-0.4	-0.4	-0.3	-0.3	-0.4	-0.6	-0.6	-0.8	-0.8	
	MAX OBS TIME ADJUSTMENT	-1.2	-1.1	-1.4	-1.4	-1.2	-1.0	-0.9	-1.0	-1.3	-1.5	-1.2	-1.4	
247 NEVADA CITY	HIGHEST MEAN	48.0	51.3	51.7	57.7	65.7	69.4	76.5	74.8	72.0	65.1	54.5	46.9	76.5
	MEDIAN	42.1	42.4	45.5	49.8	57.4	64.5	70.3	70.2	65.6	56.9	46.0	41.2	54.6
	LOWEST MEAN	35.3	38.4	39.9	40.9	48.9	59.0	65.1	63.6	58.6	49.0	39.5	32.8	32.8
	HIGHEST MEAN YEAR	1986	1991	1986	1987	1992	2000	1988	1992	1991	1988	1995	1989	1988
	LOWEST MEAN YEAR	1973	1974	1973	1975	1998	1980	1983	1976	1972	1975	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.8	0.8	0.7	0.0	0.0	0.0	-0.1	-0.2	0.4	0.2	0.6	0.6	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	
248 NEWARK (OAKLA	HIGHEST MEAN	54.7	56.3	60.0	63.8	67.2	72.7	72.7	71.8	74.5	66.8	59.8	54.5	74.5
	MEDIAN	49.5	54.1	55.9	59.1	62.6	65.8	67.6	68.6	67.3	63.5	55.9	49.4	60.0
	LOWEST MEAN	46.3	48.4	51.1	53.5	57.5	61.2	65.9	65.7	64.9	59.7	50.8	44.1	44.1
	HIGHEST MEAN YEAR	1986	1995	1984	1985	1997	1981	1984	1983	1984	1983	1995	1995	1984
	LOWEST MEAN YEAR	1992	1989	1991	1975	1999	1991	2000	1991	1989	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	0.0	-0.3	-0.2	-0.2	-0.3	-0.2	-0.2	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
249 NEW CUYAMA FI	HIGHEST MEAN	51.2	53.4	56.0	61.1	68.3	74.4	78.4	77.9	73.0	65.2	56.9	50.2	78.4
	MEDIAN	46.2	48.1	50.3	54.1	61.9	69.4	74.2	73.4	68.9	58.9	50.1	45.8	58.8
	LOWEST MEAN	42.2	44.2	44.8	47.7	54.2	64.0	67.9	65.8	62.8	55.2	45.1	40.2	40.2
	HIGHEST MEAN YEAR	1986	1995	1972	1987	1992	1981	1988	1986	1991	1991	1995	1980	1988
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1998	1983	1976	1986	1984	1994	1978	1978
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.3	-0.3	-0.3	-0.3	-0.6	-0.6	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.8	-0.9	-1.1	-0.9	-0.9	-0.7	-0.7	-1.1	-0.8	-0.8	-0.6	
251 NEWMAN	HIGHEST MEAN	52.0	54.9	59.1	65.6	73.2	78.1	82.1	80.5	75.6	69.0	59.5	51.0	82.1
	MEDIAN	45.3	50.9	54.7	59.1	67.0	73.4	76.8	75.8	72.6	64.9	52.7	44.9	61.6
	LOWEST MEAN	39.5	46.0	50.3	53.1	59.7	68.2	72.2	71.4	67.6	59.7	48.7	40.7	39.5
	HIGHEST MEAN YEAR	1995	1992	1997	1987	1992	1981	1996	1998	1991	1991	1995	1995	1996
	LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1980	1987	1976	1986	1971	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.3	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.6	-0.8	-1.0	-0.8	-0.9	-0.7	-0.7	-1.1	-0.8	-0.7	-0.6	
252 NEWPORT BEACH	HIGHEST MEAN	59.7	60.2	61.1	63.0	66.0	70.4	71.5	74.3	75.6	70.0	63.7	59.7	75.6
	MEDIAN	55.5	56.8	57.4	59.5	61.7	64.6	67.0	68.2	67.6	64.8	60.2	56.5	61.8
	LOWEST MEAN	51.6	52.9	54.3	55.2	58.0	60.7	64.0	65.2	64.8	62.0	55.5	51.6	51.6
	HIGHEST MEAN YEAR	1981	1980	1978	1992	1984	1981	1984	1998	1984	1983	1976	1977	1984
	LOWEST MEAN YEAR	1972	1990	1991	1975	1991	1991	1991	1975	1991	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.4	-0.5	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.9	-0.8	-0.4	-0.6	
256 OAKLAND MUSEU	HIGHEST MEAN	54.9	58.1	59.9	61.9	65.6	70.5	69.4	69.8	72.2	68.8	61.5	55.5	72.2
	MEDIAN	50.9	54.9	56.2	58.8	60.8	63.3	64.9	66.3	65.6	63.8	57.0	51.3	59.2
	LOWEST MEAN	47.3	50.2	52.3	51.8	58.1	60.2	61.6	62.1	61.7	59.6	52.0	46.5	46.5
	HIGHEST MEAN YEAR	1978	1992	1978	1992	1978	1981	1992	1983	1984	1992	1995	1995	1984
	LOWEST MEAN YEAR	1987	1989	1976	1975	1974	1975	1994	1973	1986	1988	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
258 OCEANSIDE MAR	HIGHEST MEAN	58.3	59.7	59.9	62.1	64.5	69.8	73.0	73.1	74.4	68.9	63.8	58.6	74.4
	MEDIAN	54.4	55.4	56.5	58.1	61.3	64.2	67.4	68.7	67.3	63.7	58.7	55.0	60.6
	LOWEST MEAN	52.0	50.7	51.5	54.4	58.0	60.1	63.9	64.3	63.0	60.7	53.4	51.5	50.7
	HIGHEST MEAN YEAR	1986	1977	1978	1992	1997	1981	1984	1984	1984	1983	1976	1976	1984
	LOWEST MEAN YEAR	1987	1990	1999	1999	1999	1999	1987	1999	1986	1996	1994	1987	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-0.9	-0.9	-0.7	-0.6	-0.7	-0.6	-1.0	-1.1	-0.7	-0.9	
260 OJAI	HIGHEST MEAN	57.5	59.4	61.3	63.9	69.8	74.4	76.7	77.7	78.5	68.6	62.0	57.4	78.5
	MEDIAN	52.5	54.0	56.1	59.7	63.2	68.1	72.9	72.7	70.6	64.8	56.9	53.4	62.1
	LOWEST MEAN	48.8	50.3	50.4	52.1	59.1	62.0	67.6	70.0	65.3	60.5	51.3	46.9	46.9
	HIGHEST MEAN YEAR	1986	1995	1972	1992	1997	1981	1984	1998	1984	1991	1986	1977	1984
	LOWEST MEAN YEAR	1973	1989	1991	1975	1977	1982	1987	1989	1985	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.2	-1.0	-1.0	-0.8	-0.8	-1.3	-1.4	-1.1	-1.0	
261 ORANGE COVE	HIGHEST MEAN	51.3	55.1	59.8	67.7	74.1	80.6	84.0	82.4	78.7	69.3	59.9	51.1	84.0
	MEDIAN	46.1	51.1	55.9	60.4	68.9	75.8	80.5	79.5	74.4	65.2	53.9	45.4	63.2
	LOWEST MEAN	39.6	46.6	50.4	54.8	60.7	72.2	75.1	73.2	67.6	60.6	48.4	40.9	39.6
	HIGHEST MEAN YEAR	1986	1991	1986	1989	1997	1981	1988	1998	1979	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1971	1977	1975	1998	1980	1987	1976	1986	1971	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	-0.4	-0.2	-0.5	-0.5	-0.4	-0.5	-0.4	-0.4	-0.7	-0.7	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	0.0	0.1	0.0	-0.1	0.1	0.0	0.0	-0.1	-0.2	-0.3	-0.2	-0.1	
262 ORICK PRAIRIE	HIGHEST MEAN	49.5	50.3	50.7	53.3	55.9	58.6	60.9	61.9	63.0	56.7	53.0	49.5	63.0
	MEDIAN	43.6	46.3	47.7	48.6	51.9	55.3	58.1	59.1	57.9	53.8	48.1	43.9	51.1
	LOWEST MEAN	39.9	39.6	43.2	43.7	49.2	51.5	55.2	56.5	55.8	49.7	41.9	36.5	36.5
	HIGHEST MEAN YEAR	1995	1995	1978	1989	1997	1992	1996	1971	1997	1979	1997	1995	1997
	LOWEST MEAN YEAR	1982	1989	1977	1975	1990	1991	1977	1980	1986	1971	1985	1990	1990
	MIN OBS TIME ADJUSTMENT	0.6	0.3	-0.1	-0.1	-0.3	-0.2	-0.2	-0.3	-0.2	-0.3	0.2	0.4	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	
263 ORLAND	HIGHEST MEAN	50.6	55.5	58.9	64.3	73.9	79.5	82.7	80.3	76.9	71.0	59.2	50.3	82.7
	MEDIAN	46.4	51.2	54.1	58.9	66.8	73.1	78.5	76.7	73.8	65.0	53.6	46.6	62.0
	LOWEST MEAN	43.1	46.7	49.4	52.9	58.7	68.2	73.0	72.4	68.4	60.9	48.0	40.9	40.9
	HIGHEST MEAN YEAR	1978	1991	1984	1987	1992	1981	1984	1996	1991	1991	1995	1977	1984
	LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1980	1987	1976	1986	1975	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.4	-0.4	-0.5	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
264 ORLEANS	HIGHEST MEAN	49.0	56.2	57.1	61.0	68.0	71.4	77.5	76.6	73.7	65.1	54.8	48.6	77.5
	MEDIAN	43.6	47.5	51.6	56.0	61.6	67.4	73.5	72.8	68.5	59.5	49.5	43.1	58.0
	LOWEST MEAN	40.4	41.2	47.5	50.9	56.2	63.9	68.8	69.2	64.3	56.4	42.3	35.0	35.0
	HIGHEST MEAN YEAR	1978	1995	1986	1989	1992	1985	1996	1986	1991	1988	1995	1995	1996
	LOWEST MEAN YEAR	1982	1990	1999	1975	1977	1980	1983	1976	1986	1998	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.7	-0.5	-0.5	-0.6	-0.4	-0.4	-0.3	-0.4	-0.6	-0.7	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.6	-0.8	-1.2	-1.0	-0.9	-0.8	-0.8	-1.0	-0.7	-0.8	-0.8	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
265	OROVILLE	HIGHEST MEAN	49.4	53.8	58.8	64.9	71.9	78.0	82.5	80.3	75.0	67.8	57.9	51.2	82.5
		MEDIAN	45.6	50.3	53.9	58.6	66.7	73.2	78.1	76.1	71.3	63.1	51.8	45.7	61.1
		LOWEST MEAN	40.5	45.8	48.1	53.3	60.3	69.1	73.0	72.6	62.8	57.9	46.2	40.6	40.5
		HIGHEST MEAN YEAR	1998	1992	1993	1987	1973	1981	1984	1971	1974	1991	1995	1995	1984
		LOWEST MEAN YEAR	1985	1990	1991	1975	1977	1980	1987	1976	1986	1984	1994	1972	1985
		MIN OBS TIME ADJUSTMENT	0.8	0.8	0.6	0.0	0.0	0.0	-0.1	-0.2	0.4	0.2	0.5	0.5	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
266	OXNARD (CAMAR	HIGHEST MEAN	61.1	60.9	61.5	63.5	65.2	69.0	69.2	71.2	73.2	67.8	64.3	59.6	73.2
		MEDIAN	55.5	56.0	56.4	58.6	60.0	63.0	65.7	66.6	65.9	63.3	59.5	55.8	60.7
		LOWEST MEAN	51.9	51.2	53.0	53.7	57.6	60.6	63.1	63.1	62.6	60.7	55.2	50.0	50.0
		HIGHEST MEAN YEAR	1986	1995	1988	1992	1997	1981	1984	1984	1984	1983	1976	1976	1984
		LOWEST MEAN YEAR	1979	1979	1973	1975	1971	1982	1978	1999	1999	1971	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.3	0.4	-0.1	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	0.3	0.3	
		MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1	
268	PACIFICA 4 SS	HIGHEST MEAN	54.1	55.3	56.1	58.9	62.4	64.0	64.0	65.5	66.5	63.9	58.0	53.8	66.5
		MEDIAN	50.2	52.3	52.5	54.4	56.5	59.4	61.0	60.9	61.5	59.7	54.9	50.8	56.3
		LOWEST MEAN	45.9	47.4	48.5	48.3	52.9	55.1	58.2	58.0	59.6	56.3	49.2	45.8	45.8
		HIGHEST MEAN YEAR	1999	1992	1986	1989	1997	1981	1995	1990	1984	1992	1995	1977	1984
		LOWEST MEAN YEAR	1972	1989	1973	1975	1977	1980	2000	1973	1972	1971	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	-0.4	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	-0.2	-0.4	-0.4	-0.5	-0.3	
		MAX OBS TIME ADJUSTMENT	-0.2	-0.2	-0.2	-0.6	-0.3	-0.3	-0.2	-0.2	-0.3	-0.2	-0.3	-0.2	
271	PALMDALE (LAN	HIGHEST MEAN	51.2	56.3	61.7	68.5	75.2	79.7	85.6	84.9	79.7	71.1	60.7	52.7	85.6
		MEDIAN	46.4	50.3	54.0	59.7	67.6	75.4	81.9	80.9	75.9	64.6	53.0	46.0	62.8
		LOWEST MEAN	41.7	45.4	47.7	52.0	59.6	70.0	76.5	76.1	68.5	59.8	47.9	39.8	39.8
		HIGHEST MEAN YEAR	2000	1995	1972	1989	1997	1985	1996	1986	1974	1988	1995	1977	1996
		LOWEST MEAN YEAR	1979	1979	1973	1975	1998	1998	1983	1976	1986	1981	1994	1984	1984
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.9	-0.9	-0.8	-0.7	-0.7	-0.7	-1.1	-1.0	-0.5	-0.7	
272	PALM SPRINGS	HIGHEST MEAN	63.3	66.8	72.9	78.9	86.0	92.0	95.6	96.2	89.7	81.2	70.1	63.4	96.2
		MEDIAN	57.2	61.0	64.5	71.3	78.5	87.0	92.2	91.0	86.2	75.9	64.8	57.1	74.0
		LOWEST MEAN	50.1	57.0	58.9	63.6	71.7	81.1	87.8	85.9	79.7	70.1	57.1	51.0	50.1
		HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1998	1995	1991	1995	1980	1998
		LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1982	1987	1976	1986	1972	1994	1978	1979
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.3	-0.2	-0.3	-0.3	-0.5	-0.5	-0.6	-0.7	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.0	-0.9	-0.7	-0.8	-0.9	-1.1	-1.2	-0.8	-1.0	
273	PALO ALTO	HIGHEST MEAN	53.7	55.4	59.5	62.3	66.0	71.9	70.5	71.1	70.9	63.8	59.0	53.4	71.9
		MEDIAN	48.5	53.1	54.8	58.2	62.4	66.3	67.8	68.0	65.9	61.5	54.3	48.8	59.2
		LOWEST MEAN	45.2	47.7	51.2	53.5	58.0	62.4	64.9	65.6	60.7	58.0	49.0	43.4	43.4
		HIGHEST MEAN YEAR	1986	1980	1978	1989	1997	1981	1972	1971	1984	1978	1981	1981	1981
		LOWEST MEAN YEAR	1994	1994	1991	1994	1977	1994	1994	1986	1993	1971	1993	1993	1993
		MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	0.0	-0.3	-0.2	-0.2	-0.3	-0.2	-0.3	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	
275	PALOMAR MOUNT	HIGHEST MEAN	49.9	51.4	58.1	59.7	67.4	74.1	77.4	77.4	72.0	66.2	56.0	50.9	77.4
		MEDIAN	43.1	44.0	46.1	51.2	58.1	67.1	73.2	72.7	68.9	58.4	48.6	44.7	56.1
		LOWEST MEAN	35.6	37.8	37.4	40.5	47.3	60.2	66.6	67.6	59.5	54.0	40.5	34.5	34.5
		HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1981	2000	1988	1995	1981	1996
		LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1998	1987	1976	1986	1984	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.8	-0.6	-0.7	-0.8	-1.1	-1.1	-0.7	-0.9	
278	PARADISE	HIGHEST MEAN	50.5	55.0	56.8	63.1	71.5	76.8	83.3	81.8	77.5	69.4	58.7	50.4	83.3
		MEDIAN	45.9	48.2	50.4	55.6	63.5	71.5	77.9	76.9	73.4	62.5	51.3	46.2	60.4
		LOWEST MEAN	41.8	43.5	44.4	48.7	55.0	65.7	72.3	69.9	65.0	56.8	45.3	39.1	39.1
		HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1985	1996	1996	1991	1991	1995	1976	1996
		LOWEST MEAN YEAR	1973	1990	1991	1975	1977	1980	1987	1976	1986	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.3	-0.3	-0.4	-0.4	-0.5	-0.3	-0.4	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
279	PARKER RESERV	HIGHEST MEAN	59.7	63.7	72.9	80.1	88.3	94.6	97.5	97.1	93.4	82.6	68.6	60.1	97.5
		MEDIAN	53.2	59.3	64.2	71.4	80.3	90.2	95.5	93.3	88.1	75.9	62.6	53.8	73.8
		LOWEST MEAN	47.2	54.5	56.9	63.1	73.2	85.4	92.5	90.8	80.6	69.9	57.0	49.0	47.2
		HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1994	1996	1998	1979	1988	1995	1980	1996
		LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1998	1987	1979	1986	1984	1994	1978	1979
		MIN OBS TIME ADJUSTMENT	0.7	0.9	1.1	0.7	0.7	0.1	0.4	0.3	0.2	0.4	0.4	0.6	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	
280	PASADENA	HIGHEST MEAN	61.1	63.7	64.3	68.2	71.9	76.5	78.8	81.6	80.8	74.4	65.5	60.3	81.6
		MEDIAN	56.2	57.9	59.1	63.3	65.4	70.9	75.5	76.1	74.7	69.0	61.1	56.0	65.3
		LOWEST MEAN	51.7	54.3	54.9	56.1	60.5	65.2	71.4	72.5	68.1	65.5	55.8	51.4	51.4
		HIGHEST MEAN YEAR	1986	1991	1997	1992	1984	1981	1985	1998	1984	1999	1976	1980	1998
		LOWEST MEAN YEAR	1979	1975	1973	1975	1977	1982	1987	1976	1986	1975	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.1	-0.8	-0.7	-0.7	-0.7	-1.2	-1.2	-0.8	-1.0	

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No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
282 PASO ROBLES	HIGHEST MEAN	51.7	54.8	57.9	62.3	68.7	72.9	76.1	74.8	73.2	66.4	57.2	52.7	76.1
	MEDIAN	47.5	50.2	53.3	56.3	62.3	67.6	71.9	71.6	68.0	61.8	51.9	46.1	59.3
	LOWEST MEAN	43.1	46.2	48.2	50.9	56.6	63.2	66.9	67.6	61.6	57.2	46.2	40.2	40.2
	HIGHEST MEAN YEAR	1986	1991	1972	1992	1997	1981	1985	1992	1984	1991	1995	1977	1985
	LOWEST MEAN YEAR	1972	1990	1973	1975	1998	1982	1993	1987	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.7	0.7	0.5	0.7	0.0	0.0	0.0	-0.1	0.3	0.3	0.5	0.4	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
283 PASO ROBLES M	HIGHEST MEAN	52.4	56.4	57.9	62.2	72.0	73.9	77.7	78.1	74.6	67.3	57.9	53.3	78.1
	MEDIAN	48.1	50.9	53.4	56.8	63.2	69.6	73.3	73.6	70.3	62.4	52.4	47.3	60.3
	LOWEST MEAN	43.1	47.0	48.5	50.4	57.6	65.6	70.5	70.4	64.0	56.7	46.8	41.2	41.2
	HIGHEST MEAN YEAR	1986	1991	1993	1989	1997	1981	1996	1998	1984	1991	1995	1977	1998
	LOWEST MEAN YEAR	1972	1971	1977	1975	1971	1998	1993	1975	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
285 PEARBLOSSOM	HIGHEST MEAN	50.7	55.4	59.1	65.4	73.2	80.0	84.7	84.1	76.3	72.7	60.3	52.1	84.7
	MEDIAN	45.3	48.6	52.0	57.6	66.4	74.5	80.8	79.7	74.1	64.1	52.6	45.8	61.9
	LOWEST MEAN	39.7	44.5	46.1	50.6	57.0	68.5	75.6	75.5	66.1	59.5	45.9	39.5	39.5
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1996	1998	1984	1988	1995	1980	1996
	LOWEST MEAN YEAR	1979	1979	1973	1975	1998	1998	1987	1976	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.5	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.9	-0.9	-0.8	-0.7	-0.7	-0.7	-1.1	-1.0	-0.5	-0.7	
286 PETALUMA FIRE	HIGHEST MEAN	53.0	56.1	58.4	61.3	65.1	70.5	71.8	70.3	71.4	65.8	59.0	52.0	71.8
	MEDIAN	48.3	52.3	54.0	57.0	60.7	64.4	67.2	67.5	66.4	62.3	54.2	48.2	58.4
	LOWEST MEAN	43.7	47.2	50.3	51.2	55.6	61.9	64.5	64.0	63.6	58.9	49.0	43.3	43.3
	HIGHEST MEAN YEAR	1986	1991	1986	1990	1987	1981	1984	1983	1984	1983	1995	1981	1984
	LOWEST MEAN YEAR	1972	1989	1977	1975	1998	1982	2000	1973	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.4	-1.1	-1.1	-0.9	-0.9	-1.3	-1.1	-1.0	-0.7	
288 PINNACLES NAT	HIGHEST MEAN	52.7	55.4	58.7	63.5	68.2	74.1	77.1	75.8	75.0	67.1	60.5	53.6	77.1
	MEDIAN	48.2	50.0	51.9	55.4	61.5	67.5	72.9	72.5	68.8	61.7	52.9	48.3	59.6
	LOWEST MEAN	44.4	45.9	46.7	49.8	55.8	63.5	67.8	67.5	62.3	58.2	46.2	43.3	43.3
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1998	1984	1991	1995	1977	1996
	LOWEST MEAN YEAR	1982	1994	1991	1975	1998	1998	1983	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.2	0.0	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.5	-0.6	-0.3	-0.2	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	-0.1	-0.1	-0.1	0.0	
290 PISMO BEACH	HIGHEST MEAN	58.2	58.3	61.1	63.3	65.9	65.4	65.1	65.9	70.6	65.9	61.0	59.8	70.6
	MEDIAN	53.4	55.1	55.2	57.6	57.8	60.6	61.7	62.8	63.1	61.7	57.2	53.7	58.4
	LOWEST MEAN	47.2	51.1	50.6	51.2	54.8	56.6	58.9	60.2	58.4	57.4	53.2	49.2	47.2
	HIGHEST MEAN YEAR	1986	1992	2000	2000	1997	1981	1985	1983	1984	1995	1977	1977	1984
	LOWEST MEAN YEAR	1990	1990	1999	1975	1975	1999	1975	1989	1986	1988	1978	1987	1990
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
293 PLACERVILLE	HIGHEST MEAN	50.4	54.0	55.6	61.2	68.7	75.8	80.8	79.5	76.4	68.8	57.8	49.3	80.8
	MEDIAN	45.6	48.8	50.7	54.6	61.9	69.2	75.6	75.2	70.8	60.8	50.3	45.8	59.1
	LOWEST MEAN	41.4	43.4	44.7	47.4	54.0	64.4	66.0	68.7	62.8	55.4	43.8	40.6	40.6
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1981	1996	1996	1991	1991	1995	1977	1996
	LOWEST MEAN YEAR	1983	1990	1985	1983	1998	1980	1983	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
294 PLACERVILLE I	HIGHEST MEAN	51.6	56.1	56.2	62.4	69.3	77.1	82.7	80.4	79.3	71.5	59.1	54.1	82.7
	MEDIAN	47.1	48.0	49.4	53.9	62.4	70.4	78.0	77.6	73.1	63.0	50.5	46.0	60.0
	LOWEST MEAN	42.0	42.5	44.3	47.1	53.0	65.9	72.5	68.9	64.6	56.8	43.6	39.3	39.3
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1981	1985	1988	1991	1991	1976	1980	1985
	LOWEST MEAN YEAR	1979	1989	1982	1975	1977	1980	1987	1976	1985	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.6	-0.5	-0.4	-0.5	-0.4	-0.5	-0.6	-0.7	-0.8	-0.7	
	MAX OBS TIME ADJUSTMENT	-1.1	-1.0	-1.3	-1.5	-1.3	-1.6	-1.2	-1.2	-1.5	-1.2	-1.2	-1.0	
295 POINT ARENA	HIGHEST MEAN	51.9	52.9	55.3	55.5	57.6	58.8	60.4	61.3	62.8	58.3	54.4	52.1	62.8
	MEDIAN	47.4	49.2	50.0	51.2	53.3	56.4	57.9	59.0	58.2	55.3	51.2	47.6	53.1
	LOWEST MEAN	43.9	44.1	45.6	46.9	51.5	53.9	56.0	54.3	56.0	51.2	45.4	41.7	41.7
	HIGHEST MEAN YEAR	1995	1992	1978	1992	1997	1986	1995	1997	1979	1983	1995	1995	1979
	LOWEST MEAN YEAR	1972	1989	1976	1975	1999	1976	1971	1973	1972	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.6	0.3	-0.1	-0.1	-0.3	-0.2	-0.2	-0.2	-0.1	-0.2	0.2	0.1	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	
296 POINT MUGU NF	HIGHEST MEAN	60.8	60.9	61.7	62.5	63.8	66.7	69.4	71.2	74.6	67.5	63.0	60.0	74.6
	MEDIAN	55.8	56.4	56.4	58.4	60.5	63.4	65.7	67.0	66.3	63.8	59.2	55.3	61.1
	LOWEST MEAN	52.1	51.8	51.8	52.0	56.3	59.0	63.4	61.8	62.4	60.4	54.4	51.2	51.2
	HIGHEST MEAN YEAR	1986	1995	1978	1989	1992	1981	1993	1984	1984	1987	1976	1980	1984
	LOWEST MEAN YEAR	1982	1979	1999	1975	1980	1999	2000	1999	1999	1971	2000	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
297 POMONA FAIRPL	HIGHEST MEAN	59.8	63.1	62.0	65.0	70.5	74.8	78.7	77.5	78.3	70.4	64.6	59.2	78.7
	MEDIAN	55.0	56.2	56.3	60.8	63.7	69.1	73.5	73.9	72.1	66.5	59.7	55.1	63.6
	LOWEST MEAN	50.2	52.1	52.0	52.2	58.8	63.8	67.6	69.7	66.2	62.9	52.6	48.8	48.8
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1997	1981	1984	1998	1984	1990	1976	1977	1984
	LOWEST MEAN YEAR	1973	1975	1973	1975	1977	1982	1987	1992	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
298 PORTERVILLE	HIGHEST MEAN	54.5	58.3	63.3	69.7	76.6	82.4	86.0	84.7	80.8	72.2	61.1	53.7	86.0
	MEDIAN	48.6	54.3	58.1	64.0	71.3	77.5	83.0	81.4	76.3	67.5	55.8	48.1	65.6
	LOWEST MEAN	41.9	50.1	53.5	58.2	63.2	73.5	78.1	75.8	71.4	63.5	51.3	43.8	41.9
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1981	1996	1971	1991	1991	1995	1977	1996
	LOWEST MEAN YEAR	1972	1971	1977	1975	1977	1998	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
299 PORTOLA	HIGHEST MEAN	38.0	39.7	42.6	48.4	57.2	62.3	68.2	65.7	59.4	52.3	42.7	36.2	68.2
	MEDIAN	29.8	33.0	37.7	42.9	49.7	56.9	62.7	62.0	56.4	47.1	36.3	29.9	45.0
	LOWEST MEAN	20.9	24.8	31.1	33.9	42.4	51.6	57.5	55.0	49.6	42.3	28.8	20.4	20.4
	HIGHEST MEAN YEAR	1986	1991	1986	1987	1992	1977	1996	1988	1991	1988	1995	1981	1996
	LOWEST MEAN YEAR	1993	1990	1985	1975	1977	1980	1983	1976	1986	1984	1985	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.4	-0.4	-0.4	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
301 POTTER VALLEY	HIGHEST MEAN	48.6	51.9	55.2	59.1	66.6	71.5	76.8	74.0	72.4	64.9	55.8	48.1	76.8
	MEDIAN	45.4	48.7	50.9	54.0	60.5	66.5	72.6	71.2	67.6	59.3	49.4	45.0	57.8
	LOWEST MEAN	42.0	42.9	45.6	49.7	54.0	61.0	67.8	67.9	60.8	54.3	43.3	37.9	37.9
	HIGHEST MEAN YEAR	1986	1991	1986	1985	1992	2000	1988	1978	1974	1991	1976	1977	1988
	LOWEST MEAN YEAR	1982	1999	1991	1975	1977	1980	1987	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.4	-0.5	-0.4	-0.4	-0.3	-0.4	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-1.1	-0.8	-1.0	-1.5	-1.2	-1.1	-1.0	-0.9	-1.3	-1.2	-1.1	-0.7	
303 PRIEST VALLEY	HIGHEST MEAN	49.1	50.6	52.2	56.1	65.9	70.9	75.9	74.8	71.0	62.7	53.9	47.9	75.9
	MEDIAN	42.7	45.6	48.3	52.1	58.7	65.9	71.5	71.3	66.5	57.9	47.4	42.8	55.8
	LOWEST MEAN	38.7	41.7	42.5	45.8	52.9	61.8	66.6	66.4	60.0	54.3	42.3	36.6	36.6
	HIGHEST MEAN YEAR	1986	1995	1972	1992	1997	1981	1996	1996	1984	1991	1995	1977	1996
	LOWEST MEAN YEAR	1972	1990	1977	1975	1998	1998	1987	1976	1986	1981	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.4	-0.3	-0.3	-0.5	-0.6	-0.6	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.7	-0.8	-1.0	-0.8	-0.9	-0.7	-0.7	-1.1	-0.8	-0.8	-0.5	
304 QUINCY	HIGHEST MEAN	39.9	47.9	48.9	53.9	66.2	66.8	74.3	72.2	68.3	58.7	50.0	41.7	74.3
	MEDIAN	36.3	39.5	43.9	48.4	55.7	62.4	67.4	66.5	60.9	51.8	42.6	35.1	50.6
	LOWEST MEAN	26.2	34.0	37.0	40.5	48.7	57.8	61.9	60.1	55.1	47.1	37.8	28.3	26.2
	HIGHEST MEAN YEAR	1986	1991	1994	1992	1992	1977	1994	1992	1991	1991	1995	1995	1994
	LOWEST MEAN YEAR	1972	1989	1977	1975	1977	1980	1983	1976	1978	1971	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	0.9	0.9	0.7	0.0	0.0	0.0	-0.1	-0.2	0.4	0.3	0.6	0.7	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
305 RAMONA FIRE D	HIGHEST MEAN	58.1	58.6	58.3	62.8	68.3	74.4	77.5	77.7	75.6	69.2	61.8	59.0	77.7
	MEDIAN	52.3	52.9	54.4	57.8	62.2	67.7	73.2	74.0	71.4	64.4	57.9	51.6	61.8
	LOWEST MEAN	48.6	50.0	50.0	51.6	57.1	63.5	68.2	70.0	64.7	60.1	50.2	48.3	48.3
	HIGHEST MEAN YEAR	1986	1980	1993	1989	1997	1981	1984	1998	1997	1978	1977	1980	1998
	LOWEST MEAN YEAR	1973	1998	1973	1975	1971	1982	1987	1976	1986	1971	1994	1987	1987
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.8	-0.6	-0.6	-0.7	-1.0	-1.2	-0.9	-1.0	
306 RANDSBURG	HIGHEST MEAN	49.8	54.4	59.4	66.6	75.2	81.8	85.9	84.8	78.8	70.5	59.7	50.8	85.9
	MEDIAN	44.0	47.8	51.0	57.6	67.4	76.2	82.0	80.2	74.4	62.9	51.0	44.9	61.7
	LOWEST MEAN	38.3	43.1	44.3	49.6	57.8	70.8	77.3	75.0	67.0	57.0	43.8	37.4	37.4
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1997	1981	1996	1996	1979	1988	1995	1980	1996
	LOWEST MEAN YEAR	1979	1998	1973	1975	1998	1998	1987	1976	1986	1984	1994	1984	1984
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.6	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.8	-0.9	-1.1	-0.9	-0.8	-0.7	-0.7	-1.1	-0.8	-0.5	-0.7	
307 RED BLUFF AP	HIGHEST MEAN	51.2	54.8	58.8	65.4	74.4	81.8	87.3	82.7	79.9	71.6	58.4	50.3	87.3
	MEDIAN	46.9	50.8	54.3	59.1	68.1	76.3	82.3	79.3	75.2	65.1	52.7	46.5	62.9
	LOWEST MEAN	43.3	46.4	49.3	52.7	60.1	70.9	74.0	76.9	65.8	60.1	46.9	40.5	40.5
	HIGHEST MEAN YEAR	1978	1991	1978	1990	1992	1985	1988	1978	1991	1978	1976	1980	1988
	LOWEST MEAN YEAR	1973	1989	1991	1975	1998	1980	1987	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
308 REDDING MUNIC	HIGHEST MEAN	48.9	53.6	56.5	64.1	74.6	79.7	86.0	81.8	78.6	68.7	57.3	48.7	86.0
	MEDIAN	45.4	49.0	51.8	57.9	66.0	74.9	81.3	79.1	73.7	63.1	50.5	45.5	61.6
	LOWEST MEAN	41.5	45.4	48.1	51.8	57.1	69.8	77.4	74.7	67.4	58.3	45.3	40.0	40.0
	HIGHEST MEAN YEAR	1986	1988	1993	1990	1992	1977	1988	1996	1991	1988	1995	1977	1988
	LOWEST MEAN YEAR	1972	1994	1973	1975	1998	1998	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
309 REDLANDS	HIGHEST MEAN	58.8	61.5	62.9	67.3	73.7	77.3	81.6	83.5	80.9	72.2	63.8	57.1	83.5
	MEDIAN	52.9	54.6	56.3	61.5	65.8	72.5	77.6	77.8	74.8	66.7	58.7	53.5	64.5
	LOWEST MEAN	48.2	51.5	50.7	53.4	59.5	64.6	73.7	73.9	69.0	61.9	53.1	46.6	46.6
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1997	1981	1984	1998	1984	1991	1995	2000	1998
	LOWEST MEAN YEAR	1979	1998	1973	1975	1977	1982	1987	1976	1986	1972	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.2	-0.1	-0.3	-0.3	-0.3	-0.2	-0.3	-0.4	-0.4	-0.5	-0.6	-0.3	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	-0.1	-0.1	-0.1	0.1	
310 REDWOOD CITY	HIGHEST MEAN	52.8	55.1	57.5	61.3	66.8	70.5	71.0	70.4	70.8	64.5	57.8	53.0	71.0
	MEDIAN	48.0	51.9	54.4	57.3	61.2	65.7	67.8	68.0	65.5	60.8	53.4	48.0	58.5
	LOWEST MEAN	44.2	47.2	51.0	52.3	56.9	62.6	64.4	65.2	61.9	56.4	49.2	43.6	43.6
	HIGHEST MEAN YEAR	1995	1986	1978	1992	1997	1981	1984	1998	1984	1992	1995	1995	1984
	LOWEST MEAN YEAR	1972	1989	1999	1975	1977	1980	1987	1973	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.2	-0.8	-0.7	-0.7	-0.6	-1.0	-0.7	-0.7	-0.5	
312 RICHARDSON GR	HIGHEST MEAN	48.3	50.3	54.3	57.0	63.1	67.6	72.7	72.9	71.1	63.1	52.3	48.9	72.9
	MEDIAN	43.5	46.9	49.5	53.1	58.4	64.4	70.0	70.3	66.7	58.1	48.9	42.5	56.1
	LOWEST MEAN	41.1	41.1	44.9	48.0	53.1	60.5	65.0	67.0	61.7	54.6	42.1	36.2	36.2
	HIGHEST MEAN YEAR	1978	1995	1986	1990	1992	1985	1996	1972	1974	1987	1981	1981	1972
	LOWEST MEAN YEAR	1982	1989	1991	1975	1977	1980	1987	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.7	0.4	-0.1	0.0	-0.3	-0.3	-0.2	-0.3	-0.2	-0.3	0.2	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
313 RICHMOND	HIGHEST MEAN	54.6	57.0	58.2	61.7	64.0	66.9	66.5	65.8	69.4	65.7	59.9	54.1	69.4
	MEDIAN	49.9	53.4	54.8	57.4	59.2	62.5	62.9	63.4	64.1	62.3	55.8	50.3	58.1
	LOWEST MEAN	45.8	47.9	51.2	51.7	56.2	59.0	60.1	59.8	61.6	57.3	51.2	44.9	44.9
	HIGHEST MEAN YEAR	1995	1992	1993	1992	1997	1993	1995	1997	1984	1995	1995	1995	1984
	LOWEST MEAN YEAR	1982	1989	1999	1975	1971	1975	1971	1973	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.7	-0.9	-1.4	-1.0	-0.9	-0.8	-0.7	-1.2	-1.1	-1.0	-0.7	
314 RIVERSIDE FIR	HIGHEST MEAN	59.8	62.2	63.7	68.1	74.6	78.9	81.9	84.4	82.7	72.9	64.2	59.5	84.4
	MEDIAN	55.5	56.7	58.4	62.7	67.4	73.1	79.0	79.0	76.3	68.5	60.2	55.3	66.0
	LOWEST MEAN	51.2	54.0	53.6	56.2	61.9	67.9	74.0	75.9	68.9	64.9	54.8	50.0	50.0
	HIGHEST MEAN YEAR	1986	1991	1997	1989	1997	1981	1984	1998	1984	1991	1995	1977	1998
	LOWEST MEAN YEAR	1979	1990	1973	1975	1977	1982	1987	1989	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.7	-0.8	-0.8	-0.7	-0.5	-0.6	-0.6	-1.0	-0.9	-0.5	-0.6	
315 RIVERSIDE CIT	HIGHEST MEAN	60.0	61.2	63.8	67.1	73.4	78.0	81.5	83.0	80.9	72.7	63.9	59.2	83.0
	MEDIAN	54.1	55.5	57.4	62.2	66.4	72.4	77.6	77.6	74.9	67.8	59.6	55.3	65.1
	LOWEST MEAN	49.0	52.1	51.7	55.7	61.0	64.9	71.8	74.8	69.3	64.0	53.6	48.5	48.5
	HIGHEST MEAN YEAR	1986	1991	1997	1992	1997	1981	1984	1998	1984	1991	1976	1980	1998
	LOWEST MEAN YEAR	1982	1971	1973	1975	1977	1982	1987	1989	1986	1981	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
317 SACRAMENTO AP	HIGHEST MEAN	51.4	55.0	58.8	63.4	71.9	75.2	80.4	78.3	75.5	68.8	59.3	51.1	80.4
	MEDIAN	46.7	51.4	54.6	58.4	65.4	71.7	75.5	75.1	71.6	64.3	53.5	46.2	61.1
	LOWEST MEAN	41.1	47.1	50.1	51.3	58.7	66.7	71.8	71.9	66.2	60.8	47.2	40.6	40.6
	HIGHEST MEAN YEAR	1986	1991	1986	1990	1997	1981	1988	1996	1984	1991	1995	1996	1988
	LOWEST MEAN YEAR	1972	1989	1975	1975	1998	1982	1987	1980	1986	1971	1982	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
318 SACRAMENTO 5	HIGHEST MEAN	52.6	57.6	61.1	65.9	74.5	79.2	81.6	80.7	77.3	70.7	61.6	52.5	81.6
	MEDIAN	47.9	53.8	56.7	61.2	68.3	73.9	77.2	76.7	74.5	66.1	55.0	48.2	63.2
	LOWEST MEAN	43.2	48.1	52.7	56.6	61.5	69.1	72.9	73.4	67.2	61.8	49.8	42.6	42.6
	HIGHEST MEAN YEAR	1986	1991	1997	1992	1997	1981	1988	1998	1979	1991	1995	1996	1988
	LOWEST MEAN YEAR	1972	1989	1991	1975	1977	1980	1987	1980	1986	1984	1994	1985	1985
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
319 SAGEHEN CREEK	HIGHEST MEAN	34.5	36.6	38.8	44.3	51.1	56.5	61.2	60.7	54.8	47.8	41.2	32.4	61.2
	MEDIAN	27.0	28.7	33.2	37.7	45.3	52.0	57.2	57.5	51.6	42.9	32.8	26.6	41.1
	LOWEST MEAN	20.6	21.9	27.5	31.6	38.9	48.3	53.8	52.5	45.0	38.6	25.5	20.1	20.1
	HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1985	1996	1981	1974	1988	1995	1981	1996
	LOWEST MEAN YEAR	1982	1990	1985	1975	1977	1980	1983	1976	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.8	-1.1	-1.2	-1.1	-1.2	-1.0	-1.0	-1.2	-0.9	-0.9	-0.8	
320 SAINT HELENA	HIGHEST MEAN	52.7	55.1	58.2	63.4	69.6	74.1	76.4	74.9	73.1	65.4	58.8	51.5	76.4
	MEDIAN	47.6	51.5	53.6	58.3	63.5	68.8	71.3	70.7	69.1	62.8	53.2	47.9	59.6
	LOWEST MEAN	44.0	46.3	50.2	51.9	57.7	65.2	68.9	67.9	63.4	58.1	48.2	42.4	42.4
	HIGHEST MEAN YEAR	1984	1995	1997	1987	1997	1981	1996	1996	1997	1991	1995	1996	1996
	LOWEST MEAN YEAR	1972	1989	1991	1975	1977	1980	1987	1976	1986	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.4	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.4	-1.1	-1.1	-1.0	-0.9	-1.3	-1.1	-1.0	-0.7	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
321	SALINAS NO 2	HIGHEST MEAN	56.3	56.8	58.1	60.1	63.6	65.4	65.4	67.1	69.7	65.4	60.4	55.4	69.7
		MEDIAN	51.8	54.3	54.4	56.0	57.9	60.8	61.9	63.1	62.7	60.6	55.3	51.4	57.3
		LOWEST MEAN	47.5	47.6	49.4	52.4	54.8	56.7	59.1	60.0	60.5	56.7	50.3	46.0	46.0
		HIGHEST MEAN YEAR	1986	1988	1986	1992	1997	1981	1995	1983	1983	1983	1995	1983	1983
		LOWEST MEAN YEAR	1990	1990	1985	1975	1985	1984	1989	1973	1986	1971	1985	1990	1990
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.3	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-1.4	-0.9	-1.0	-0.8	-0.7	-1.1	-1.1	-1.1	-0.7	
322	SALINAS AP	HIGHEST MEAN	55.8	56.7	58.6	61.2	65.0	64.5	66.7	68.7	70.4	66.4	60.9	54.7	70.4
		MEDIAN	50.7	53.2	54.6	56.4	58.9	62.0	63.1	64.2	64.0	61.7	56.0	50.9	57.8
		LOWEST MEAN	45.3	48.4	49.4	51.5	54.4	57.8	60.3	61.7	61.3	55.7	51.0	45.9	45.3
		HIGHEST MEAN YEAR	1981	1992	1978	1992	1997	1981	1983	1983	1983	1983	1995	1980	1983
		LOWEST MEAN YEAR	1982	1989	1977	1975	1977	1982	1971	1982	1986	1971	1994	1971	1982
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
325	SALT SPRINGS	HIGHEST MEAN	49.8	52.8	54.4	61.3	66.3	72.7	78.6	77.5	75.4	68.0	56.9	49.4	78.6
		MEDIAN	44.4	45.6	47.5	52.2	60.0	67.2	74.0	73.6	69.2	59.7	49.3	43.8	57.3
		LOWEST MEAN	38.3	40.9	39.7	44.0	51.3	60.1	67.1	67.6	60.2	53.9	40.2	36.4	36.4
		HIGHEST MEAN YEAR	1984	1991	1972	1987	1992	1985	1972	1992	1974	1988	1976	1989	1972
		LOWEST MEAN YEAR	1982	1993	1991	1975	1977	1998	1983	1976	1986	1984	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.6	-0.5	-0.4	-0.5	-0.4	-0.4	-0.6	-0.7	-0.8	-0.7	
		MAX OBS TIME ADJUSTMENT	-1.2	-1.1	-1.4	-1.6	-1.3	-1.4	-1.1	-1.1	-1.6	-1.4	-1.4	-1.2	
326	SAN BERNARDIN	HIGHEST MEAN	58.2	60.8	63.6	66.9	74.7	80.4	84.1	83.9	82.6	72.9	64.1	60.0	84.1
		MEDIAN	54.2	56.0	57.8	62.6	67.5	74.2	79.7	79.6	76.1	68.5	59.2	54.6	65.7
		LOWEST MEAN	49.7	52.1	51.9	55.3	60.5	68.6	73.8	76.0	68.3	64.6	52.9	48.8	48.8
		HIGHEST MEAN YEAR	1986	1995	1997	1996	1997	1981	1984	1971	1984	1999	1995	1980	1984
		LOWEST MEAN YEAR	1979	1989	1991	1975	1977	1982	1987	1989	1986	1972	1994	1987	1987
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.5	-0.5	-0.6	-0.7	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.1	-1.0	-0.8	-0.9	-0.9	-1.3	-1.2	-0.8	-1.0	
328	SANDBERG	HIGHEST MEAN	49.8	52.7	53.4	60.2	64.9	73.7	79.3	79.7	75.1	67.5	61.4	47.6	79.7
		MEDIAN	42.6	44.8	45.6	49.6	57.6	66.7	73.8	73.1	70.0	58.7	49.2	43.1	56.1
		LOWEST MEAN	36.3	39.2	37.6	40.4	47.6	62.1	68.2	66.1	56.6	51.8	43.5	33.1	33.1
		HIGHEST MEAN YEAR	1994	1991	1972	1989	1997	1994	1994	1995	1995	1987	1995	2000	1995
		LOWEST MEAN YEAR	1973	1979	1973	1975	1977	1980	1987	1976	1986	1972	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
329	SAN DIEGO MIR	HIGHEST MEAN	60.4	61.8	62.5	67.3	67.8	72.4	76.6	76.5	78.2	70.0	65.3	59.8	78.2
		MEDIAN	55.5	55.5	56.5	59.8	63.0	66.9	70.5	72.3	70.3	66.6	59.7	55.4	63.1
		LOWEST MEAN	49.5	51.3	51.5	52.2	57.9	60.6	67.0	66.4	66.7	61.1	53.9	47.4	47.4
		HIGHEST MEAN YEAR	1986	1992	1988	1992	1997	1981	1984	1983	1984	1987	1976	1977	1984
		LOWEST MEAN YEAR	1972	1975	1975	1975	1971	1975	1975	1975	1973	1971	1971	1971	1971
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
330	SAN DIEGO N I	HIGHEST MEAN	62.2	62.2	62.4	67.7	68.3	70.3	73.9	74.8	76.2	69.9	66.1	62.5	76.2
		MEDIAN	56.7	57.9	59.1	61.6	63.7	66.3	68.6	70.9	69.7	66.5	60.7	56.7	63.3
		LOWEST MEAN	52.7	52.6	54.7	57.0	59.7	61.7	65.1	65.6	66.2	61.8	56.2	52.8	52.6
		HIGHEST MEAN YEAR	1986	1992	1988	1992	1992	1981	1984	1992	1984	1987	1977	1977	1984
		LOWEST MEAN YEAR	1972	1990	1999	1975	1975	1975	1975	1975	1999	1989	1971	1971	1990
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
331	SAN DIEGO LIN	HIGHEST MEAN	61.3	63.5	64.3	67.0	68.7	72.9	77.2	77.4	78.9	72.2	66.8	63.3	78.9
		MEDIAN	57.4	58.9	60.2	62.4	64.6	67.6	70.2	72.4	71.0	67.3	61.9	57.5	64.1
		LOWEST MEAN	54.3	55.2	56.5	58.7	60.5	62.8	67.1	68.0	66.9	64.3	56.4	53.9	53.9
		HIGHEST MEAN YEAR	1981	1980	1978	1992	1997	1981	1984	1983	1984	1983	1976	1977	1984
		LOWEST MEAN YEAR	1971	1990	1991	1975	1999	1999	1987	1999	1986	1996	1994	1987	1987
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
333	SAN FRANCISCO	HIGHEST MEAN	54.1	55.7	56.6	57.5	58.8	58.6	60.6	63.2	64.5	62.1	58.3	54.3	64.5
		MEDIAN	50.4	52.8	52.8	53.6	54.4	55.7	57.1	58.3	59.0	59.0	55.0	50.9	55.1
		LOWEST MEAN	47.1	49.0	49.6	49.1	51.0	53.1	52.9	54.6	56.7	55.4	50.8	46.8	46.8
		HIGHEST MEAN YEAR	1986	1992	1992	1992	1997	1992	1995	1983	1997	1987	1997	1983	1997
		LOWEST MEAN YEAR	1972	1989	1985	1975	1971	1972	1971	1973	1975	1975	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.5	-0.6	-0.4	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.3	-0.8	-0.7	-0.7	-0.6	-1.0	-0.7	-0.7	-0.5	
334	SAN FRANCISCO	HIGHEST MEAN	53.2	55.8	57.3	60.1	64.4	65.0	64.9	66.9	69.0	64.7	58.4	53.9	69.0
		MEDIAN	49.0	52.6	54.1	55.7	58.4	61.5	62.8	63.5	63.2	60.9	55.3	49.7	57.3
		LOWEST MEAN	45.2	48.0	50.8	50.8	55.5	58.5	60.5	60.3	60.7	56.8	49.9	45.0	45.0
		HIGHEST MEAN YEAR	1986	1986	1978	1989	1997	1981	1992	1997	1984	1992	1995	1996	1984
		LOWEST MEAN YEAR	1982	1989	1985	1975	1999	1991	1971	1986	1989	1971	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
335 SAN FRANCISCO	HIGHEST MEAN	56.3	58.5	59.9	61.7	62.6	64.7	65.2	67.1	70.4	65.9	61.3	56.3	70.4
	MEDIAN	52.2	55.6	55.8	57.3	58.0	60.2	61.0	62.2	63.0	62.8	57.6	52.9	58.2
	LOWEST MEAN	49.3	49.6	51.2	53.0	53.7	56.4	58.3	58.9	60.5	59.0	51.3	48.2	48.2
	HIGHEST MEAN YEAR	1986	1986	1978	1992	1997	1993	1984	1983	1984	1992	1976	1979	1984
	LOWEST MEAN YEAR	1972	1989	1999	1975	1999	1999	2000	1973	1975	1971	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
338 SAN GABRIEL F	HIGHEST MEAN	62.3	62.9	64.6	68.1	73.3	77.1	79.2	80.7	81.6	73.4	64.7	60.3	81.6
	MEDIAN	56.4	57.8	59.5	63.4	66.8	71.7	75.5	76.2	74.6	69.1	61.0	56.7	65.7
	LOWEST MEAN	52.4	54.8	55.6	57.0	61.8	66.1	71.4	73.0	68.3	66.1	55.7	51.2	51.2
	HIGHEST MEAN YEAR	1986	1995	1997	1992	1997	1981	1984	1998	1984	1999	1976	1980	1984
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1982	1987	1975	1986	1975	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-1.1	-0.9	-0.7	-0.7	-0.7	-1.2	-1.2	-0.8	-1.0	
339 SAN GREGORIO	HIGHEST MEAN	54.0	54.7	56.2	56.6	59.0	60.8	63.7	64.4	65.5	62.8	57.4	54.1	65.5
	MEDIAN	50.0	51.1	51.4	52.7	54.8	57.8	60.1	61.1	60.6	57.6	53.5	50.2	55.1
	LOWEST MEAN	47.3	46.4	46.9	48.8	52.0	55.2	57.5	58.3	58.3	52.5	47.8	44.9	44.9
	HIGHEST MEAN YEAR	1981	1980	1978	1989	1997	1992	1992	1990	1983	1983	1976	1980	1983
	LOWEST MEAN YEAR	1989	1989	1999	1975	1971	1991	1971	1973	1996	1971	1994	1998	1998
	MIN OBS TIME ADJUSTMENT	-0.4	-0.3	-0.4	-0.4	-0.3	-0.3	-0.3	-0.2	-0.4	-0.4	-0.5	-0.3	
	MAX OBS TIME ADJUSTMENT	-0.2	-0.2	-0.2	-0.6	-0.3	-0.3	-0.2	-0.2	-0.3	-0.2	-0.3	-0.2	
340 SAN JACINTO R	HIGHEST MEAN	58.2	60.4	62.0	68.1	73.4	80.2	83.7	83.8	80.7	71.7	64.0	58.6	83.8
	MEDIAN	52.0	53.8	55.5	61.9	67.7	74.2	80.1	80.1	75.3	67.2	57.5	53.1	64.9
	LOWEST MEAN	47.0	50.6	51.3	54.7	60.3	67.5	73.3	76.8	69.8	63.4	51.4	47.5	47.0
	HIGHEST MEAN YEAR	1986	1991	1989	1987	1984	1981	1984	1986	1984	1991	1995	1980	1986
	LOWEST MEAN YEAR	1979	1998	1973	1975	1998	1998	1993	1976	1986	1981	1994	1987	1979
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.3	-0.2	-0.3	-0.3	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.7	-0.7	-0.8	-0.8	-0.8	-0.6	-0.8	-0.7	-1.1	-0.9	-0.5	-0.7	
341 SAN JOSE	HIGHEST MEAN	55.1	57.5	60.2	64.7	69.7	73.4	74.2	74.4	73.0	67.7	59.9	54.7	74.4
	MEDIAN	50.1	54.2	57.1	60.3	64.4	68.7	70.7	70.8	69.2	64.0	55.9	49.8	61.2
	LOWEST MEAN	46.2	50.3	52.2	54.4	59.3	65.0	68.3	68.6	66.1	59.9	50.2	44.4	44.4
	HIGHEST MEAN YEAR	1986	1991	1993	1989	1997	1981	1984	1998	1984	1992	1995	1983	1998
	LOWEST MEAN YEAR	1985	1989	1985	1975	1977	1982	1987	1973	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.4	-1.0	-1.1	-1.0	-0.9	-1.3	-1.1	-1.0	-0.7	
342 SAN LUIS DAM	HIGHEST MEAN	50.8	54.4	60.8	65.5	73.6	79.1	82.1	80.5	77.7	70.4	60.0	50.8	82.1
	MEDIAN	45.2	50.4	54.5	60.3	66.8	72.3	77.3	76.7	73.4	65.3	54.2	44.9	61.8
	LOWEST MEAN	39.1	46.8	51.4	54.0	60.5	67.0	71.3	72.4	68.0	61.6	49.2	40.1	39.1
	HIGHEST MEAN YEAR	1995	1991	1972	1987	1997	1981	1996	1992	1984	1991	1995	1995	1996
	LOWEST MEAN YEAR	1972	1989	1973	1975	1998	1998	1987	1976	1986	1971	1994	1985	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	-0.3	-0.2	-0.3	-0.3	-0.3	-0.2	-0.3	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
343 SAN LUIS OBIS	HIGHEST MEAN	57.3	59.4	59.3	63.9	67.2	71.7	70.5	71.1	75.8	68.4	63.1	59.5	75.8
	MEDIAN	53.4	54.7	55.5	58.4	60.2	63.9	66.6	67.2	66.7	64.3	58.5	54.0	60.3
	LOWEST MEAN	49.5	51.2	51.0	51.4	57.0	60.0	63.5	64.4	62.8	61.1	52.5	47.4	47.4
	HIGHEST MEAN YEAR	1986	1977	1997	1992	1997	1981	1985	1998	1984	1983	1976	1977	1984
	LOWEST MEAN YEAR	1972	1979	1973	1975	1991	1991	1994	1989	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.7	0.7	0.5	0.7	0.0	0.0	0.0	-0.1	0.4	0.3	0.6	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	
344 SAN PASQUAL A	HIGHEST MEAN	58.8	62.3	63.4	66.3	72.8	74.0	78.7	79.3	79.5	70.2	63.9	59.0	79.5
	MEDIAN	54.7	55.6	56.9	60.7	64.2	70.2	74.1	75.0	73.4	66.8	58.8	54.2	63.8
	LOWEST MEAN	50.3	52.1	52.3	53.3	59.8	65.5	70.8	72.5	67.1	63.0	54.0	49.2	49.2
	HIGHEST MEAN YEAR	1986	1995	1997	1992	1997	1981	1984	1992	1984	1999	1995	1977	1984
	LOWEST MEAN YEAR	1979	1979	1973	1975	1977	1982	1987	1975	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.8	-0.8	-0.9	-0.9	-0.8	-0.6	-0.7	-0.7	-1.0	-1.1	-0.7	-0.9	
345 SAN RAFAEL CI	HIGHEST MEAN	52.6	55.5	58.8	61.4	66.8	71.8	71.4	70.8	71.9	65.4	58.7	52.9	71.9
	MEDIAN	49.0	52.8	54.8	57.7	61.0	65.0	67.7	68.0	66.7	62.5	54.8	49.1	59.0
	LOWEST MEAN	44.1	47.5	50.5	52.9	56.8	61.7	64.1	65.3	61.8	58.8	49.0	44.0	44.0
	HIGHEST MEAN YEAR	1978	1988	1972	1992	1997	1981	1988	1998	1984	1983	1980	1981	1984
	LOWEST MEAN YEAR	1985	1989	1999	1975	1999	1982	1994	1973	1986	1975	1994	1985	1985
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
346 SANTA ANA FIR	HIGHEST MEAN	62.8	63.5	64.8	68.2	71.4	74.5	76.6	78.0	80.4	72.0	66.6	61.3	80.4
	MEDIAN	58.2	58.8	60.1	63.0	65.8	69.8	72.7	74.4	73.0	68.6	62.3	57.8	65.5
	LOWEST MEAN	54.9	55.5	55.6	56.5	61.7	65.3	69.5	70.7	68.2	65.4	57.8	52.7	52.7
	HIGHEST MEAN YEAR	1986	1995	1997	1992	1997	1981	1984	1983	1984	1983	1976	1977	1984
	LOWEST MEAN YEAR	1979	1971	1973	1975	1971	1982	1987	1975	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.7	-0.6	-0.6	-0.7	-1.1	-1.1	-0.7	-0.9	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
347	SANTA BARBARA	HIGHEST MEAN	58.1	60.6	61.1	63.5	66.8	69.0	70.2	72.2	74.1	67.7	63.2	59.2	74.1
		MEDIAN	54.9	56.0	57.3	59.5	60.8	63.8	66.8	68.0	66.7	64.2	58.8	55.2	61.0
		LOWEST MEAN	49.7	51.7	52.9	55.0	58.1	60.2	64.2	65.6	63.1	60.3	54.9	49.3	49.3
		HIGHEST MEAN YEAR	1986	1995	1988	1996	1997	1981	1984	1984	1984	1997	1976	1977	1984
		LOWEST MEAN YEAR	1972	1990	1991	1975	1971	1991	1991	1999	1993	1971	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
348	SANTA BARBARA	HIGHEST MEAN	57.8	59.3	61.2	63.3	65.7	69.4	70.1	72.5	74.8	67.9	62.2	59.1	74.8
		MEDIAN	53.1	54.9	56.7	58.6	60.6	64.0	67.1	68.5	66.8	63.6	57.6	52.9	60.3
		LOWEST MEAN	49.5	51.2	53.5	54.1	57.6	60.8	64.4	65.2	62.9	59.6	52.0	49.6	49.5
		HIGHEST MEAN YEAR	1978	1983	1983	1992	1997	1981	1985	1971	1984	1976	1977	1977	1984
		LOWEST MEAN YEAR	1989	1989	1999	1975	1975	1991	1994	1989	1986	2000	2000	1990	1989
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
349	SANTA CRUZ	HIGHEST MEAN	55.4	56.2	58.2	61.1	64.2	66.0	66.7	67.5	69.1	63.4	58.9	53.9	69.1
		MEDIAN	50.4	53.1	54.1	56.8	58.9	62.0	63.7	64.5	63.4	60.7	54.5	50.8	57.7
		LOWEST MEAN	47.2	48.5	50.0	50.2	55.9	58.4	60.9	62.0	60.6	57.3	49.6	45.1	45.1
		HIGHEST MEAN YEAR	1986	1995	1978	1992	1997	1981	1985	1983	1984	1987	1976	1977	1984
		LOWEST MEAN YEAR	1972	1979	1991	1975	1974	1999	1994	1989	1986	1971	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.5	-0.6	-0.4	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.3	-0.8	-0.8	-0.7	-0.6	-1.0	-0.7	-0.7	-0.5	
351	SANTA MARIA A	HIGHEST MEAN	56.6	57.4	58.7	60.3	62.6	64.4	68.7	68.8	71.9	66.2	60.4	57.4	71.9
		MEDIAN	52.0	53.0	53.7	55.5	57.5	60.7	63.6	64.0	63.2	60.9	55.5	51.5	57.8
		LOWEST MEAN	47.5	49.0	48.8	49.8	54.0	57.6	60.9	61.4	60.8	56.2	50.1	45.9	45.9
		HIGHEST MEAN YEAR	1986	1992	1998	1996	1997	1981	1985	1983	1984	1983	1977	1977	1984
		LOWEST MEAN YEAR	1973	1979	1973	1975	1991	1999	1987	1999	1986	1971	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
352	SANTA MONICA	HIGHEST MEAN	61.2	60.9	60.7	63.5	65.3	67.8	68.9	71.9	73.1	68.6	66.6	63.2	73.1
		MEDIAN	57.1	57.6	57.5	58.3	60.0	62.6	65.1	66.4	66.1	64.4	61.1	57.7	61.2
		LOWEST MEAN	53.2	52.9	53.3	54.4	56.7	59.4	62.7	62.8	62.9	60.1	56.0	52.7	52.7
		HIGHEST MEAN YEAR	1986	1992	1988	1992	1997	1981	1984	1983	1984	1983	1976	1976	1984
		LOWEST MEAN YEAR	1972	1979	1999	1975	1975	1982	1978	1975	1999	2000	2000	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-0.9	-0.6	-0.5	-0.5	-0.6	-1.0	-1.1	-0.7	-0.9	
353	SANTA PAULA	HIGHEST MEAN	60.0	60.4	60.6	64.1	67.4	70.3	72.1	74.3	75.0	68.1	63.9	58.3	75.0
		MEDIAN	54.6	55.5	56.7	59.4	61.5	65.5	68.2	69.0	67.5	63.5	58.6	54.8	61.4
		LOWEST MEAN	50.1	52.0	52.5	53.6	58.6	61.3	63.2	65.1	63.4	59.3	53.3	48.5	48.5
		HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1984	1971	1984	1983	1976	1976	1984
		LOWEST MEAN YEAR	1973	1989	1991	1975	1977	1982	1987	1987	1986	1975	1975	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.1	-1.2	-1.0	-0.9	-0.7	-0.7	-1.3	-1.3	-1.1	-1.0	
354	SANTA ROSA	HIGHEST MEAN	51.9	55.1	59.0	61.2	65.8	73.4	70.4	70.9	71.9	66.6	58.8	52.6	73.4
		MEDIAN	48.8	52.7	54.6	57.2	61.7	65.8	68.0	68.2	67.1	63.0	54.3	48.6	59.1
		LOWEST MEAN	43.8	47.8	50.1	52.3	57.3	62.2	62.6	62.0	60.8	59.4	48.9	43.4	43.4
		HIGHEST MEAN YEAR	1984	1991	1984	1989	1984	1981	1983	1983	1984	1983	1995	1977	1981
		LOWEST MEAN YEAR	1985	1989	1985	1975	1985	1991	1987	1986	1986	1971	1994	1985	1985
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
		MAX OBS TIME ADJUSTMENT	-0.8	-0.7	-0.9	-1.4	-1.1	-1.1	-0.9	-0.9	-1.3	-1.1	-1.0	-0.7	
357	SCOTIA	HIGHEST MEAN	53.5	54.7	55.5	58.0	61.0	61.3	64.2	64.3	64.8	61.0	57.5	52.5	64.8
		MEDIAN	48.1	49.3	51.1	52.5	55.0	58.6	60.8	61.8	60.4	57.4	51.5	47.9	54.7
		LOWEST MEAN	43.8	45.1	46.7	47.5	52.0	55.4	58.4	57.9	57.9	51.5	45.7	42.2	42.2
		HIGHEST MEAN YEAR	1986	1991	1992	1992	1997	2000	1992	1990	1997	1987	1999	1995	1997
		LOWEST MEAN YEAR	1972	1990	1977	1975	1977	1976	1971	1973	1972	1971	1985	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.5	
		MAX OBS TIME ADJUSTMENT	-1.0	-0.8	-1.0	-1.4	-1.2	-0.9	-0.7	-0.8	-1.1	-1.2	-1.0	-0.9	
358	SHASTA DAM	HIGHEST MEAN	50.2	55.5	57.1	66.0	74.8	79.6	85.3	83.6	80.8	71.9	58.8	50.9	85.3
		MEDIAN	46.2	48.8	52.0	57.3	66.4	74.2	81.3	80.2	75.0	64.3	52.6	47.1	62.2
		LOWEST MEAN	40.7	44.1	47.3	50.5	55.4	67.4	75.3	73.1	68.7	59.0	46.0	39.4	39.4
		HIGHEST MEAN YEAR	1984	1991	1986	1985	1992	1985	1985	1996	1991	1988	1986	1989	1985
		LOWEST MEAN YEAR	1982	1998	1975	1975	1998	1980	1983	1976	1985	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.8	0.4	-0.1	0.0	-0.3	-0.4	-0.3	-0.5	-0.3	-0.5	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
359	SHELTER COVE	HIGHEST MEAN	53.9	55.3	56.5	57.7	61.5	64.7	64.5	64.8	66.2	62.4	58.2	55.1	66.2
		MEDIAN	51.4	52.2	52.7	54.0	56.9	59.6	60.0	60.7	60.4	59.7	54.7	52.0	56.3
		LOWEST MEAN	47.3	46.9	48.5	49.5	52.9	54.6	57.9	57.0	57.4	56.2	50.5	46.3	46.3
		HIGHEST MEAN YEAR	1984	1977	1978	1992	1997	1985	1993	1984	1983	1991	1989	1995	1983
		LOWEST MEAN YEAR	1993	1989	1976	1975	1977	1982	1999	1986	1974	1986	1985	1972	1972
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.5	
		MAX OBS TIME ADJUSTMENT	-1.0	-0.8	-0.9	-1.4	-1.1	-0.9	-0.8	-0.8	-1.0	-1.1	-1.0	-0.9	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
362 SIERRA CITY	HIGHEST MEAN	43.6	47.7	49.2	56.4	62.7	67.7	74.3	73.1	69.3	64.6	53.2	45.9	74.3
	MEDIAN	38.7	39.8	42.7	47.8	55.1	62.5	68.7	68.4	63.8	55.4	43.6	38.3	52.2
	LOWEST MEAN	32.8	35.5	35.5	39.7	44.5	57.7	63.4	63.2	57.5	48.7	35.3	30.2	30.2
	HIGHEST MEAN YEAR	1986	1991	1986	1987	1992	1987	1988	1988	1975	1988	1976	1989	1988
	LOWEST MEAN YEAR	1973	1999	1991	1975	1998	1971	1983	1976	1986	1984	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	
363 SIERRAVILLE R	HIGHEST MEAN	37.0	42.3	44.4	49.2	57.7	63.3	68.0	67.1	60.5	54.1	44.2	37.1	68.0
	MEDIAN	29.3	33.5	39.5	43.7	51.4	58.3	64.3	63.4	57.5	48.3	37.9	31.3	46.3
	LOWEST MEAN	22.0	26.9	33.7	35.8	43.8	55.1	60.4	59.3	51.5	43.4	29.6	22.9	22.0
	HIGHEST MEAN YEAR	1981	1991	1972	1989	1992	1977	1996	1981	1981	1988	1995	1981	1996
	LOWEST MEAN YEAR	1972	1989	1985	1975	1977	1991	1993	1976	1986	1984	1985	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.4	-0.5	-0.3	-0.4	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.3	0.2	0.2	0.3	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
366 SONOMA	HIGHEST MEAN	52.5	56.0	58.5	61.0	66.9	75.1	73.8	72.7	73.3	66.1	57.9	52.7	75.1
	MEDIAN	47.8	52.2	54.1	57.2	62.0	67.8	71.2	70.6	68.5	63.4	53.6	47.5	59.9
	LOWEST MEAN	42.8	47.0	50.2	52.0	57.1	63.4	67.3	67.4	63.3	59.8	48.7	43.1	42.8
	HIGHEST MEAN YEAR	1978	1980	1978	1990	1997	1981	1984	1998	1984	1978	1995	1977	1981
	LOWEST MEAN YEAR	1972	1989	1999	1975	1998	1980	1987	1985	1986	1971	1994	1990	1972
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.3	-0.5	-0.6	-0.7	-0.5	
	MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.4	-1.1	-1.1	-1.0	-0.9	-1.3	-1.1	-1.0	-0.7	
367 SONORA RS	HIGHEST MEAN	48.2	52.6	54.5	59.5	68.2	73.9	78.8	78.1	74.0	64.9	54.5	48.5	78.8
	MEDIAN	43.6	46.7	49.0	53.4	61.0	69.2	76.0	74.7	69.6	60.0	49.7	43.4	57.8
	LOWEST MEAN	40.0	41.9	44.7	46.1	54.4	64.6	68.2	68.5	60.8	54.2	42.7	38.5	38.5
	HIGHEST MEAN YEAR	1986	1991	1972	1989	1992	1981	1996	1971	1991	1991	1995	1977	1996
	LOWEST MEAN YEAR	1972	1990	1991	1975	1977	1980	1987	1976	1986	1984	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	0.8	0.8	0.6	0.0	0.0	0.0	0.0	-0.2	0.3	0.2	0.5	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
368 SOUTH ENTR YO	HIGHEST MEAN	42.0	42.8	43.4	48.7	56.3	62.6	67.2	65.8	62.4	56.9	47.8	41.6	67.2
	MEDIAN	35.1	36.3	37.8	43.2	50.1	56.8	63.0	62.8	57.9	48.3	39.8	36.0	47.4
	LOWEST MEAN	30.0	31.4	30.9	32.7	41.0	51.9	57.6	59.4	49.7	44.4	31.9	28.7	28.7
	HIGHEST MEAN YEAR	1986	1991	1997	1989	1992	1981	1976	1981	1974	1988	1995	1980	1976
	LOWEST MEAN YEAR	1979	1990	1991	1975	1977	1998	1983	1979	1986	1982	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.3	0.4	-0.1	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
372 STOCKTON AP	HIGHEST MEAN	52.8	54.8	59.5	64.9	72.3	80.5	81.8	79.9	77.0	69.6	60.2	50.5	81.8
	MEDIAN	45.6	51.1	55.0	60.5	66.6	73.0	77.4	76.6	72.9	64.8	53.1	45.1	62.1
	LOWEST MEAN	40.3	47.4	49.7	53.3	59.4	68.4	72.8	73.3	67.1	60.5	48.5	40.9	40.3
	HIGHEST MEAN YEAR	1995	1992	1972	1977	1992	1981	1984	1996	1979	1991	1995	1995	1984
	LOWEST MEAN YEAR	1972	1990	1985	1975	1998	1998	1987	1976	1986	1998	2000	1990	1972
	MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
373 STOCKTON FIRE	HIGHEST MEAN	51.6	54.7	60.0	63.7	72.2	77.5	79.6	78.4	75.8	66.8	60.0	51.1	79.6
	MEDIAN	45.1	51.2	54.8	59.1	66.2	71.5	75.1	74.1	71.3	64.1	52.6	45.7	60.9
	LOWEST MEAN	40.9	46.6	50.1	53.4	60.4	67.2	68.9	71.0	61.7	59.9	48.9	39.9	39.9
	HIGHEST MEAN YEAR	1995	1995	1997	1987	1997	1981	1996	1996	1984	1991	1995	1995	1996
	LOWEST MEAN YEAR	1985	1990	1991	1975	1977	1982	1987	1976	1986	1984	1985	1990	1990
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
375 STONY GORGE R	HIGHEST MEAN	48.0	53.0	55.0	62.3	70.1	77.5	83.2	79.4	77.1	68.6	55.8	47.7	83.2
	MEDIAN	44.7	48.0	50.4	55.4	63.6	72.3	78.0	75.8	71.4	62.3	50.0	44.7	59.7
	LOWEST MEAN	39.9	43.5	47.1	49.5	55.1	66.5	73.1	70.9	66.0	58.3	42.8	37.6	37.6
	HIGHEST MEAN YEAR	1984	1991	1972	1987	1992	1977	1988	1971	1991	1991	1976	1980	1988
	LOWEST MEAN YEAR	1973	1994	1977	1975	1998	1980	1983	1976	1986	1984	1994	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
376 STRAWBERRY VA	HIGHEST MEAN	44.6	47.3	47.3	52.9	61.6	65.7	70.7	70.3	67.5	61.0	51.2	45.8	70.7
	MEDIAN	39.2	39.5	42.1	46.4	53.8	60.7	66.9	66.0	62.2	53.6	43.8	39.5	51.4
	LOWEST MEAN	33.8	34.5	35.6	39.0	45.2	55.4	61.6	61.3	54.7	47.1	36.0	31.4	31.4
	HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1977	1988	1992	1991	1988	1995	1989	1988
	LOWEST MEAN YEAR	1982	1990	1991	1975	1998	1980	1983	1976	1986	1984	1973	1971	1971
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.4	-0.4	-0.4	-0.4	-0.5	-0.3	-0.3	0.2	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
377 SUN CITY	HIGHEST MEAN	56.1	59.3	61.0	66.5	73.5	79.0	83.0	83.7	80.3	71.4	63.1	56.7	83.7
	MEDIAN	51.3	52.5	55.5	60.3	66.2	73.3	78.1	78.2	74.5	66.3	57.1	51.0	63.7
	LOWEST MEAN	47.6	50.0	49.6	52.9	60.8	65.8	71.0	74.6	69.1	62.1	51.4	45.3	45.3
	HIGHEST MEAN YEAR	1986	1995	1997	1989	1997	1981	1984	1998	1984	1978	1986	1980	1998
	LOWEST MEAN YEAR	1973	1990	1973	1975	1977	1982	1993	1976	1986	1971	1994	1987	1987
	MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.3	-0.2	-0.3	-0.3	-0.5	-0.6	-0.7	-0.6	
	MAX OBS TIME ADJUSTMENT	-1.0	-0.7	-0.9	-0.9	-0.8	-0.5	-0.7	-0.8	-1.0	-1.2	-1.1	-1.1	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
378	SUSANVILLE 2	HIGHEST MEAN	38.3	42.8	47.0	54.1	61.6	67.8	74.2	72.0	63.4	55.8	44.8	38.2	74.2
		MEDIAN	31.2	36.3	41.3	46.5	54.1	63.1	69.7	68.4	60.1	49.1	38.9	31.0	49.3
		LOWEST MEAN	19.2	26.3	37.2	39.1	47.7	58.0	62.2	60.4	54.1	45.6	31.5	24.1	19.2
		HIGHEST MEAN YEAR	1986	1995	1986	1990	1992	1977	1988	1998	1987	1988	1995	1981	1988
		LOWEST MEAN YEAR	1993	1989	1985	1975	1977	1993	1993	1976	1986	1981	1993	1990	1993
		MIN OBS TIME ADJUSTMENT	-0.3	-0.1	-0.4	-0.5	-0.4	-0.4	-0.4	-0.6	-0.6	-0.7	-0.4	-0.4	
		MAX OBS TIME ADJUSTMENT	0.1	0.2	0.2	0.1	0.2	0.2	0.1	-0.1	-0.1	-0.2	-0.1	0.0	
379	TAHOE CITY	HIGHEST MEAN	36.5	38.3	39.1	46.5	53.9	58.4	64.4	63.8	58.3	52.0	43.6	35.3	64.4
		MEDIAN	30.9	31.3	34.9	39.6	47.2	54.4	60.8	60.9	55.6	45.2	37.0	31.1	44.1
		LOWEST MEAN	23.7	27.0	26.5	33.0	39.8	50.1	56.3	54.1	48.7	40.0	29.4	25.1	23.7
		HIGHEST MEAN YEAR	1986	1991	1997	1992	1992	1985	1988	1988	1981	1988	1995	1981	1988
		LOWEST MEAN YEAR	1993	1990	1977	1975	1977	1980	1983	1976	1986	1971	1994	1971	1993
		MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.3	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
380	TAHOE VALLEY	HIGHEST MEAN	34.3	36.6	40.2	45.8	51.5	58.0	64.1	66.0	58.4	50.0	42.2	33.4	66.0
		MEDIAN	28.7	29.7	34.0	39.4	46.6	53.4	58.7	59.2	52.5	43.5	34.6	28.6	42.5
		LOWEST MEAN	20.4	22.7	28.0	26.9	39.9	49.0	55.7	52.1	45.1	38.9	27.9	20.1	20.1
		HIGHEST MEAN YEAR	1986	1991	1972	1985	1992	1977	1988	1988	1988	1988	1995	1996	1988
		LOWEST MEAN YEAR	1979	1990	1973	1975	1977	1980	1983	1976	1986	1971	1978	1971	1971
		MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.3	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
381	TEHACHAPI	HIGHEST MEAN	48.4	48.8	52.1	56.7	62.9	71.8	75.0	75.1	69.4	62.1	52.6	48.2	75.1
		MEDIAN	41.1	43.5	45.7	50.2	58.2	65.3	72.6	71.3	65.8	56.3	46.7	42.1	54.9
		LOWEST MEAN	36.2	39.5	40.3	42.7	50.7	61.9	67.2	65.6	58.6	51.2	40.1	35.1	35.1
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1984	1998	1974	1988	1995	1980	1998
		LOWEST MEAN YEAR	1979	1989	1991	1975	1977	1998	1983	1976	1986	1984	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7	-0.7	-0.7	
		MAX OBS TIME ADJUSTMENT	-0.9	-1.0	-1.2	-1.5	-1.2	-1.1	-0.9	-0.9	-1.5	-1.2	-0.8	-1.0	
382	TEJON RANCHO	HIGHEST MEAN	54.2	56.0	61.4	67.2	73.1	81.5	86.0	84.4	79.5	72.8	58.2	51.1	86.0
		MEDIAN	46.6	51.0	54.8	60.1	69.0	76.0	81.3	79.3	75.1	65.7	53.4	46.1	63.4
		LOWEST MEAN	41.7	46.6	48.3	53.7	60.1	70.0	74.2	75.9	68.7	61.1	48.1	41.9	41.7
		HIGHEST MEAN YEAR	1986	1991	1972	1987	1972	1981	1984	1998	1984	1978	1995	1979	1984
		LOWEST MEAN YEAR	1972	1990	1973	1975	1977	1980	1987	1976	1973	1975	1994	1990	1972
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.6	-0.6	-0.7	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.8	-0.9	-1.1	-0.9	-1.0	-0.7	-0.7	-1.2	-0.8	-0.8	-0.7	
383	TERMO 1 E	HIGHEST MEAN	34.2	38.7	41.8	47.1	55.6	61.3	67.9	65.8	58.5	50.2	40.9	34.2	67.9
		MEDIAN	27.5	31.8	36.5	41.6	49.2	56.0	64.1	62.5	55.5	45.0	33.9	27.3	44.1
		LOWEST MEAN	17.1	21.8	31.6	34.6	42.4	51.6	57.0	55.9	49.2	41.0	24.7	17.4	17.1
		HIGHEST MEAN YEAR	1986	1991	1986	1990	1992	1977	1973	1986	1974	1987	1995	1981	1973
		LOWEST MEAN YEAR	1989	1989	1977	1975	1977	1980	1993	1976	1986	1984	1994	1990	1989
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.5	-0.6	-0.6	-0.7	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.3	-0.3	-0.3	-0.3	-0.4	-0.2	-0.4	-0.4	-0.5	-0.3	-0.4	-0.3	
384	THERMAL RGNL	HIGHEST MEAN	60.5	64.1	71.7	77.7	83.3	90.9	93.5	93.2	88.5	78.5	65.8	59.6	93.5
		MEDIAN	54.8	59.5	64.6	71.7	79.4	86.9	91.2	90.0	84.5	73.5	61.7	54.0	72.6
		LOWEST MEAN	49.6	55.1	59.9	64.4	73.3	83.1	86.5	87.0	79.6	67.1	51.7	49.5	49.5
		HIGHEST MEAN YEAR	1986	1991	1972	1989	1984	1981	1989	1986	1984	1988	1995	1980	1989
		LOWEST MEAN YEAR	1979	1994	1991	1975	1977	1995	1993	1993	1985	1971	1994	1992	1992
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
385	THREE RIVERS	HIGHEST MEAN	52.2	57.2	59.2	65.4	74.3	82.0	85.6	84.0	79.5	70.5	59.0	50.8	85.6
		MEDIAN	47.4	50.7	53.6	59.8	67.4	76.2	82.3	81.3	75.4	64.9	53.3	46.3	63.2
		LOWEST MEAN	42.5	46.7	49.4	52.6	59.6	70.8	76.9	75.7	68.1	60.3	47.1	40.9	40.9
		HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1981	1988	1998	1974	1991	1995	1980	1988
		LOWEST MEAN YEAR	1972	1990	1973	1975	1998	1998	1983	1976	1986	1981	1994	1978	1978
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.6	-0.6	-0.4	-0.5	-0.4	-0.4	-0.7	-0.7	-0.7	-0.7	
		MAX OBS TIME ADJUSTMENT	-1.1	-1.0	-1.4	-1.8	-1.4	-1.5	-1.1	-1.1	-1.6	-1.5	-1.2	-1.2	
386	TIGER CREEK P	HIGHEST MEAN	46.5	51.7	53.2	58.3	65.5	71.2	76.0	75.5	72.2	64.2	54.2	44.3	76.0
		MEDIAN	41.6	45.3	47.8	52.7	59.2	66.2	72.5	72.2	68.2	58.9	47.0	40.6	55.9
		LOWEST MEAN	36.6	40.3	42.0	44.3	51.1	61.9	67.2	66.2	60.9	54.5	40.0	34.3	34.3
		HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1977	1988	1971	1991	1991	1995	1977	1988
		LOWEST MEAN YEAR	1982	1990	1991	1975	1998	1980	1983	1976	1986	1975	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.7	-0.6	-0.5	-0.5	-0.4	-0.5	-0.4	-0.4	-0.6	-0.7	-0.8	-0.6	
		MAX OBS TIME ADJUSTMENT	-1.0	-0.9	-1.2	-1.4	-1.2	-1.4	-1.1	-1.1	-1.5	-1.2	-1.1	-0.9	
388	TORRANCE	HIGHEST MEAN	61.1	61.4	62.8	65.8	67.9	71.6	72.9	74.4	76.6	69.1	65.6	59.7	76.6
		MEDIAN	56.3	57.3	58.2	60.9	63.0	66.3	69.2	70.2	69.2	65.4	60.2	56.5	62.8
		LOWEST MEAN	53.0	53.3	54.8	55.3	60.1	62.9	66.3	66.4	65.2	62.7	55.3	51.5	51.5
		HIGHEST MEAN YEAR	1986	1977	1988	1992	1997	1981	1985	1983	1984	1983	1976	1977	1984
		LOWEST MEAN YEAR	1979	1979	1991	1975	1975	1982	1987	1975	1986	1996	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-1.0	-0.9	-0.6	-0.5	-0.5	-0.6	-1.0	-1.1	-0.7	-0.9	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
389	TRACY CARBONA	HIGHEST MEAN	49.9	54.2	58.6	63.5	70.9	77.4	79.3	77.5	74.1	68.1	58.4	49.5	79.3
		MEDIAN	44.8	50.1	53.6	58.1	64.7	70.7	73.7	73.1	70.1	63.2	52.6	44.5	59.9
		LOWEST MEAN	39.4	45.6	49.7	51.7	57.9	65.3	69.7	69.1	65.2	58.0	47.1	39.9	39.4
		HIGHEST MEAN YEAR	1995	1991	1972	1987	1992	1981	1996	1996	1984	1991	1995	1996	1996
		LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1980	1987	1976	1985	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.7	0.7	0.6	0.7	0.0	0.0	-0.1	-0.1	0.3	0.2	0.5	0.5	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
390	TRACY PUMPING	HIGHEST MEAN	52.5	56.2	60.6	66.1	74.8	78.1	80.8	79.5	77.2	70.2	62.1	53.0	80.8
		MEDIAN	47.0	51.6	55.3	60.2	67.5	72.2	76.1	75.7	73.2	66.3	55.4	46.8	62.3
		LOWEST MEAN	41.4	47.9	51.3	54.1	60.4	66.9	72.0	71.8	67.9	61.7	50.0	42.1	41.4
		HIGHEST MEAN YEAR	1995	1991	1972	1990	1992	1981	1988	1992	1984	1991	1995	1995	1988
		LOWEST MEAN YEAR	1972	1989	1985	1975	1977	1982	1987	1976	1986	1971	1982	1985	1972
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.3	-0.4	-0.3	-0.4	-0.6	-0.6	-0.7	-0.5	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.7	-1.0	-1.4	-1.0	-1.1	-1.0	-0.9	-1.4	-1.1	-1.1	-0.7	
391	TRINITY RIVER	HIGHEST MEAN	43.5	48.9	51.4	57.7	66.2	71.6	77.1	74.4	70.4	61.1	51.5	43.4	77.1
		MEDIAN	39.6	42.6	46.1	50.5	58.5	65.5	71.9	70.7	65.3	56.0	44.2	39.1	54.1
		LOWEST MEAN	35.6	38.8	41.8	43.4	51.4	60.4	66.8	66.5	59.6	50.1	38.1	33.1	33.1
		HIGHEST MEAN YEAR	1986	1995	1993	1990	1992	1977	1994	1977	1991	1987	1995	1995	1994
		LOWEST MEAN YEAR	1982	1989	1975	1975	1977	1980	1983	1976	1986	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.8	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
392	TRONA	HIGHEST MEAN	54.1	63.9	65.7	72.9	80.8	90.2	92.2	94.0	85.5	74.1	60.4	51.1	94.0
		MEDIAN	45.0	51.9	56.8	63.7	73.1	81.5	87.0	85.0	79.7	67.2	54.2	44.7	65.8
		LOWEST MEAN	41.1	48.1	50.6	54.7	63.0	74.1	82.4	79.1	70.8	60.8	47.7	39.4	39.4
		HIGHEST MEAN YEAR	1996	1996	1997	1989	1997	1996	1996	1996	1997	1988	1999	1995	1996
		LOWEST MEAN YEAR	1994	1975	1977	1975	1977	1995	1987	1976	1985	1972	1994	1978	1978
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
393	TRUCKEE RS	HIGHEST MEAN	36.1	39.1	42.0	47.0	54.6	60.5	66.6	65.5	59.4	53.8	43.0	35.0	66.6
		MEDIAN	29.0	31.5	35.6	41.0	48.6	55.7	62.5	62.1	56.3	46.0	35.2	28.9	44.4
		LOWEST MEAN	23.3	25.2	30.3	31.6	40.8	51.5	57.4	55.4	48.7	41.3	27.7	22.0	22.0
		HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1977	1996	1981	1981	1988	1995	1981	1996
		LOWEST MEAN YEAR	1979	1990	1991	1975	1977	1980	1983	1976	1986	1984	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	0.4	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.4	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	
394	TULELAKE	HIGHEST MEAN	38.5	41.0	44.7	51.0	60.3	64.3	69.1	66.6	60.0	53.1	42.5	35.5	69.1
		MEDIAN	30.8	34.0	38.9	44.0	52.2	59.0	64.8	63.4	57.0	47.1	35.9	29.1	46.4
		LOWEST MEAN	14.3	23.3	33.9	38.3	45.3	54.4	59.5	58.8	50.5	41.9	27.5	22.8	14.3
		HIGHEST MEAN YEAR	1986	1991	1978	1990	1992	1986	1994	1992	1991	1988	1995	1995	1994
		LOWEST MEAN YEAR	1977	1989	1977	1975	1977	1980	1993	1976	1986	1971	1985	1971	1977
		MIN OBS TIME ADJUSTMENT	-0.8	-0.7	-0.7	-0.7	-0.5	-0.5	-0.5	-0.6	-0.7	-0.9	-0.9	-0.8	
		MAX OBS TIME ADJUSTMENT	-1.4	-1.1	-1.2	-1.4	-1.5	-1.3	-1.3	-1.4	-1.7	-1.2	-1.4	-1.1	
395	TURLOCK #2	HIGHEST MEAN	52.2	55.7	60.0	65.8	73.7	78.3	81.9	80.9	77.0	69.2	59.3	50.8	81.9
		MEDIAN	46.6	52.5	55.7	60.5	67.4	73.2	77.4	76.4	73.1	64.6	53.9	45.4	62.1
		LOWEST MEAN	40.8	48.6	51.1	53.5	60.7	68.7	72.9	72.5	67.3	60.4	48.6	40.3	40.3
		HIGHEST MEAN YEAR	1995	1992	1994	1987	1992	1981	1996	1998	1984	1991	1995	1995	1996
		LOWEST MEAN YEAR	1972	1990	1973	1975	1977	1980	1987	1976	1986	1971	1994	1985	1985
		MIN OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		MAX OBS TIME ADJUSTMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
396	TUSTIN IRVINE	HIGHEST MEAN	58.7	60.9	62.8	65.9	72.9	73.0	77.0	79.6	80.6	72.1	65.9	58.8	80.6
		MEDIAN	54.7	55.6	56.4	61.4	64.1	68.6	71.8	73.1	71.0	66.5	59.3	54.1	63.2
		LOWEST MEAN	48.9	51.0	53.2	54.0	59.9	62.0	68.3	68.9	65.3	60.3	54.2	47.3	47.3
		HIGHEST MEAN YEAR	1997	1995	1998	1989	1997	1981	1984	1998	1997	1999	1997	1997	1997
		LOWEST MEAN YEAR	1972	1990	1991	1975	1971	1982	1987	1979	1986	1972	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.7	0.6	0.5	0.0	0.0	0.1	0.0	-0.1	0.3	0.3	0.2	0.5	
		MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	-0.1	0.0	0.1	
397	TWENTYNINE PA	HIGHEST MEAN	55.0	59.3	65.6	73.0	81.8	87.7	91.6	90.6	84.1	74.9	62.7	55.8	91.6
		MEDIAN	49.4	53.8	58.3	65.5	74.3	82.8	88.6	86.5	80.5	68.7	56.8	49.0	68.1
		LOWEST MEAN	44.8	50.6	53.4	58.4	67.4	78.5	84.7	82.8	74.3	63.3	49.9	44.8	44.8
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1998	1995	1988	1995	1980	1996
		LOWEST MEAN YEAR	1973	1979	1973	1975	1977	1998	1987	1983	1986	1972	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.4	-0.5	-0.6	-0.7	-0.7	
		MAX OBS TIME ADJUSTMENT	-1.1	-0.9	-1.2	-1.3	-1.1	-0.8	-0.9	-1.0	-1.3	-1.5	-1.1	-1.3	
398	TWIN LAKES	HIGHEST MEAN	34.5	34.1	37.5	42.2	49.8	57.5	61.7	62.5	55.8	51.7	42.7	35.8	62.5
		MEDIAN	28.0	28.1	31.1	34.3	42.7	49.8	56.4	57.4	52.4	43.4	33.3	29.5	40.6
		LOWEST MEAN	21.4	22.6	23.2	23.7	33.3	44.3	53.1	50.3	44.2	37.0	23.5	20.4	20.4
		HIGHEST MEAN YEAR	1986	1995	1994	1992	1992	1985	1994	1981	1979	1988	1995	1980	1981
		LOWEST MEAN YEAR	1979	1990	1991	1975	1977	1980	1993	1976	1986	1984	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.3	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
399	TWITCHELL DAM	HIGHEST MEAN	56.8	57.6	60.5	62.7	66.3	70.7	71.1	72.1	75.8	67.9	63.9	59.7	75.8
		MEDIAN	53.3	54.8	54.9	58.1	60.2	63.7	66.5	67.1	66.8	63.8	58.2	53.7	60.2
		LOWEST MEAN	48.7	50.8	50.8	53.5	56.2	60.3	63.3	64.3	61.1	60.4	52.2	48.3	48.3
		HIGHEST MEAN YEAR	1976	1995	1972	1992	1997	1976	1992	1977	1984	1993	1977	1977	1984
		LOWEST MEAN YEAR	1987	1979	1973	1975	1998	1982	1987	1987	1986	1973	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.7	
		MAX OBS TIME ADJUSTMENT	-0.9	-1.0	-1.1	-1.4	-1.1	-0.9	-0.7	-0.8	-1.2	-1.2	-1.2	-1.2	
400	UKIAH	HIGHEST MEAN	49.9	54.0	57.0	61.2	68.0	72.2	77.1	75.2	73.6	66.6	56.6	49.8	77.1
		MEDIAN	46.6	49.9	52.1	55.7	61.4	67.0	73.1	72.2	68.8	61.1	50.5	46.4	58.7
		LOWEST MEAN	43.1	45.2	47.9	50.4	54.8	61.9	68.5	68.8	64.3	56.7	46.0	40.6	40.6
		HIGHEST MEAN YEAR	1986	1991	1986	1989	1992	1985	1984	1986	1991	1991	1976	1995	1984
		LOWEST MEAN YEAR	1982	1989	1991	1975	1977	1980	1987	1976	1986	1984	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.5	-0.4	-0.3	-0.3	-0.3	-0.4	-0.5	-0.6	-0.4	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.3	-0.4	-1.0	-0.6	-0.6	-0.5	-0.4	-0.6	-0.4	-0.4	-0.3	
402	U C L A	HIGHEST MEAN	63.3	62.7	63.4	65.8	68.3	71.4	73.2	74.9	77.6	71.7	67.1	63.5	77.6
		MEDIAN	57.7	58.2	58.4	61.6	62.7	66.2	69.4	70.5	70.0	66.7	62.2	59.1	63.7
		LOWEST MEAN	54.3	53.5	54.4	54.5	58.8	61.5	65.8	66.2	64.8	63.5	57.9	52.4	52.4
		HIGHEST MEAN YEAR	1986	1995	1988	1992	1997	1981	1984	1983	1984	1999	1976	1979	1984
		LOWEST MEAN YEAR	1979	1975	1973	1975	1975	1975	1987	1975	1986	2000	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.6	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.9	-1.0	-0.9	-0.6	-0.5	-0.5	-0.6	-1.0	-1.1	-0.7	-0.9	
404	UPPER SAN LEA	HIGHEST MEAN	54.0	56.2	58.0	60.4	64.2	67.2	67.9	67.8	71.8	66.5	60.2	56.7	71.8
		MEDIAN	49.6	52.6	53.9	56.3	58.7	62.3	64.7	65.2	64.8	62.3	55.5	49.8	58.3
		LOWEST MEAN	46.0	47.7	49.4	49.7	54.5	59.0	61.9	62.0	62.4	57.8	49.3	44.0	44.0
		HIGHEST MEAN YEAR	1986	1991	1986	1987	1997	1981	1984	1998	1984	1991	1995	1976	1984
		LOWEST MEAN YEAR	1982	1989	1976	1975	1977	1982	1975	1973	1986	1975	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.6	0.5	0.8	1.0	0.5	0.5	0.4	0.3	0.8	0.6	0.5	0.4	
		MAX OBS TIME ADJUSTMENT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	
405	VACAVILLE	HIGHEST MEAN	51.4	56.5	60.0	65.2	72.9	79.1	83.5	79.4	76.3	70.0	60.2	51.5	83.5
		MEDIAN	47.6	52.3	55.7	60.6	67.2	73.6	77.1	76.2	73.2	65.7	54.1	47.4	62.4
		LOWEST MEAN	41.8	48.4	51.0	54.6	59.8	68.8	73.5	73.5	67.2	60.9	49.4	43.0	41.8
		HIGHEST MEAN YEAR	1995	1991	1986	1987	1992	1981	1988	1996	1984	1991	1995	1995	1988
		LOWEST MEAN YEAR	1972	1990	1991	1975	1998	1980	1987	1976	1986	1971	1994	1990	1972
		MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.4	-0.3	-0.4	-0.5	-0.6	-0.7	-0.4	
		MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.3	-0.8	-0.9	-0.8	-0.8	-1.1	-0.7	-0.7	-0.4	
408	VICTORVILLE P	HIGHEST MEAN	50.6	54.2	60.1	66.0	73.6	79.6	83.9	83.0	78.0	69.2	58.7	51.3	83.9
		MEDIAN	45.4	48.9	52.7	58.6	66.4	74.4	80.2	79.0	73.5	62.5	51.5	44.9	61.5
		LOWEST MEAN	41.3	44.1	47.4	50.6	58.7	69.2	73.0	73.5	67.1	57.2	45.3	39.5	39.5
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1996	1998	1984	1988	1995	1977	1996
		LOWEST MEAN YEAR	1973	1979	1973	1975	1977	1998	1987	1976	1986	1971	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	-0.3	-0.2	-0.1	-0.2	-0.4	-0.3	-0.4	-0.4	0.3	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.1	0.1	
411	VISALIA	HIGHEST MEAN	51.5	55.3	60.1	66.4	74.4	78.6	83.7	81.4	77.4	70.5	59.1	50.8	83.7
		MEDIAN	45.7	51.6	55.9	60.7	67.8	74.6	79.0	77.8	73.4	65.2	53.3	45.0	62.3
		LOWEST MEAN	39.0	46.1	50.5	54.2	60.9	70.1	75.0	72.3	66.8	60.0	48.3	40.7	39.0
		HIGHEST MEAN YEAR	1986	1992	1997	1992	1992	1981	1988	1996	1984	1991	1995	1995	1988
		LOWEST MEAN YEAR	1972	1971	1973	1975	1977	1980	1983	1976	1986	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.4	0.5	0.0	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.1	
412	VISTA 2 NNE	HIGHEST MEAN	62.1	61.1	62.0	66.0	70.1	72.1	76.7	78.0	78.8	72.2	65.0	60.8	78.8
		MEDIAN	56.4	56.5	58.0	60.9	63.8	67.4	71.1	72.7	71.5	67.0	61.2	56.7	63.7
		LOWEST MEAN	52.4	52.8	53.5	54.7	59.1	62.8	67.4	67.3	67.1	63.5	56.4	51.1	51.1
		HIGHEST MEAN YEAR	1986	1995	1997	1992	1997	1981	1984	1998	1984	1999	1976	1980	1984
		LOWEST MEAN YEAR	1973	1975	1973	1975	1977	1975	1987	1975	1973	1975	1994	1971	1971
		MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5	-0.5	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-0.8	-0.9	-0.9	-0.7	-0.6	-0.7	-0.6	-1.0	-1.1	-0.7	-0.9	
415	WARM SPRINGS	HIGHEST MEAN	50.8	53.7	58.0	61.1	67.4	73.0	74.1	73.7	70.6	65.0	57.4	51.8	74.1
		MEDIAN	46.4	50.8	52.2	56.4	62.4	67.5	70.0	70.0	67.3	61.5	52.1	46.7	58.6
		LOWEST MEAN	42.3	45.4	47.8	50.2	56.1	63.5	68.5	66.6	62.2	57.8	46.9	41.5	41.5
		HIGHEST MEAN YEAR	1986	1991	1997	1987	1997	1981	1988	1998	1997	1978	1995	1995	1988
		LOWEST MEAN YEAR	1972	1989	1991	1975	1977	1980	1981	1973	1986	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.3	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	0.1	0.1	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
416	WASCO	HIGHEST MEAN	52.3	56.3	62.5	69.0	76.6	81.0	85.2	82.7	79.7	70.5	59.1	52.4	85.2
		MEDIAN	46.6	52.3	56.9	62.3	69.7	76.8	81.1	80.2	74.9	65.2	53.5	45.4	63.9
		LOWEST MEAN	39.9	47.7	52.6	56.2	62.4	71.1	76.1	74.8	69.0	60.9	47.5	40.4	39.9
		HIGHEST MEAN YEAR	1986	1991	1997	1987	1992	1981	1988	1992	1991	1991	1995	1977	1988
		LOWEST MEAN YEAR	1972	1971	1973	1975	1998	1998	1987	1976	1986	1971	1994	1990	1972
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.5	-0.6	-0.4	-0.5	-0.4	-0.4	-0.7	-0.7	-0.7	-0.6	
		MAX OBS TIME ADJUSTMENT	-0.9	-1.0	-1.2	-1.6	-1.3	-1.4	-1.0	-1.0	-1.6	-1.3	-1.1	-0.9	

NORMALS STATISTICS

No.	Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
417	WATSONVILLE W	HIGHEST MEAN	54.3	55.9	57.4	60.9	63.7	64.8	65.7	66.9	69.3	63.6	59.0	53.2	69.3
		MEDIAN	49.5	52.2	53.6	55.9	58.2	61.0	62.0	62.8	62.3	60.1	54.0	49.7	56.8
		LOWEST MEAN	45.7	47.6	49.1	50.6	54.7	57.9	59.6	60.5	59.2	55.8	49.5	44.4	44.4
		HIGHEST MEAN YEAR	1986	1995	1978	1992	1997	1981	1992	1983	1984	1983	1995	1977	1984
		LOWEST MEAN YEAR	1982	1979	1991	1975	1977	1991	1994	1973	1986	1971	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	0.3	0.3	-0.1	-0.1	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	
418	WEAVERVILLE	HIGHEST MEAN	42.2	47.1	49.6	57.4	65.0	70.8	76.7	75.9	69.0	62.1	51.0	41.6	76.7
		MEDIAN	38.3	41.7	45.5	49.2	57.7	64.7	71.7	71.2	65.6	55.4	44.3	38.0	53.8
		LOWEST MEAN	34.3	36.9	41.4	43.8	52.5	59.9	66.8	67.0	59.7	51.0	35.5	30.0	30.0
		HIGHEST MEAN YEAR	1986	1995	1986	1987	1992	1977	1996	1986	1991	1987	1995	1995	1996
		LOWEST MEAN YEAR	1982	1989	1991	1975	1977	1980	1993	1976	1982	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.8	0.4	-0.1	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
419	WEED FIRE DEP	HIGHEST MEAN	40.1	43.0	46.7	52.6	59.4	65.0	70.1	70.1	64.1	58.4	45.4	39.1	70.1
		MEDIAN	34.0	38.2	41.7	45.5	53.0	60.2	67.1	66.4	59.7	49.5	40.2	34.3	49.0
		LOWEST MEAN	26.7	33.5	37.7	40.3	46.0	55.6	61.2	60.7	53.4	44.5	33.0	27.3	26.7
		HIGHEST MEAN YEAR	1986	1995	1978	1987	1992	1986	1985	1986	1974	1988	1995	1981	1986
		LOWEST MEAN YEAR	1977	1990	1977	1975	1977	1980	1983	1976	1986	1984	1985	1990	1977
		MIN OBS TIME ADJUSTMENT	0.8	0.5	-0.1	-0.4	-0.3	-0.4	-0.3	-0.5	-0.3	-0.4	0.2	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
422	WHISKEYTOWN R	HIGHEST MEAN	48.7	54.3	56.3	63.1	72.9	77.0	83.7	82.5	79.9	70.9	57.6	49.2	83.7
		MEDIAN	44.8	47.0	50.5	55.6	65.0	73.0	79.4	78.6	73.2	62.3	50.1	44.9	60.5
		LOWEST MEAN	39.6	42.1	46.6	49.2	55.6	67.0	74.6	71.2	66.1	56.5	43.3	37.2	37.2
		HIGHEST MEAN YEAR	1984	1991	1986	1987	1992	1977	1994	1996	1991	1991	1995	1989	1994
		LOWEST MEAN YEAR	1993	1999	1975	1975	1998	1980	1983	1976	1986	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.8	0.4	-0.1	0.0	-0.3	-0.3	-0.3	-0.5	-0.3	-0.4	0.1	0.2	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
424	WILDROSE R S	HIGHEST MEAN	47.8	51.6	56.8	64.5	71.7	78.6	84.0	82.0	77.1	68.0	55.0	49.5	84.0
		MEDIAN	41.8	44.8	48.6	56.2	65.2	74.4	80.3	78.2	72.2	60.6	48.2	41.7	59.3
		LOWEST MEAN	35.4	40.4	44.1	47.8	56.0	68.2	76.3	72.6	64.0	53.1	42.3	35.4	35.4
		HIGHEST MEAN YEAR	1986	1995	1972	1989	1997	1981	1972	1986	1979	1988	1995	1980	1972
		LOWEST MEAN YEAR	1974	1998	1991	1975	1977	1998	1983	1976	1985	1984	1994	1987	1987
		MIN OBS TIME ADJUSTMENT	-0.6	-0.5	-0.6	-0.6	-0.5	-0.4	-0.4	-0.4	-0.6	-0.7	-0.7	-0.7	
		MAX OBS TIME ADJUSTMENT	-1.0	-1.0	-1.3	-1.7	-1.4	-1.2	-1.0	-1.0	-1.5	-1.2	-0.9	-1.1	
425	WILLITS 1 NE	HIGHEST MEAN	47.2	51.3	53.0	55.2	61.2	65.6	69.9	68.4	65.7	59.6	53.7	47.9	69.9
		MEDIAN	43.5	46.0	47.8	50.5	55.1	61.0	66.1	65.3	62.0	55.9	47.0	43.0	53.7
		LOWEST MEAN	39.5	41.0	43.8	45.6	50.1	57.1	62.0	62.3	58.2	52.6	41.9	36.7	36.7
		HIGHEST MEAN YEAR	1986	1995	1993	1989	1992	1977	1996	1998	1991	1991	1995	1995	1996
		LOWEST MEAN YEAR	1982	1989	1985	1975	1977	1980	1987	1985	1986	1998	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	0.3	-0.1	-0.3	-0.4	-0.4	-0.3	-0.3	-0.4	-0.4	-0.5	-0.3	-0.3	
		MAX OBS TIME ADJUSTMENT	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	-0.1	0.0	0.0	
426	WILLOW CREEK	HIGHEST MEAN	48.0	52.2	56.4	61.2	66.6	73.3	79.1	77.6	73.0	63.8	54.2	47.6	79.1
		MEDIAN	43.2	47.6	50.3	54.8	61.1	68.1	73.9	73.3	67.8	58.7	49.4	42.6	57.8
		LOWEST MEAN	39.7	41.4	44.2	47.8	55.3	62.7	69.9	69.0	63.1	53.1	43.5	38.0	38.0
		HIGHEST MEAN YEAR	1978	1995	1978	1987	1992	1977	1996	1986	1991	1978	1995	1981	1996
		LOWEST MEAN YEAR	1975	1990	1975	1975	1998	1980	1989	1979	1986	1981	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	0.7	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.3	-0.4	0.2	0.5	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	0.0	0.1	
427	WILLOWS 6 W	HIGHEST MEAN	49.5	53.4	58.3	64.0	71.9	77.6	80.3	78.5	76.2	69.7	57.9	49.6	80.3
		MEDIAN	45.1	49.6	53.2	57.7	65.6	72.5	77.0	74.8	72.0	64.4	52.3	45.5	60.9
		LOWEST MEAN	41.6	45.4	46.6	53.0	57.6	65.5	72.1	71.9	65.9	60.4	45.9	39.3	39.3
		HIGHEST MEAN YEAR	1978	1991	1972	1977	1992	1977	1984	1996	1991	1991	1995	1995	1984
		LOWEST MEAN YEAR	1973	1989	1991	1975	1998	1980	1987	1980	1986	1984	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.4	-0.4	-0.5	-0.3	-0.4	0.1	0.1	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	0.0	0.1	
428	WINTERS	HIGHEST MEAN	50.3	55.7	60.4	66.2	74.4	80.4	82.6	80.3	77.9	71.3	60.0	50.9	82.6
		MEDIAN	46.3	51.1	54.4	60.8	68.1	74.4	77.8	76.8	73.9	65.3	54.2	46.7	62.2
		LOWEST MEAN	41.4	47.1	51.2	54.4	60.9	69.4	73.9	72.4	67.9	61.3	48.7	41.1	41.1
		HIGHEST MEAN YEAR	1995	1991	1997	1987	1997	1981	1988	1992	1984	1991	1995	1995	1988
		LOWEST MEAN YEAR	1972	1989	1991	1975	1998	1980	1987	1976	1986	1971	1994	1972	1972
		MIN OBS TIME ADJUSTMENT	-0.2	-0.1	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5	-0.6	-0.4	-0.3	
		MAX OBS TIME ADJUSTMENT	0.2	0.2	0.1	0.2	0.2	0.1	0.0	0.0	-0.1	-0.2	-0.1	0.0	
430	WOODFORDS	HIGHEST MEAN	41.4	41.9	49.1	52.2	60.1	66.5	73.0	71.3	64.2	58.3	45.9	41.2	73.0
		MEDIAN	34.2	36.6	40.9	45.6	53.4	60.7	68.3	67.8	60.6	50.0	39.8	33.7	49.2
		LOWEST MEAN	26.0	29.4	35.6	37.2	45.5	56.8	63.2	58.3	52.5	45.5	33.1	25.8	25.8
		HIGHEST MEAN YEAR	1986	1991	1972	1987	1992	1977	1988	1971	1981	1988	1995	1977	1988
		LOWEST MEAN YEAR	1979	1989	1980	1975	1977	1995	1993	1976	1986	1984	1994	1990	1990
		MIN OBS TIME ADJUSTMENT	-0.8	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	
		MAX OBS TIME ADJUSTMENT	-1.1	-1.1	-1.4	-1.5	-1.4	-1.5	-1.2	-1.2	-1.5	-1.2	-1.2	-1.1	

NORMALS STATISTICS

No. Station Name	Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
431 WOODLAND 1 WN	HIGHEST MEAN	51.3	55.2	60.0	65.0	73.3	78.7	80.9	79.5	76.4	71.0	59.8	50.9	80.9
	MEDIAN	45.6	50.6	54.2	60.2	66.5	72.8	76.4	75.8	72.2	64.3	53.5	45.7	61.6
	LOWEST MEAN	40.3	46.7	50.5	53.1	59.6	68.7	72.4	71.4	66.6	60.1	48.1	40.3	40.3
	HIGHEST MEAN YEAR	1995	1991	1997	1987	1997	1981	1988	1998	1991	1991	1995	1995	1988
	LOWEST MEAN YEAR	1972	1974	1973	1975	1977	1980	1987	1976	1986	1971	1982	1972	1972
	MIN OBS TIME ADJUSTMENT	0.4	0.4	0.0	0.0	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	0.1	0.1	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
432 WOODSIDE FIRE	HIGHEST MEAN	52.2	55.2	57.7	61.6	67.7	71.3	72.2	73.6	71.9	65.3	58.5	52.4	73.6
	MEDIAN	47.6	51.6	53.9	56.9	61.7	66.1	69.7	69.4	67.1	61.9	53.1	47.5	58.9
	LOWEST MEAN	43.7	46.0	49.7	51.0	55.8	62.1	64.1	66.6	62.8	58.3	49.8	42.8	42.8
	HIGHEST MEAN YEAR	1998	1991	1997	1992	1997	1981	1984	1998	1984	1999	1995	1995	1998
	LOWEST MEAN YEAR	1972	1989	1991	1975	1977	1980	1987	1973	1986	1971	1994	1990	1990
	MIN OBS TIME ADJUSTMENT	-0.5	-0.4	-0.4	-0.5	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.6	-0.4	
	MAX OBS TIME ADJUSTMENT	-0.6	-0.5	-0.7	-1.2	-0.8	-0.7	-0.7	-0.6	-1.0	-0.7	-0.7	-0.5	
434 YOSEMITE PARK	HIGHEST MEAN	44.3	48.7	52.1	57.7	65.8	70.8	76.8	76.8	71.7	63.5	50.7	44.1	76.8
	MEDIAN	38.1	41.2	44.6	51.0	58.4	65.2	72.3	72.8	67.3	56.7	44.6	37.3	54.5
	LOWEST MEAN	32.0	36.2	38.3	41.8	48.5	58.8	66.8	65.5	59.6	50.9	36.8	29.0	29.0
	HIGHEST MEAN YEAR	1986	1991	1997	1992	1992	1981	1981	1981	1991	1978	1995	1980	1981
	LOWEST MEAN YEAR	1972	1998	1991	1975	1998	1998	1983	1976	1986	1971	1994	1971	1971
	MIN OBS TIME ADJUSTMENT	0.4	0.4	-0.1	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3	-0.4	0.1	0.2	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.0	-0.1	-0.1	-0.1	0.1	
435 YREKA SISKIYO	HIGHEST MEAN	41.1	44.5	47.9	55.2	63.3	69.4	75.2	74.4	67.9	58.9	47.4	40.5	75.2
	MEDIAN	34.5	38.8	42.9	48.0	56.0	63.3	70.5	70.6	63.0	52.1	40.5	34.1	51.3
	LOWEST MEAN	25.8	32.2	38.6	41.1	49.2	58.8	63.8	63.7	56.7	47.5	34.0	27.2	25.8
	HIGHEST MEAN YEAR	1986	1995	1986	1990	1992	1986	1996	1986	1991	1987	1995	1995	1996
	LOWEST MEAN YEAR	1977	1989	1977	1975	1977	1980	1993	1976	1978	1984	1994	1972	1977
	MIN OBS TIME ADJUSTMENT	0.8	0.5	-0.1	0.0	-0.3	-0.3	-0.3	-0.5	-0.3	-0.5	0.2	0.5	
	MAX OBS TIME ADJUSTMENT	0.2	0.2	0.2	0.3	0.2	0.3	0.1	0.0	-0.1	-0.1	0.0	0.1	

Hydrology

Humboldt county General Plan Update, chapter 1 – Water Resources

What are the nature, extent and flow of local rivers?

The information regarding the nature, extent, and flow of our local rivers is provided within the General Plan Update in chapter 1, *Water Resources.* See figure 1-1 from the General Plan Update, showing the major streams and watershed within Humboldt County.

In section 1.1 a table is found (Table 1-1) illustrating the County's local water basins, the watersheds within the basins, each basin's total acres within the County, and the overall total acres of each.

In section 1.2, titled Local Planning Watershed Features, an inventory of Humboldt County's planning watersheds are found. The section gives detailed information within the inventory describing the nature, extent and flow of Humboldt County's rivers. The section also provides information of the state that the local rivers are in. First described it the local water basin that the planning watersheds are found in and then complete information on each planning watershed is given. The information is categorized under each planning watershed in the following way. Overall information characterizing the watershed is provided such as, the size of it, the acres of land the watershed drains, the volume of flow of the main waterway, and locations of headwaters and discharge point. The sub-sections within the planning watershed are *Rivers and Streams, Land Cover Type, Water Quality, Current Sediment Runoff, Temperature Problems, Watershed Management Problems, and Fish.* The four water basins are Klamath-Trinity, Mad-Redwood, Eel, and Mattole. The Klamath-Trinity Basin described below is a summary to offer an example of the type of information that can be found in

Chapter 1, Water Resource of General Plan update. The example is not organized in the same manner found in the General Plan due to not all of the information is relevant.

Klamath-Trinity Basin

Planning watershed included are Lower Klamath, Lower Trinity, and South Fork Trinity. The northeaster corner of Humboldt County is covered by these watersheds. Lower Klamath has 1832 miles of waterways and drains 332,787 acres in Humboldt County. It flows downstream from the Scott River to the Pacific Ocean. The flows range from 7,432 cubic feet per second (cfs) to 39,830 cfs. Tributaries to Lower Klamath include the Shasta, Scott, Salmon, and Trinity Rivers. Many other smaller tributaries flow to the Lower Klamath along its length.

Lower Klamath provides high quality water resource for the area stated by the North Coast Region of Water Quality Control Board. Issues for the river are sedimentation and temperature. "The Watershed Management Council states that pools in the lower Klamath River and its estuaries have been filled in by sediment" (Chp. 1, pg 11). High temperatures in the summer, up to 80 degrees Fahrenheit and low dissolved oxygen levels create an environment lethal to riparian salmon (1-12).

The Trinity River is designated as a Wild and Scenic River. Trinity River has 172 miles of waterways and drains 1,304,179 acres of watersheds in Humboldt and Trinity counties. Ninety five percent of the watershed is in mountainous regions, the tributaries form steep V-shaped valleys. Headwaters of the Trinity are found in high elevation in the Trinity Alps and the Trinity Mountains. The highest areas analysis is found on Sawtooth Mountain in the Trinity Alps at 8,888 ft. elevation. "The lowest point at the confluence of the North Fork Trinity River is approximately 1,475 feet in elevation" (1-12). Trinity

River's major tributaries are South Fork Trinity River, New River, French Creek, North Fork Trinity River and Canyon Creek. There are many smaller tributaries flow to the Trinity River along its length. The Trinity flows east to west and is the main tributary to the Klamath River. It meets the Klamath around 40 miles away from the Pacific Ocean.

The majority of water in the Trinity River watershed (70%) is exported to the Central Valley Project by Bureau of Reclamation (BOR). The remaining 30% inflow from the Trinity Dam is allocated for in-river purposes (1-13). BOR adopted minimum flow requirements of 300 cfs in winter, highest peak in late spring at 2000 cfs, and dropping to 450 cfs in summer. Recommendations from Fish and Wildlife Service are that an increase of inflow by 47% is needed.

Along the river are potential pollution sources. These include contaminated mining sites, a US EPA Superfund site, old gas station with storage tanks with possible leaks, PG&E substations under investigation for mineral oil releases with PCBs and storm water discharges from the facilities. Other pollution potentials come from several above ground storage tanks are in the area, multiple lumber mills with use of wood preservatives contaminating groundwater and soils, and a burn dump in the area that requires investigation for determining potential hazardous materials and impacts on water quality. See the County's general plan for specific locations. Sedimentation is a problem within the river and insignificant flow rates to transport the sediment designates the Trinity River by the EPA as sediment impaired. More information regarding soil type and erosion impairing the watershed can be found within the General Plan Update. The Lewiston and Trinity dams are indirectly responsible for the reduction of the coarse size sediment component that is beneficial to aquatic habitats.

It is important to know that in Humboldt County the main issues that our local rivers and streams are faced with is temperature and sediment problems.

The Section 1-2 of General Plan Update gives a summary of the watersheds, see page 1-37. The summary highlights important information and problems within each watershed. Issues such as diversions, high temperatures, sediment problems, damaged aquatic habitats, and other key information is provided.

Ground water

In section 1.3 of General Plan Update there is information regarding groundwater. There are four groundwater basins located in Humboldt County; Eel River Valley, Eureka Plain, Mad River Valley, and Hoopa Valley and they are in North coast Hydrologic Area (1-37). These basins are labeled Coastal Basin aquifers that are composed of marine, terrestrial, and volcanic rocks deposited from the tectonic activity millions of years ago that formed the Klamath and Salmon Mountains in Northern California (1-37). Three of the basins are recharged through the runoff from the hills; they are the Eureka Valley basins including Eel River Valley, Eureka Plain, and Mad River Valley. Section 1.3 covers the issue within groundwater basins and how much water they supply to their planning area. Groundwater concerns are also addressed. The main problems deal with contamination from nutrient loading, pesticide and herbicide runoff, and wood preservatives used at various lumber mills.

Map of Private vs. Federal owned land

1 Water Resources

This chapter presents Humboldt County's water resources, including rivers (and their watersheds) and groundwater. This chapter is divided into sections on watersheds and surface water, groundwater, stormwater, the regulatory framework, and policy issues.

1.1 WATERSHEDS AND SURFACE WATER

A watershed is an area of land within which all rain and snowfall drains or seeps into a particular stream, water body, or aquifer. Ten of Humboldt County's 12 planning watersheds each drain to a single stream or river, all of which either drain directly to the Pacific Ocean or to another river that empties into the Pacific. Eureka Plain and Trinidad are drained by many smaller streams, which terminate in Humboldt Bay or the Pacific Ocean, respectively. Watershed mapping allows for the environment to be studied along its natural lines of division, particularly in the case of water, biological, forest, agricultural, and even some cultural resources.

LOCAL WATER BASINS

Humboldt County is part of the Klamath-North Coast Hydrologic Basin Planning Area, which includes all basins draining into the Pacific Ocean from the Oregon border southerly through the Russian River Basin. The County's 12 planning watersheds, covering between 73,000 and 333,000 acres each (see Table 1-1), are displayed in Figure 1-1. These can be grouped into four larger basins: Klamath-Trinity, Mad-Redwood, Eel, and Mattole.

Table 1-1: Humboldt County Planning Watershed Areas

Watershed	*Basin*	*Total Acres within County*	*Total Acres*
Lower Klamath	Klamath-Trinity	332,787	493,453
Lower Trinity	Klamath-Trinity	192,286	654,967
South Fork Trinity	Klamath-Trinity	73,205	596,497
Redwood Creek	Mad-Redwood	187,788	187,819
Trinidad	Mad-Redwood	83,684	83,684
Mad River	Mad-Redwood	221,337	322,143
Eureka Plain	Mad-Redwood	124,617	124,617
Van Duzen	Eel	234,899	274,083
Lower Eel	Eel	191,052	191,052
Middle Main Eel	Eel	138,509	333,345
South Fork Eel	Eel	200,395	441,213
Cape Mendocino	Mattole	311,774	319,628
Total		**2,292,332**	**4,039,132**

Source: Humboldt County GIS, 2002.

River run-off, or the amount of water discharged through surface streams, is determined by a combination of factors, including local geology, topography, drainage area, and rainfall patterns. The hydraulic basins in Humboldt County, like most of Northern Coastal California, provide large surface water volumes (30 percent of the runoff in the entire State of California), 80 percent of which is deposited between November and March. Flooding is covered in Chapter 11 of this document.

The current Humboldt County Framework Plan, adopted in 1984, notes that the County's water quality is "relatively high." The Framework Plan also states that advances in sewage treatment plant technology coupled with the Federal Clean Water Grant Program (which has since been phased out in favor of state-based programs) had, by the Plan's writing, substantially reduced riverine and bay pollution problems from previous levels.

The state and Federal wild and scenic rivers programs and total maximum daily load designations are today the strongest measures being taken toward waterway protection and rehabilitation, respectively.

WILD, SCENIC, AND RECREATIONAL RIVERS

Subject to a declaration that rivers with "extraordinary scenic, recreational, fishery, or wildlife values" should be preserved in their free-flowing state as the "highest and most beneficial use,"[1] the California State Legislature created a California Wild and Scenic Rivers System in 1972, now administered by the California Resources Agency. While the U.S. Congress had created a national system designating the same rivers in 1968, the California system is intended to enhance local coordination of riparian management.

Under the California system, rivers were classified as wild, scenic, or recreational, according to the following criteria as stated in the California Public Resources Code § 5093.53:

- Wild rivers are those "free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted."
- Scenic rivers are those "free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads."
- Recreational rivers are those "readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past."

Sections of rivers in the Klamath-Trinity and Eel River basins were classified as wild, scenic, or recreational by the California State Legislature, as summarized in Table 1-2 and illustrated in Figure 1-2.

[1]California Public Resources Code § 5093.50.

Table 1-2: Wild, Scenic, and Recreational Rivers of Humboldt County

River	*Section*	*Designations*
Klamath River, Mainstem	From 100 yards below Iron Gate Dam to the Pacific Ocean	Recreational
Trinity River, Mainstem	From 100 yards below Lewiston Dam to the river mouth at Weitchpec	Scenic, Recreational
Trinity River, South Fork	From the junction of the river with State Highway Route 36 to the river mouth near Salyer	Wild, Scenic
Eel River, Mainstem	From 100 yards below Van Arsdale Dam to the Pacific Ocean	Wild, Scenic, Recreational
Eel River, South Fork	From the mouth of Section Four Creek near Branscomb to the river mouth below Weott	Wild, Recreational
Eel River, Middle Fork	From the intersection of the river with the southern boundary of the Middle Eel-Yolla Bolly Wilderness Area to the river mouth at Dos Rios	Wild, Scenic, Recreational
Van Duzen River	From Dinsmores Bridge downstream to the river mouth near Fortuna	Scenic, Recreational

Source: California Public Resources Code § 5093.545.

TOTAL MAXIMUM DAILY LOAD (TMDL) DESIGNATIONS

TMDL Studies are pollution control plans drafted by the US Environmental Protection Agency (EPA) to meet the requirements of Section 303(d) of the Federal Clean Water Act. The TMDL serves as the means to attain and maintain water quality standards for impaired water bodies. In Humboldt County, TMDLs are most often applied because of pollution related to sedimentation and siltation, whereas in most other regions of the state they are necessary to control chemicals and nutrient imbalances (see Table 1-3).

Current Designations

Under Section 303(d) of the Federal Clean Water Act, California is required to develop a list of water bodies where industrial and technological waste limits or other legally required mechanisms for pollution control are not sufficient or stringent enough to meet water quality standards applicable to such waters. In such cases, the water body is deemed "impaired."

Placement of a water body on the 303(d) List requires the development of a pollution control plan, called a Total Maximum Daily Load (TMDL), for each water body and associated pollutant or stressor[2] on the list. The TMDL serves as the means to attain and maintain water quality standards for the impaired water body. The Van Duzen River in Humboldt County was an EPA TMDL pilot area.

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[2] A stressor is a nonpollutant factor that negatively affects riverine ecology, such as excessive sedimentation, high temperatures, or low levels of dissolved oxygen.

Table 1-3: Total Maximum Daily Load (TMDL) Designations in Humboldt County

Water Body	*Basin*	*Stressor Requiring TMDL*	*Size Affected*	*Priority*
South Fork Trinity	Klamath-Trinity	Sedimentation/Siltation, Temperature	80 miles	Low
Trinity River	Klamath-Trinity	Sedimentation/Siltation	170 miles	Medium
Klamath River	Klamath-Trinity	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Temperature	190 miles	Medium
Mattole	Mattole	Sedimentation/Siltation, Temperature	56 miles	Medium
Redwood Creek	Mad-Redwood	Sedimentation/Siltation	63 miles	Low
Mad River	Mad-Redwood	Sedimentation/Siltation, Turbidity	90 miles	Low
Freshwater Creek	Mad-Redwood	Sedimentation/Siltation	72.7 miles	Medium
Elk River	Mad-Redwood	Sedimentation/Siltation	87.5 miles	Medium
Eel River Delta	Eel	Sedimentation/Siltation, Temperature	6,350 acres	Low
South Fork Eel River	Eel	Sedimentation/Siltation, Temperature	85miles	Low
Middle Main Fork Eel River	Eel	Sedimentation/Siltation, Temperature	1,075 miles	Low
Van Duzen	Eel	Sedimentation/Siltation	63 miles	Low

Source: 1998 California 303(d) List and TMDL Priority Schedule.

The most recent 303(d) List was published in 1998. A revision process is currently underway and a new list will be published later in 2002.

A water body may be listed once any of the following criteria are met:

- Pollution control requirements are not stringent enough to assure protection of beneficial uses (such as drinking, recreation, aquatic life, and irrigation),
- There is a fishing, drinking water, or swimming advisory currently in effect,
- Beneficial uses are impaired or are expected to be impaired within the listing cycle,
- The water body is on the previous 303(d) List and has not improved,
- Concentrations of pathogens in consumable body parts of fish or shellfish exceed applicable guidelines, or
- Overall water quality is of such concern that the Regional Water Board determines the need for 303(d) Listing.

Figure 1-2 shows TMDL priorities, as determined by the State Water Resources Control Board, generalized by watershed.

Recommended New Designations

Updates to the 303(d) List include adding or removing waters and indicating priorities and schedules for developing TMDLs. The North Coast Region Water Quality Control Board states that "ideally, this process should involve review of information such as monitoring data, scientific literature, or resource management agency files that document water quality conditions and trends" in accordance with the US EPA's inclusionary directive, and in 2001 submitted a list of recommended updates for the 2002 revision to the North Coast 303(d) List (see Table 1-4).

Table 1-4: Recommended Updates to 303(d) List in Humboldt County

Water Body	*Basin*	*Potential Action*	*TMDL Category*
Jacoby Creek	Mad-Redwood	Add to List	Sediment
Mad River	Mad-Redwood	Add to List	Temperature
Redwood Creek	Mad-Redwood	Add to List	Temperature
Humboldt Bay	Mad-Redwood	Add to Watch List	Sediment, PCBs and Dieldrin
Mad River Slough	Mad-Redwood	Add to Watch List	PCBs
Klamath River	Klamath-Trinity	Add to Watch List	Sediment

Source: North Coast Region Water Quality Control Board, 2001.

A water body and pollutant combination will be recommended for a Watch List if information regarding water quality impairment is ambiguous or insufficient. This action does not require the development of a TMDL, but does highlight the need to obtain information for determining the condition of a water body prior to future 303(d) List updates.

Evidence that watershed conditions are declining in at least some areas can be found in the 303(d) List update recommendations: while three rivers in Humboldt County are recommended for new listings and three more are recommended for placement on watch lists, there is no mention of de-listing any Humboldt County waterways. All that is necessary for a water body to be de-listed is demonstration that objectives are being met and beneficial uses are not impaired; objectives are revised; or control measures are put in place resulting in protection of beneficial uses.

SURFACE WATER DISTRIBUTION

Four water districts serve Humboldt County: Alderpoint County, Hydesville County, Jacoby Creek County, and Humboldt Bay Municipal Water Districts. The largest of the water suppliers is Humboldt Bay Municipal Water District (HBMWD) serving the greater Humboldt Bay Area, including Eureka, Arcata, and Blue Lake as well as community service districts serving the unincorporated areas of McKinleyville, Cutten, Fairhaven, Fieldbrook, and Manila. HBMWD serves about 65,000 people a day and can deliver up to 20 million gallons daily. The rest of the county's unincorporated areas are served by community service districts. The water for the systems comes from rivers and wells.

1.2 LOCAL PLANNING WATERSHED FEATURES

This section provides an inventory of Humboldt County's planning watersheds. Each is described in terms of the rivers and streams that characterize it; its size (acreage of land drained) and the main waterway's volume of flow; the locations of the headwaters and discharge point, where applicable; the type and volume of sediment runoff; any problems (natural or human-induced) affecting the watershed's flow, ability to support anadromous fish, or water quality; the dominant land cover or vegetation in the area; overall water quality; and anadromous fish present in local waterways. (Chapter 2: Biological Resources examines vegetative covers and special status species in each planning watershed; further detail of each planning watershed is provided in Volume II of this report.)

Sedimentation and temperature are the chief watershed management issues in Humboldt County; the following is a brief description of their importance.

- Sedimentation is a natural process but can be greatly accelerated by land use activities which modify drainage patterns or remove vegetative cover in highly erosive areas. Increased erosion and sedimentation may alter runoff characteristics and destroy aquatic and terrestrial wildlife habitat. Stream sedimentation from various activities limits coldwater aquatic uses—including the migration, spawning, reproduction, and development of cold water fish—and contributes to flooding.
- Temperature is such an important requirement of fish that coho and chinook salmon, and steelhead are known as "cold water fish." Many physiological processes of salmon are affected by temperature including metabolism, food requirements, growth rates, developmental rates of embryos and young, timing of life-cycles such as adult migration, emergence from gravel nests, proper life stage development and sensitivity to disease. In general, the types of effects are usually divided into lethal and sublethal effects. These effects are relevant for all the life stages of salmon.

KLAMATH-TRINITY BASIN

The Klamath-Trinity Basin includes the Lower Klamath, Lower Trinity, and South Fork Trinity planning watersheds, and covers the northeastern quarter of Humboldt County. A large portion of this area is under the jurisdiction of the Six Rivers National Forest and the Hoopa Indian Reservation.

LOWER KLAMATH PLANNING WATERSHED

The Klamath is California's second largest river, draining a watershed of approximately 979,816 acres in three counties. The Lower Klamath River planning watershed, draining 332,787 acres in Humboldt County, has 1,832 miles of waterways, all but 53 miles of which are naturally occurring. Records indicate that flows have ranged from 7,432 cubic feet per second (cfs) to 39,830 cfs.

The Lower Klamath planning watershed encompasses that portion of the Klamath River and its tributary watershed downstream from the Scott River to the Pacific Ocean (excluding the

Trinity River), and is 2,564 square miles in area. Included in the watershed are the Salmon River, Blue Creek, numerous smaller perennial streams, and the Klamath River delta/estuary. The area is largely rugged, steep forest land with highly erodible soils. The population of the area is small and scattered. Its discharge point in is Del Norte County near the town of Klamath, approximately 10 miles north of the Humboldt County border.

Rivers and Streams

The Klamath River is the main waterway in the Lower Klamath planning watershed, which covers northernmost Humboldt County; its main tributaries are the Shasta, Scott, Salmon, and Trinity Rivers. Numerous other, smaller tributaries enter the Lower Klamath River along its entire length. The Shasta, Scott, and Salmon rivers do not flow through Humboldt County and are not studied separately here.

Land Cover Type

The Lower Klamath planning watershed is dominated by montane hardwood forest (to the west) and Douglas fir (to the east), with montane chaparral and Klamath mixed conifer forest present in the central watershed. The U. S. Forest Service manages the majority of the forest lands in the basin. Six Rivers National Forest was created in 1947 from parts of the Klamath, Trinity, and Siskiyou national forests. Public ownership of forest land in the basin was centered in the remote areas, especially on the upper watersheds of the many full-flowing streams. Private timberlands originally developed on the more accessible tracts, which were nearest the two ends of the Klamath Basin with access to interstate highways or railroads. Each of the three tribes of the area has some forest land within its jurisdiction, ranging from 76,000 acres for the Hoopa Valley Tribe, to 3,840 acres on the Yurok Reservation, to about 100 acres for the Karuk Tribe. Most of these sites were logged in recent decades.

Water Quality

The Water Quality Control Plan for the North Coast Region (Basin Plan) and the Watershed Management Initiative recognize that the Klamath watersheds are culturally, climatically, and geologically diverse. The watershed provides some of the highest-quality water resources of the Region, yet it simultaneously produces some of the most-challenging water-resource conflicts. The Basin Plan contains specific water quality objectives for many index points within the Basin and it provides implementation programs to protect and enhance identified beneficial uses of water. The over-arching regulatory provision of the Basin Plan is its discharge prohibitions section, which prohibits direct waste discharge to all freshwater surface waters in this management area. The one exception to this prohibition results from the situation of City of Tulelake at a place that was once submerged by the waters of Tule Lake.

Current Sediment Runoff

The Watershed Management Council states that pools in the lower Klamath River and its estuary have been filled in by sediment. No information on ongoing runoff is available.

Temperature Problems

Summer temperatures (reaching a high of 80 degrees Fahrenheit) and low dissolved oxygen have combined to form an environment often lethal to riparian salmon. Some cold-water regions have ameliorated the conditions for local fish.

Watershed Management Problems

The US Bureau of Reclamation's (BOR) Klamath Project controls most of the flow in the Klamath River, and has typically provided water for irrigation without regard to downstream deliveries during below-average water years. Due to the BOR's diversions, the minimum flows mandated by the Federal Energy Regulatory Commission have frequently not been met.

Fish

According to the California Department of Fish and Game (DFG), the Lower Klamath River supports a number of anadromous[3] fish species including spring, fall and late fall-run chinook salmon, coho salmon, fall, winter and summer-run steelhead trout and coastal cutthroat trout. The mainstem Lower Klamath River provides habitat for all life stages of chinook salmon, coho salmon, and steelhead trout.

The Six Rivers National Forest portion of the Lower Klamath planning watershed includes several important spawning tributaries for salmon and steelhead. The DFG estimates that an escapement of as much as 106,000 fall-run chinook salmon are needed to adequately occupy the currently available spawning habitat in the Klamath-Trinity River system. Although both quality and quantity of available spawning habitat have declined, the low number of fall chinook salmon returning to spawn is presently the dominant constraint upon recovery of this population. The reasons for the decline of Klamath fall chinook have been conjectured to be flow reductions caused by drought conditions, reduced ocean productivity, over-harvest, and high-seas drift net fisheries.

Coho occur in low numbers in forest tributaries of the Lower Klamath planning watershed. The coho population in the Klamath is primarily supported by a hatchery program. The available habitat for naturally spawning coho currently is very under utilized.

LOWER TRINITY PLANNING WATERSHED

The Lower Trinity planning watershed lies within the area known as the Klamath Province, including headwater reaches of the Trinity Alps and the Trinity Mountains. The highest point in the analysis area is in the northern headwaters in the Trinity Alps on Sawtooth Mountain, elevation 8,888 feet. The lowest point at the confluence of the North Fork Trinity River is approximately 1,475 feet in elevation. Virtually the entire watershed area is mountainous, with steep V-shaped valleys formed by the tributaries. Only 5.1 percent of the whole Trinity Basin is farmland, most of which occurs in the Hayfork Valley. Most ridgetop elevations range from 4,000 to 5,000 feet.

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[3] Anadromous refers to the predisposition of salmonids (salmon and trout) to swim upstream in order to spawn.

Approximately 29 percent of the watershed lies within Humboldt County. The largest single private land owner is Simpson Timber; however, much of the watershed is under the management of the U. S. Forest Service, which accounts for the land use of open space/parks as being the dominant land use.

The Trinity River, flowing 172 miles, drains approximately 1,304,179 acres of watersheds in Humboldt and Trinity counties. Seventy (70) percent of water in the Trinity Watershed is exported to the Central Valley Project by the Bureau of Reclamation (BOR), leaving 30 percent of the available inflow above Trinity Dam to be allocated for in-river purposes. The DFG estimates that minimum releases during the year total 340,065 acre-feet.

The current minimum flow requirements adopted by the BOR are 300 cfs in winter, rising to a peak of 2000 cfs in late spring and falling to 450 cfs in summer. The U.S. Fish and Wildlife Service has recommended that instream flows be increased to 47 percent of inflow (from the current 30 percent), but no action will be taken until a conclusive EIR is prepared.

Rivers and Streams

The major tributaries to the Trinity River are the South Fork Trinity River, New River, French Creek, North Fork Trinity River and Canyon Creek, though many smaller tributaries enter the Trinity throughout its reach.

The Trinity River flows east to west and is the largest tributary to the Klamath River, joining the Klamath 40 river miles from the ocean. The Trinity basin as a whole is among the three largest California anadromous river systems north of San Francisco, second to the Klamath and similar to the Eel River in volume and drainage area. The portion within Humboldt County comprises approximately 14 percent of the entire Trinity River Basin.

The headwater streams originate in the Trinity Alps and Trinity Mountains in eastern Trinity County; the Trinity joins the Klamath River at Weitchpec, about 40 river miles from the Pacific Ocean.

Land Cover Type

A highly diverse plant community flanks the Trinity due to the extreme range of altitudes and microclimates. The upland landscape is characterized by three major forest types. The mixed evergreen conifer forest with chinquapin, madrone, black oak and canyon live oak includes a portion of the Rush Creek drainage and upper sections of Grass Valley Creek, Indian Creek, Reading Creek, and Browns Creek. The Klamath montane mixed conifer forest includes higher elevations north of the Trinity mainstem. The Oregon white oak forest is typical throughout lower elevations along the mainstem. Extensive south slope areas of the watershed are shrub-dominated.

The northern extent of the watershed is noted for its diversity of conifer species, with the center of this richness located just north of the Trinity Alps in the Klamath Mountains. Characteristic influences include boreal, maritime, continental, and Mediterranean, with aspect and elevation determining the location and extent of these influences.

In sum, conifers dominate the upland areas; the main corridor is dominated by hardwood trees (willow and alder) and grasses. A sizable portion of the easternmost county is almost wholly white fir forest.

Water Quality

While designated a wild and scenic river, this area has experienced hydraulic mining in the past. Current mine practices consist of small placer sluicing and hard rock milling operations. An assessment of abandoned mines, and past and present mining activities needs to be conducted. A formal inventory needs to be compiled with exploratory site information on the disposition of acid mine drainage, sedimentation, waste handling and remediation as appropriate, to meet long-term water quality standards.

Potential solution

There are several contaminated mining sites in the area. The Copper Bluff Mine continues to emit toxins. Celtor Chemical Works, located on the Hoopa Valley Reservation, is a US EPA Superfund site. A remedial action plan has been implemented. Twelve sites are being investigated in the Hoopa/Willow Creek area where known releases from underground storage tanks occurred. A possible release from underground fuel tanks located at a closed gas station in Salyer needs to be investigated. There are PG&E electrical substations in Hoopa and Willow Creek being investigated for historic releases of mineral oil that may have contained PCBs. Storm water discharges from these facilities are also being investigated. An unknown number of aboveground storage tanks exist in the area. There are also a number of lumber mills (such as the Burnt Ranch Mill) that have a history of using wood preservatives (including pentcholorophenol) that may be the source of soil and groundwater contamination. These sites need to be investigated. A burn dump at Burnt Ranch was operated for years and closed. It needs to be investigated and assessed for hazardous materials and impacts on water quality.

Current Sediment Runoff

Due to insufficient flows to transport sediments, the Trinity has been classified by the EPA as sediment impaired. Large amounts of decomposed granite from highly erodible soils enter the Trinity due to environmental disturbances. Soils in the Trinity River Watershed are generally thin and well drained.

Geology and soils interact with vegetation, climate, various land disturbances and stream channel sediment transport characteristics to produce sediment. Highly erosive granitic soils constitute 17 percent of the analysis area and are distributed over eight tributaries. Estimates indicate that these areas produce 72 percent of the sediment reaching the Trinity main stem. Land use activities that modify drainage patterns or remove vegetative cover in these highly erosive areas can greatly accelerate erosion and sedimentation. Efforts to curb sediment production and delivery are concentrated in these geographic areas.

Granitic sediment produces the size fraction that is most detrimental to the aquatic habitat in the Trinity river. Granitic soils contain a high percentage of sand, a sediment that becomes embedded in the river bed, destroying aquatic habitat. It is the major particle constituent of the sediment berms deposited on natural gravel bars along the river. Non-granitic soils dominantly have very gravelly loam and very gravelly clay loam soil textures, which produce a bimodal distribution of sediment. The fine size sediment component remains suspended and is transported down the river. The coarse size sediment component constitutes the gravel fraction, which is beneficial to the aquatic ecosystem. This coarse sediment is currently in deficit, an indirect result of the Lewiston and Trinity dams.

Temperature Problems

The Department of Fish and Game rates the Trinity as fair in terms of temperature; in the upper 40 miles, temperatures rarely exceed 70 degrees Fahrenheit, though lower river stream temperatures typically exceed 70 degrees during the summer months.

Watershed Management Problems

The Department of Fish and Game reports that the upper 40 miles between the North Fork and Lewiston Dam has lost its ability to effectively transport sediment and consequently the upper Trinity has become channelized and aggraded (meaning the channel bed has risen due to deposited sediment).

Large, severe wildfire events destroy vegetation and leave the soil susceptible to severe erosion. Erosion following fire can produce large sediment influxes to the tributary streams, which may be transported and deposited in the main stem Trinity River. The suppression of wildfire has resulted in the buildup of fuel throughout the analysis area and has increased the potential for large fires, which burn with greater intensity than under "natural" conditions and generally result in greater resource damage. Large scale watershed disturbance such as wildfire can result in soil hydrophobicity, loss of vegetative cover, increased runoff and severe erosion and sediment production, which may damage aquatic habitat.

Fish

According to the Department of Fish and Game, the Trinity supports several anadromous fish populations, including chinook salmon, coho salmon, steelhead trout, and Pacific lamprey. Resident fish species also include rainbow trout, three-spined stickleback, speckled dace, and Klamath small-scale sucker. Eastern brook trout and brown trout have been introduced as sport fish. The Klamath-Trinity Watershed supports the second largest run of chinook salmon in the State, second only to the Sacramento River watershed. Historic accounts of huge salmonid runs are typical of the rivers of the Pacific Northwest and are described anecdotally as having spooked horses at river crossings.

Major reductions in anadromous fish populations have occurred in the river. By 1980, it is estimated that in comparison to a 1950 base, the upper river steelhead population had declined by 90 percent and the lower river by 80 percent. According to the Six River National Forest Draft Environmental Impact Statement for the National Forest Plan, the natural chinook salmon populations have declined by 85 percent. The hatchery at Lewiston has mitigated for some loss, especially with regard to spring-run chinook. Some of the major factors commonly cited as possible causes of salmonid reductions include the construction of

Trinity Dam (and subsequent reduced stream flows), the 1964 flood, overharvest of salmon, and intensive logging practices.

SOUTH FORK TRINITY PLANNING WATERSHED

The South Fork Trinity is the planning watershed with the smallest area within Humboldt County; the Humboldt County portion also represents a small portion of the entire watershed. The 1998 U.S. EPA Total Maximum Daily Load (TMDL) Study summarizes the physical and biological setting in the watershed as follows.

"The South Fork originates in the North Yolla Bolly Mountains about 50 miles southwest of Redding, and runs northwest for approximately 90 miles before reaching its confluence with the Trinity River near Salyer. It flows mostly through Trinity County, forming the boundary between Trinity and Humboldt Counties in its lower 12 miles. The South Fork Trinity River is the largest undammed river in California, and constitutes 31 percent of the Trinity River sub-basin, and 6 percent of the Klamath basin (USDA FS 1998). The 56 mile stretch from Forest Glen to the mouth is protected by the California Wild and Scenic Rivers Act."[4]

Rivers and Streams

Using the Strahler stream order classification system,[5] there are 2,522 miles of streams in the South Fork Trinity planning watershed with 2,310 miles in Trinity County and 212 miles in Humboldt County. In Humboldt County, approximately 78 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 13 percent of the streams are classified in orders 4-7. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River planning watershed, has 920 miles of streams in Humboldt County with 75 percent of the streams in orders 1 and 2, and 12 percent in orders 4-8.

Land Cover Type

Vegetative cover within the watershed in Humboldt County consists primarily of timberlands and oak woodlands: (73 percent in fir, redwood and pine, and 19 percent in oak woodland). the remaining vegetative cover is in chaparral (6 percent) and other vegetative cover types (2 percent).

Water Quality

The 1998 U.S. EPA study summarized water quality concerns in the South Fork Trinity planning watershed as follows.

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[4] U.S. Environmental Protection Agency, Region 9, *South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads*, December 1998.

[5] In this stream classification system, as an order 1 stream connects with another order 1 stream, the stream becomes an order 2 stream; as an order 2 stream connects with another order 2 stream, the stream becomes an order 3 stream, and so on.

"Past and present land use practices have accelerated natural erosion processes in the South Fork Trinity River basin, resulting in increased sedimentation in the river channels and decreased support of the cold water fishery, evidenced by significantly decreased runs of spawning salmonids. In particular, available data and anecdotal observations indicate that, following the December 1964 flood, numerous landslides and debris flows delivered considerable quantities of sediment to the stream channel in some reaches, resulting in formation of river deltas in some locations, channel aggradation (i.e., filled with sediment) and widening, decreased depths and numbers of pools, decreased numbers of fish, increases in fine sediments in the bed material, and, apparently, increases in temperatures associated with decreased depths and loss of riparian canopy (Haskins & Irizarry 1988, PWA 1994, Matthews 1998). The overall quantity of sediment delivery to the stream has decreased since then, but chronic inputs of sediment from roads as well as episodic inputs from washouts and mass wasting continues."[6]

Water quality problems from accelerated erosion rates have been worst in the more erodible portions of the basin in the Upper and Lower South Fork sub-basins, particularly west of the mainstem, and in areas where land management practices are most intense. Smaller tributaries generally have been affected less severely than mainstem lower gradient reaches. The impacts have been most notable in the Hyampom Valley, with most of the sediment being delivered from South Fork Mountain tributaries, which have been heavily logged since the 1940s.

Current Sediment Runoff

The South Fork Trinity River drains an area containing steep, unstable slopes adjacent to some of the most rapidly eroding terrain in the United States. Rivers to the south and west, such as the Eel, have some of the highest recorded suspended sediment loads in the world.

While many of the past and present effects of the December 1964 flood are part of the natural variation in sediment supply, it is clear that additional stresses have been caused by management activities. The oversupply of sediment in the South Fork basin resulted in pool filling, decreased spawning habitat, lowered invertebrate production, and increased temperatures.

Land management activities that historically and currently contributed to the decline in the cold water fishery include: timber operations, with road building on erodible terrain likely being the greatest cause of concern; agricultural operations such as ranching, with bank erosion contributing to excess sediment and diversion of water leading to higher water temperatures and nutrient contributions; and mining operations, although there are very few mining operations in the basin. Residential land uses probably do not contribute significant amounts to the problem.

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[6] U.S. Environmental Protection Agency, Region 9, *South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads*, December 1998.

Roads generate about twice the levels of sediment loading as timber harvesting. Roads are the most significant component of management-related sediment production. In the Hayfork Creek sub-basin, roads and bank erosion are the most significant components of the overall sediment production, largely due to the fact that mass wasting is a much less significant process in that sub-basin.

Watershed Management Problems

The logging boom expanded through the basin in the 1960s, and probably exacerbated the detrimental effects of the 1964 flood. In particular, many logging practices on the erodible geology of the western basin altered the natural hillslope hydrology—e.g., through construction of roads and stream crossings—causing additional erosion and sediment impairment. Continued accelerated sediment production is found in many of these areas, particularly where large-scale forest fires have further exacerbated the problems. Some continued in-channel changes are also part of the natural cycle of adjustments to natural and management-induced events that would be expected following a major disturbance such as the 1964 flood.

Fish

The US EPA TMDL study of 1998 summarized the status of the fishery in the South Fork Trinity River as follows.

"Six known stocks and runs of anadromous fish utilize the South Fork Trinity River watershed. The most abundant historically is the spring-run chinook salmon (*Oncorhyncus tshawytscha*). The second most abundant, historically and currently, is the fall-run chinook, which is also a significant indicator of the fish population in the basin. Other cold-water species include winter and summer steelhead (*O. mykiss*), coho salmon (*O. kisutch*), and pacific lamprey (*Lampetra pacifica*). Chum salmon (*O. keta*) have been infrequently observed in the watershed (PWA 1994).

"The fishery in the South Fork has declined dramatically since the flood of December 1964. Unstable geology and erosion-producing land use practices have been blamed for the many mass wasting events triggered by that flood, which resulted in dramatic instream changes, including channel widening, aggradation, and loss of pool depth, all of which adversely affect the fishery. Since that time, further channel changes suggest improvements in some locations, while continued, chronic sediment inputs may be hindering a more complete or faster recovery overall. The chinook salmon spawning run has increased slightly in the last several years, and sediment slugs continue to move downstream, which may suggest the beginnings of a trend toward recovery."[7]

[7] Ibid.

MAD-REDWOOD BASIN

The Mad-Redwood Basin includes the Mad River, Redwood Creek, Eureka Plain, and Trinidad planning watersheds. The average annual runoff for the combined basin is estimated to be 1,000,000 acre-feet. These watersheds lie completely within the Coast Ranges geologic province, mainly composed of highly unstable and easily eroded rock units, which contribute a large amount of sediment to the streams. Combined with timber harvest, road construction, and grazing activity, the region has one of the highest erosion rates in the United States.

REDWOOD CREEK PLANNING WATERSHED

Redwood Creek planning watershed is a narrow, elongated fault-controlled basin that drains an area of approximately 282 square miles, from the center of Humboldt County to its northwestern corner. The creek flows for 65 river miles from its headwaters, located near Board Camp Mountain in central Humboldt County, to the Pacific Ocean near the town of Orick. Redwood National Park occupies the northern half of the watershed. Streamflow averages 255 cfs near Blue Lake and 1,290 cfs as it passes Orick near its outlet to the Pacific Ocean.

The 1998 U.S. EPA TMDL Study summarizes the physical and biological setting in the Redwood Creek watershed as follows.

"The Redwood Creek watershed consists mostly of mountainous, forested terrain from sea level to about 5,300 feet elevation. Primary land uses are tourism and fishing on parklands and timber and livestock production on lands upstream of Redwood National Park. The watershed is narrow and elongated, about 65 miles in length, from 4 to 7 miles wide. The lower basin includes the Park area and the middle and upper basin are located upstream from the Park."[8]

Rivers and Streams

Redwood Creek is the main waterway in the watershed; it is fed along its length by a few dozen smaller creeks. Streamflow in Redwood Creek is highly variable from year to year as a result of annual rainfall variations. Streamflow also varies seasonally, owing to the highly seasonal distribution of rainfall. Winter flood flows can be as much as four orders of magnitude higher than summer low flows.

Floods are critical events for the resources of Redwood Creek because they erode hillslopes, reshape channels, and transport large proportions of fluvial sediment loads. Recent large floods occurred in 1953, 1955, 1964, 1972 (two floods), and 1975. The 1964 storm was a regionally significant event that caused major damage to towns, highways, and other structures, as well as significant hillslope erosion and channel changes.

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[8] U.S. Environmental Protection Agency, Region 9, *Total Maximum Daily Load for Sediment Redwood Creek, California*, December 30, 1998.

No large floods occurred after 1975, until the recent 11-year return period flood in January of 1997. During January 1997, the relatively small 11-year return period flood initiated debris torrents of mud, boulders, and whole trees directly into Redwood Creek adjacent to Tall Trees Grove; the effects of a major storm would probably be much more severe.

Using the Strahler stream order classification system, there are 544 miles of streams in the Redwood Creek planning watershed. Approximately 79 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 13 percent of the streams are classified in orders 4 and 5. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75 percent of the streams in orders 1 and 2, and 12 percent in orders 4-8.

Land Cover Type

Coniferous forest covers nine-tenths of the watershed, the rest accommodating oak woodland and prairie. The coast redwood is the dominant tree, usually found alongside Douglas fir, Sitka spruce, big leaf maple, tan-oak and red alder. The redwood forest is also home to many types of ferns.

The County's GIS shows vegetative cover within the watershed consists primarily of timberlands and oak woodlands: (56 percent in fir, redwood and pine, and 31 percent in oak woodland). The remaining vegetative cover is in annual grass (6 percent), riparian (4 percent) and other cover types (3 percent). The EPA TMDL Study states that the distribution of plant communities in the watershed depends primarily on water availability and fire regime.

Old-growth forest currently covers 24,315 acres in the watershed, equivalent to 14 percent of its total area. Near the coast, the most common forest tree is the Sitka spruce. Coast redwoods, however, dominate most of the lower basin forest. Farther inland, where summer temperatures are higher and fog is less frequent, Douglas fir is more common than redwood. Several hardwood species grow in association with both redwood and Douglas fir, including bigleaf maple, red alder, tanbark oak, madrone, and bay. Prairies and oak woodlands occur on south and west-facing ridgetops and hillslopes on the east side of Redwood Creek.

Water Quality

The EPA does not state concern about water quality in the Redwood Creek planning watershed, noting that water chemistry and oxygen dissolution are within the normal and expected range for salmonid habitat and human consumption. Suspended sediment loads appear to have been lessening over the past 30 years, which is considered beneficial to native fish species.

The 1998 U.S. EPA Total Maximum Daily Load (TMDL) Study[9] and the draft North Coast Watershed Assessment Program (NCWAP) Redwood Creek Watershed Synthesis Report[10]

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[9] For more information on the program, see the sections titled "Other Total Maximum Daily Load Watersheds" and "Regulatory Framework" later in this chapter.

summarized water quality concerns in the Redwood Creek Watershed. In general, stream channels in the Redwood Creek basin are wider, shallower, and more homogeneous than is desirable or were historically present.

The draft NCWAP reports that the Redwood Creek estuary provides an important transition between marine and freshwater environments. Because of their high productivity and isolation from predators, the estuary normally provides a very productive environment for fish. Sediment supply to the estuary is naturally high due to its position near the mouth of Redwood Creek. As discussed later in this chapter, land management practices upstream and the adjacent flood control levee have accelerated the natural processes.

Stream channel structure along the mainstem of Redwood Creek and its tributary watersheds has changed substantially over the last 50 years. Key changes in the mainstem of Redwood Creek include: (1) increases in the volume of stored sediment, (2) decreases in pool numbers and depth, (3) increases in stream width and decreases in stream depth, (4) reduced amounts of large woody debris, and (5) deposition of high levels of fine sediments on the stream bottom.

Temperature Problems

Tributary water temperatures are generally suitable for salmon and steelhead, but are too high along much of the mainstem for optimal fish habitat conditions.

Current Sediment Runoff

Tectonic action has crumbled the bedrock underlying the watershed, making it relatively weak and susceptible to landsliding and erosion. With the addition of heavy rainfall, widespread landsliding and high sediment streamloads have naturally resulted. Frequent landslides contribute a large portion of sediment to the Redwood Creek planning watershed.

More sediment has been supplied to the low gradient reaches of the mainstem than it can effectively transport. Low gradient reaches of the mainstem Redwood Creek have acted as long term repositories of eroded sediment that originated in upstream areas.

The NCWAP assessment found that intensive fine and suspended sediment problems arose in the Prairie Creek subbasin during and after the construction of the Highway 101 bypass in 1988-90. Studies indicated that impacts to salmonid habitat occurred as a result and that the habitat may not yet be fully recovered.

Sediments born primarily by the 1964 flood, and to a lesser extent by other high magnitude events between 1954 and 1975, filled most mainstem pools. Pool frequency and mean depth appeared to increase since 1975 as the creek began to move out previously deposited sediment

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[10] The interagency North Coast Watershed Assessment Program produces assessments of watershed conditions to determine factors affecting fish production and recommend measures for watershed improvements.

loads, and pool recovery is more apparent in the upper basin. However, following the moderate 1997 storm season, sediments again filled many pools. Reduced pool frequency and depth impairs rearing habitat by reducing availability of cool water refuges and increasing predation.

The EPA report concludes that Redwood Creek is particularly prone to storm-induced erosional events; however, land management activities have accelerated this natural process, overwhelming the stream channel's ability to efficiently move the delivered sediment.

Watershed Management Problems

Land management patterns and practices have contributed to increased erosion beyond natural rates through landsliding and gullying and stream bank erosion. The resultant erosion causes sediment to enter the stream, filling deep pools and depositing silt in spawning gravels.

A flood control project constructed by the U.S. Army Corps of Engineers in 1968 impaired the physical and biological functions of the Redwood Creek estuary, according to the Department of Fish and Game, by "confining the river channel, removing streamside riparian vegetation and tree cover, reducing adjacent wetlands, altering valley drainage patterns, decreasing instream woody debris structures, and reducing pool depths along the lower creek."[11] Sediment has filled half the lower estuary, blocking salmon from their spawning grounds.

Most of the likely future erosion potential in the basin caused by human activity is associated with logging roads and skid trails, although roads constructed for other purposes also pose significant erosion potential.

The EPA TMDL Study states that past studies indicate that streamside landsliding and gullying on hillslopes may be the most significant processes delivering sediment to Redwood Creek. A large proportion of observed erosion is associated with an extensive road network (7.3 miles of road per square mile of land) on private lands, improperly designed and maintained roads and skid trails, and timber harvesting.

Fish

Redwood Creek supports chinook salmon, coho salmon, and steelhead and cutthroat trout. Except for cutthroat trout, these species are all federally protected in Redwood Creek. The US EPA TMDL study of 1998 summarized the status of the fishery in Redwood Creek as follows.

"The cold water fishery is identified by the Regional Water Board as a beneficial use of the Redwood Creek watershed. In 1965, the DFG roughly estimated spawning escapement of 5000 chinook, 2000 coho, and 10,000 winter steelhead."

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[11] http://www.dfg.ca.gov/nafwb/cohoEIR_final/EIR_coho11_fnl.pdf

Sedimentation due to natural geologic instability, past and present land use practices, and other factors has contributed to the reduction and loss of habitat necessary to support cold water fish including salmonids. The second most abundant, historically and currently, is the fall-run chinook, which is also a significant indicator of the fish population in the basin.

The EPA TMDL Study points out that in recent years, spawning habitat is improving slowly as gravels are cleaned of fine sediment. Anadromous and resident salmonid populations in Redwood Creek are much reduced in comparison to historic levels. Habitat conditions are probably still quite degraded relative to pristine conditions, but are showing signs of improvement. Although channel deepening and pool development have been observed in all but the lower few miles of the Creek, the mainstem generally lacks an adequate pool-riffle structure and cover.

TRINIDAD PLANNING WATERSHED

The Trinidad Planning Watershed covers 83,684 acres, making it the smallest watershed in Humboldt County next to South Fork Trinity (seven-eighths of which lie outside the County; see Table 1-1). Patricks Point State Park occupies a small area of the watershed north of the City of Trinidad.

Maple Creek and Little River arise at the foot of the Coast Ranges, the latter in a crook between the Mad and Redwood watersheds. Little River discharges to the Pacific Ocean three miles south of the city of Trinidad, while Maple Creek empties to an estuary north of Trinidad Head. Patricks Point State Park occupies a small area of the watershed north of the City of Trinidad.

Rivers and Streams

Maple Creek, extending 18.3 river miles (with a north fork of 7.8 river miles), and Little River, extending 19.6 river miles, are the main waterways in the Trinidad Watershed, which is spread along the northern Humboldt County coast.

Land Cover Type

The Trinidad planning watershed is predominantly redwood forest (57 percent) with significant amounts of oak woodlands (14 percent), riparian areas (10 percent) and some pine forest (8.5 percent).

Water Quality

Trinidad is the only watershed in Humboldt County for which no TMDLs have been instituted. However, the watershed could still be subject to development impacts that increase sediment loading in streams and rivers. Protective measures under local government control identified in other watersheds in the County would serve to address these concerns in the Trinidad watershed as well.

Current Sediment Runoff

Due to the low-volume, slow-moving streamflow through the Trinidad Watershed, sedimentation is negligible.

Watershed Management Problems

No problems are in evidence. The vast majority of the watershed is zoned TPZ, but no timber-related problems are in evidence.

Fish

The anadromous salmon and trout present in neighboring watersheds are can also be found in the Trinidad planning watershed. However, for the most part, the watershed consists of smaller coastal streams that do not have the inland reach of other watersheds. Much of this coastal fisheries habitat is protected as parks and open space.

MAD RIVER PLANNING WATERSHED

The Mad River flows through Trinity and Humboldt Counties 100 miles to the Pacific Ocean, draining a watershed area of 497 square miles. The easternmost portion of the watershed is part of Six Rivers National Forest; Mad River County Park occupies a small area in the northwest. Average flows in the Mad River range from less than 300 cfs to flood stages of up to 81,000 cfs. Mean discharge is 1,381 cfs, ranging from 45 cfs in late summer to 3,646 cfs midwinter.

Headwaters of the Mad River originate at the southeast end of the watershed at an elevation of 6,070 feet; the watershed runs diagonally across the county from the central eastern border northwest to the Pacific Ocean just north of the Humboldt Bay area.

Rivers and Streams

The Mad River is the main waterway in the Mad River planning watershed and has numerous tributaries throughout its run.

Land Cover Type

Vegetation in the Mad River planning watershed varies with location: upland regions are predominately prairie, Douglas fir, and oak grassland; lower elevation areas near the coast are dominated by redwood and Douglas fir. Forested areas predominate over 85 percent of the watershed, with fir (36 percent), redwood (22.9 percent), oak woodlands (19.8 percent), and pine forest (6.2 percent) being most common.

Water Quality

The EPA describes the Mad River as having "less serious problems: low vulnerability" overall. Its most serious problems are wetlands loss and estuarine pollution susceptibility.

Freshwater streams in this unit support production of anadromous salmonids, including steelhead and cutthroat trout, coho, and chinook salmon. The Mad River is the drinking water and industrial supply for the Humboldt Bay Area, and other coastal streams provide drinking water for local communities and individual homes.

The upper hillslope areas of the Mad River planning watershed, while populated to varying degrees, are primarily occupied by timber production and harvesting activities. Coast redwood is the predominant species harvested. Past practices and continued problems with harvesting techniques and road construction have added to stream sedimentation, in varying degrees, in all the drainages in the watershed.

Current Sediment Runoff

The Mad River is on the EPA's 303(d) List of waterways for which sedimentation is a point of concern requiring the implementation of a total maximum daily load. Stream sedimentation from rural subdivisions is an issue with regard to aquatic habitat, especially for salmonids. Logging roads are a concern because of the potential to increase runoff and delivery of sediment to local waterbodies on private and federal lands.

Watershed Management Problems

The Department of Fish and Game reports that Sweasey Dam was built in 1938 upstream of the mouth of the Mad River to provide water to Eureka. High sediment load accumulation caused the dam to fill in by 1960, after which it was removed; it is estimated that it will take 35 to 40 years for the channel to recover downstream of the dam. Ruth Dam, further upstream, is a barrier to adult salmonids, and has a considerable influence on streamflow for 80 miles below the dam.

Fish

The Mad River supports runs of anadromous salmonids including chinook salmon, coho salmon, and steelhead and cutthroat trout. Except for cutthroat trout, all anadromous salmonids in the Mad River are federally protected.

Anadromous fish spawning takes place in the main channel and in several main tributaries. Downstream from the Mad River Hatchery, the main spawning tributaries are Warren Creek, Lindsay Creek, Mill Creek, and the North Fork of the Mad River. Lindsay Creek appears to be extremely important for both coastal cutthroat and coho salmon. The coldwater fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality.

EUREKA PLAIN (HUMBOLDT BAY) PLANNING WATERSHED

Humboldt Bay is the largest estuary in California north of San Francisco. The planning watershed is 223 square miles in area, though the Bay's smaller tributaries only drain a total of approximately 35 square miles. Public landholdings are the Headwater Forest Reserve, Humboldt Bay National Wildlife Refuge, Mad River Wildlife Area, and Lanphear Dunes. Eureka Plain is also host to more urban land than any other watershed in the county.

Streamflow in the Humboldt Bay planning watershed peaks in the winter (November through March) and is lowest during the summer. Maximum flow at the Jacoby Creek inlet is approximately at 737 cfs, with a range of peaks between 380 cfs and 2,510 cfs.

Sand spits separate the Humboldt Bay from the ocean; the Bay (officially categorized as a multi-watershed coastal lagoon) is split into the South Bay, Entrance Bay, and North Bay. The headwaters of the Bay's tributaries originate in nearby hills, which separate the watershed from the Eel and Mad River watersheds to the south and north. This plain consists of both tidal marshes and stream floodplain surrounding the Bay's edge.

Rivers and Streams

The four major streams of the Eureka Plain are Jacoby Creek (draining 17 square miles), Freshwater Creek (draining 31 square miles), Elk River (draining 29 square miles), and Salmon Creek (draining 17 square miles). Jacoby and Freshwater Creeks drain into Arcata Bay to the north, Elk River into Entrance Bay near Eureka, and Salmon Creek into South Bay. Smaller streams flow primarily into the North Bay. Although the Mad River delta is cradled in its own planning watershed to the north, its floodplain and slough extend south to Arcata Bay.

Land Cover Type

At least two-thirds of the total watershed is steep and heavily forested; the lower end is dominated by tidal marshland.

The Eureka Plain is the most developed of the Humboldt County watershed areas, with about 7 percent of the watershed characterized as urban. Nonetheless, redwood forest make up over 61 percent of the watershed, and agriculture-crop lands account for 8.6 percent.

Water Quality

The Department of Fish and Game describes the Eureka Plain as "known for its unpolluted water and diverse biotic community."

The Pacific Lumber Company (PALCO) has been required by State and Regional Water Board orders to monitor water quality in association with some timber harvesting activities. Regional Board staff believes that the interim prescriptions of the habitat conservation plan may not be adequate to restore, protect or maintain water quality objectives and beneficial uses in 303(d)-listed waterbodies.

Potential ground water contamination, such as nutrient loading via ground water to streams, is of concern. Problem sites should receive progressive enforcement per the Nonpoint Source Pollution Control Program.

Current Sediment Runoff

Freshwater Creek and the Elk River are on the State 303(d) List, requiring medium-priority TMDLs for sedimentation and siltation. Other waterbodies in the Humboldt Bay watershed may be added to the list for excessive sediment in the near future.

Stream sedimentation from rural subdivisions is an issue with regard to aquatic habitat, especially for salmonids. Logging roads are a concern because of the potential to increase runoff and delivery of sediment to local waterbodies on private and federal lands.

Watershed Management Problems

Flooding in Freshwater Creek and Elk River has increased in frequency. The increased flood frequency may be related to stream aggradation and sediment discharges. Humboldt Bay tributaries have experienced problems from urbanization and agricultural uses in addition to timber harvest issues. Additionally, they flow into Humboldt Bay and can impact uses there. Local concerns include sedimentation of Freshwater Creek and Elk River and subsequent flooding and domestic water supply degradation. Some industrial timberland owners are developing Sustained Yield Plans that will address sensitive watershed issues to some degree.

The majority of the population in this watershed basin lives in the Humboldt Bay area and the cities of Eureka and Arcata. Suburban growth is occurring in the unincorporated community of McKinleyville, north of Arcata. Flat land areas around the bay are predominantly pastureland with some limited cultivation, primarily lily bulb farms. Humboldt Bay is an important commercial and recreational shellfish growing area, as well as deep-water port. Discharge of treated wastewater to Humboldt Bay is permitted from the Arcata treatment plant and marsh complex in Arcata Bay (north Humboldt Bay) and the Elk River plant, which serves the greater Eureka area. The Arcata plant discharges to a constructed marsh/pond complex prior to discharge to Arcata Bay. The Elk River plant times its discharges to out-going tidal flow so that effluent promptly exits the bay. The College of the Redwoods operates a small sewage treatment plant that discharges indirectly to south Humboldt Bay. Contamination from collection system overflows of raw sewage during high intensity rainfall events is a continued threat to commercial and recreational uses of the Bay.

Fish

There are five species of salmon and trout found in the Eureka Plain planning watershed: coho salmon, chinook salmon, chum salmon, steelhead trout, and coastal cutthroat trout. Steelhead trout and cutthroat trout are found in all streams capable of supporting salmonids. All of the main streams of the Eureka Plain planning watershed that flow into Humboldt Bay support wild populations of salmon, steelhead trout, and cutthroat trout.

The deltas of the Elk River and Mad River Slough support commercial and sport shellfish production and harvesting. The coldwater fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality.

EEL RIVER BASIN AND WATERSHEDS

The Eel River is the third largest river system in California, encompassing approximately 3,684 square miles and 3,488 miles of streams within Humboldt, Mendocino, Trinity, and other Northern California counties. The Eel Basin covers much of the southern half of Humboldt County, excepting the southwestern coast. Within the county, the Eel River system contains four major planning watersheds (from north to south): the Van Duzen (367 square miles), Lower Eel (298.5 square miles), Middle Main Eel (216.4 square miles), and South Fork Eel (313.1 square miles). The Lower Eel River begins at the confluence of the Middle Main Eel and South Fork Eel; the Van Duzen River flows into the Lower Eel at approximately halfway to the Pacific Ocean.

Mean annual discharge for the Eel River is approximately six million acre-feet. Ninety-three percent of this streamflow is discharged between November and April. Discharges normally range from 145 cfs in September to 19,560 cfs in February, with a record low flow of 54 cfs recorded in September 1994 and a record high of 752,000 cfs measured in December 1964. Headwaters arise at elevations between 6,000 and 8,000 feet in the neighboring counties of Trinity, Lake, and Mendocino. Waters from the Eel River flow through alluvial valleys and tidal plains to its estuary to the Pacific Ocean, 14 miles south of the City of Eureka.

High seasonal rainfall combined with a rapid runoff rate on unstable soils delivers large amounts of sediments to the river. As a result, the Eel River may transport more sediments than any other river of its size in the world, due to heavy winter rainfall running through highly unstable soils. These sediments are deposited throughout the lower gradient reaches of the system.

VAN DUZEN RIVER PLANNING WATERSHED

The Van Duzen River (VDR) planning watershed is located in California's North Coast Range, primarily in Humboldt County, and encompasses a total area of approximately 428 square miles: 367 square miles in Humboldt County and 61 square miles in Trinity County. The watershed is southeast of Eureka and approximately 50 miles east of the "triple junction" of the North American, Pacific, and Gorda tectonic plates near Cape Mendocino (see Chapter 10 for further information on tectonic plates).

Rivers and Streams

Using the Strahler stream order classification system, there are 808 miles of streams in the VDR planning watershed in Humboldt County and 128 miles in Trinity County. In Humboldt County, approximately 79 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 13 percent of the streams are classified in orders 4, 5 and 6. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75 percent of the streams in orders 1 and 2, and 12 percent in orders 4-8.

Land Cover Type

Vegetative cover within the Humboldt County portion of the planning watershed consists primarily of timberlands and oak woodlands (55 percent in fir, redwood and pine, and 25 percent in oak woodland). The remaining vegetative cover is in grasslands (15 percent) and other vegetative cover types (5 percent).

Water Quality

For purposes of characterizing watershed conditions and water quality concerns, the U.S. EPA has divided the watershed into three distinct areas: lower basin, middle basin, and upper basin. The lower basin encompasses approximately 129 square miles from the confluence with the Eel River to the confluence with Grizzly Creek, including the lower Yager Creek and Lawrence Creek tributary, but excluding the North, Middle, and South Fork of Yager Creek. The middle basin encompasses approximately 202 square miles ranging from the upper Yager Creek Basin to the confluence of Grizzly Creek. The upper basin encompasses approximately 98 square miles and includes the remainder of the upper portions of the watershed.

The 1999 U.S. EPA study summarized water quality concerns based on the three identified basins.

"Lower Basin: Intensive management activities, particularly timber harvest and road-related, have exacerbated delivery rates and pose a continued threat, particularly in critical spawning and rearing reaches such as Lawrence Creek, Grizzly Creek and Cummings Creek. Continued sediment reduction efforts in the lower basin, particularly road storm-proofing and less intensive management on steep unstable areas, could yield beneficial results for anadromous fish habitat more quickly than in other areas of the basin.

"Middle Basin: Although natural sediment sources contribute the majority (84 percent) of sediment from the middle basin, certain road and timber related management activities have historically represented a risk to water quality and fish habitat. Continued sediment reduction efforts, particularly road inventories, storm-proofing and maintenance, would reduce the risk of sediment delivery to low gradient spawning reaches in the middle and lower basin.

"Upper Basin: Fine sediment levels, as indicated by embeddedness measurements, may potentially be impacting spawning gravel and pool habitat for steelhead in the South Fork VDR. The steep headwater areas of the South Fork VDR and West Fork VDR are capable of supplying large volumes of sediment to the lower depositional reaches thereby impacting steelhead-spawning habitat. The main concern in the upper basin is to avoid additional disturbance of sensitive hillslope areas and to correct potential sediment delivery problems associated with existing roads, thereby protecting downstream resources."[12]

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[12] U.S. Environmental Protection Agency, Region 9, *Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment*, December 16, 1999.

Fish

The VDR planning watershed maintains an aquatic habitat that supports coho and chinook salmon, steelhead trout, particularly summer stocks, rainbow trout, Pacific lamprey, West coast three-spined stickelback, Sacramento sucker, Coast Range sculpin, prickly sculpin, Coastal Cutthroat trout, California roach (introduced), speckled dace (introduced), and Sacramento pike minnow or squawfish (introduced).

According to the 1999 U.S. EPA study, the salmon industry which thrived in the nineteenth century declined through the twentieth century, and a "spawning reconnaissance study of chinook salmon carried out by the U.S. Fish and Wildlife Service in 1959 in the VDR indicated that the basin had the capability to support 7,000 chinook and reported 1,500 occupied redds (spawning grounds) at the time. In 1965, DFG estimated that the annual adult salmon runs in the Van Duzen numbered 2,500 chinook and 500 coho."[13]

LOWER EEL RIVER PLANNING WATERSHED

The Lower Eel planning watershed is comprised of the region draining into the Eel River from the confluence of the Middle Main Eel and South Fork Eel to the Pacific Ocean; all land draining to the Van Duzen River is considered part of the Van Duzen planning watershed. Covering 191,052 acres, the Lower Eel planning watershed is the only watershed in the Eel River Basin completely located within Humboldt County. At the western end of the watershed lies the 33,000 acre Eel River Delta. Over 200 different species of birds have been observed utilizing the Eel River Delta, and it is considered a vital link of the coastal flyway. Additionally, riparian corridors attract many types of land birds, including song birds, upland game birds, and raptors.

Rivers and Streams

Using the Strahler stream order classification system, there are 639 miles of streams in the Lower Eel planning watershed. Approximately 85 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 5 percent of the streams are classified in orders 4, 5, and 6.

Land Cover Type

Land cover is similar to the Klamath River watershed: mostly forested with a variety of conifers and hardwoods, though the presence of red alder and willow are also notable.

Water Quality

The EPA has classified the Lower Eel with a rating of "more serious problems." Presumably this is due to the aggregate strain of the sedimentation loads of the tributaries as well as the regulation of flows by human means.

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[13] Ibid.

Current Sediment Runoff

The amount of sediment washed through the Eel River is legendary, a process known as sediment production or yield. In 1971, Brown & Ritter found that the Eel River was one of the highest sediment producing rivers in the world, carrying fifteen times as much sediment as the notoriously muddy Mississippi. While the Brown & Ritter study calculated that the South Fork Eel had proportionally less sediment than other Eel tributaries, the levels calculated are substantial. The study measured sediment yield during a time of widespread soil disturbance from road building and highly erosive timber harvest practices.

Watershed Management Problems

The towns of Scotia, Ferndale, and Rio Dell will be granted Phase II NPDES storm water permits. At the town of Redcrest, there is an underground tank that is leaking MTBE to the river and a failing onsite disposal system that needs investigation. In the Ferndale and Fortuna areas, there are about 85 dairies, many with manure management problems and some where cows have direct access to streambanks.

Pacific Lumber Company (PALCO) is harvesting heavily, above quantities in the Sustained Yield Plan, in the lower Eel River and Van Duzen River watersheds including Bear, Stitz, and Jordan Creeks. PALCO is currently conducting a watershed analysis in this area and there is extensive Regional Water Quality Control Board oversight. Also, cattle grazing on PALCO land and many poorly maintained roads contribute sediment to local creeks, which are aggrading and causing flooding and domestic water supply problems. The Regional Water Quality Control Board is conducting both a watershed analysis in the lower Eel River area and an effectiveness monitoring study downstream of where PALCO has installed Best Management Practices (BMPs) to reduce erosion and sedimentation effects.

Fish

The Eel River supports the largest remaining native coho salmon population in California, as well as fall-run chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey.

According to the National Marine Fisheries Service, the Eel was once the largest producer of chinook and coho salmon in the state, and second largest of steelhead trout. commercial fishing along the Eel was once a million dollar industry. The canneries of the Lower Eel reported 100,000 salmon per year with a maximum annual harvest estimated at 500,000 fish in the early 1900s. In 1988, the Department of Fish and Game estimated there were 31,000 fish in the entire Eel River System. They are now listed as threatened under the Endangered Species Act.

The Lower Eel portion of the watershed is of little significance as spawning ground for anadromous fishes, but is important as a migration route to upstream spawning grounds and as a return route to the ocean for surviving adult steelhead, juvenile trout, and salmon. In addition, salmon utilize the downstream pools as holding areas until there is sufficient flow from the fall rains to permit upstream passage. It is also likely that some downstream juvenile migrants use the estuary as a nursery area throughout much of the year, since juvenile king salmon and steelhead have been found there during fall, winter, and spring months.

MIDDLE MAIN EEL RIVER PLANNING WATERSHED

The Middle Main Eel River (upstream of its confluence with the South Fork Eel) encompasses a planning watershed of approximately 482,136 acres (753.3 square miles) within Humboldt and Mendocino counties. Average precipitation per year is 56.86 inches. Public landholdings include part of Six Rivers National Forest.

Rivers and Streams

Using the Strahler stream order classification system, there are 504 miles of streams in the Middle Main Eel planning watershed. Approximately 81 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Twelve percent of the streams are classified in orders 4 and higher.

Land Cover Type

Within Humboldt County, the Middle Main Eel River planning watershed is approximately 76 percent moderate to heavily forested, with some patches of annual grassland, pine forest and chaparral. Much of the watershed has been used for timber production and harvested at various times in the recent past. The predominant vegetative cover types include: fir forest (33.28 percent), oak woodlands (31.5 percent), annual grasslands (21.3 percent), and redwood forest (9.41 percent). Agricultural crop land account for only 0.08 percent or 117 acres.

Water Quality

The EPA has classified the Middle Fork Eel as having "less serious problems." As with the Lower Eel River watershed, the Middle Eel River has high seasonal rainfall combined with a rapid runoff rate on unstable soils that delivers large amounts of sediments to the river. With or without changes in the channel from increases in coarse sediment, salmon are negatively affected by the additions of fine sediment. Fine sediment smothers spawning sites, reducing the ability of salmon to reproduce successfully.

Fish

The Eel River supports the largest remaining native coho salmon population in California, as well as fall-run chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey.

The abundance of salmon and steelhead in the Eel River system has been declining over the past 60 years. Factors contributing to the declines are habitat loss caused by timber harvesting practices, associated road building following World War II, as well as certain types of grazing practices, water diversion, and over-fishing.

For a more detailed discussion of the Eel River fisheries, their life stages, and status, the reader is referred to the sections for the Lower Eel River watershed and the South Fork Eel River watershed.

SOUTH FORK EEL RIVER PLANNING WATERSHED

The South Fork Eel River planning watershed covers approximately 690 square miles in northern Mendocino and southern Humboldt counties. The watershed surrounds the South Fork of the Eel River, winding from approximately 58 miles from the Laytonville area of Mendocino County, up U.S. Highway 101 through Humboldt Redwoods State Park and the famed Avenue of the Giants in Humboldt County. The river itself winds for nearly 100 miles, flowing northward joining the Eel River near Weott.

Rivers and Streams

Using the Strahler stream order classification system, there are 1,527 miles of streams in the South Fork Eel River planning watershed with 838 miles in Mendocino County and 689 miles in Humboldt County. In Humboldt County, approximately 79 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 14 percent of the streams are classified in orders 4-6.

Land Cover Type

Vegetative cover consists primarily of timberlands and oak woodlands (64 percent in fir and redwood, and 19 percent in oak woodland). The remaining vegetative cover is in annual grass (14 percent) and other vegetative cover types (3 percent).

Water Quality

The EPA has classified the South Fork Eel as having "less serious problems." The major concerns for the South Fork Eel are sedimentation and temperature.

Current Sediment Runoff

While the South Fork Eel has proportionately less sediment than other Eel tributaries, sediment levels are substantial. According to the 1999 U.S. EPA study, the main channel of the South Fork Eel has been subject to stream aggradation (sedimentation) since 1964. U.S. Army Corps of Engineers measurements of aggradation show increases in elevation for four sections of the river from 1.6 feet in 1968 to approximately 11 feet in 1998 with the elevation at one cross-section decreasing by 1.3 feet. (USACE, 1999). Channel widening also appears to be continuing, although the trend is less evident. These types of channel changes result from both local and upstream sediment inputs.

Sedimentation of tributary streams in the South Fork Eel has also reached notable levels. Sediment from Cuneo Creek, a tributary of Bull Creek, has buried two bridges with more than 10 meters of sediment and the channel widened from tens to hundreds of meters (LaVen, 1987 and Short, 1987). The 1964 flood resulted in widening of Bull Creek by up to 400 feet (Jager and LaVen, 1981.) Because precise historical measurements of stream changes are rarely undertaken, there is uncertainty about the spatial extent of similar channel changes within tributaries of the South Fork Eel. Department of Fish and Game observers (DFG, 1996 and DFG, 1996-1998) find that some channel changes (e.g. filling of pools with sediment) that reduce the habitat complexity needed by salmon, are frequent.

Watershed Management Problems

For the South Fork Eel, the major sources of sediment were found to be road-related, including roads associated with timber harvest. More specific issues identified as concerns for sediment loading are road surface erosion, road crossing failures and gullies, and skid trails, as well as landslides from roads and harvest.

Temperature Problems

Stream temperatures have been measured at many locations in the South Fork Eel and it is well documented that many locations have summer temperatures that exceed the tolerances of cold water fish. In the South Fork Eel, the most sensitive period for salmon is the summer-rearing period, when young coho and steelhead stay in freshwater streams while they mature.

The 1999 EPA TMDL study focuses on the role of shading in preventing stream water temperature increases, expressing load allocations as percent effective shade for individual stream requirements. Effective shade is a function of vegetation height, stream width, and/or topographical barriers. As a means of controlling temperature pollutant load allocations, effective shade is useful in that it is measurable, meets legal requirements, and has a greater value in guiding management activities than a loading capacity for heat. For the South Fork Eel, narrow streams need to be almost totally shaded while wider streams would not be totally shaded even under natural vegetation conditions.

Fish

As stated above, the Eel River supports the largest remaining native coho salmon population in California, as well as fall-run chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey. The South Fork Eel in particular is considered to have significant remnant populations of coho salmon (DFG, 1996). University of California fisheries experts (Brown, 1994) found that the South Fork Eel population is important because it has very little hatchery influence and thus is important for the genetic integrity of the stock.

MATTOLE RIVER BASIN

The Mattole River Basin encompasses the Cape Mendocino planning watershed in the southern portion of Humboldt County.

CAPE MENDOCINO PLANNING WATERSHED

The Cape Mendocino planning watershed (also known as the Mattole Watershed) is located in California's North Coast Range. The watershed is immediately east of the "triple junction" of the American, Pacific, and Gorda tectonic plates, a highly active geologic province (see

Chapter 10 for details on geologic conditions), and encompasses a total area of approximately 319,628 acres. Almost all (98 percent) of it lies in Humboldt County and the remainder is in Mendocino County. The Cape Mendocino planning watershed is largely circumscribed by mostly steep mountains. Headwater elevations range from 1,350 feet to 4,087 feet.

Rivers and Streams

The Mattole River is the main waterway in the watershed; it receives water from over 74 tributary streams. There are approximately 545 perennial stream miles in the watershed. The mainstem Mattole is approximately 62 miles and its watershed encompasses approximately 304 square miles, most of which is within Humboldt County south of the Eel Basin. Kings Range National Conservation Area occupies the southwestern coast of the County.

According to the Mattole Restoration Council, the Mattole River's winter streamflow averages between 1,710 and 4,170 cfs while summer and fall flows are often below 60 cfs, with a minimum measured flow of 20 cfs.

There are 40 sub-watersheds in the Cape Mendocino watershed and 1,062 miles of streams in the Humboldt County portion. (There are also 18 miles of the Planning Area's streams in Mendocino County.) Based on the Strahler stream order classification system approximately 80 percent of the streams fall in orders 1 or 2 (the smallest tributaries), similar to other coastal watershed planning areas in the County.

The Mattole River enters the Pacific Ocean approximately 10 miles south of Cape Mendocino. During most summers, a sand spit encroaches all the way across the river mouth to form a bay mouth barrier, which creates a lagoon behind it. Generally the barrier remains until runoff from fall rains breeches it. However, in some years large swells at times of high tide overtop the barrier and a new outlet channel is carved through the barrier.

Land Cover Type

Unlike other watersheds in Humboldt County and the North Coast region, the Cape Mendocino is marked by prairie grassland instead of redwood forest. This is largely explained by the dry climate of the Cape Mendocino planning watershed, due to the King Range along its western edge blocking summer fog moisture from entering into the region. Forested stands consist primarily of tan-oak and Douglas fir as the major tree species, and madrone, big-leaf maple, chinquapin, bay, canyon live-oak, and alder to a lesser extent. Fir forests and oak woodlands are the predominant vegetation types in the area, with 46 percent presently in fir forests and 20 percent of the area in oak woodlands. Only about five percent of the vegetative cover is redwood forest, unusual for the North Coast.

Natural prairie grassland is concentrated on the northwestern portion of the basin, but prairie soils occur throughout the basin, mostly on ridgetops. Approximately one fifth (21 percent) of the area is covered by grasslands. According to the public review draft Mattole Watershed Synthesis Report (March 22, 2002), half of the forest land in the watershed is comprised of trees that have an average size of 12-24 inches diameter at breast height (DBH). As these trees mature, harvesting will likely increase in the watershed planning area. Twenty percent (20 percent) of the area is covered by stands that average greater than 24 inch DBH trees and another 11 percent is covered by pole-sized trees 6-11 inches DBH.

Water Quality

The California Regional Water Quality Control Board has stated that groundwater near Blue Slide Creek, one of the Mattole River's tributaries, has been impacted with petroleum hydrocarbons leaked from diesel-powered generators.

The watershed sits at the confluence of three tectonic plates, putting great stress on the area's rock. Mattole rock therefore breaks down very easily and is highly susceptible to erosion, which contributes large amounts of sediments to the river. High winter rainfall and rapid runoff on unstable soils delivers large amounts of sediment to the river, and as a result, the Mattole River transports huge sediment loads.

Current Sediment Runoff

Sediment supplied to streams from landslides can vary, dependent on the bedrock and/or landslide types being eroded. For example, debris slides in the King Range are likely to produce coarser grained materials (sands and cobbles), while earthflows in the Coastal terrane (a region geologically distinct from its surroundings) will produce significant amounts of finer grained materials (silts and clays) during high water flows.

Watershed Management Problems

Road construction throughout the watershed contributed to the erosive forces and high volume of sediment in the river and its tributaries, perhaps up to 76 percent of the total sediment load.

Fish

Fishery resources of the Cape Mendocino planning watershed include fall-run chinook salmon, coho salmon, and steelhead trout, although both chinook and coho salmon are thought to be in decline. A wide variety of fish utilize the estuary for spawning and juvenile rearing habitat.

According to the NCWAP, two notable fish species that have apparently gone extinct in the Mattole Basin are spring- run chinook salmon and green sturgeon. Many fish in the Mattole Basin use the estuary for spawning and juvenile rearing habitat. Excessive logging is historically responsible for reducing fish production, primarily from oversiltation.

The NCWAP notes that chinook salmon juveniles are detained in the estuary at the mouth of the Mattole River because of the creation of lagoon conditions early in the summer. This prevents them from going to the ocean until it reopens in Fall. Unfortunately, conditions in the estuary through the summer are not hospitable and studies conducted by Humboldt State University within the past fifteen years have shown high, and perhaps total, mortality in some years.

SUMMARY OF WATERSHEDS

- The Klamath is the second-largest river in California; the mouth of the Klamath-Trinity complex, however, is not part of the Humboldt County coast.
- The flows of both the Klamath and Trinity Rivers have been heavily reduced by Bureau of Reclamation diversions, and are marked by summer temperatures lethally high for salmonids.
- Redwood Creek and the Mad River are highly erosive and filled with sediment, to the point that anadromous species are no longer able to reach spawning grounds, yet have good to fair water quality.
- Neither Trinidad nor Eureka Plain drains to a single waterway; while Eureka Plain has some sediment problems and the majority of the County's population, both have generally good water quality.
- The Eel River complex, the largest river system draining to Humboldt County's coast (and third-largest in California), is plagued by massive sediment loads from unstable soils and heavy rains. Water quality decreases downstream. The Eel River is also host to Humboldt County's largest fisheries.
- The Cape Mendocino watershed is highly erosive due to road construction, is drier and more mountainous than other coastal watersheds, and has poor water quality.
- Nearly all major waterways are host to anadromous fisheries, particularly chinook and coho salmon and cutthroat and steelhead trout.

1.3 GROUNDWATER

REGIONAL SETTING

The western portion of Humboldt County is defined as part of the California Coastal Basin Aquifer. Individual aquifers in Humboldt County are located in the valleys of the Klamath Mountains and the Coast Ranges and are distributed along California's Pacific Coast. This region has been subjected to intense tectonic forces for millions of years leading to folding and faulting and the rise of the Klamath and Salmon Mountains in Northern California. Terrestrial, marine, and volcanic rocks deposited in intermontane valleys compose the aquifers referred to as Coastal Basin aquifers.

Humboldt County is in the North Coast Hydrologic Area. There are four groundwater basins in Humboldt County: Hoopa Valley, Mad River Valley, Eureka Plain, and Eel River Valley (see Table 1-5). The Eureka Valley Basins, comprised of the Mad River Valley, the Eureka Plain, and the Eel River Valley, are a part of the Coastal Basins. These basins consist of unconsolidated deposits of sand, gravel, silt, and clay and are bounded by consolidated and semi-consolidated rocks. The aquifer is recharged by runoff from the hills.

Chloride concentrations in excess of the 250 milligrams per liter drinking-water recommendation are reported in water from wells near the Eel River. This may be the result of brackish water from the tidal reaches of the river. Shallow wells in the dune sands also are prone to seawater intrusion because they must obtain freshwater from a thin lens that floats on saltwater. Excessive withdrawals or minimal recharge lower the freshwater layer in the dunes and allow salty water to be drawn into wells. Groundwater is monitored by the Department of Water Resources, Northern District.

The North Coast Region's Basin Plan groundwater policy (for domestic and municipal supplies) includes maximum standards for substances affecting taste and odor; coliform; and chemicals and radioactive materials in concentrations above state hazardous materials levels.[14]

Table 1-5: Groundwater Basins in Humboldt County

Groundwater Basin	*Tributaries*	*Size (sq.mi.)*	*Average Well Yield (gpm)*	*Maximum Well Yield (gpm)*	*Storage Capacity (acre-feet)*
Eel River Valley	Eel and Van Duzen Rivers	120	400	1,200	136,000
Eureka Plain	Freshwater, Salmon, and Jacoby Creeks and the Elk River	60	400	1,200	n/a
Mad River Valley	Mad River	60	400	n/a	60,000
Hoopa Valley	Lower Trinity and Lower Klamath Rivers	5	300	n/a	19,000

Source: Department of Water Resources, 1998.

COMMUNITY AQUIFERS

Arcata reports that aquifers in its planning area are generally less than 100 feet deep. While there are approximately 60 small groundwater contamination sites in the city, the municipal water supply is not threatened. Groundwater quality is not expected to change in the near future, as few new homes and businesses are expected to withdraw water from wells. The water service in North Arcata is currently drawing one million of the approximately two million gallons per day which the local aquifer can provide.[15]

Eureka's planning area is included in the Table Bluff – Eureka Plain groundwater region, with the Eureka terrace, Elk River basin, and Freshwater Creek basin primarily supplying groundwater. Humboldt Community Services District is currently able to deliver 1,500 gallons per minute (or 2,400 acre-feet per year). According to the USGS, the quality of groundwater in the Eureka area is generally acceptable for most uses, although concentrations of dissolved iron in water from many wells may exceed the EPA's secondary drinking-water recommendation of 300 micrograms per liter, and ionic and bacterial levels make groundwater unsuitable for domestic or municipal use.

McKinleyville lies within the Eureka Area Basin, which is fed by the lower Little, Mad, and Eel Rivers. Groundwater is primarily used for pastureland irrigation in this area, with industry

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[14] City of Eureka, *General Plan Background Report*, Feb 1997.

[15] City of Arcata, *Draft Program EIR: Arcata General Plan: 2020 and Local Coastal Land Use Plan*, Nov 1998.

and public-supply withdrawals benefiting to a lesser degree. Current rates of withdrawal do not appear to exceed recharge rates. Agricultural activities, sewage disposal, and fertilizer use deposit nutrient- and bacterium-rich water in to the local aquifer, but groundwater pollution is not considered significant. No cases of methemoglobinemia ("blue baby syndrome"), the most salient public-health concern related to nitrate-tainted well water, have been reported.[16]

The Avenue of the Giants Community Planning Areas (including Stafford, Redcrest, Weott, Myers Flat, Miranda, and Phillipsville) are associated with the Eel River groundwater basins, with the prime source being at the Eel-Van Duzen delta. Approximately 10,000 of the estimated annual yield of 40,000 to 60,000 acre-feet are currently being pumped for agriculture. Groundwater in rural Humboldt County is generally directed to individual domestic needs and irrigation for farmed areas of the deltas, and the Eel's well water is considered suitable for these uses.

GROUNDWATER CONCERNS

The Eel River, Humboldt Bay, Trinity River, and Klamath River Watershed Management Areas all list groundwater contamination as a primary water quality issue.

Potential ground water contamination, such as nutrient loading via ground water to streams, is of concern. Pesticide and herbicide applications on private and public lands are also of concern. Use of pesticides and herbicides along roadways, in agricultural operations, in urban areas, and in lily bulb farming and forestlands in Watershed Management Areas poses a threat to ground and surface waters. There are also a number of lumber mills (such as the Burnt Ranch Mill) that have a history of using wood preservatives including pentcholorophenol that may be the source of soil and groundwater contamination. See also the section on underground storage tanks and leaking underground fuel tanks in Chapter 12: Fire and Other Hazards.

To protect water resources within a watershed context, a mix of point and nonpoint source discharges, ground and surface water interactions, and water quality/water quantity relationships must be considered. These complex relationships present considerable challenges to water resource protection programs. The State and Regional Boards are responding to these challenges with the Watershed Management Initiative (WMI). The WMI is designed to integrate various surface and ground water regulatory programs while promoting cooperative and collaborative efforts within watersheds. It is also designed to focus limited resources on key issues.

1.4 STORMWATER AND NONPOINT SOURCE POLLUTION

Stormwater is an important factor in the distribution of sediments, chemicals, and other natural and human-produced compounds throughout a watershed. Runoff from heavy rains picks up these potential pollutants and carries them downstream, where they may be

[16] McKinleyville Community Planning Area, *Draft Program EIR for McKinleyville Community Plan Update*, June 1999.

deposited or remain suspended in sensitive ecological areas. With its wet climate and large amount of land dedicated to timber production and agriculture, pollution due to stormwater runoff is particularly important in Humboldt County.

NONPOINT SOURCE POLLUTION

Nonpoint source (NPS) pollution, also known as polluted runoff, is the leading cause of water quality impairments in California and the nation. Nonpoint sources, including natural sources, are the major contributors of pollution to impacted streams, lakes, wetlands, estuaries, marine waters, and ground water basins. Unlike pollution traceable to a single location or "point" (such as a sewage treatment plant), NPS pollution comes from many diffuse sources, and is principally caused by stormwater, snowmelt, or agricultural runoff moving across and diffusing into the ground. The runoff picks up natural and human pollutants and deposits them throughout the natural watershed (in rivers, lakes, coastal areas, and aquifers).[17]

While point source pollution is much better-known, the U.S. EPA states that nonpoint source pollution is the leading cause of water quality problems. In California, NPS pollution is estimated to represent 80 percent of the State's water pollution.[18] Its effects on specific waters vary and may not always be fully assessed, but overall it has harmful effects on drinking water, recreation, fisheries, and wildlife.[19] NPS pollution sources come from a wide range of human activity, including agriculture, forestry, roads and transportation, boating and marine activity, wetlands management, and general urban activity; suspended sediments are the largest mass of pollutants.[20] Some of these pollutants are summarized in Table 1–6.

Table 1-6: Nonpoint Source Pollutants by Source

Source	*Types of Pollutants*
Agriculture	Fertilizers, herbicides, pesticides, sediments (erosion), nutrients, salts
Forestry and Construction	Sediments (erosion), pesticides, fertilizers
Roads and Automobiles	Petroleum hydrocarbons, heavy metals, oil, brake fluid, road salts, sediments (erosion), debris
Marinas and Recreational Boating	Low dissolved oxygen, metals, petroleum hydrocarbons, solvents, antifreeze, surfactants, acids, debris
Urban and Residential	Oil, grease, toxic chemicals, paints, battery acid, household cleaning products, nutrients and pathogenic bacteria (from garden fertilizers, leaves, grass clippings, pet wastes, and faulty septic tanks), viruses, sediment, oxygen-demanding substances, heavy metals

Sources: California EPA, U.S. EPA, Pennsylvania Dept of Environmental Protection, Tennessee Dept of Agriculture.

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[17] EPA's Polluted brochure EPA-841-F-94-005, 1994.

[18] State of California, Office of the Governor, Annual Environment Report and Message of the Governor, 1995-1996.

[19] EPA's Polluted brochure EPA-841-F-94-005, 1994.

[20] California Coastal Commission, California Management Measures for Polluted Runoff Vol. 2, Jan 2000, p 59.

NPS POLLUTION AND FISHERIES

A sample Watershed Management Initiative (explained under "Abatement Programs–State," below) for the Middle Eel River includes the following nonpoint source issues relating to concerns about cold water fisheries identified by the Regional Water Quality Control Board (RWQCB) staff:

- **Stream Sedimentation.** Changes in the morphology of channels have occurred from increased sedimentation rates; shallower, wider channel form increases insolation (sunlight penetration), decreases low flow velocity, increases deposition of very fine material. Sedimentation of small streams in the Eel River delta has caused localized flooding and accelerated erosion in some cases from redirected stream channels. Gravel extraction is also a concern. The regulation of gravel extraction is primarily through a US Army Corps and California Department of Fish and Game process.
- **Timber Harvest Practices.** Logging has decreased the canopy cover over tributaries and the mainstem of the river. Lack of canopy cover increases the solar radiation reaching the water and increases water temperature. High water temperatures are detrimental to cold water fisheries' reproduction.
- **Dairies and Grazing.** While the potential impacts from livestock uses have not been fully evaluated, concern has been raised regarding dairy industry and grazing impacts to the watershed from direct discharges of waste and/or whey, animals in the creeks and waterways, trampling of stream banks, and other erosion mechanisms. Dairies should be brought up to Title 27 standards. Grazing issues include erosion and sedimentation, and water chemistry issues.
- **Herbicide Application.**
- **Interbasin Transfers of Water and Regulated Flows from Dams.** These activities affect sediment, flow, and temperature dynamics and may contribute to the impairment of the beneficial uses.

Storm water runoff from all watersheds draining to Humboldt Bay conveys indicators of bacterial contamination that impacts shellfish harvest. Seasonal and rainfall-based shellfish harvesting closures are in effect to mitigate the effects of nonpoint source runoff. A shellfish Technical Advisory Committee was established in November of 1995 to address nonpoint source runoff issues.

ABATEMENT PROGRAMS

Federal

At the Federal level, the United States Environmental Protection Agency (EPA) is the primary force concerned with pollution abatement. While the EPA works in partnerships with state agencies and provides information on NPS issues, it does not conduct any NPS-targeted programs of its own. However, although runoff is generally considered nonpoint source pollution, upon entering a storm drain system it may be considered point source pollution and be subject to the EPA's National Pollutant Discharge Elimination System (NPDES) Storm Water permit program.

Congress amended the Clean Water Act (CWA) in 1987 to establish the Section 319 Nonpoint Source Management Program. Through this program, states, territories, and Indian Tribes can receive grants as defined in Section 319(h) to be used toward NPS-abatement activities "including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects."[21] In Humboldt County, there are currently five projects open (see Table 1-7).

Table 1-7: Section 319(h) Grants in Humboldt County Watersheds

Project Title	*Contracting Agency*	*Amount Awarded*	*Actions*
Humboldt Bay Watershed	Redwood Community Action Agency	$215,000	Decommissioning of abandoned logging roads, removal of stream crossings and fish passage barriers, construction of livestock exclusion fencing, riparian corridor revegetation, water quality monitoring, and K-12 watershed education
Humboldt Bay Watershed Enhancement	Redwood Community Action Agency	$239,315	BMP implementation, water quality monitoring, and community education
Klamath River Watershed Restoration	U.S. Fish and Wildlife Service	$187,504	Modifying irrigation diversions, installation of livestock exclusion fencing, installation of riparian plantings, and public education
Klamath River Watershed Restoration	U.S. Fish and Wildlife Service	$180,000	Installation of an irrigation tailwater recovery pond, installation of livestock exclusion fencing, and implementation of upslope sediment reduction and road stabilization
Eel River Cooperative Sediment Reduction and Water Quality Improvement	Humboldt County RCD	$248,751	Reducing sedimentation and improving riparian habitat and water temperatures

Source: U.S. EPA, 2002.

State

In California, the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) have primary responsibility for the protection of water quality. In 1990, Congress improved and expanded the Coastal Zone Act through the Coastal Zone Act Reauthorization Amendments (CZARA), which expanded the

[21] U.S. EPA Office of Water website, www.epa.gov/owow/nps/cwact.html, 29 Mar 2002.

SWRCB/RWQCBs' NPS management partnership to include the California Coastal Commission (CCC).

The Coastal Act (section 30519.5) requires the CCC to conduct periodic reviews of certified Local Coastal Plans (LCPs) to evaluate whether or not the LCPs are being implemented by the local governments in a manner that conforms with the act. Because of this, it is important that the County of Humboldt address the nonpoint source program requirements in the General Plan Update process. The CCC will review all new LCPs, LCP Amendments, and coastal development permits (CDPs) applications brought before it for appropriate nonpoint source pollution prevention and control activities.

The State's NPS Pollution Control Program created a 15-year State NPS Plan in 1998, known as the *Nonpoint Source Program Strategy and Implementation Plan, 1998-2012* or *PROSIP*, with three elements: California's Management Measures for Polluted Runoff (CAMMPR) in the areas of agriculture, forestry, urban areas, marinas, hydromodification, and wetlands; a 15-year program strategy; and the first of three five-year Implementation Plans (which identifies a process and actions for administrative coordination, public participation, technical assistance, critical coastal areas, additional management measures, and monitoring). The Program additionally requires construction and other industrial sites to develop a Storm Water Pollution Prevention Plan (SWPPP) to identify and control pollutants that may be picked up in stormwater runoff.[22]

Under the Plan, the State is committed to implementing mitigation measures addressing NPS by 2013, with a three-tiered approach with priorities identified in the Watershed Management Initiative (WMI) chapters of the Plan. The WMI, approved by the SWRCB in 1995, uses an integrated planning approach to create and implement unique solutions for each watershed. The chapter is revised annually to reflect the changing priorities and conditions in the State's watersheds.

Past State and Regional Board programs tended to be directed at site-specific problems. This approach was reasonably effective for controlling pollution from point sources. However, with diffuse nonpoint sources of pollutants, a new regulatory strategy was needed. The WMI uses a strategy to draw solutions from all interested parties within a watershed, and to more effectively coordinate and implement measures to control both point and nonpoint sources. Greater detail on the WMI is provided in Volume II of this report.

The California Coastal Commission has instituted a Plan for Controlling Polluted Runoff (CPR) in the Coastal Zone for July 1999 through June 2003, with programs including erosion and sediment control; facility wastewater and runoff from confined animal facilities; nutrient, pesticide, grazing, and irrigation water management; and education and outreach. Elements of the Plan include implementation of Management Measures (MMs), administrative coordination, public participation and education, and funding.

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[22] State of California, Office of the Governor, Annual Environment Report and Message of the Governor, 1995-1996, p 70.

1.5 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act requires that a permit be obtained from the U.S. Army Corps of Engineers prior to the discharge of dredged or fill materials into any "waters of the United States" including wetlands. Waters of the United States are broadly defined in the Corps' regulations (33 CFR 328) to include navigable waterways, their tributaries, lakes, ponds, and wetlands. Wetlands are defined as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."[23] Such permits often require mitigation to offset losses of these habitat types. Wetlands that are not specifically exempt from section 404 regulations (such as drainage channels excavated on dry land) are considered to be "jurisdictional wetlands." The Corps of Engineers is required to consult with the U.S. Fish and Wildlife Service, Environmental Protection Agency, State Regional Water Quality Control Board and DFG (among other agencies) in carrying out its discretionary authority under Section 404.

The Corps of Engineers grants two types of permits, individual and general. Individual permits are required for certain activities that may have a potential for more than a minimal impact and necessitate a detailed application. The most common type of general permit is a nationwide permit. Nationwide permits pre-authorize certain specific activities, and are designed to regulate with little delay or paperwork activities having minimal impacts. Nationwide permits typically take two to three months to obtain, whereas individual permits can take a year or more. To qualify for a nationwide permit, strict conditions must be met. If conditions are met, permittees may proceed with specified activities without notifying the Corps of Engineers. However, some nationwide permits require a 30-day pre-construction notification period before activities can begin. Activities for which nationwide permits are available include minor road crossings, utility corridors, and stormwater outfalls.

Part III of the *Federal Register*[24] contains a Final Notice of Issuance and Modification of Nationwide Permits (NWPs) by the U.S. Army Corps of Engineers (Corps). The maximum acreage limits of most of the new and modified NWPs is 0.5 acre. Most of the new and modified NWPs require notification to the district engineer for activities that result in the loss of greater than 0.1 acre of waters of the United States.

For projects requiring individual 404 permits that are not considered "water dependent" (such as marinas or harbors) that occur in "special aquatic sites" (which include wetlands), the Environmental Protection Agency 404(b) (1) guidelines and Corps regulations require

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[23] Code of Federal Regulations, *Wetlands definition*, 1982.
[24] Code of Federal Regulations, *Final Notice of Issuance and Modification of Nationwide Permits*, 65 CFR 12818-12899, Volume 65(47) March 9, 2000.

that an alternatives analysis be conducted. Before an individual permit may be granted, the conclusion of the analysis must demonstrate to the agencies' satisfaction that there are no "practicable alternatives" that are less damaging to aquatic habitats than the proposed project. The first step in the 404(b) (1) process is to analyze alternatives that meet project objectives and would avoid filling special aquatic sites. If project sponsors are able to demonstrate that the proposed filling of wetlands is necessary to meet project objectives and there are no practicable alternatives to this filling, then the project mitigation plan would be reviewed by the U.S. Fish and Wildlife Service (USFWS) in relation to their mitigation policies.

Section 401 of the Clean Water Act

A Section 401 Water Quality Certification or waiver from the California State Water Resources Control Board is required before a Section 404 permit becomes valid. The Regional Board will also review the project for consistency with Waste Discharge Requirements under the State land disposal regulations (Subchapter 15). In reviewing the project, the Regional Board will consider impacts to waters of the State in addition to filling of wetlands in accordance with the State wetland policy. Usually, mitigation is required (if not already a condition of the 404 permit) in the form of replacement of restoration of adversely impacted "waters of the U.S."

STATE AGENCIES AND REGULATIONS

Agencies

The State Water Resources Control Board (SWRCB) holds joint authority for water allocation and water quality protection in California and is composed of five members appointed by the Governor. The State Board oversees nine Regional Water Quality Control Boards (RWQCBs), which develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the State's waters. Regional Boards develop basin plans for their hydrologic areas, issue waste discharge requirements, take enforcement action against violators, and monitor water quality. Each RWQCB has nine part-time members appointed by the Governor.

The State Department of Water Resources (DWR) prepares and updates the California Water Plan to guide development and management of the State's water resources; operates the State Water Resources Development System to supply good quality water; regulates dams, provides flood protection, and assists in emergency management; educates the public about the importance of water and its proper use; and serves a variety of local water needs.

The DFG and Department of Forestry and Fire Protection (CDF) often work in concert with the Water Boards and DWR.

California Environmental Quality Act

The California Environmental Quality Act (CEQA), passed in 1970, requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

CEQA applies to certain activities of state and local public agencies. A public agency must comply with CEQA when it undertakes an activity that is subject to discretionary approval and that may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment. Most proposals for physical development in California are subject to the provisions of CEQA, as are many governmental decisions that do not immediately result in physical development (such as adoption of a general or community plan). Every development project that requires a discretionary governmental approval will require at least some environmental review pursuant to CEQA, unless an exemption applies.

The environmental review required imposes both procedural and substantive requirements. At a minimum, an initial review of the project and its environmental effects must be conducted. Depending on the potential effects, further review may be conducted in the form of an environmental impact report (EIR). A project may not be approved as submitted if feasible alternatives or mitigation measures are able to substantially lessen the significant environmental effects of the project

CEQA is a self-executing statute. The Agency does not enforce CEQA, nor does it review for compliance with CEQA the many state and local agency actions that are subject to CEQA. Public agencies are entrusted with compliance with CEQA and its provisions are enforced, as necessary, by the public through litigation and the threat thereof. It is each public agency's duty to determine what is and is not subject to CEQA. The Resources Agency does not review the facts and exercise of discretion by public agencies in individual situations.[25]

North Coast Watershed Assessment Program

In 1999, the California Resources Agency and the California Environmental Protection Agency began developing an interagency watershed assessment program for California's North Coast. The purpose of the program is to develop consistent, scientifically credible information to guide landowners, agencies, watershed groups, and other stakeholders in their efforts to improve watershed and fisheries conditions.

The agencies brought together the DFG, CDF, Department of Conservation's Division of Mines and Geology (DMG), DWR, and the North Coast RWQCB to identify the appropriate role and objectives of a state assessment program. The resulting North Coast Watershed Assessment Program, or NCWAP, is designed to meet four goals:

- Develop baseline information about watershed conditions.
- Guide watershed restoration programs.
- Guide cooperative interagency, non-profit, and private sector approaches to protect the best through stewardship, easement, and other incentive programs.
- Better implement laws requiring watershed assessments such as Forest Practices, Clean Water and Porter-Cologne Acts, Lake or Streambed Alteration Agreement, and others.

[25] California Environmental Resources Evaluation System, "Frequently Asked Questions about CEQA," 1998.

The program provides a process for collecting and analyzing information to answer a set of critical questions designed to characterize current and past watershed conditions. While NCWAP will not produce prescriptions, design projects, analyze cumulative effects of proposed projects, perform risk management, or recommend policy development or regulations, information will be used to guide watershed management and restoration planning, restoration and recovery planning for anadromous fisheries, and implementation of watershed protection policies and regulations.

LOCAL GOVERNMENT REGULATION

General Plan

As a local government's basic planning document, the General Plan is a key component of a local government's effort to control negative impacts to water resources. Through its policies and standards, the General Plan can be an effective tool in controlling the effects of development and a particularly valuable tool for addressing nonpoint source pollution issues. Four mandatory elements deal with issues relating to water quality and pollution issues:

1. land use – density and intensity of use affect nonpoint pollution sources;
2. conservation – may address watershed protection, land or water reclamation, prevention or control of the pollution of stream and other coastal waters, regulation of land uses along stream channels, etc.;
3. open space – applies to preservation of natural resources, including fish and wildlife habitat, rivers, streams, bays and estuaries, and other open spaces; and
4. circulation – should plan not only for transportation but also for water, sewage, and storm drainage infrastructure.

The County Framework Plan (1984) serves as the General Plan and establishes numerous water resources policies (see Section 1.6 for a complete listing of existing policies). This report is part of phase II of Humboldt County's General Plan update process and the information presented in this report will serve as the basis for making informed decisions on future policies which will impact watersheds and water quality.

Local Coastal Plans

Local Coastal Plans (LCP) are required by the State Coastal Act to be prepared for the County's portion of the coastal zone. The LCP consists of a local government's land use plans (LUPs), zoning ordinances, zoning district maps, and within sensitive coastal resource areas, other implementing actions which meet the requirements of and implements the provisions and policies of the Coastal Act at the local level.

By controlling the type, location, and intensity of land uses in the coastal zone, the LCPs have a direct relation to efforts to control the impact of pollution on water bodies along the coastal zone. As the California Coastal Commission (CCC) develops more comprehensive review procedures for nonpoint source pollution (see Volume II of this report), it is important that Humboldt County address the nonpoint source program requirements in the General Plan Update process to ensure compliance.

Grading, Erosion Control, Geological Hazards, Streamside Management Areas and related Ordinances.

Completing the regulatory framework provided by local government are the ordinances that implement the General Plan and Local Coastal Plans' policies and standards. Humboldt County's ordinances dealing with grading, erosion control, geological hazards, and streamside management areas were recently strengthened with revisions adopted by the Board of Supervisors in May 2002.

Key revisions include:

- update of Building Regulations to incorporate updated uniform codes.
- creation of a subsection within the Building Regulations addressing Grading, Excavation, Erosion, and Sedimentation.
- modification of other sections relating to geologic hazards and processing of grading and building permits within or affecting Streamside Management or Other Wet Areas.
- addition of Geologic Hazards Regulations, including the incorporation of "area of demonstration of stability" provisions.
- establishment of a Streamside Management Ordinance, which codifies the Interim Implementation Standards for the Open Space Element of the General Plan (applicable to Non-Coastal areas only).
- ordinance revisions addressing vegetation removal or other land disturbing activities, and an ordinance revision needed to assure consistency between County regulations.

These revisions completed efforts to codify and implement comprehensive provisions for dealing with the development and conservation activities with potential impacts to streamsides as well as addressing nonpoint source pollution from runoff water. These ordinance revisions have a number of critical benefits including:

- implementation of various General Plan elements including water quality, biological resources, critical and sensitive habitats, geologic hazards, open space, conservation, and erosion and sedimentation control.
- additional guidance on the application of erosion and sediment control measures to various developments.
- enhancement of existing zoning regulations which conform to all local, state, and federal requirements to protect property rights, sensitive habitats, and coastal and other sensitive resources.
- management of risk in geologically unstable areas and improvement of erosion control regulations.

- implementation, to varying degrees, of numerous mitigation measures included within the Environmental Impact Report prepared and adopted for the County's Framework Plan.

These revisions are detailed in Volume II of this report.

I.6 POLICY ISSUES

This section focuses on water resource issues from a public policy perspective. In evaluating existing and future conditions, the County must consider the various policy options for the issues identified in Phase I of the General Plan Update, which are summarized in the Critical Choices Report. These key questions help frame the issues for policy options for biological resources. As background, the existing policies in the General Plan are presented, followed by a discussion of issues and policy options that respond to them. The policy evaluation worksheets that will be used to guide discussion of these issues are in the Appendix. These worksheets are provided as a tool for members of the public to evaluate policy options and indicate preferences for accepting, modifying or rejecting these options.

EXISTING POLICIES

Existing policies regarding water resources are found in several sections of the County General Plan (Framework Plan). This are listed below, followed by policies that pertain specifically to the Coastal Zone.

GOALS

1. To maintain or enhance the quality of the County's water resources and the fish and wildlife habitat utilizing those resources.

2. To maintain a dependable water supply, sufficient to meet existing and future domestic, agricultural, industrial needs and to assure that new development is consistent with the limitations of the local water supply.

POLICIES

1. Ensure that land use decisions are consistent with the long term value of water resources in Humboldt County.

2. Regulate development that would pollute watershed areas.

3. Ensure that the intensity and timing of new development will be consistent with the capacity of water supplies.

4. Existing water uses shall be considered during the review for new water uses.

5. The availability of groundwater should be used as a prime factor in determining the desirable amount of residential development in a particular area in order to protect groundwater resources from depletion or contamination.

6. Projects must provide evidence of water availability prior to recordation of map.

7. Maximize the use of water conservation techniques appropriate for new and existing development.

8. Continue participation in all state, regional or local water resource planning efforts effecting surface run-off or groundwater supplies.

9. Encourage further investigation on the County's water resources by federal and state water resource agencies.

10. Large water export projects will not be approved or supported unless specific requirements and assurances are satisfied. These shall include the 1978 water policy statement policies regarding "Water Export Projects on Humboldt County Streams". (See Standards 5a-1)

11. Support flow release schedules from existing reservoirs that maintain or enhance the fisheries of those rivers.

12. Support the development of fisheries enhancement projects on small Humboldt County streams.

13. Ensure that projects located within state designated wild, scenic or recreational river basins are consistent with the guidelines in the State Wild and Scenic Rivers Act (as amended).

14. The development of environmentally sound small hydroelectric projects on publicly and privately owned lands in Humboldt County is generally encouraged. The County should only examine small hydroelectric project proposals for impacts not reviewed by other agencies and for overall consistency with the intent of the General Plan.

COASTAL ZONE POLICIES

The Humboldt County Local Coastal Program's Technical Study on Water Quality lists the following sections of the Coastal Act (within the California Public Resources Code) as directly related to water quality and water resources.

30231. The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.

30236. Channelizations, dams, or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to (1) necessary water supply projects, (2) flood control projects where no other method for protecting existing structures in the flood plain is feasible and where such protection is necessary for public safety or to protect existing development, or (3) developments where the primary function is the improvement of fish and wildlife habitat.

POLICY ISSUES AND OPTIONS

Each key question or issue raised in the Critical Choices Report that relates to water resources is discussed below. Based on County and public input, these policy options will be refined. Some of these options also will shape preparation of "sketch plans" (generalized land use plans for accommodating future development), while others will be implemented through zoning and subdivision regulations or other programs. Appendix B provides a worksheet for the public to evaluate these policy options in the same format as used for the Building Communities Report.

ISSUE

- *How can County land use policies implement Clean Water Act - Total Maximum Daily Load (TMDL) requirements?*

In Humboldt County, the majority of 303(d) listings and TMDL designations are initiated in response to sedimentation and siltation. While these are largely natural processes, they can be aggravated by human interference. In most cases the potential sources of impairment include riparian grazing, rangeland, and streambank modification.[26] Land use policies designed to buffer high-velocity or high-flow regions of streams from grazing animals would allow riparian vegetation to grow freely, which would in turn reduce destabilization of streambanks and lessen overall sedimentation. The second most common impairment, temperature, is believed to have similar sources, with removal of riparian vegetation explicitly listed as well.

Option 1.1 Continue to use the Streamside Management Areas and the Streams and Riparian Corridors Protection Regulations for the Coastal Zone to protect water resources. These provisions establish development restrictions within a prescribed setback zone varying in width from 100 feet to 200 feet on either side of the stream. The County's zoning regulations allow the width of the riparian zone to be expanded to protect special habitat areas with the concurrence of the property owner.

Option 1.2 Establish a secondary watershed protection zone along streams and riparian corridors where TMDL designations have been established. The secondary zone would

[26] North Coast Regional Water Quality Control Board, *1998 California 303(d) List and TMDL Priority Schedule*, approved 12 May 1999.

protect and improve water quality by establishing performance standards, such as no increase in natural runoff, and review procedures to minimize pollution, siltation, and other environmental impacts from upland development that would directly or indirectly affect water quality. This new policy would be consistent with a watershed-based planning approach.

Option 1.3 **Continue to require use of Best Management Practices for Stormwater Control to minimize pollution from area sources.** Best Management Practices manuals have been developed by the California Stormwater Quality Task Force for construction activity and for residential, commercial and industrial development; similar guides are available for agricultural operations. The County requires Best Management Practices in its grading ordinance. Timber operations, however, are exempt from compliance with best management practices because the State Water resources Control Board has determined that best management practices result in less water quality protection than adherence to water quality control plans that conform to the State Water Code.

Option 1.4 **Pursue grant funds to rehabilitate impacted watersheds to meet TMDL targets for sediment control and water temperature reductions.** The County should pursue funding assistance to develop and implement programs to facilitate achievement of TMDL targets.

ISSUE

- *What is the County policy on exporting water?*

Seventy percent of the Trinity River's water is exported (under the auspices of the Bureau of Reclamation) to the Central Valley Project; water from the Eel River has been exported for agriculture (via the Federal Energy Regulatory Commission) since 1922.[27] The County's current water export policy was adopted by the Board of Supervisors in 1978 and did not provide for any strong protection or holding of the County's water resources. Efforts to draft a new water policy limiting exports to 10 percent of any stream's natural flow is underway, but will likely not be completed within the next year and may be difficult to reconcile with Federal authority and practice.[28]

Option 1.5 **Update the County's Water Export Policy to strongly encourage the reduction of water exports from Humboldt County and to ensure that water quality, fisheries and sensitive habitat will not be adversely affected by a new water export project. Include specific standards for habitat and fisheries protection and water quality in an updated policy.** Although much of the water exported from the County is done under the auspices of other government agencies, the County should actively pursue the reduction of water exports. However, if new water export projects are proposed, it is very important that County policy provide standards for the protection of water quality, fisheries, and habitat

[27] California Department of Fish and Game, Final Environmental Document Analyzing the…Take of Coho Salmon North of San Francisco, Dec 2001.

[28] Don Tuttle, Humboldt County Public Works Department, personal communication, 28 March 2002.

protection. This approach is preferable to a numerical limit on the percent of surface water that could be exported because of seasonable variations in rainfall and the fact that the County has surplus water supplies that could generate needed income. The current policy only requires that ecological impacts be considered and that water quality control be included in a project, with no specific standards to ensure non-degradation – no adverse impacts. Also, flow release schedules are only to provide for the maintenance of fishery resources, not enhancement, which means where fisheries and water quality have been degraded, there is no obligation to meet a specified standard.

ISSUE

- *How can streams be protected from increasing flow velocities in urban areas?*

Increased velocities may occur as a result of stream channelization or increased storm water runoff from paved surfaces of urban development. Minimizing runoff and maintaining a natural, permeable streambed are the primary means of protecting streams from increased velocities. Where streambeds have already been channelized, a stream can be slowed by regrading its channel to minimize acceleration.

Option 1.6 **Establish standards for maximum allowable runoff from new development where streams and water quality could be adversely impacted.** The TMDL designations would be a starting point, but additional factors related to flood control and watershed management also would need to be considered as part of the standard-setting process.

Option 1.7 **Establish flood control and stormwater management standards on a watershed basis, taking account of planned urban development, not just existing uses.** Currently, flood hazard mapping is based on existing conditions, without analysis of the effects of planned urban development that can increase runoff unless controls, such as catch basins, are installed. This option would impose significant costs on the County because new flood zone mapping would be needed.

ISSUE

- *What are the cumulative impacts of water withdrawal for rural development?*

Water resources are plentiful enough in the County that withdrawal of any kind is not considered an issue of great importance in the foreseeable future. Groundwater remains abundant (the water table is estimated at 9 to 10 feet below ground level in much of the County) as summer fog and the lack of high-consumption agriculture minimize the need for irrigation,[29] and current infrastructure and surface rights are estimated to allow for double the estimated 2025 demand.[30]

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[29] Don Tuttle, Humboldt County Public Works Department, personal communication, 28 March 2002.

[30] Dyett and Bhatia, *Building Communities*, Feb 2002, p 5-3.

Option 1.8 Continue to monitor groundwater withdrawals associated with rural subdivisions. The County's new GIS system can facilitate this process.

Option 1.9 Eliminate the special provisions for subdivisions over 60 acres in size, which exempt them from having to provide information on water availability. Asking all subdividers to provide this information will enable the County to track groundwater demands.

Option 1.10 Restrict residential development in resource production areas. Restricting residential development in resource production areas will not only reduce land use conflicts but also minimize water demand and help to reduce erosion impacts from road and housing construction.

Humboldt County Energy Plan

We have striven to gather together the most complete list of reports and documents that aid in understanding Humboldt County's various energy potentials. However, the Humboldt County Energy Plan draft will not be available to the public until the end of May and this document is doing exactly the same thing we are doing. So we want to insert the table of contents for the plan that the Outpost organization should look into at least acquiring the draft.

Humboldt County Energy Element Background Technical Report

<u>Table of Contents</u>

Humboldt County Plan to Accelerate Economic Development of Local Energy Resources

This report gives an inventory of the different types of resources that can be utilized in Humboldt County. The resources covered are: hydropower, biomass, wind, cogeneration, as well as some discussion on conservation. For each resource the following points are covered: abundances of the resource in Humboldt County, applicability of technology that uses the resource, public benefits, main barriers and how the county can help.

*For hydroelectric generation, the technology has changed very little since the gold mining days. In Humboldt there are a multitude of small streams that can be used for individual (off-grid) power production. Humboldt County has over 100 small hydroelectric systems running independent of the utility grid. The Redwood Trails RV park near Orick produces about 3 ½ kilo-watts of electricity. There are some problems with utilizing hydroelectric generation, primarily the effects on fish migration. This is a big issue in Humboldt County because we have a couple species of salmon that are listed as endangered. The report then goes into the different types of projects being proposed and different criteria used to grade them.

Biomass, also known as co-generation because it produces electricity from steam, is electrical generation from wood wastes. This is not a new technology, but certainly one that deserves a closer look in Humboldt due to our large amount of trees. What happens is the wood waste is burned to heat water in a boiler which gives off steam. The steam then turns a turbine and produces electricity. The county has had a history of using wood wastes to fire boilers, especially during the 1980's when the county was responsible for 25% of the State's timber production. The efficiency of using wood waste depends on the following factors: the ages of the power plant, the type of fuel used, the overall size of the facility and whether the wood fuel is green, wet or aged. The report goes on to look at the major timber companies in Humboldt County at that time.

Gas cogeneration is a technology that also has a long history in Humboldt County. A fuel is used to produce electricity and heat. Cogeneration is supposed to increase efficiency by moving the electricity generating plants closer to the heat users. A barrier to this type of technology is the difficulty of retrofitting older buildings so they can handle the technology.

*Wind energy is an exciting new form of energy. The report states Cape Mendocino is the most "promising geographic sector in terms of wind resource with a projected average annual power output equated to between 150 to 200 megawatts." This study found the rest of Humboldt County to have marginal or no potential for wind development. Other problems include transmission line costs, access roads, no wind periods, and land use designation conflict in coast areas.

***- these forms of energy are discussed elsewhere in more detail.**

THE HUMBOLDT COUNTY PLAN TO ACCELERATE ECONOMIC DEVELOPMENT OF LOCAL ENERGY RESOURCES

EXECUTIVE SUMMARY

This report develops the basis for and presents a plan to accelerate development of Humboldt County's renewable energy resources. This is done by: 1) assessing the near term potential for development of the renewable resources considered abundant here, 2) quantifying the comparative and cumulative economic impacts of small-scale renewable energy projects at the level of development which could be expected in the next decade, and 3) suggesting actions which would speed up the development (e.g. removing barriers, demonstration projects, etc.)

After briefly recapping the county's economic development needs and how energy use affects the local economy, the first chapter covers job creation potential, income production and other economic development indicators. Over 1000 jobs, half temporary and half permanent, are estimated to result from development. New business or expansion opportunities are found to be numerous. The added income production capability could be up to $62 million annually, but could be a lot less, as little as $6 million, if all of the investment monies were "imported" to accomplish the development.

In addition to these benefits to the private sector, the report finds that County or other local government revenues from increased property value alone could reach nearly $2 million annually, not counting retail sales tax and other tax revenues. Several local governments, including the County, were found to have potential electricity (and revenue) generating projects that could be developed to produce a total of $1.5 million annually.

Regulatory barriers and infrastructural requirements (primarily electric transmission lines) threaten to diminish the near term jobs and income production benefits from resource development by lengthening lead times and increasing development costs.

A final conclusion of the chapter is that local expertise in the economic development field is adequate here, but local experts, such as those in the several local development corporations, need to be made aware of the economic benefits of local energy development projects and to target this area for future economic development efforts.

The second chapter contains the inventory of resources used to project the level of development possible. Hydropower, biomass, wind, cogeneration, solar energy and energy management (conservation) are investigated with specific findings on the following:

1) the resource here (i.e. its abundance and how much it is developed)

2) the status and applicability of the technologies available to develop the resource

3) the public benefits from development

4) the main barriers to development and what is needed to overcome them

5) what the county can do to assist in development

This inventory is summarized in Chapter 3 along with the major conclusions and recommendations of the report. Three tables are presented which combine all of the major findings o each resource. For the reader's ease, these major conclusions and recommendations and the tables are included in this summary on the following pages. Chapter 3 concludes with a brief plan to accelerate development.

The plan is simple but very ambitious. It relies on the private sector to create the initiative needed to develop our hydropower, biomass-electric, and wind potential with the help of the county as a facilitator and clearinghouse of information. Since cogeneration potential exists primarily in public agency facilities, the plan calls for government initiative to complete the necessary feasibility studies on the government's own facilities with the possible help of third-party or shared-energy savings developers. Biogas and biomass-alcohol fuels are seen as needing to be demonstrated as to effectiveness here. The plan calls for the county to work through its Energy Advisory Committee to procure grant funding for demonstration projects. Solar energy is to be given a boost via the County's participation in a county-wide solar leasing program and via removing barriers to passive solar additions in the building codes and zoning regulations. Finally, the county is urged to link efficiency improvements on County facilities to budgetary rewards to the departments achieveing the improvements.

CHAPTER 2

HUMBOLDT COUNTY'S SMALL-SCALE RENEWABLE ENERGY RESOURCES (AN INVENTORY)

Introduction

Humboldt County's major renewable energy resources are discussed in this chapter. The Project Independence Committee added three resources, (energy management, solar energy and agricultural biomass) to the original list in the project's scope of work which included hydro power, wind, biomass, and cogeneration.

These additions were made because the Committee (rightly) felt that if economic development and its benefits were the major focus of the study, then these other resources would probably stack up as well and were thus worth inventorying and studying, too.

The rest of this chapter covers each of these resources and the associated technologies which are applicable to Humboldt County in the near term (ten years).

The main points briefly covered in the following sections are what Project Independence found about:

1) the resource here (i.e. its abundance and how much it is developed)

2) the status and applicability of the technologies available to develop the resource

3) the public benefits from development

4) the main barriers to development and what is needed to overcome them

5) what the county can do to assist in development

Before moving into these sections, however, a few generalizable observations will be made here to avoid repetition.

- the Public Utility Regulatory Policies Act (PURPA) of 1978. PURPA set up certain requirements for area electric utilities. One of those requirements was that the utility must buy power from small power producers at the utility's "avoided cost", or the cost of fossil fueled electrical generation.

- the environmental effects of small power projects are generally less severe than those effects associated with large-scale generation projects such as dams or nuclear and coal plants. Small-scale projects are generally not as capital intensive and have shorter construction lead times than these more traditional forms of electrical generation; further, small-scale projects generally utilize a renewable resource and help to reduce dependence on fossil fuels.

HYDROELECTRIC GENERATION

The State of California has been experiencing a surge in development of small scale hydroelectric projects since PURPA after a long period of inactivity within the state. Small hydroelectric generation ranges from less than 100kw to 15MW and accounts for 700MW of the present total electrical generation in the state. This amount is projected to double by 1991.[9] Much of this projected activity can be expected to occur here since 30% of the total run-off water in the state flows through Humboldt County. Also, around 180 applications for hydroelectric permits have been filed in the last 5 years with the Federal Energy Regulatory Commission (FERC) which is charged with licensing all hydroelectric projects regardless of size. Humboldt County also has a myriad of very small streams traversing its landscape. Small streams are ideal for individual (or off-grid) power production. Small off-grid or pre-grid, hydroelectric systems have been producing power here since the gold miners moved to our hills and needed power to help them find their fortunes.

The technology has changed very little since then although system efficiency has been vastly improved. The time and expense of developing hydro projects are great, but so are the returns. The average payback period for a small hydro project is usually less than eight years. This is a short period of time given the 30-50 year life expectancy of the system. For example, a projected revenue stream for a 500kw project operating for 210 days a year is $138,000 @ .055/kwh. At a development cost of $2000 a kilowatt, or $1,000,000, the breakeven year is year seven.

Besides these individual off-grid systems, and the flurry of recent FERC activity, only a handful of projects seem to be active here at present. A project at Redwood Trails RV park near Orick recently began operating and produces about 3 1/2 kw of electricity. The power is being used entirely on site.

A number of other projects are in the development stages. Tables 1&2 provide details on the local projects which have begun at least one of the major permit processes and/or contract negotiations with PG&E. These projects add up to about 7MW. The recent report for the Board of Supervisors, "An Analysis of Small Hydroelectric Planning Strategies", May, 1982, prepared by Oscar Larson and Associates, listed another 62MW of projects from the active FERC filings. Although a number of uncertainties surround hydroelectric development at present, the Committee felt comfortable with a ten year development potential of 50MW.

One of the uncertainties is caused by the peculiarities of the hydro power licensing procedures of FERC. Many potential projects that have filed a preliminary application for a FERC license may not be the most viable projects in the county. It is felt that many filings were done without benefit of even a site visit and may never be developed. In addition several of the listed projects have been delayed because they have not been able to obtain necessary state agency approvals, primarily from the State Department of Fish and Game and the State Department of Water Resources Control Board. See Figure 3 following for an idea of the complexity of the regulatory process. The main concern of both of these agencies is maintaining the quality of the water resource especially for its other beneficial uses, such as fishing.

This concern for the fisheries is a valid one. Even though hydro projects are generally environmentally benign, fish habitat can be inadvertently destroyed or fish migration reduced if projects are not properly conceived and assessed.

Other issues in development of hydroelectric development were covered in detail in the Oscar Larson report and will not be repeated here. In order to further refine its estimates of resource potential, Project Independence looked further into what makes projects most viable and which projects might go ahead fastest here. The projects that appear most viable are those that have a good return, easily satisfy all regulatory agencies, and have very limited environmental impact. More specifically, projects have a good chance if they:

1) can be installed for less than $2000/kw

2) are under 5MW (and even better if under 100kw)

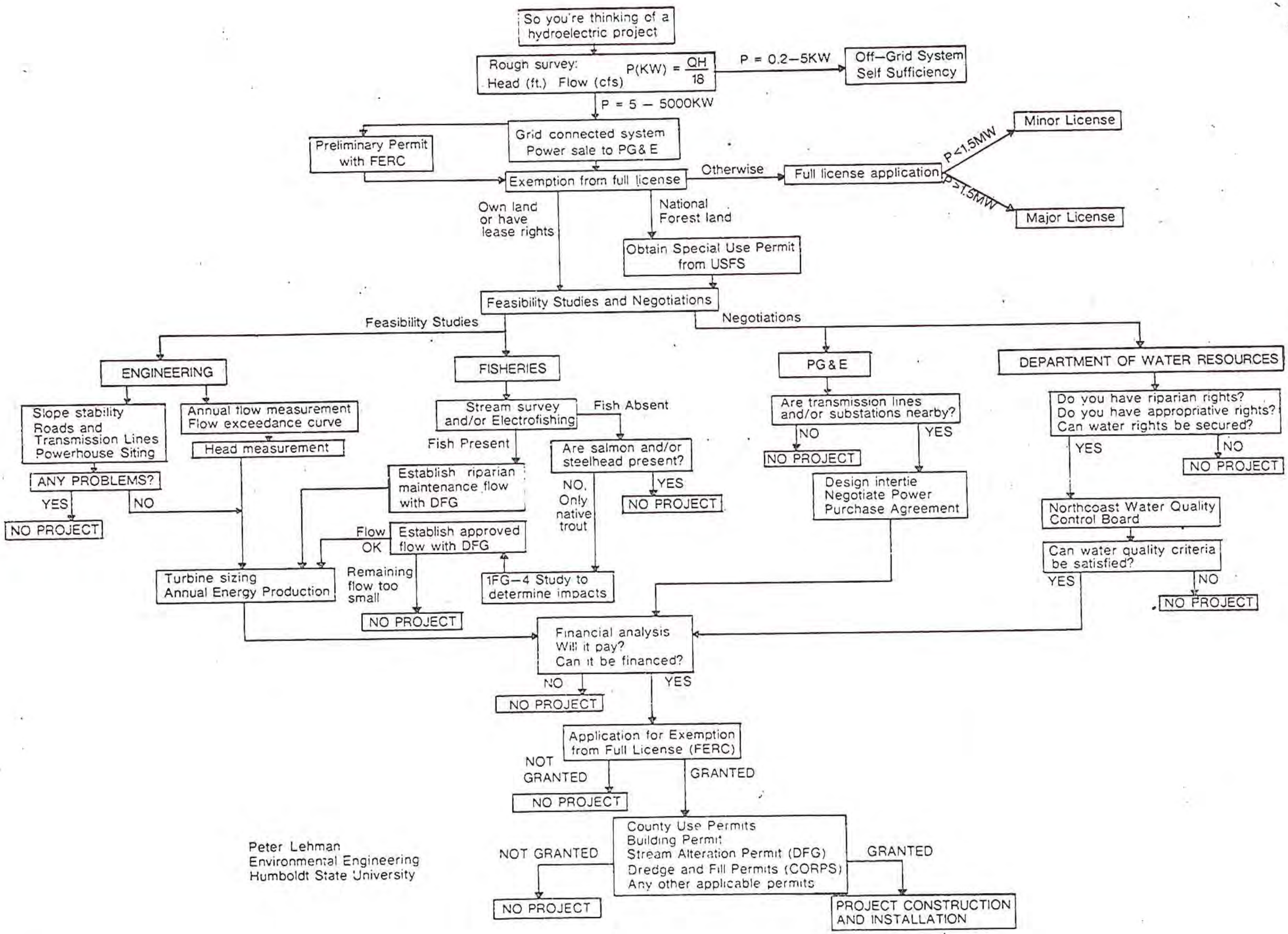
3) will not significantly change the stream's flow regime

4) require new power lines of less than 1 mile

5) will not reduce stream flow below minimum allowed for fish.

6) will not affect existing fish populations (and even better if no fish are present)

7) have discharges less than 300 feet from toe of the diversion



So you're thinking of a hydroelectric project
Rough survey: Head (ft.) Flow (cfs) P(KW) = QH/18
P = 0.2–5KW
Off–Grid System Self Sufficiency
P = 5 – 5000KW
Grid connected system Power sale to PG& E
Preliminary Permit with FERC
Exemption from full license
Otherwise
Full license application
P<1.5MW
P>1.5MW
Minor License
Major License
Own land or have lease rights
National Forest land
Obtain Special Use Permit from USFS
Feasibility Studies and Negotiations
Feasibility Studies
Negotiations
ENGINEERING
FISHERIES
PG& E
DEPARTMENT OF WATER RESOURCES
Slope stability Roads and Transmission Lines Powerhouse Siting
ANY PROBLEMS?
YES
NO
NO PROJECT
Annual flow measurement Flow exceedance curve
Head measurement
Turbine sizing Annual Energy Production
Stream survey and/or Electrofishing
Fish Absent
Fish Present
Establish riparian maintenance flow with DFG
Establish approved flow with DFG
Flow OK
Remaining flow too small
NO PROJECT
Are salmon and/or steelhead present?
YES
NO PROJECT
NO, Only native trout
1FG–4 Study to determine impacts
Are transmission lines and/or substations nearby?
NO
NO PROJECT
YES
Design intertie Negotiate Power Purchase Agreement
Do you have riparian rights? Do you have appropriative rights? Can water rights be secured?
YES
NO
NO PROJECT
Northcoast Water Quality Control Board
Can water quality criteria be satisfied?
YES
NO
NO PROJECT
Financial analysis Will it pay? Can it be financed?
NO
NO PROJECT
YES
Application for Exemption from Full License (FERC)
NOT GRANTED
NO PROJECT
GRANTED
County Use Permits Building Permit Stream Alteration Permit (DFG) Dredge and Fill Permits (CORPS) Any other applicable permits
NOT GRANTED
NO PROJECT
GRANTED
PROJECT CONSTRUCTION AND INSTALLATION
Peter Lehman
Environmental Engineering
Humboldt State University

Table 1

Humboldt County Small-Scale Renewable Energy Projects, On-Line: Hydroelectric Generation

Location/ Company	Project Description	Installation Date	Size/ Output	Comments
Redwood Trails Stone Lagoon, CA McBrindle Creek	Off-grid Run-of-the-river	6/83	3½kw 17,600kwh (7mos)	The system will supply power to the Redwood Trails RY recreation area for 7 months of the year. Two construction jobs created Cost unknown
Individual homes; remote locations	more than 100 Run-of-the river non-grid connected systems	currently operating	usually 300-2000 watts (7 months) 2kw x100= 200kw - 1MW (5x)	These systems usually supply the operaters with their power needs. Systems operate usually 7 mos. annually. Costs are estimated to be between $500-$750 per kw.
Mathews Dam, Ruth Lake, Trinity Co. Not located in Humboldt County but developed by Humboldt Bay Municipal Water District, Eureka, CA	Added generation to existing dam.	in start-up mode as of 6/83	1.2MW	

Table 2

Humboldt County Small-Scale Renewable Energy Projects, In Developmental Stages: Grid-Connected Hydro-Electric Generation

Location/Company	Process/Description	Projected Start-up	Projected 1) Output/size	Projected 3) Cost	Comments/Special Problems
Davis Creek, General Plastics Mfg.Co.,Maple Crk	Run-of-the-river	11/83	100kw 2) 504,000kwh/yr	$150,000	In construction phase power purchase w/PG&E signed 3/83
Pearch Creek, Pritch Jordan, Orleans,CA	Run-of-the-river	unknown	600kw 3,024,000kwh/yr	$900,000	The project has been held up because of potential fish impacts
Bidden Creek;Biber & Spellenberg, Eureka,CA	Run-of-the-river	10/83	28kw 141,120kwh/yr	$42,000	Power purchase contract signed 2/83. Project in construction phase
Mill & Sulfer Creeks, David Demera, Carlotta, CA	Run-of-the-river	11/83	1000kw 5,040,000kwh/yr	$700,000 *per conv.	Project in initial surveying & planning phase;awaiting permit from SWRCB
Jacoby Creek, City of Arcata, Arcata,CA	Run-of-the-river	10/85	400kw 2,016,000kwh/yr	$600,000	Project being reviewed by CA Fish&Game
Kirkham Creek; China Flat Co., Willow Creek,CA	Run-of-the-river	10/85	700kw 3,528,000kwh/yr	$1,500,000	Filed for FERC exemption; initial surveying studies being done
Aikens Creek, Company unknown, Weitchpec,CA	Run-of-the-river	10/85	255kw 2,200,000kwh/yr	$382,500	Initial surveying studies in process. FERC application filed
Baker Creek Al Hunt Bridgeville	Run-of-the-river	12/83	1.5MW	N.A.	In design stage working with PG&E for interconnection study

1) Projects expected to operate 210 days yearly,source: Harold Hough,PG&E 1/83
2) FERC application for 130kw scaled down in contract negotiation with PG&E
3) Estimated to be $1500/kw/ BRIV Report CEC 1983

Table 2 (cont.)

Humboldt County Small-Scale Renewable Energy Projects, In Developmental Stages: Grid-Connected Hydro-Electric Generation

Location/Company	Process/Description	Projected Start-up	Projected Output/size	Projected Cost	Comments/Special Problems
Lost Man Creek; Prairie Creek Fish Hatchery, Humboldt County, Orich, CA	Run-of-the-river	unknown	unknown assessing head/flow	unknown	The County of Humboldt has requested $75,000 from the federal Economic Development Administration with which to develop a hydro project on Lost Man Creek. The project will satisfy the hatchery's electrical needs plus provide revenues from the sale of surplus electricity to PG&E.
McCloud/Bishop Creeks; Willow Creek Community Services District, Willow Creek, CA	Run-of-the-river	1/85	2000kw 10,080,000kwh	$3 million	Watershed surrounding project is highly impacted by many proposed hydro projects; working currently on FERC permit
Bluford Creek Ross Burgess	Run-of-the-river	11/84	1.45MW 4,000,000kwh	N.A.	In design stage, working with PG&E for interconnection. Project has estimated interconnection costs of approx.$330,000

8) do not affect water quality nor need to appropriate water

9) are located outside sensitive habitat areas

10) are located outside historically designated areas

11) are located outside critical watersheds

Project Independence felt that off-grid systems, very small grid-connected systems and "in-line" or in-pipe systems deserved further investigation. Additional findings are presented in the next three sections.

Off-grid systems

Humboldt County has over 100 small hydroelectric systems ranging in size of 300-2000 watts operating independently of the utility grid.[10] The operators either use all the electricity directly from the generators or they store the energy in a simple system of batteries and use the electricity when needed.

The major reasons usually given for not connecting a small hydro system to the electrical grid are threefold. First, often the potential output of the project is so small that it would barely meet the user's needs and would not warrant the extra cost of interconnecting. Second, the distance from the grid often makes hooking up economically unattractive since the developer must bear the costs of running the power lines to the existing grid structures. This could cost the developer as much as $50,000 a mile for power lines.[11] Finally many owners of remote properties value their independence from centralized systems. These individual systems are usually highly cost effective when compared to new line extensions. The installed costs are as low as $500-$750 a kilowatt. The viability of more installations depend on accurate assessment of each potential project. Proper assessment will probably take at least a year to assess the flow of water, fish impacts, etc.

Business is good for the couple of local retail stores that supply the equipment for these installations. Usually the pipes, batteries, electrical equipment, and generators are purchased locally.

There is a growing interest among remote property owners to learn more about site assessment, feasibility, and design of hydro systems. Between the local retail stores and local PG&E expertise, sufficient information can be obtained to properly assess and develop a potential off-grid hydro site; although where to go to get the information is not well publicized.

The major barriers for off-grid hydro development are the same as those for on-grid systems. The plethora of permits are still required, including a Humboldt County building permit, and the fisheries and water rights issues must still be addressed. However, it should be noted that there has been no permit activity at the Planning Department for off-grid systems. Because of this, the County of Humboldt has not developed any standards for off-grid battery systems relative to wiring, ventilation, and safety.

What is needed then to assist off-grid hydro development is publicity on the local availability of site assessment information and assistance and more locations where this information can be obtained.

Recommendations on Off-grid Systems

- The county should obtain "how-to" information on off-grid hydro systems to be available at the Building Inspection and Planning offices as well as the county library.

- The county should encourage off-grid system developers to obtain the necessary permits

- The county building inspectors should become familiar with battery systems and safety considerations relating to their installation and use, such as proper wiring, ventilation, etc.

- If and when permit activity picks up, a brochure should be made available at the Planning Department describing safety considerations of off-grid systems which will assist developers to more standardized and safer practices.

Small-Grid-Connected Systems

Project Independence found that small systems (less than 1MW or so) are usually quite economically viable, but since they must still go through all of the regulatory processes, they are unnecessarily burdened with the time delays and costs of the regulatory process. Project Independence felt that several things need be done to alleviate this.

First the regulatory process should be modified to reduce the burden on this size of project, probably through exemptions and reduced permit processing fees. Second, whether or not this first need can be met, small project developers need to understand the regulatory process better(i.e. which hoops, when, etc.)

Project Independence held the Hydroelectric Conference in May which was specifically aimed at this size project. Current project developers and regulators were brought together to try to educate each on the others point-of-view, needs etc. This effort was a success in communicating what the regulatory process entails, but frankly served to depress many developers who did not realize the complexity, etc.

Recommendations on Small-Grid-Connected Systems

- The county should support legislation(and even legal action) to exempt small projects from undue regulatory costs and requirements.

- The county should assign a staff person to keep abreast of hydro regulations and should provide information to developers upon request on state and federal regulatory processes.

In-Line Hydro Systems

The third type of hydro electric generating system considered by Project Independence is the in-line energy recovery system. The hydro power plant is installed in a water distribution system (irrigation, drinking, etc.) where hydraulic energy is being lost through pressure reducing stations or pressure break reservoirs. These small hydroelectric power generating plants can recover this lost energy and convert it to electrical energy to be consumed by the producer or to be sold to the local utility company. Usually these systems do not require the construction of new diversions. The power plants are fitted in to the existing system with few modifications.

To assess the in-line hydro potential in Humboldt County, Project Independence interviewed twenty Community Services Districts (CSD) in the county. The criteria for establishing whether or not a CSD had a potential project were based on engineering data supplied by private firms and included: having an 8 inch line or larger, a pressure drop of at least 50psi, and/or a flow of over 50 gallons per minute.

It was found that the various CSDs have a wide variety of water systems. Some CSDs (Campton Heights, Fieldbrook) pump their water into tanks and therefore do not need to reduce pressure. Others have very small water lines (Garberville,WestHaven) that proved to be too small to work with.

There are some CSDs that appear to have potential projects. The Phillipsville CSD, McKinleyville CSD, Orleans CSD, and the City of Arcata all have some potential for developing an in-line hydro project.

The range of projected economic returns varied with the size of the project. For example, Phillipsville CSD uses 75,000 gallons a day, has a drop in pressure of 115 psi. They could produce around $473 of electricity the first year. The cost of their system would be around $2000. The pay-back is less than four years.[12] Partly as a result of Project Independence's interest the CSD is doing a feasibility assessment of the project.

The Orleans CSD project is located in the Pearch Creek watershed. This project has already been studied and the permit process begun. It is designed to move water through a 12-inch conduit to the reservoir and then drop the water through a turbine. The rated power capacity is 65kw. The rated output is 569,400 kwh with a value of $39,858 a year. This would not only pay the expenses of the CSD, but would also provide revenues from the sale of surplus electricity.[13] The project, however, has run into conflict with the fisheries of Pearch Creek. The DFG is requesting that less water be diverted from the creek.

The McKinleyville and Arcata projects may have potential but needed further on-site assessment to determine this. Project Independence had no recommendations for county action on in-line systems especially since the county did not have any applicable projects.

County Projects

Although Project Independence did not do an exhaustive search of county land holdings to determine if any had hydro potential, one project was conceived (independent of Project Independence) which deserves mention. This is at the Prairie Creek Fish Hatchery on Lost Man Creek. A project at the Hatchery would decrease the net cost to the county of operating the hatchery. Utility bills for running lights and pumping water are $38,000 a year (expected to rise by 20% in 1984) which is proving to be cost prohibitive. A hydro project could be developed on Lost Man Creek at a number of locations. The main concern is if there is enough fall or flow.

The County Board of Supervisors has requested $75,000 of funds from the Economic Development Administration for development of this project. The Project Independence Committee endorses the Board's action because there is a need for a feasibility study, an environmental assessment, and a system design before construction can begin.

The County Permit Process

One of the results of the Oscar Larson study last year was a suggested permit process for the county. In the meantime, a draft ordinance outlining the process has been developed. Essentially the county proposes to make hydro projects under 5MW permitted uses in all but coastal and residential zones. One good effect is to reduce the regulatory burden on projects; another effect (when an EIR is required) is to put "lead agency" status into the lap of the state agencies with jurisdiction over water rights or environmental protection. Project Independence is uncomfortable with this second effect because it puts the control further away from Humboldt County, but understands that the county proposes this course to reduce costs.

Table 3

Humboldt County Small-Scale Renewable Energy Projects, In Developmental Stages: "In-Line" Hydro-Electric Generation

Location/Company	Process/Description	Projected Start-up	Projected Output/size	Projected Cost	Comments/Special Problems
Pearch Creek; Orleans Community Services District(CSD) Orleans, CA	in-line hydro unit to replace pressure reduction valve on water system at CSD reservoir	on hold	65kw 569,400kwh/yr	Est.$65,000	The project is being held up by CA. Fish & Game concerns over low creek flows. The project will supply the CSD with electricity for pumping; surplus electricity will be sold to PG&E

Recommendations

- The county should adopt the ordinance and permit process presently being considered with the idea that it may have to be modified if major delays are encountered with state agencies because of their distance from project sites and lack of familiarity with Humboldt County conditions

- When a state agency becomes lead agency on environmental review of a project, the county should request that any necessary hearings are held locally to ensure local input, etc.

- The county should publish a brochure describing its permit process and how it fits into the FERC licensing process and the state environmental review processes. The brochure should contain information on who to contact at each agency with purview over hydroelectric projects.

- The county should work with PG&E to develop a hydroelectric project clearinghouse which would include maintaining a public file on the FERC filings in the county. (The county already receives notices from FERC as applications are received, etc.) and publications from state agencies on hydroelectric regulations, etc.

- The county should continue to assess and develop the Prairie Creek Fish Hatchery hydro project.

BIOMASS: Electrical Generation From Wood Wastes

Generating electricity by burning forest product residues is not a new technology.*(See Table 4 and Attachment 1 for a more detailed process description.) Timber residues are used as a fuel in electrical generation in a similar manner as oil, natural gas or coal. Wood wastes are burned to heat water in a boiler to produce steam, which turns a turbine and produces electricity. Although many timber processing facilities utilize wood wasted to produce steam alone for kiln-drying or other direct uses, a number of mills also produce electricity from steam. This technology is commonly known as "co-generation", a name given to a variety of processes which produce both electricity and process heat or steam jointly utilizing the same fuel.

Historically, many isolated rural areas in northwestern California have relied on wood wastes to produce electricity for local use. Since Humboldt County is responsible for 25% of the State's lumber production, and since 40% of every log transported to a lumber mill ends up as some form of mill waste, it is not too surprising that the County has had a history of using wood wastes to fire boilers, either for kiln-drying lumber and/or for cogenerating electricity.

Table 4

WOOD BIOMASS TECHNOLOGIES

Energy Form Produced	Method to Produce	By Products
Process Steam	Boiler	Ash, waste water, air pollutants
Electricity	Diesel engine, boiler and turbine	Ash, waste water, air pollutants
Variable: solid, liquid and gaseous fuels	Pyrolysis/ Gasification	Charcoal, tar
Cogeneration: Process heat/ steam and electricity	Boiler, turbine, heat recovery equipment	Ash, waste water air pollutants

Since 1931, the Pacific Lumber Company in Scotia has produced steam and electricity and supplied the town with lighting and other conveniences. The plant's five boilers (three built in 1931, one in 1937, another in 1958) together produce almost 10MW of electricity. As Table 5 indicates, there are four mills in addition to Pacific Lumber in Humboldt County which currently cogenerate electricity and steam. They range from a production of 5MWe to 48MWe of electricity per facility. The total electrical generating capacity of plants already on-line in the County is approximately 78MW. Table 5 lists and describes the individual facilities.

The supply of wood waste can be a limiting factor in a mill's electrical generating capacity. It is also a potentially limiting factor in the total amount of electricity which could be produced in the County. In 1981, approximately 140,000 to 180,000 tons of slash and mill waste went unused in the County. This represents about 15% of the total wood waste available.* Based on the current efficiency of electrical generation, it appears that lumber production in 1981 could have supported an additional 10 to 40MW of power production without additional logging or wood gathering efforts.

The map entitled "Location of Lumber Mill and Forest Residue in California", Figure 1 , gives an indication of the approximate amount and location of unused lumber mill residue and forest slash resources in California, as of 1978. New timber management practices require the removal of "cull" logs (felled trees unusuable for lumber) from the forest floor during logging operations. Removal of forest slash and cull logs can have positive impacts such as improved fire control, reduced threat of insect infestation and disease, and improved forest growth.[14)]

Much of the recent interest in wood waste electricity production is based on speculation that slash and cull logs can be removed after timber harvests at a cost low enough to make this wood waste useable for electricity generation. The California Division of Forestry has estimated that while wood-fired electrical generating plants are competitive in cost to both coal and oil-fired conventional plants when mill residues are used as the main fuel source, power plants using the lower-cost types of forest slash were at the time of the study (1981) only "marginally cost competitive with oil-fired plants." Power generation costs are a function of the wood-fired power plant's size, generating equipment, overall thermal efficiency, and the type and cost of fuel used. [15)]

Many projects have been proposed recently for location in Humboldt County. See Table 6. Most rely in part or wholly on slash and cull log collection. Together they total over 62 MW.

* 15% of the total wood waste is now either land filled or burned, 60% is used in the manufacture of products (paper & particle board), and 25% is burned for power production.

LOCATION OF LUMBER MILL AND FOREST RESIDUE IN CALIFORNIA

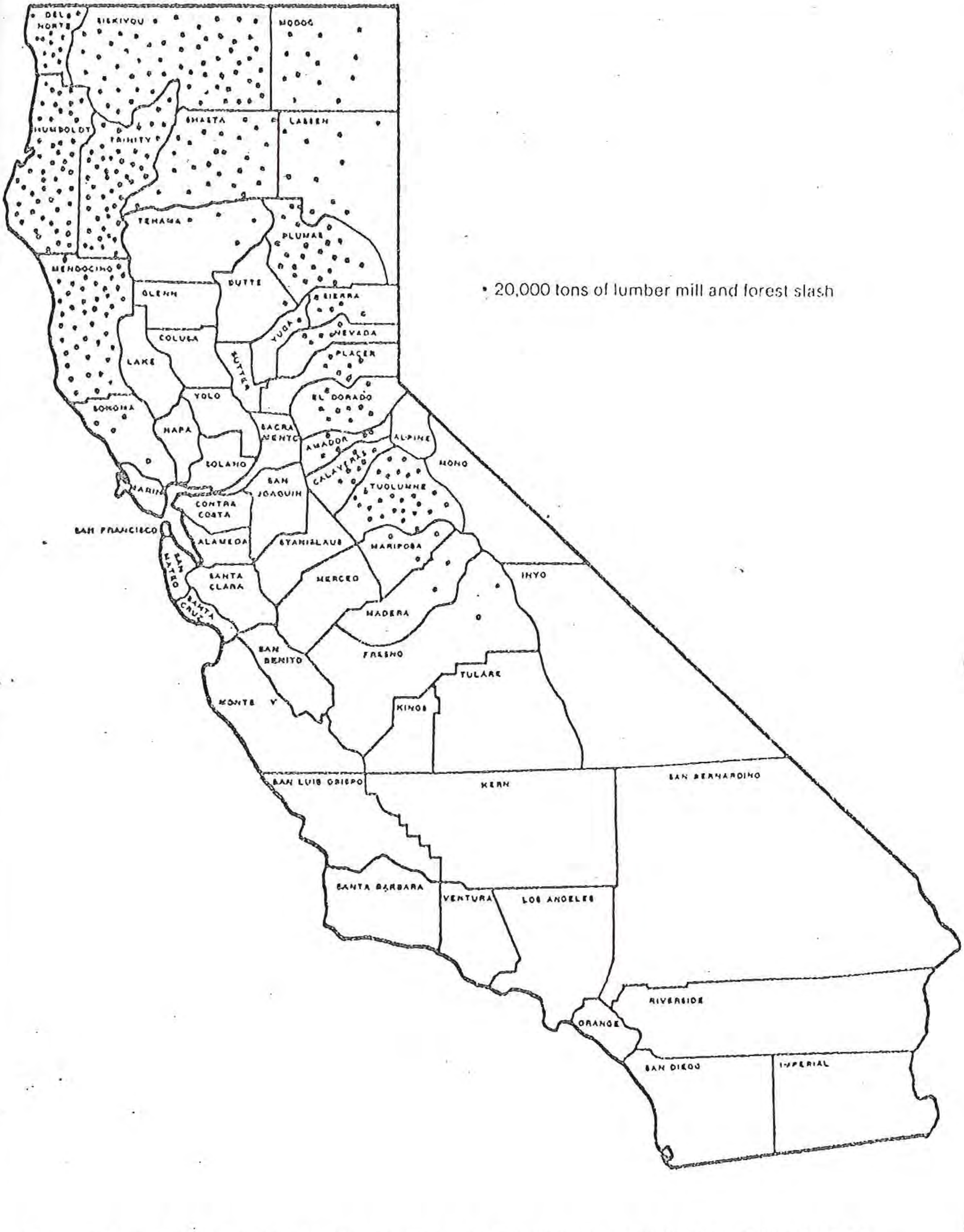


Fig. 1 General location of unused lumber mill residue and forest slash produced in California, 1978.

Source: Cooperative Extension Services, "Agricultural Residues (Biomass) in California....Factors Affecting Utilization" University of California, Division of Agricultural Sciences, April, 1982. Page 15.

Table 5

Humboldt County Small-Scale Renewable Energy Projects, On-Line:

Company/ Location	Project Description	Installation Date	Size/ Output	Comments
Louisiana-Pacific Corp. Samoa Peninsula Samoa	Electric power/ steam project fuel source: woodwaste	Operational	48MW	The corp.consumes 32MW at the facility. It sells its excess capacity to PG&E. Fuel source secured
Pacific Lumber Co. Scotia Mill, Scotia	Electric power/ steam project fuel source: wood-waste	Operational	10MW	PL provides the town of Scotia with power and heat. None of the power is sold to PG&E. The fuel source is secured.
Simpson Paper Co. Samoa Peninsula Fairhaven	Electric power/ steam project fuel source: biomass	Operational	15MW	The company consumes 11MW onsite. It sells its excess capacity to PG&E. Fuel source is secured.

Table 6

Humboldt County Small-Scale Renewable Energy Projects, In Developmental Stages:

Company/Location	Process/Description	Projected Start-up	Projected Output/size	Projected Cost*	Comments/Special Problems
Humboldt Bay Power Co. Samoa Peninsula Eureka	Electricity from woodwaste	unknown	32MW	$40 million	This project was originally studied by the County of Humbodlt in 1978. Most recently downgraded in size from 40MW and cancelled refuse-derived-fuel portion. Fuel supply unsecured
Simpson Timber Co Arcata plant Arcata	Cogeneration from woodwaste	unknown	5MW	$6.25million	The Simpson Timber Co has decided to put this project on hold corporate capital not available at this time Owns fuel supply
American Chemurgic Industries Fields Landing	Electric power/ steam project Fueled initially by woodwaste, and later: oak	12/83	7½MW	$9.375mill	Signed power purchase agreement with PG&E 9/81. Fuel supply available on open market. Upsized system from 3MW because of fuel supply and economics of scale
Ultrapower, Inc. Probably Blue Lake	Electric power/ steam project Fueled by woodwaste	1985	10-15MW	$20 mill	Ultrapower, Inc. has been studying the availability of fuel supply. No power purchase contract has been signed
				* cost estimates ~~$1250/kwh~~	

CEC BRIV 1983

Table 6 (cont.)

Humboldt County Small-Scale Renewable Energy Projects, In Developmental Stages:

Location/Company	Process/Description	Projected Start-up	Projected Output/size	Projected Cost*	Comments/Special Problems
Pacific Carbons, Inc. Blue Lake Blue Lake	Electric power/steam project using gas turbine topping cycle	unknown	1MW	$1.25 mill	The plant is currently shut down for environmental reasons. Project put on hold. Power purchase contract signed with PG&E 4/82
Hoopa Valley Business Council Hoopa Valley	Electric power/ steam project. Fuel source: woodwaste	11/84	3.3MW	$7.2 mill	The feasibility studies have been completed 5/83. Public hearings are being held. Fuel supply secured from the council's logging operation
Humboldt Loaders Gary Blanks Arcata	Electric power/ steam project fuel source: woodwaste	5/85	4MW	$5.0mill	The project would utilize an existing facility that is currently non-operating The fuel supply is secure. Feasibility studies not yet complete.
				*Based on CEC BRIV 1983 $1250/kwh	

The 32MW biomass facility proposed by the Humboldt Bay Power Co.(HBPC) would be the largest non-lumbermill project in California. As proposed, most of the wood fuel would come from mill residues (wood shavings, bark and sawdust) with the remainder from forest slash and cull. The HBPC also proposed to burn solid waste in the facility to produce electricity. However, this aspect of the project ran into a snag with State regulatory agencies which haven't yet determined proper disposal methodologies for the ash produced by solid waste incineration, considered to be a hazardous waste. It is uncertain how soon this project will come on line.

The American Chemurgic 7.5MW power plant is slated to go on-line this year. Therefore, a range of approximately 3.5 to 32.5MW could reasonably be expected to be generated from the remaining wood wastes based on the availability of wood waste estimated above and based on the assumption that forest residue, or slash and cull logs, would be included as the wood fuel source and will become economically viable. Thus, it appears that there are presently more projects being proposed than there will be available wood waste.

One way to increase the availability of wood waste for firing new power plants, and to better utilize the waste wood currently available, is to improve the efficiency of currently operating wood-fired boilers and cogeneration plants.

Table7 indicates that efficiencies in the use of wood vary widely from plant to plant. Variations in the number of tons per hour required to generate a megawatt of electricity can be explained by several factors: the age of the power plant, the type of fuel used (wood waste, sawdust, bark, hogged fuel, etc.), the overall size of the facility and whether the wood fuel is green, wet or aged. Another factor affecting the efficiency of power production is the level of use for steam: if the plant's operators place a priority on using steam for kiln-drying lumber, then less electricity will be produced. Since the enactment of the Public Utilities Regulatory Policy Act (PURPA), it has proven more cost-effective for many mill operators to divert the steam to power production as a higher priority, or else to over-size a power plant beyond the mill's drying needs in order to sell excess power tothe utility at a profit.

A majority of mills in Humboldt County do not currently cogenerate electricity while producing steam for kiln-drying and other uses within the mill. Again, efficiencies in wood usage can be improved by upgrading older facilities. But adding cogeneration capability to these mills, would be a major step towards increasing the amount of energy derived from wood wastes which are already being consumed. (Cogeneration is usually viable when both electricity and steam are used in the process.)

Although an individual assessment was not undertaken for each individual mill, an extrapolation based on the amount of steam produced by currently non-generating mills indicates that an additional 10-11MW of electricity could be produced. Adding cogeneration to

TABLE 7

LUMBER COMPANIES
PRODUCING STEAM AND ELECTRICITY

COMPANY	Input (tons/hr)	Steam (lbs/hr)	Input (tons/hr) Steam (lbs/hr)	MW Produced	Efficiency: Tons/hr input per MW Produced	Year Built
Pacific Lumber Co. (Scotia)	21.8	390,000	.044	9.6	2.27	1931-1958
Louisiana Pacific (Samoa)	25.1	480,000	.052	48.0	.52	1965-1976
Crown-Simpson (Eureka)	33.0	450,000	.073	20.0	1.63	1965

LUMBER COMPANIES
PRODUCING STEAM ALONE

COMPANY	Input (tons/hr)	Steam (lbs/hr)	Input (tons/hr) Steam (lbs/hr)	MW Produced	Efficiency: Tons/hr input per MW Produced	Year Built
Sierra Pacific (Arcata)	.88 bark	15,000	.059			1978
Louisiana Pacific (Arcata)	1.5 sander dust	20,000	.075			1971
Arcata Redwood	1.0 sawdust	15,000	.067			1966
Simpson Timber (Fairhaven)	10.0 woodwaste	100,000	.10			1947
Simpson Timber (Arcata)	1.3 woodwaste	15,000	.087			1969
Schmidbauer Lumber Co. (Eureka)	2.5 redwood bark	30,000	.083			1978

Source: Virginia Lew, "Forest Residues Utilization Chart", California Energy Commission, Oct. 1982.

plants currently producing steam alone would not only increase profitability for the mills, but would also increase the efficiency of wood waste utilization. (Existing mills that burn hogged fuel to produce steam are operating low pressure boilers which would have to be replaced with high pressure systems.)

Several new technologies are being developed that may also make more efficient use of wood waste in generating electricity. One example of such a system is the "Kleensmoke" Inverse Pile Burner designed by Ed Burton of Willits, CA. It works on the principle of burning wood or other wastes in a starved oxygen condition. After initial start-up, no visible plumes or odors are emitted. Burton predicts that, due to the high stack temperatures (100-2300 degrees F), a wide variety of fuels can be used, including urban trash, orchard prunings, hospital wastes, forest residue, and even scrap automobile tires.(Conversation w/Ed Burton, Kleensmoke, Inc. 2/82)

In addition to methods of generating electricity by burning wood wastes, there is a method of producing solid, liquid or gaseous fuels that can be burned for a variety of uses, including producing electricity. This method, termed "Pyrolysis", involves the chemical decomposition of wood (or any biomass) by heating it to a high temperature (about 900°F) in the absence of oxygen. Volatile gases are separated out by the heat and collected for use as a fuel, leaving charcoal as a by-product.

There are two currently-existing pyrolysis plants on the west coast--one in North Medford, Oregon (owned by Husky), and in Sacramento (owned by Kingsford). Several others are being planned; notably one of these is by a Humboldt County developer, Mike Evenson, from Garberville. Evenson does not currently plan to locate his facility here, however, because of a lack of a firm fuel supply availability.

Benefits to the community from utilizing the wood waste resource to produce electricity include: increased revenues, job creation, greater local energy self-reliance, secondary economic impacts, a reduction in landfilling of wood wastes, potential beneficial impacts to the forests by removing slash and other fire-and disease-promoting materials, and increased profitability for local businesses.

Potential barriers to the development of biomass power plants include: fuel availability and cost, air quality, capital costs involved in building new plants or retooling existing lumber mills, the current price paid by utilities for electricity, waste disposal, unknown impacts of slash harvesting on forests and related problems such as burning solid waste along with wood. A potential problem which might be encountered as the utilization of wood waste increases is a significant rise in the cost of wood fuel, which would affect both existing and future users. Other barriers are institutional in nature, such as the length of time required for permitting, availability of financing, and public opposition.

Recommendations:

1) PG&E should continue to work closely with existing timber products plants to improve the efficiency of steam-production and cogeneration facilities;

2) the County should encourage increased efficiency in existing facilities and should require improvements in the use of wood waste material as conditions of approval for other plant-related permits;

3) a number of new wood-fired power production plants are under consideration in the County. As a part of the County's environmental review and permitting process the following studies should be required in order to ensure that existing facilities will have sufficient wood fuel sources at a reasonable price and that substantial negative impacts to the forests are avoided:

   a) If forest slash removal is proposed, the availability of forest slash, impacts resulting from its removal, and the amount and type of slash which can be removed from the forest without inflicting significant negative impacts. Cooperation in funding such a study should be encouraged among potential wood waste harvesters and state and federal agencies with timber management and regulatory responsibilities.

   b) Based on the above information and on the fuel requirements of existing and projected wood-fired projects, an analysis of the impacts of new power plants on the availability and cost of wood fuel supplies should be conducted.

GAS COGENERATION

Cogeneration is an established technology with a long history. The technology can have a variety of different system designs but the common aspect is that a fuel (natural gas, here) is used to produce electricity and heat. The heat is then used for process heat, space heat or other uses. Cogeneration can achieve a savings of approximately 30% in fuel costs when compared to the separate production of heat and electricity. Our current centralized electric utility system has an overall fuel efficiency factor of 29%,[16] because the heat produced in generation can not be conveniently used as a heat supply for some other use.

Cogeneration offers a significant improvement utilizing existing technology. By moving the electricity generating plants closer to heat users and interconnecting with the grid, efficiencies of up to 80 percent are attainable, or a two and ½ times improvement over the present system.[17] Thus, cogeneration reduces fuel use and costs.

The State of California recently performed an inventory of State buildings for potential cogeneration projects which would reduce State operating costs and produce at least as much electricity as the State consumed at the facility.

The inventory found a technical potential of 700MW at 188 State facilities, 400MW of which are currently economically feasible. This 400MW of cogenerated electricity would save 8.8 billion cubic feet of natural gas or 1.5 million barrels of oil annually and would produce more than 2.4 billion kwh of electricity annually, enough to supply nearly one million new homes in California. The dollar savings from 400MW of cogenerated electricity was conservatively estimated at $140 million annually. 18) Over the life of the projects, the State would save $7 for every $1 invested. 19) The first batch of projects are now getting started. They are Napa State Hospital (2.5MW), San Jose State (4MW), and Soledad Correctional Facility (4MW).

Gas cogeneration has not been introduced to Humboldt County but potential exists to convert several large buildings or facilities that presently use natural gas or fuel oil to heat water and space. Project Independence found about 2.3MW capacity of cogeneration projects that are economically viable at this time. Economic viability means that these projects could be designed, financed and constructed for a profit within six year payback period. The potential projects were reviewed for Project Independence by Amos & Andrews, Inc. an engineering firm. These potential projects are:

	System Capacity (kw)	Simple Payback (years)	Annual Utility Savings ($)
1) The County Courthouse/ Health Center	325	6	80,763
2) The Humboldt State University	1100	3.5	473,865
3) The Jolly Giant Complex	450	5	132,805
4) The Arcata High School/ Arcata Pool	450	12	57,572
5) St.Joseph's Hospital	425	4	156,713
6) Mad River Community Hospital	300	11.5	39,623

These projects are the currently known resources. Other facilities whose high energy use could make them a cogeneration site include, but are not limited to:

- College of the Redwoods
- General Hospital
- The Clark Complex *
- Eureka High School
- Eureka Inn
- Sewage Treatment Facilities

The Project Independence Committee concluded that there are potentially 7.5MW of gas cogeneration projects developable in the County in the next decade. As the costs of energy rise and the operating budgets expand, cogeneration projects at these and other facilities will probably become economical.

Barriers to Gas Cogeneration

One big barrier to cogeneration projects is the difficulty of retrofitting old buildings to accomodate the equipment. Since most buildings weren't designed to have all energy needs met from one source, retrofitting can prove to be cost prohibitive. Detailed feasibility studies must be performed on each facility.

Additionally, cogeneration projects could run into the problems of financing. Some engineering firms do not study buildings under a certain size or certain energy usage. That means small projects could be bypassed because of small dollar returns.

Presently legislation is being enacted that would give general law local governments authority to participate in the same third-party financing of energy facilities **as the State and charter cities currently have. The legislation, AB1942, will encourage development of available cogeneration potential on more government facilities. The main impetus for entering into a third-party financing arrangement is to avoid the upfront costs of developing a project. Cogeneration projects generally require a capital expense of $1000 - $1500 dollars per kilowatt capacity installed.

Recommendations

- The County government should continue to proceed with the feasibility studies on the Courthouse Complex and should do the project if it proves out to be economically viable. If it is successful, the project should be publicized in order to motivate other public agencies and private facilities to investigate cogeneration for their large facilities.

* this could potentially be added to a financing package with the Courthouse Complex.

** this method of financing allows the facilities to lease the cogeneration equipment, or buy energy, from a private sector investor who has installed cogeneration equipment in the facility.

- The County should consider cogeneration if and when it modifies its structures or builds new facilities.

- The County government should continue to investigate the methods of financing its cogeneration projects in order to gain the most favorable return.

- The County should request that PG&E make its Financial Analysis Program and its Environmental Regulations Assistance Program available to the County to analyze potential cogeneration projects on the County facilities.

- The County should request the assistance of the California Energy Commission in analyzing third-party financing proposals received by the County.

- The County government should support AB1942 which allows third-party financing of cogeneration equipment on County buildings.

- The County government should oppose the repeal of the State and Federal energy tax credits and any legislation limiting the availability of tax-exempt or third-party financing.

WIND ENERGY

The power of the wind can be tremendous. Wind power can be thought of as power flowing through an open window held above the ground. The more wind flowing through the open window, the more power one gets from it. Wind power is proportional to the wind speed cubed. So that means that with small changes in wind speed, the amount of power changes greatly! For example, the amount of power generated by the wind at 14 mph is 8 times that of power generated at 12 mph. 20)

A recently completed study by the CEC found Cape Mendocino to be a "promising geographic sector in terms of wind resource" with a projected "average annual power output equated to between 150 to 200 megawatts." 21) This study found the rest of Humboldt County to be marginal or have no potential for wind development. See figure 2.

California is leading the nation in wind energy development. The wind in California is one of the reasons. Others are the technical expertise here, the active role of government, the solar energy (and wind) tax credits, and the ability to contract to sell power to the utility companies at a levelized rate. There are currently nine wind turbine manufacturing companies located in California producing 50% of the nation's wind turbines. 22)

There are also over 1000 wind turbines producing power in California. In PG&E's service territory alone, PG&E has contracted with 17 different developers to buy 330MW of electricity and is in contract negotiations with another nine wind-farm developers for an additional 188 MW.[23][24]

Wind farms are simply areas where many wind turbines are placed in order to capture the maximum amount of available wind. Several factors besides wind potential of an area affect viability of wind projects. These include:

- proximity to transmission lines
- " " access roads
- land use considerations
- aesthetics and public acceptance
- environmental impacts
- electromagnetic communication interference.

The potential windsites (sub-windfarm size) in Humboldt County are not limited to Cape. A site might not be commercially viable at 12 mph, but it could satisfy the power needs of a few homes surrounding the site. Or it could pump the well water for the homes without meeting any of their power needs. Other sites located by Project Independence that deserve further study are: Shelter Cove, Table Bluff, Cape Ridge, Barry Ridge, Bald Hills, Patrick's Point, Windy Gap, Prosper Ridge. See Figure 3. Several other sites have actually been tested (Arcata, Hoopa) but showed that the proposed projects were not viable because of low wind speeds.[25][26] Many very small off-grid wind systems (300-1000 watt)have been installed in Humboldt County at remote locations for a few years. These systems provide the operators with their power needs (usually through a battery system) and/or their energy needs (pumping,compressing, etc). According to Harold Hough of PG&E, there are over 50 systems operating in Humboldt County today. Hough expects this number to steadily move higher as the costs of electricity and extending utility lines increase.

The Barriers to Developing the Wind Resource

The potential barriers to developing the wind resource in Humboldt County are many. The CEC wind assessment report reiterates the concerns of the environment, business, social, economical, technological and aesthetics effects. The persistance and advancements of the wind industry will eliminate some of these barriers (technological reliability, component safety, reducing effects of communication interference.) Some barriers will be harder to eliminate than others (transmission line costs, access roads, no wind periods, land use designation conflict in coastal areas). The majority of barriers must be overcome before the wind potential in Humboldt County can be realized.

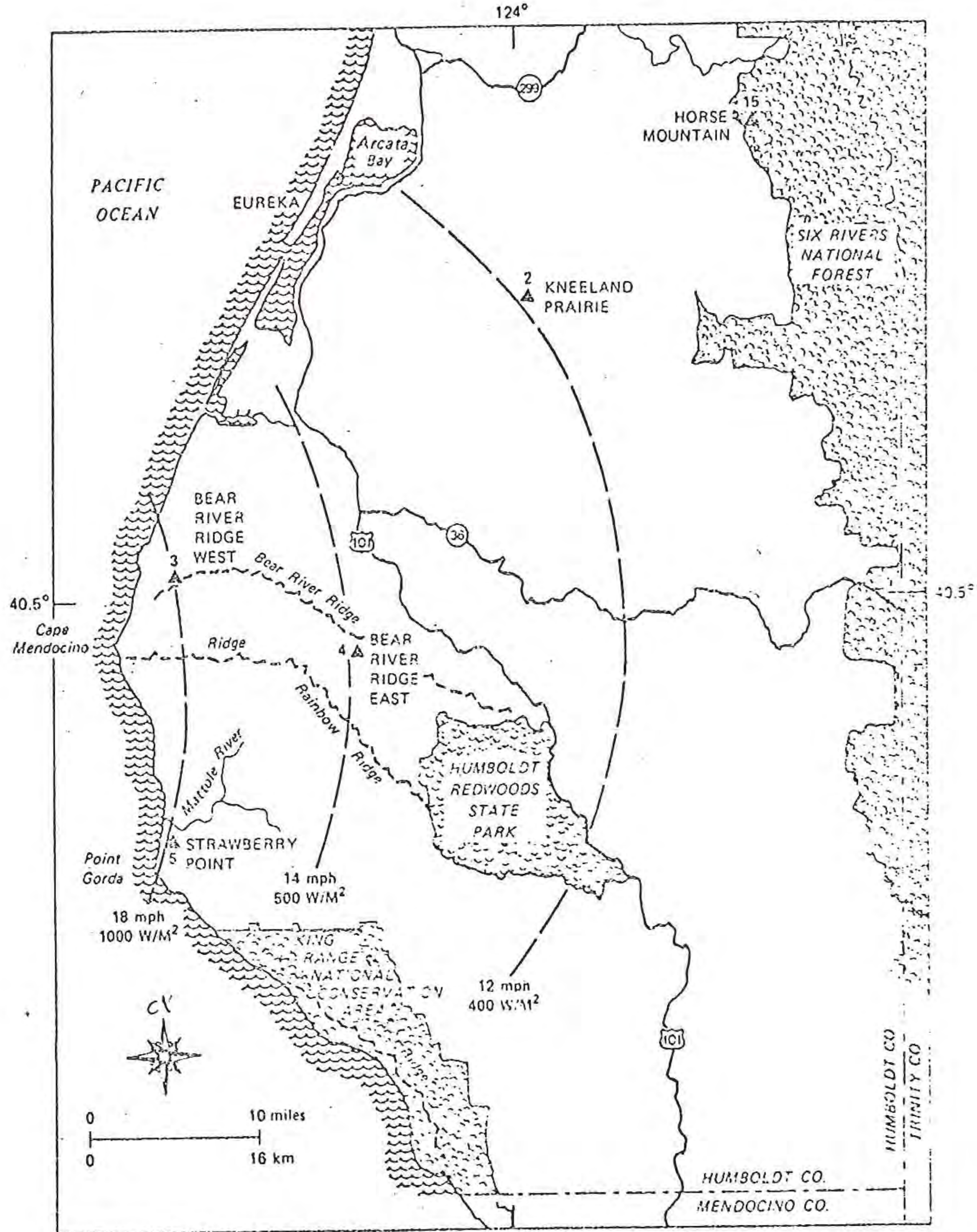


FIGURE 2 ESTIMATE OF POTENTIAL WIND RESOURCE AT 46 m ON EXPOSED RIDGES NEAR CAPE MENDOCINO

Source: "Wind Energy Assessment- for Northwestern California" Executive Summary, California Energy Commission, 3/83

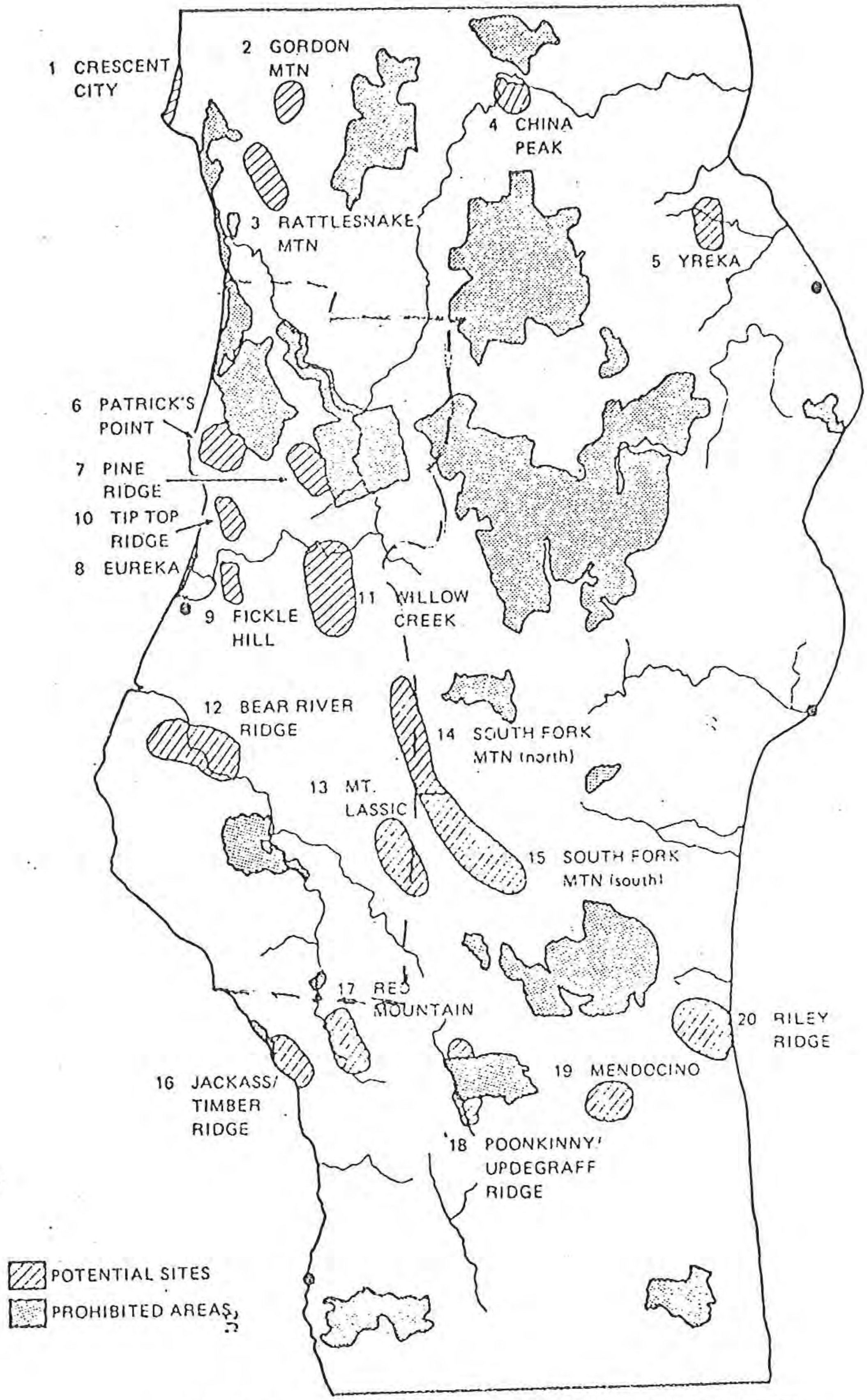


FIGURE 3 MAP OF NORTHWESTERN CALIFORNIA SHOWING PROHIBITED AREAS AND POTENTIAL WINDFARM SITES

Source: Wind Energy Assessment-for Northwestern California, California Energy Commission. Three interim reports. Consultant report. June 1982.

Developing any of the other potential wind sites in the County will require wind testing at each site. Limited wind data on some sites is available but not compiled in one place. Anemometers for wind testing, are costly for individuals, only used once (for a year), and may only prove that a site is not a viable one. This is a major barrier for individual wind installations which might be placed elsewhere in the County.

Project Independence felt that the role of the County in accelerating wind resource development should be that of a facilitator for private sector development.

Recommendations

- The County should support the extension of the California and Federal solar tax credits.
- The County government should work with PG&E in coordinating the wind developers with land owners on Cape Mendocino.
- The County should define the permits that will be needed for wind farms and individual wind generators.
- The County should develop a wind ordinance that protects the rights of wind developers (like the solar access ordinance)
- The County should work with PG&E to develop a clearinghouse of the available wind data and studies to be made available to the public
- The County should apply to the CEC Anemometer Loan Program for anemometers to be made available for assessing potential windsites by the public.

BIOGAS GENERATION

Biogas (or methane produced from digestion of manure) can be produced and then used to generate electricity by farmers and consequently reduce operating costs. While Humboldt County has over 15,000 cows, few farms have enough cows (over 300) to produce the quantities of manure considered necessary for economical production of biogas. However, there is a concentration of farms in the Ferndale area which together have far in excess of this minimum amount of cows.

Farms elsewhere in California have proven the economic viability of the process. Project Independence felt that a cooperative biogas production facility might be economically feasible, but further assessment was beyond the scope of the study. There are currently monies available from the California Energy Commission and The Farmer's Home Administration for doing biogas projects.

Recommendation:

The County Board of Supervisors should request the Humboldt County Energy Advisory Committee (HCEAC) to take over the development of the biogas resources as an ongoing project. The HCEAC should work with the College of the Redwoods, Humboldt State University, the CEC, FHA, Agriculture Extension Office, Farm Advisors Office, The Production Credit Association, Bank of Loleta's Agriculture Loan Program, and other agencies involved with agriculture development to assist farmers in receiving the funding for a demonstration project.

OTHER FORMS OF BIOGAS GENERATION

The generation of biogas is being done or being planned at some waste tretament facilities in the county. At the Arcata plant, the process of trapping the methane gas from the decaying waste water is similar to the methane digester process. The methane gas is recovered, used as a fuel source to run the combustion engine, which is used to run the pumps and electrical needs of the plant. The waste heat from the engine is then cycled back into the waste water to heat it up which causes a greater and faster release of methane gas.

There are some treatment facilities, McKinleyville for example, that cannot recover the methane gas because the process used is aerobic, not anaerobic. The production of methane does not occur with aerobic digestion.

Recommendations

- Older waste water facilities should be retrofitted with methane recovery units where economically feasible, technically possible, and environmentally stable.

- For any new facilities, anaerobic digestion should be evaluated during the design stage for the facility.

Methane recovery from existing landfills is sometimes a viable process, but each landfill is different. The technology has been working profitably in other parts of the state. The resource here, if any, is untapped.

Recommendation:

- The County should invite landfill methane recovery speculators to assess its landfill sites.

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ALCOHOL FUELS

Project Independence decided to study alcohol fuels (produced from agricultural wastes and/or crops) because of the county's large consumption of transportation fuels and because the cost of fuel here is substantially higher than in areas that have local refining facilities, added fuel costs are rolled in to the local prices of goods purchased here and for products exported. Despite state and federal financial incentives, alcohol fuels are just barely economic compared to the present cost of conventional fuels. In addition, to develop a production system here will take large amounts of capital and quite a number of changes in the present operations of local farmers and the fuel distribution systems.

On the other hand, if these hurdles were overcome, the county easily has the cropland to produce 1/3 of our present fuel requirements. This amounts to a reduction in export of fuel monies on the order of $30 million annually.

What is needed for development of this resource is a team effort on the part of many local agencies including HSU, College of the Redwoods, FHA, the County Agricultural Extension Office, etc. to develop a demonstration project as the first step to showing the viability on a large scale.

Recommendations

- The County should proceed with its planned conversion of some of its vehicles to run on alcohol fuels
- The county should request that the HCEAC work with other local agencies to get funding to develop a demonstration project

LOW-TEMPERATURE SOLAR USES

Project Independence added solar systems to its scope of study because of the local economic benefits associated with its further development. Since it is felt that this technology is common and well understood, this section will cover only the barriers found to complete development of the local resource.

Solar Energy in Humboldt

In Humboldt County solar energy is proving to be a very good way of saving dollars and energy for those who can afford to install systems. The passive design applications work well here in Humboldt because we require no cooling, and houses can be designed strictly to be passively heated. Greenhouses and home remodeling are the best applications of passive design here. Active solar water heating systems are being sold quite steadily by a number of local solar firms. There are even commercial-size active systems in place in Humboldt County; The Redwood and Sunset Manors on the HSU campus; and the planned active system at CalCourts. Nevertheless, high initial costs of solar hot water systems is a big barri to rapid conversion to solar energy. Solar leasing is one approach to lowering the cost of a solar system to the user by having an investor purchase a system and lease it to the user. The way the Federal and State tax credits are designed, the investor can take both tax credits, business investment tax credits, and depreciation write-offs. The user can receive a tax credit on the lease payment for the system in cases where leasing is done via a municipal solar utility (MSU). The investor would receive monthly lease payments from the user, and the user would save money on his energy bill because the lease payment would be less than the user's monthly energy savings.

The concept of solar leasing is being explored in Humboldt County. The County and several cities have passed enabling ordinances which allow for the formation of a Municipal Solar Utility. The County is now considering starting up the program.

Recommendation:

- The County should move forward on implementing the solar leasing program.

- The County should continue to support the extension of the state tax credits.

The solar access ordinance recently passed by the County is a sound and necessary first step to ensuring the long-term viability of solar installations within the County. However, information on how to apply the solar access ordinance to specific building sites, especially hillsides, is still needed. HCEAC is developing a booklet which should fill this purpose once completed; however, speedier implementation is needed as applications are being received every day at the Planning and Building Departments which could benefit from the information to be presented.

Passive solar additions to existing buildings can be very effective for reducing energy bills in most areas of the County. High capital costs for the purchase and/or construction are one barrier to rapid implementation. Certain restrictions in zoning and building codes could be further barriers to full usage. For example, present zoning law restricts the expansion of any non-conforming use of a building or property. Older dwellings which might benefit from a passive solar addition to replace high cost fossil fuel use would be prohibited from same if the building is classified as a non-conforming use.

Recommendation:

- The local economic development agencies should apply for low interest loan monies for passive solar additions from such sources as the Federal Conservation and Solar Bank.

- The County should identify specific barriers in the County regulations which could be eliminated to enhance the rate of installation of passive solar additions. Passive solar additions should be exempted from such restrictions where other, more substantive zoning regulations are not involved.

PHOTOVOLTAIC ENERGY

Solar (photovoltaic) cells produce electricity directly from the sun without moving parts. They have been used successfully in remote rural areas where other forms of electricity are not available for residential energy requirements, agricultural water pumping, remote communication stations, forestry outlook towers, and weather stations. The price per peak watt of photovoltaic generating capacity has declined from $20 per peak watt in 1977 to the current price of $8.50 per watt. The cost of photovoltaics is high due to a number of reasons: expensive materials, energy-intensive processing, the hand assembly of cells, and support equipment including the array structure, tracking mechanism, electrical wiring, and battery storage.

A photovoltaic array to supply 100% of the electrical needs of a home would cost about $21,250 for the solar cells, plus an additional $2,500 for a voltage regulator, wiring, racks and batteries, for a total of $23,750.

Residential use of photovoltaics is very popular in the sunny rural areas of Humboldt County. According to a PG&E representative, with over 1,000 installations, Humboldt County is the largest user of photovoltaics for residential applications in the nation. (Harold Hough, PG&E Small Power Advisor, conversation, March, 1983)

The potential establishment of a county-wide municipal solar utility could encourage the use of photovoltaics by providing leasing opportunities to apartment owners.

A "fog belt" extends from 7 to 20 miles inland along the entire Humboldt County coast. Most photovoltaic applications will therefore probably occur in the isolated inland areas of the County especially since in many cases, it is less expensive to install photovoltaic cells than to pay the high cost of extending utility lines several miles.

Until photovoltaics is cost-effective for other than remote applications, it will probably not contribute a great deal to local economic development. However, as prices decline in the future, there is likely to be an increase in the number of photovoltaics-related jobs in the fields of distribution, sales and installation. Project Independence has no specific recommendations relating to development of photovoltaics.

ENERGY MANAGEMENT/CONSERVATION

Project Independence added energy management/conservation to its study on Humboldt County's energy resources; energy management is an energy resource because it extends the life of our non-renewable resource and reduces the need for development of new resources. By consuming the resources more efficiently today, hence, the less we use, the longer the resources will last. The role of energy conservation or energy management is that of the stabilizer of the energy supply. Also it was felt that energy management would rank high in economic development benefits.

Description of this resource and local activity will be limited here because it is felt this resource is well developed and well understood here. Instead only specific recommendations of Project Independence will be presented.

Recommendations

- The Board of Supervisors should place a high priority on achieving the energy management, conservation, and alternative energy goals, policies, and action plans in the proposed General Plan Hearing Draft and the additions proposed by the Humboldt Energy Commission and which staff included as recommended additions in the January 20, 1983 Staff Report on the Hearing Draft, especially those relating to reducing energy and transportation costs throughout the County.

- The County should continue its commitment to having effective energy management strategy for all improvements made on public facilities and for all new facilities, equipment, or vehicles.

- The County should appoint an energy manager who is responsible for implementing county energy management programs.

- County offices should continue to maintain energy use/savings records for analysis of the effectiveness energy saving steps taken. These records should be put in the form of a chart/graph for public display at the courthouse.

- The County should request an energy use analysis by PG&E every two years to keep up with changes in technology, etc.

- The County should develop an incentive program for cost-effective improvements to facilities, etc. such as part of savings accruing to department budget or an energy management fund for future improvements and/or for a self-supporting energy management program.

- The County should propose that a portion of the next revenue sharing monies be put into an energy management program to install energy efficiency improvements in County facilities with the savings being pooled and used with the above recommendation.

- The County should use the Humboldt County Energy Advisory Committee to develop the idea of the self supporting energy management program with initial funding from revenue sharing monies.

- Any notable efforts, especially successes, should be publicized.

- County should support state level legislation to authorize local ordinances designed to give incentives to homeowners/multi-family dwelling owners and businesses such as tax breaks, reduced permit fees, etc.

- The County should endorse efforts of the Campus Center for Appropriate Technology on HSU's campus and support the reopening of the Net Energy Demonstration House.

Recommendations for Other Local Agencies on Energy Management

- Highly visible demonstrations of techniques in energy management like CCAT are needed in each sector of the community as a continuing and concrete form of both education and motivation for people.

- PG&E should do a thermographic scan in cooperation with local contractors/installers/weatherization programs, etc. to follow up and to close the sale "with ZIP", etc. This could be accompanied by brochures, radio and TV spots, announcing vehicle locations and showing the typical pictures from one house.

- PG&E should do more clever marketing of energy management such as TV cartoon ads on conservation showing animated figures turning off shower nozzle while someone is soaping up, an animated cold water heater asking for a blanket, etc. and ending up with the idea of "here's your monthly check" (from PG&E).

Transportation

- The variety of Bus transportation systems within the system should coordinate their schedules with each other and with the airlines

- The transportation systems should provide more bus shelters for passengers

Footnotes

Chapter 1:

1. Redwood Region Economic Development Commission, An Economic Development Action Plan and Strategy for Humboldt County, California, February, 1978.

2. Pacific Gas and Elactric Land Department, Humboldt Division Growth and Development Study, September, 1982.

3. Office of Economic Policy, Planning and Research, Department of Economic and Business Development, Eureka Economic Profile, September, 1982.

4. Humboldt County Planning Department, "Background Study: Economic Development, Hearing Draft, General Plan," October, 1982.

5. OEPPR, p.13.

6. OEPPR, p. 54

7. Humboldt County Energy Advisory Committee, "A Report on Energy Use in Humboldt County, and an Identification of Major of Policy Recommendations," April, 1981.

8. Project Independence Scope of Work, Grant Agreement, April, 1982.

Chapter 2:

9. California Energy Commission, Securing California's Energy Future, Draft 1983 Biennial Report, Ocotber, 1982, p. 5-3.

10. Harold Hough, PG&E, Eureka, January, 1983.

11. Mike Benson, PG&E, Eureka, January, 1983.

12. Bill Burton, Project Independence Intern, May, 1983.

Chapter 3:

13. North Coast Energy Services, "Fact Sheet on Biomass Generation," February, 1983.

14. Office of Appropriate Technology, State of California, Biofuels Development and Soil Productivity, June, 1982.

Humboldt County Energy Report

The Redwood Coast Energy Authority (RCEA) was formed in 2003 and represents 7 municipalities. They are: Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Trinidad and Rio Dell. This report is discussing the various topics of the purpose of the RCEA including; develop/implement sustainable energy initiatives the reduce energy demand, increase energy efficiency and advance the use of clean, efficient and renewable resources available in the region. This draft report is divided up into 8 chapters.

- Chapter 1- Background and Introduction
- Chapter 2- Electricity and Natural Gas Demand
- Chapter 3- Regulatory Environment
- Chapter 4- Electricity Supply
- Chapter 5- Natural Gas
- Chapter 6- Demand Side Management/Energy Efficiency
- Chapter 7- Distributed Generation and Renewables
- Chapter 8- Recommendations for Additional Research and Next Steps

This is a very pertinent report that addresses many of the energy demands of Humboldt County residents. It does not cover any of the alternative forms of energy, but that we found in other reports. This report was written to address our local energy needs and help with the state's goal of conservation, local clean generation and renewables. The report goes into the history of energy planning in Humboldt and sites earlier documents, one of which we have included (The Humboldt County Plan to Accelerate the Economic Development of Local Energy Resources). We get most of our electricity from PG&E which is a public utility and our rates, as with the rest of California, are about twice the national average. The researchers who compiled this report state "there is about 10-14 megawatts of potential local renewable generation capacity that might be readily brought on-line to improve the supply-demand imbalance in this area".

The most useful thing about this report is it is up to date and therefore the information is accurate. This draft report was given to the public June of last year and the final report will be coming out soon. The report divides Humboldt County energy users into 4 categories: residential sector, commercial section (except timber and agriculture), industrial sector (mostly timber) and agricultural sector. It gives the percentage of demand by each sector with the industrial sector using a whopping 47% of the county's total electricity consumption. This report should definitely be used by the Outpost, but keep in mind the final report is soon coming out and the Energy section of the Humboldt County General Plan, out in lat May, covers much of this report.

Humboldt County Energy Report

Draft

June 2004

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Customer Disclosure and Funding Source Notice

The Regional Energy Authority Pilot Project operated by the Local Government Commission and its subcontractors is funded by Public Goods Charge funds paid by California ratepayers under the auspices of the California Public Utilities Commission. You are not obligated to purchase any full fee service or other service beyond that which is funded by the Public Goods Charge funds.

Table of Contents

Chapter 1: Background and Introduction

The Redwood Coast Energy Authority (RCEA) was formed in 2003 as a Joint Powers Association, representing seven municipalities (the Cities of Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Trinidad and Rio Dell) and Humboldt County. RCEA's purpose is to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient and renewable resources available in the region.

This draft Energy Report was developed as a current snapshot of electricity and natural gas supply and demand[1], provide a current situation analysis, and highlight the growing importance energy efficiency in accomplishing long-term energy resource adequacy. The Report will establish a framework and the information upon which the region can develop a preferred energy supply strategies with the goal of achieving a reliable, affordable and sustainable energy future for Humboldt County. The Report is not complete in its current form, but merely a starting point for engaging in discussions and a more collaborative process for developing local energy strategies, plans and programs.

Since being formed in 2003, the RCEA Board has been considering the potential programs and strategies it can pursue to best serve its mission. Currently, the RCEA program efforts are primarily focused on energy conservation. To a large extent, these programs are limited by the objectives of its funding sponsors.[2]

In order to best understand the need and importance of energy conservation, one must fully understand the broader issues of supply and demand that motivate and drive the need for these programs. Current government state energy planning efforts place the highest priority on conservation, local clean generation and renewables to meeting the State's resource needs through an Integrated Resource Planning (IRP)[3] process. A local energy plan could be a valuable contribution to this process.

The need for energy conservation and other alternative strategies like renewables, is driven by the growing imbalance between supply and demand and the industry's increasing dependence on natural gas. Additional motivation for such planning comes from the growing costs of electricity and natural gas. These costs have significant impacts on the local economy. This Report will enable the region to address how it can best utilize energy programs to reduce the drain of energy dollars from the region.

Research for this Report included a comprehensive review of all available data sources on regional electricity and natural gas supply and consumption, and some economic indicators

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[1] This study addresses electricity and natural gas only. For the purpose of this study, the use of the term "energy" refers only to electric and natural gas use in Humboldt County. Transportation energy is not addressed as part of this Report.

[2] The RCEA has received funding from the California Public Utilities Commission (CPUC) for an energy efficiency information and education program, as well as Department of Energy Million Solar Roofs Program funding for addressing market barriers for the accelerated deployment of solar systems throughout the County.

[3] Integrated Resource Planning is a public planning process and framework within which the costs and benefits of both demand- and supply-side resources are evaluated to develop the least-total-cost mix of energy resource options. In many cases, IRP includes a means for considering environmental damages caused by electricity supply/transmission and identifying cost-effective energy efficiency and renewable energy alternatives.

that drive energy use, such as housing. In addition, a review of previous energy planning efforts was conducted as well as interviews with several key stakeholders in regional energy issues.

Why a Regional Energy Plan?

The current emphasis on statewide energy planning does not necessarily mean that local energy planning is not necessary. The importance of local planning is essential and well understood for issues like transportation, land use, waste management, water supply and housing, but less understood for energy. In today's environment of constrained electricity and natural gas resources, the need for local energy planning is even greater than ever before. The drivers of energy use, supply and the potential for unique strategies and innovative programs are unique to Humboldt County. For example, Humboldt County is one of the few winter electricity load peaking planning regions in the state of California[4]. In addition, Humboldt County has a tremendous amount of renewable energy capacity and potential[5]. This potential could be utilized to a greater extent to assist PG&E and the State of California achieve its aggressive Renewable Portfolio Standard[6] goals.

The Benefits to local government engaging in energy planning are significant, including the potential to:

- Improve the quality of life for their citizens;
- Retain energy dollars in the local economy;
- More effectively incorporate the concerns of local citizens in energy decisions;
- Improve local air quality; and
- Identify the areas where the local County can best assist the State to meet or exceed its policy goals.

The RCEA is well positioned to provide the leadership for such planning. A Regional Energy Plan could become the basis for the organization to build on its current successes to access additional funding for regional energy programs. In addition, a Regional Energy Plan could provide the necessary focus on energy issues that are often lacking in County general Plans. Humboldt County is currently updating its General Plan, so now is an appropriate time for the RCEA to engage in a formal energy planning process. An overview of the issues that can be considered in General Plans is outlined in Appendix A.

Humboldt County has a long history of local energy planning. A Study was completed in April 1981 by the Humboldt County Energy Advisory Committee (HCEAC) entitled A Report on Energy Use in Humboldt County and the Identification of Major Areas of Policy Recommendations. This report was done during a time when utility costs were estimated to be rising at 17 percent per year. This report estimated that in 1980, $151 million was spent on energy (including all forms), and of this, $135 million left the local economy. At that time,

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[4] Typically, electricity demand peaks occur during the summer months due to high air-conditioning loads.

[5] Humboldt County's idle renewable capacity (power plants that are fully operational but shut down due to economic or other regulatory constraints) exceeds the total capacity of many California counties that are much larger.

[6] California's Renewable Portfolio Standard (RPS) [Senate Bill 1078. Chapters 516, Statutes of 2002, Sher] was enacted in response to growing concerns about over dependence on natural gas. The RPS requires all retail suppliers of electricity in the state, including IOUs supply at least 20 percent of their sales from renewable energy resources by 2017. Current legislation is considering accelerating the RPS to achieve 20 percent by 2010.

transportation fuels accounted for 61 percent of the total energy use (on a Btu basis), representing $91 million dollars, or approximately two-thirds of energy costs. The report recommended that the two major actions would be necessary to decrease the amount of dollars leaving the county - conserving energy and alternative energy development.

In 1983, as a result of "Project Independence," the County published The Humboldt County Plan To Accelerate The Economic Development of Local Energy Resources. That plan was motivated by the slowing economy and its impact on the local timber industry – the primary economic driver for the region. The study assessed the near-term development of renewable resources, quantified the comparative and cumulative economic impacts of small-scale renewable energy projects, and suggested actions to speed the development of these projects. Some of the conclusions of this report included:

- The County should place a high priority on achieving energy management, conservation, and alternative energy goals, policies and action plans in General Plans.
- The County should develop an incentive program for cost-effective improvements to facilities. As part of this program, savings would accrue to an energy management fund for future improvements and/or for a self-supporting energy management program.
- The County should use the Humboldt County Energy Advisory Committee to develop the idea of the self-supporting energy management program with initial funding from revenue sharing projects.
- An estimated 250 to 375 megawatts of energy resource development existed in Humboldt County.
- Over 560 permanent jobs could be created by pursuing these energy resources.
- County or other revenues generated by this development could reach $2 million annually.
- Local resource development could help stabilize the region from energy supply interruptions.

In 1981, the City of Arcata also pursued the Arcata Municipal Solar & Conservation Utility. The purpose of this entity was to overcome the major barriers to the widespread implementation of conservation and solar programs in the Humboldt and Arcata area, including: 1) high initial capital costs and low capital availability, 2) lack of risk assurances for consumers to reduce and/or eliminate risk for new and innovative technology, and 3) the lack of credible data for area-specific decision making and cost benefit analysis.

It is interesting to note that many of the challenges that the region faced in 1980, it still faces today. Although electricity rates did not grow at 17 percent per year, as a result of the energy crisis of 2000-2001, PG&E and the State of California rates are nearly twice that of the average in the US[7].

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[7] PG&E's system average rate is 13.8 cents/kWh (Source: CPUC). The average rate for all utilities in the U.S. is 7.2 cents/kWh (Source: DOE).

Since 1980, electricity costs in Humboldt County have grown over 200 percent from $36.9 million to an estimated $120 million. Natural gas costs have increased 83 percent from $19.7 million to approximately 36 million[8].

In addition, there still remains a significant potential for energy efficiency, local self-generation and addition renewable energy resources to be developed in Humboldt County. According to recent data, there are at least 10-14 megawatts of potential local renewable generation capacity that might be readily brought on-line to improve the supply-demand imbalance in this area. There are also several areas within Humboldt County that have promising potential for major wind projects to assist PG&E and the State to achieve its Renewable Portfolio goals. In additional, there are tremendous opportunities to better focus energy efficiency programs that are available to consumers of the region.

Organization of the Report

Chapter 2 provides an overview of both electricity and natural gas demand, including discussion of contributions by respective sectors (including residential, commercial and industry) and various drivers to demand.

Chapter 3 provides and overview of the regulatory environment surrounding electricity and natural gas industry. Included are discussions of the current regulatory trends and issues that could impact Humboldt County's ability to achieve a more sustainable energy future.

Chapter 4 addresses utility-scale electricity supply issues, including the generation and transmission infrastructure.

Chapter 5 addresses natural gas supply issues.

Chapter 6 addresses energy efficiency resources.

Chapter 7 addresses distributed generation and renewables resources.

Chapter 8 consists of recommendations for additional study and issues for consideration by the RCEA.

[8] 1980 data source Arcata Municipal Solar & Conservation Utility Final Report. Current data derived from CEC consumption figures for 2003, and PG&E tariff data.

Chapter 2: Electricity and Natural Gas Demand

Total Historical Electricity Consumption and Demand

Humboldt County's electricity consumption for 2003 was approximately 939.8 million kilowatt-hours (kWh)[9], which represents approximately 0.26 percent of the total California consumption. For the past decade, electricity consumption has grown an average of 0.6 percent. While consumption saw over a 7 percent decrease during the energy crisis of 2001, like much of the State, much of that savings was behavior-driven as evidenced by a subsequent increase in consumption of over 5 percent in 2003.

Electricity peak demand is estimated to be about 146 megawatts for 2004. Peak demand is estimated to increase on average by 1.3 percent per year[10], slightly less than the average of 1.5 percent for all of PG&E service territory. To put this electricity demand into perspective, it is only about 12 percent more than the total output of the PG&E generating units at the Humboldt Bay Power Plant and is approximately 54 percent of the total in-County generation capacity.

Electricity Consumption By Sector

Residential Sector

Humboldt County's residential sector uses approximately 35 percent of the total electricity consumption for the County. This compares to an average of 30 percent residential electric consumption for the State of California.

The 2003 costs for electricity for the residential sector for Humboldt County are approximately $41.8 million.

The primary end-uses for the residential sector include: lighting, refrigerators and freezers, laundry, heating and ventilation, pools and spas, water heating, cooking and miscellaneous plug loads (e.g. televisions, computers, etc.)

Commercial Sector (except Timber and Agriculture)

Humboldt County's commercial sector (excluding timber and agricultural industries) uses a total of 16 percent of the total electricity consumption for the region. This compares to an average of 35 percent commercial electric consumption for the State of California. The 2003 costs for electricity for this sector was approximately $29.7 million.

The primary end-uses for the commercial sector include: lighting, plug loads (e.g. computers, office equipment), heating and ventilation, refrigeration and exterior lighting.

Industrial Sector (primarily Timber)

Humboldt County's industrial sector (primarily timber) uses a total of 47 percent of the total electricity consumption for the region. This compares to an average of 22 percent industrial electric consumption for the State of California. The 2003 costs for electricity for this sector was approximately $44 million.

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[9] Electricity consumption does not include consumption offset by small distributed generation systems, like rooftop solar and off-grid hydro. It does include consumption of larger customers that have larger generation systems, like Fairhaven Power Company (Eel River Sawmills, Inc.) and Pacific Lumber Company.

[10] PG&E Transmission Study.

Agricultural Sector

Humboldt County's agricultural sector uses a total of approximately 2 percent of the total electricity consumption for the region. This compares to an average of 7 percent agricultural electric consumption for the State of California. The costs for electricity for this sector was approximately $4.1 million.

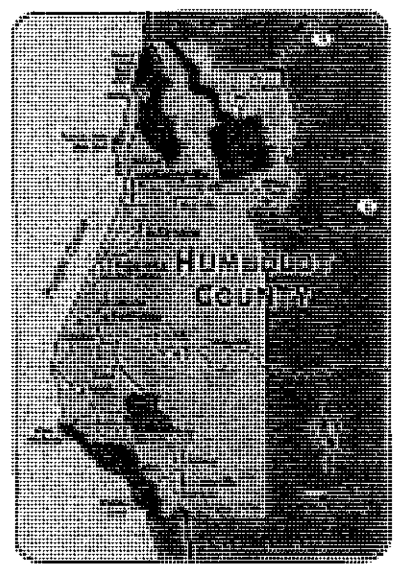
Per Capita Electricity Consumption

The per capita electricity consumption of Humboldt County was approximately 7.3 MWh, compared to a statewide average of about 7.1 MWh. It is difficult to draw conclusions from this statistic without further detailed analysis. It is likely that the average residential demand is much lower than that of the average of the state due to the milder climate and lack of air-conditioning loads. On the other hand, the relative contribution of the energy intense timber sector in Humboldt County is much larger than that of the rest of the state.

Electricity Demand Drivers

Long-term electricity use trends are driven by many factors, the most significant being economic, population, commercial building and new housing.

Geographic



Humboldt County is bounded on the north by Del Norte County (served by PacifiCorp); on the east by Siskiyou (served by PacifiCorp) and Trinity counties (served by Trinity County Public Utility District); on the south by Mendocino County and on the west by the Pacific Ocean. The County encompasses 2.3 million acres, 80 percent of which is forestlands, protected redwoods and recreation areas.

Climate

Climate plays the most significant role in driving energy demand. Humboldt County is a region with moderate temperatures and considerable precipitation. While the average summer temperature of some areas of Northern California is as high as 111°F, Humboldt County's average summer temperature is 79.8°F. Temperatures along the coast varies only 10 degrees from summer to winter, although a greater range is found over inland areas. Temperatures of 32 degrees or lower are experienced nearly every winter throughout the area, and colder temperatures are common in the interior. Humboldt County differs from many parts of the state. Like the Pacific Northwest, Humboldt County has a winter electricity peak demand, rather than a summer peak demand like most of the state.

In most years, rainfall is experienced each month of the year, although amounts are negligible from June through August. Seasonal totals average more than 40 inches in the driest area, and exceed 100 inches in the zones of heavy precipitation. Precipitation does not play a major role in consumption, but contributes significantly to the availability of renewable hydro resources that will be discussed later in this Report.

Population

The 2000 population of Humboldt County was 126,518 and the 2002 estimated population was 127,159. This population growth rate of 0.5 percent trails the State of California growth rate of 3.7 percent[11]. The primary growth areas of the County are around the unincorporated communities of McKinleyville and Garberville, and the cities of Arcata and Fortuna.

Table 1 details County population projections over the next two decades, including estimates for several of the incorporated areas.

Table 1: County Population Forecasted Changes

Location	1998 Population	2010 Population	2020 Population
Eureka	27,750	28,870	29,830
Arcata	16,330	18,180	20,000
Fortuna	10,140	12,560	15,000
Humboldt County	124,000	131,600	140,000
Unincorporated	67,400	67,800	68,140

Housing trends

Housing is a primary driver of load growth. Humboldt County had 54,434 households in 2002 and is projected to add about 5,500 households by 2025[12]. The County has a slightly higher home ownership rate than the state average (57.6 percent versus 56.9 percent), which may suggest that the non-ownership barrier to implementing energy efficiency should not be as significant as other regions.

The County has a much lower percentage of housing units in multi-unit structures (18.1 percent versus 31.4 percent for the State of California). This would tend to increase the energy consumption per household, as multi-unit housing tends to be more energy efficient.

Economy

In many parts of the state, economic factors are a secondary driver of energy consumption. This is not the case in Humboldt County. With such a large percentage of electricity consumption being contributed by industry, economic factors are likely to be most significant.

In addition to the production of commercial and industrial sectors, personal income drives residential demand through the increased demand for electrical appliances such as computers, printers, additional televisions, or refrigerators.

Commercial demand is driven in a large measure by number of businesses and square footage of commercial building space. Other factors influencing commercial energy use are vacancy rates, taxable sales, and population.

Industrial energy use is driven by employment and the output of manufacturing plants as measured in value of shipments.

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[11] Source: U.S Census Bureau. http://quickfacts.census.gov/qfd/states/06/06023.html.

[12] Technical Background Study for the 2003 Humboldt County Housing Element. Chapter 2, page 10. http://www.co.humboldt.ca.us/planning/housing%20element/pdf/2003tbs2.pdf.

During the past 25 years, Humboldt County has experienced a gradual transition from the timber industry to more service-related industries. For example, in 1976 employment in the goods producing sectors, (mining, construction, and manufacturing), was 28 percent of total employment in the County, (EDD 1998). In 1999 employment in the goods producing sectors was 18 percent of total employment, (EDD April 1999). Over the same period, employment in the service producing sectors, (transportation, utilities, trade, finance, other services, and government), went from 74 percent of total employment to 84 percent of total employment. In other words, while employment in goods producing sectors fell 10 percent as a percentage of total employment from 1976 to 1999, employment in services producing sectors increased 10 percent.

The employment decline in the goods producing sectors was due to declining employment in lumber/paper products manufacturing. In 1976 County employment in lumber/paper products manufacturing was 7,325, while in 1999 it was 3,900. Employment in lumber/paper products manufacturing went from 18 percent of total employment in 1976 to 8 percent of total employment in 1999. Employment in other goods producing sectors, (mining, construction, other durable manufacturing, and non-durable manufacturing), taken together, as a percentage of total employment, remained constant from 1976 to 1999. Experts have characterized the transition as becoming a more "resource extractive" economy, toward becoming a more sustainable resource-based economy[13].

Table 2 shows the business patterns for the County 's business patterns

2000 County Business Patterns for Humboldt, CA Source: Bureau of Census			
NAICS/ Industry	Total Establish ments	Number with 10 employees or less	Percent > 10 Employees
11 Forestry, fishing, hunting, and agriculture sup	113	100	88%
22 Utilities	7	6	86%
23 Construction	415	393	95%
31-33 Manufacturing	186	138	74%
42 Wholesale trade	109	95	87%
44-45 Retail trade	661	575	87%
51 Information	59	48	81%
52 Finance & insurance	148	136	92%
53 Real estate & rental & leasing	140	138	99%
54 Professional, scientific & technical services	246	235	96%
55 Management of companies & enterprises	13	8	62%
56 Admin, support, waste mgt, remediation servi	125	111	89%
61 Educational services	35	32	91%
62 Health care and social assistance	418	369	88%
71 Arts, entertainment & recreation	52	43	83%
72 Accommodation & food services	347	281	81%
81 Other services (except public administration)	323	316	98%
95 Auxiliaries (exc corporate, subsidiary & regior	3	3	100%
99 Unclassified establishments	53	53	100%
Total	3538	3151	89%

13 Dan Ihara PhD, Executive Director of the Center for Environmental Economic Development.

Electricity Consumption Forecasts

According to the CEC, overall statewide electricity growth during the next decade is expected to start out at approximately 2.2 percent and level off to an average of 1.4 percent. In general, Humboldt County's electricity growth has lagged the rest of the state significantly in the last decade. More analysis of economic indicators would be necessary to determine whether this trend would continue.

Electricity Prices

California's electricity consumers currently face considerably higher rates than consumers in other Western states. Residential, commercial, and industrial consumers pay as much as 53, 110 and 117 percent more in electricity rates in California than similar consumers in other Western states, however, PG&E rates are expected to decrease somewhat starting in 2004 through 2008 due to its emerging from Chapter 11 proceedings. PG&E rates for 2003 are shown in Table 3.

Table 3: PG&E Electricity Rates by Sector[14]

Sector	**2003-2004 Electricity Rates (Nominal cents/kWh)**
Residential	12.9
Commercial	17.0
Industrial	12.4
Agricultural	19.7

Natural Gas Consumption

Direct natural gas end-use consumption (excluding natural gas used in electricity production) in 2003 totaled 48 million therms (MTh). Natural gas consumption has actually decreased by an average of 0.9 percent per year for the last ten years, compared to an average increase of about 1.0 percent per year for the State of California. This decrease is likely to be primarily due to the shifting economic basis of the region as previously discussed.

Natural Gas Consumption By Sector

Residential

Humboldt County's residential sector accounts for the largest share of primary natural gas consumption[15], using 43 percent of the total natural gas consumption. This compares to an average of 21 percent gas consumption for the State of California. The 2003 costs for natural gas for the residential sector for Humboldt County are approximately $15.3 million.

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[14] Source: CALIFORNIA INVESTOR-OWNED UTILITIES RETAIL ELECTRICITY PRICE OUTLOOK 2003 – 2013, JULY 2003. CEC Publication No. 100-03-003.

[15] Direct natural gas consumption is for typical end uses, and excludes natural gas consumption of power plants like the Humboldt Bay Power Plant.

The most significant residential natural gas end-uses are space heating and hot water heating, each of which comprises about 40 percent of all residential gas use. About 85 percent of California homes use natural gas for heating.

According to recent studies, the Statewide potential for reducing electricity and natural gas consumption exceeds 10 percent. This means that Humboldt County could be saving over $1.5 million per year in residential energy costs alone.

Commercial (except Timber)

Humboldt County's commercial sector (excluding timber and agricultural industries) contribute a total of 26.5 percent of the total natural gas consumption for the region. The costs for natural gas for this sector is approximately $9.4 million.

According to recent studies, the Statewide potential for reducing natural gas consumption in this sector is between 18 and 22 percent. If Humboldt County could achieve this level of savings, they would save over $1.9 million per year in commercial natural gas costs alone, keeping these resources in the local community.

The commercial sector has more diversity in its end-uses than the residential sector. The most significant direct commercial natural gas end-uses are heating (35-40 percent) and hot water heating (10 percent). Restaurants account for the largest share of commercial building usage (22 percent), followed by miscellaneous buildings (e.g., auto repair shops, libraries, theaters), offices, hospitals, and hotels.

Industrial (primarily Timber)

Humboldt County's industrial sector (primarily timber) contributes a total of 30.5 percent of the total natural gas consumption for the region. The costs for natural gas for this sector are approximately $10.8 million. The primary uses in this sector are fuel for heating processes and as a fuel source for combined, heat and power electrical generation.

Chapter 3: Regulatory Environment

One of the primary lessons learned from the recent energy crisis is the need for comprehensive, integrated, long-term energy planning. During the recent energy crisis of 2000-2001, many agencies stopped energy planning efforts, trusting that markets would entice suppliers to produce sufficient energy to meet growing demand. It is common knowledge now that electricity is unlike many commodities - for all practical purposes, it must be produced at the instant that it is used, making a market-driven supply/demand model extremely risky and expensive. A resurgence in energy planning at the state and local level has identified energy efficiency as the primary means to achieve resource adequacy in the coming years.

Current State and Utility Planning Efforts

Currently, the State of California is undergoing a process of shoring up its energy planning efforts. The California Public Utilities Commission, in collaboration with the California Energy Commission and the California Power Authority recently adopted a statewide Energy Action Plan (EAP)[16]. In addition, the California Energy Commission adopted the Integrated Energy Policy Report[17], which lays the groundwork for achieving the broader goals outlined in the EAP. These plans lay out broad policy objectives of the State, including:

- Meeting 100 percent of demand growth with energy efficiency, demand response, and renewable resources.
- Ensuring reliable, affordable, and high quality power supply for all who need it in all regions of the state by building sufficient new generation.
- Accelerating the state's goal for renewable resource generation.
- Upgrading and expanding the electricity transmission and distribution infrastructure and reducing the time before needed facilities are brought on line.
- Promoting distributed generation, and
- Ensuring a reliable supply of reasonably-priced natural gas.

The Energy Action Plan recognizes that energy efficiency programs are among the most important tools available to California in meeting these goals.

In addition, the investor-owned utilities, including PG&E, are once again required to develop long-term integrated resource plans. PG&E filed its draft Long-Term Resource Plan[18] in April 2004 and it is expected to be updated in July 2004. Lastly, PG&E files an annual Transmission Plan with the California System Operator (CA-ISO). Planning for transmission generally considers the most adverse conditions, such as low levels of hydroelectric power from the Pacific Northwest, higher than anticipated levels of generation outages inside the state, and the forced or economic retirement of older generation capacity.

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[16] See http://www.cpuc.ca.gov/static/industry/electric/energy+action+plan/

[17] http://www.energy.ca.gov/energypolicy/

[18] CPUC Proceeding R. 01-10-024 Order Instituting Rulemaking to Establish Policies and Cost Recovery Mechanisms for Generation Procurement and Renewable Resource Development filed April 15, 2004.

Chapter 4: Electricity Supply

Electric supply to the Humboldt area is provided by both local generation and transmission imports. Local generation consists of larger, utility-owned generations plants; smaller, privately owner cogeneration plants that are located at industrial and commercial facilities; and small electric generation located at homes and businesses. Many of the smaller generation systems are off-grid (small-scale, distributed generation and renewables will be discussed in Chapter 7).

Utility and Other Large-Scale Generation

Humboldt County has a mix of local electricity generation that totals over 265 megawatts (MW) of capacity. This represents over 181 percent of the estimated 2004 total peak demand of 146 MW, making Humboldt County a net exporter of electricity generation outside the County.

Local generation includes the Pacific Gas & Electric (PG&E) Humboldt Bay Power Plant (HBPP) located at the eastern shore of south Humboldt Bay at King Salmon. The HBPP consists of three power generating units. Units 1 and 2, constructed in 1956 and 1958, respectively, are fossil-fueled (oil and natural gas) and have a gross generating capacity of 53 megawatts (MW) each. The HBPP also includes two diesel-powered turbine Mobile Electric Power Plants (MEPPs), with a capacity of 15 MW each run that run intermittently. The long-term availability of the PG&E thermal units is a concern due to their age and dependability. The MEPPs are limited in the total number of hours of operation per year due to emission limits. The capacity factor[19] of the plants from 2001 through 2003 was only about 35 percent (normally, base load power plants operate at capacity factors in excess of 80 percent).

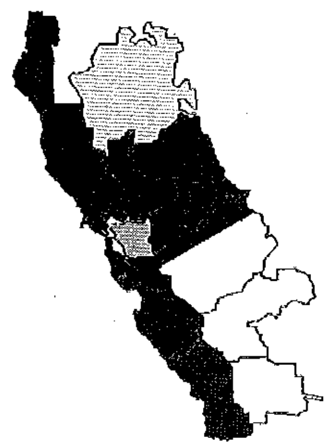

Figure 4: Humboldt County relative to the PG&E Service Territory (Humboldt County shown in dark purple at the upper left hand of the figure).

Unit 3, constructed in 1963, was a boiling water, nuclear-fueled reactor with a gross generating capacity of 65 MW that was in operation by PG&E from August 1963 to July 1976. It was closed because the economics of a required seismic retrofit could not be justified following a moderate earthquake from a previously unknown fault just off the coast. It was permanently shut down July 2, 1976, and retired in 1985. The plant was then placed in SAFSTOR (with spent nuclear fuel rods stored in water pools on site) until anticipated full decommissioning in 2015.

Electricity Transmission

The second means to provide electricity supply to the region is through high-voltage transmission interconnection to broader energy markets. The transmission grid provides for a number of functions. These functions include:

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[19] Capacity factor is the ratio of the net electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

- Support wholesale market transactions and help stabilize electric prices,
- Improve system reliability,
- Improve system stability and reliability,
- Provide additional voltage support.
- The disadvantages of new transmission are:
- New transmission can be very costly,
- Siting issues for new transmission lines are often complex due to the large number of parties that are affected by such projects (e.g. visual impacts, potential impacts on property values, concerns for the impacts of electric and magnetic fields (EMF))[20].
- This capital cost is taxed for 30 or more years.

In the recent past, Humboldt County has been identified by the CA-ISO as a region of concern due to congestion of the transmission system, as well as the potential for stability, voltage collapse, and thermal overload issues. These problems are further compounded by the reduced level of availability of the area generation due to age, generator maintenance outages, and potential shortages or limitations of fuel (i.e. natural gas, oil, wood chip fuels).[21]

Pursuant to California ISO (Cal-ISO) regulations, PG&E prepares and submits an annual electric transmission expansion plan. This Report identifies the electric transmission facilities within the PG&E territory that are projected to not meet the Cal-ISO Grid Planning Criteria during the next 5-years. The latest filing of this plan was September 23, 2003.

According to the recent PG&E Study, the Humboldt transmission system covers about 3,000 square miles, and is located at the northwest corner of PG&E's service territory (see Figure 4). The Humboldt electric transmission system is comprised of 60 and 115 kV transmission facilities.

The Humboldt area is connected to the bulk PG&E transmission system by four transmission circuits, each ranging from 31 to 115 miles. Transmission import occurs primarily through the two 115 kV circuits from the Cottonwood Substation. A one-line diagram of the transmission system for Humboldt County is shown in Figure 5.

The power import capability of the Humboldt transmission system is a function of the load within Humboldt and the amount of internal generation. Previous longer-term studies (10-years) have demonstrated that the existing system's import capability can adequately serve the projected load growth up to 10 years and beyond.

Under winter peak conditions, an overlapping outage of the Humboldt-Arcata-Janes Creek 60 kV line with Fairhaven PP unit offline could create low voltages within the Humboldt 60 kV system. The Cal-ISO has identified that about 4 MW of "Required-Must-Run (RMR) generation is required for year 2004[22].

By Oct 2004, PG&E is scheduled to construct a new 60 kV line section between Humboldt Substation and Arcata Junction. This project will eliminate the need for RMR contracts in Humboldt County.

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[20] For more information on EMF see http://www.niehs.nih.gov/oc/factsheets/emf/emf.htm.

[21] California ISO 2003 Summer Assessment April 11, 2003.

[22] RMR generation is contracted with the CA-ISO to be available during peak periods.

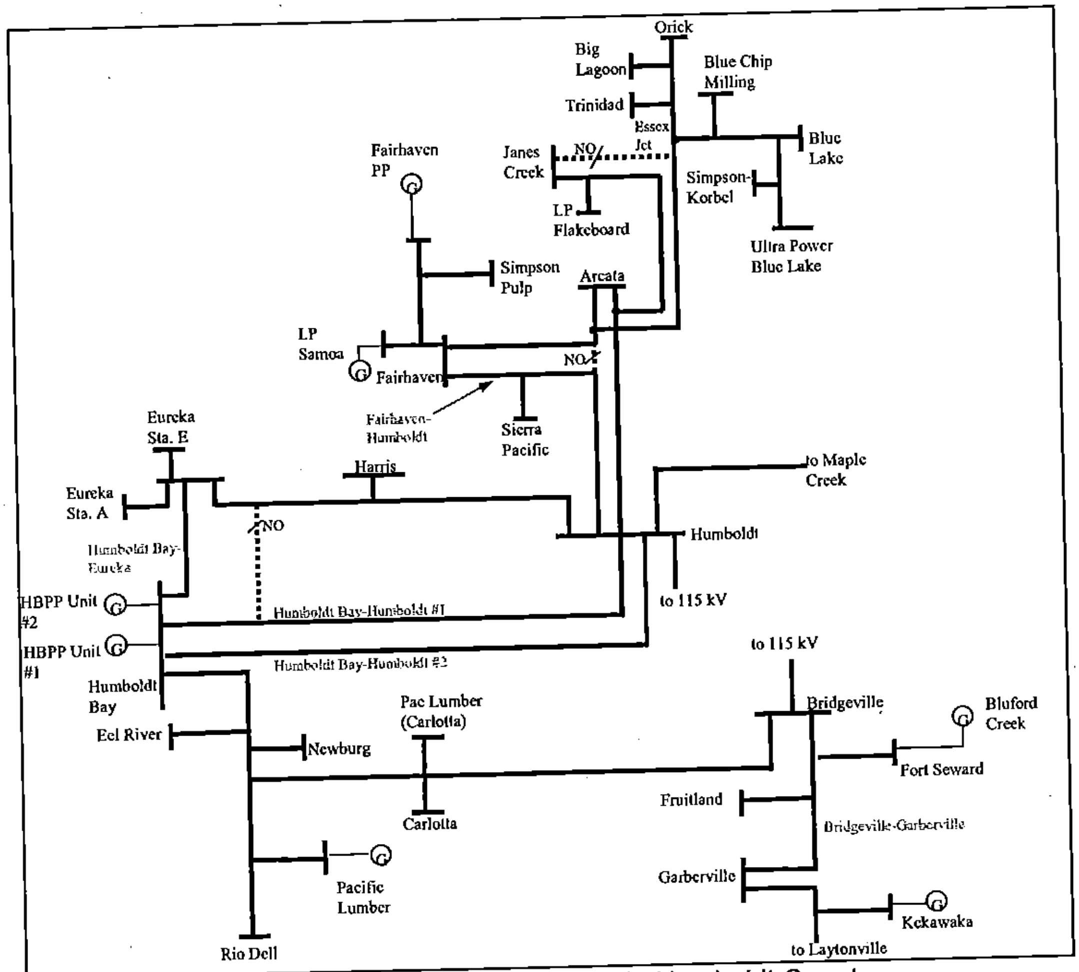


Figure 5: Diagram of the PG&E Transmission system in Humboldt County.

Chapter 5: Natural Gas

This chapter examines issues regarding the supply of natural gas for Humboldt County. The western United States, and especially California, are undergoing a tremendous increase in demand for natural gas as several thousand megawatts of new natural gas-fired electric generating capacity are being constructed.

PG&E is the local distribution company (LDC) for natural gas in Humboldt County. PG&E imports a majority of its natural gas supply from Canada as shown in Figures 6 and 7.

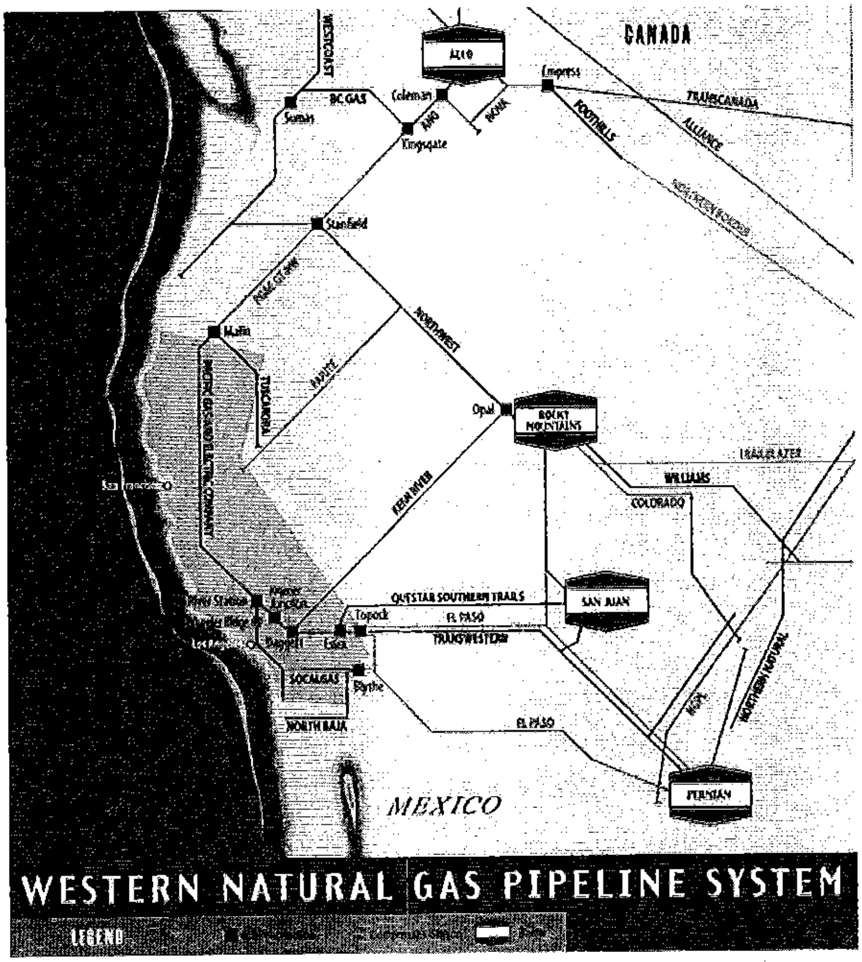


Figure 6: Diagram of the natural gas pipelines interconnecting PG&E to Canadian natural gas supply basins.

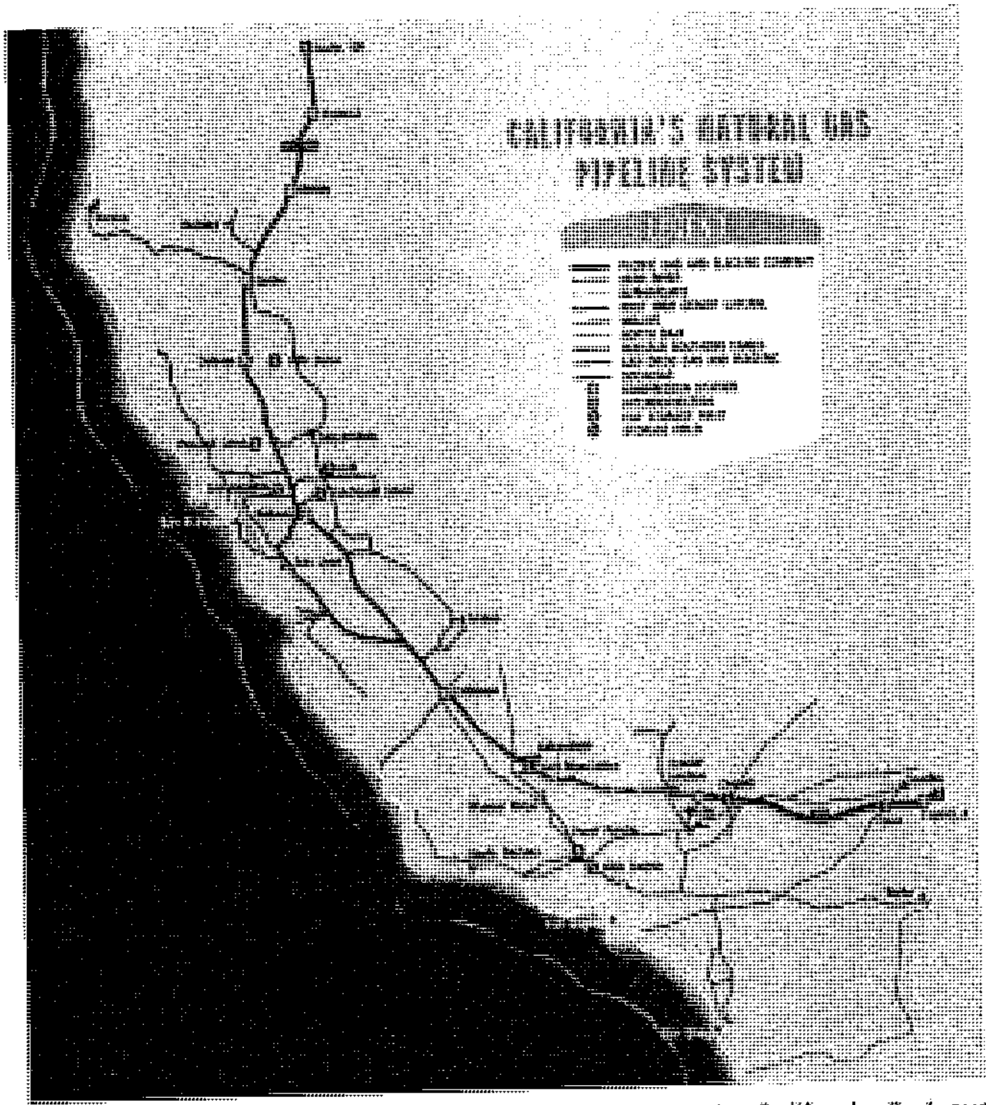


Figure 7: Diagram of the natural gas pipelines within California that supplies Humboldt County.

Natural Gas Resources in Humboldt County[23]

There are natural gas deposits present in Humboldt County. Active gas wells are concentrated in the Tompkin Hills Gas Field. Of the County's 39 gas wells, 31 are currently producing and 8 are considered shut in, meaning they cannot produce gas at their current depths and are sealed off in order to maintain the pressure on remaining deposits.3 In 2000, net gas production was 1,337,796 million cubic feet (mcf); this represents a 31 percent decrease in gas production since 1992, when net production was 1,927,787 mcf. Also in

[23] http://www.co.humboldt.ca.us/planning/gp/meetings/natl_res/nr_report.asp

1992, 34 gas wells were in production and 5 were shut in.4 Humboldt County contains three inactive oil wells and has not produced oil in at least the past ten years.

FOREXCO, Inc. of Greensboro, NC, recently secured a 20-year lease (through 2022) to engage in the exploration of natural gas in Humboldt County on the east and west side of the Eel River near Alton to determine potential natural gas reserves. As part of this lease, they have the rights to the exploration and operation of up to five previously developed well sites that have the potential for up to five wells per site. FOREXCO has proposed to construct a natural gas collection and transportation system that would cross the Eel River and interconnect with the existing gas sales delivery point at the Pacific Gas and Electric Company's (PG&E) natural gas meter station in Alton. The pipeline will be designed to operate at a maximum allowable operation pressure of 1,360 pounds per square inch (psi). The design of the project allows for greater capacity for possible future development of natural gas reserves west of the Eel River.

LNG (Liquefied Natural Gas)

As natural gas prices soared in the last 4 years, many companies began pursuing plans to built facilities to import LNG. Calpine Energy was recently turned away from performing a feasibility study for the potential construction of an LNG facility on the Samoa peninsula.

Natural Gas Prices

Natural gas prices have climbed steadily in the last 5 years and have been extremely volatile as can be seen in Figure 8.

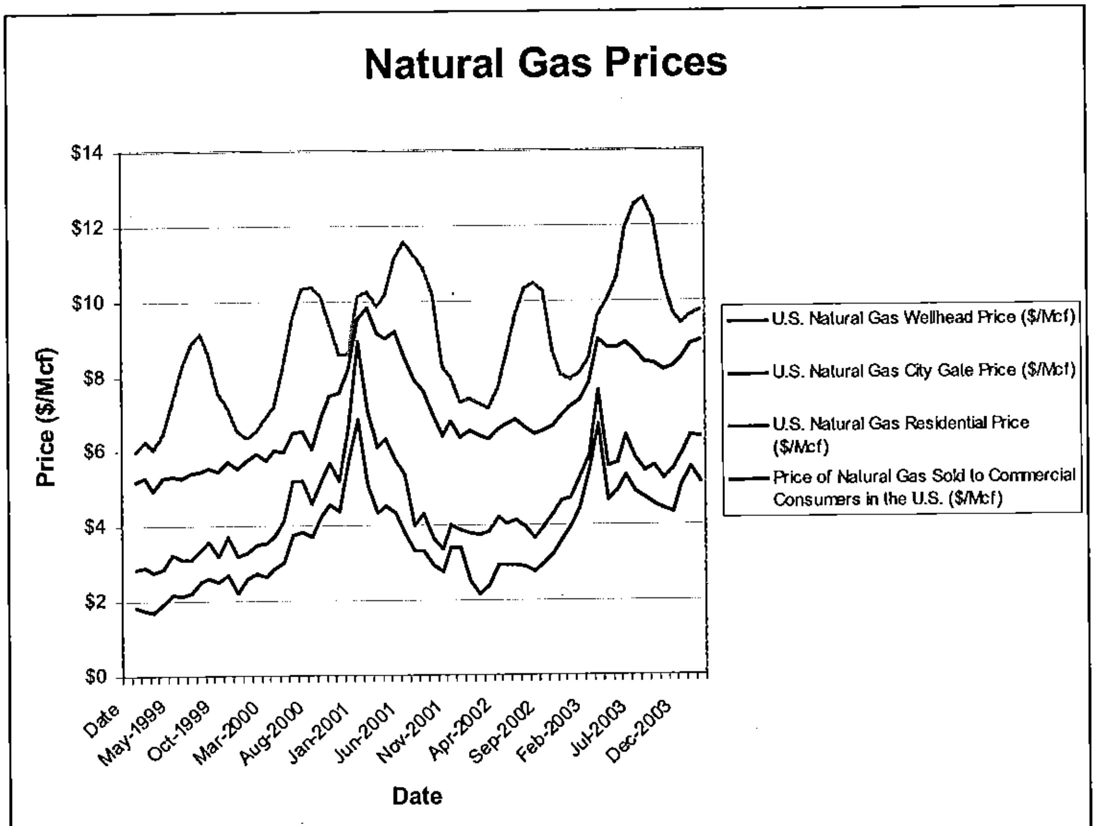


Figure 8: Natural Gas Prices from 1999 to Present (Source: DOE EIA).

Chapter 6: Demand Side Management/ Energy Efficiency

Demand side management has long been recognized as the best means to provide for energy resources. The adage that "the cheapest kilowatt-hour is the one that is not used" is more true today than ever. Based on recent studies, estimates of potential savings for energy efficiency range from 35 to 100 gegawatt-hours, or $20 to 43 million between 2002 and 2011 for Humboldt County[24].

Public-Good Energy Efficiency Programs

PG&E and other third parties, like the RCEA, are currently funded to offer a broad range of energy efficiency programs that provide information, education and incentives to encourage the purchase of energy efficient equipment and support practices for the design and construction of energy efficient buildings and homes. These programs are funded by a surcharge on electricity and natural gas rates. In 2000, the State of California enacted two bills—AB995 and SB1194—extending the systems benefits charge on electric distribution service to support energy efficiency programs with approximately $250 million in statewide funding for energy efficiency programs through 2012. It is estimated that about $1M of these funds are collected from customers in Humboldt County each year.

Energy efficiency programs are categorized in several ways, including by sector, by technology or strategy and statewide versus local. Statewide programs are those that are those that are offered by the utilities throughout the entire state. They are generally applicable to any region in a like manner. Examples of statewide programs include rebates for high efficiency appliances. An example of a local program is the Redwood Coast Energy Authority information and education program.

Humboldt County, by virtue of its remote, rural geographic location, is defined as "hard-to-reach" by the CPUC. This designation generally presumes that customers do not have easy access to program information or generally do not participate in energy efficiency programs due to their being distant from the urban centers.

Codes and Standards

California's building (Title 24) and appliance standards and are the most cost-effective means of achieving energy efficiency in the state. Since 1975, the annual peak savings have been significant. Title 34 codes are enforced by local government jurisdictions and there are opportunities for local agencies to create programs to promote exceeding Title 24 minimum standards. There are also incentive programs to help offset the costs of builders of residential and commercial buildings to improve their efficiency.

This Chapter will be the primary focus of the RCEA in the coming months, as its program is focused primarily on energy efficiency. Through this program, the RCEA will seek to determine:

- How much cost-effective demand reduction and energy efficiency exists in Humboldt County?
- What sectors should be addressed and how?
- What barriers to tradition energy efficiency programs exist that are unique to Humboldt County due to its rural nature, geography, climate, etc.?

[24] Estimates are based on a proportionate share of estimated statewide savings potential.

Energy report

Definitions

Demand-Side Management (DSM)

DSM includes energy efficiency, conservation, and load management. These measures are also collectively referred to as "demand response" strategies because they focus on influencing customer demands for gas and electricity. The primary difference between these measures is that efficiency and conservation are means of reducing overall energy use, whereas load management is a way of shifting energy use in response to the needs of the electric system.

Energy efficiency refers to the permanent installation of energy efficient technologies or the elimination of energy losses in existing systems. Examples include high efficiency motors that use less energy, building insulation, or new ways of sealing ducts to prevent air leakage. The purpose of pursuing energy efficiency is to deliver the same level of service with less energy.

Energy conservation refers to behavioral changes in how one uses any energy-consuming appliance, such as turning off lights when leaving a room, or running the dishwasher only when full. The behavioral change may last for a short duration or may be incorporated into a habit or lifestyle.

Load management refers to strategies employed by electricity distribution companies to manage their overall system load by "shaving peaks" and or "filling valleys" on a daily or seasonal basis. Load management makes sense because it is more expensive to purchase energy to meet limited term energy peaks than it is for the utility to sponsor program or tariffs that encourage customers to either shift or reduce their energy usage during these peak periods. There are three principal types of load management programs being operated in California today: air conditioner and pool pump cycling programs, time-of-use rates, and curtailable rate programs. In the last two years, the energy agencies in California have been working to expand the effectiveness of time-of-use pricing by adding a more dynamic element. "Dynamic pricing" uses price signals to induce customers to cut back their energy use during periods of peak demand and high energy costs. With dynamic pricing in place, electricity prices charged to customers can be adjusted on short notice (typically an hour or day ahead) to reflect changes in the cost of purchasing and delivering electricity. These measures help to make the energy system more flexible by making the overall system demand level more responsive to changes in supply.

Potential Impacts of Energy Efficiency on the Local Economy

In is widely recognized that investment in energy efficiency can have a positive effect on the local economy. These benefits accrue through the following:

1. Increased spending on energy efficiency in the local economy,
2. Reduced spending on power purchased from outside other region,
3. The possibility if increased regional spending on energy efficiency creating jobs.

Additional long-term benefits accrue to the region through lowered overhead or operating costs for participants (resulting from the continued energy savings of energy efficiency improvements over the 10 to 20-year life of the efficiency measure) and, therefore, increased

Solar Energy

"I'd put my money on the sun and solar energy. What source of power! I hope we don't have to wait 'til oil and coal run out before we tackle that." –Thomas Edison

Solar energy is a viable energy source Humboldt County should look into. That being said, Humboldt County does not receive very much sunlight throughout the year. Humboldt's peak months are Many, June and July where an average daily insolation in Arcata reaches 7-kilowatts. From a study done by the Solar Energy Group, the average is 4.4 peak hours a day in Butler Valley Ranch. Now, these are two isolated areas that have been studied and proven to get a decent amount of insolation. But the county is very diverse in terms of sunlight. The research should be getting done inland, away from the coast which is shutting out the sunlight with coastal fog. That is why Butler Valley Ranch is a good study to examine.

Humboldt County has a manufacturer of solar devices. There is Six Rivers Solar in Eureka, CA right on Broadway. They manufacture the TrendSetter which is a solar water heating, radiant floor heating system that gives homes energy efficient certification. According to their phamplet, the TrendSetter is cost-effective for heating the home, doing laundry, taking showers and heating pools and spas. The TrendSetter system can certify a home as Energy Star efficient as well. Energy Star is a government-backed program which is helping businesses and individuals protect the environment through incentives to be more energy efficient. To be Energy Star efficient, a home has to be built with 30% more energy efficiency that homes built in 1993.

Six Rivers Solar also installs photovoltaic panels on homes, offices and schools. We currently do not have any statistics on how efficient these panels are but they promised to get the information to us as soon as possible. There are a # of installers you can locate in the "Source Book". Overall, solar energy is

CALIFORNIA SOLAR DATA MANUAL

MARCH 1978

Paul Berdahl, Donald Grether, Marlo Martin, and Michael Wahlig

Solar Energy Group, Energy and Environment Division
LAWRENCE BERKELEY LABORATORY
University of California
Berkeley, California 94720

Supported by:

CALIFORNIA ENERGY COMMISSION
1111 Howe Avenue
Sacramento, California 95825

James Lerner and Mat Ginosar, Program Managers

and

Division of Solar Energy
DEPARTMENT OF ENERGY
20 Massachusetts Avenue N.W.
Washington, D.C. 20545

Monthly Solar Data, Butler Valley Ranch

Latitude: 40.77° Longitude: 123.90° Elevation: 421'

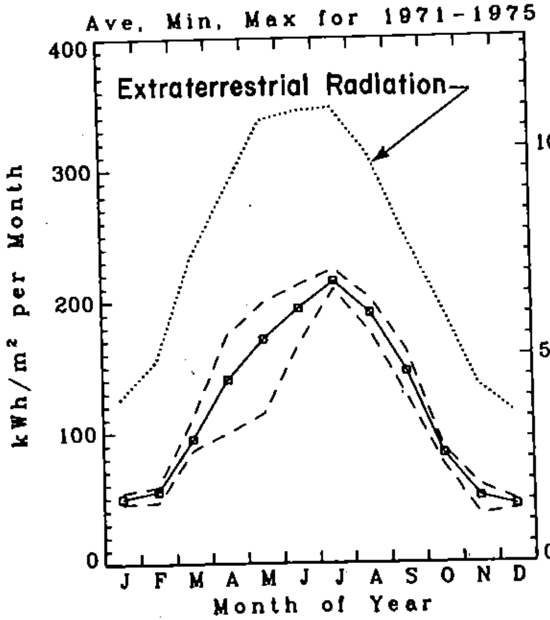
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
SOLAR RADIATION (kWh/m^2 per month) horizontal surface direct beam (normal incidence)	50 77	55 62	95 99	140 145	171 168	194 200	215 237	190 218	146 181	83 99	50 67	43 69	1432 1623
SOLAR RADIATION (KBtu/ft^2 per month) horizontal surface direct beam (normal incidence)	16 24	17 20	30 31	44 46	54 53	61 63	68 75	60 69	46 57	26 32	16 21	14 22	454 514
PERCENT OF POSSIBLE SUNSHINE*	42	46	50	55	55	57	52	47	53	49	42	40	50
MEAN CLOUD COVER (in tenths)*	7	7	7	7	7	6	7	7	6	6	7	7	7
FRACTION OF EXTRATERRESTRIAL RADIATION (K_T)	.39	.36	.41	.49	.51	.56	.62	.61	.58	.43	.37	.38	.48

Recording interval: 1971-1975
*Data for Eureka, 40° 48'N, 124°10' W, elevation 43'
Source of solar data: U.S. Army Corps of Engineers, pyranograph.

4.4 peak hrs/day

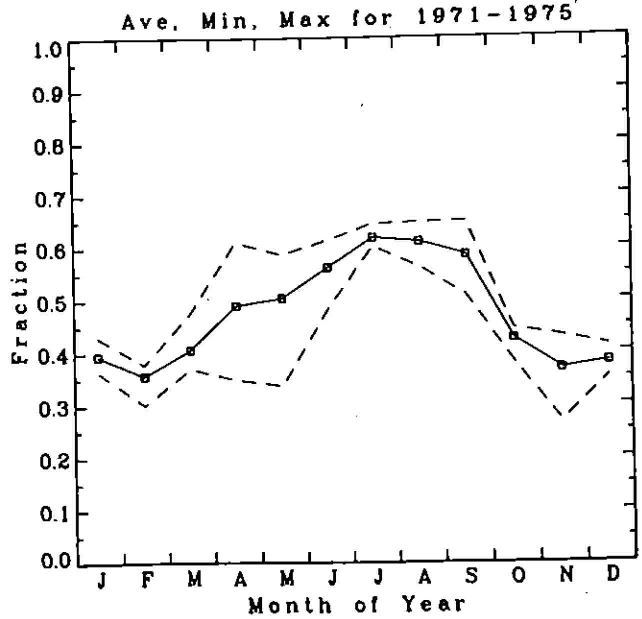
Monthly Total Horizontal Radiation Butler Valley Ranch

Ave, Min, Max for 1971-1975



Monthly Total/Extraterrestrial (K_T) Butler Valley Ranch

Ave, Min, Max for 1971-1975



Total Radiation on a Tilted Surface (Calculated Values)
Metric Units (kWh/m²)
Butler Valley Ranch

SURFACE ORIENT-ATION	ANGLE OF TILT (DEGREES FROM HOR-IZONTAL)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
		DIRECT BEAM + DIFFUSE (GROUND REFLECTION EXCLUDED)												
SOUTH	15	64	65	105	147	172	191	213	197	161	96	61	56	1529
SOUTH	30	74	70	110	146	164	178	201	193	167	104	70	66	1542
SOUTH	45	81	72	108	137	147	156	177	177	162	106	74	72	1471
SOUTH	60	82	70	101	121	123	127	145	152	149	102	74	74	1320
SOUTH	75	79	65	88	98	93	92	106	118	126	92	70	72	1100
SOUTH	90	71	55	71	71	61	56	64	80	97	78.	62	65	831
SE, SW	15	60	61	102	145	171	191	213	194	156	92	58	52	1493
SE, SW	30	66	65	103	142	163	180	202	189	158	96	62	58	1485
SE, SW	45	69	64	100	134	149	162	182	176	152	95	64	61	1408
SE, SW	60	68	61	92	119	129	138	156	154	139	89	62	61	1267
SE, SW	75	63	55	80	100	104	109	124	127	119	79	57	57	1074
SE, SW	90	55	46	65	77	78	79	90	96	95	66	49	50	844
E, W	15	49	54	93	137	167	189	209	186	143	81	49	42	1401
E, W	30	47	52	89	130	157	178	197	175	135	78	47	41	1325
E, W	45	45	48	82	119	143	161	178	160	125	72	44	38	1214
E, W	60	40	43	73	105	125	140	155	140	111	64	40	35	1072
E, W	75	35	37	62	88	105	117	129	118	94	55	34	30	906
E, W	90	29	30	50	70	82	92	102	94	76	45	28	25	723
		GROUND REFLECTION FOR REFLECTIVITY = .2 (MULTIPLY BY RHO/.2 FOR REFLECTIVITY = RHO)												
ANY	15	0	0	0	0	1	1	1	1	0	0	0	0	5
ANY	30	1	1	1	2	2	3	3	3	2	1	1	1	19
ANY	45	1	2	3	4	5	6	6	6	4	2	1	1	42
ANY	60	2	3	5	7	9	10	11	10	7	4	2	2	72
ANY	75	4	4	7	10	13	14	16	14	11	6	4	3	106
ANY	90	5	6	9	14	17	19	21	19	15	8	5	4	143

Total Radiation on a Tilted Surface (Calculated Values)
Engineering units (kBtu/ft²)
Butler Valley Ranch

SURFACE ORIENT-ATION	ANGLE OF TILT (DEGREES FROM HOR-IZONTAL)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
		DIRECT BEAM + DIFFUSE (GROUND REFLECTION EXCLUDED)												
SOUTH	15	20	20	33	47	54	61	68	62	51	30	19	18	484
SOUTH	30	24	22	35	46	52	56	64	61	53	33	22	21	489
SOUTH	45	26	23	34	43	47	49	56	56	51	34	23	23	466
SOUTH	60	26	22	32	38	39	40	46	48	47	32	23	24	418
SOUTH	75	25	20	28	31	30	29	34	38	40	29	22	23	349
SOUTH	90	23	18	22	22	19	18	20	25	31	25	20	21	263
SE, SW	15	19	19	32	46	54	61	67	62	49	29	18	17	473
SE, SW	30	21	20	33	45	52	57	64	60	50	30	20	18	470
SE, SW	45	22	20	32	42	47	51	58	56	48	30	20	19	446
SE, SW	60	21	19	29	38	41	44	49	49	44	28	20	19	402
SE, SW	75	20	17	25	32	33	35	39	40	38	25	18	18	340
SE, SW	90	17	15	21	24	25	25	29	30	30	21	15	16	267
E, W	15	16	17	29	43	53	60	66	59	45	26	16	13	444
E, W	30	15	16	28	41	50	56	62	56	43	25	15	13	420
E, W	45	14	15	26	38	45	51	56	51	39	23	14	12	385
E, W	60	13	14	23	33	40	44	49	45	35	20	13	11	340
E, W	75	11	12	20	28	33	37	41	37	30	18	11	10	287
E, W	90	9	10	16	22	26	29	32	30	24	14	9	8	229
		GROUND REFLECTION FOR REFLECTIVITY = .2 (MULTIPLY BY RHO/.2 FOR REFLECTIVITY = RHO)												
ANY	15	0	0	0	0	0	0	0	0	0	0	0	0	2
ANY	30	0	0	0	1	1	1	1	1	1	0	0	0	6
ANY	45	0	1	1	1	2	2	2	2	1	1	0	0	13
ANY	60	1	1	2	2	3	3	3	3	2	1	1	1	23
ANY	75	1	1	2	3	4	5	5	4	3	2	1	1	34
ANY	90	2	2	3	4	5	6	7	6	5	3	2	1	45

Solar Resource Data for Arcata, CA

Data from National Solar Radiation Database
30 Year Average, Arcata, CA (Secondary Data)

Solar Radiation on a South Facing Sloped Surface (kWh/m2/day = peak sun hours per day)

Collector Slope	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Lat - 15	2.7	3.3	4.3	5.4	5.9	5.9	5.8	5.3	5.1	3.9	2.9	2.5	4.4
Lat	3	3.5	4.4	5.3	5.5	5.4	5.4	5	5.1	4.1	3.2	2.8	4.4
Lat + 15	3.2	3.6	4.3	4.9	4.9	4.7	4.7	4.6	4.9	4.1	3.3	3	4.2

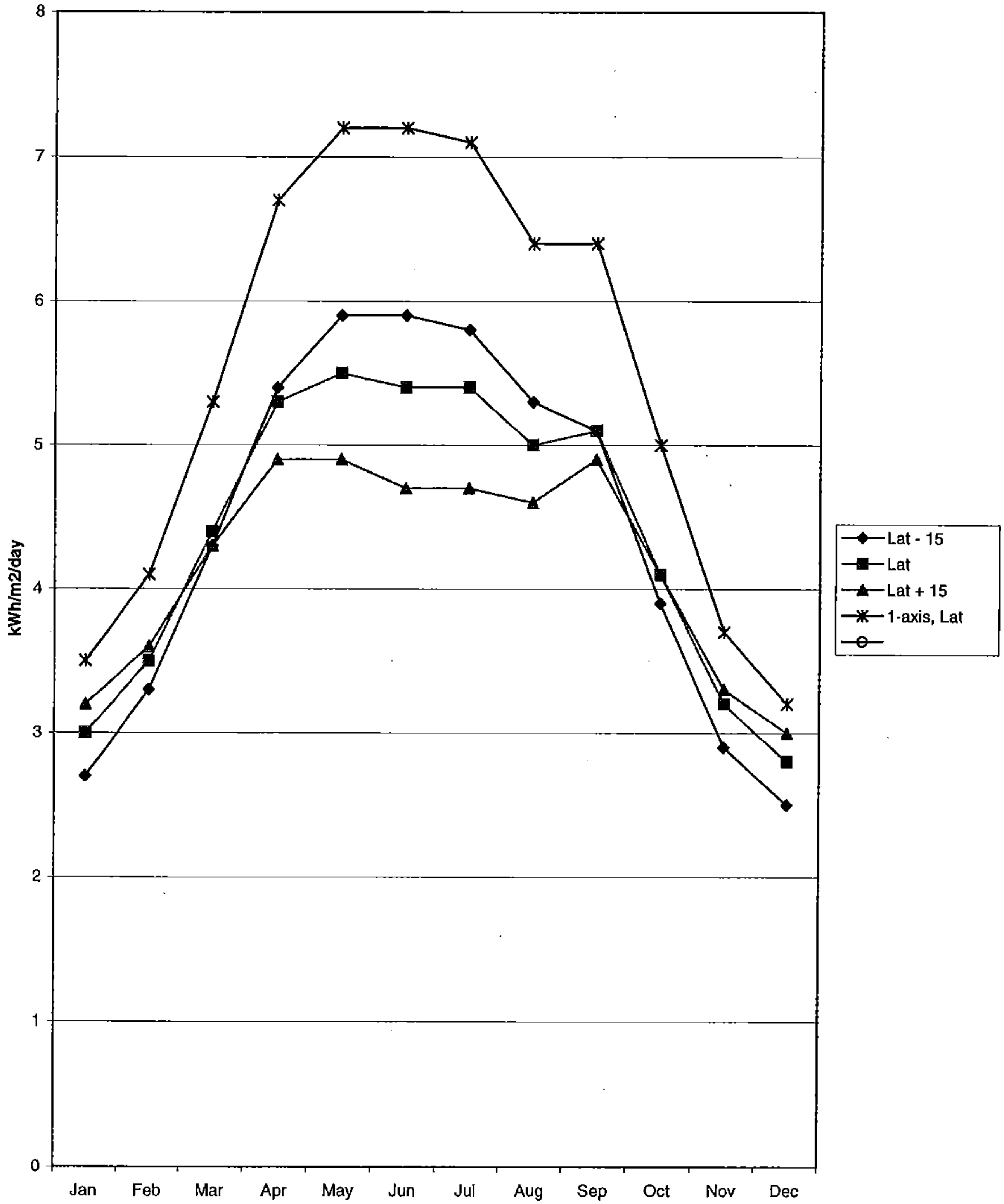
Solar Radiation for 1-Axis Tracking (N-S Axis) Flat Plate Collector Sloped at Latitude (kWh/m2/day = peak sun hours per day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1-axis, Lat	3.5	4.1	5.3	6.7	7.2	7.2	7.1	6.4	6.4	5	3.7	3.2	5.5

Solar Radiation for 2-Axis Tracking Flat Plate Collector (kWh/m2/day = peak sun hours per day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2-Axis	3.6	4.2	5.4	6.8	7.5	7.7	7.5	6.5	6.5	5	3.8	3.4	5.7

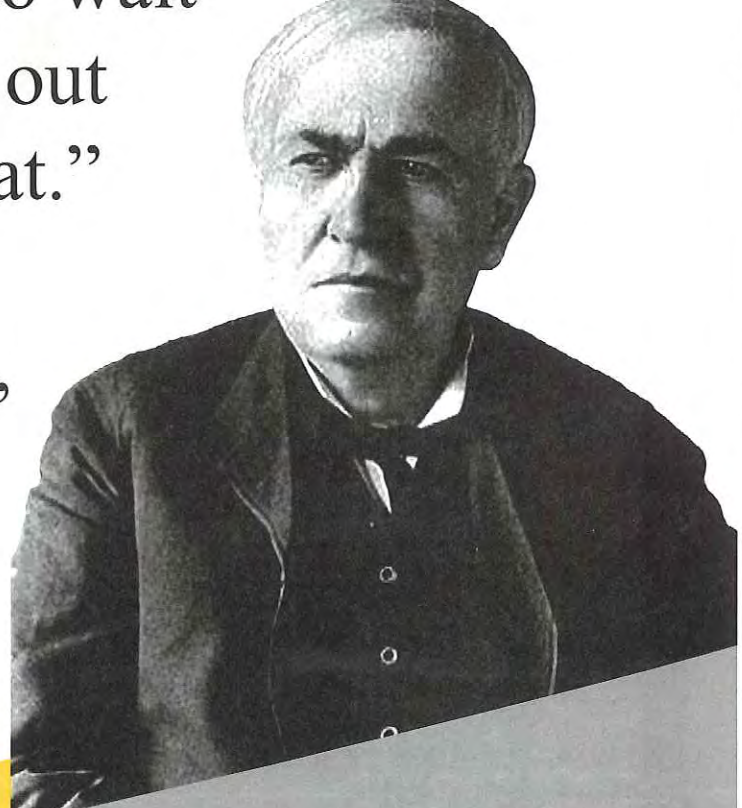
Average Daily Insolation - Arcata, CA



TrendSetter™ industries

"I'd put my money on the sun
and solar energy.
What a source of power!
I hope we don't have to wait
'til oil and coal run out
before we tackle that."

-Thomas Edison,
1847-1931



energy

TrendSetter™

Solar Water Heating Systems

Trendsetter turns sunlight into heat!

Trendsetter systems provide clean, reliable, and cost-effective hot water for heating your home, doing laundry, or taking showers. Our systems can even heat your pool and spa!

Trendsetter systems improve your quality of life and add security to your future by making your home more comfortable and your energy bills more affordable.

Trendsetter systems are designed to be reliable and easily maintained. Our ***20-year limited warranty*** protects your investment and ensures that your Trendsetter system will pay for itself over and over.

Trendsetter Systems are fully certified by the Solar Rating Certification Corporation (SRCC). The SRCC certification is nationally recognized quality assurance.

Trendsetter Systems combine over twenty-five years of experience in state-of-the-art solar technology providing the most time-tested and durable system available.

Solar Radiant Floor Heating

Trendsetter takes the mystery out of Solar Radiant Floor Heating.

Trendsetter sets the standard for the industry because we combine Radiant Floor Heating with Solar Water Heating Technology. Radiant Floor Heating uses hot water to primarily heat your floors instead of hot air that heats your ceilings and leaves your feet cold.

Trendsetter Radiant Floor Systems are pre-designed and pre-assembled, saving you hours of time and expensive labor costs. Our systems are uniform and code compliant. Trendsetter Radiant Floor Systems are simple and functional, requiring low maintenance.

The Trendsetter System is the only radiant floor heating system specifically designed to be THERMODYNAMICALLY COMPATIBLE WITH SOLAR. The Trendsetter engineering models for solar radiant floor systems perform up to ***47% higher in efficiency*** than the older typical closed loop boiler systems.

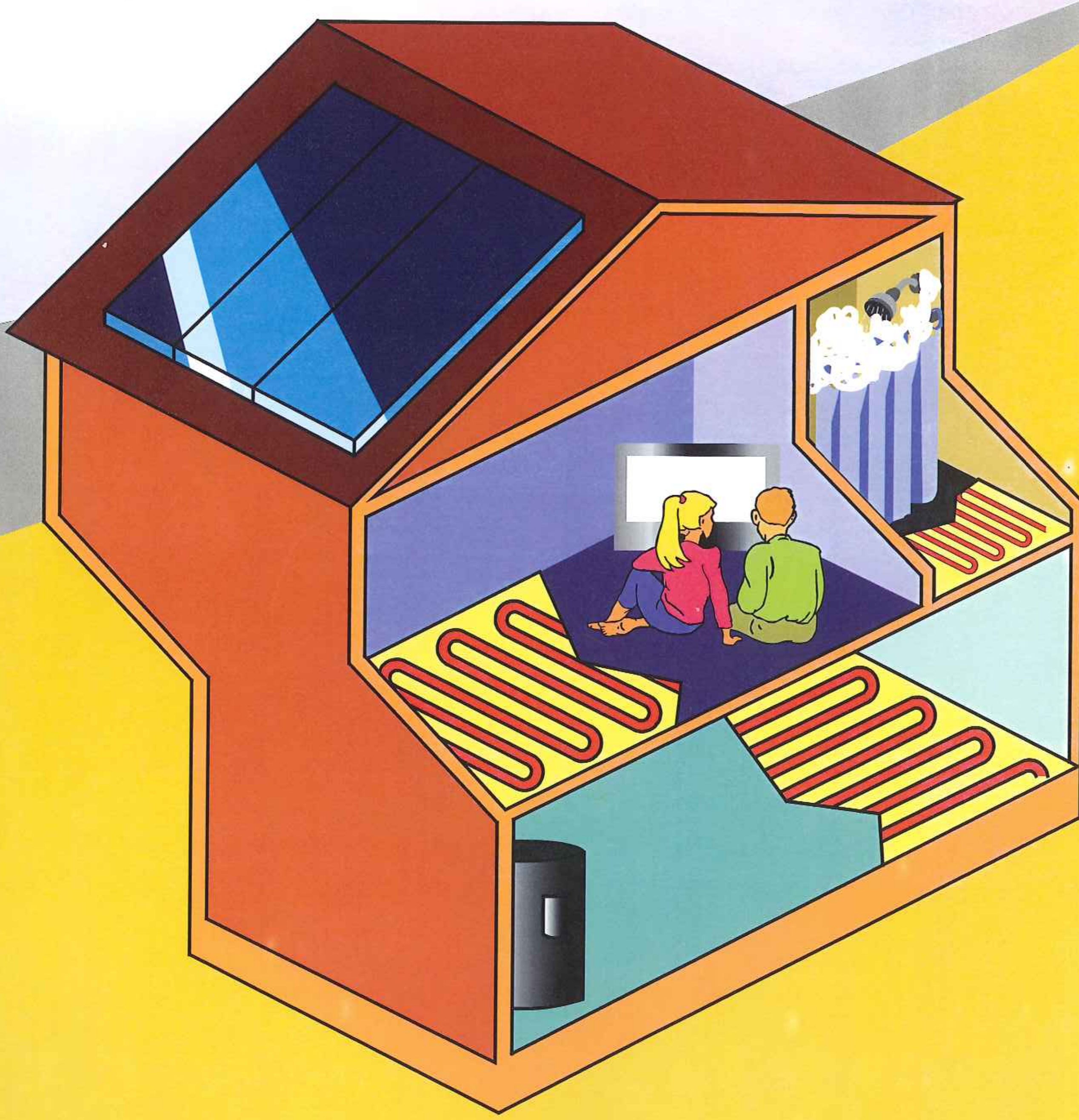
Trendsetter Radiant Floor Heating provides superior comfort at a much lower cost.

... it's worth the energy.

energy Certification

Energy Star is a government-backed program helping businesses and individuals protect the environment through superior energy efficiency. To earn the Energy Star rating, homes must be built with 30% more energy efficiency than homes built to the 1993 national Model Energy Code.

As a service to our customers, Trendsetter Industries offers an Energy Star certification for each project using Trendsetter Systems.



Top 10 reasons to use TrendSetter combined SOLAR-tankless water PLUS radiant floor heating instead of ...forced air and a water heater

1. *LESS EXPENSIVE....* the federal and state government offers a variety of economic incentives for energy star rated homes. In most cases when applying the tax credits and state rebates the net cost of the TrendSetter system, may surprise you. Consult website http://www.dsireusa.org/index.cfm maintained by the Department of Energy for a continuously updated list of incentives offered by each state and federal government.

2. *PURCHASERS QUALIFY FOR FINANCING...* affordable homes that are energy star rated and meet certain criteria will help to qualify more home purchasers because lenders may increase the loan amount $8,000 with no additional income. Energy star qualified lenders consider the additional cost of energy efficient measures will be offset by lower monthly utility payments.

3. *INCREASED MARKET APPEAL MEANS HIGHER RESALE VALUE...* energy star homes have instant positive consumer recognition. "Green Building" projects will continue to gain in favor with government-backed projects and are favored by planning officials.

4. *SUPERIOR COMFORT...* Just ask anyone who has experienced warm floors and the comfort of radiant floor heating. Radiant slab construction is becoming the heating system of choice. No drafts or noise, hot and cold spots where drapes or furniture can obstruct the heat. Comfort is usually achieved by radiant floors with air temperatures several degrees cooler than with convection type forced air.

5. *PROMOTES HEALTHIER INDOOR AIR QUALITY...* Forced air heating circulates dust particles, pollutants and spread microbiotic germs around the house many times per hour. Many people have become sensitized to allergens and chemicals commonly used in new home construction. Radiant floor construction with controlled ventilation will pay off in health benefits.

6. *LOWER OPERATING COSTS...* Computer models are used to certify the home as an energy star home. We will certify compliance with local energy codes and in the process verify that the home will typically perform up to 30% more efficient to qualify for new federal tax incentives, rebates and energy star registration standards.

7. *LOW OR NO MAINTENANCE COSTS...* The entire system is comprised of non-corrosive components. Poor water quality will have no adverse affects on the longevity of the solar components and radiant heating system. The entire system uses four small water-cooled pumps with replaceable cartridges.

8. *"FOOLPROOF" DESIGN AND PERFORMANCE...* The best part about this system is that it uses microprocessors to adjust the system on a real-time basis as out door conditions change. This "smart" system monitors outdoor temperature, indoor temperature, and heat losses in the floor and constantly adjusts the temperature of the water in the floor by adding the right amount of make up heat to maintain optimum performance. This is called "heat anticipation" and is important because of the high thermal mass of a radiant floor system.

9. *SAVES SPACE...* Since only one appliance is used for generating both hot water and space heat, only one space is necessary for installation of the equipment. The system requires only one exhaust flue, one electrical circuit, and only one gas line. No consideration need be given to placement of furniture, which often blocks forced air registers.

10. *REDUCES FOSSIL FUEL CONSUMPTION...* Today, the United States pumps more carbon monoxide into the atmosphere than any other country in the world. Each of us contributes about 22 tons of carbon dioxide emissions per year, whereas the world per capita is about 6 tons. You can make a significant impact on reversing this trend by installing the Trendsetter hydronic based integrated heating system and reduce about 2-1/2 tons of pollution each year for each new house built.

Take a look at TrendSetter... it's worth the energy.

Phone: 800-492-9276

Fax: 707-442-0110

E-mail: energystar@sixriverssolar.com

Web: www.trend-setter.org

Wave Energy

Wave energy is another form of energy for Humboldt County to take into consideration. With a relatively open sea that reaches 6,000 miles between Japan and the Humboldt coastline, we have strong waves that constantly batter the coast. There is currently a new wave-power system, called the Seadog, being tested in Trinidad. The Seadog differs from other surf energy devices that have failed in the past because they did not produce enough electricity directly from the wave action and could not store the power. The Seadog would pump seawater from the ocean to an elevated reservoir, water would be released from the reservoir down a pipe or flume and then the turbine would be driven by the released water (Independent Natural Resource, Inc.).

The Seadog was manufactured by the Independent Natural Resources Inc. of Eden Prairie, Minnesota. The Seadog was tried in laboratory trials where in a 26 inch surf, it generated an operational pressure of 125 to 168 pounds per square inch, pushing water almost 400 feet. This confirmed the Seadog could theoretically do what the company predicted, but it has yet to be tested in the ocean. By the end of this year, the Seadog will be stored in Trinidad.

The project has received $270,000 in venture capital. If all goes well when the single pump is installed, a 16-pump project will follow next. This will cost about $3,000,000 and will yield about 537 kilowatts which is enough power for 600 homes. If all goes well, next would come a 200-pump project, 6,700-killowatts generated and enough power for 7,000 homes. Ultimately, the project would expand to 750 megawatts, enough power for 100,000 homes and a price tag of $217 million to construct and costing $110 million a year to operate.

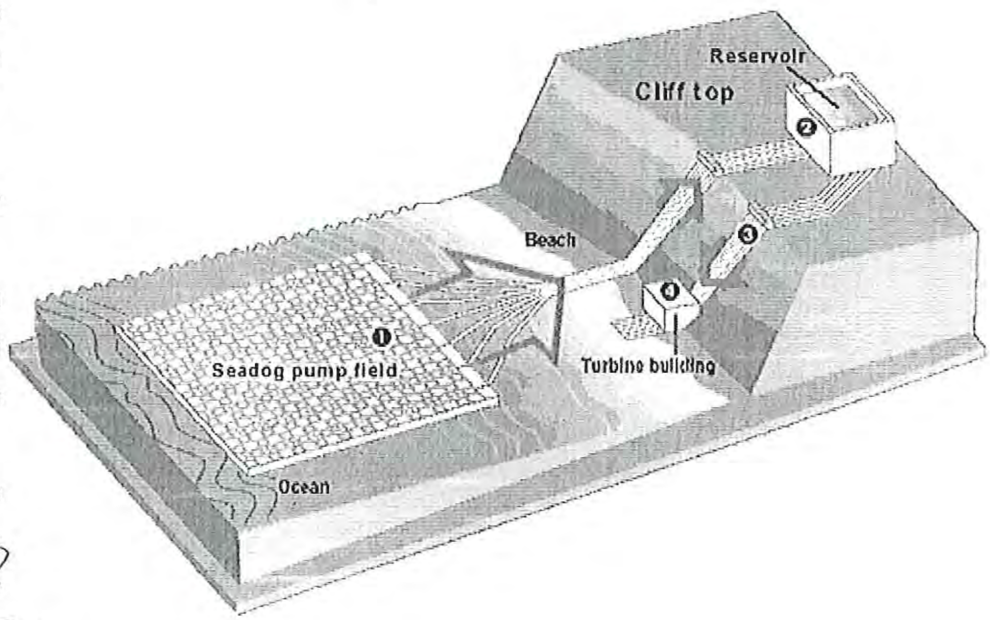
There is certainly great potential in wave energy for Humboldt County. But all these numbers and projections are estimates. A major drawback is that currently, the Seadog has yet to be tested in Trinidad. But this is definitely another form of energy that should be researched and utilized in order to make Humboldt County more energy independent. There are no large reports in this section because nobody has found a wave system that is successful in the ocean yet. But included are a document on the Seadog and a report by the California Energy Commission.

Wave Power Plan Gets a Test in Trinidad California

GLEN MARTIN / SF Chronicle 4aug04

Town hopes new device will tap surf for energy

Trinidad, Hum Cou - -



Harnessing the surf

An experimental new wave-power system, called Seadog, differs from most other surf energy devices in that it doesn't produce electricity directly from wave action. Instead, it would pump seawater (1) from the ocean to an elevated reservoir (2). Water from the reservoir is then released down a pipe or flume (3) to drive a turbine (4). Theoretically, this overcomes a disadvantage of other wave energy systems — the inability to store power. With Seadog, energy would be stored latently in the reservoir, to be released as demand requires. source: Independent Natural Resources, Inc. Graphic by Joe Shoulak.

Ther are abou 6,00 mile: of open wate betw northern Japan and the Humboldt County coast, and the end result of such a long and unobstructed fetch is easy to see from this picturesque little harbor: constant surf. Usually, big surf.

"We have one record of waves breaking over the top of our lighthouse," said

Trinidad's mayor, Dean Heyenga. "That's 90 feet above sea level."

That's also a tremendous amount of power, which seems to invite a question: Could a solution to California's energy woes be found right off the beach?

Many coastal communities worldwide have toyed with the notion, and San Francisco is co-hosting a conference on wave energy projects in September. But probably the most ambitious project is planned for Humboldt's remote and battered coast, where a Minnesota energy-engineering company will introduce the Seadog, a pump that operates on wave motion.

This mechanical marine hound, its developers say, will reliably turn churning surf into clean, green energy.

Community leaders are intrigued.

J. Warren Hockaday, executive director of the Eureka Chamber of Commerce, said the Seadog could guarantee long-term energy independence for Eureka, which now depends on power generated by Pacific Gas and Electric Co.

"Right now we get most of our electricity from a (PG&E) oil-burning plant that's pretty old and presents some significant air pollution concerns," he said. "We're right on the borderline of the state grid. We're vulnerable to power disruption. So we see some real potential benefit to the community in a project like this."

It's hardly the first cheekily named gadget someone has peddled as a means of harnessing the power of the sea. In fact, about 30 wave-energy ventures have been tried somewhere around the world in recent years -- and most have foundered.

The Wave Dragon? Abandoned in its native land of Denmark after it proved less than rugged, though Wales is now considering a test model of the machine.

The Salter Duck? Dead in the water off the United Kingdom. The Archimedes Wave Swing in the Netherlands? In a state of flux after its original investors pulled out. The Sea Clam, the Tapchan, the Pendulor? All belly up.

Some systems have managed to move from drawing boards to the sea, where they are actually producing small amounts of power, including such projects as the Pelamis in Scotland and the Limpet in Ireland. But, generally speaking, wave energy technology has been a wipeout. In most coastal areas, waves are intermittent, which means energy production is spotty. Virtually all of the devices tested in the past only produced electricity when the surf was up, with no means of storing power.

The devices typically produce what's known as low-frequency power, which can be difficult and expensive to convert to high-frequency electrical grids.

Also, many of the devices are complicated and somewhat fragile, and do not stand up well to heavy surf. And past wave technologies involved lots of electrical components, hydraulic fluids and oils -- all presenting a pollution risk.

The Seadog, say its inventors, represents a different, simpler and more rugged approach that can actually turn an elusive dream into a commercial reality.

Manufactured by Independent Natural Resources Inc. of Eden Prairie, Minn., the device is an anchored mechanical pump that uses wave action to transport seawater to an elevated reservoir onshore. Water from the reservoir is then released down a flume to turn a turbine, which produces high-frequency electricity.

Energy is stored latently, as water in the reservoir. When more electricity is needed, more water is released down the flume. The system involves no hydraulics, no noxious fluids, no submerged cables.

Laboratory trials last year by the Offshore Technology Research Center at Texas A&M University showed the Seadog, in 26-inch surf, generated an operational pressure of 125 to 168 pounds per square inch, enough to push water almost 400 feet. That was within 95 to 98 percent of the performance figures cited by the company, and confirmed that the device could theoretically do what it was claimed to do.

Mark Thomas, the founder and president of Independent Natural Resources, said the Seadog evolved from a related energy production device that drove a motor by using the compressed air that is routinely fed into pipelines to move natural gas from one location to another.

Bolstered by $270,000 in venture capital, Thomas plans to have a single unit installed off the Humboldt coast by the end of the year to demonstrate the essential feasibility of the technology in the real marine world. The project must be approved by the California Coastal Commission and the State Lands Commission.

If the pump isn't battered into flotsam by Humboldt's heavy surf -- always a possibility -- a 16-pump project will follow, hooked up to a 50,000- gallon tank to store seawater for the hydropower production. That would cost about $3 million and yield about 537 kilowatts, enough power to service about 600 homes.

A 200-pump, 6,700-kilowatt system would follow, powering more than 7,000 homes. According to the company's business plan, that would cost about $16 million to build and require about $1.6 million in annual maintenance and operational costs. Its electricity would cost about 31/2 cents a kilowatt-hour, which, generally speaking, is comparable to the cost of coal-generated electricity, cheaper than natural gas generation and more expensive than nuclear.

Ultimately, said Thomas, a 1-square-mile array could be built, generating about 750 megawatts, enough power for about 100,000 homes. If things ever get that far, such a plant would cost $217 million to construct, cost about $110 million a year to operate, and yield power priced at 2.08 cents a kilowatt-hour.

Jim Bushnell, the research director for the University of California Energy Institute in Berkeley, said it is highly unlikely wave energy will ever solve the state's energy problems.

"These things all sound really great, but you have to see if they live up to the hype," Bushnell said, "and you won't know that until there's either massive private investment or public subsidies to get them tested, then built on a commercial scale."

Still, said Bushnell, the Seadog appears to have addressed a major problem with past wave energy devices.

"A big issue for alternative energy systems is that they can't store energy very well," he said. "If they've found a way around that, it's progress. "

source: http://www.sfgate.com/cgi-bin/article.cgi?
file=/chronicle/archive/2004/08/04/BAGN382BIC1.DTL&type=printable
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OCEAN ENERGY

Generating technologies for deriving electrical power from the ocean include tidal power, wave power, ocean thermal energy conversion, ocean currents, ocean winds and salinity gradients. Of these, the three most well-developed technologies are tidal power, wave power and ocean thermal energy conversion. Tidal power requires large tidal differences which, in the U.S., occur only in Maine and Alaska. Ocean thermal energy conversion is limited to tropical regions, such as Hawaii, and to a portion of the Atlantic coast. Wave energy has a more general application, with potential along the California coast. The western coastline has the highest wave potential in the U.S.; in California, the greatest potential is along the northern coast.

Wave energy conversion takes advantage of the ocean waves caused primarily by interaction of winds with the ocean surface. Wave ener irregular and oscillating low-frequency energy source that must be converted to a 60-Hertz frec before it can be added to the electric utility grid.

Although many wave energy devices have been invented, only a small proportion have been te: evaluated. Furthermore, only a few have been tested at sea, in ocean waves, rather than in art tanks.

As of the mid-1990s, there were more than 12 generic types of wave energy systems. Some sy extract energy from surface waves. Others extract energy from pressure fluctuations below the surface or from the full wave. Some systems are fixed in position and let waves pass by them, follow the waves and move with them. Some systems concentrate and focus waves, which incr height and their potential for conversion to electrical energy.

A wave energy converter may be placed in the ocean in various possible situations and location floating or submerged completely in the sea offshore or it may be located on the shore or on th relatively shallow water. A converter on the sea bed may be completely submerged, it may ext the sea surface, or it may be a converter system placed on an offshore platform. Apart from wa navigation buoys, however, most of the prototypes have been placed at or near the shore.

The visual impact of a wave energy conversion facility depends on the type of device as well as from shore. In general, a floating buoy system or an offshore platform placed many kilometers not likely to have much visual impact (nor will a submerged system). Onshore facilities and offs platforms in shallow water could, however, change the visual landscape from one of natural sce industrial.

The incidence of wave power at deep ocean sites is three to eight times the wave power at adja coastal sites. The cost, however, of electricity transmission from deep ocean sites is prohibitive Wave power densities in California's coastal waters are sufficient to produce between seven anc megawatts (MW) per mile of coastline.

As of 1995, 685 kilowatts (kW) of grid-connected wave generating capacity is operating worldw capacity comes from eight demonstration plants ranging in size from 350 kW to 20 kW. None o plants are located in California, although economic feasibility studies have been performed for a wave converter to be located at Half Moon Bay. Additional smaller projects have been discussec Bragg, San Francisco and Avila Beach. There are currently no firm plans to deploy any of these

As of the mid-1990s, wave energy conversion was not commercially available in the United Sta technology was in the early stages of development and was not expected to be available within future due to limited research and lack of federal funding. Research and development efforts ar sponsored by government agencies in Europe and Scandinavia.

Many research and development goals remain to be accomplished, including cost reduction, effi reliability improvements, identification of suitable sites in California, interconnection with the ut better understanding of the impacts of the technology on marine life and the shoreline. Also es: demonstration of the ability of the equipment to survive the salinity and pressure environments ocean as well as weather effects over the life of the facility.

Permitting Issues. Some of the issues that may be associated with permitting an ocean wave conversion facility include:

- Disturbance or destruction of marine life (including changes in the distribution and types life near the shore)
- Possible threat to navigation from collisions due to the low profile of the wave energy dev the water, making them undetectable either by direct sighting or by radar. Also possible i interference of mooring and anchorage lines with commercial and sport-fishing.
- Degradation of scenic ocean front views from wave energy devices located near or on the from onshore overhead electric transmission lines

References

1. *Ocean Energy Recovery: The State of the Art*, American Society of Civil Engineers, 1992.
2. Natgerman, George, "Wave Power," in *Encyclopedia of Energy Technology and the Enviro* John Wiley & Sons, 1995.
3. *Ocean Energy Technology Information Module*, Advanced Energy Systems, Pacific Gas & I Company, Department of Research and Development, Report 007.6-91.4, September 30,

4. Shaw Ronald, *Wave Energy: A Design Challenge*, Ellis Horwood Limited, England, 1982.
5. *1992 Energy Technology Status Report - Final Report*, California Energy Commission, Rep 500-92-007, December 1992. Fact Sheet 14.2 (Ocean Energy Conversion - Wave Energy Conversion).
6. *1992 Energy Technology Status Report*, Appendix A, Volume II: Detailed Electric Generat Technology Evaluations, California Energy Commission, Report no. 500-92-007A V2, Dec 1992. Sections 14.0 (Ocean Energy) and 14.2 (Wave Energy).

Source: Energy Awareness Planning Guide II: Energy Facilities

LINKS ABOUT OCEAN ENERGY

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Companies Involved in Ocean Energy Development

- AquaEnergy
- Archimedes WaveSwing
- Blue Energy Canada
- Energetech Australia
- Float Incorporated
- Hydam Technology Ltd
- Independent Natural Resources
- Marine Development Associates Inc.
- Ocean Motion International
- Ocean Power Delivery Ltd.
- Ocean Wave Energy Company
- OreCON Ltd.
- Sea Power International AB
- S.D.E. Ltd., Sea Wave Power Plants
- WaveEnergy (Denmark)
- WaveDragon ApS
- WaveGen
- WavePlane International A/S

Other Links

- Energy Innovation Institute & EPRI Report on Assessment Offshore Wave Energy Co Devices (Acrobat PDF file, 52 pgs, 1 MB)
- Energy Efficiency and Renerable Energy Network (EREN - U.S. DOE) Ocean Energy
- Hawaii Ocean Energy Thermal Conversion
- NREL Ocean Energy Info
- National Renewable Energy Laboratory Ocean Thermal Energy
- Pacific International Center for High Technology Research (Ocean Thermal)
- Practical Ocean Energy Management Systems Inc. (POEMS) - education about ocea
- Scripps Institution of Oceanography
- U.S. Department of Commerce National Oceanic and Atmospheric Administration,

Wind Energy Assessment for Northwestern California

This report describes 7 counties wind potential from a one year study. The study look at 3 factors: assessment of the land use and environmental restraints related to the siting of wind farms, selection of sites for monitoring and a 1-year wind speed and direction measure program at 15 locations. Rather than summarizing what the study reported, I feel the abstract does a fantastic job of summarizing itself, therefore I am just going to quote it. "The results indicate that the Cape Mendocino areas has the most promising wind resource potential in Northwestern California, with a developable resource of 425 megawatts. The megawatte estimates are based upon the installation of 170 Mod-2 wind turbines spaced 5 diameters apart along 50 miles of ridgeline. Bear River Ridge, located in the Cape Mendocino Highlands, ranked as the most accessible site in the project and had the best rating of any site for transmission line availability. Annual average wind speeds, as measured at 10 meters or 33 feet, ranged from 15 mph near the coast of Cape Mendocino to 12 mph a few miles inland. No other area monitored in the project showed better than marginal potential for wind farm development."

So, I guess the conclusion we derived from this report is that wind energy is really not going to play a huge role in Humboldt County's basket of energy sources. We have only one area that shows any potential with the rest of the county showing little to no potential at all. But in Cape Mendocino, we believe a wind farm should be started in order to utilize the little amount of wind energy we can capitalize on.

Wiyot Tribe
Environmental Department

Kirk Cohune, Environmental Director

Dylan Gray, Environmental Specialist I

Wind Quality Monitoring Program – this program took place from October 2002 to January 2004 in order to determine the potential for the new Reservation in regards to wind energy harvesting development (i.e. – wind turbines). The data collected over the monitoring period have indicated that the Reservation does have an adequate wind resource, though be it marginal. The department is now researching technology, scale, and funding options. The department has developed a wind quality report, as well as an air quality report; both documents are available for review at the Tribal Office.

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California Energy Commission

WIND ENERGY ASSESSMENT FOR NORTHWESTERN CALIFORNIA

Volume 1

Final Report

Contract No. 500-79-117
SRI Project 2052

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November 1983

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ILLUSTRATIONS

TABLES

LEGAL NOTICE

Copies of this report are available from the California Energy Commission Publications Unit, 1516 Ninth Street, Sacramento, California 95814.

ABSTRACT

This document describes the results of a one-year assessment study of the wind resource potential in seven counties of Northwestern California. The study consisted of three parts: (1) an assessment of the land use and environmental restraints related to the siting of wind farms, (2) selection of sites for monitoring, and (3) a 1-year wind speed and direction measurement program at 15 locations. Volume 1 contains a discussion of the methods and analysis, including graphic summaries of the results. Volume 2 contains listings of the hourly data by site and month.

The results indicate that the Cape Mendocino area has the most promising wind resource potential in Northwestern California, with a developable resource of 425 megawatts. The megawatt estimates are based upon the installation of 170 Mod-2 wind turbines spaced 5 diameters apart along 50 miles of ridgeline. Bear River Ridge, located in the Cape Mendocino Highlands, ranked as the most accessible site in the project and had the best rating of any site for transmission line availability. Annual average wind speeds, as measured at 10 meters or 33 feet, ranged from 15 mph near the coast of Cape Mendocino to 12 mph a few miles inland. No other area monitored in the project showed better than marginal potential for wind farm development.

ACKNOWLEDGMENTS

This document has been prepared by SRI International for the California Energy Commission under Contract No. 500-79-117. The work was performed under the direction of Ronald W. Kukulka, Chief, Development Divison, Leon G. Vann, Jr., Deputy Division Chief, Development Division, Michael Shapiro, Manager of the Office of Small Power Producers, and Michael Batham, Wind Program Manager.

The authors appreciate the excellent field services provided by Environmental Systems and Service in Kelseyville, California. ES&S installed and maintained all the sites described in this document. The authors also appreciate the support of the CEC Contract Managers, Mr. Joseph P. Hennessey, Jr. and Mr. David Waco. Their timely suggestions and feedback have been invaluable throughout the conduct of this work.

I INTRODUCTION

SRI International was commissioned in 1981 by the California Energy Commision (CEC) to study the wind energy resources in northwestern California. The region of interest is shown in Figure 1. The CEC outlined a program calling for SRI to select potential sites, verify their suitability by field survey, evaluate wind-monitoring equipment, and conduct a long-term wind-measuring program and data analysis. The results of this program have been analyzed to assess the wind energy potential at the monitored sites and elsewhere in the region.

The study consists of four major components, as outlined below:

- Land Use and Environmental Assessments--Identification and evaluation of the land use and environmental siting restraints in the study area. For this assessment, geographic areas having at least one square mile of terrain or three miles of ridgeline were of special interest because they represented the minimum spatial requirements of a windfarm.
- Selection of Monitoring Sites—Consisting of two tasks:
  - --Wind Resource Analysis--Evaluation of the potential wind resource at promising sites, based on the analysis of historical wind data and application of the SRI windflow model (COMPLEX).
  - --Field Survey Assessment—Inspection of each candidate site for suitability as a continuous monitoring location. Access rights were then secured for those 15 sites selected for continuous monitoring.
- Evaluation, Selection, and Maintenance of Equipment--Evaluation of wind sensors and the data system, selection of instruments, and reevaluation after subjecting the selected instruments to laboratory and field tests. Based on initial test results, a maintenance program was established and adhered to during the one-year period.
- Long-Term Monitoring and Data Analysis--Installation of the selected instruments on 10-m towers at 15 locations and their operation for 1 year. Data from this operation were reduced and analyzed. Both data and results are presented in this report.

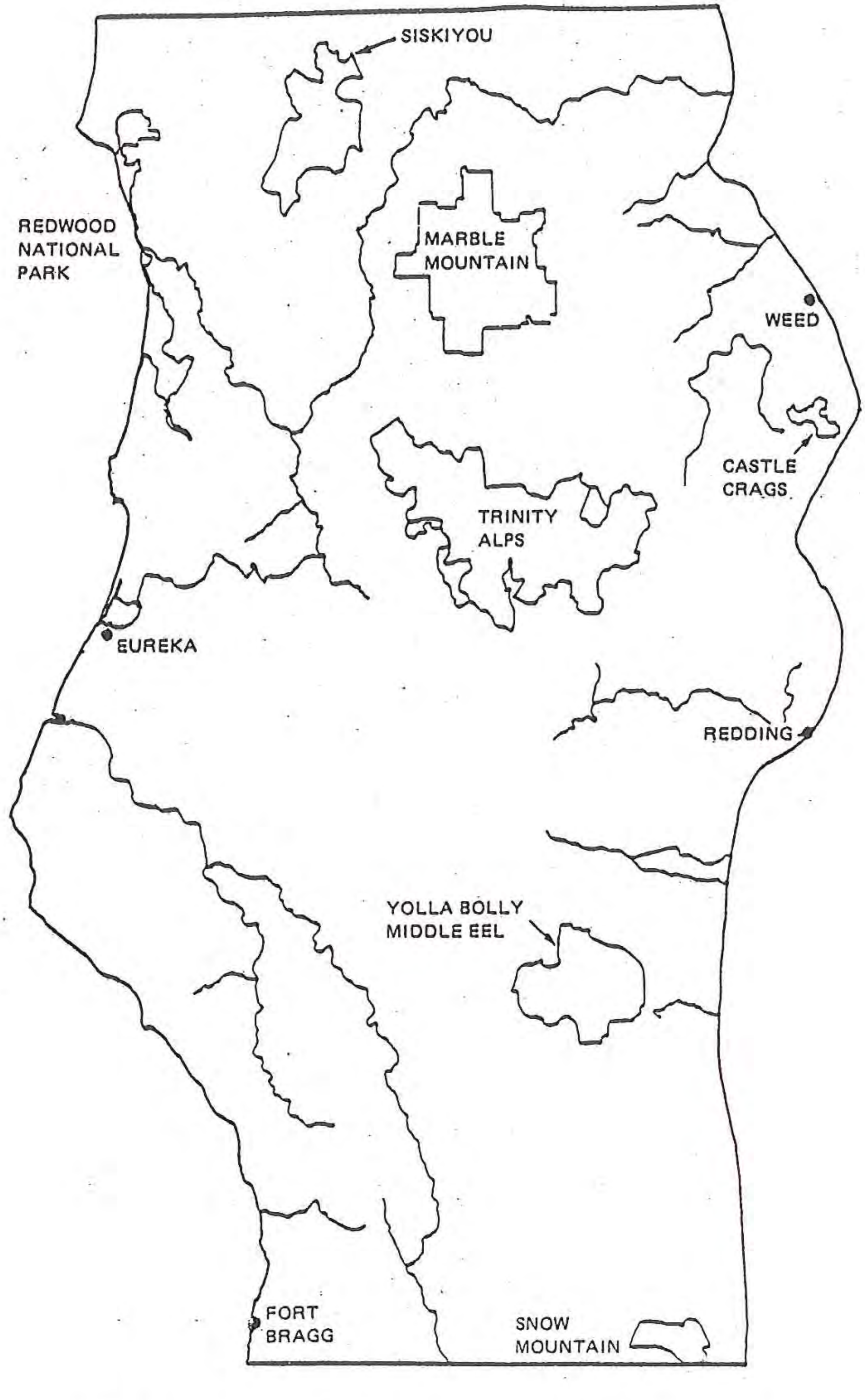

FIGURE 1 STUDY AREA FOR NORTHWESTERN CALIFORNIA WIND ENERGY RESOURCE ASSESSMENT

II LAND USE AND ENVIRONMENTAL ASSESSMENTS

A. Introduction

The objectives of this task were to identify and evaluate land use and environmental siting restraints in the study area, other than those related to wind resource characteristics. Our analyses assumed that the machines installed at the windfarms* would be large, 2.5-MW wind machines similar to the Boeing MOD-2. Construction and operational details of such windfarms were obtained from various reports (Bortz et al., 1979; CEC, 1980a, 1980b; U.S. Department of Energy (DOE), 1978, 1979a, 1979b, 1979c; Martin et al., 1979; Rogers et al., 1976; Vachon et al., 1979).

B. Phase I Analysis

The analysis was conducted in two phases. In Phase I, a base map of the study area was prepared that identified regions in which windfarm development would be prohibited because of existing land use or other environmental factors. Areas prohibited from development correspond to the shaded areas identified in Figure 2, and include the following:

- Existing wilderness areas
- Proposed U.S. Forest Service wilderness areas
- National parks
- "Designated areas" of the California Coastal Commission
- National wildlife refuges
- Water bodies
- Critical habitats of endangered species
- Areas with poor access, or that lack existing transmission line facilities

Twenty candidate sites (Figure 2), each covering approximately 300 to 1000 acres of land, were selected from the remaining regions on the basis of their proximity to existing transmission lines and access roads and their apparently favorable wind characteristics. (Wind resource analysis is discussed in Section III.)

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*A windfarm is defined in this report as an area having at least 3 miles of ridgeline or comprising 1 square mile in area.

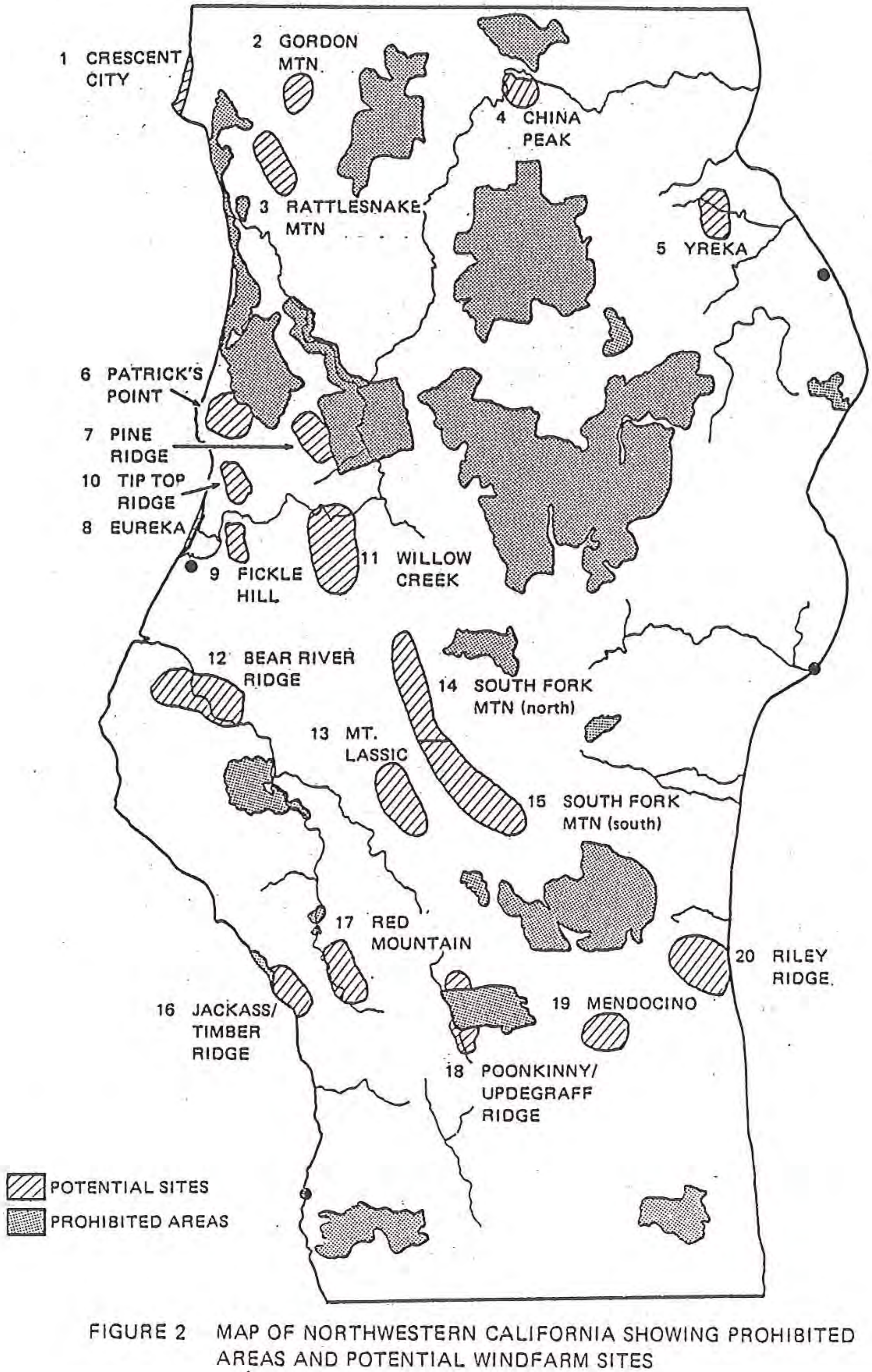

FIGURE 2 MAP OF NORTHWESTERN CALIFORNIA SHOWING PROHIBITED AREAS AND POTENTIAL WINDFARM SITES

The results presented below are those of the Phase II analysis, in which each of the 20 sites was evaluated to determine its potential for environmental conflict. Two types of evaluation were made at each site:

- An analysis of the factors that impact only the site and areas near the site
- An analysis of those factors associated with connecting the site to existing transmission lines and access roads.

C. Phase II Results

The Phase II analysis was conducted on those areas not eliminated in Phase I. The following restraints to windfarm development were analyzed separately:

- Land use, institutional, and legal
- Public acceptance and aesthetics
- Biological
- Physical (e.g., icing, soil, noise, and seismic activity)
- Electromagnetic communication interference
- Transmission line and site access.

A detailed discussion on each restraint is presented in Appendix A, which ranks, by restraint, 20 potential sites. These 20 regions were selected as a result of Phase I analyses plus other promising characteristics. Included were subjective appraisals of the restraints listed above, emphasizing the proximity to existing transmission lines and access roads, and potential wind resource.

The final ranking was a composite of the individual rankings (shown in Appendix A). The composite (Table 1) summarizes the site and transmission line/access road siting conflict ratings at these 20 sites--results of Phase II of the analysis. The sensitivity ratings indicate the likelihood of substantial environmental restraints with regard to windfarm development. A site with a high environmental conflict rating might nonetheless be environmentally acceptable if suitable measures were taken. However, sites with high environmental conflict ratings (and rankings) also appear to have more potential siting conflicts than those with lower ratings.

Seven sites that were ranked 17 or above* were given high combined site-sensitivity ratings. In the order of the least desirable, these are:

---

*Several sites received tie rankings.

Table 1

SUMMARY OF SITE AND TRANSMISSION LINE/ACCESS ROAD SITING CONFLICTS

		(1) SITE COMPONENT							(2) TRANSMISSION/ACCESS				(3) TOTAL CONFLICTS (1 + 2)	
Site	Name	Land Use/ Institutional/ Legal	Aesthetics/ Public Acceptance	Biological	Physical	Electromagnetic Communications Interference	Site Rank[1]	Site Sensitivity	Transmission Line	Access Road	Transmission Line/ Access Rank[1]	Transmission Line/ Access Sensitivity	Overall Site Rank[2]	Overall Site Sensitivity[3]
1	Crescent City	High	High	High	Low	High	20	High	Low	Low	3	Low	20	High
2	Cordon Mountain	Low	Mod	Mod	Mod	Low	3	Low	Mod	Mod	17	Mod	14	Mod
3	Rattlesnake Mountain	Low	Mod	Mod	High	Low	5	Low	High	Mod	20	High	20	High
4	China Peak	Low	Mod	High	High	Mod	13	Mod	Low	Low	6	Low	8	Mod
5	Yreka	Mod	Mod	Mod	High	Mod	17	High	Low	Low	5	Low	14	Mod
6	Patrick's Point	Mod	High	High	High	Low	17	High	Mod	Low	10	Low	14	Mod/ High
7	Pine Ridge	Mod	Low	Mod	Low	Low	2	Low	Mod	Mod	17	Mod	14	Mod
8	Eureka	Mod	Mod	High	Low	High	19	High	Low	Mod	10	Low	18	High
9	Fickle Hill	Mod	High	Mod	Mod	Low	18	High	Low	Low	3	Low	15	High
10	Tip Top Ridge	Mod	Low	Mod	Mod	Mod	6	Mod	Low	Mod	13	Mod	8	Mod
11	Willow Creek	Mod	Low	High	High	Low	11	Mod	Low	Mod	10	Low	5	Mod
12	Bear River Ridge	Mod	High	Mod	Low	Low	10	Mod	Low	Low	3	Low	3	Low
13	Mt. Lassic	Low	Mod	High	High	Low	9	Mod	Low	Mod	11	Mod	5	Mod
14	South Fork Mountain (north)	Mod	Low	Mod	Mod	Low	2	Low	Low	Low	5	Low	1	Low
15	South Fork Mountain (south)	Mod	Low	Mod	High	Low	4	Low	Low	Low	10	Low	3	Low
16	Jackass/Timber Ridge	Mod	Mod	High	High	Low	12	Mod	High	Low	19	High	18	High
17	Red Mountain	Mod	High	High	Low	Mod	17	High	Low	Mod	14	Mod	14	Mod/ High
18	Poonkinny/Updegraff Ridge	High	Mod	Mod	Mod	Mod	17	High	Mod	Mod	17	Mod	14	Mod
19	Mendocino Pass	Mod	Mod	Mod	High	Low	9	Mod	High	Low	19	High	18	High
20	Riley Ridge	Mod	Low	Mod	High	Low	7	Mod	Mod	Low	13	Mod	8	Mod

Key: Low = low siting conflict; mod = moderate siting conflict; high = high siting conflict.

[1]Based on a sum of the site component ratings ranked on a base of 20. The higher the number, the higher the siting conflict potential.

[2]Based on reranking the highest rank of the site sensitivity or transmission line/access rank on a base of 20.

[3]Based on the combined site rankings.

- Crescent City
- Eureka
- Fickle Hill
- Patrick's Point
- Red Mountain
- Poonkinny/Updegraff Ridge
- Yreka.

Five sites that ranked 5 or below received low ratings. In the order of the most desirable, these sites are:

- Pine Ridge (north)
- South Fork Mountain (north)
- Gordon Mountain
- South Fork Mountain (south)
- Rattlesnake Mountain.

The remaining eight sites received moderate site ratings:

- China Peak
- Tip Top Ridge
- Willow Creek
- Bear River Ridge
- Mt. Lassic
- Jackass/Timber Ridge
- Mendocino Pass
- Riley Ridge.

Six of the twenty sites above were judged to have high overall (site plus transmission/access) environmental sensitivity ratings:

- Crescent City
- Rattlesnake Mountain
- Eureka
- Fickle Hill
- Jackass/Timber Ridge
- Mendocino Pass

Three sites received low overall ratings:

- South Fork Mountain (north)
- South Fork Mountain (south)
- Bear River Ridge

The remaining 11 sites received moderate or moderate-high ratings.

These environmental conflict ratings and rankings are based on readily available information, but before specific site selection is undertaken, more detailed analyses will be required, including site reconnaissance.

III SELECTION OF MONITORING SITES

A. Overview

The selection of monitoring sites was guided by the results of the land use and environmental assessment tasks. However, the primary objective was to obtain the maximum amount of wind resource information for the northwestern California area as a whole. To realize this objective, a few compromises were made in selecting sites which would provide us with the desired monitoring coverage, even though some of them were objectionable from a land-use standpoint.

A review of existing meteorological data, in concert with the assessment of land use and environmental constraints, provided us with an initial list of promising geographic areas for wind-monitoring purposes (see Figure 2 in Section II). We then conducted aerial surveys to determine if good monitoring locations existed in the geographic areas. Subsequently, the selection was refined, based on the results of our ground-based surveys and application of our wind flow model (COMPLEX). Finally, access rights to certain sites could not be obtained. In these cases, we chose an alternate site, usually in the same geographic area.

B. Review of Existing Wind Data

In general, meteorological data are sparse for northwestern California. Existing long-term data consist primarily of records from conventional National Weather Service (NWS) stations in a few locations. In addition, a limited amount of short-term data is available from other agencies (e.g., U.S. Forest Service). However, most data are not for locales having high wind energy potential. The most comprehensive assessment was performed by Global Weather Consultants, Inc., under contract to Battelle Pacific Northwest Laboratory (Simon et al., 1980). These data (albeit sparse) were extremely useful in the initial wind resource assessment.

The review of the existing data employed a variety of maps and two types of aerial photography. Raised relief maps (at a 1:250,000 scale) were used to assess the general wind exposure of candidate sites. Information about specific, local site characteristics was obtained from topographical maps (at a scale of either 1:62,500 or 1:24,000) and high-altitude, U-2 aerial photography.

C. Site Surveys and Initial Screening

Results from the above analysis, and from the environmental and land use task, were used to develop the first version of a list of potential wind measurement sites. Low-level aerial photographs were then taken by Environmental Systems and Service (ES&S). Figure 3 (Bear River Ridge West) and Figure 4 (China Peak) are examples of photographs for sites where monitors were later installed. From the photographs of these two sites, it was apparent that a well-exposed and accessible monitoring location could be found. In other cases, photographs were used to eliminate sites--for instance, one site (Timber Ridge) was too heavily wooded, while another (Riley Ridge) had poor access. A second aerial survey checked for alternatives to the deficient sites.* Efforts were made to select alternative sites that would provide a measurement representative of the area as a whole. Hence, if a site were deficient for monitoring, measurements from the alternative site would serve to quantify the wind potential at the deficient site.

While the aerial surveys helped to identify monitoring locations that were well-exposed to the mean wind flow, and were reasonably accessible by a 4-wheel drive vehicle, at certain sites a ground survey was needed to help resolve questions concerning their suitability. Table 2 contains the list of sites that were deemed promising after this initial screening. Figure 5 shows the corresponding locations.

Table 2 also contains additional sites that indicate the number and types of surveys and potential access problems. The word "totalizer" in the last column refers to a microprocessor-controlled instrument that records the frequency distribution of the wind data rather than one that records the hour-by-hour values. The totalizer will operate as long as battery power lasts, unlike the hourly recording type of instrument which runs out of memory after a specified number of hours. For this reason, the totalizer can be the better choice of instrument for sites where poor access inhibits routine (e.g., monthly service) visits.

The next step in the site selection procedure consisted of estimating the expected mean wind speeds for the sites under consideration. The SRI COMPLEX wind flow model was used to make these estimates. The model application and results are described next.

D. Application of the SRI Windflow Model

1. Model Synopsis

The SRI windflow model uses historical weather data to estimate the potential wind energy at sites where data are not available. The method

*While deficient for purposes of monitoring, the site might have a high potential that could be realized if site access were improved and obstructions (e.g., trees) were removed.

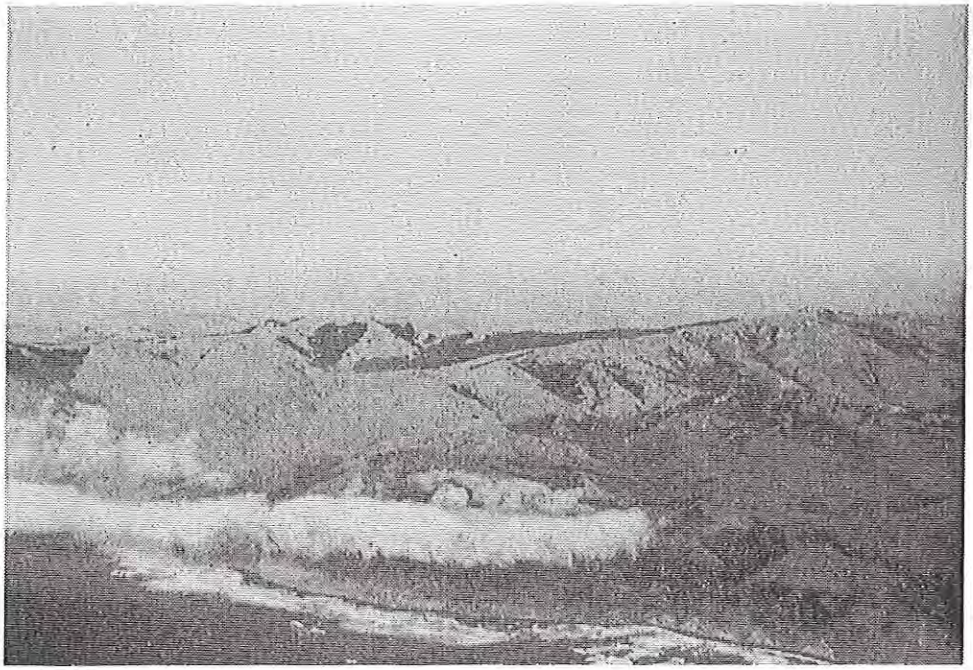

FIGURE 3 AERIAL PHOTOGRAPH OF BEAR RIVER RIDGE ON CAPE MENDOCINO

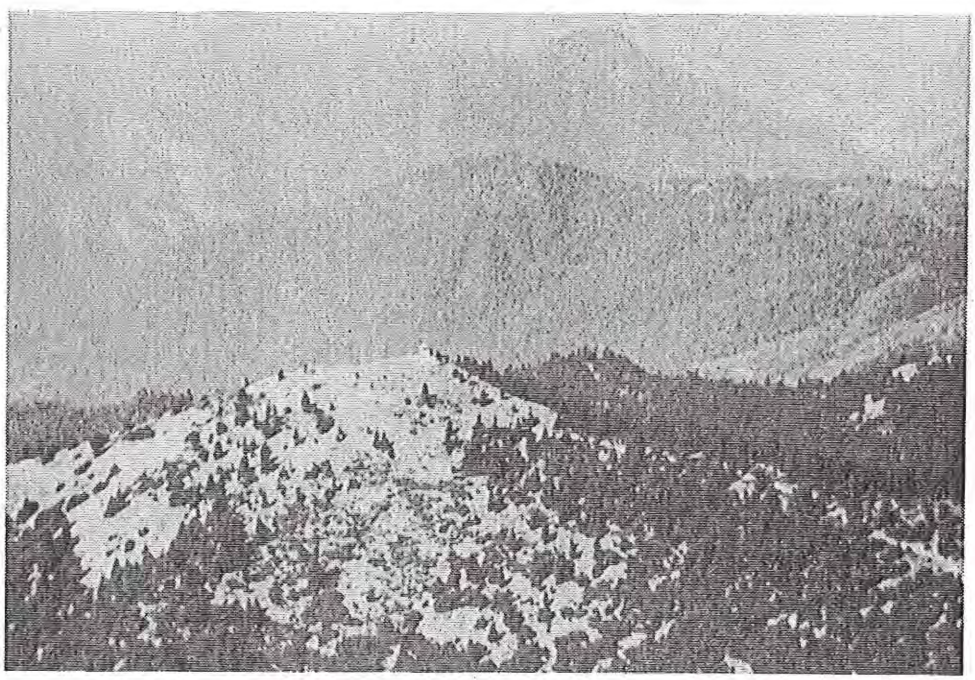

FIGURE 4 AERIAL PHOTOGRAPH OF CHINA PEAK

Table 2

POTENTIAL WIND MEASUREMENT SITES

Site	Name	Map Ref.*	Quadrangle	Rating	Aerial Surveys	Ground Survey	Notes
1	South Fork Ridge (north)	D-15	Picket Peak	High	2	Yes	Tower taller than 10-m tower recommended; "Windy Gap" location
2	Kneeland Prairie	C-6	Blue Lake Iaqua Buttes	High	2	Yes	Excellent location
3	Bear River Ridge	C-2	Capetown	High	2	Yes	Excellent location; good access
4	Rainbow Ridge or Mt. Pierce	C-2 D-2A		High	1	Yes	In order of preference; good exposure inland; windfarm possibilities on Rainbow; access to be determined
5	Mattole River (Moore Hill or alternative)	D-3	Petrolia	High	2	Yes	Satisfies need for site on southern part of Cape Mendocino
6	Smith River Hills	A-2A	Crescent City	High	1	Yes	Excellent site, good access
7	Westport (1 mile southeast of town; alternate to Timber Ridge)	E-21	--	High	1	Yes	12 miles north of Ft. Bragg; hill overlooks ocean; wind flagging; good exposure; alternate is Rockport
8	Murphy's Meadow (alternate to Willow Creek)	C-9	--	High	1	Yes	Much better exposure than Willow Creek
9	Cahto Peak	E-20	Cahto Peak	High	1	Yes	Site near lookout; good dirt access; totalizing site?
10	China Peak	A-13	Happy Camp	High	1	No	Well exposed; fair access
11	Scott Bar Mountains	A-19	Hornbrook	High	1	No	Wind flagging evident; good exposure and access
12	Hull Ridge Road	E-11	Ball Mountain	High	1	No	Evidence of wind flagging; good exposure and access
13	Shasta Bally	C-17	French Gulch	High	1	No	Permission granted; possible winter test site
14	Yreka Scarface Ridge	A-23	Yreka	High	2	Yes	Difficult winter access; totalizer?
15	Willow Creek	C-11	Blacksburg	Medium	2	No	Exposure not as good as others; possible totalizing site
16	Bald Hills	B-3	--	High	1	No	CDF 10-ft site to south; possible totalizing site to north
17	Laughlin Ridge	F-20	Potter Valley Willets	Medium to high	1	No	Possible site on peak near radio facility
18	Rattlesnake Mtn	A-9	Klamath Ship Mtn	Medium or low	1	No	Look again at northern end
	or McAlvey Ridge			?	0	No	Ridge between Kneeland and South Fork Mtn; needs aerial survey
19	Sugar Loaf	C-19	--	Medium	2	No	Totalizing site possibility at lookout; poor access; questionable winds
20	Hobo Gulch Ridge	C-12	Helena	Reject	2	No	Poor general exposure; too heavily wooded
21	South Fork Ridge (south)	D-15	Picket Peak	Reject	2	No	Poor exposure
22	Riley Ridge	E-13	Riley Ridge	Reject	1	No	Poor access; no open areas
23	Pine Ridge (south)	F-3	--	Reject	2	No	No evidence of wind; heavily wooded

*Used only in informal discussions with the CEC and not referenced herein.

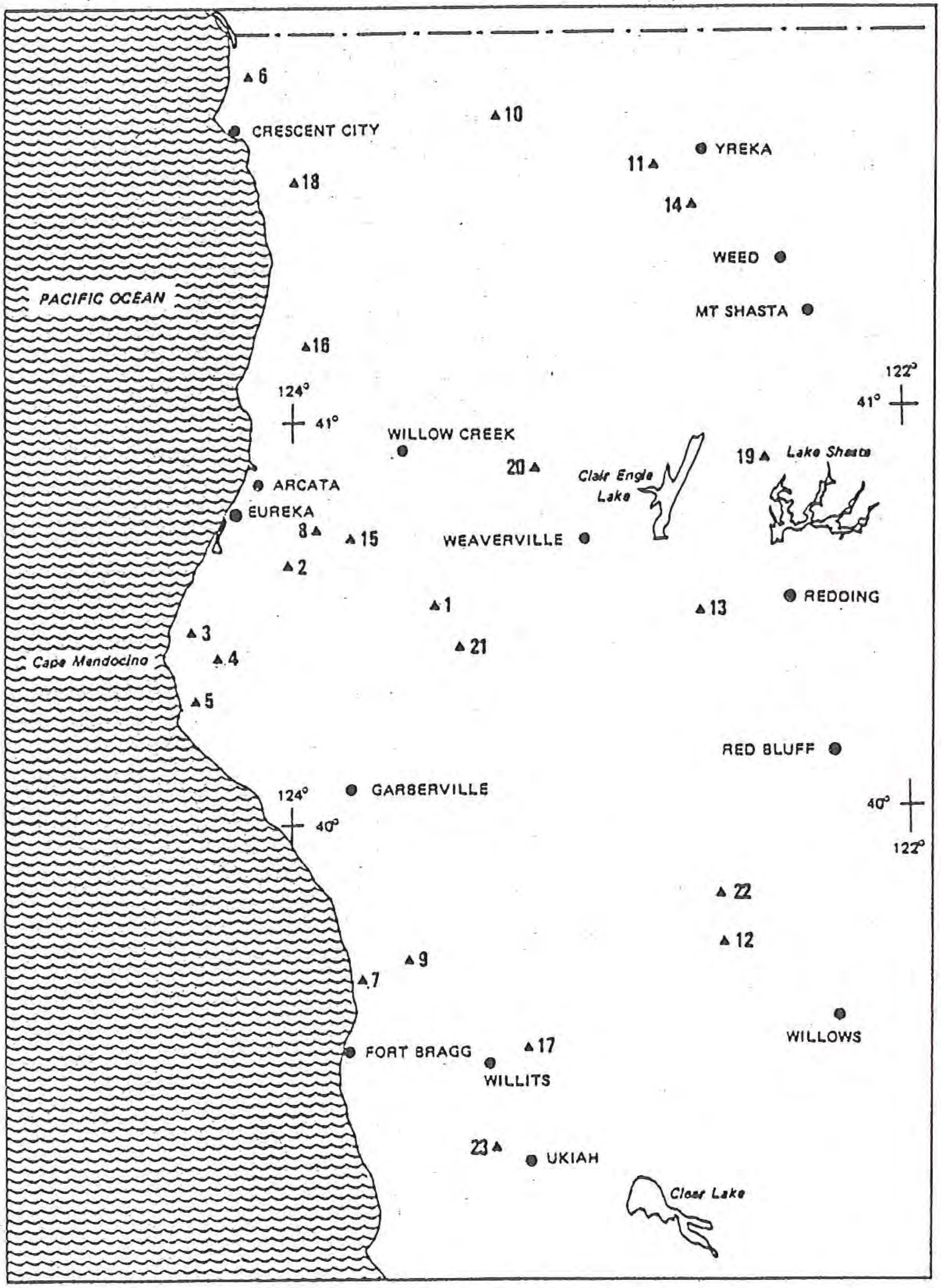

FIGURE 5 LOCATIONS OF THE POTENTIAL WIND MEASUREMENT SITES

is based on historical weather data for 1 year or more at National Weather Service (NWS) stations. (These stations are generally not at the windiest places.) The weather data are analyzed statistically to determine the average flow and the principal wind patterns, defined in terms of eigenvectors (Ludwig and Byrd, 1980). In addition, the time history of winds is described in terms of the coefficients of the eigenvectors for each observation time, generally made in increments of 3 hours. For each wind pattern, an initial analysis of the boundary-layer winds is made for the region of interest. The region is represented by a three-dimensional mesh of grid points--typical mesh distances are 5 to 10 km in the horizontal and 100 m in the vertical. The terrain shape is represented by the smoothed heights at the lowest level of grid points. The top of the boundary layer is generally taken as a curved surface with an appropriate shape as shown by climatological data. The intervening levels are at proportionate distances (such as one-tenth of the way) between the surface and the boundary-layer top at that location. Thus, the intervening levels tend to follow the terrain. For each wind pattern, an objective analysis is made of the winds at anemometer height. Also, the wind at the top of the boundary layer is taken as the geostrophic wind which is computed from sea-level pressure gradient data. Between the anemometer height and the upper surface, smooth changes in speed and direction are introduced by logarithmic interpolation. This gives the largest wind shear in the lowest layers, as desired.

To allow for the effect of the terrain and the height of the boundary-layer top on each wind pattern, the initial flow is adjusted to be nondivergent according to the well-known continuity equation. This causes the flow to speed up over high terrain and to deflect through lower pathways. For each representative wind pattern, the model gives the appropriate wind at the potential wind turbine site. A simulated time history of winds at the site is computed from the modeled site winds and the appropriate eigenvector coefficients. The statistical properties of these simulated winds are computed and include the annual average wind speed, seasonal and diurnal averages, and frequency distributions of speed and direction.

2. Use of the Model

In examining historical data to determine when the largest number of reporting stations were operational, we discovered that in 1950 a maximum of six stations existed; accordingly, we selected that year for study. Data from the six sites--Crescent City, Arcata, Ukiah, Red Bluff, Mount Shasta, and Yreka (Montague)--were obtained on magnetic tape (not without some problems) from the National Climatic Center. Because of previous experience (Endlich et al., 1982), we selected 3-hr observations for analysis.

The statistical analysis of the 1950s data revealed the mean vectors (not the same as mean speeds) shown in Figure 6. The mean geostrophic vector for the area computed from the sea-level pressure reports is also

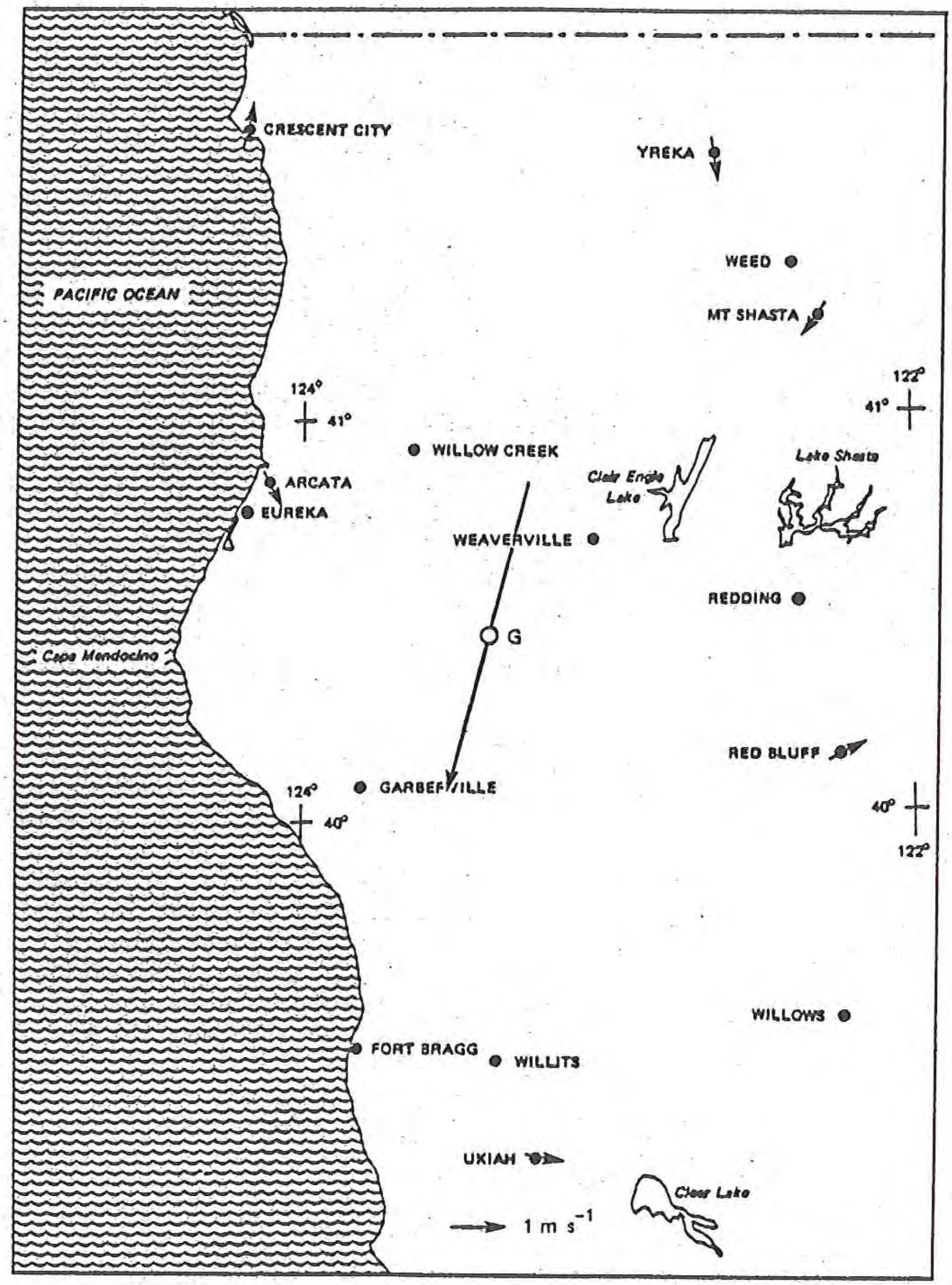

FIGURE 6 MODEL-DERIVED MEAN WIND VECTORS FOR 1950

shown, and has a magnitude of approximately 8 $m \cdot s^{-1}$, which is quite strong. The pattern of the principal eigenvector is shown in Figure 7 and the second-most important eigenvector is shown in Figure 8. A computer printout of the smoothed terrain height for the 10-km grid is shown in Figure 9. The grid covers the study area as shown in Figure 1.

Because of the lack of information about certain features related to the boundary-layer top (discussed later), we made computations for Case A, which gave speeds at the upper end of the range of anticipated true results, and Case B, which was intended to be more conservative.

For Case A, the daytime thickness values are fairly low (approximately 600 m) over the ocean and slope upward approximately 1000 m toward the east, as shown by the climatological data of Holzworth (1972). The values over the higher terrain are less than over lower elevations. This pattern was computed by the appropriate subroutine using a mean boundary-layer thickness for the area of 800 m, a west-east gradient of 1000 m, a slope factor of 0.5, and a minimum thickness (over high terrain) of 350 m. The nighttime boundary-layer thickness has approximately the same values over the ocean as in the daytime; elsewhere, the nighttime values are lower. The computations were made using a mean thickness of 425 m, a west-east gradient of -100 m (see Holzworth), a slope factor of 0.3 (flatter than in the daytime), and a minimum thickness of 350 m. Because of the lack of radiosondes in the area, the accuracy of these patterns cannot be checked in detail; however, we believe them reasonable. For Case B, we increased the depth of the boundary layer over high terrain, while leaving other features essentially unchanged. For daytime, the minimum thickness was increased to 450 m (from 350 m used in Case A); for nighttime it was increased to 400 m (from 350 m).

The most important aspects of the wind simulations are the annual and seasonal average speeds for a level 46 m above the terrain. Table 3 shows the annual averages for the different locations. Values are given for Case A (higher estimate) and Case B (conservative estimate), and the average of the two. Differences between the two increase with terrain altitude. As a result of previous experience, we expect the average of the two estimates to be accurate to within ± 1 $m\ s^{-1}$.

The statistics given below apply only to well-exposed sites. The highest annual average (9.3 $m\ s^{-1}$) is for the northern end of South Fork Mountain and Cape Mendocino Highlands (specifically, Bear River Ridge). The windflow patterns indicate a similar value at Horse Mountain (Willow Creek). At Kneeland Prairie the simulated average is 9.1 $m\ s^{-1}$, and the windflow patterns indicate that similar values would apply to Murphy's Meadow and to the Bald Hills. The annual average of 9.0 $m\ s^{-1}$ was calculated for the northern end of Rattlesnake Ridge (a suitable site was not found); at the eastern end of the Scott Bar Mountains it is 8.0 $m\ s^{-1}$. For the areas simulated, Hull Ridge shows the lowest value (7.3 $m\ s^{-1}$); however, even the lowest value may eventually be promising in terms of economically feasible wind energy.

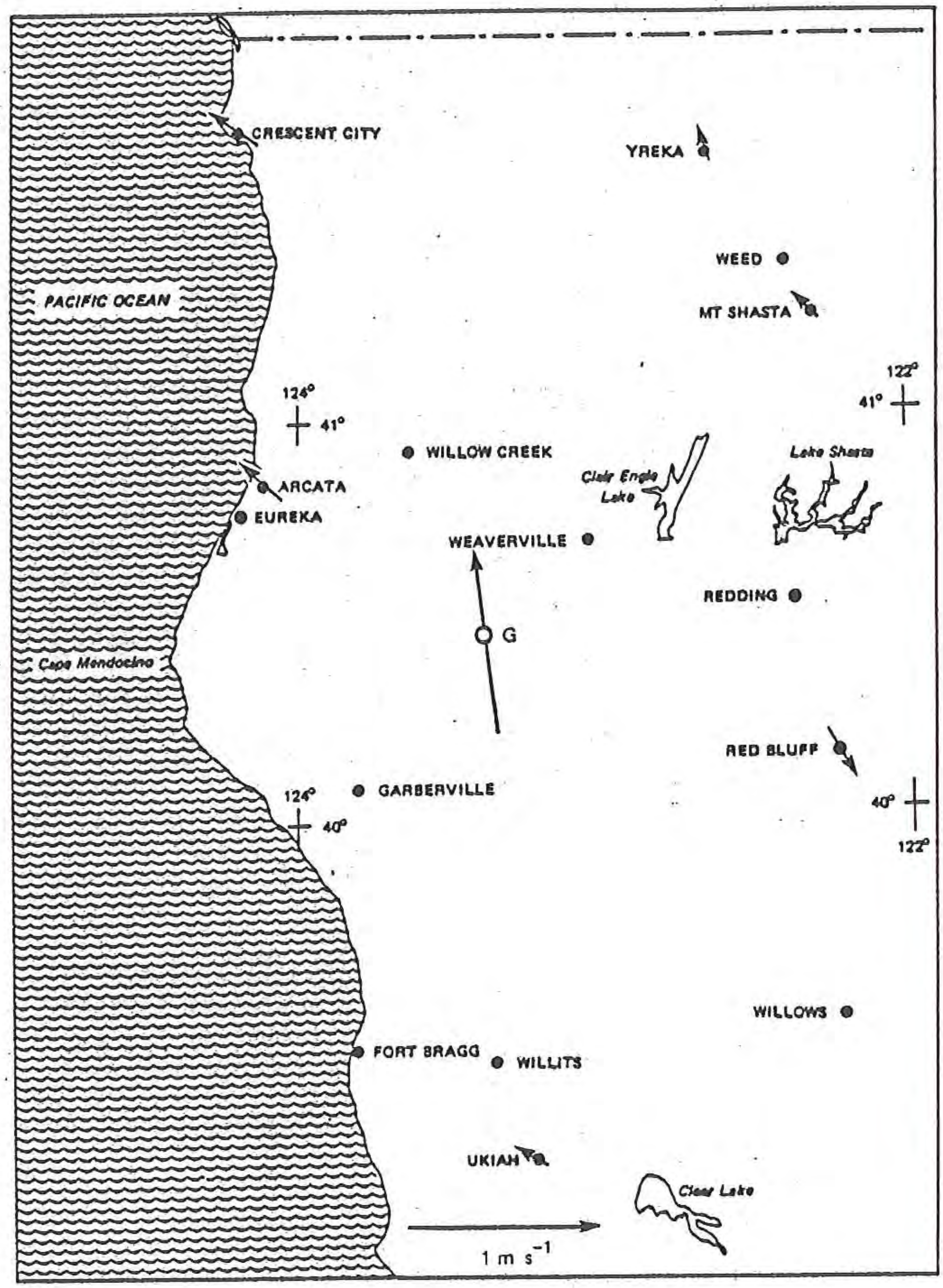

FIGURE 7 PRINCIPAL EIGENVECTORS FOR THE STUDY AREA

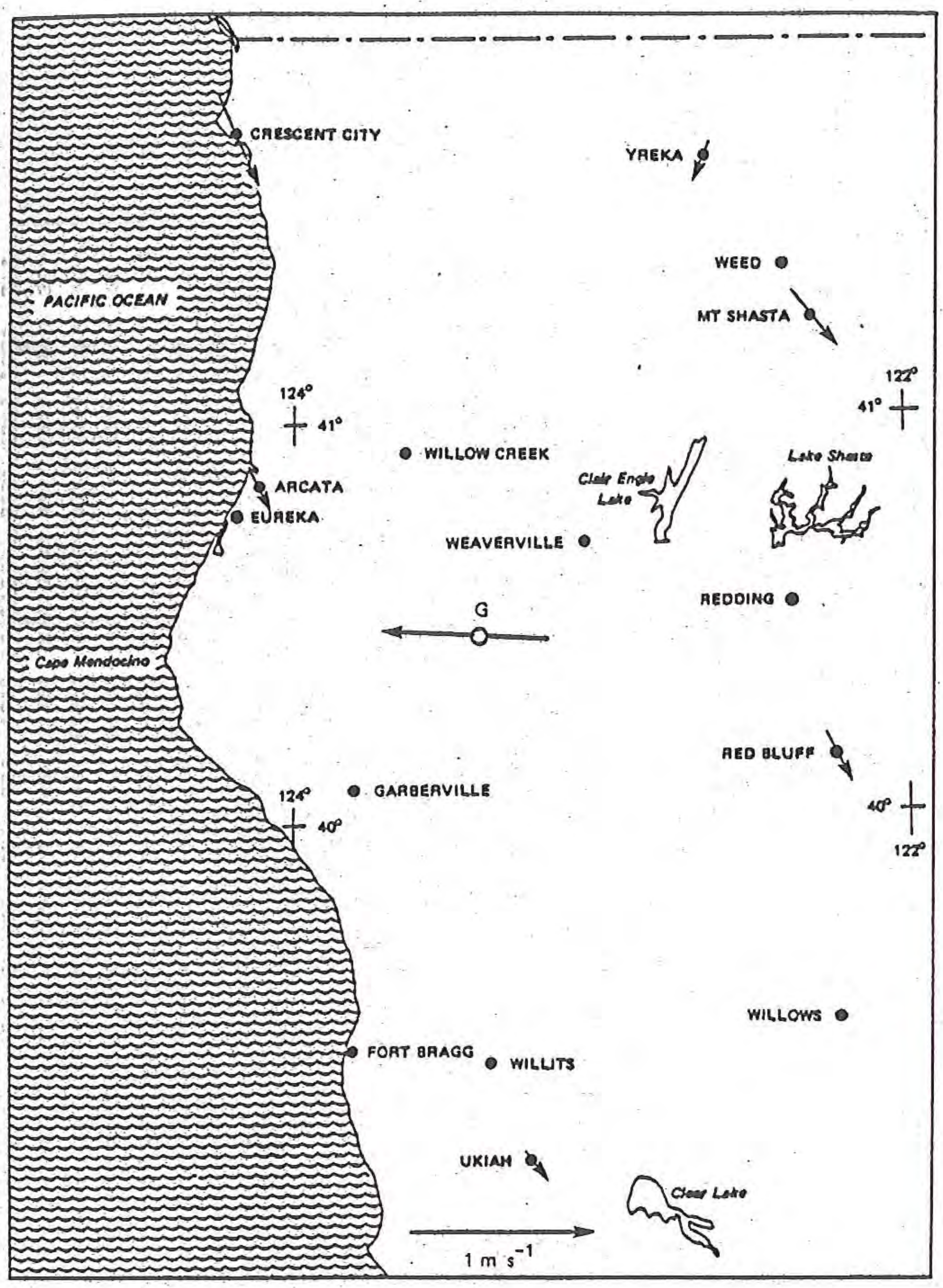

FIGURE 8 SECONDMOST IMPORTANT EIGENVECTORS FOR THE STUDY AREA

TERRAIN HEIGHT, M. 1ST ROW IS TO NORTH

0.	0.	144.	437.	679.	627.	1007.	1349.	913.	1100.	1466.	1367.	1670.	1083.	1317.	913.	812.	968.	1507.
0.	0.	76.	306.	582.	676.	1296.	1341.	887.	707.	688.	920.	632.	732.	943.	879.	825.	1148.	1953.
0.	0.	133.	415.	580.	1174.	1261.	943.	649.	736.	1392.	1373.	1052.	1397.	1207.	792.	810.	983.	1638.
0.	0.	117.	484.	466.	663.	1380.	1182.	593.	1047.	1693.	1091.	1134.	1045.	1232.	960.	807.	889.	1843.
0.	0.	0.	206.	693.	1149.	1244.	778.	964.	1725.	1706.	1931.	925.	850.	1239.	1132.	841.	882.	1234.
0.	0.	0.	165.	486.	643.	1031.	725.	1189.	1172.	1438.	1623.	1427.	876.	1458.	1233.	940.	1047.	1780.
0.	0.	0.	177.	297.	1039.	1015.	876.	628.	1252.	1436.	1510.	1749.	956.	1216.	1877.	1653.	1249.	2618.
0.	0.	0.	220.	352.	693.	677.	381.	1092.	940.	996.	1092.	1901.	1218.	1401.	1718.	2083.	1155.	1479.
0.	0.	8.	227.	516.	410.	531.	662.	1466.	939.	949.	1231.	1967.	1943.	1740.	1544.	1828.	1423.	1020.
0.	0.	112.	385.	411.	491.	406.	1163.	1430.	1267.	1139.	1091.	1784.	1457.	1239.	1397.	1735.	911.	1194.
0.	0.	9.	211.	581.	904.	349.	643.	1433.	1099.	1461.	1880.	1946.	2012.	982.	1349.	1332.	705.	1091.
0.	0.	10.	176.	407.	661.	680.	719.	1048.	1002.	1546.	1826.	1504.	1780.	895.	1189.	711.	616.	711.
0.	0.	0.	229.	357.	716.	1032.	482.	698.	1163.	1211.	1052.	1627.	848.	872.	988.	725.	397.	544.
0.	0.	56.	304.	303.	1004.	1246.	629.	986.	846.	837.	713.	883.	797.	1069.	743.	906.	398.	370.
0.	27.	169.	357.	709.	823.	1127.	1112.	922.	1017.	1266.	1079.	629.	817.	920.	594.	448.	237.	207.
1.	61.	80.	380.	488.	736.	907.	1252.	728.	1119.	944.	941.	909.	1024.	1293.	857.	319.	181.	173.
148.	449.	176.	220.	324.	481.	840.	962.	945.	1248.	937.	1013.	1175.	1105.	804.	392.	234.	169.	132.
121.	426.	643.	490.	219.	482.	945.	1175.	994.	1078.	1212.	1175.	1101.	758.	405.	269.	197.	183.	139.
6.	183.	488.	470.	299.	338.	478.	1363.	977.	1166.	1066.	1376.	892.	681.	371.	308.	198.	183.	154.
0.	356.	294.	380.	379.	315.	396.	645.	1001.	984.	1151.	1236.	1645.	1075.	466.	330.	244.	182.	119.
0.	0.	392.	334.	326.	274.	717.	538.	823.	816.	1152.	1630.	1530.	1328.	642.	388.	211.	160.	99.
0.	0.	0.	467.	351.	301.	605.	525.	937.	730.	1240.	1519.	1878.	1926.	1343.	408.	246.	173.	106.
0.	0.	0.	0.	391.	351.	683.	806.	485.	776.	1077.	1457.	1549.	1411.	1515.	447.	225.	153.	97.
0.	0.	0.	0.	72.	324.	550.	835.	572.	845.	748.	919.	1719.	1166.	1010.	319.	250.	158.	92.
0.	0.	0.	0.	0.	353.	506.	596.	623.	776.	471.	973.	1149.	1326.	1007.	546.	262.	156.	87.
0.	0.	0.	0.	0.	97.	552.	635.	795.	652.	646.	859.	1301.	1743.	911.	408.	256.	155.	67.
0.	0.	0.	0.	0.	29.	218.	477.	582.	588.	964.	723.	1706.	1305.	1347.	393.	303.	148.	50.
0.	0.	0.	0.	0.	34.	210.	374.	667.	724.	611.	1414.	1197.	997.	1402.	617.	354.	135.	43.
0.	0.	0.	0.	0.	63.	135.	308.	477.	500.	601.	925.	690.	1062.	1388.	526.	422.	147.	36.
0.	0.	0.	0.	0.	81.	93.	213.	392.	521.	424.	550.	981.	755.	1330.	828.	454.	156.	37.
0.	0.	0.	0.	0.	24.	130.	203.	349.	556.	258.	520.	693.	988.	1056.	778.	499.	201.	34.
0.	0.	0.	0.	0.	0.	232.	150.	364.	664.	232.	816.	502.	647.	856.	763.	711.	256.	47.

FIGURE 9. COMPUTER PRINTOUT OF THE AVERAGE TERRAIN HEIGHT (m) FOR THE STUDY AREA (Figure 1).

Table 3

ANNUAL AVERAGE WIND SPEEDS ($m\ s^{-1}$) 46 m ABOVE GROUND SIMULATED BY THE WINDFLOW MODEL FOR 1950

Location	Average Estimate ($m\ s^{-1}$)	Range of Estimates ($m\ s^{-1}$)
Cape Mendocino Highlands	9.3	9.0 - 9.7
South Fork Mountain	9.3	8.6 - 10.0
Kneeland Prairie	9.1	8.8 - 9.5
Rattlesnake Ridge	9.0	8.7 - 9.3
Cahto Peak	8.2	7.6 - 8.8
Scott Bar Mountains	8.0	7.3 - 8.8
Smith River Hills	7.8	7.6 - 8.0
Hull Ridge	7.3	7.0 - 7.6

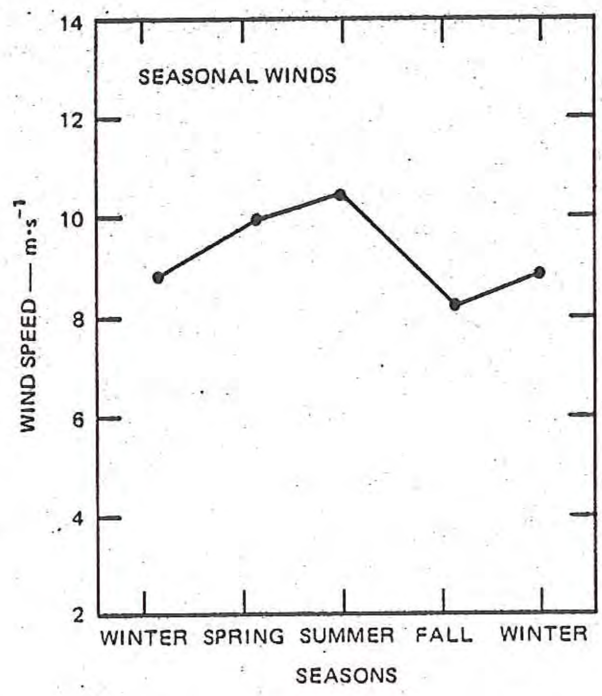

FIGURE 10 SEASONAL WIND SPEEDS AT BEAR RIVER RIDGE, CASE B

FIGURE 9. COMPUTER PRINTOUT OF THE AVERAGE TERRAIN HEIGHT (m) FOR THE STUDY AREA (Figure 1).

The seasonal values at Bear River Ridge for Case B are shown in Figure 10. The seasonal patterns are similar at other locations and show a pronounced summer maximum, which is evidently due to the strength and steadiness of the summertime geostrophic flow. In fall and winter the winds are strong during stormy periods, but weak otherwise, giving relatively low seasonal values.

In assessing these values, we must realize that the principal adjustable variables of the windflow model relate to the thickness and shape of the boundary layer. The average boundary-layer thickness is given by climatological data with reasonable accuracy, but the shape of the boundary-layer top in relation to the mountains and the minimum thickness of the boundary layer over elevated terrain is unknown. The lack of this information constitutes the major uncertainty in the present results. We have used values for slope and minimum thickness based on our experience in previous model simulations.

All of the annual average speeds are larger than expected. (Of course at ordinary anemometer height, the speeds could be as much as 25% less than at 46 m because of the ordinary low-level shear.) We believe that the model results are most reliable near the ocean where the temperature inversion at the top of the boundary is well developed; the model results lose some reliability inland because of the partial destruction of the boundary-layer top over high terrain as a consequence of turbulence and localized daytime heating which is not treated by the model. As discussed later (Section V), these model estimates were too high for most locations.

The model simulations, allowing for the limitations discussed above, were useful in comparing the expected wind speeds at the different prospective instrumentation sites. In particular, the results for the Cape Mendocino Highlands indicated strong winds in a large area that had good access; therefore, we established three instrument sites in this region. Similarly, instruments were placed at other promising places such as Kneeland Prairie, South Fork Mountain, and the Scott Bar Mountains. Winds at the Smith River Hills, Hull Ridge,* and Westport were somewhat weaker, but measurements at these places were needed to check the simulations and to cover the entire area of interest. Also, measurements at China Peak and Shasta Bally were needed for full areal coverage and high altitude wind information, respectively.

E. Final Selection

After application of the SRI COMPLEX model, ground surveys were conducted at the most promising locations. The ground survey consisted of examining the sites for evidence of wind flagging, evaluating the exposures of potential wind tower locations, and identifying access

*Renamed Valley View

routes and site ownerships. The site owners were contacted concerning access rights to their property.

Access rights could not be obtained for Rainbow Ridge and Murphy's Meadow (see Table 2). Alternatives for these two sites were found, and the final site selections are given in Table 4. The corresponding locations are shown in Figure 11, and the U.S.G.S. topographical map segment for each site is given in Appendix B. The high density of monitoring sites on the Cape Mendocino highlands reflects our assessment that the wind resource there is the most promising in the northwestern part of California (see Table 3). For similar reasons, we had hoped to place two monitors on South Fork Mountain. However, we could find only one good monitoring location with reasonable access. The remaining sites were located in a manner that provided good geographic coverage of the northwestern part of the state.

Names of some of the sites differ between Table 2 and Table 4 because, in the former case, only broad geographic areas were known; in the latter case, exact locations are identified. The location designator, or U.S.G.S. Quad name, can be used to compare exact locations with the initial list in Table 2. One site (#8, Cow Mountain) did not appear on the original list. This was selected to provide geographic coverage in the southeastern section of the study area.

Table 4

SITE DESIGNATIONS AND LOCATIONS

Site Number	Site Name	Location Descriptor	U.S.G.S. Quad*	Latitude (N)	Longitude (W)
1	Pickett Peak	South Fork Mountain	Pickett Peak	40°20'45"	123°21'45"
2	Kneeland Prairie	Barry Ridge	Iaqua Buttes	40°43'36"	123°58'30"
3	Bear River Ridge West	Cape Mendocino	Cape Mendocino	40°29'18"	124°20'36"
4	Bear River Ridge East	Cape Mendocino	Scotia	40°26'57"	124° 8'38"
5	Strawberry Point	Mattole River	Cape Mendocino	40°16'54"	124°21' 0"
6	Smith River Hills	Smith River	Crescent City	41°54'42"	124° 3'30"
7	Westport	Westport	Cape Vizcaino	39°36'24"	123°46'36"
8	Cow Mountain	Cow Mountain Ridge	Ukiah	39° 7'48"	123° 4'24"
9	Cahto Peak	Cahto Peak	Bramscomb	39°41'12"	123°34'36"
10	China Peak	China Peak	Happy Camp	41°50' 6"	123°16'18"
11	Mahogany Point	Scott Bar Mountains	Yreka	41°44' 0"	122°44'42"
12	Valley View	Skidmore Ridge	Hall Ridge	39°46'15"	122°41' 0"
13	Shasta Bally	Shasta Bally	French Gulch	40°36'10"	122°39' 0"
14	Scarface Ridge	Scarface Ridge	Yreka	41°32'42"	122°37'36"
15	Horse Mountain	Horse Mountain	Willow Creek	40°52'30"	123°44' 0"

*All maps are the 15 minute scale except for Hall Ridge which is 7 1/2 minutes.

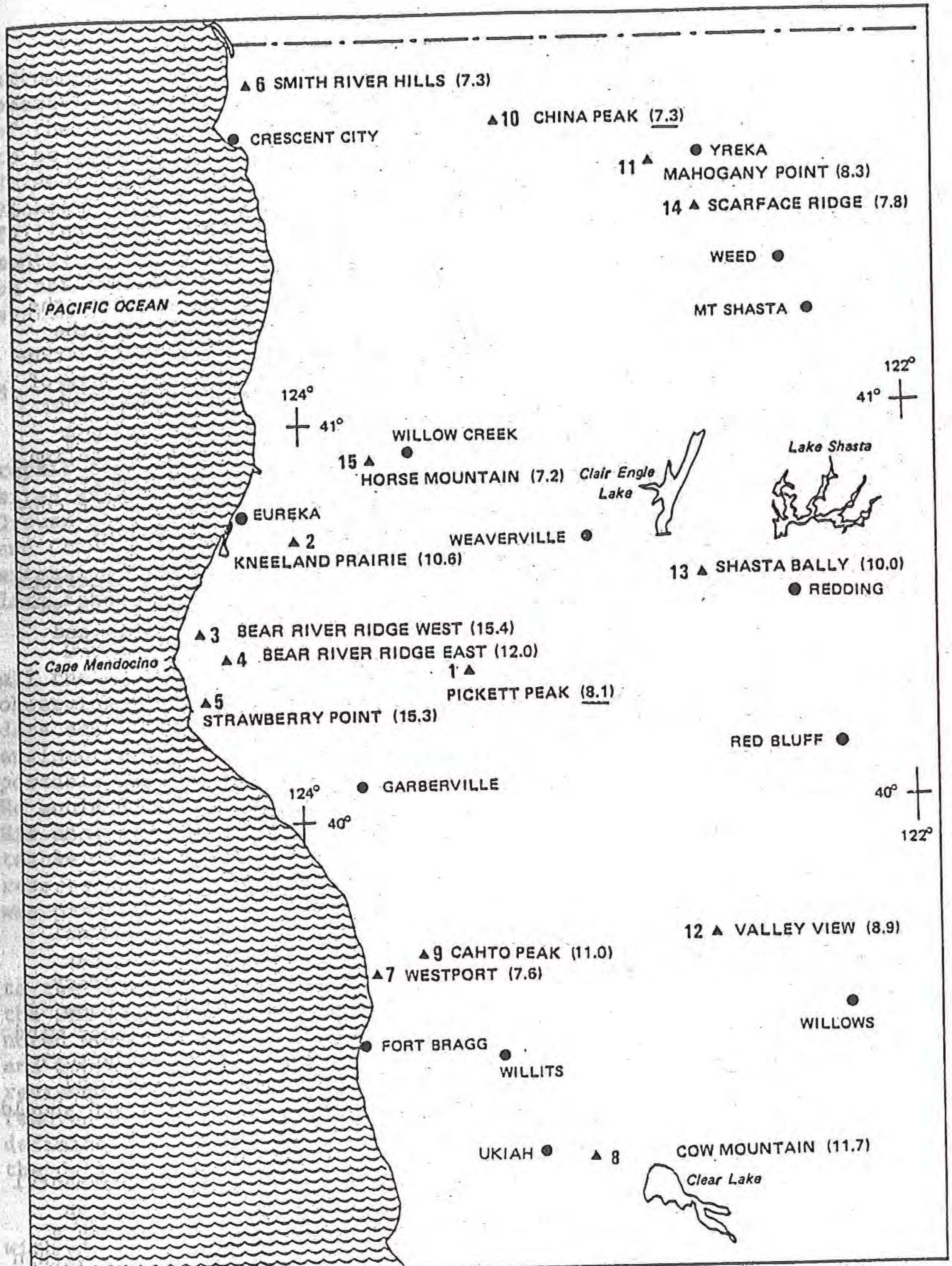

FIGURE 11 FINAL LOCATIONS (▲) OF THE 15 WIND MONITORING SITES
Numbers in parenthesis are measured annual average wind speeds (mph) at 10 m.
The underscore indicates an annual data capture below 50 percent.

IV EVALUATION OF EQUIPMENT AND MAINTENANCE PROGRAM

A. Instrument Selection and Testing

The instrumented package consists of three basic components: the speed sensor (anemometer), the direction sensor (wind vane), and the data acquisition system. Originally, the intent was to procure instruments from several different manufacturers, test them under a range of applicable environmental conditions, and then select instruments that performed best. However, time and budget constraints inhibited our ability to perform such an operational evaluation. Instead, we relied on manufacturers' specifications, and testimonies from wind energy specialists who had applicable experience with the equipment under consideration. Our selection was based on this type of information.

The next step was to procure and test the equipment in a timeframe that would allow us to make corrections or change equipment if the selected equipment did not perform satisfactorily under laboratory and actual field conditions. The equipment consisted of

- Maximum contact anemometers
- Downeaster wind vanes
- Aeolian Kinetic MS778 digital data acquisition systems and an MC-65 portable microcomputer for field data reduction.

Sixteen data systems and eighteen sets of wind sensors were procured to instrument the fifteen sites and supply ample spare parts.

Initial tests of the Maximum anemometers in the SRI wind tunnel revealed that the units are linear between 10 and 100 ft/s and that calibration factors among sensors agree within experimental accuracy limits. SRI calibration factors were slightly different from those supplied by the manufacturers (registering about a 5 percent lower wind speed at 75 ft/s than factory values). We decided to use the factory values, which are based on experimental results taken at MIT's wind tunnel. The MIT tunnel has a larger cross section than SRI's and should provide more accurate calibration factors.

To test the anemometer and data system under adverse environmental conditions, one anemometer and digital data system was placed in an environmental chamber (about 4 x 4 x 4 ft). Wind was simulated by a blower located about 3 inches from the anemometer. The velocity within the blower's exit section was monitored by a pitot static tube, and held constant by adjusting the blower power with a Variac. Qualitative tests showed that the anemometer maintained remarkably constant readouts for the same simulated velocity between -18°C and 25°C, and maintained its characteristics in the presence of ice on the assembly.

To test the equipment under field conditions, five sites were instrumented and visited one month after installation to verify their operation. These sites were installed several months before the startup of the one-year monitoring period. This allowed ample time for changes to be made if performance was not satisfactory. The test sites were Strawberry Point, Kneeland Prairie, Bear River Ridge-West, Westport, and Pickett Peak. The anemometer at the Pickett Peak site was destroyed by falling ice. The other sites performed and recorded valid wind measurements. Figure 12 contains a photograph of the equipment, as installed on the 10-meter mast at Site 7, Westport. Figure 13 shows the data system as mounted in its container on the mast.

B. Maintenance Program

The maintenance program included routine service visits, use of repair facilities near the study area, and periodic data reviews. The sites were visited monthly, except for certain sites in the winter. Ground access to four sites--Pickett Peak, Mahogany Point, Valley View, and China Peak--was prevented during the winter months because of the extensive snow cover. These sites were accessed by helicopter once in late February.

During each site visit, the field service engineer would inspect all the equipment for mechanical defects and exercise the entire system, observing its performance on the visual display of the Aeolian Kinetic's data acquisition system. Prior to this mechanical check, the field engineer would "milk" the data from the solid state memory onto his portable computer which printed all the results from the previous month. He would then analyze the printout, noting any potentially invalid data. His analysis was entered onto his service report form before returning to his office (Environmental Systems and Service, Kelseyville). His reports and printouts were reviewed by the data analyst. Another form was prepared for each site, summarizing problems and data capture.

The forms and data printout were forwarded to SRI. Data were input to the computer and the resulting listings were reviewed once more by the SRI principal investigator. Any inconsistencies not previously noted were immediately brought to the attention of the field engineer, and appropriate remedial action was taken. Hence, the data were manually reviewed at least twice before acceptance. Invalid data were immediately removed from the data records. However, there were occasions when definite decisions concerning validity could not be made. In these cases, the data were not removed from the record.

In light of the preceding discussion and the unknowns associated with an untended station in a remote area, there are bound to be errors in the data base. There are some sites (e.g., Kneeland Prairie) where a few of the hourly wind speed values are suspiciously high. However, the number of these occurrences is so low that there is negligible effect on the monthly wind speed averages. Such values were not thrown out because physical evidence did not justify invalidating the data.

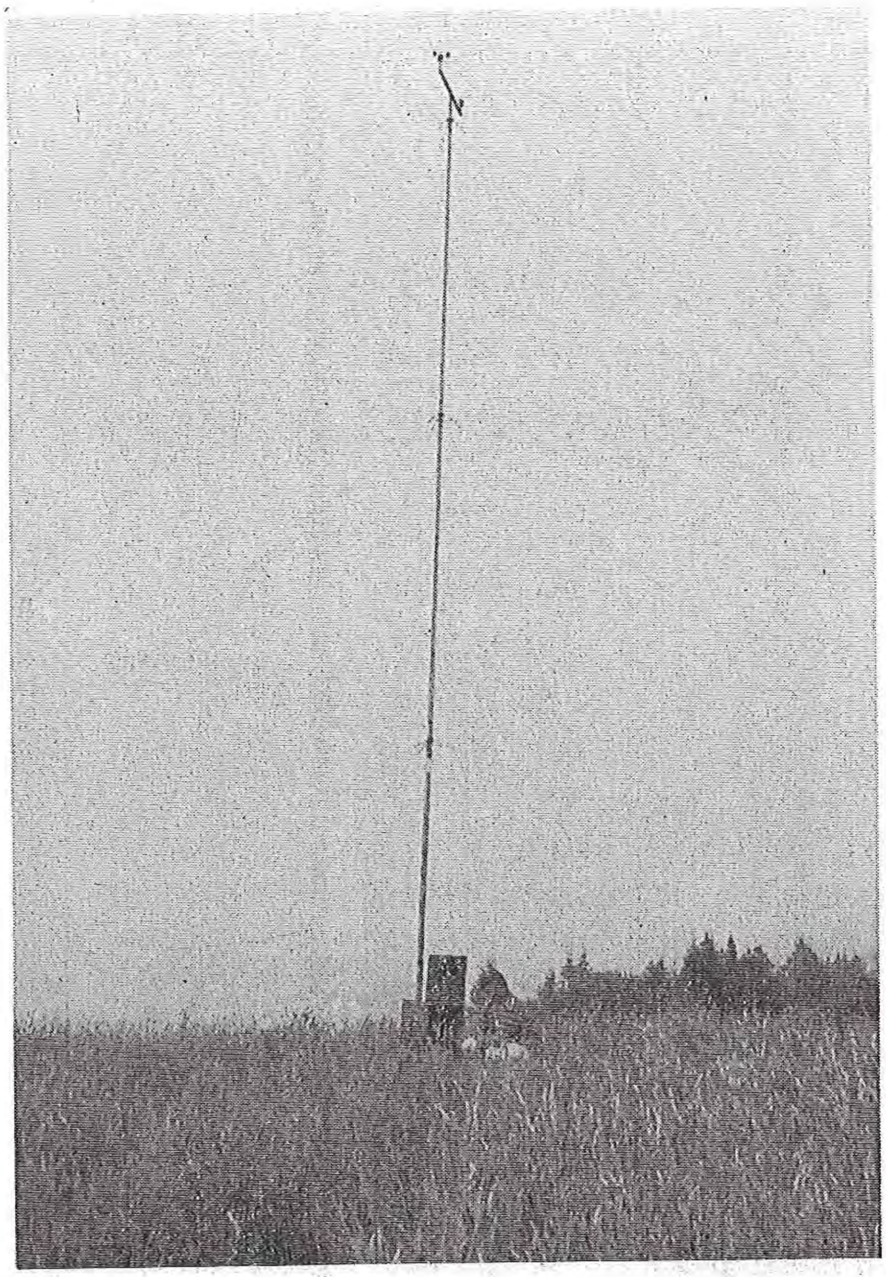

FIGURE 12 PHOTOGRAPH OF THE WESTPORT WIND MONITORING STATION

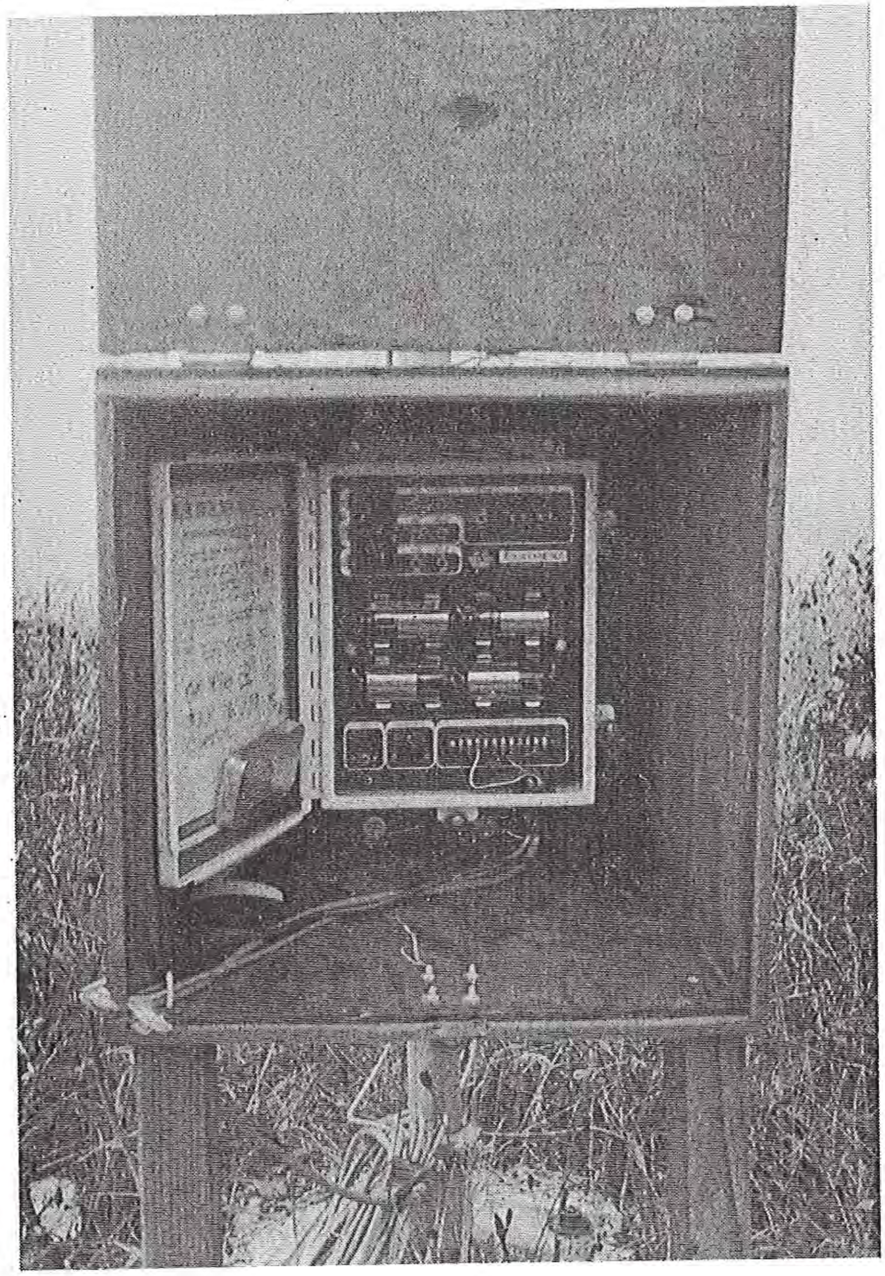

FIGURE 13 INSTALLATION OF THE AEOLIAN-KINETICS DATA ACQUISITION SYSTEM AT THE WESTPORT SITE

Most likely, the most frequent data problems occurred in the winter months when anemometer icing was a problem. There were times when this was obvious and data were invalidated; however, there were other times when the problem was not clearly detectable and the data, though suspiciously low, were not removed from the data base. As before, we do not think the number of such occurrences is high enough to substantially alter (change) the monthly averages.

C. Performance

The annual data capture was 75 percent when all the sites are combined. A higher data capture was hindered by a number of problems, mostly related to the harsh environment. As stated previously, access to four of the higher elevation sites was hindered by extensive snow cover which in two cases rendered the unmaintained access roads impassable until April. Furthermore, at certain of the higher elevation sites, icing caused both permanent damage to the wind sensors and also temporary loss of data when the ice froze on the sensors, inhibiting their response to wind motions. Permanent damage resulted when falling ice (e.g., from nearby towers) struck the sensor or data system, causing complete loss of data until the next service call.

The data capture percentage by site is given in Table 5. Pickett Peak, at an elevation of about 5,800 feet on South Fork Mountain, had the lowest data capture. Falling ice caused most of the data lost in the winter. September data was also lost because of damage to the wind sensor, caused by some falling object or by a bird collision. China Peak had the second lowest data capture, primarily because of vandalism. Data loss at other sites resulted from an assortment of failures, mostly mechanical in nature and induced by the harsh environment. There were also cases where human error caused loss of data for one month (e.g., September at Bear River Ridge East).

The Aeolian Kinetics MS778 data system performed extremely well, and was not the cause of significant data loss. The Maximum contact anemometers had icing problems but, for the most part, recovered as soon as environmental conditions became favorable (i.e., higher temperatures and higher winds). In one case (January at Shasta Bally), the wind sensor apparently failed because high wind loadings on a frozen anemometer caused a stress-related failure. It should be noted that icing problems were expected, and the Maximum unit was chosen because it is thought to be more resistant to these problems than other wind sensors of comparable price.

ABSTRACT

This document describes the results of a one-year assessment study of the wind resource potential in seven counties of Northwestern California. The study consisted of three parts: (1) an assessment of the land use and environmental restraints related to the siting of wind farms, (2) selection of sites for monitoring, and (3) a 1-year wind speed and direction measurement program at 15 locations. Volume 1 contains a discussion of the methods and analysis, including graphic summaries of the results. Volume 2 contains listings of the hourly data by site and month.

The results indicate that the Cape Mendocino area has the most promising wind resource potential in Northwestern California, with a developable resource of 425 megawatts. The megawatt estimates are based upon the installation of 170 Mod-2 wind turbines spaced 5 diameters apart along 50 miles of ridgeline. Bear River Ridge, located in the Cape Mendocino Highlands, ranked as the most accessible site in the project and had the best rating of any site for transmission line availability. Annual average wind speeds, as measured at 10 meters or 33 feet, ranged from 15 mph near the coast of Cape Mendocino to 12 mph a few miles inland. No other area monitored in the project showed better than marginal potential for wind farm development.

Table 5

DATA RECOVERY PERCENTAGES BY STATION

Site Number	Site Name	Location Descriptor	1981 Sep	1981 Oct	1981 Nov	1981 Dec	1982 Jan	1982 Feb	1982 Mar	1982 Apr	1982 May	1982 Jun	1982 Jul	1982 Aug	Total*
1	Pickett Peak	South Fork Mountain	0	77	79	28	0	0	0	0	15	100	84	100	41
2	Kneeland Prairie	Barry Ridge	100	89	99	100	80	90	97	100	100	93	66	43	88
3	Bear River Ridge West	Cape Mendocino	100	85	99	80	55	94	98	97	76	0	33	59	73
4	Bear River Ridge East	Cape Mendocino	0	78	35	62	78	100	97	100	93	99	100	86	77
5	Strawberry Point	Mattole River	100	70	11	65	80	100	9	58	68	25	58	100	62
6	Smith River Hills	Smith River	100	76	100	100	82	94	94	48	98	99	100	100	91
7	Westport	Westport	100	100	100	71	77	100	100	58	46	100	100	99	87
8	Cow Mountain	Cow Mountain Ridge	50	89	97	92	60	100	11	5	100	100	100	100	78
9	Cahto Peak	Cahto Peak	100	99	99	100	50	94	55	8	97	15	37	99	71
10	China Peak	China Peak	100	87	74	96	39	0	0	0	0	25	71	0	45
11	Mahogany Point	Scott Bar Mountains	100	96	95	78	0	77	58	91	86	100	100	100	82
12	Valley View	Skidmore Ridge	100	99	95	100	76	93	83	98	100	100	100	100	95
13	Shasta Bally	Shasta Bally	100	94	73	71	0	85	42	67	100	100	100	82	76
14	Scarface Ridge	Scarface Ridge	100	99	99	98	86	95	90	77	50	18	28	100	78
15	Horse Mountain	Horse Mountain	100	95	84	84	50	89	5	55	97	99	100	100	80

*Percentage is calculated by dividing the number of valid hourly observations (over the 12-month period) by the number of hours possible (8760); for all sites combined, the data capture is 75%.

V ANALYSIS OF THE WIND DATA

A. Summary of Data by Location

Table 6 contains a summary of wind data for each location. The summary includes monthly and annual wind speed averages and an estimate of the annual power density for each site. The power density, $\bar{P}$ (watts m^{-2}), was computed from:

$$\bar{P} = \frac{1}{2} \bar{\rho} \sum_{j=1}^{c} f_j \, V_j^3$$

where $\bar{\rho}$ = the mean air density (in kg m^{-3}) at the appropriate site elevation

c = the number of wind speed clases

f_j = frequency of occurrence of wind in the jth class and

V_j = the median wind speed (in m s^{-1}) of the jth class

The values for c, f_j, and V_j were obtained from the calculated frequency distributions given in the Appendix.

In estimating $\bar{P}$, the measured 10-m wind speeds were extrapolated to an assumed hub height of 46-m using the equation:

$$V_{46} = V_{10} \left(\frac{46}{10}\right)^{\alpha}$$

where V_{46} = 46-m level wind speed

V_{10} = 10-m level wind speed

α = site exponent (dimensionless).

For estimates in Table 6, α was conservatively estimated to be 0.1. However, there is evidence (Sandusky et al., 1982) to support a less conservative estimate for α of 0.2 at the coastal locations and 0.15 inland.

Appendix C contains the following graphs for all sites covering the 12-month monitoring period:

- average wind speed versus time of day

Table 6

WIND SPEED AND POWER DENSITY SUMMARIES BY SITE

Site Number	Site Name	Wind Speed (mph) 1981 Sep	Oct	Nov	Dec	1982 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Annual Average 10-m	46-m	46 m Power Density watts/M^2
1	Pickett Peak	--	9.0	12.2	*12.9*	--	--	--	--	*6.4*	7.1	6.4	5.5	*8.1*	*9.4*	132
2	Kneeland Prairie	8.3	8.9	13.4	15.1	12.5	14.7	11.6	11.6	8.7	6.6	6.3	*5.4*	10.6	12.3	418
3	Bear River Ridge West	13.6	10.3	14.4	17.7	14.8	16.4	14.4	17.8	17.8	--	*19.7*	16.4	15.4	17.9	1037
4	Bear River Ridge East	--	8.4	7.5	15.5	11.7	14.3	13.2	14.2	15.4	9.5	10.7	8.9	12.0	14.0	487
5	Strawberry Point	14.0	10.8	*13.1*	19.9	13.8	17.0	*20.4*	15.0	19.6	*17.0*	15.7	13.0	15.3	17.8	992
6	Smith River Hills	5.1	7.0	11.0	11.6	8.9	10.6	8.2	*9.0*	6.4	4.6	3.3	3.4	7.3	8.5	132
7	Westport	7.4	5.9	9.2	10.9	7.1	9.2	8.3	11.2	9.3	5.8	5.2	5.5	7.6	8.9	182
8	Cow Mountain	7.9	9.9	13.2	14.7	10.5	12.8	*15.8*	*8.7*	11.9	11.3	11.1	10.7	11.7	13.6	354
9	Cahto Peak	10.3	9.8	14.2	13.7	13.3	12.9	*11.1*	*8.6*	12.0	*6.6*	6.9	7.9	11.0	12.8	351
10	China Peak	5.9	6.8	8.2	8.4	*13.7*	--	--	--	--	*4.7*	5.1	--	7.3	*8.5*	104
11	Mahogany Point	6.4	7.6	12.3	14.7	--	12.6	8.0	9.6	7.1	5.8	4.6	5.2	8.3	9.7	239
12	Valley View	7.5	8.9	10.3	11.0	13.8	10.3	8.2	11.0	9.4	6.9	5.4	5.7	8.9	10.4	214
13	Shasta Bally	8.5	9.3	15.3	15.7	--	13.3	*11.0*	9.2	7.9	6.9	7.6	9.2	10.0	11.7	255
14	Scarface Ridge	6.7	6.2	8.3	10.8	7.6	8.9	8.3	9.4	7.0	*8.2*	5.9	5.7	7.8	9.1	146
15	Horse Mountain	6.5	6.1	8.1	9.1	8.2	7.6	*8.0*	7.2	8.5	6.5	6.6	5.7	7.2	8.4	80

Note: Italicized wind speeds indicate that data capture was less then 50 percent.
The annual average is mean value for all valid observations during the 12-month period (not the average of the monthly values)

- average wind speed versus wind direction
- average wind speed by month
- frequency distribution (in percentage of occurrence) of wind speeds in 4 mph increments (all wind speeds greater than 60 mph are shown in the 60+ mph category); Table 7 lists these data for each site.

Appendix D graphically illustrates the wind speed characteristics by month for each site. Appendix E (in Volume 2) contains hourly values of wind speed and direction and joint frequency distributions for each month and site.

B. Discussion

The data listed in Table 6 suggest that the land in close proximity to Cape Mendocino is the only promising geographic sector in terms of wind resource. If we assume that an annual average wind speed (at hub height) of 12 mph is necessary to support efficient wind turbine operation, then only 6 of the 15 sites meet the criterion. Three of these sites (Kneeland Prairie, Cahto Peak, and Cow Mountain) are marginal, and the remaining three (Strawberry Point, Bear River Ridge West, and Bear River Ridge East) are within 15 miles of Cape Mendocino. The two coastal locations have annual wind speeds significantly higher than the inland location.

Section III discussed the wind simulations made using the windflow model (based on weather data for 1950). These simulations indicated that the annual average wind speed at the Cape Mendocino highlands would be approximately 9.3 m s^{-1} (20.5 mph), and that speeds would generally decrease inland. The simulated values apply at a height 46 m above ground. Table 6 shows that the measurements at the 2 recording stations in this area (Site 3, Bear River Ridge West and Site 5, Strawberry Point) have annual average speeds of 15.4 and 15.3 mph at 10 m above ground. As discussed earlier, the 10-m measurements can be extrapolated upward to 46 m by a power law using an exponent of 0.2, which might be appropriate for this area. This would increase the speeds by 36 percent, giving a value of approximately 20.9 mph, which is very slightly larger than the simulated value of 20.5. In this instance, the model performed very well.

In all other areas the model simulations gave winds too strong by several mph. The reason for this overestimation is related primarily to the height and shape assumed for the top of the boundary layer. The boundary layer top (BLT) is not directly measured and climatic data was used to estimate its height. The climatic data are based on radiosonde observations, which have always been sparse or nonexistent in northwestern California. Along the coast we used a value of 600 m for the BLT height, and this worked well. Although we assumed that the top sloped upward to about 1.2 km over the Sacramento Valley in daytime, this slope was gradual. In reality, the top evidently slopes upward

Table 7

ANNUAL WIND SPEED FREQUENCY DISTRIBUTIONS IN PERCENTAGE OF OCCURRENCE*

Site	Wind Speed in mph															
	0-4†	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	41-44	45-48	49-52	53-56	57-60	> 60 mph
1 Pickett Peak	18.4	38.3	21.7	10.4	5.8	3.9	1.1	0.23	0.07	0.10						
2 Kneeland Prarie	19.0	29.7	22.7	11.9	5.9	3.8	2.4	1.8	1.1	0.89	0.37	0.24	0.13	0.04	0.03	
3 Bear R. Ridge W	10.3	15.5	15.4	15.2	14.3	11.6	7.5	4.4	2.1	1.3	0.71	0.61	0.61	0.32	0.04	0.10
4 Bear R. Ridge E	16.9	20.6	18.1	17.7	11.2	5.9	4.6	3.2	1.4	0.27	0.08	0.04				
5 Strawberry Pt.	14.9	12.7	12.8	13.7	11.7	11.0	9.8	6.3	4.0	2.0	0.58	0.33	0.14	0.02		
6 Smith R. Hills	34.9	24.1	20.8	11.5	5.0	2.3	0.91	0.43	0.07	0.02						
7 Westport	36.4	25.4	14.0	10.4	6.5	4.0	1.8	1.1	0.31	0.05	0.03	0.01				
8 Cow Mountain	12.9	18.4	23.4	20.2	14.6	6.1	2.5	1.3	0.30	0.14	0.11	0.01				
9 Cahto Peak	16.4	23.7	22.8	16.1	9.2	6.1	3.0	1.7	0.53	0.33	0.08	0.01				
10 China Peak	24.0	37.5	22.6	8.4	4.1	1.8	1.5	0.14								
11 Mahogany Pt.	31.2	29.0	17.1	9.2	5.0	2.9	2.1	1.6	0.71	0.50	0.25	0.34	0.08	0.03	0.02	
12 Valley View	21.7	34.3	17.9	11.2	6.9	3.9	2.3	1.3	0.34	0.08	0.02	0.03	0.02	0.01		0.03
13 Shasta Bally	19.2	26.2	22.3	13.0	9.1	5.0	2.5	1.0	0.61	0.76	0.23	0.07	0.05			
14 Scarface Ridge	28.6	31.1	20.5	10.2	5.1	2.8	1.2	0.38	0.08	0.08	0.01					
15 Horse Mtn	23.6	36.4	27.4	9.2	2.5	0.81	0.15	0.02								

*Estimated from the annual frequency of occurrence graphs in Appendix C and the monthly joint frequency tabulations in Appendix E.

†In this table, the lowest wind speed interval combines wind speeds of less than 1 mph ("calm") with those between 1 and 4 mph; these intervals were displayed separately in the above appendices.

very sharply just inland from the coast, due to the combined effects of terrain roughness and heating. This is indicated by the marked decrease in wind speed from Site 3 inland to Site 4. Farther inland the BLT slope becomes more gradual.

Another important feature of the boundary layer is its thickness over the mountain ridges or peaks where many of the instrument sites were located. In the simulations we assumed that the minimum boundary layer thickness (over peaks) could be as little as 250 m. In retrospect, it can be seen that using a larger value (on the order of 400 to 500 m) would have given more realistic (weaker) winds at Site 1, and Sites 8 through 15.

It is also worth noting that wind directions from the west are relatively infrequent at coastal and inland sites. During strong wind periods, southerly and northerly directions are common. Therefore, the air trajectories do not reach the inland sites on a short path from the ocean (to the west), but travel much longer distances, allowing for terrain interaction that produces a substantial decrease in speed.

Cow Mountain (Site 8, a few miles northwest of Clear Lake) appears to be an anomaly because it has stronger winds than other sites at similar altitudes and distances from the ocean. The wind speeds are higher in the summer than they are at these other sites, but comparable in other seasons. These higher summer wind speeds may be due to local thermal differences between the mountain and Clear Lake.

C. Analysis of the Cape Mendocino Resource Area

A separate discussion of the geographic area surrounding Cape Mendocino is merited because of its promising wind resource potential. However, the potential drops off dramatically with increasing distance from the Cape. Figure 14 demonstrates how the mean 46-m wind speed is estimated to behave as a function of distance inland. The difference in the annual average between coastal and inland sites is dominated by the differences in the summer months.

Assuming the estimates of wind potential are as shown in Figure 14, it would appear that development of this potential would be limited by the geographic area between the outer arc (12 mph and above) westward to the coast. This represents a rather small area of about 750 square miles. Some parts of this area are suited for development and other parts are not. The most promising areas appear to be the highest ridges in the area, about 50 miles of ridgeline altogether. These would include Bear River Ridge, Rainbow Ridge and its extension to the coast, and a major ridge line in the King Range National Recreation Area.

To estimate the potential installed power output for the 50 miles of ridgeline, a number of assumptions were made. These were based on information published in previous CEC reports (e.g., Zambrano et al., 1980).

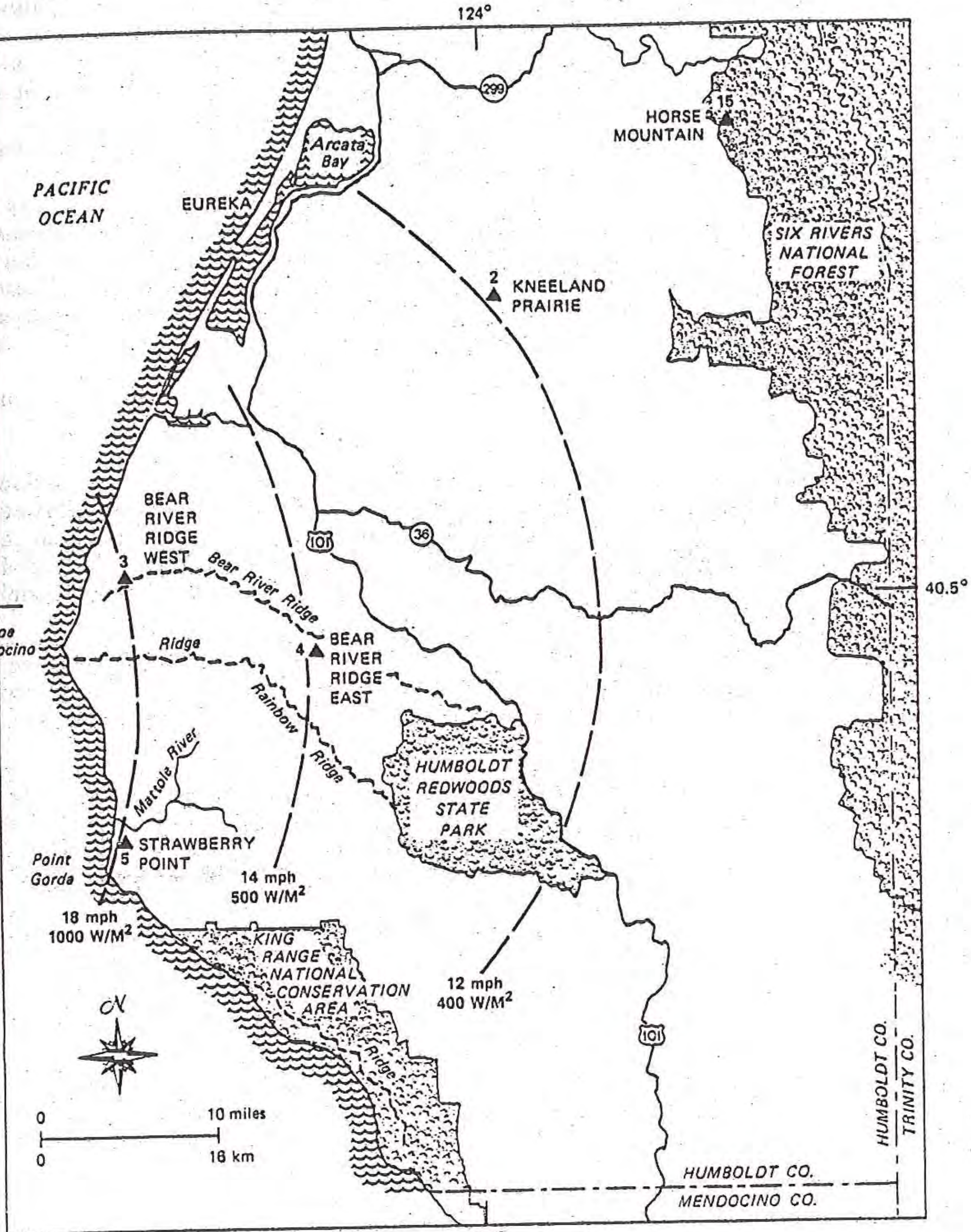

FIGURE 14 ESTIMATE OF POTENTIAL WIND RESOURCE AT 46 m ON EXPOSED RIDGES NEAR CAPE MENDOCINO

For convenience, we assumed that a single row of the Boeing MOD-2 wind turbines were installed on the 50 miles of ridgeline, spaced 5 rotor lengths apart (approximately 1500 feet between turbines). This equates to approximately 170 turbines and an installed capacity of approximately 425 megawatts. However, given the actual wind measurements for the year beginning August 1, 1981, the average annual power output equated to between 150 and 200 megawatts (1,300,000 to 1,750,000 MWh).

The above "ball park" estimate relies on many assumptions and can be improved upon only after acquiring more detailed data on the spatial wind variability within the region of interest, land use and environmental restrictions, full technical evaluation of the site characteristics, and a comprehensive wind farm design.

D. Summary

The results presented in this chapter suggest that large-scale wind farm development is impractical for most parts of northwestern California. The exception is the geographic area surrounding Cape Mendocino. For smaller scale development, there appears to be a modest potential at other locations, such as Cow Mountain to the northwest of Clear Lake.

VI CONCLUSIONS

In the initial phase of the project, 20 sites were evaluated for land use and environmental restraints related to wind farm development in Northwestern California. Factors considered in the evaluation included the intensity of land use, aesthetics, biological and physical restraints, communication interference, transmission line availability, and road access. Two areas - South Fork Mountain and Bear River Ridge - received favorable overall ratings for all the criterea combined. Six sites were judged to have high environmental sensitivity. The remaining eleven sites received either moderate or moderate-high environmental conflict ratings.

The selection of the 15 monitoring sites was guided by the results of the land use and environmental conflict ratings, as well as the desire to obtain the maximum amount of wind resource information for the Northwestern California region. Analysis of the results from the one-year monitoring effort at the 15 sites showed that one area - the Cape Mendocino Highlands - has a potential for the installation of 425 MW of wind turbines. Based upon the 12 to 15 mph annual average for the wind speed and the wind speed distributions, a capacity factor of 35% to 45% was computed for the Mod-2 wind turbines which were assumed for this discussion. This equated to an average annual power output of 150 to 200 MW or 1,300,000 to 1,750,000 MWh.

None of the other areas monitored in Northwestern California appeared to be suitable for large-scale wind farm development. Average annual wind speeds in these areas were generally below 12 mph, with several sites as low as 7 to 9 mph.

REFERENCES

Bortz, S.A. et al., 1979: "Navy-New Hampshire Wind Energy Program," prepared for Navy Material Command, Washington, D.C. by ITT Research Institute, Chicago, Illinois (November).

California Energy Commission, 1980a: "Estimated Costs of Transmission Lines for Wind Farms," memorandum from Mat Ginosar, March 21, 1980, updated June 9, 1980.

________, 1980b: "Final Environmental Impact Report for the California Energy Commission Solar Program and Wind Program," California Energy Commission, Sacramento, California.

Endlich, R.M., F.L. Ludwig, C.M. Bhumralkar, and M.A. Estoque, 1982: "A Diagnostic Model for Estimating Winds at Potential Sites for Wind Turbines," J. Appl. Meteor., 19(1): 98-108.

Ludwig, F.L., and G. Byrd, 1980: "An Efficient Method for Deriving Mass-Consistent Flow Fields from Wind Observations in Rough Terrain," Atmos. Env., 14(15): 585-587.

Holzworth, G.C., 1972: "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States," Report AP-101, Environmental Protection Agency, Office of Air Programs, Research Triangle Park, Raleigh, North Carolina, 118 pp.

Martin, P. et al., 1979: "A Feasibility Study of Windpower for the New England Area," prepared for Navy Material Command, Washington, D.C. by SRI International, Menlo Park, California (October).

Rogers, S.E. et al., 1976: "Evaluation of the Potential Environmental Effects of Wind Energy System Development," prepared for the National Science Foundation, NSF/RA-760188, by Battelle Columbus Laboratories (August).

Sandusky, W.F., J.W. Buck, D.S. Renne, D.L. Hadley, and O.B. Abbey, 1982: "Candidate Wind Turbine Generator Site Annual Data Summary for January 1981 through December 1981," Pacific Northwest Laboratory Report PNL-4283/UC-60, Richland, Washington.

Simon, R.L., G.T. Norman, D.L. Elliott, W.R. Barchet, and R.L. George, 1980: Wind Energy Resource Atlas: Volume 9--The Southwest Region, PNL-3195 WERA-9, Pacific Northwest Laboratory, Richland, Washington.

U.S. Department of Energy, 1978: "Wind Turbine Generator System Block Island, Rhode Island," Final Environmental Impact Statement, DOE/EIS-0006 (July).

________________________, 1979a: "Proceedings of the Workshop on Economic and Operational Requirements and Status of Large Scale Wind Systems," Electric Power Research Institute, Palo Alto, California (July).

________________________, 1979b: "Eighteen Prospective MOD-2 Wind Turbine Sites--The Goodnoe Hills, Washington Installation Site, Klickitat County, Washington, Environmental Assessment, DOE/EA-0096 (December).

________________________, 1979c: "Installation and Field Testing of a Large Experimental Wind Turbine Generator System near Kahuky Point on the Island of Oahu, Hawaii," Environmental Assessment, DOE/EA-0097 (December).

Vachon, W.A et al., 1979: "Wind Energy in the Mountains of New Hampshire as a Potential Energy Source for the Portsmouth Shipyard," prepared for Navy Material Command, Washington, D.C. by A.R. Little, Inc., Cambridge, Massachusetts (October).

Zambrano, T.G., S.N. Walker, and R.W. Baker, 1980: "Wind Energy Assessment of the Palm Springs Whitewater Region," California Energy Commission Consultant Report P500-80-016, AeroVironment, Inc., Pasadena, CA (March).

A Report to the Humboldt County, CA Board of Supervisors*; An Analysis of Small Hydroelectric Planning Strategies,* Prepared by Oscar Larson & Associates

This is chapter 2 from An *Analysis of Small Hydroelectric Planning Strategies*. It provides an inventory of potential micro-hydroelectric sites within Humboldt County. These sites described are projects that a permit application has been filed to the Federal Energy Regulatory Commission (F.E.R.C.). Some projects that were investigated have been abandoned for various reasons. There are 25 projects discussed with information regarding location of the project, the estimated average energy produced annually, structure needed, potential access roads, and environmental issues specific to locations. This inventory may prove helpful giving data on the types of issues that comes up in pursuing energy production through micro-hydro technology.

DRAFT

V. Review of Small Hydro Projects in Humboldt County

This section of the report describes each hydroelectric project in Humboldt County for which a permit application has been filed with the Federal Energy Regulatory Commission (F.E.R.C.). Appendix B includes a chart which provides supplementary information on each of these projects. In addition, several projects are herein described which have been investigated and abandoned for one reason or another, as well as the identification of certain hydro sites which might have the potential for generating electricity.

1. Camp and China Creek: The Camp and China Creek project is located near the confluence of the two creeks, approximately 7 miles northwest of Orleans, on land located within the Six Rivers National Forest. The proposed project would consist of: (1) two natural rock diversion structures; (2) a 116-foot long, 5-foot high, 8-foot wide concrete diversion structure; (3) a 147-foot long, 5-foot high, 8-foot wide concrete diversion structure; (4) two diversion conduits or channels with a total length of 7,390-feet; (5) a transition structure; (6) an 800-foot long, 57-inch diameter penstock; (7) a powerhouse containing generating equipment with a combined capacity of 4,800 KW; and (8) a 7-mile long, 12.5 KV transmission line. The estimated average energy production would be 19.3 million KWh. Access roads will need to be constructed.

2. Mill Creek: Mill Creek, a tributary to the Trinity River, is located approximately 7 miles southeast of Weitchpec on land within the Six Rivers National Forest. The proposed project would consist of: (1) a rock-and-concrete diversion structure; (2) a 6,000 foot long conduit; (3) a rock-and-concrete diversion structure; (4) an 8,400 foot long conduit; (5) a transition structure; (6) a 1,200-foot long and 42-inch diameter steel penstock; (7) a powerhouse containing one generating unit rated at 3,430 KW; and (8) a 7 mile long transmission line through the Hoopa Valley Indian Reservation. The estimated average annual energy production would be 17.3 million KWh. The Hoopa

Valley Indian Reservation controls water rights to Mill Creek, therefore would have to give their approval. Environmental issues have been raised on this project because Mill Creek is the major spawning area within the reservation. Access roads will need to be constructed off the existing Forest Service Roads out of Orleans. There has been a competing application filed on this project.

3. Campbell Creek: Campbell Creek, a tributary to the Trinity River, is located south of the Hoopa Indian Reservation. The project is located on land within the Six Rivers National Forest. The proposed project would consist of (1) a 5-foot high, 60-foot long diversion structure; (2) a 30-inch diameter, 1,050-foot long penstock; (3) a powerhouse containing a single generating unit with a capacity of 1500 KW, and (4) a 0.5-mile long, 12-KV transmission line interconnecting with an existing PG&E transmission line. The annual average energy production would be 15 million KWH. Indian Water rights may be an issue which would require review and approval from the Hoopa Valley Tribe. There is an existing access road within 1500 feet of the proposed powerhouse. A proposed road will serve as access to the powerhouse, headworks, diversion conduit route, and diversion structure. There has been a competing application filed on this project.

4. Bull Creek: Bull Creek, a tributary to the Trinity River, is located approximately 2 miles south of Weitchpec. The project is located on land within the Hoopa Valley Indian Reservation and requires Tribal approval. The proposed project would consist of (1) a natural rock diversion structure; (2) a 55-five foot long, 5-foot high, 8-foot wide concrete diversion structure; (3) a 3,550-foot long diversion conduit or channel; (4) a 900-foot long, 28-inch diameter penstock; (5) a powerhouse containing generating equipment with a combined capacity of 2,100 KW; and (6) a 0.1-mile long, 12.5 KV transmission line. The average annual energy output would be 8.4 million KWh. The proposed access road will need to be built connecting with Highway 96. A preliminary permit has been issued to the applicant.

5. <u>Soctish Creek</u>: Soctish Creek, a tributary to the Trinity River, is located near the town of Hoopa. The proposed project is on land within the Hoopa Valley Indian Reservation, therefore requires tribal approval. The proposed project would consist of: (1) a 5-foot high, 80-foot long diversion structure; (2) a 48-inch diameter, 4,000-foot long conduit; (3) a 36-inch diameter, 800-foot long penstock; (4) a powerhouse containing a single generating unit with a capacity of 1600 KW, and (5) a 0.5-mile long, 12-KV transmission line interconnecting with an existing Pacific Gas & Electric Company transmission line. The estimated annual average energy production would be 15.8 million KWh. A proposed road serving the powerhouse, diversion, conduit channel and headworks will intersect Highway 96. There has been a competing application filed on this project.

6. <u>Pine Creek</u>: There are three separate projects on Pine Creek. The first is located approximately 3 miles northwest of Weitchpec on privately owned lands. The other two are located within the Hoopa Valley Indian Reservation. The downstream project would consist of: (1) a 5-foot high rock and concrete diversion dam; (2) a 7,000-foot long diversion conduit or channel; (3) a 350-foot long steel penstock; (4) a 43-foot long and 22-foot wide powerhouse containing one generating unit rated at 4,560 KW; and (5) a 3-mile long transmission line. The proposed project may effect a wild and scenic river. Water rights to Pine Creek are under the control of the Hoopa Valley Tribe who would have to give approval of any project on Pine Creek. The estimated average annual energy production would be 18.7 million KWh.

The up-stream projects as proposed, utilize reservation land and therefore would require tribal approval. There is an existing access road in the area which will need to be extended to other areas of the project site. There has been a competing application filed on this project.

7. <u>Tish Tang a Tang Creek</u>: Tish Tang a Tang Creek is a tributary to the Trinity River. The project is located approximately 8 miles east at Hoopa on land within the Six Rivers National Forest. The proposed

project would consist of (1) a 5-foot high rock and concrete diversion dam; (2) a 7,700-foot long diversion conduit or channel; (3) a 1,750-foot long and 33-inch diameter steel penstock; (4) a powerhouse containing one generating unit rated at 4,500 KWh; and (5) a 7.5 mile long transmission line through the Hoopa Valley Indian Reservation. The estimated average annual energy production would be 21.1 million KWh. Access will be located off existing Forest Service Roads. There has been a competing application filed on this project.

8. Hostler Creek: Hostler Creek is a tributary to the Trinity River. The project is located approximately two miles north of Hoopa on land within the Hoopa Valley Indian Reservation and would require tribal approval. The upper facility would consist of: (1) a natural rock diversion structure; (2) a 48-foot long, 5-foot high, 8-foot wide concrete diversion structure; (3) a 4,000-foot long diversion conduit or channel; (4) an 825-foot long, 30-inch diameter penstock; (5) a powerhouse containing generating equipment with a combined capacity of 1,250-KW; and (6) a 2-mile long, 12.5 KV transmission line. The estimated average annual energy production would be 4.9 million KWh.

The lower facility would consist of: (1) a natural rock diversion structure; (2) a 67-foot long, 5-foot high, 8-foot wide concrete diversion structure; (3) a 9,250-foot long diversion conduit or channel; (4) an 1,070-foot long, 33-inch diameter penstock; (5) a powerhouse containing generating equipment with a combined capacity of 2,010 KW; and (6) a 0.5 mile long 12.5 KV transmission line. The estimated average annual energy production would be 7.9 million KWh. There are existing access roads adjacent to Hostler Creek. The preliminary permit has been granted to the competing applicant.

9. Bear Creek: Bear Creek is a tributary to the South Fork of the Trinity River. The project is located approximately 16 miles south of Willow Creek on land within the Six Rivers National Forest. The proposed project would consist of: (1) a 62-foot long, 5-foot high rock and concrete diversion structure; (2) a 3,700-foot long diversion conduit or channel; (3) a 1,050-foot long, 32-inch diameter steel

penstock; (4) a powerhouse containing generating units with a combined rated capacity of 1,450 KW; and (5) a 0.5-mile long 12,5 KV transmission line. The estimated average annual energy production would be 5.7 million KWh. Access will be by existing Forest Service Roads. Some additional access roads may be required. There has been a competing application filed on this project.

10. Slide Creek: Slide Creek is a tributary to Blue Creek. The project is located approximately 19 miles northwest of Weitchpec on land within the Six Rivers National Forest. The proposed project would consist of: (1) a 5-foot high 100-foot long natural rock and concrete diversion structure; (2) a 4,000-foot long, 52-inch diameter diversion conduit; (3) a 1,400-foot long, 38-inch diameter steel penstock serving, (4) a powerhouse with an installed capacity of 3.35 MW; and (5) an 11-mile long, 12.5 KV transmission line to connect to an existing Pacific Power and Light Company transmission lines in Del Norte County. The estimated average annual energy production would be 13.2 million KWh. Access roads will need to be constructed off existing Forest Service roads. A competing application has been filed on this project.

11. Horse Linto Creek: Horse Linto Creek, a tributary to the Trinity River is located approximately 1 mile south of Tish Tang. The proposed project, on land within the Six Rivers National Forest, would consist of three facilities. The Upper Facility would consist of (1) a 5-foot high by 20-foot long diversion structure on East Fork Horse Linto Creek; (2) a 3,000 foot long diversion conduit; (3) a 5-foot high by 80-foot long diversion structure on Horse Linto Creek; (4) a 7,200 foot long diversion conduit; (5) a 1,000-foot long, 36-inch diameter steel penstock; (6) a powerhouse with an installed capacity of 4.5 MW and (7) a 1.5 mile long 12-KV transmission line to connect the powerhouse to the Middle Facility. The Middle Facility would consist of: (1) a 5-foot high by 80-foot long diversion structure; (2) an 8,300 foot long diversion conduit; (3) a 900-foot long, 36-inch diameter steel penstock; (4) a powerhouse with an installed capacity of 3 MW and (5) a 1-mile long 12-KV transmission line to connect the powerhouse to the Lower Facility. The Lower Facility would consist of: (1) a 5-foot high by 45-foot long

diversion structure; (2) a 4,500 foot long diversion conduit; (3) a 1,500 foot long, 28-inch diameter steel penstock; (4) a powerhouse with an installed capacity of 2.05 MW; and (5) a 6-mile long 12-KV transmission line to connect to an existing Pacific Gas & Electric Company line. There is a potential problem with archaeological sites in the area so further evaluation will be required. There is an existing access road to the Upper Project and a proposed road will be required to serve the remainder of the project. There are two competing applications on this project.

12. Grouse Creek: Grouse Creek is a tributary to the South Fork of the Trinity River. There have been two separate filings on Grouse Creek. The upstream Grouse Creek project is located approximately 6 miles upstream on land within the Six Rivers National Forest. The downstream Grouse Creek project is located on Forest Service land and privately owned land.

The proposed upstream Grouse Creek project would consist of two (2) facilities. The upper facility would consist of: (1) a 5-foot high by 31-foot long diversion structure on the East Fork Grouse Creek; (2) a 7,200-foot long diversion conduit; (3) a 5-foot high by 13-foot long diversion structure on the Grouse Creek; (4) a 1,200-foot long diversion conduit; (5) a 1,300-foot long, 36-inch diameter steel penstock; (6) a powerhouse with an installed capacity of 1 MW; and (7) a 1.5-mile long, 12-KV transmission line to connect to the lower facility. The lower facility would consist of: (1) a 5-foot high by 960-foot long diversion structure on the Grouse Creek; (2) a 10,200-foot long diversion structure; (3) an 800-foot long, 36-inch diameter penstock; (4) a powerhouse with an installed capacity of 2.4 MW; and (5) a 0.5-mile long, 12-KV transmission line to connect to an existing Pacific Gas and Electric Company line. Access roads will need to be constructed that connect with existing Forest Service access roads. There have been 2 competing applications filed on this project.

The second, or downstream, Grouse Creek project would consist of: (1) a 23-foot long, 7-foot high diversion structure; (2) a 4,960-foot long diversion conduit; (3) a 500-foot long penstock; (4) a powerhouse with a total related capacity of 2,400 KW; and (5) a 7.5 mile long transmission line. The estimated average annual energy production would be 9.01 million KWh. There are existing access roads to the site.

13. Willow Creek: Willow Creek is a tributary to the Trinity River. The project is located approximately 4 miles west of the town of Willow Creek on Six Rivers National Forest and privately owned land. The proposed project would consist of: (1) a diversion structure; (2) a 4,000-foot long penstock; (3) a powerhouse containing generating units with a total rated capacity of 840 KW; and (4) appurtenant facilities. The estimated average annual energy production would be 3.5 million KWh. The project is adjacent to Highway 299. The project has been revised increasing the penstock length and moving the powerhouse site approximately 1 mile downstream. The revised project would consist of: (1) a diversion structure; (2) a 9,500-foot long penstock; (3) a powerhouse containing generating units with a total rated capacity of 5,600 KW. The estimated average annual energy production would be 22.9 million KWh.

14. Madden Creek: Madden Creek, a tributary to the Trinity River, is located south-west of Salyer on land within the Six Rivers National Forest and under private ownership. The proposed project would consist of: (1) an existing 7-foot high, 32-foot long concrete and steel diversion dam; (2) a short 42-inch diameter pipe; (3) and existing 1,065-foot long earthen channel; (4) an 800-foot long steel syphon, 5) an existing 7,200-foot long channel; (6) a 5,400-foot long penstock; (7) a powerhouse containing a generating unit rated at 2,000 KW; and (8) a 1,000-foot long transmission line. The average annual energy generation is 7.9 million KWh. There are existing access roads to some areas of the project. Some additional access roads may be required. An exemption from licensing has been filed on this project.

15. Pearch Creek: Pearch Creek, a tributary to the Klamath River is located east of Orleans. The project proposes to use both private and Six Rivers National Forest land. The project would consist of: (1) two

rock-filled structures diverting water from Pearch Creek and its South Fork; (2) a 42-inch diameter and 4,000-foot long galvanized pipe carrying water to a pressure box of reinforced concrete; (3) a 30-inch diameter, 1,400 foot long penstock; (4) a powerhouse with an installed capacity of 500 KW; (5) a switchyard to convert the power into three phase power; (6) a 1,000-foot long 12-KV transmission line to connect with an existing Pacific Gas & Electric Company 12-KV transmission line. The estimated average annual energy production would be 2.1 million KWh. Proposed access roads will intersect Highway 96. The preliminary permit was granted to the applicant.

16. Baker Creek: Baker Creek, a tributary to the South Fork of the Van Duzen River is located approximately 6 miles northwest of Dinsmore. The project is located on private land. The project would consist of: (1) a 10-foot high rock diversion dam; (2) a 3,700-foot long 30-inch diameter pipe carrying water from the creek into a pressure box; (3) a pressure box; (4) a 3,500-foot long, 24-inch diameter penstock; (5) a powerhouse containing a total installed capacity of 1,500 KW; (6) a one-mile long 12-KV transmission line. The estimated average annual energy production would be 5.58 million KWh. There are some existing access roads to the creek but extensions may be required to reach certain areas of the project. The preliminary permit has been granted to the applicant.

17. Ammon Creek: Ammon Creek, a tributary to the South Fork of the Trinity River, is located approximately 4 miles south of Salyer. The project is located within the Six Rivers National Forest. The project would consist of: (1) three diversion structures, one on each of Ammon Creek's three forks; (2) a 7,400-foot long canal; (3) a reinforced concrete headworks; (4) a 1,425-foot long, 12-inch diameter penstock; (5) a powerhouse with a total installed capacity of 400 KW; and (6) an upgraded 12-KV transmission line to interconnect with an existing Pacific Gas & Electric Company transmission line. The estimated average annual energy production would be 1.47 million KWh. There are existing access roads in the area but some extensions may be required. The preliminary permit has been granted to the applicant.

18. Aikens Creek: Aikens Creek, a tributary to the Klamath, is located approximately 5 miles northeast of Weitchpec on property within the Six Rivers National Forest. The proposed project would consist of: (1) a 20-foot long, 5-foot high diversion structure; (2) a 1,500-foot long, 24-inch diameter diversion conduit; (3) a 600-foot long, 12-inch diameter penstock; (4) a powerhouse with a total installed capacity of 255 KW; and (5) a 300-foot long, 12.5 KW transmission line interconnecting with an existing Pacific Gas & Electric Company transmission line. The estimated average annual energy production would be 2.2 million KWh. There is an existing access road to the diversion site and the powerhouse site is adjacent to Highway 96. A competing application has been filed for the project with a proposed generating capacity of 500 KW.

19. Boise Creek: Boise Creek, a tributary to the Klamath River is located approximately 3 miles south-west of Orleans on land within the Six Rivers National Forest. The proposed project consists of: (1) a 4-foot high, 18-foot long diversion structure; (2) a 23,000 foot long 36-inch diameter steel conduit, and, a concrete pressure box; (3) a 1,500-foot long, 30-inch diameter steel penstock; (4) a powerhouse with a total installed capacity of 2,600 KW, and (5) a half-mile long, 12 KV transmission line which would connect the powerhouse to the existing Pacific Gas & Electric Company 12 KV line near the Klamath River. The estimated average annual energy production would be 10.7 million KWh. An access road will need to be developed which will intersect Highway 96. The preliminary permit has been granted to the applicant.

20. Boulder Creek: Boulder Creek, a tributary to the Mad River, is located near the town of Maple Creek on land owned by the Arcata Redwood Co. The proposed project would consist of: (1) a 6-foot high reinforced-concrete diversion structure; (2) a 42-inch diameter, 10,000-foot long steel conduit; (3) a 42-inch diameter, 7,000-foot long steel penstock to extend from the headworks to the powerhouse; (4) a powerhouse to contain a single generating unit with a total rated capacity of 8,170 KW, and (5) a 12 KV transmission line to extend one-mile north of the powerhouse to an existing line. The estimated average annual energy production is 25.6 million KWh. There are existing roads located

on some areas of the project. Some additional access roads will need to be built. A competing application was filed and the permit issued to the competing applicant.

21. Mingo Creek: Mingo Creek, a tributary to the South Fork of the Trinity River, is located approximately 11 miles south-east of Willow Creek. The project is located entirely within the Six Rivers National Forest. The project would consist of: (1) a 20-foot long, 4-foot high diversion structure; (2) a 9,000 foot long, 24-inch diameter diversion conduit; (3) a 2,400-foot long, 18-inch diameter penstock; (4) a powerhouse with a total rated capacity of 500 KW; and (5) a 1-mile long, 12.5 KV transmission line from the powerhouse to an existing Pacific Gas & Electric Company transmission line. The estimated average annual energy output would be 4.4 million KWh. There are existing access roads in the area but they will have to be extended to the project.

22. Mawah Creek: Mawah Creek, a tributary to the Klamath River is located approximately 8 miles north of Weitchpec. The project is located on property owned by the applicant. The project would consist of: (1) a 6-foot high, 30-foot wide low concrete diversion dam; (2) a 30-inch diameter, 1,000 foot long conduit channel; (3) an 18-inch diameter, 500-foot long penstock; (4) a power plant to house a single generating unit with an installed capacity of 350 KW; and (5) a transmission line extending from the power plant to an existing line which is to be upgraded. The estimated average annual energy production is 700,000 KWh. The project is adjacent to Highway 169 which will serve as access.

23. Jacoby Creek: The Jacoby Creek project is located approximately 7 miles southeast of Arcata on private lands. The proposed project would consist of: (1) a 3-foot high, 15-foot line diversion structure; (2) a 36-inch diameter, 6,000-foot long conduit; (3) a 30-inch diameter 4,000-foot long penstock; (4) a powerhouse containing a turbine generating unit with a rated capacity of 400 KW; and (5) a 200-yard long 12-KV transmission line connecting to an existing Pacific Gas & Electric line.

The estimated annual energy production would be 1.2 million KWh. There are existing access roads near the project area.

24. <u>Maple Creek</u>: Maple Creek, a tributary to the Mad River, is located approximately 3 miles north of the town of Maple Creek. The project is located on privately owned lands. The proposed project would consist of: (1) a 3-foot high, 15-foot long diversion structure; (2) a 36-inch diameter, 5,000-foot long conduit; (3) a 30-inch diameter, 5,000-foot long penstock; (4) a powerhouse containing a turbine generating unit with a rated capacity of 750 KW; and (5) a 12,000 foot long, 12 KV transmission line connecting to an existing Pacific Gas and Electric line. The estimated average annual energy production would be 2.2 million KWh. There is an existing access road to the diversion area and another near the powerhouse. Additional access may be needed to serve the other access areas of the project.

25. <u>Cannon Creek</u>: Cannon Creek, a tributary to the Mad River, is located approximately 5 miles southeast of Korbel on private land. The proposed project would consist of: (1) a 3-foot high, 15-foot long diversion structure; (2) a 36-inch diameter, 15,000 foot long conduit; (3) a 30-inch diameter, 7,000-foot long penstock; (4) a powerhouse containing a turbine generating unit with a rated capacity of 700 KW; and (5) a 6.5-mile long 12-KV transmission line connecting to an existing Pacific Gas and Electric line. The estimated average annual energy production would be 2.1 million KWh. There is an existing access road from Korbel and access to the powerhouse would be from Mad River Road. Some new access may be required to reach the diversion site.

There are other projects currently under consideration for Willow Creek and feasibility has not yet been determined.

The following projects are either currently under investigation or have been investigated and abandoned. In our discussions with Pacific Gas and Electric Company, it is quite apparent that there are far more projects being considered by land owners and small hydro developers in the County. Client confidentiality has prevented us from obtaining further information on these other potential sites although we have received estimates that as many as 100 sites are under consideration in the County.

Nixon Creek: Nixon Creek is a tributary to the Trinity River. The Creek is located approximately 7 miles north of Hoopa and is located within the Hoopa Valley Indian Reservation. The project will need authorization from the tribe. The specifics of the proposed project are not known.

Beaver Creek: Beaver Creek, a tributary to the Trinity River, is located approximately 5 miles north of Hoopa on land within the Hoopa Valley Indian Reservation. The project will require authorization from the tribe. The specifics of the proposed project are not known.

Hospital Creek: Hospital Creek, a tributary to the Trinity River is located near Hoopa or land within the Hoopa Valley Indian Reservation. The project will require approval from the Hoopa Valley tribe. The specifics of the project are not known.

Supply Creek: Supply Creek, a tributary to the Trinity River is located near Hoopa on land within the Hoopa Valley Indian Reservation. The project has been proposed by the Hoopa Valley tribe and will generate 333 KW. There is an existing retaining structure but the penstock may have to be replaced. There are existing access roads adjacent to the creek.

Lost Man Creek: Lost Man Creek, a tributary to Prairie Creek, is located approximately 5 miles north of Orick. The State Fish Hatchery has looked at this site to reduce high monthly utility costs. The project is located on land within the Redwood National Park. It is unknown if the State Fish Hatchery can arrange use of National Park Land for a small hydro facility.

Other potential creeks for hydro development that have been studied are as follows:

- Blue Creek - Northern Humboldt County
- Upper Freshwater Creek - further investigation would be required to determine feasibility
- Minor Creek - a Redwood Valley creek that was determined non-feasible due to low flows, limited access, and small head
- Browns Creek - a tributary to the Van Duzen near Bridgeville that was determined not to be feasible
- Van Duzen River - an area of the Van Duzen above the Wild and Scenic designation was looked at for development but was found not to be feasible because of unstable slopes.

Anaerobic Digestion

Anaerobic Digestion (AD) is a technology whose purpose is to process manure and address many of the problems that come with dairy farms. There are three types of AD systems; the lagoon digester, complete mix digester and the plug flow digester. The AD works best under certain conditions that include the following factors: local weather conditions, local water tables, manure collection technique, manure storage capacity and the end use of AD products.

For Humboldt County, most of the dairy farms would not need to look into AD technology. However, there are some dairy farms that could benefit from using the technology in the county. These farms have at least 400 cows that live in barns for the wet season, and other factors that are located on page 9 of the report. The best AD system for these dairy farms would be the plug flow digester. All three of the AD systems are described in detail in the report, but I will summarize the information on the plug flow digester. It is designed to hold about 20 days worth of undiluted manure. Each time more manure is put in the holding tank, some manure is forced out the other side and biogas is captured in the space between the newly digesting manure and the cover. The manure is continuously heated in order to keep the temperature around 100 degrees Faranheit. With constant exposure to heat, the bacteria and weed seeds will be killed while the manure is being digested.

With a plug flow digester, there are many benefits for the dairy farmer. It could produce anywhere from 4 million to 6.4 million cubic feet of biogas annually, depending on the amount of manure. The plug flow digester would generate 124,000 to 198,000 kilowatt-hours of electricity annually. By making so much electricity, the farmer can look forward to having a decrease in annual electricity bills ranging from $11,000 to $23,800. Other benefits included getting thermal energy for water or space heating from the engine-generator set, thus not using 3,400-5,500 therms of natural gas annually and therefore creating savings from $2,800 to $4,500 on the farms heating bills. Another benefit is the plug flow digester would produce fiber and this could be an additional income ranging from $4,800 to $8,000 annually. Manure pit costs would be reduced by about $9,000 a year as well. In conclusion, with all the savings and additional income generated by the plug flow digester, those Humboldt dairy farms that fit the qualifications can look forward to an annual income increase of $45,000. Some of the intangible benefits are odor control, decrease in fly populations and environmental stewardship.

There are problems associated with AD that have deterred farmers from implementing any of the three digesters. The installation costs are huge, about $500 to $1,000 per cow which adds up to about $200,000 to $400,000 for the digester system. It takes about 5.6 years for a system to have any economic payback, which is usually considered too long for some farmers. However, with financial systems, more farmers could be enticed into installing a plug flow digester. The Dairy Power Production Program offers to pay half of the costs. The rest of the costs could be picked up by PG&E's Self-Generation Incentive Program which will pay about 40% of the costs of the digester. With financial assistance, dairy farmers could see economic payback within 2.6 years.

In conclusion, the AD seems like a viable technology for the larger dairy farms in Humboldt County. The AD effectively takes care of problems with manure while also generating financial awards and intangible benefits. The report by Schatz Energy

Research Center describes in details the technology, feasibility of AD technology in Humboldt County, water quality benefits, cost of equipment and installation, and funding sources for implementing AD technology.

FEASIBILITY STUDY ON IMPLEMENTING ANAEROBIC DIGESTION TECHNOLOGY ON HUMBOLDT COUNTY DAIRY FARMS

Funded by: State of California Community Development Block Grant
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Submitted to: Humboldt County Economic Development Office

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SCHATZ
ENERGY
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CENTER

Executive Summary

The purpose of this report is to consider the feasibility of implementing anaerobic digestion (AD) technology as a means of dairy manure management on Humboldt County dairy farms. Funding for this project was supplied by the State of California Community Development Block Grant # 01-EDBG-782 through the Humboldt County Economic Development Office.

Current trends in milk production have forced dairies to intensify their operations. The larger herd numbers required by today's dairy operators in order to stay in business have led directly to an increase in manure production. The volume of manure has become a social and environmental issue. Dairies also consume significant amounts of energy in their daily operation. Anaerobic digestion of manure is a promising technology that has been shown to effectively address many of the problems associated with manure management while providing a reliable energy resource. AD technology has the ability to offer substantial benefits to dairy operators. In many cases, without the implementation of AD technology on U.S. farms, many farmers would have been forced to cease their operation.

There are a variety of AD systems used on U.S. farms, including covered lagoon digesters, complete mix digesters, and plug flow digesters. Choosing the appropriate system depends on many factors including local weather conditions, local water tables, manure collection technique, manure storage capacity, and end use of AD products. The U.S. Environmental Protection Agency's *AgStar Handbook* offers five preliminary screening questions that should be considered to determine whether AD technology is a suitable manure management technique for Humboldt County. Based on the screening questions, it would appear that many Humboldt County pasture-based dairies are not currently ready to consider implementing AD technology as part of their manure management plan. Some of the larger dairies in the county may be able to benefit from a plug flow AD system. In order to conduct an analysis, a suitable Humboldt County pasture-based dairy is defined. In summary, the dairy would have at least 400 cows that are housed in freestall barns for a portion of the year. A more extensive description of these requirements are listed on page 9. A dairy meeting these criteria could consider a plug flow digester as part of their manure management plan, as long as benefits besides energy production can be realized.

A digester on such a Humboldt County dairy could produce between 4 million and 6.4 million cubic feet of biogas and 124,000 to 198,000 kilowatt-hours of electricity annually, leading to potential annual avoided electrical costs of $11,100 to $23,800. Valuable thermal energy for water or space heating could be recovered from the engine-generator set displacing between 3,400 and 5,500 therms of natural gas per year, leading to a potential annual savings of $2,800 to $4,500 on heating costs. The digester would also produce enough fiber each year for an additional annual income of $4,800 to $8,000. Manure pit maintenance costs could be reduced by $9,000 per year. In summary, anaerobic digester products and avoided operation and maintenance (O&M) on current manure storage systems have a capacity to generate up to $45,000 for a suitable Humboldt County dairy.

One of the main issues discouraging dairy operators from utilizing AD technology in their manure management plan is the high capital investment necessary for installing the system. A plug flow system for a suitable Humboldt dairy would cost between $500 and $1,000 per cow, leading to an installed cost of $200,000 to $400,000 for the complete system. Expected operations and maintenance costs of an AD project may be another deterrent. Based on costs reported for existing systems, O&M costs for a typical Humboldt County digester designed to handle the manure from 400 dairy cows are estimated to be $10,000 to $20,000 annually.

In the best case scenario, an AD system installed on a Humboldt County dairy without funding assistance has an economic payback period of approximately 5.6 years. This length of time is often considered too long for a project to be considered viable solely on an economic basis. In the worst case scenario, the project will not pay for itself during the system's expected lifetime. Without significant financial assistance, AD systems are only a viable option for Humboldt County dairies whose operators place significant value on intangible benefits such as odor control, decrease in fly populations, and environmental stewardship.

Fortunately, there are many programs designed to help dairy operators fund and install AD systems on their farms. With these types of assistance, implementation of AD technology on a suitable Humboldt County dairy would become more feasible than previously indicated. The best case payback period is reduced to 2.6 years with outside financial assistance. The Dairy Power Production Program (DPPP) offers up to 50% of project capital cost or up to $2,000/kW capacity. The remaining portion of the project cost could be partially offset with PG&E's Self-Generation Incentive Program (SGIP) that would pay a rate of $1,500/kW or up to 40% of the projects' capital cost. The available financial assistance can significantly decrease the simple payback period of an AD system installed on a suitable Humboldt County dairy. These results, combined with the project's intangible benefits, could make AD technology a viable option for a local dairy's manure management system. The USDA's Rural Development Program also offers funding for purchase of renewable energy systems, including biogas generators, by agricultural producers.

Anaerobic digestion is a technology that has been shown to effectively manage dairy manure while yielding resources with significant financial and intangible value. The smaller pasture-based dairies of Humboldt County initially appear to be ill-suited for the implementation of this technology, but under the right circumstances, a suitable Humboldt County dairy could effectively use a plug flow digester as part of their manure management plan.

INTRODUCTION

Current trends in milk production have forced dairies to intensify their operations. The larger herd numbers required by today's dairy operators in order to stay in business have led directly to an increase in manure production. The volume of manure produced, which was once manageable when herd sizes were smaller and less densely populated, has become a social and environmental problem. Inadequate capturing, storage, and treatment techniques increase manure's capacity to degrade local air, soil, and water quality. Pollutants generated by mismanaged livestock manure include biochemical oxygen demand (BOD), pathogens, nutrient loading, methane, and ammonia[1]. Costs associated with increased regulation of these pollutants have left many dairy operators struggling to survive. This affects not only the dairy operators and their families, but also the health of the local economy.

Dairies consume significant amounts of energy. Dairy energy loads include chiller systems to cool milk, air compressors to operate milking equipment, heaters or boilers for providing hot process water, and various types of pumps. Similar to other business owners, especially here recently in California, dairy operators have to face increasing and uncertain energy costs. The ability to buffer themselves against this uncertainty would prove to be an valuable asset.

Anaerobic digestion (AD) of manure is a promising technology that has been shown to effectively address many of the problems associated with manure management while providing a reliable energy resource. AD is by no means a new technology. It has been used on a small scale for many centuries in India and China. In Europe, AD systems have become common on many farms. When properly designed, constructed, and managed, AD systems have been a successful manure management tool on U.S. farms since 1972. Using manure as the only input, an anaerobic digester yields three valuable outputs: biogas, solid fiber, and a nutrient-rich liquid. In addition, AD technology offers a host of intangible benefits that help keep farms operational. The principal reasons a dairy farmer would consider installing an AD system include the following:

<u>On-site energy production.</u> By recovering biogas and producing energy on the farm, dairy operators can reduce or eliminate monthly energy expenses. Electricity produced by utilizing biogas in an engine-generator can be used on the farm or sold to a local utility. Thermal energy for heating water or buildings can be acquired by directly burning biogas in a boiler or furnace, or from a heat recovery system connected to the engine-generator set.

<u>Generation of stable, high quality liquid fertilizer and solid soil amendment.</u> Digestion does not reduce the quantities of nutrients in manure. The process converts them to new,

[1] Lusk, P. (1998) *Methane Recovery from Animal Manures: A Current Opportunities Casebook.* 3rd Edition. NREL/SR-25145. Golden, CO: National Renewable Energy Laboratory. Work performed by Resource Development Associates, Washington, D.C.

more soluble, and often more available forms[2]. The liquid, commonly called filtrate, is a valuable fertilizer that can be applied directly to the land. The AD process converts the chief nutrients in manure, nitrogen, phosphorus, and potassium, into a soluble form that is more readily available to plants. In the process of anaerobic digestion, the organic nitrogen in the manure is largely converted to ammonium, a primary constituent of commercial fertilizer, which is readily available and utilized by plants. The AD process also produces an essentially sterile fiber that is nearly free of weed seeds and pathogens. The solid fiber can be used as livestock bedding material or as an excellent soil amendment.

Reduction in odors. AD systems have the ability to reduce offensive odors from overloaded or improperly managed manure storage facilities. These odors impair air quality and may be a nuisance to nearby communities, particularly as new residential and commercial development continue to expand into historically agricultural areas. Biogas systems reduce these offensive odors because volatile organic acids, the odor-causing compounds, are consumed by biogas-producing bacteria.

Reduction in ground and surface water contamination. Digester effluent is a more uniform and predictable product than untreated manure. Its higher ammonium content allows better crop utilization, and its physical properties allow easier land application. Properly applied, digester effluent reduces the likelihood of surface or groundwater pollution. Once the filtrate is properly applied, the risk of further ammonia losses is extremely small compared to raw manure. There are three reasons for this: 1) due to the lower viscosity of the filtrate, it penetrates faster into the soil. 2) soil ammonium adsorption is high, resulting in low washout. 3) ammonium is more readily available to plants than the organic nitrogen found in untreated manure; hence, the uptake through nitrification is faster, and the chance for washout is reduced[3].

Reduction in public health risk. Heated digesters reduce manure pathogen populations dramatically in a few days. Many farmers have reported that their AD system has substantially decreased fly populations on their farm[4].

AD technology has the ability to offer substantial benefits, both economic and intangible, to dairy operators. In many cases, without the implementation of AD technology on U.S. farms, many farmers would have been forced to cease their operation.

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[2] Lusk, P. (1998) *Methane Recovery from Animal Manures: A Current Opportunities Casebook.* 3rd Edition. NREL/SR-25145. Golden, CO: National Renewable Energy Laboratory. Work performed by Resource Development Associates, Washington, D.C.

[3] Lusk, P. (1998) *Methane Recovery from Animal Manures: A Current Opportunities Casebook.* 3rd Edition. NREL/SR-25145. Golden, CO: National Renewable Energy Laboratory. Work performed by Resource Development Associates, Washington, D.C.

[4] Roos, K.F., and Moser, M.A. (1997) *A Manual for Developing Biogas Systems at Commercial Farms in the United States.* AgStar Handbook. U.S. Environmental Protection Agency, Washington, D.C. EPA-430-B-97-105

Description of the Technology

Anaerobic digestion is a biological process in which bacteria break down organic matter in an airless environment, with biogas as the end product. Biogas derived from dairy manure is comprised of approximately 60% methane (CH_4), 40% carbon dioxide (CO_2), and trace amounts of other gases, including hydrogen sulfide (H_2S). Due to its high methane content, biogas can be used as a fuel for energy conversion devices. Alternatively, it can simply be flared, as the resulting carbon dioxide makes a lesser impact on global climate than the methane. Anaerobic digestion can occur within three different temperature ranges: psychrophilic, mesophilic, and thermophilic.

Psychrophilic digestion occurs at temperatures below 68°F and is usually associated with systems that operate at ground temperature. Psychrophilic AD has the lowest biogas production rate of the three temperature ranges. The production rate is susceptible to seasonal and diurnal fluctuations in temperature, making it difficult to predict how much biogas will be available.

The mesophilic range is between 68°F and 105°F. The optimal temperature for mesophilic AD is approximately 100°F, which is nearly the same as the body temperature of dairy cattle. This allows the same bacteria at work in a cow's ruminant system to continue breaking down the excreted organic matter for a period of several days. Digesters operating in the mesophilic range require constant heating in order to maintain a temperature of 100°F.

The thermophilic range is between 110°F and 160°F. The elevated temperature allows for the highest rate of biogas production and the lowest hydraulic retention time (HRT). The HRT is the amount of time material must remain in the digester before it is sufficiently processed. Digesters that operate in the thermophilic range require substantial amounts of energy to maintain the proper temperature and are prone to biological upset due to temperature fluctuations. To avoid upset, they require closer monitoring and maintenance. Another drawback is that the effluent is not odor free.

There are a variety of AD systems used on U.S. farms. Choosing the appropriate system depends on many factors including local weather conditions, local water tables, manure collection technique, manure storage capacity, and end use of AD products. Following is a brief description of the three most common digester types used on U.S. dairy farms, presented in ascending order of applicability to Humboldt County.

Covered Lagoon

Covered lagoons are the least technical and least expensive of the AD systems used on U.S. dairy farms. They require large land areas, have the lowest biogas production rate, and can only be used in areas with low water tables. Covered lagoons are not normally heated, therefore they operate approximately at ground temperature in the psychrophilic range. This technique is designed to work in a warm climate on diluted manure with less than 2 percent solids content. Dairies that use water to flush feeding lanes, freestall barns, and other surfaces could consider this AD technology as part of their manure management plan, especially if the main priority is to reduce odors associated with manure storage.

Biogas is captured by placing an impermeable floating cover over part or all of the manure storage lagoon. Biogas production rates vary based on the temperature of the lagoon, which in turn is affected by daily and seasonal fluctuations in ground temperature, air temperature, and feedstock temperature.

Complete Mix Digester

Complete mix digesters are the most technical and most expensive to build and operate of the AD systems used on U.S. dairy farms. The heated tank can be placed either above or below ground and is designed to treat manure with a solids content between 2 percent and 10 percent. The manure slurry is continuously mixed either mechanically or by using pumped gas circulation to keep the solids in suspension. It is often operated in the thermophilic range, thereby generating biogas at a high rate. Substantial amounts of energy are required to maintain digester temperature and mix the digester contents. The high capital and energy costs generally limit complete mix AD systems to large farms or centralized facilities.

Plug Flow Digester

Plug flow digesters are designed to handle undiluted dairy manure with an 11% to 14% solids content. The standard design consists of a covered rectangular concrete tank that holds approximately 20 days worth of manure. Each time fresh manure is added to the plug flow digester, which is normally done daily, an equal volume of digested manure is forced out at the other end. Biogas is captured in the space between the digesting material and the cover. A daily plug of manure requires about 20 days to pass through the digester.

Digestion is carried out by mesophilic bacteria in a temperature range of 95°F and 103°F. The manure in the digester must be continuously heated in order to maintain the optimal temperature range. This heat can come either from engine waste heat or from the biogas stream itself. As with the complete mix digester, the long, constant exposure to heat kills most pathogens and weed seeds in the manure. Plug flow digesters only work with undiluted dairy manure. It is the optimal design for dairies that scrape manure daily and that are looking to acquire energy from the biogas stream.

DETERMINING THE FEASIBILITY OF AD TECHNOLOGY IN HUMBOLDT COUNTY

In order to determine whether AD technology is a suitable manure management technique for Humboldt County, five preliminary screening questions need to be considered[5].

(1) *Does the dairy have at least 300 cows from which 100% of the manure is collected regularly?* Dairies of this size and larger can generate the amount of biogas necessary to make the project financially viable. In Humboldt County there are many dairies

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[5] Roos, K.F., and Moser, M.A. (1997) *A Manual for Developing Biogas Systems at Commercial Farms in the United States*. AgStar Handbook. U.S. Environmental Protection Agency, Washington, D.C. EPA-430-B-97-105

with at least 300 cows, but few of them can collect 100% of the manure because the cows are pastured for a substantial portion of the year.

(2) *Is manure production and collection stable year-round?* AD systems are generally designed to handle a consistent feeding rate. This is done to ensure a constant flow of biogas and a consistent HRT. In the wet winter months in Humboldt County, dairies that house their cows in freestall barns can collect 80% to 100% of the produced manure. In the dry months, cows are either sent to pasture or given access to corrals. While cows are being pastured, only about 30% of the manure can be collected from feeding and milking areas. About 40% to 55% can be collected from cows that spend time in corrals[6]. This variability in available manure can make it difficult to design and operate an effective AD system.

(3) *Is the current manure management system compatible with AD technology?* Biogas technology requires the manure to be collected regularly at a single point and to be free of large quantities of bedding and other undigestible foreign material. Many dairies in Humboldt County collect their manure regularly to a central location and therefore could consider AD technology. Dairies that scrape manure could consider a plug flow system, which requires a relatively high percentage of solids in the manure. Dairies that flush would be limited to a covered lagoon system because of the low percentage of solids in flushed manure. However, covered lagoon systems are not practical in most Humboldt County dairylands because of the high water tables in the Arcata Bottoms and Ferndale areas. Disregarding the water table problem, the relatively cool weather in the county would substantially limit the production of biogas in unheated lagoon systems. For lagoon systems in Humboldt County, the main benefit of the system would thus be odor control.

(4) *Is there a use for the recovered energy?* All dairies in the county have a substantial demand for electrical and thermal energy. These demands could be met in whole or in part by producing energy on-site through the implementation of AD technology and an associated engine-generator.

(5) *Is someone able to manage the system efficiently?* Dairy operators in the county would need to ask themselves if they are willing and able to spend the necessary time and energy to keep their AD system working well. An AD system requires someone to pay regular attention to system operation, provide necessary repair and maintenance, and have the desire to see the system succeed.

There is another question that local dairy operators need to answer that is not part of the AgStar screening process. That question is:

(6) *Does the dairy operator own the land or hold a lease with a remaining lifetime in excess of the project's expected lifetime on the land that is currently being used for*

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[6] Burke, D.A. (2001) *Dairy Waste Anaerobic Digestion Handbook: Options for Recovering Beneficial Products From Dairy Manure.* Environmental Energy Company

the dairy operation? Unless this can be positively answered, the significant capital investment necessary to build an AD system would not be justified.

A RECOMMENDED BIOGAS SYSTEM DESIGN FOR HUMBOLDT COUNTY

Using the previous screening questions, it would appear that many Humboldt County dairies are not currently ready to consider implementing AD technology as part of their manure management plan. Some of the larger dairies in the county may be able to benefit from a plug flow AD system if other benefits besides energy production are considered. In order to conduct an analysis, a suitable Humboldt County pasture based dairy would need to fit the following profile:

(1) Manure from at least 400 cows can be collected on a regular basis.
(2) Cattle are housed in freestall barns during the wet season. This allows for maximum manure collection for a portion of the year.
(3) During the months the cattle are given access to pasture or corrals, the cattle spend enough time around the barn and feeding area in order to collect at least 40% of the manure.
(4) Undiluted manure, free of undigestible material, is scraped daily into a single collection point. Plug flow digesters do not operate properly if the solids content falls below 11%.
(5) A qualified operator is available to spend time daily, normally less than 30 minutes but occasionally up to a few hours, in order to maintain proper operation of the digester without sacrificing the dairy's main priority, the well-being of the herd.
(6) The land on which the dairy exists is owned, or a long-term lease is secured, by the dairy operators.

If these criteria can be met, local dairy operators could consider a plug flow digester as part of their manure management plan, as long as benefits besides energy production can be realized. The other types of digesters have drawbacks that prevent them from being used in Humboldt County. The high capital costs, high operating and maintenance expenses, and technical complexity of complete mix digesters make them a poor choice for Humboldt County. The high water tables and cooler climate of the county are not compatible with effective operation of a covered lagoon digester.

There are AD systems currently in operation on U.S. farms that were designed and built by the farm operator, but this approach is not normally recommended. Design and installation of an AD system should be conducted by an engineering firm experienced with the complicated design calculations, technical requirements, and regulatory issues associated with these systems. Appendix A lists companies with a proven track record in the design and installation of successful AD systems on U.S. farms.

ESTIMATE OF BIOGAS, ENERGY, AND FERTILIZER PRODUCED BY A SUITABLE DAIRY IN THE COUNTY.

According to published reports and actual case studies, 50 to 80 cubic feet of biogas can be produced per cow per day when 100% of a cow's manure is collected[7]. A suitable Humboldt County dairy, as defined previously, would have the capacity to produce substantial amounts of biogas, electrical and thermal energy, digested fiber, and nutrient rich substrate from a plug flow digester. These products would have an immediate positive impact on the dairy operation.

A complete plug flow AD system for a suitable Humboldt County dairy could be constructed on a footprint of less than one-quarter of an acre. Based on a dairy size of 400 cows and the rest of the assumptions from the previous section, such a digester would produce between 4 million and 6.4 million cubic feet of biogas annually with an approximate energy value of 600 Btu/per cubic foot. Using an engine-generator efficiency of 23%, between 124,000 and 198,000 kilowatt-hours of electricity (kWhe) would be produced annually. These values assume the engine-generator would be on-line 85% of the year and that 10% of the generated electricity would be used for parasitic loads such as compressors, pumps, and blowers. Many Humboldt County dairies are charged for their electricity at a time of use (TOU) rate of $0.09 to $0.12 per kWh[8], leading to potential annual avoided electrical costs of $11,100 to $23,800.

Valuable thermal energy for water or space heating could be recovered from the engine-generator set. A conservative estimate of 2,800 Btu/kWhe produced[9] would displace between 3,400 and 5,500 therms of natural gas per year. Current natural gas rates of $0.98 per therm during the winter and $0.65 per therm during non-peak periods lead to a potential savings of $2,800 to $4,500 on heating annually . The digester would also produce approximately 800 cubic yards of valuable fiber each year[10]. This virtually pathogen- and weed seed-free fiber has multiple uses. It can be used as freestall bedding or as a high quality soil amendment. Dairy operators have reported receiving between $6 to $10 per cubic yard when the material is sold as a bulk soil amendment, for an additional annual income of $4,800 to $8,000. When used as freestall bedding, dairy operators have saved $20 to $50 per cow annually with an added benefit of lower mastitis rates[11]. Another area of substantial savings arises from manure pit maintenance due to

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[7] Roos, K.F., and Moser, M.A. (1997) *A Manual for Developing Biogas Systems at Commercial Farms in the United States.* AgStar Handbook. U.S. Environmental Protection Agency, Washington, D.C. EPA-430-B-97-105

[8] Cherry, R. (30 May, 2003) Personal communication. PG&E

[9] Lusk, P. (1998) *Methane Recovery from Animal Manures: A Current Opportunities Casebook.* 3rd Edition. NREL/SR-25145. Golden, CO: National Renewable Energy Laboratory. Work performed by Resource Development Associates, Washington, D.C.

[10] White, J., and Van Horn, C., (1998) *Anaerobic Digester at Craven Farms: A Case Study.* Oregon Office of Energy, U.S. DOE DE-FG51-94R020021

[11] Lusk, P. (1998) *Methane Recovery from Animal Manures: A Current Opportunities Casebook.* 3rd Edition. NREL/SR-25145. Golden, CO: National Renewable Energy Laboratory. Work performed by Resource Development Associates, Washington, D.C.

less frequent cleanings and operation of manure spreaders. Annual savings of $9,000 can be realized for a 400 cow dairy[12].

The AD process produces a weed seed-free and nutrient-rich filtrate. Dairy operators currently using AD technology have reported savings due to reduced herbicide and commercial fertilizer use when they apply the filtrate to their land. However, the typical Humboldt County dairy uses very little, if any, herbicides or commercial fertilizers on its pasture lands. These benefits are thus of little financial value to local dairy operators. The main benefits to the Humboldt County dairy operator of using digester filtrate on their land would be greater ease of manure handling and higher quality forage material in the pasture. The digested filtrate is a liquid that is much easier to manage, store, and then later apply to the pastures than raw manure. Destruction of weed seeds and increased nutrient value of the filtrate could allow for higher yields from pasture lands.

A plug flow digester installed on a suitable Humboldt County dairy thus has the potential to generate income for the dairy operator through avoided costs and revenue. Energy savings alone will range from approximately $14,000 to $28,000 annually. The sale of digested fiber could generate up to $8,000 annually and avoided manure pit cleanouts could save up to $9,000 a year. In summary, anaerobic digester products and avoided O&M on current manure storage systems have a capacity to generate up to $45,000 for a suitable Humboldt County dairy.

WATER QUALITY BENEFITS FROM UTILIZING AD TECHNOLOGY.

Studies show that digester heat and retention time destroy fecal coliform bacteria that are present in raw cow manure by more than 99%. This can potentially reduce the amount of bacteria polluting a local watershed and possibly harming aquatic resources. Separation of solids during the digester process removes about 25% of the nutrients from manure[13]. These benefits may be of limited value to Humboldt County dairy farmers, however, as most of the manure that infiltrates local waters appears to come from manure deposited on the pastures, not manure that is captured and stored. There is currently no available data regarding the effect of dairy manure on local watersheds.

COST OF THE EQUIPMENT AND INSTALLATION, OPERATING EXPENSES, AND PAYBACK PERIOD.

One of the main issues discouraging dairy operators from utilizing AD technology in their manure management plan is the high capital investment necessary for installing the system. A plug flow system for a suitable Humboldt dairy would cost between $500 and $1,000 per cow, leading to an installed cost of $200,000 to $400,000 for the complete system[14]. The complete system includes manure collection, the anaerobic digester, gas handling equipment, engine-generator and switchgear, effluent separation and storage equipment, engineering costs, permitting fees, and labor. A system that is both well engineered and maintained has the capacity to remain functional for 20 years or more.

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[12] Langerwerf, L. (14 February, 2003) Personal communication. Langerwerf Dairy, Durham, CA.
[13] White, J., and Van Horn, C., (1998) *Anaerobic Digester at Craven Farms: A Case Study.* Oregon Office of Energy, U.S. DOE DE-FG51-94R020021
[14] Moser, M. (12 February, 2003) Personal communication. RCM Digesters, Inc., Berkeley, CA.

Anticipated operation and maintenance costs of an unfamiliar technology may be another factor discouraging many dairy operators from implementing AD projects. In reality, however, these costs tend to be modest. Once installed, the cost of O&M on the system is heavily dependent on the quality of the equipment used and the dedication of the operator to keep the system running as well as possible. Engine-generator maintenance is estimated to be approximately $0.015 per kWhe produced for an annual cost of $1,800 to $3,000. This cost includes regular oil and filter changes, spark plugs, and an amortized estimate for major overhauls during the life of the system[15, 16]. O&M for the remainder of the system is more difficult to estimate. A good rule of thumb is that complete system O&M is approximately 5% of the initial capital cost[17]. Total annual O&M for a typical Humboldt County digester designed to handle the manure from 400 dairy cows is estimated to be $10,000 to $20,000.

In order to evaluate the economic viability of an AD project, a simple payback period is calculated for best case, median, and worst case scenarios. The results are summarized on an annual basis in Table 1.

Table 1. Economic summary and simple payback period for an AD system installed on a suitable Humboldt County dairy.

	Best Case	Median Case	Worst Case
Capital cost	$200,000	$300,000	$400,000
Annual value of electricity	$23,824	$17,496	$11,168
Annual value of thermal energy	$4,558	$3,703	$2,849
Annual value of fiber	$8,026	$6,420	$4,815
Annual savings on lagoon cleanout	$9,000	$4,500	0
Annual O&M	$10,000	$15,000	$20,000
Simple payback period	5.6 years	17.5 years	> 20 years

In the best case scenario, an AD system installed on a Humboldt County dairy will pay for itself in 5.6 years. This length of time is often considered too long for a project to be considered viable solely on an economic basis. In the worst case scenario, the project will not pay for itself during the system's expected lifetime. Without significant financial assistance, AD systems are only a viable option for Humboldt County dairies whose operators place significant value on intangible benefits such as odor control, decrease in fly populations, and environmental stewardship. High capital costs and the inability to collect adequate amounts of manure, due to the pasture-based dairy economy of Humboldt County, currently make these systems economically infeasible, unless substantial assistance can be found to defray the initial costs.

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[15] White, J., and Van Horn, C., (1998) *Anaerobic Digester at Craven Farms: A Case Study.* Oregon Office of Energy, U.S. DOE DE-FG51-94R020021

[16] Ross, C.,Drake, T., and Walsh, J. (1996). *Handbook of Biogas Utilization, Second Edition.* Muscle Shoals, AL: Southeastern Regional Biomass Energy Program.

[17] Ross, C.,Drake, T., and Walsh, J. (1996). *Handbook of Biogas Utilization, Second Edition.* Muscle Shoals, AL: Southeastern Regional Biomass Energy Program.

There are many programs designed to help dairy operators fund and install AD systems on their farms. A few of these programs are described in the following section. With these types of assistance, implementation of AD technology on a suitable Humboldt County dairy would become more feasible than the previous analysis indicates. The Dairy Power Production Program (DPPP) offers up to 50% of project capital cost or up to $2,000/kW capacity. The remaining portion of the project cost could be offset with PG&E's Self-Generation Incentive Program (SGIP) that would pay a rate of $1,500/kW or up to 40% of the projects' capital cost.

The capacity of the engine-generator set for the suitable Humboldt County dairy would be approximately 40 kW. This system size would make $80,000 available from the DPPP and $48,000 to $60,000 available from the SGIP. The revised economics are summarized in Table 2.

Table 2. Revised economic summary and simple payback period for an AD system installed on a suitable Humboldt County dairy assuming financial assistance from the DPPP and SGIP.

	Best Case	Median Case	Worst Case
Revised capital cost	$92,000	$180,000	$280,000
Annual value of electricity	$23,824	$17,496	$11,168
Annual value of thermal energy	$4,558	$3,703	$2,849
Annual value of fiber	$8,026	$6,420	$4,815
Annual savings on lagoon cleanout	$9,000	$4,500	0
Annual O&M	$10,000	$15,000	$20,000
Simple payback period	2.6 years	10.5 years	> 20 years

As Table 2 indicates, available financial assistance can significantly decrease the simple payback period of an AD system installed on a suitable Humboldt County dairy. These results, combined with the intangible benefits discussed previously, could make AD technology a viable option for a local dairy's manure management system.

FUNDING SOURCES CONTRIBUTING TO IMPLEMENTATION OF AD TECHNOLOGY ON DAIRY FARMS.

Funding is available from a variety of sources to assist dairy operators with the costs of installing and operating an AD system on their farm. A brief description of some funding options follows.

Grants

The primary source of funding for dairy farm biogas projects in California recently has been the Dairy Power Production Program (DPPP). This program was funded by the State under Senate Bill 5X and is administered by the Western United Resource Development Corporation (WURD), a dairy operators' industry association. This program was originally funded with $9.6 million and, as of September 2002, had approved $2.5 million in funding for nine projects representing approximately 1.5 MW in generating capacity.

The program offers two funding alternatives. The "buydown" option provides up to 50% of project capital costs or $2,000/kW capacity, whichever is less, in up-front funding. The applicant is required to demonstrate the technical feasibility of their project to receive funding. Under the "incentive" option, considered to be riskier financially, the applicant is not required to prove feasibility in advance and is given a 5.7¢/kWh incentive for energy generation up to 50% of project capital cost over the first five years the project is in operation. Most applicants to the program have chosen the buydown option in order to get up-front capital. DPPP grants cannot be combined with any other form of State of California energy funding.

As of June 2003, funding is still available from the DPPP. For more information, call Kathi Schiffler at (209) 527-6453. The program's website is www.wurdco.com, or write to:

Western United Resource Development, Inc.
1315 K Street
Modesto, CA 95354

In a May 2003 telephone conversation, Ms. Schiffler pointed out some important limitations on the Dairy Power program. Some dairy operators have inquired about aggregating their manure to more cost-effectively operate a multi-dairy digester. WURD consulted with the State and have expressed the opinion that this may not be an appropriate use of DPPP funds, in part because it raises regulatory concerns about permitting and licensing requirements for the digester system operator, who in accepting manure from other parties for processing would be operating as a commercial waste handler. There are also regulatory issues connected with the hauling of manure between farms on public roads.

Ms. Schiffler also provided information on concerns expressed to the California Public Utilities Commission (CPUC) by her organization and others that California's investor-owned utilities have structured their proposed net-metering rates applicable to dairy biogas projects in a way that would under-compensate dairy operators for electricity generated via such projects. In response to complaints by WURD and other groups, the CPUC has suspended implementation of these electric tariffs until they can resolve the fairness issue. In general, PG&E and other major California utilities have shown reluctance to purchase electricity from their customers who use distributed generation. They are under no legal obligation to buy biogas-generated electricity, although recent State legislation will require them to buy a percentage of their energy from "green" generating sources, including biogas, by 2017.

PG&E's "Self-Generation Incentive Program" offers financial incentives for up to 1.0 MW of on-site distributed generation systems. Biogas projects would be compensated at a rate of $1,500/kW or up to 40% of the projects' capital cost, whichever is less, at program level 3-R (internal combustion engines and small gas turbines operating on renewable fuel). Certain restrictions apply to this incentive program, among them that the electricity generated by the system must be used on-site, and the equipment installed needs to be factory-new and carry a minimum three-year warranty. See www.pge.com/selfgen for more information, or contact:

Self-Generation Incentive Program
P.O. Box 770000
Mail Code B29R
San Francisco, CA 94177
(415) 973-6436

According to WURD's Kathi Schiffler, WURD does not place any restriction on combining their grant with PG&E's ratepayer-supported incentive program. However, she reports that PG&E will deduct the portion of a project supported by WURD from the total project cost *before* calculating the portion of the project cost the utility will support. For example, a $200,000 project receiving $80,000 in support from WURD could not be eligible for more than $48,000 (40% of the remaining $120,000 project cost) from PG&E.

The USDA's Rural Development Program is offering funding for purchase of renewable energy systems by agricultural producers. A total of $23 million is available nationwide, to be disbursed in individual grants of $10,000 to $500,000. The grant cannot exceed 25% of total project costs, and the 75% match provided by the applicant cannot include any other federal funds. While biogas systems are eligible under this grant program, note that "operating, maintaining, routine repairs, or fuel costs for biogas or biomass renewable energy projects" are specifically *not* eligible for funding. The original grant proposal deadline of June 6, 2003 was recently extended to June 27, 2003. For more information or to download the Notice of Funds Availability, see:

www.rurdev.usda.gov/rd/farmbill/9006resources.html or contact:

Charles Clendenin, USDA Rural Development
430 G Street, Agency 4169
Davis, CA 95616-4169
(530) 792-5825

Tax Credits

At this time there appears to be no state or federal tax incentive for biogas-based electricity generation other than standard equipment depreciation. The federal government offers a Renewable Electricity Production Credit to commercial/industrial taxpayers, which includes "closed-loop biomass" systems where crops are grown specifically to produce electricity. IRS Form 8835, used to apply for the credit, explicitly excludes manure-based generation systems. The State of California's Solar or Wind Energy System Credit specifically applies only to photovoltaic and wind energy systems.

CONCLUSION

Anaerobic digestion is a technology that has been shown to effectively manage dairy manure while yielding resources with significant financial and intangible value. The smaller pasture-based dairies of Humboldt County initially appear to be ill-suited for the implementation of this technology, because of the high initial capital cost of these systems and thc fact that local pasture-based operations may not allow for adequate manure collection. Under the right circumstances, which include the acquisition of available funding, a suitable Humboldt County dairy could effectively use a plug flow digester as part of their manure management plan.

The plug flow digester would produce biogas and an effluent that could be separated into a solid fiber and a liquid filtrate. The biogas can be used to generate electrical and thermal energy for on-site use, thereby reducing energy expenses. The fiber can be sold as a high quality soil amendment or used as animal bedding. The liquid filtrate can be land applied as a high quality fertilizer. Intangible benefits such as odor control and decreased fly populations are invaluable if the operation plans to expand or if residential areas are located nearby.

APPENDIX A: SYSTEM CONSULTANTS AND DESIGNERS

Listed below is the contact information for companies that specialize in designing AD systems. They were chosen for their proven track record with dairy-based systems. This is not to be considered an exhaustive list because many other companies can assist in the development of farm-based AD projects.

RCM Digesters, Inc.
P.O. Box 4715
Berkeley, CA 94704
Phone: (510) 658-4466
Fax: (510) 658-2729
Website: www.rcmdigesters.com
e-mail: contact@RCMDigesters.com

Environomics
P. O. Box 371
Riverdale, NY 10471
Phone: (718) 884-6740
Fax: (718) 884-6726
Website: www.waste2profits.com
e-mail: environomics@waste2profits.com

APPENDIX B: QUICK REFERENCE SUMMARY TABLE

BIOGAS COST & BENEFIT CALCULATIONS

Number of cows	400	
	Worst Case	**Best Case**
CAPITAL AND MAINTENANCE COSTS		
Capital Costs		
Digester system cost per cow	$1,000	$500
Total digester system cost	$400,000	$200,000
Avoided O&M Costs		
Lagoon cleanout annual cost	$9,000	$9,000
Source: Langerwerf		
O&M Costs		
Engine generator maintenance		
cost per kWh generated	$0.015	
annual cost	$1,861	$2,978
Fiber recovery system maintenance		
cost per yd ^{3}	$1	$1
annual cost	$803	$803
Complete system (5% of capital)	$20,000	$10,000

AVOIDED COSTS AND REVENUE OPPORTUNITIES

Avoided Energy Costs

Season	Wet	Dry	Wet	Dry
Cows	400	400	400	400
Months	4	8	4	8
Biogas (ft ^{3}/cow/day)	50	50	80	80
Fraction manure collected	0.85	0.4	0.85	0.4
ft ^{3}/day	17000	8000	27200	12800
ft ^{3}/season	2,067,200	1,945,600	3,307,520	3,112,960
BTU/ft ^{3}	600	600	600	600
BTU/day	10,200,000	4,800,000	16,320,000	7,680,000
BTU/season	1,240,320,000	1,167,360,000	1,984,512,000	1,867,776,000
Genset efficiency	23%	23%	23%	23%
Gross kWh/day	687	323	1,099	517
Gross kWh/season	83,560	78,645	133,696	125,831
kW capacity	29	13	46	22
Net avail. electricity	90%	90%	90%	90%
Plant availability	85%	85%	85%	85%
Net kWh/season	63,923	60,163	102,277	96,261
BTU heat/season	178,985,369	168,456,818	286,376,591	269,530,909
Therms heat/season	1,790	1,685	2,864	2,695
Avoided elec. Rate ($/kWh)*	$0.09	$0.09	$0.12	$0.12
Avoided gas rate ($/th)*	$0.98	$0.65	$0.98	$0.65
Seasonal avoided elec costs ($)	$5,753	$5,415	$12,273	$11,551
Seasonal avoided gas costs ($)	$1,754	$1,095	$2,806	$1,752
Annual avoided energy costs ($)	$14,017		$28,383	

*Source: Robert Cherry, PG&E

Soil Amendment Revenue Opportunity

Seasonal cubic yards fiber	413	389	413	389
Value ($/yd ^{3})	6	6	10	10
Seasonal value	$2,481	$2,335	$4,134	$3,891
Annual value	$4,815		$8,026	
Simple Payback w/o Funding	51.1 years		5.6 years	

[capital cost/(annual revenue-annual O&M costs)]

Funding Opportunities - See report for more information

Dairy Power Production Program	50% of capital cost or $2,000 per kW capacity
PG&E Self-Generation Incentive Program	40% of capital cost or $1,500 per kW capacity
USDA Rural Development Program	$10,000 to $500,000 but not to exceed 25% of total project cost

Land area required for housing	Length (ft)	Width (ft)	Area (ft ^{2})
Digester	150	40	6000
Engine-generator and Switchgear	25	25	625
Effluent collection	20	20	400
Solids separator	50	25	1250
		Total	8275 ft ^{2}
			0.19 acre

Biodiesel

We have a book called "From the Fryer to the Fuel Tank" that is useful resource when checking out biodiesel. The book is by Joshua Tickell and is what CCAT refers to when they have their biodiesel site up and running. When you use vegetable oil as a fuel, you know the crops can grow more for you to use each year so that there is a cycle that is being followed and it is sustainable. There are many benefits to biodiesel that include; safer for the environment, nontoxic, burns cleaner and 100% biodegradable. There is an infinite source because there will always be plants and therefore there will always be vegetable oil. This energy does not depend on a finite source such as oil which is extracted under the earth's surface and took millions of years to form. This is a annual product that if managed correctly, can be continued infinitely.

A drawback to biodiesel is if we depend on it solely, then our needs could outpace plant production, thus landing us right back at square one. But this should not be a problem because the Outpost is look at having a variety of energy sources be utilized so there is no dependency on one energy source. Another drawback is it is still emitting CO2 which means we still have not found a way to reduce global warming and still keep our cars going. This is a huge problem because global warming is changing the environment everywhere and there is a danger that millions of plant and animal species will be wiped out because they cannot adapt to the different climate quickly enough.

We did not find any reports on biodiesel and Humboldt County. However, I am happy to report there are two sources of biodiesel Humboldt residents can currently choose from. The first is Andy Cooper and he co-owns "Footprint Recycling". He produces about 2500 gallons per month and sells all of it. Theye collect from 80 vendors which represents about half of the county's restaurants and businesses. Many of the fastfood oil waste is collected by an outside vendor that pays higher prices. It would be difficult to collect fastfood grease anyhow because much of it is from animal fat which does not do well in engines in cold weather. The drawbacks with Andy need to be addressed. Humboldt County has about 130,000 resdients and they consume, on average, 4.4 million gallons of gasoline a month (derived from state average). Even if Footprint Recylcing used all the fryer grease in the county, it would supply less than 0.2% of the county's transportation fuel needs. The other source is Renner, and they will even deliver the biodiesel to your door. The problem with using them is they use virgin oil which defeats the purpose of reusing waste oil. But it is good to have a variety so they should certainly still be considered an option.

As an energy to be thrown in the pot with a multitude of other energy sources, biodiesel is great. It is available cheaply, we have 2 manufacturers of the product, and it can be made in your own backyard if you wanted. The drawback is it keeps the status quo in regards to global warming, it would not account for a large percentage of our energy consumption, and much of the county's potential fryer grease is being taken out by an out of town company. However, I advise looking through the various articles we have included in this section for more education on the energy and to look for possibilities and solutions we may have overlooked.

Article 15 - Biodiesel production methods, costs and available capacity- Anthony Radich - EI

Biodiesel can be produced by several processes.

Vegetable oils or fats can be converted to fatty acids, which in turn are converted to esters. Oils or fat converted to methyl or ethyl esters directly, using an acid or base to accelerate (catalyze) the transest reaction. Base catalyzation is preferred, because the reaction is quick and thorough. It also occurs at l temperature and pressure than other processes, resulting in lower capital and operating costs for the b

The most common method of producing biodiesel is to react animal fat or vegetable oil with methanol of sodium hydroxide (a base, known as lye or caustic soda). This reaction is a base-catalyzed transest produces methyl esters and glycerine. If ethanol is substituted for methanol, ethyl esters and glycerine Methanol is preferred, because it is less expensive than ethanol.

Feedstock Prices

The cost of vegetable oil feedstocks like soy or waste vegetable oil (know as yellow grease) is the larg component of biodiesel production costs. Yellow grease is much less expensive than soybean oil, but it limited, and it has uses other than fuel. For example, yellow grease is used as an animal feed additive production of soaps and detergents. From 1993 to 1998, the average supply of yellow grease in the Ur was 2.633 billion pounds, enough to make 344 million gallons (22,440 barrels per day) of biodiesel. EI assumes that competing uses would limit biodiesel production from yellow grease to 100 million gallon (6,523 barrels per day).

EIA's price projections for soybean oil are based on data from the U.S. Department of Agriculture (USDA), Office of Energy Policy and New Uses. The USDA estimated the effect on agricultural markets of a renewable fuels requirement for gasoline and diesel fuel by constructing two agricultural market forecasts: a renewable fuels standard case with, and a reference case without, biodiesel production from soybean oil. The EIA forecasts of soybean oil prices are based on an assumed quantity of oil used for biodiesel production in each forecast year (Table 1).

In the renewable fuels standard case, the quotient of the increase in soybean oil prices and the quantity of soybean oil used for biodiesel production provides the rate of change in soybean oil prices with respect to the quantity of soybean oil input to biodiesel production. The most current baseline soybean oil prices, assuming no biodiesel production, are also obtained from the USDA.

Table 1. Soybean Oil Prices as a Function of Use for biodiesel Production, 2004-2013 (20 Gallon)

Marketing Year	50 Million Gallons of Soybean Oil Used for Biodiesel Production	200 Mi of Soy Used f Produ
2004/05	1.95	2.22
2005/06	1.91	2.17
2006/07	1.87	2.15
2007/08	1.84	2.12
2008/09	1.86	2.20
2009/10	1.89	2.25
2010/11	1.94	2.35
2011/12	1.99	2.41
2012/13	2.06	2.47

The USDA does not forecast yellow grease prices, although in the past the prices of yellow grease and have moved together. The results of a linear regression are:

Yellow grease price = 0.49 x Soybean oil price .

Yellow grease price projections (Table 2) are estimated by using soybean oil price projections in the above equation.

Biodiesel Production Costs

Operating expenses were estimated at 31 cents per gallon (2002 cents), excluding the cost of the oil or grease and energy, and the sale of the glycerol was estimated to reduce the cost by 15 cents per gallon of biodiesel.

Table 2. Projected Prices for Yellow Grease, (2002 Dollars per Gallon)

Marketing Year	Price
2004/05	1.09
2005/06	1.07
2006/07	1.05
2007/08	1.04
2008/09	1.08
2009/10	1.10
2010/11	1.15

2011/12	1.18
2012/13	1.21

The biodiesel production process uses, for each gallon, 0.083 kilowatthours of electricity and 38,300 British thermal units (Btu) of natural gas. EIA estimates energy costs (in 2002 cents) of 18 cents per gallon in 2004 and 16 cents per gallon in 2005 and 2006.

A new biodiesel plant is estimated to cost $1.04 per annual gallon of capacity. EIA assumes that the pl by equity with an annualized return of 10 percent over 15 years. Treating the hypothetical income stre annuity over the 15 years, the estimated capital cost is $1.36 million per year, or 13.6 cents per gallor at full output.

Total cost of production

A comparison of total production costs of diesel fuel by type of feedstock is provided in Table 3.

The cost comparison in Table 3 is made between the cost of biodiesel (excluding capital) and the cost of petroleum diesel. (Including capital)

Table 3. Projected Production Costs for dies feedstock, 2004-2013 (2002 Dollars per Gal

Marketing Year	Soybean Oil	Yellow Grease
2004/05	2.54	1.41
2005/06	2.49	1.39
2006/07	2.47	1.38
2007/08	2.44	1.37
2008/09	2.52	1.40
2009/10	2.57	1.42
2010/11	2.67	1.47
2011/12	2.73	1.51
2012/13	2.80	1.55

Current Biodiesel Production Capacity

There is currently excess production capacity in the biodiesel industry. Petroleum refiners, on the other hand, use more than 90 percent of their capacity, and additional capital investments are needed to keep up with increasing demand and tightening product specifications, such as the transition in 2006 from a highway diesel sulfur limit of 500 parts per million per million. Soybean oil biodiesel has essentially no sulfur.

The National Biodiesel Board claims that dedicated biodiesel plants with a total capacity of 60 to 80 mi per year (3,414 to 5,219 barrels per day) have already been built. In addition, 200 million gallons (13, per day) of capacity are available from oleochemical producers, such as Proctor and Gamble.

Biodiesel producers will produce up to 80 million gallons per year at a price just high enough to cover The capacity in the oleochemical industry will not come on-stream unless the price of biodiesel is suffic draw methyl esters out of other uses.

Because soybean biodiesel producers have overcapacity and a product that more than meets the upco diesel sulfur limit, they need make no additional capital investments to produce output up to 80 millior 2006 and beyond.

Government Incentives for Biodiesel Production

For the past several years, the USDA has offered grants for biodiesel production through the Commodity Credit Corporation (CCC). The CCC payments for expansion of biodiesel production in the fiscal years 2004-06 are $1.45-$1.47 (2002 dollars) per gallon for soybean oil biodiesel (Table 4) and 89-91 cents per gallon for yellow grease biodiesel (Table 5).

Base production payments apply to production up to the level of the prior fiscal year, and additional production payments are for production above the level of the prior fiscal year. CCC payments for producers with output levels of 65 million gallons per year or less are shown in Tables 4 and 5. Payments for output levels above 65 million gallons per year are approximately 30 percent lower than the values shown in Tables 4 and 5.

Table 4. Soybean Oil Biodiesel Production C Subsidies, 2004-2006 (2002 Dollars per Gal

	Fiscal Yea	
Costs and Subsidies	2004	20
Variable Cost	2.55	2.
CCC Base Production Payment	-0.43	-0.
Variable Cost of Base Production, Net	2.12	2.
Variable Cost	2.55	2.
CCC Additional Production Payment	-1.45	-1.
Variable Cost of Additional Production, Net	1.10	1.

The CCC payments effectively reduce the variable cost of additional soybean oil and yellow grease biodiesel to $1.10 and 53 cents per gallon, respectively, in fiscal year 2004. Additional units produced in fiscal year 2004, however, become base units in fiscal year 2005 and are eligible only for much smaller, and declining, base

Table 5. Yellow Grease Biodiesel Production Subsidies, 2004-2006 (2002 Dollars per Gal

	Fiscal Yea	
Costs and Subsidies	2004	20
Variable Cost	1.42	1.

production payments. The variable cost of soybean oil and yellow grease biodiesel added in fiscal year 2004 jumps to $2.32 and $1.27 per gallon, respectively, in fiscal year 2005.

CCC Base Production Payment	-0.27	-0.[illegible]
Variable Cost of Base Production, Net	1.15	1.[illegible]
Variable Cost	1.42	1.[illegible]
CCC Additional Production Payment	-0.89	-0.[illegible]
Variable Cost of Additional Production, Net	0.53	0.[illegible]

The transportation bill passed by the Senate on February 12, 2004, includes excise tax credits for biodiesel blending. The legislation allows diesel blenders to claim a credit against the applicable Federal motor fuels excise tax if a batch of diesel fuel contains biodiesel. If the blender uses biodiesel made from virgin oil, such as soybean oil, the credit is $1 (nominal dollars) per biodiesel. If the blender uses biodiesel made from nonvirgin oil, such as yellow grease, the credit is 50 gallon of biodiesel. The proposed legislation also includes business income tax credits at the same rate blending of biodiesel from virgin or non virgin oil. The proposed Federal tax credits would expire after [illegible]

Eureka Times-Standard

Liquid gold: Biodiesel in Humboldt County

By Ann Johnson-Stromberg The Times-Standard

Sunday, March 20, 2005 -

Taking a page out of the backpacker's mantra, Footprint Recycling is treading lightly in our community. Starting out on grants and a dream, Andrew Cooper, a 31-year-old Humboldt State University master's student, decided to set out in pursuit of developing and selling biodiesel.

"It just fascinated me so much that you could make a fuel source for a diesel engine out of waste vegetable oil, I mean anybody can make biodiesel -- you can make it in a blender," Cooper said. "But I wanted to know and experiment with how I could make biodiesel for the community."

A recent recipient of the Humboldt County Waste Reduction Award, for effective use of recycled materials in manufacturing, Cooper said Footprint Recycling isn't just about providing an alternative fuel. The company is committed to all aspects of reducing and reusing, in fact 75 percent of the equipment used is salvaged tanks and other odds and ends from various places that were modified.

The facts are clear: Biodiesel is safer for the environment than its petro diesel counterpart. Biodiesel is nontoxic, burns cleaner, and is 100 percent biodegradable. Another big plus for biodiesel is that it can be used in any diesel vehicle with no engine modifications and it can be mixed with conventional diesel with no ill-effects.

While many may be unaware of the benefits of biodiesel, Cooper and his partners have no problem selling his product. "We make 2,500 gallons a month and we sell every drop," he said. "I would really like to see that double or even triple. Our limiting factor is the available grease."

Cooper and his partners, Greg Bender and Chad Christensen-Woods, aren't getting rich at this though. After covering their expenses to collect and produce the fuel, Cooper said at the end of the year the three partners split a current profit of $30,000 to cover their labor. Not exactly enough to support three families, and without their HSU interns Doug Kelly, Todd Frisbee, Christopher Cook and Michael Kroger Footprint would be lost, he said.

Still, Cooper has big plans for the future of his company and says every new business that chooses Footprint Recycling translates into less vehicular pollution in Humboldt County, and more alternative fuel for its citizens.

Footprint Recycling collects from 80 vendors, representing about half of the area's available restaurants and businesses. Among them are Six Rivers and Lost Coast breweries, St. Joseph Hospital, Humboldt State University, College of the Redwoods and Mazzotti's.

You might ask yourself --What about the fried fat biggies such as McDonald's and Burger King restaurants? Well, Cooper said, he would love to be their recycling man, but he currently can't match the prices of an out of area "renderer" who currently services many of the remaining half available.

As a renderer, there are other services besides providing and draining oil tanks. Since animal fats solidify at room temperature, that waste cannot run a diesel engine in a cold weather environment, but restaurants still need to get rid of it. Depending on the amount of waste vegetable oil, the amount of additional waste needing to be hauled off and the location of the vendor, all come into play when determining what the nominal fee for Footprint Recycling would be.

Footprint already takes rendered butcher scraps to another facility near Medford, Ore., so they are hoping to break into out-of-area markets along that route, like Crescent City.

"If I can out-bid my competitor up there, and if they are willing to support us it would be great," Cooper said. "The influx of oil into this shop would benefit us greatly, enough to warrant going there."

Ron Rudebock, HSU director of dining services, said that it is kind of an unspoken policy to support the university alumni and said he's been happy to have Footprint recycle their oil. Humboldt State has been recycling its waste oils for more than 20 years, but Rudebock said that he is glad to know it's now being used for biodiesel production.

"Andrew is doing a very good job, he upgraded our tanks and has worked diligently with us on educating staff and students on what he is using the products for," Rudeback said. "That's what we are here for -- education, and it's nice to see him successful."

Businesses aren't the only users of vegetable oil and Mark Loughmiller executive director of Arcata and Eureka Recycling Centers is happy to offer the public a place to recycle theirs.

"The people who use the service, love the fact we take it," Loughmiller said. "It really was kind of an experiment for us to accept from the public, I don't know how many people realize we collect it."

Loughmiller said he assumes not a lot of people use bunches of oil, but did notice that just after Thanksgiving there was a boost in oil collection from deep frying turkeys. To insure that Footprint gets a clean supply, customers must give the oil to an employee rather than dumping it themselves. A well-learned lesson was when someone dumped motor oil in the vegetable oil container and the center had to clean it out.

Loughmiller said Footprint empties a 25 gallon drum once a month, but said he couldn't speak to whether it is full every month.

"It's unfortunate that he can't produce more because I know the demand out there would support it," he said. " You have to applaud him for what he is doing and hope he has enough activity to stay in business."

For more information about biodiesel or Footprint Recycling call (707) 826-2606.

Humboldt County: 130,000 residents
- consume 4.4mil/gal of gasoline per/month
(assuming we consume state avg)

Even if Footprint Recycling used all the fryer grease in the county, it would supply less than 0.2% of county's transportation fuel needs.

Wood Gasification

Wood gasification has been around for over 150 years. It works when there is a lot of thinning occurring in an area. During WWII, several European countries started using wood gasification to fuel their machines because they were short on petroleum. Typically the costs have been too high for small-scale users, but I found a website with a host of information on the possibilities for small-scale use. The website has a host of links to other pages and I found it very educational. You can virtually make your own small wood gasification machine http://www.fluidynenz.250x.com/ link. There are reports wood-powered engines being used around the world on http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/T0512E/T0512e00.htm There is a mass of information including the following topics: homebuilt gasifiers, Swedish charcoal gasifier, and a list of books and articles on wood gasification. The website for all this information is: http://www.colostate.edu/programs/cowood/New_site/Useful_links/Links/Wood-gasifiers.htm and I highly recommending checking it out. Wood gasification is definitely an energy source that should be implemented here in Humboldt County because we have so many trees that it would be natural to thin them at a sustainable rate. In Denmark, during WWII, 95% of their farm equipment, stationary engines, ferries and boats were fueled with wood gasification. The possibilities for Humboldt County are endless, and this is a technology I recommend really trying to get happening on a large scale.

Ground source heat pump

Ground source heat pumps (GSHP) work differently than traditional heat systems because they do not use fuel (propane or natural gas). The natural heat of the earth is used instead. A series of pipes are put into the ground at varying depths called a loop. In the loop is a water based fluid that circulates and absorbs the heat from the earth. The heat is transported into the home or building and provides the winter heat. Inside the home or building, a GSHP system concentrates the heat and released it at a higher temperature.

During the warmer seasons the GSHP work in reversed replacing the need for an air conditioning unit. The excess heat is pulled from the building into the loop, and re-absorbed by the earth. (Redding Electric Utility)

http://www.reddingelectricutility.com/energysvc/howgshpworks.html

Michael Winkler is an Arcata resident with a ground source heat pump installed at his home. His house heating is from Water Furnace ES Split (30,000 BTU/hour); using 2 – 150 ft. vertical ground loops. He provided the following information.

The cost of the ground-source heat pump depends on a number of factors including:

1. Climate (how cold or hot the weather is, as measured in "heating degree-days" and "cooling degree-days" per year)
2. The size of the house and how well insulated it is.
3. Loop type (horizontal or vertical; horizontal is much cheaper, but requires a large yard)
4. Soil composition and moisture content (a more porous soil conducts heat better; softer soil is easier to bore holes in)
5. Soil temperature
6. Travel distance for the well driller

Winkler's residence ground source heating system price is $12,802.

Local installers
Crystal Air
1413 Main Street, P.O. Box 1501
Weaverville, CA 95926
1-877-845-5739

Michael Ericksen
Earth Energy Systems, Inc.
956 Piner Rd.
Santa Rosa, CA 95403
PHONE: 707-523-4363
FAX: 707-523-4360

Manufacture
WaterFurnace International, Inc.
9000 Conservation Way
Fort Wayne, IN 46809

Energy Conservation

Design of Energy Conservation and Renewable Energy Program for Residential Sector, prepared by Schatz Energy Research Center, July 2, 2001.

Schatz Energy Research Center (SERC) prepared a report, *Design of Energy Conservation and Renewable Energy Program for Residential Sector*, offering results of their work in design of energy conservation and renewable energy programs for Humboldt County households (SERC, 2). Each area of analysis is covered thoroughly and in some areas recommendations are provided. The report provides analysis on the following areas;

Energy Education – Provides education of energy conservation and efficiency methods to illustrate immediate savings. This demonstrates that investments in solar hot water systems and solar electric systems are more cost effective than most people realized. Energy education can come from community fairs, workshops, mailing list, tours of energy efficient demonstrations homes in Humboldt County, and youth education.

Electric Load Reduction – Provides information on two energy reduction methods: compact fluorescent lights and phantom load reduction. Table 3.1 gives a comparison of the cost of compact fluorescent, incandescent, and halogen bulbs and their electrical use. Phantom load reduction analysis provides information that through education a substantial amount of energy can be conserved.

Weatherization – Provides information on energy savings through basic home weatherization measures. Estimates of saving from $933 to $3,226 depending on house size are possible from weatherization (SERC, 10). Table 4.1 shows the results of analysis.

Solar Hot Water Systems – Provides cost-effectiveness for Humboldt County geographical area determining the expected performance of the system. Information on the basic types of hot water systems is provided, key information of energy education, along with considering hot water conservation techniques (SERC, 16). Table 5.1 gives savings and payback periods for solar hot water systems. The report also provides guidelines recommended for solar hot water systems.

Solar Electric Systems – Provides list of equipment for two types of residential photovoltaic PV system, cost of installation, and energy production potential. The systems analyzed are grid-connection systems in that there is not a battery backup. Table 6.1 and 6.2 itemized the equipment needed for a 1-kW and 2-kW system. Figure 6.1 shows the configuration of typical residential PV system. This section of the report also gives information on solar access and rebates from California Energy Commission.

Economic, Regulatory, and Utility Issue – Provides information on what local government can take into account to help make available renewable energy programs. The section includes economic, regulatory and utility-related concerns the local government should consider. Attention to PV systems specific issues of permits, rebates, utility rates, and grid interconnection are offered in this section, along with some information on solar hot water systems.

Report #1

Design of Energy Conservation and Renewable Energy Program for Residential Sector

prepared by
Schatz Energy Research Center (SERC)
for
Humboldt Energy Task Force

July 2, 2001

CONTENTS

1. EXECUTIVE SUMMARY

This report presents the first results of our work on the design of energy conservation and renewable energy programs for Humboldt County residences. These results are preliminary and subject to revision. The systems discussed here should not be considered recommended standardized systems, but instead represent common or current practice. All economic analyses use June 2001 prices for electricity and natural gas. In this report, cost-effectiveness of measures is presented in terms of simple payback time, i.e. the time period required for energy cost savings to repay the materials and labor costs of implementing the measure. We have not considered savings that would result from bulk purchases of equipment and standardization of systems.

Energy Education

- Educating the public about energy efficiency and conservation techniques would produce immediate savings and would make solar hot water systems and solar electric systems more cost effective.
- Several distinct audiences exist for educational outreach: residential consumers, small business owners, contractors, and government.

Electric Load Reduction

- Lighting consumes 25-30% of household electrical energy use. Replacing incandescent lights with compact fluorescent bulbs in moderate to high use areas in homes generally provides a 1- to 2-year energy savings payback at current prices of electricity. Initial costs would range from $8 to $12 per bulb.
- A "phantom load" reduction effort would yield modest savings of electrical energy but would be simple and inexpensive to implement.

Weatherization

- Weatherization measures would primarily reduce natural gas consumption.
- SERC engineers used a residential energy use model produced by Lawrence Berkeley Laboratory, cost data collected from local contractors, and custom-designed analysis spreadsheets to estimate potential savings, costs, and payback periods for a number of weatherization and lighting efficiency measures applied to generic small, medium and large Humboldt County homes.
- The full package of seven weatherization measures would result in savings ranging from $500 to $1,700 per house per year, depending on house size and other variables. Implementation costs would range from $2,000 to $4,000 per home, resulting in energy savings paybacks between 2.4 and 5.0 years at current prices of natural gas.

Solar Hot Water Systems

- Before investing in a solar hot water (SHW) system, it is more cost effective to invest in making homes more energy efficient. By taking steps to use less hot water and to lower the temperature of the hot water, users will reduce the size and cost of solar water heaters.
- The estimated installed cost of typical SHW systems that are currently being offered locally ranges from $4000 to $4600.
- Depending on the circumstances and at current prices of electricity, SHW systems can be expected to have reasonable (5-6 year) to longer (10 year) payback times when supplementing an existing electric hot water heater.

- When supplementing an existing gas hot water heater, SHW system payback times exceed 20 years at current prices of natural gas.
- SHW systems offer many other benefits such as improved environmental quality, enhanced energy security, and local economic development opportunities.

Solar Electric Systems

- Homeowners should first greatly reduce their overall electrical energy use through conservation and efficiency before installing photovoltaic (PV) systems. Humboldt County households use an average of 15 kWh/day of electrical energy.
- It is much less expensive to meet energy needs through conservation and efficiency than to install a larger PV system.
- Homeowners installing PV systems should switch to "net metering" so that they will be billed for net annual electricity use.
- A 1 kW system would cost approximately $5200 installed after the California Energy Commission (CEC) rebate. With good solar access, such a system could meet 100% of the net annual electricity use of an extremely energy efficient home (i.e., one that uses 4 kWh/day or about 25% of the current average).
- A 2 kW system would cost approximately $9300 installed after the CEC rebate. With good solar access, such a system could meet 100% of the net annual electricity use of a very energy efficient home (i.e., one that uses 8 kWh/day or about 50% of the current average).
- PV systems offer many other benefits such as improved environmental quality, enhanced energy security, and local economic development opportunities.

Economic, Regulatory, and Utility Issues

- Energy efficiency and conservation measures are almost always a less expensive way to avoid energy costs than installing renewable energy generation equipment. Local government and homeowners should thus ensure homes are as energy-efficient as possible before investing in solar thermal or solar electric (photovoltaic) systems.
- To effectively use solar energy to heat water or generate electrical power a building must have good solar access. The building must have an unshaded, south-facing roof area. The legal right to receive solar energy across another person's property (a solar easement) is guaranteed by California state law and by ordinance in Arcata. More active enforcement of these laws may be required to protect solar access.
- Solar water heating is generally a more cost-effective measure than photovoltaic electricity generation.
- Rebates offered by the State of California make PV systems more affordable, but these rebates alone do not make PV an inexpensive investment. Bulk purchasing discounts leveraged by local government and customer time-of-use metering could, however, give grid-connected residential PV systems a much faster economic payback. Administrators at the Sacramento Municipal Utility District (SMUD) have expressed willingness to allow Humboldt County governments to take advantage of discounted bulk PV equipment purchase agreements already used by SMUD as part of their existing residential PV program.
- Local government could significantly reduce the cost to the consumer of SHW and PV systems by:
  1) Buying in bulk. Local government could pay less for system components and help the consumer avoid crating charges.

2) Creating standardized SHW and PV systems. Building permits can be made less expensive and quicker to generate. These standardized systems may be quicker to install, reducing labor costs.

2. ENERGY EDUCATION

The objective of this section is to present methods for educating the public about the energy efficiency and conservation techniques outlined in this report. Educational outreach methods should be designed to reach a large audience in a cost-effective manner. We have identified the following four separate audiences that should be targeted: residential consumers, small business owners, contractors, and local government building and planning officials. The following lists describe possible educational outreach methods.

Residential Consumers and Small Business Owners:

- **Community Fairs:** Host energy education booths at community fairs (e.g. July 4th, Humboldt County Fair, North Country Fair) to make energy efficiency and conservation information available to the public. Community fairs are opportunities to promote simple solutions, such as racks to dry clothes and power strips to eliminate phantom loads, and to provide information on more complex measures, such as weatherization.
- **Workshops:** Present energy education workshops at community centers throughout the county. In addition to general information, these workshops should include instructions for implementing energy conservation measures, such as weather stripping and insulating a home. The workshops should also educate consumers about state, federal and utility rebates and other energy system cost savings programs. Local government may provide incentives to attend these workshops, such as free compact fluorescent light bulbs or energy audits.
- **Mailing Lists:** Distribute informational postcards or packets to county residents and businesses informing them of the program and inviting them to request an appointment for a free or low-cost energy audit. The mailing could include interesting facts about energy, phrased both in terms of dollars saved and the overall value of conservation.
- **Tours:** Organize tours of energy-efficient homes and businesses in Humboldt County to showcase and explain technologies.
- **Youth Education:** Encourage local performing arts groups, such as Del Arte, to develop dramatic presentations for county schools that focus on energy efficiency and conservation. These presentations should be developed with input from local teachers to maximize their effectiveness.

Contractor and Government Official Education:

- **Workshops:** Present energy education workshops for contractors and local building and planning department officials to educate them on measures that reduce the need for energy expenditures in a home or business. Local government should survey contractors and building and planning officials to determine appropriate content for these workshops. An important aspect of this survey would be to determine if workshops should be tailored to specific disciplines.
- **Tours:** Organize tours of energy-efficient homes in Humboldt County to showcase and explain technologies.

3. ELECTRIC LOAD REDUCTION

The objective of this section is to present low-cost measures for reducing electrical loads, which should always be the first step in the design of a renewable energy system. Two load reduction measures are considered in this section: compact fluorescent lights and phantom load reduction.

Compact Fluorescent Lights
Lighting consumes 25-30% of household electrical energy use. Compact fluorescent (CF) light bulbs use less power (in watts) to deliver the same number of lumens as incandescent or halogen lighting. The quality of CF bulbs has improved dramatically in recent years. Many types of CF bulbs are available, and their light quality varies from a cool blue hue to warm yellow tones. People's preference for certain brands differs depending on the desired application and light quality. CF light bulbs operate most efficiently when they are used in fixtures that are left on for over 2 hours per day. They may fail prematurely if they are turned "on" and "off" excessively.

Table 3.1 summarizes a cost and payback time analysis based on a typical CF bulb (life expectancy of 10,000 hrs), compared to incandescent bulbs (life expectancy of 750 hours) and halogen bulbs (life expectancy of 2,000 hours). An initial investment of $8 to $12 per bulb would result in a payback time of 12 to 14 months.

Also included is a comparison of the cost of purchase and operation of a CF torchiere light compared to a halogen torchiere light. Initial cost of the CF torchiere fixture (approximately $75) might be a barrier to consumer acceptance and could be offset using a torchiere trade-in program. These programs entail the consumer exchanging their halogen torchiere, along with $15 to $35, for a new CF torchiere fixture with a CF bulb. CF torchieres also offer a safety advantage, as halogen torchieres pose a serious fire hazard. Utility and/or state conservation funds have supported many successful torchiere trade-in events in other communities in recent years.

Phantom Loads
Many home appliances and consumer electronics products are using electricity constantly, even when their power switch is in the "off" position. Examples of such "phantom loads" are the clocks in VCRs and microwave ovens, the small black wall cubes that adapt DC appliances to run on AC house current, and the instant-on features in televisions and home entertainment centers. These loads typically range from 1 to 10 watts per appliance. A study by Lawrence Berkeley National Laboratory estimated the average standby power load in California residences to be 67 watts. While this may appear to be a fairly small waste of energy, it amounts to a lot of power when added up community-wide. Based on 67 watts per household, Humboldt County's approximately 50,000 households have a total phantom load on the order of 3.4 MW, or nearly one and a half times the total output capacity of Matthews Dam hydroelectric plant at Ruth Lake.

A phantom load reduction program should consist mainly of consumer education. Phantom loads can be reduced by teaching residents to remember to unplug appliances that are not in use, to enable Energy Star® power-down modes on computer equipment, and to buy products with Energy Star® labels, which have little or no standby power consumption. Local government could also distribute low-cost power outlet strips (available for $4-$10 each) that would allow residents to disable phantom loads. Estimated payback time for this measure would be approximately one year, assuming that each household could reduce their phantom load by one-third by using three outlet strips.

Table 3.1. Comparison of the Costs of Compact Fluorescent, Incandescent, and Halogen Bulbs and their Respective Electrical Use

	60 W Incandescent	**15 W CF**	**75 W Incandescent**	**20 W CF**	**100 W Incandescent**	**25 W CF**	**275 W Halogen**	**55 W CF**
Number of bulbs purchased*	13	1	13	1	13	1	5	1
Total cost of bulb(s)	$ 6.50	$ 8.00	$ 8.45	$ 10.00	$ 9.75	$ 12.00	$ 24.95	$ 24.95
kWhrs. used in 10,000 hrs.	600	150	750	200	1,000	250	2,750	550
Cost to operate @ 0.13/kWhr.	$ 78.00	$19.50	$ 97.50	$ 26.00	$ 130.00	$ 32.50	$ 357.50	$ 71.50
Fixture Cost	N/A	N/A	N/A	N/A	N/A	N/A	$ 15.00	$ 75.00
Total cost to purchase bulb(s) and to operate for 10,000 hours	$ 84.50	$ 27.50	$ 105.95	$ 36.00	$ 139.75	$ 44.50	$ 382.45	$ 96.45
Cost savings over lifetime of CF bulb	$ 57.00		$ 69.95		$ 95.25		$ 286.00	
Simple payback time**	14 months		14 months		12 months		w/o fixture cost - 8 months w/ fixture cost - 29 months	

* To provide 10,000 hours of illumination.
** Calculated at 3 hrs./day use. N/A means not applicable.

4. WEATHERIZATION

The objective of this section is to present the potential energy savings that could be achieved through a basic set of home weatherization measures. In order to estimate the potential savings, we set up three before-and-after computer models representing 1000-, 1500-, and 2000-ft^2 ("small", "medium" and "large") homes. The models were developed using Lawrence Berkeley National Laboratory's online energy analysis tool, "Home Energy Saver" (HES), which is available at http://hes.lbl.gov. HES is very user-friendly and uses the industry standard building energy analysis computer program, DOE-2, to perform its internal calculations. The analysis is quite sophisticated, incorporating local weather data to calculate year-round energy costs for the modeled home.

We made a number of assumptions in setting up the models to reflect "typical" local homes. The homes are assumed to have been built in 1956 with wood siding, attics and vented crawl spaces, and use natural gas for space and water heating. The space heating system is a central forced air unit with ducts in the crawl space. Existing insulation is assumed to be R-11 in the attic with no wall or floor insulation. While HES also analyzes gas and electric use by appliances such as dryers and stoves, the present discussion considers only energy used for space and water heating.

In addition to changing the house's square footage to create the different models, we also adjusted the home's features in proportion to the size of the house. These features include the number of occupants, heat output capacities of the furnace and water heater, total window square footage, number of laundry loads per week, and other minor features. The 1000- and 1500-ft^2 homes are single-story, while the 2000-ft^2 home is two-story.

The package of weatherization measures analyzed included:

- weather stripping all doors and windows;
- increasing attic insulation from R-11 to R-49 (*Note*: R-49 is the level of attic insulation recommended by the U.S. Dept. of Energy for the local climate zone. California Title 24 residential standards require only R-19 for ceiling/attic insulation in new construction.);
- insulating water heater and hot water pipes;
- tuning up furnace to raise efficiency from 78% to 83%;
- adding heating duct insulation;
- sealing heating duct leaks; and
- installing a programmable thermostat.

Figure 4.1 illustrates where these measures would be incorporated in a typical home.

Table 4.1 shows the results of the analysis. Base case (pre-weatherization) annual space and water heating costs range from $933 to $3,226, depending on house size. These costs come down to $446 - $1500 with the weatherization package implemented, resulting in annual savings of $487 - $1,726. In other words, the model indicates that this package of energy efficiency measures could reduce water and space heating costs in typical area homes by more than half.

We also used the model of the 1500-ft^2 house with each of the seven measures implemented individually in order to rank the measures according to energy savings value. The results of these runs are shown in Table 4.2. Weather stripping, which presumably is defined in HES as general infiltration reduction (door and window weather stripping and caulking of other gaps) achieves the greatest savings, followed by duct insulation, programmable thermostat installation, and attic insulation.

Cost estimates were generated by surveying local contractors and by seeking "typical" weatherization cost data on the Internet, primarily from Lawrence Berkeley National Laboratory's "Home Improvement Tool" (HIT) website (http://hit.lbl.gov). For each measure, our collected cost data showed a fairly wide range. We used the lowest and highest reported costs for each measure to estimate the "best" and "worst" energy savings payback periods, respectively.

As shown in Table 4.3, estimated payback periods range from less than half a year to over eight years. Weather stripping, duct insulation, programmable thermostats, and furnace tune-ups all show rapid paybacks (i.e. less than three years), while attic insulation, hot water system insulation, and duct sealing showed longer paybacks. (Note that our model assumed existing R-11 insulation in attics; insulating a completely uninsulated attic would provide a faster payback.) Overall payback for the full package of seven measures ranges from two and a half to five years. These are favorable results, as even a five-year payback represents a 20% annual return on investment.

With the exception of duct sealing, each of the analyzed measures has an expected useful lifetime well in excess of its payback period, assuming that the measures are performed by trained contractors using quality materials. Tune-ups are recommended for gas furnaces every three to five years.

Plans for Further Study

As part of our further study of weatherization measures, we plan to perform the following tasks:

- Analyze more weatherization measures.
- Coordinate with RCAA's weatherization manager, Val Martinez, to avoid program duplication.
- Acquire NEAT (U.S. Dept. of Energy's National Energy Audit Tool) software.
- Investigate PG&E (and other) certification programs for weatherization contractors.
- Analyze potential benefits of introducing local "beyond Title 24" energy codes for new construction.
- Refine recommendations for energy education program.

5. SOLAR HOT WATER SYSTEMS

The objective of this section is to determine the cost-effectiveness of solar hot water systems based on their expected performance in our geographic area. A typical system that is appropriate for our area is examined. In addition, the basic types of solar hot water systems are discussed, the importance of energy education and hot water conservation measures are considered, and recommended guidelines for a solar hot water program are presented. Finally, plans for further study are outlined.

Background
Solar water heating systems use energy from the sun to heat water for domestic use. A typical system consists of flat plate solar collectors mounted on the roof, a solar hot water storage tank, an auxiliary water heater (either gas or electric), and miscellaneous components such as pumps, valves, controls, and heat exchangers. The basic function of the system is to circulate water or some other heat transfer fluid through the solar collectors and thereby collect solar heat. This heated fluid then transfers energy to potable water in the solar storage tank. The solar storage tank acts as a pre-heater for the auxiliary water heater. Cold potable water enters the solar storage tank and is heated. When hot water is demanded, water from the solar storage tank is fed to the auxiliary water heater and is further heated, if necessary, before being provided to the end user.

Numerous types of solar hot water systems are available. Four general types are:

- Forced circulation, or "active" systems, which use a pump to circulate fluid through the collector;
- Integral collector storage systems, or "batch" water heaters, which combine the collector and storage tank into one;
- Thermosyphon systems, which have a separate storage tank above the collector that allows fluid to naturally circulate through the collector; and
- Self-pumping systems that use a phase-change or other passive means to cause the fluid to circulate through the collector.

The most common system type is the forced circulation system. Within this system type there are several freeze protection strategies. These include draindown systems, drainback systems, recirculation systems, and closed loop anti-freeze systems. The appropriate type of freeze protection depends on local climatic conditions. The most common type of system installed locally is a forced circulation drainback system. A schematic of this system and its components is shown in Figure 5.1.

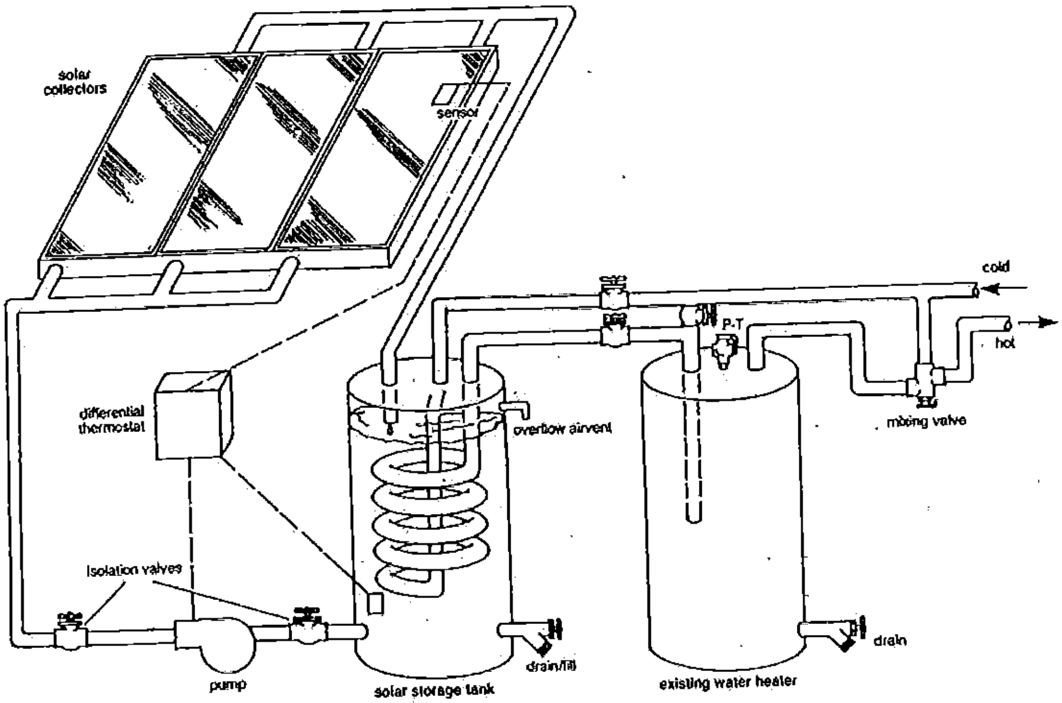


Figure 5.1. Forced Circulation Drainback Solar Water Heating System

Solar hot water systems have been in use for many years. In the 1860's rooftop solar water heaters became popular, but then lost favor when natural gas became readily available. In the 1970's and 1980's, the solar water heating industry saw another resurgence in interest due to a perceived energy crisis and favorable tax credits. Unfortunately, many non-reputable vendors sprang up and installed systems that were less than optimal. As the years passed, however, there was a shake-out in the industry so that most of the systems manufactured and installed today are generally reliable and of high quality.

Many solar hot water collectors and complete solar hot water systems are now certified and rated by the Solar Rating and Certification Corporation (SRCC). SRCC was incorporated in 1980, and is a non-profit, independent third-party certification entity. They are the only nationally recognized certification agency. The SRCC certification criteria cover the following: system design, reliability, durability, safety, operation, servicing, installation, operation and maintenance manuals, and system performance.

The California Energy Commission (CEC) is offering grants of up to $750 for solar hot water systems through their Solar Energy and Distributed Generation Grant Program. To qualify for these rebates the installed system must meet the following criteria:

- The complete solar hot water system must be certified by the SRCC.
- The system must have a minimum Solar Energy Factor (SEF) rating (from SRCC) of 1.4 for systems using electric supplemental heaters and of 0.8 for systems with gas supplemental heaters.
- The system must be covered by a 3-year warranty.

- The system must be installed and operated in accordance with all laws, codes, regulations, standards and manufacturer specifications.
- The system must be installed by a licensed contractor (Class A, C-46, C-53) or the homeowner.

Conservation Measures and Energy Education

As part of a solar hot water program, consumers should first be educated about the importance of using energy wisely. Before investing in a solar hot water system, it is more cost-effective to invest in reducing hot water use. Good first steps include:

- installing low-flow showerheads and faucet aerators;
- insulating existing water heater;
- insulating hot water pipes;
- lowering the thermostat setting on the water heater to 120°F-130°F;
- replacing the washers in any dripping faucets;
- using the cooler cycles on your clothes washing machine whenever possible;
- using cold water, not hot whenever possible; and
- using a timer to turn the electric heating element off during times when hot water is not needed.

In addition, consumers should be informed about how to get the most out of their newly installed solar hot water system. This information should include:

- Shower and wash clothes and dishes late in the day, after the sun has heated your water.
- During warm, sunny weather, turn the electric heating element off completely.

Cost and Savings Analysis for Solar Water Heating

SERC evaluated the potential cost and savings of two solar water heating systems that are currently being offered locally. These were both forced circulation drainback systems featuring SRCC certified SunEarth 4'x10' flat plate collectors. One system, consisting of two collectors and a 120-gallon solar storage tank, had an estimated installed cost of $4000. The second system, featuring three collectors and a 210-gallon solar storage tank, had an estimated installed cost of $4600. Assumptions used in the analysis were for a typical single family residence in the U.S. (a household of 3 or 4 people) and were generally consistent with SRCC rating assumptions. Analyses were performed for systems with either electric or gas auxiliary water heaters. Economic evaluations included the $750 CEC rebate.

Results shown in Table 5.1 incorporate the current cost of electricity or natural gas for quantities below baseline usage. As shown in the table, solar water heating is much more economically attractive if the resident is currently using an electric water heater. The payback times in this case may range from 8 to 10 years, whereas the payback times are nearly three times as long for somebody who is currently using a gas water heater. These numbers will vary based on numerous system conditions. However, the variables that by far make the most difference are the initial installed cost of the system and the cost of the auxiliary fuel (electricity or gas).

Table 5.1. Savings and Payback Periods Associated with Solar Hot Water Systems

System Size	Energy Use/Yr (before)	Energy Use/Yr (after)	$ Savings/ Year	Payback Period (yrs)	SSF*	SEF**
Electric auxiliary water heater						
2 collectors, 120 gal. storage	5468 kWh	2643 kWh	$327	10	52%	1.9
3 collectors, 210 gal. storage	5468 kWh	1813 kWh	$431	8.9	67%	2.7
Gas auxiliary water heater						
2 collectors, 120 gal. storage	187 therms	90 therms	$122	27	52%	1.9
3 collectors, 210 gal. storage	187 therms	62 therms	$167	23	67%	2.7

*SSF = Solar Savings Fraction. This is the percent of the hot water load met by the solar water heating system.
**SEF = Solar Energy Factor. This factor is calculated as the ratio of the delivered hot water energy divided by the total non-solar energy (gas or electric) required to heat the water. This factor is analogous to the Energy Factor (EF) rating that is given to all electric and gas water heaters.

Table 5.2 examines the effect of the higher electricity prices associated with usage over baseline quantities. If a household uses 130% to 200% of baseline, their electric rate for their above baseline usage will be $0.194/kWh, and for 200% to 300% of baseline, the cost rises to $0.238/kWh. These increases in cost dramatically reduce the payback period for a solar water heater to about 5 to 6 years.

Recommended Solar Hot Water System Guidelines

The following is a list of recommended criteria that participants in a solar hot water program should meet:

- All sites should have clear solar access between at least 9 a.m. and 3 p.m. solar time throughout the year.
- The collector orientation should be within 15° of true south.
- The collector slope should be in the range of 26° to 56° (within 15° of our latitude of 41°N).
- Installed systems should be SRCC certified and should meet CEC requirements.
- Participants should be encouraged, or even required, to adopt basic hot water conservation measures as listed above.

Table 5.2. Payback Times for Solar Hot Water Systems Based on Above Baseline Electric Rates

System Size	$ Savings/ Year	Payback Period (yrs)
Electric auxiliary water heater 130% to 200% above baseline		
2 collectors, 120-gal. storage	$503	6.5
3 collectors, 210-gal. storage	$664	5.8
Electric auxiliary water heater 200% to 300% above baseline		
2 collectors, 120-gal. storage	$617	5.3
3 collectors, 210-gal. storage	$815	4.7

Plans for Further Study

As part of our further study of solar hot water systems, we plan to perform the following tasks:

- Research and analyze other available systems.
- Investigate the availability of solar installers.
- Verify system installed costs.
- Identify the most cost-effective systems for our locale.
- Examine the option of replacing the existing water heater with an on-demand water heater.
- Research the possibility of making bulk purchases of solar hot water systems at a reduced cost.
- Research the lessons learned in other solar hot water programs, such as those promoted by the Sacramento Municipal Utility District (SMUD) and by the State of Florida.

6. SOLAR ELECTRIC SYSTEMS

The objective of this section is to provide approximate installed costs, energy production potential, and typical equipment for two example residential photovoltaic (PV) systems. The two systems specified would generate a peak of approximately 1 kW (AC) and 2 kW (AC), respectively. They would be grid-connected with no battery backup. Lifecycle costs are based on an expected lifetime of 20 years. Participating homeowners would switch their electrical service to "net metering" and would be billed for net annual grid electric use subject to a minimum monthly charge, which is $5.

A residential PV system would allow homeowners to stabilize their electricity costs, contribute to generating electricity in our area, and reduce the environmental impact of their electricity use by generating electricity from a renewable source (the sun).

We assume that homeowners who have PV systems installed will also greatly reduce their overall energy use through conservation and efficiency measures. It is much less expensive to meet energy needs through conservation and efficiency than to install a larger PV system. Average residential electricity use in Arcata is approximately 450 kWh/month (15 kWh/day). In a very energy efficient home, electricity use could be reduced to approximately 240 kWh/month (8 kWh/day). In an extremely energy efficient home, it could be reduced to approximately 120 kWh/month (4 kWh/day). At a site in Arcata with good solar access, a 1-kW system could, on a yearly basis, meet 100% of the electricity needs of an extremely energy efficient house. A 2-kW system at the same type of site could, on a yearly basis, meet 100% of the electricity needs of a very energy efficient house.

Battery backup was excluded from these conceptual designs because it would:

- approximately double the lifecycle cost of the system;
- produce approximately 20% less net energy for the same number of solar panels;
- require battery replacement approximately every five years;
- require active involvement by the homeowner in maintaining the system; and
- require a dedicated shed or room for batteries and other support equipment.

Tables 6.1 and 6.2 list the typical equipment required for 1-kW (AC) and 2-kW (AC) PV systems and their associated costs. The PV modules make up almost 75% of the total hardware costs. A typical configuration for a 2-kW system is shown in Figure 6.1.

Table 6.1. Typical Equipment for a 1-kW (AC) Residential PV System

Quantity	Item	Manu-facturer	Model	$/ea	Watts total	$ total
12	PV Module	Photowatt	PW1000-95	$370	1025 (DC)	$4,440
1	Inverter	AES	GC-1000	$1,000	953 (AC)	$1,000
2	Rack	UniRac	U-GR/160	$325		$650
					Total	$6,090

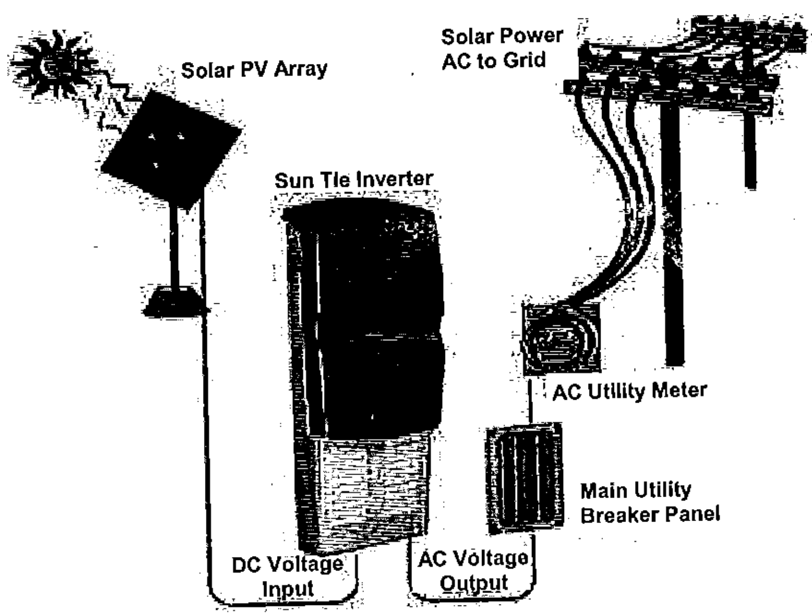
Table 6.2. Typical Equipment for a 2-kW (AC) Residential PV System

Quantity	Item	Manu-facturer	Model	$/ea	Watts total	$ total
24	PV Module	Photowatt	PW1000-95	$370	2050 (DC)	$8,880
1	Inverter	Trace	ST-2500	$1,865	1906 (AC)	$1,865
4	Rack	UniRac	U-GR/160	$325		$1,300
					Total	$12,045

Note: The modules listed are nominally 95 Watts, but are derated to 85.4 Watts by the CEC. The AES inverter has a CEC-rated efficiency of 93%. The Trace inverter has a CEC-rated efficiency of 94%.

SMUD has provided us with a quote for PV modules and inverters for a quantity of 100 2-kW systems. We do not yet have information on the cost of mounting racks. The modules quoted are made of amorphous silicon, which has approximately half the efficiency of the Photowatt multi-crystalline modules and would therefore require twice the module area as compared to the system listed in Table 6.2. Assuming that mounting racks would cost approximately the same as racks for modules of similar size, the hardware cost for a 2-kW system using the quoted modules would be approximately $2000 less than the cost listed in Table 6.2. Installation costs are likely to be significantly higher than the system listed in Table 6.2.

Table 6.3 presents the estimated monthly output at local latitude using local insolation data for a site with good solar access.



Source: Trace Engineering

Figure 6.1. Typical Residential PV System Configuration

Table 6.3. Monthly Output for PV Systems in Arcata with Good Solar Access

System Size	AC Watts total	kWh/month (ave)
1 kW	953	120
2 kW	1906	240

Note: kWh/month is based on average solar insolation for Arcata.

Installed Cost

Based on conversations with four PV installers in Humboldt County and one in Mendocino County, installed costs are approximately $9 to $10 per watt for a 1-kW (AC) system ($9000 to $10,000 total) and $8 to $10 per watt for a 2-kW (AC) system ($16,000 to $20,000 total). The difference between these installed costs and the equipment costs listed in Tables 6.1 and 6.2 reflect the labor costs for installation and the costs of balance-of-system components, such as wires and disconnect switches. Costs will be significantly higher for difficult installations. Output will be significantly lower for sites with a large percentage of shading or roof orientations that are far from optimal.

Solar Access

A site has good solar access if it has:

- minimal shading between 9 a.m. and 3 p.m. solar time year-round;
- roof facing within 15° of true South; and
- tilt within 15° of our latitude of 40.9° on the south-facing roof.

California Energy Commission Rebates

CEC rebates are $4.50/AC Watt or up to 50% of total installed system cost, whichever is less.
For the specified 1-kW (AC) system the CEC rebate would be $4300.
For the specified 2-kW (AC) system the CEC rebate would be $8670.

Summary

Residential 1-kW and 2-kW photovoltaic systems are available that can meet up to 100% of the annual electric use for very energy efficient homes with good solar access. Typical installed costs after CEC rebates are $5200 and $9300 respectively.

Areas for Further Study

- Time of use electric service in conjunction with refrigerator and other timers to improve cost-effectiveness of PV systems
- Group purchasing with SMUD or other organizations to reduce equipment costs
- "Stay-clean" coatings for PV panels
- Develop outreach to builders to include PV systems in new construction
- Develop tie-in with U.S.Department of Energy "Million Solar Roofs" program (http://www.eren.doe.gov/millionroofs/).
- Work with local lenders on low-cost financing of PV systems. Include PV systems in "energy-efficient" mortgages. (http://www.consumerenergycenter.com/homeandwork/homes/inside/mortgages.html)
- Encourage PV systems as mitigation for environmental impact of new construction.
- Expand and publicize solar access ordinances in Humboldt County.

- Develop database of PV systems and PV installers in Humboldt County.
- Expand PV education in Humboldt County.
- Educate news media about PV and expand coverage.
- Encourage local manufacturing of PV system components.

7. ECONOMIC, REGULATORY, AND UTILITY ISSUES

In this section, we consider economic, regulatory and utility-related concerns that local government should take into account in creating residential renewable energy programs. Solar hot water systems are discussed briefly. Greater attention is given to PV systems, as many special issues, including rebates, permits, utility rates, and grid interconnection, all come into play when using this technology.

First, we must state some observations:

- We don't always spend the minimum possible amount of money to get a product or service. For example, people are not necessarily attracted to the cheapest form of transportation: some of the least expensive cars are some of the least sought-after, and mass transit is often the cheapest but least chosen option. Glamour, status, attractiveness, etc. are also factors.
- Our system of economics doesn't tell the whole story of costs. It doesn't recognize externalities (the value of avoided CO_2, SO_2, NO_X). It cannot recognize the value of things that we don't pay for (for example, peace and quiet, elimination of risk of future price increases, philosophical stance).
- Plugging the "leaks" in energy systems by improving efficiency and reducing consumption is almost always cheaper and better for the environment than finding new sources of energy.

Table 7.1 lists examples of energy cost reduction measures and their associated capital costs and payback periods. Of the activities that require some investment, installation of simple, low-cost conservation measures such as CF light bulbs and clothes drying racks probably give the best return per dollar spent. The most beneficial use of solar energy for most consumers is to install a solar hot water heater.

Solar Access

Using passive and active solar energy can substantially reduce energy needed from other external sources, such as electricity and natural gas.

To effectively use solar energy:

- A building must be properly oriented.
- Shading from other buildings and from vegetation must be minimized.
- Installation of solar energy systems must not be prohibited or unreasonably restricted.

Minimizing shading on active solar collectors such as solar waters heaters and solar electric panels is especially important.

Table 7.1. Examples of Energy Cost Reduction Measures, Capital Costs, and Payback Periods

Activity (in decreasing order of cost-effectiveness)	**Cost**	**Estimated Payback Time** (at current local utility rates)
Turn off unused lights (porch lights, etc.)	zero	immediate
Hang up clothes on a drying rack	$20	5-8 months
Change incandescent bulb to CF	$8-12	12-14 months at three hours/day
Reduce unneeded "phantom" loads	$10	1 year
Install a solar hot water system	$4,000	5-10 years (replacing electric heater) 20-30 years (replacing gas heater)
Install a solar PV system	$5,000 - $25,000	19-37 years (see economic analysis)

A legal right to receive solar energy across another person's property is termed a solar easement. Solar easements are guaranteed by California state law and by ordinance in Arcata.

The California Shade Control Act (AB 2321, 1/1/1979) "prohibits any tree or shrub occurring subsequent to the installation of a solar system on another property from casting a shadow greater than 10% over the collector area between the hours of 10 a.m. to 2 p.m.. standard time."

The California Solar Rights Act of 1978 (AB 3250, 9/25/1978) gives people the right to install solar energy systems, grants solar easement rights to property owners and requires that subdivisions be configured to maximize passive solar heating and cooling opportunities.

Arcata city ordinance Section 1-0311 (Solar Siting and Solar Access) defines rules for solar easements and requires that:

- One building may not shade another by more than 10% from 10 a.m.-2 p.m. at any time of the year.
- In subdivisions, 80% of buildings must be oriented within 15° of N-S/E-W.

Legal rights to solar access already exist in state law and Arcata city regulations. Making citizens and planning agencies aware of these laws and regulations can increase enforcement and contribute to increased use of solar energy in Humboldt County.

Solar Hot Water Heaters

California residents who install solar hot water heaters are eligible for a CEC rebate of $750/system. This offer expires June 29, 2001. CEC expects a renewal/extension but will not know for sure until the state budget is signed. The CEC will continue to accept and hold applications pending reauthorization of rebates.

Local government could increase adoption of solar energy by Humboldt County residents by offering pre-approved, reliable solar hot water heating packages purchased in bulk. See the solar hot water section of this report for the analysis of solar hot water systems.

Solar Electric Systems
PV electricity is still more expensive than grid electricity. The cost of PV electricity is highly variable, depending on the capital cost of the system and the assumptions made in the economic analysis. PV electricity rates vary from $0.18/kWh to $0.60/kWh in the Eureka-Arcata area. These costs continue to decrease over time. By buying equipment in bulk and making it easy for consumers to install pre-approved packages (reducing the cost of the building permit and installation), local government can minimize the total cost to the consumer. See the economic analysis section below for more specific information.

The CEC's Emerging Renewables Buydown Program offers a rebate of $4.50/watt or 50% of system cost, whichever is less. The commission derates the output of the system to account for normal operating conditions, so the rebate often turns out to be slightly less than indicated by manufacturers' product specifications. Any homeowner wishing to take advantage of the CEC rebate must use PV modules and inverters that are on the CEC's lists of approved equipment. To be eligible for the rebate, the customer must have a site located in PG&E territory, and the system must be grid-connected. The consumer can install the PV system and still be eligible for the rebate, provided that she/he is able to understand wiring schematics, electrical codes, and mounting techniques.

Space Requirements
As part of this analysis, we examined 1-kW and 2.4-kW systems. The areas required by the sample 1-kW and 2.4-kW crystalline systems are approximately 5' x 20' and 6' x 36' respectively. The best place for such systems is on a south-facing, unshaded roof (within 15 degrees of south and at a tilt of 25 to 55 degrees from horizontal).

There is no minimum system size to qualify for the CEC buydown. The smallest CEC-approved systems are available as 100-W modules with small inverters mounted on the back. These systems tend to be more expensive per watt generated, but offer the possibility of modular expansion. To qualify for the CEC rebate, the maximum size cannot be more than 125% of the site's annual historical or current needs.

Electricity Produced
In one year, a 1-kW system installed in the Arcata-Eureka area will produce about 1200 kWh of electricity. A 2.4-kW system will generate about 3100 kWh per year.

Under California "net metering" law, the homeowner will be credited for this energy by PG&E at the same rate that the homeowner buys electricity. Essentially, the customer's electric meter will run backward as the PV electricity is generated and forward as the house draws electricity from the utility grid. Net metering can be accomplished by using the existing electricity meter. Most families consume between 3 and 30 kWh/day, or 1095 to 10,950 kWh/year. At least once a year, the resident will be charged for the net energy consumed over the past 12 months. In addition, regardless of PV output, PG&E assesses a minimum charge of $0.16 per day for electric service (about $5/month) and will not pay the customer for a net surplus of electricity produced over a 12-month period.

Economic Analysis

We present here three economic measures: $/watt, payback period, and levelized cost ($/kWh). The $/watt figure is simply the initial cost of the system divided by the number of peak watts expected from the system. The payback period is the number of years that elapse before the system generates enough electricity to pay for itself. And the levelized cost is the average annual cost that the resident will pay per kWh of PV electricity.

The conclusions of any economic analysis can change dramatically as the assumptions are varied. For now, however, we use the following: an electricity cost of $0.1332/kWh, an interest or investment rate of 8%, and an inflation rate of 4%. Note that homeowners may be able to combine net metering with time-of-use electric rates to substantially improve the economics of a PV installation. Time-of-use rates are not considered in this preliminary analysis.

The full materials cost of the 1-kW (to be precise, 960 W) system (assuming no discounts), before the CEC rebate, is $8798. Installation charges, including the building permit, are estimated to amount to another $1450, for a grand total of $10,248. The full materials cost of the 2.4-kW system materials is $20,901, with installation charges of approximately $2,150, for a total of $23,051.

The CEC buydown is based on the generating capacity of the PV system. The current rebate amount of $4.50/W will be reduced over time as program funds are depleted. Rebates are given on a first-come, first-served basis. Consumers or retailers can reserve a rebate amount at a specified funding level block. The system must be installed within nine months from the date of reservation. For this analysis, we assume the maximum rebate level of $4.50/W.

Table 7.2 outlines the costs of the 1-kW and 2.4-kW PV systems and their associated economic measures. This analysis shows the cost of PV systems to be quite high, even when the CEC rebate is included. However, these costs need not be a deterrent to the adoption of renewable energy in Humboldt County. Many cities are implementing renewable energy programs that are successful and popular. By using local government bulk purchasing power and permit process streamlining to reduce the upfront cost of the system, we get very different results.

Table 7.2. PV System Costs and Associated Economic Measures

Full Price Systems	System Size	
	960 W	**2.4 kW**
Materials Cost	$8,798	$20,901
Labor Cost	$1,450	$2,150
Total Cost	$10,248	$23,051
CEC rebate	$3,582	$8,704
Net Cost of System	$6,666	$14,347
Net $/watt (peak)	$6.94	$5.98
Payback Time (at .1332/kWh)	37 years	35 years
Levelized Cost	$0.65/kWh	$0.52/kWh

If local government buys PV system components in large volume and streamlines the permitting process to be inexpensive and quick (which would require pre-approved PV system packages), renewably generated electricity can be made affordable and accessible for most people. In the next scenario, we assume a 30% price break on the cost of the PV modules and inverter, a crating fee of zero (for a bulk purchase), and a $50 permitting fee (as opposed to a $350 fee). Table 7.3 outlines the costs of the 1-kW and 2.4 kW PV systems and their associated economic measures based on these price reductions. Labor costs could be reduced even further if installation were simplified with a single contractor performing large numbers of similar installations.

Financing

If the cost of the system is incorporated into the cost of a new house, then the interest payment is tax deductible, in that it is part of the mortgage interest paid. For those customers who are adding a PV system to an existing house, a home equity loan will allow the taxpayer to deduct the mortgage interest. Rates of various types of loans and the tax effect of these loans should all be taken into account when deciding the appropriate financing option.

The only federal incentive for PVs is a 10% tax credit or five-year accelerated depreciation for the cost of equipment. This incentive is available to business taxpayers and not to individuals.

Table 7.3. Discounted PV System Costs and Associated Economic Measures

Discounted Systems	System Size	
	960 W	2.4 kW
Materials Cost	$6,217	$14,192
Labor Cost	$1,150	$1,850
Total Cost	$7,367	$16,042
CEC rebate	$3,582	$8,021
Net Cost of System	$3,785	$8,021
Net $/watt (peak)	$3.94	$3.34
Payback Time (at .1332/kWh)	23 years	19 years
Levelized Cost	$0.27/kWh	$0.18/kWh

Property Taxes

All PV systems installed from 1999 to 2006 will not be subject to property taxes. However, the PV systems would significantly increase the sales value of the homes.

Interconnection Agreement

In order to connect to the grid, the resident must enter into an interconnection agreement with the utility and apply for a net metering rate. The interconnection agreement includes technical requirements, system permitting, maintenance obligations, and metering arrangements.

The main utility interconnection standard calls for an inverter that contains all the protective relays and disconnects necessary to protect both the homeowner and utility line workers. This equipment must comply with the standards listed in the Institute of Electrical and Electronic Engineers (P929) and Underwriters Laboratories, (subject 1741). The CEC is sponsoring classes for electricians who would like to be able to install grid-intertied systems. The two-day workshop costs $75 and takes place in a variety of Bay Area locations. Details may be found online at http://www.endecon.com/html/training.html.

The utility interconnection agreement will also specify minimum insurance requirements that the resident must keep. Standard homeowner's insurance may be adequate to meet these requirements. California law prohibits utilities from requiring the homeowner to purchase additional insurance for a PV system.

Permits

A building permit and possibly an electrical permit are required upon the installation of a PV system. Local government can help by making the permitting process fast, efficient, and inexpensive. It would also be helpful if the community or neighborhood approval process were streamlined (for example, compliance with covenants, codes, and restrictions or CC&Rs)

After the PV system has been installed, the local permitting agency, usually a building or electrical inspector, and the utility will need to inspect and approve the system. Corrections to the system installation may be required for approval.

The CEC requires a copy of the building permit showing final inspection and a recent utility statement showing electrical service at the installation location before it begins the rebate process. In addition, the CEC requires a minimum five-year full system warranty against defective parts, workmanship, or unusual degradation of output. For professionally installed systems, the warranty must also include the labor of removing and reinstalling any defective components and shipping costs. Retailers must also provide a five-year warranty against breakdown or degradation in electrical output of more than 10% of the rated output.

Installers

Properly licensed and knowledgeable installers exist in the Arcata area. Contractor costs can range from $500 for a simple installation to $2500 or more for a more complex system. Contractors holding an "A" (general engineering), "C-10" (electrical) or "C-46" (solar contractor) license would be appropriate installers.

The CEC provides many resources for those wishing to install PV systems. These include a consumer guide, a guidebook for the program, lists of eligible PV modules and inverters, links to relevant websites, etc. All of these can be found online at http://www.energy.ca.gov.

Recommendations

Because even the discounted 1-kW system has a consumer cost of nearly $4,000, we would recommend consideration of smaller PV systems, from 0.5 kW to 1 kW in size. Local governments should consider what levels of investment would be comfortable for the target residents. Participating local government agencies could also consider subsidizing the purchase of PV systems through grants or low interest loans.

Another argument in favor of smaller systems is that the area needed for smaller systems is more likely to be available on most rooftops. Note also that because crystalline PV modules have a higher efficiency than amorphous ones, they will take less room for the same output. Homeowners may also wish to fit solar hot water collectors alongside their PV modules. However, the cost per kWh generated increases as the size of the system decreases. In addition, more installations will be necessary with smaller systems to supplant grid power with green power.

Model household demonstrating energy conservation

Michael Winker and Carol McNeill home efficiency data at 1090 12th Street, Arcata

Arcata resident Michael Winkler provides model household utilizing renewable technologies with a conservation ethic. Using solar power for electricity and hot water heating, ground source heat pumped for household heating and powerful waste reduction practices creates a very energy efficient home. Michael provided the following data on his house;

Report stating the goal, objectives and implementations used to meet the stated goal towards energy conservation for his household. It provides data on energy use from 12/11/03 to 12/10/04. The solar electric system equipment list displaying type of PV panels and inverter, along with the orientation of the PV panels is provided. The house heating units are provided describing his ground-source heat pump and passive solar wall. Other conservation measures such as timer for thermostat, weatherization and insulation measure to decrease energy loss in the home are described. Efficient water heating, lighting, and cooking devices and conservation measure that apply to each are inventoried. Conservation practices and equipment list of clothes drying, refrigerator and freezer, computer, and phantom load reduction are supplied in the report. Transportation and waster reduction practices are also indicated. The Winkler house hold displays a diversity of easy to apply conservation practices and progressive renewable and sustainable technologies to achieve minimal energy use for one household. One aspect to be highlighted is the Winkler household generates 1 can of trash per year weighing a total of 30 pounds. Two tables are provided. One illustrates kwh per day from time period spanning 1/2/03-4/2/05. The second table gives annual use and generation. The conclusion of the report has a list of recommended books on energy to provide education on the current global energy crisis.

Winkler provides a list with key information on accessibility of purchasing various energy efficient household items. The list includes house heating equipment with installer and price information. Water heating unit is listed with manufacture, distributor and price information. Cooking device equipment with retailer and price information is provided. Equipment used dealing with phantom loads, standby power and energy vampire is listed with manufacture and price information

1090 12th Street, Arcata
Carol McNeill and Michael Winkler

Goal: Minimize environmental impact of our home energy use

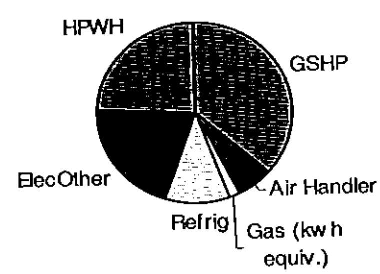
- Minimize energy use by maximizing efficiency and conservation
- Generate remaining energy using solar

12/11/03-12/10/04
Generation = 3682 kwh/ year
Total Usage = 3149 kwh/year
Net Surplus = 533 kwh

GSHP	Air Handler	Gas (equiv. kwh)	Refrig	ElecOther	HPWH	Total Usage	Generation	Surplus	
1206	198	44	329	634	738.4	3149	3682	533	kwh/year
						8.6	10.1		kwh/day
32.7%	5.4%	1.2%	8.9%	17.2%	20.1%	85.5%	100.0%	14.5%	

Solar Electric System (PV)

- 16 - Sharp Corporation, NT-S5E1U, 185W Multisilicon Modules
- 8 on house @30 degrees from horizontal
- 8 on garage @20 degrees from horizontal
- 1 - SMA America, SWR2500U, 2.5kW, Sunny Boy String Inverter
- PG&E Time-of-use metering
- Separate kwh meter for PV



House Heating

Heating Units

A. Ground-Source Heat Pump
- Water Furnace ES Split (30,000 BTU/hour)
- 2 – 150 ft vertical ground loops

B. Natural Gas Furnace (for backup)

C. Passive Solar Trombe Wall (3-foot high brick wall)
(to absorb sunlight during day and release it as heat at night and in the morning)

Conservation

A. Controls
24/7 Programmable electronic timer for system, 63 °F thermostat

B. Insulation
R-19 walls, R-19 floors, R-50 attic

C. Windows

- Double-pane, low-E, vinyl frames
- Thermal curtains
- Open curtains and mini-blinds during day
- Close curtains and mini-blinds at night

D. Leak Testing and Sealing

- Blower Door Test (house leakage @50 Pascals) 1450 CFM (before), 482 cfm (after sealing)
- Duct Blaster Test (duct leakage @50 Pascals) 26 cfm (after sealing)

E. Leak Sealing

- Metal tape, Mastic to seal ducts
- Weatherstripping for doors
- Expanding foam for ceiling light fixtures, electrical outlets and plumbing penetrations
- Silicone caulk to seal between floors and walls
- Weatherstripping for attic access
- Draft-proof outlet covers

Water Heating

Air-Source Heat Pump Water Heater (very high efficiency)
ECR International, Watter$aver

Conservation

- 24/7 Electronic Timer
- Heat traps
- Pipe insulation
- 115 °F thermostat setting (lowest comforatable temp when 100% hot water (bathing))
- Don't use hot water tap for small amounts of hot water
- Leave water in bathtub until it cools to room temperature
- Cold water for laundry

Lighting

All compact fluorescent (except in refrigerator)

Cooking

Devices

A. Solar (proportion of total cooking ~= 1/3)
Solar Cooker, Solar Chef, Concentrating Solar Cooker

B. Gas Stove

C. Microwave Oven

Conservation

A. Retained-Heat Cookers

- Thermos-Nissan RPA 4500, 4.5 quart, stainless steel vacuum cooker
- Aircore 2.5 quart and 5 quart stainless steel double-layer cookers

B. Use water from bottle kept at room temperature for cooking to minimize water heating energy and time

Clothes Drying

A. Solar (clothes line)
B. Indoor drying rack
C.. Gas dryer

Refrigerator/Freezer

Highest efficiency mass production refrigerator manufactured in 2000 (Maytag)
(Sun Frost would be more efficient, but buying more solar panels is more cost effective)

Thermostat Settings (use highest safe temperatures)

Refrigerator: 40 °F
Freezer: 0 °F

Conservation

- Timer to shut off refrigerator (midnight-5 AM and noon-6 PM weekdays)
- Keep refrigerator full to minimize chilled air loss
- Minimize number of times refrigerator is opened
- Cool food to room temperature before putting it in refrigerator or freezer
- Defrost food by moving it from freezer to refrigerator

Computers

- Turn off when not in use
- Enable EnergyStar power-savings modes and make time-outs short
- Disable screen savers (they save no energy and are unnecessary)

Phantom Loads/Standby Power/Energy Vampires

(energy wasted when devices are off)

Before taking measures to reduce them

65 watts = 570 kwh/year

After taking measures to reduce them

10 watts (doorbell transformer) = 90 kwh/year

Measures taken to eliminate phantom loads

- Power strips
- Timers
- Battery for answering machine

Transportation

- Walking
- Bicycles
- Bus (average efficiency: 125 passenger-miles per gallon)
- Train (average efficiency: 60 passenger-miles per gallon)
- Automobiles - Current - (2001 Toyota Prius (50 mpg), 1981 Honda Civic (40 mpg))
- Automobiles – Future - Plug-in hybrid (30-mile range on batteries)
- Electric motor scooters

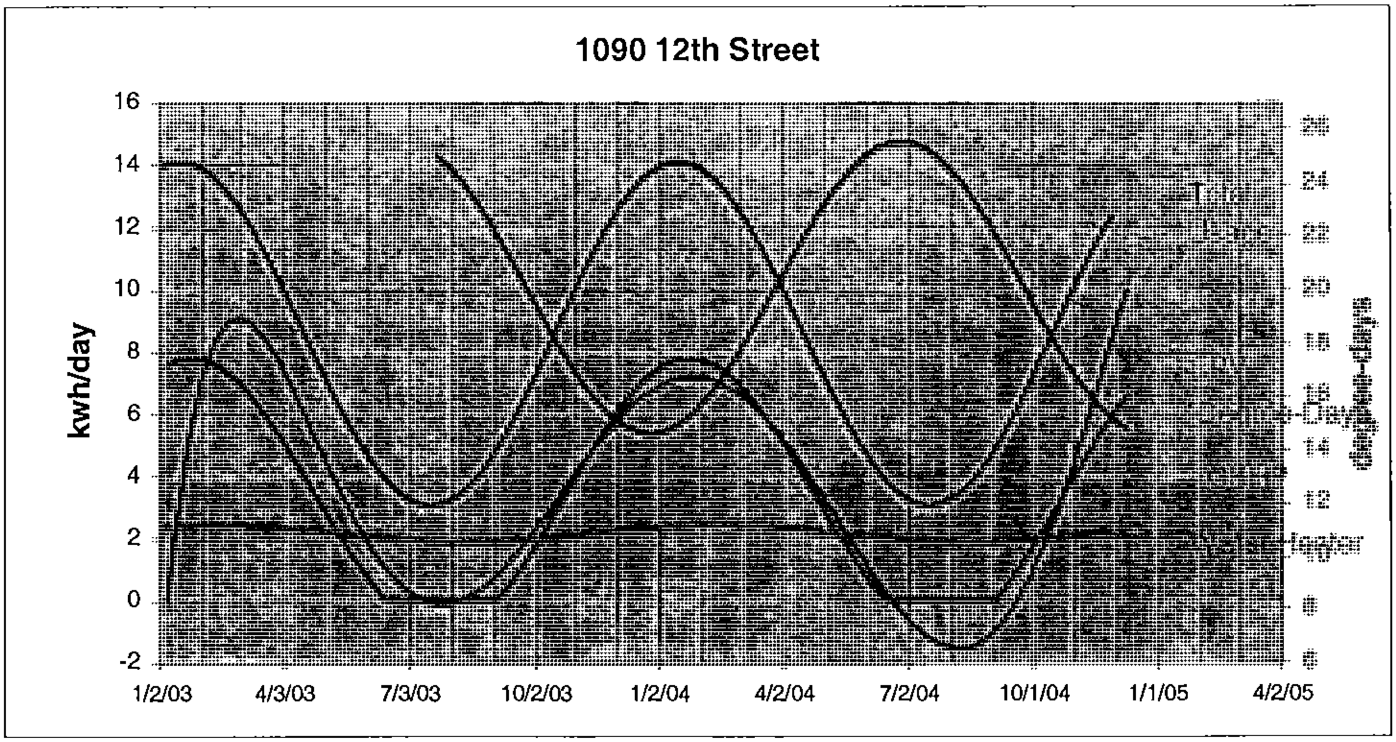
(Note: Airplanes have the worst energy efficiency of all, 25 passengers-miles per gallon and on top of that global warming impact is 3X as great for each gallon of fuel consumed giving a global warming impact 15X as great as for buses and 7X as great as for trains)

Waste Generation/Recycling (reduce, reuse, recycle, buy recycled)

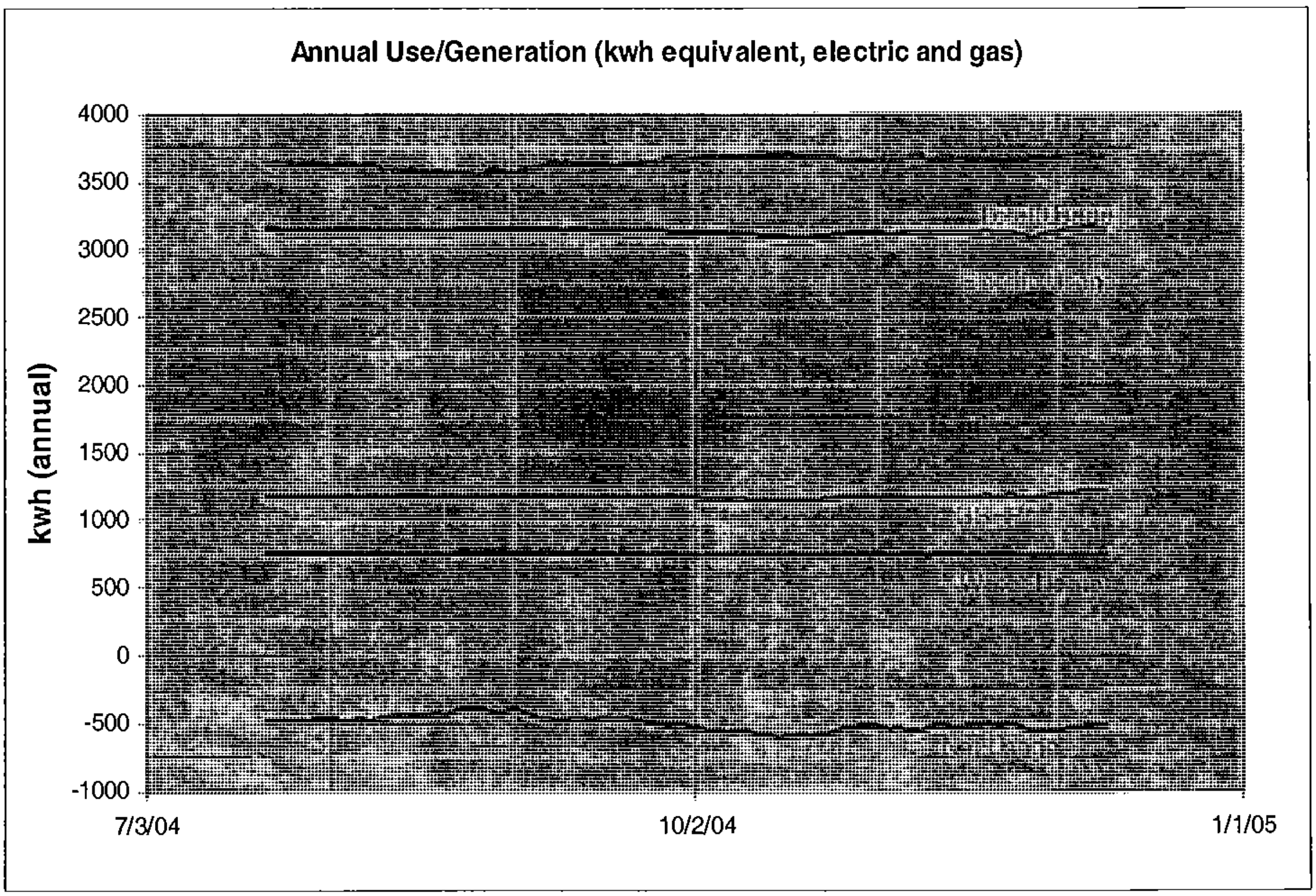
- 1 can of trash per year (30 pounds total) (last trash pick-ups, 1/16/2003, 2/27/2004)
- Source reduction
- Recycling – approximately 300 pounds per year
- Composting – approximately 100 pounds per year

Recommended Books on Energy

Title	Author	Stars
The decline of the age of oil	Brian J. Fleay	4 1/2
Geodestinies	Walter Youngquist	4 1/2
Resource Wars: The New Landscape of Global Conflict	Michael T. Klare	4
The Party's Over: Oil, War and the Fate of Industrial Societies	**Richard Heinberg**	**5**
Hubbert's Peak : The Impending World Oil Shortage	Kenneth S. Deffeyes	3 1/2
Energy at the Crossroads : Global Perspectives and Uncertainties	Vaclav Smil	4 1/2
The Oil Factor: How Oil Controls the Economy and Your Financial Future	Stephen Leeb	4
The Hype About Hydrogen: Fact and Fiction in the Race to Save the Climate	Joseph J. Romm	4 1/2
The End of the Oil Age	Dale Allen Pfieffer	3 1/2
The Coming Oil Crisis	Colin J. Campbell	4 1/2
The End of Oil : On the Edge of a Perilous New World	Paul Roberts	4 1/2
High Noon for Natural Gas: New Energy Crisis	Julian Darley	4
Powerdown: Options and Actions for a Post-Carbon World	Richard Heinberg	4
Blood and Oil : The Dangers and Consequences of America's Growing Petroleum Dependency	Michael T. Klare	



1090 12th Street
kwh/day
16
14
12
10
8
6
4
2
0
-2
1/2/03
4/3/03
7/3/03
10/2/03
1/2/04
4/2/04
7/2/04
10/1/04
1/1/05
4/2/05



Annual Use/Generation (kwh equivalent, electric and gas)
kwh (annual)
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
7/3/04
10/2/04
1/1/05

Winkler's wonderhome is sustainably energized

Arcata Eye, August 5, 2003
By Rebecca Bender

From the outside, Michael Winkler's home at the corner of 12th and K streets looks much like any other Arcata house. Several solar panels - a common-enough sight - line the roofs of the house and garage. An unremarkable blue shell on the side of the house covers a ground-source heat pump, identifiable as such only by a colorful sign on the fence. But unobtrusive though they may be, the panels and pump represent a remarkable level of energy efficiency and low-impact living.

"I want to use the most renewable, sustainable, energy efficient sources I can," Winkler explained. "Sources more secure than fighting for them in the Middle East." With his recent addition of eight more solar panels and a ground-source heat pump to his home, he's taken one more step towards that goal.

Solar Power

Though Arcata's sunlight can be sporadic, solar panels take advantage of the sun whenever it is out, sending excess electricity back to Pacific Gas & Electric Company (PG&E). "Basically it runs the meter backwards," Winkler said, creating a credit with PG&E which can be used as needed.

The addition of eight solar panels brings the total number of panels in use at Winkler's home to 16. The original eight have been in use for two years, with four producing all the house's electricity and four running the water heater, which draws heat out of the air and works about four times as efficiently as a regular water heater.

The newest eight solar panels, installed by local energy technician Roger, provide the electricity to run the geothermal heat pump.

Earth Energy

The ground-source pump, like most heat pumps, works simply by pulling heat out of one source --in this case, the earth--and pumping it into another area--Winkler's home. "It's much more efficient to move heat around than it is to create it," Winkler said.

Crystal Air, a plumbing, heating and air conditioning contractor in Weaverville, installed the pump. "The ground-source pump's applications are pretty much unlimited," explained Reno McFadden of Crystal Air. "The technology has been around since 1940--it's a proven technology." Pumps can be installed as indoor or outdoor units, with vertical of horizontal pipes. The pipes' life expectancy of about 150 years means that once a pump is installed, very little maintenance is needed.

Winkler's geothermal pump uses a standard compressor and two polyethylene pipes drilled down to a depth of 150 feet. The need for such a depth is dictated by the small size of Winkler's yard, which limits the available space from which to draw heat and have it replaced efficiently. In a more roomy setting, shallower pipes would work just as well.

About eight feet below the earth's surface, the heat is relatively constant, making the ground an excellent source for consistent heat energy. On a night when the temperature drops to 32 degrees, for example, the ground will remain right around 58 degrees.

Energy Investment

The geothermal pump compressor also works in reverse as an air conditioner, making it an especially cost effective device in a climate with extreme heat and cold fluctuations. "There's no place that a pump won't fit, from the Arctic Circle to the tropics," McFadden said. "After the initial installation, it pays for itself.

At a cost of approximately $12,000 to install, the initial outlay for a ground-source heat pump is a daunting prospect for many, especially in comparison to a regular furnace, which may cost $3,000 to $4,000. The long-term savings add up, however and for Winkler, the desire to use the most sound energy sources made the investment worthwhile, and the combination of energy-efficient measures already in use in his house made it practical.

"In the back of my mind, I'd been aware these existed for years," Winkler said. After doing some research, he decided that it was an option he'd like to explore. "For each form of energy I use," he explained, "I look at every available, feasible option."

It starts with the recycling bug

Winkler's fascination with renewable resources started with recycling. "In the late '80's I got the bug," he said. From recycling, he found it was an easy transition into exploring energy sources.

In the March 1998 issue of *Scientific American*, an article called, "The End of Cheap Oil," predicting a worldwide decline in oil production, caught Winkler's eye. "This was really a pivotal article," he said. "Carter's idea of living within limits wasn't very popular, but he was right: We just can't continue the wasteful ways we have now."

Winkler has worked at Humboldt State University's Schatz Energy Research Lab sin 1997. He's currently working with HSU students on the Energy Independence Fund, a plan to produce all electricity from renewable sources.

A 50-year investment

Winkler estimates he's spent about $32,000 altogether on solar panels, double-paned windows, insulation and other preparation and installation costs in the three years he's owned his house. "It saves about $600 a year on the electrical bill," he said. Laughing, he added, "So it's about a 50-year investment."

In addition to the personal benefits, however, Winkler's sustainable lifestyle makes an invaluable contribution on a local, community level and ultimately, on a global scale. He produces only one can of trash per year uses a solar cooker and retained heat cookers(which, incidentally keep his gas costs down to about $4 per year) and is a member of Redwood Roots Farm, a community supported agriculture collective.

Of course, he continues to explore additional use of renewable energy, from heat pump dryers to transportation. Among other projects always in the works, he's "mulling over" the possibility of a battery electric car that could even derive its battery energy from solar power.

Roger commented, "This is probably one of the most diversified households in the area in terms of its energy-efficiency measures." Winkler emphasizes that being energy efficient is something everyone can achieve without making drastic changes or compromises in comfort.

"What I want is to be a model," Winkler explained. "Yes, one way of saving energy is to be uncomfortable. But it isn't necessary. I want to be an example of a comfortable, middle-class life existing within the limitations of local, renewable resources."

1090 12th Street, Arcata
Carol McNeill and Michael Winkler

House Heating
Ground-Source Heat Pump (for house heating)
Water Furnace ES Split (30,000 BTU/hour)
2 – 150 ft vertical ground loops

Installer
Reno McFadden
Crystal Air
1413 Main St., P.O. Box 1501
Weaverville, CA 95926
1-877-847-5739 (toll-free)

Price: $12,802

Ground-Source Heat Pump (links)
How Ground Source Heat Pumps Work
http://www.reddingelectricutility.com/energysvc/howgshpworks.html

Water Furnace Inc. (manufacturer)
http://www.waterfurnace.com

Water Heating
Air-Source Heat Pump Water Heater

Manufacturer
ECR International, Watter$aver
http://www.ecrinternational.com/prod_wattersaver_summary.asp

Distributor
J.W. Wood
3676 Old 44 Drive
Redding, CA 96099-1600
Phone: 530/222-0423
redding@jwwoodco.com

Price: $1099.42

Cooking

Retained-Heat Cookers

Thermos-Nissan RPA 4500, 4.5 quart, stainless steel vacuum cooker
http://www.coffee-makers-espresso-machines.com/cookware.html

Aircore 2.5 quart and 5 quart stainless steel double-layer cookers
www.ebay.com
Fixed prices between $100 & $130

Phantom Loads/Standby Power/Energy Vampires

"Kill-A-Watt" Plug-in Kilowatt-Hour Meter

C. Crane
1001 Main Street Fortuna, CA 95540
800-522-8863
http://www.ccrane.com/kill_a_watt.asp
Price: $44.95

AHERN COMMUNICATIONS
60 Washington Court - Quincy, MA 02169
800-451-3280
http://www.ahernstore.com/p4400.html?OVRAW=kill%2Ba%2Bwatt&OVKEY=kill%20watt&OVMTC=standard
Price: $34.95

Draft-proof outlet covers

Royal Baby Safety Corp.
79 Union Place - # 102
Summit, NJ 07901
Voice: (908) 598-0500
Fax: (908) 273-8106

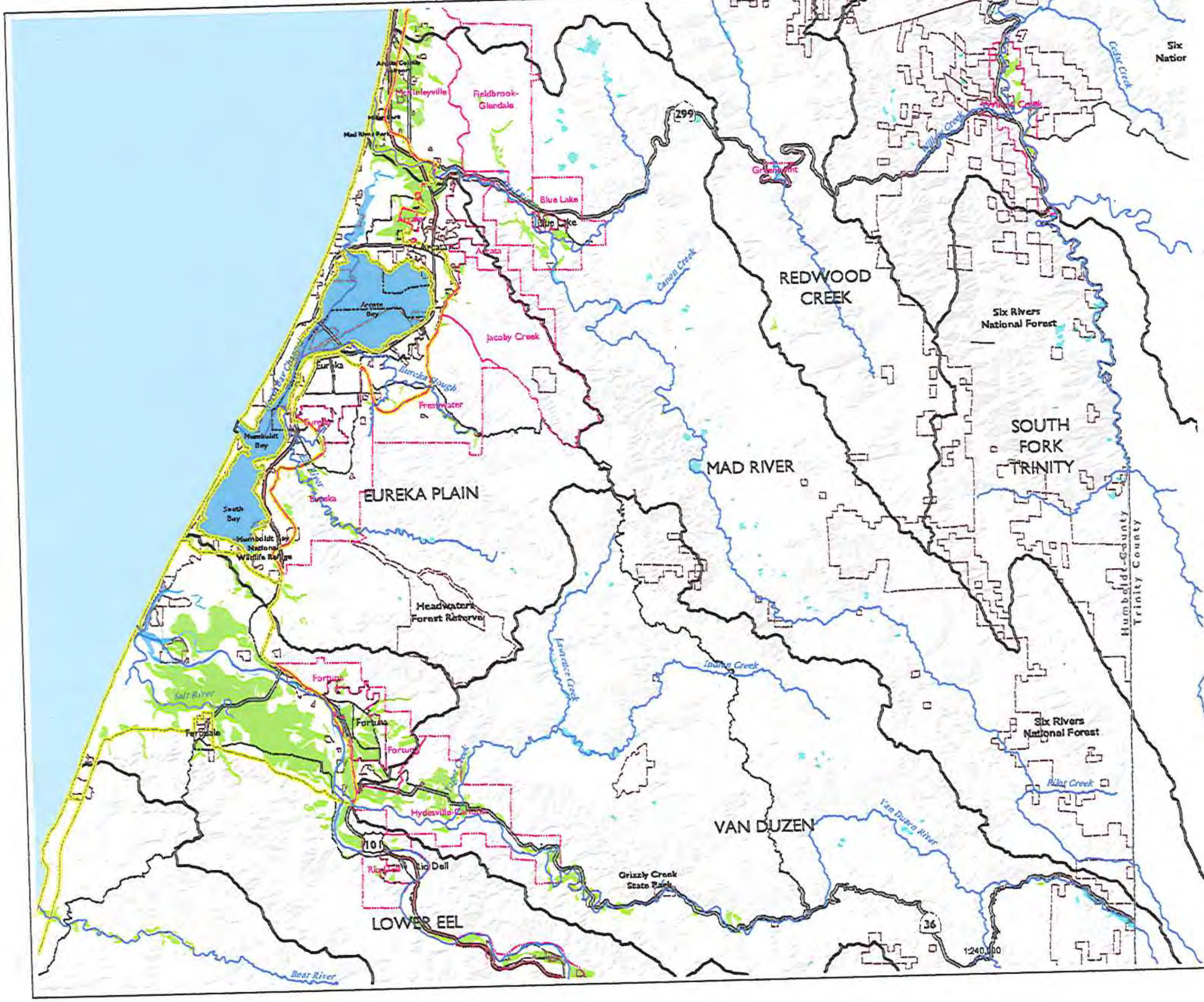
http://www.babysafe.com/electric.htm

Time-of-Use Meter (PG&E)

One-time charge: $277
Monthly: $1.00 (approximate)

Figure 4-2b

Central Humboldt Prime Agricultural Soils



Note:
More than 80% of Humboldt County's Agricultural lands are used for grazing which are not shown on this map. See Existing Land Use and Williamson Act Contract maps for these rangelands.

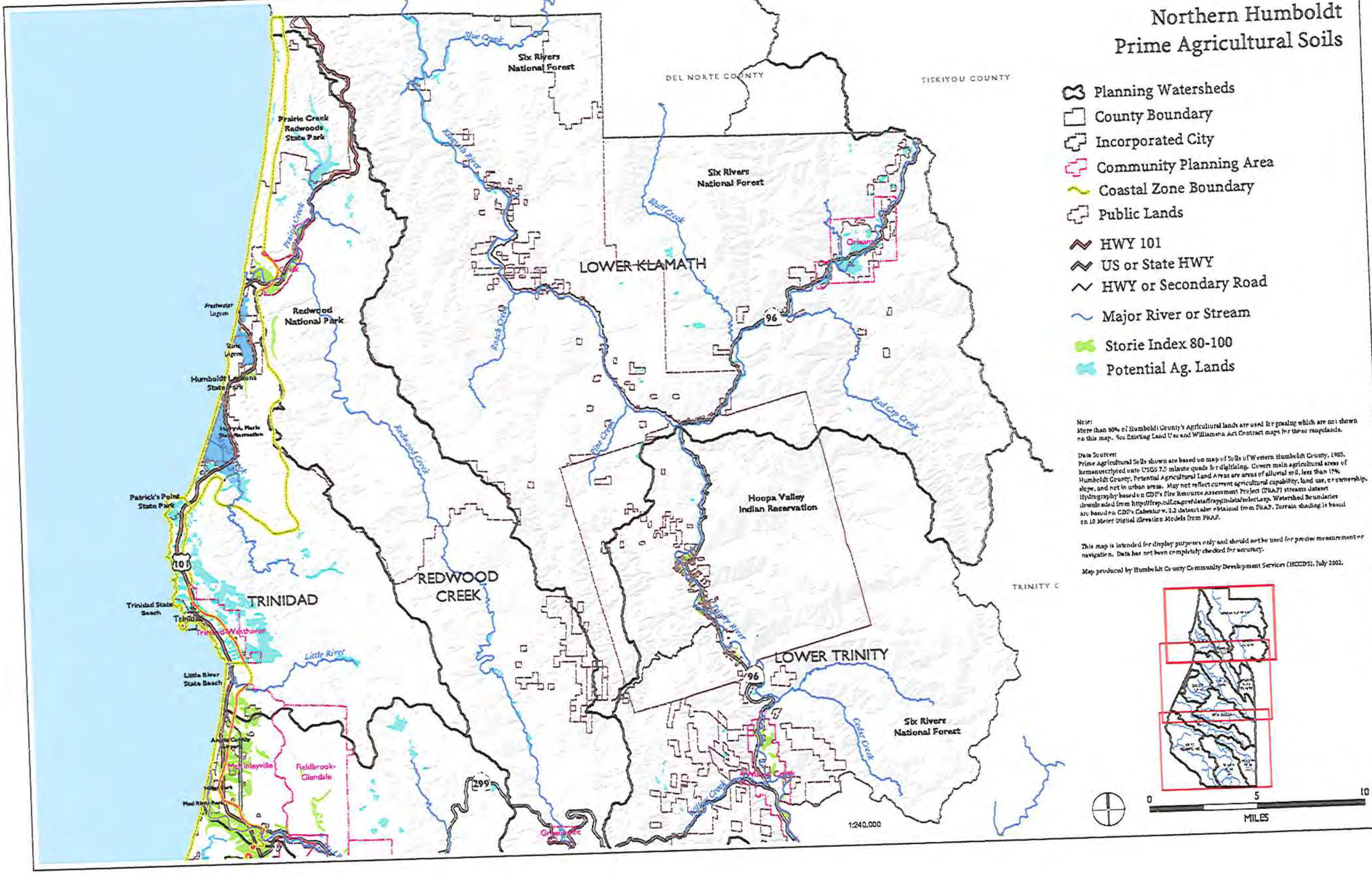
Data Sources:
Prime Agricultural Soils shown are based on map of Soils of Western Humboldt County, 1965. Remanuscripted onto USGS 7.5 minute quads for digitizing. Covers main agricultural areas of Humboldt County. Potential Agricultural Land Areas are areas of alluvial soil, less than 15% slope, and not in urban areas. May not reflect current agricultural capability, land use, or ownership. Hydrography based on CDF's Fire Resource Assessment Project (FRAP) streams dataset downloaded from http://frap.cdf.ca.gov/data/frapgisdata/select.asp. Watershed Boundaries are based on CDF's Calwater v. 2.2 dataset also obtained from FRAP. Terrain shading is based on 10 Meter Digital Elevation Models from FRAP.

This map is intended for display purposes only and should not be used for precise measurement or navigation. Data has not been completely checked for accuracy.

Map produced by Humboldt County Community Development Services (HCCDS), July 2002.

Figure 4-2a

Northern Humboldt Prime Agricultural Soils



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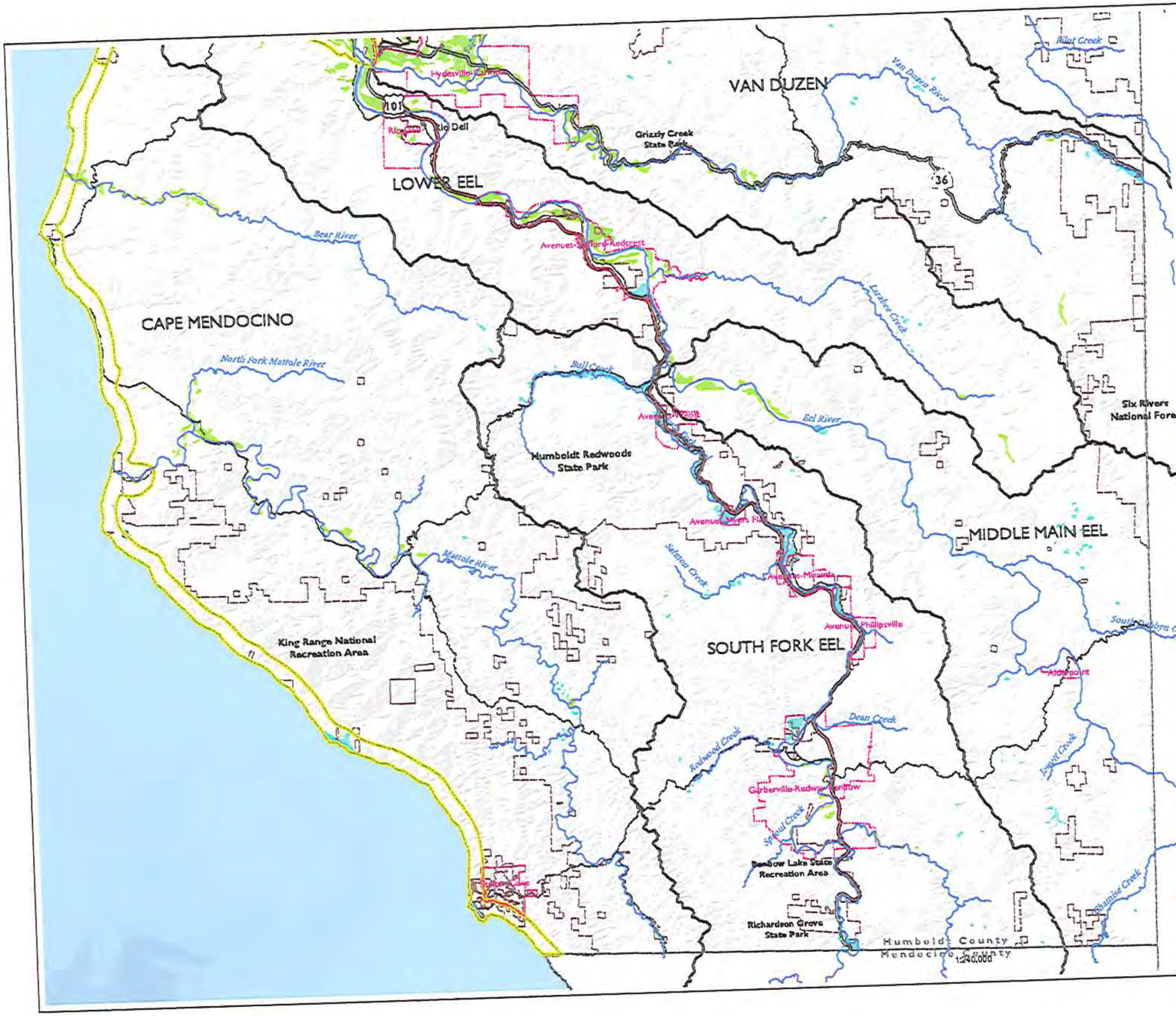
This map is intended for display purposes only and should not be used for precise measurement or navigation. Data has not been completely checked for accuracy.

Map produced by Humboldt County Community Development Services (HCCDS), July 2002.

Figure 4-2c

Southern Humboldt Prime Agricultural Soils



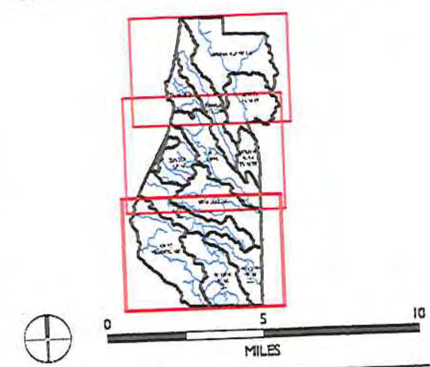
Planning Watersheds
County Boundary
Incorporated City
Community Planning Area
Coastal Zone Boundary
Public Lands
HWY 101
US or State HWY
HWY or Secondary Road
Major River or Stream
Storie Index 80-100
Potential Ag. Lands

Note:
More than 80% of Humboldt County's Agricultural lands are used for grazing which are not shown on this map. See Existing Land Use and Williamson Act Contract maps for these rangelands.

Data Sources:
Prime Agricultural Soils shown are based on map of Soils of Western Humboldt County, 1965. Remanuscripted onto USGS 7.5 minute quads for digitizing. Covers main agricultural areas of Humboldt County. Potential Agricultural Land Areas are areas of alluvial soil, less than 15% slope, and not in urban areas. May not reflect current agricultural capability, land use, or ownership. Hydrography based on CDF's Fire Resource Assessment Project (FRAP) streams dataset downloaded from http://frap.cdf.ca.gov/data/frapgisdata/select.asp. Watershed Boundaries are based on CDF's Calwater v. 2.2 dataset also obtained from FRAP. Terrain shading is based on 10 Meter Digital Elevation Models from FRAP.

This map is intended for display purposes only and should not be used for precise measurement or navigation. Data has not been completely checked for accuracy.

Map produced by Humboldt County Community Development Services (HCCDS), July 2002.



MEAN ANNUAL PRECIPITATION (INCHES)

BASED ON NORMAL PERIOD 1961-1990

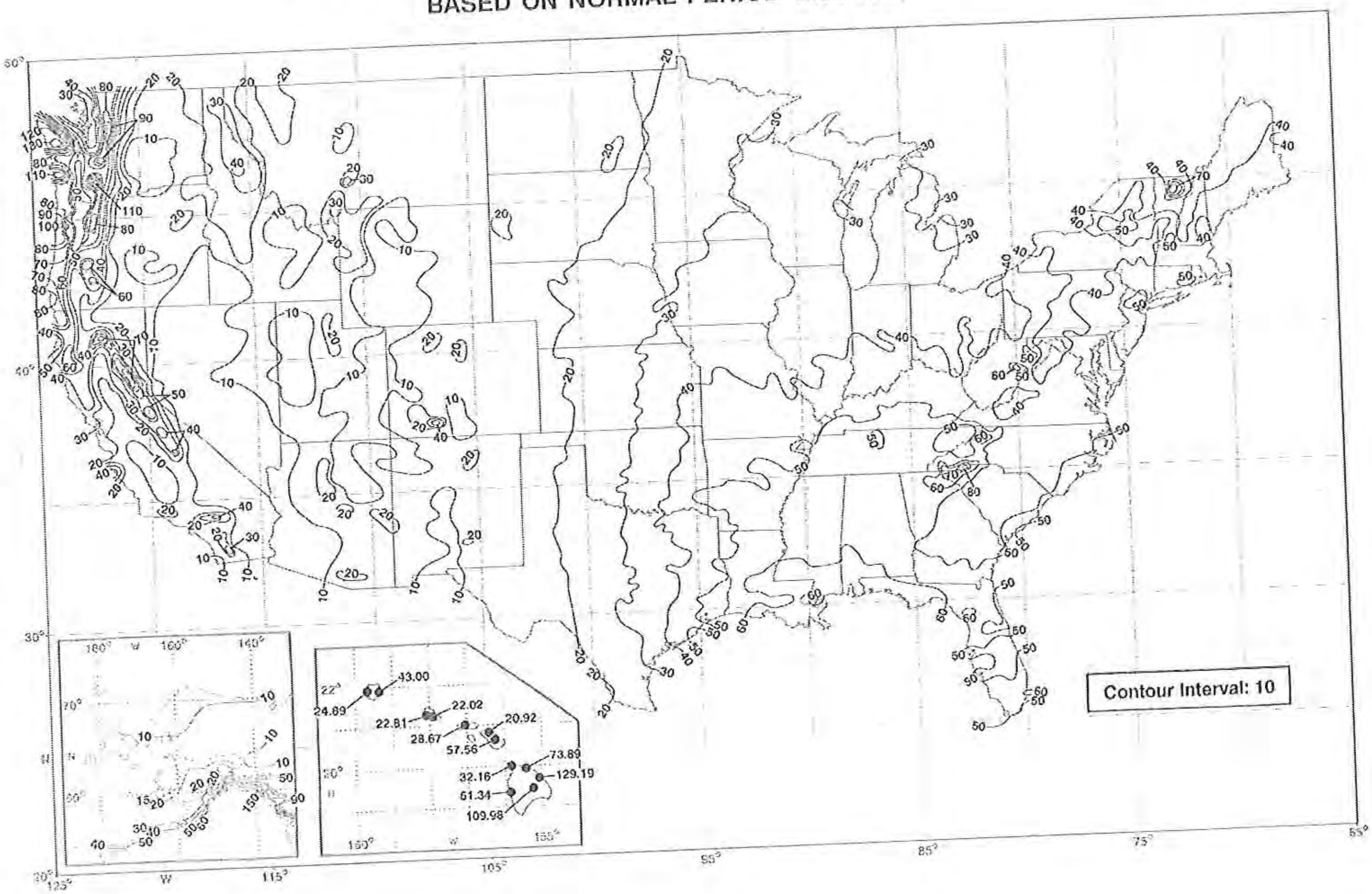
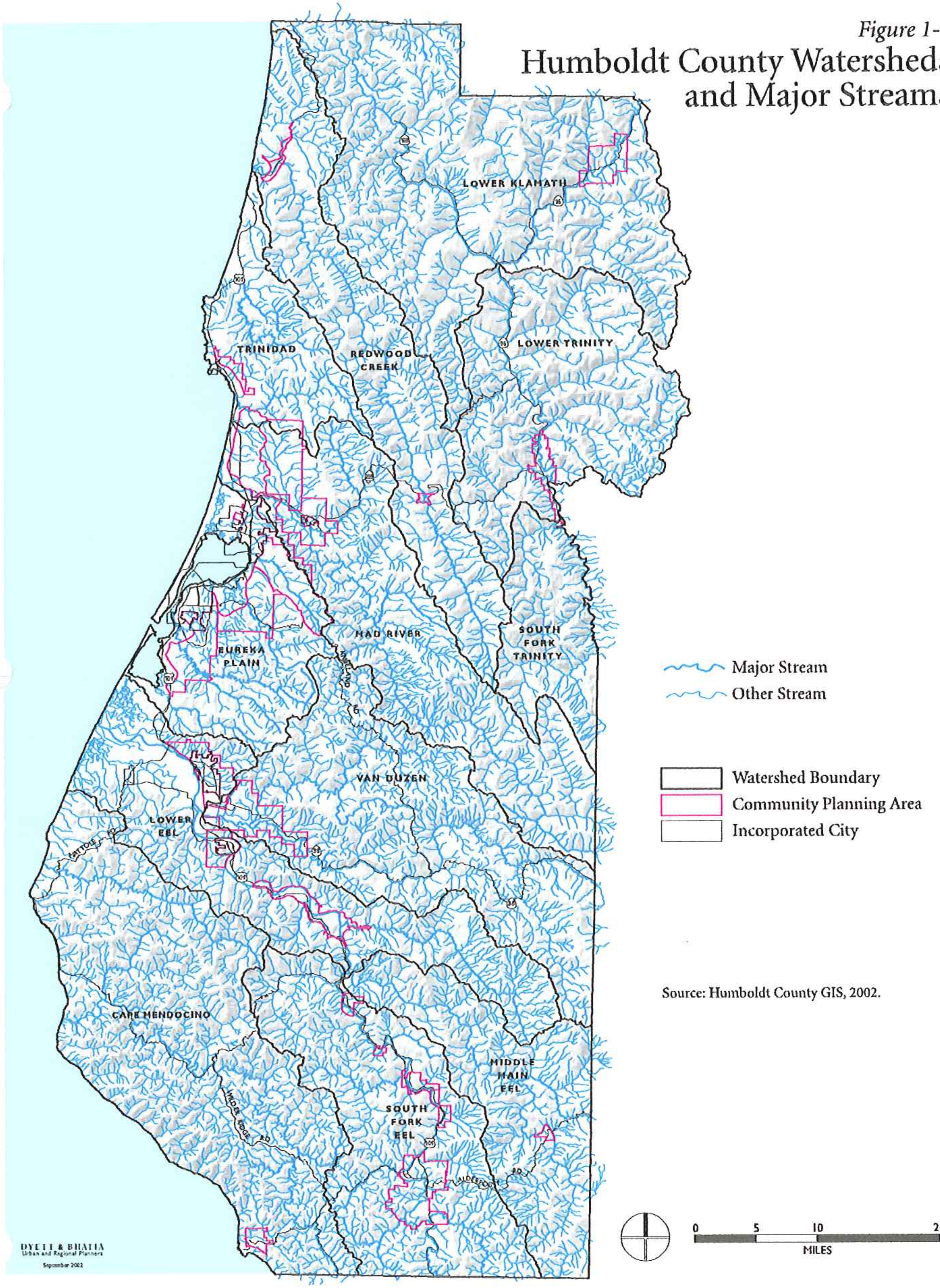


Figure 1-1

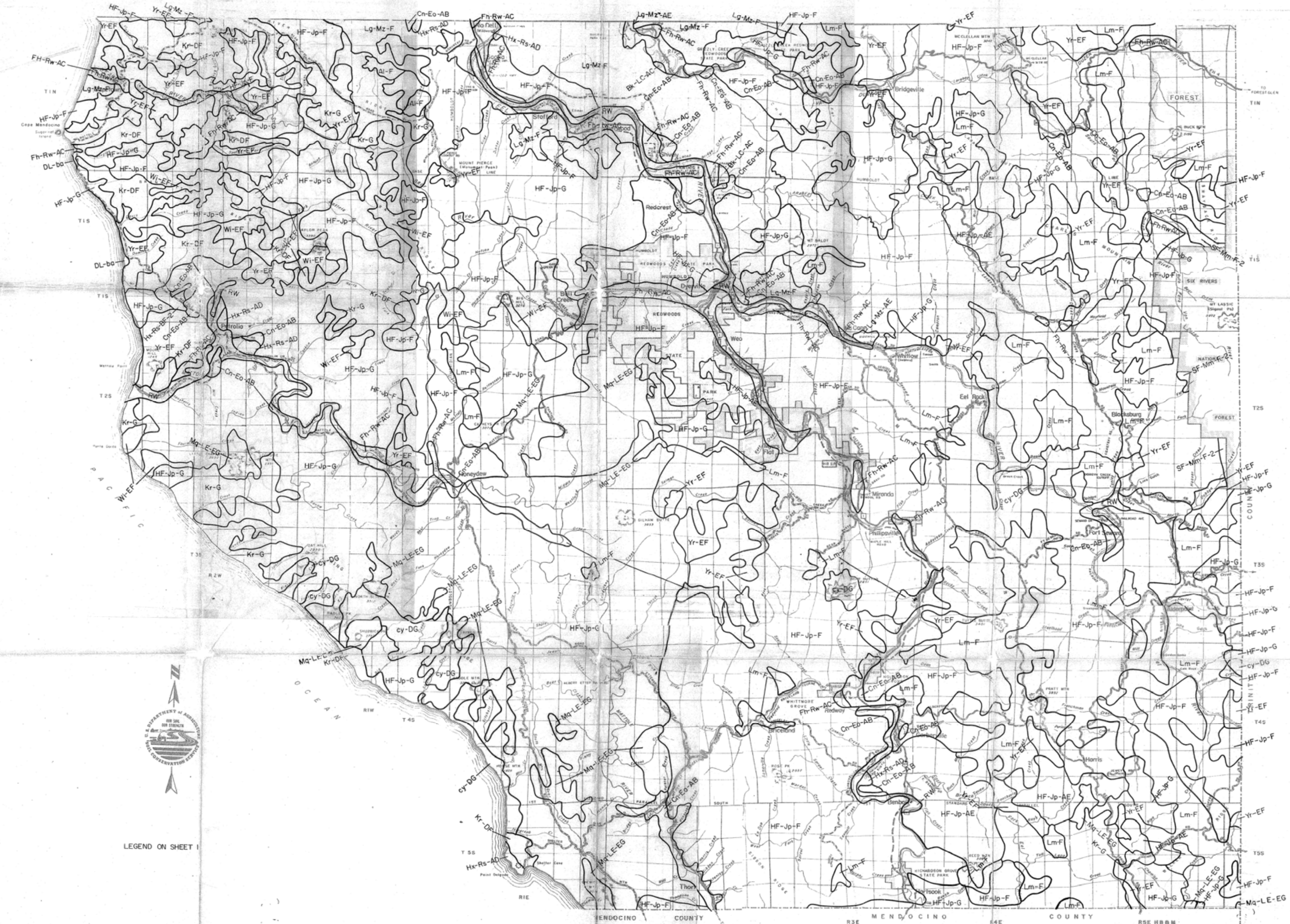
Humboldt County Watersheds and Major Streams



Major Stream
Other Stream

Watershed Boundary
Community Planning Area
Incorporated City

Source: Humboldt County GIS, 2002.



This map is intended for general planning. Each delineation may contain soils different from those shown on the map. Use detailed soil maps for operational planning, and on site inspection for more detailed decisions.

GENERAL SOIL MAP
HUMBOLDT COUNTY
CALIFORNIA

PREPARED BY U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

JANUARY 1967

SCALE IN MILES (0 1 2 3 4 5)

SUITABLE ONLY FOR GENERAL PLANNING

7-E-18268L-C

Sheet 3 of 3

Authorities:
Base prepared Mar. 1966 by SCS Cartographic Unit, Portland, Oregon from State Division of Highways 1960 County Road System map of Humboldt County, California.

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE