USGS

Schmitt and others—**Ground-Water Quality Data in the Middle Sacramento Valley Study Unit, 2006—Results from the California GAMA Program**—Data Series 385 ca.water.usgs.gov/projects/gama/water-quality-results/

Apps | Irrolis Web - Login | Solar | Backstop Solutions... | Conservis | Blu

USGS
science for a changing world

USGS CA GAMA-PBP Groundwater-Quality Results: Assessment and

DISPLAY DATA

Groundwater Sites by Study Type:

All Sites

Consitiuent Group:

Trace Elements

Constituent:

Arsenic

ADDITIONAL LAYERS

- [x] Domestic-supply Assessment Grid Cells
- [ ] Public-supply Assessment Grid Cells
- [ ] Domestic-supply Assessment Study Units
- [ ] Public-supply Assessment Study Units
- [ ] Hydrogeologic Provinces

The Groundwater Ambient Monitoring and Assessment - Priority Basin Project (GAMA - PBP) is

From: Ken Loy
To: Mary Fahey; Lisa Hunter
Cc: Byron Clark
Subject: FW: USGS Middle Sacramento Valley 2006 Water Quality Report
Date: Wednesday, October 21, 2020 10:41:58 AM

From: Ben King <bking@pacgoldag.com>
Sent: Saturday, October 17, 2020 9:59 AM
To: Ken Loy <kloy@westyost.com>
Cc: Ceppos, David M <dceppos@csus.edu>
Subject: Re: USGS Middle Sacramento Valley 2006 Water Quality Report

Thanks Ken

Perhaps we can work with the USGS to expand its network around the Sutter Buttes. Even if we get USGS testing every 10 years that may be enough to detect water quality trends. We just need a baseline because this may be 100 year issues. My concern is how the increased pumping to support permanent crops may effect the lateral and upward movement of natural contaminants. I think that recharge probably can mitigate this and may have contained the issue before the levees were built. With recharge we can tactically simulate some of the the natural benefits of the historical benefits of flooding in the Sacramento Valley while benefiting from the State's investment in flood control and reclamation.

Sent from my iPhone

> On Oct 16, 2020, at 4:07 PM, Ken Loy <KLoy@westyost.com> wrote:
>
> Ben:
>
> That's a good question worth a follow up.
>
> We'll compare the wells in the database to the report and let you know.
>
> Best,
>
> Ken
>
>> On Oct 16, 2020, at 3:37 PM, Ben King <bking@pacgoldag.com> wrote:

[This message has originated from outside of West Yost]

Thanks Ken

I was focusing on the Flow Path wells since I assumed they were deeper. Is that a good assumption – who owns the FP wells?

From: Ken Loy <kloy@westyost.com>
Sent: Friday, October 16, 2020 3:30 PM
To: Ceppos, David M <dceppos@csus.edu>; Ben King <bking@pacgoldag.com>
Cc: Mary Fahey <mfahey@countyofcolusa.com>; Lisa Hunter <LHunter@countyofglenn.net>; Byron Clark <Byron@davidsengineering.com>; John Ayres <jwayres@woodardcurran.com>
Subject: RE: USGS Middle Sacramento Valley 2006 Water Quality Report

Ben:

We are familiar with this 2006 USGS GAMA report. Now that I know which report you were referring to, were you asking if the RICE or Flow Path wells could be used for water quality monitoring in the GSP?

Thank you,

Ken

Ken Loy
Principal Hydrogeologist
We're hiring! Visit our career site, here

WEST YOST
direct 530.792.3276
Currently working from home. Please use mobile: 530.574.1940

From: Ceppos, David M <dceppos@csus.edu>
Sent: Friday, October 16, 2020 3:21 PM
To: Ben King <bking@pacgoldag.com>; Ken Loy <kloy@westyost.com>
Subject: FW: USGS Middle Sacramento Valley 2006 Water Quality Report

[This message has originated from outside of West Yost]

Thanks Ben. Ken. See below and attached and please also note Ben's email and vice versa.

Have a great weekend!

Dave Ceppos I *Managing Senior Mediator*
Consensus and Collaboration Program
College of Continuing Education – Sacramento State
304 S Street
Sacramento, CA 95811
916-539-0350 (c)
916-278-5015 (d)

He / Him / His
dceppos@csus.edu
csus.edu/cce
<image001.png>

From: Ben King <bking@pacgoldag.com>
Sent: Friday, October 16, 2020 3:17 PM
To: Ceppos, David M <dceppos@csus.edu>
Cc: Ben King <bking@pacgoldag.com>
Subject: USGS Middle Sacramento Valley 2006 Water Quality Report

Hi David,

See Figure 3 for well sites.

Also – I want to highlight the C 14 dating results and trace metal contamination levels for IASC 21 generally. See the Tables for IASC 21 at the end of the Report.

Best Regards,

Ben

ARSENIC IN CALIFORNIA DRINKING WATER

Three Years After EPA Notice of Noncompliance to State, Arsenic Levels Still Unsafe in Drinking Water for 55,000 Californians

SEPTEMBER, 2016

ACKNOWLEDGEMENTS

This report was researched and written by Tom Pelton, Courtney Bernhardt, and Eric Schaeffer of the Environmental Integrity Project. The map was created by Kira Burkhart and the graphics by Alana Natke.

THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (http://www.environmentalintegrity.org) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws.

For questions about this report, please contact EIP Director of Communications
Tom Pelton at (202) 888-2703 or
tpelton@environmentalintegrity.org.

PHOTO CREDITS

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Arsenic in California Drinking Water

More than three years after the U.S. Environmental Protection Agency found California in noncompliance with the federal Safe Drinking Water Act, 95 community water systems in the state, serving more than 55,000 people, are still providing water with illegal levels of arsenic, according to an examination of state data for the last two years.[1] Arsenic occurs naturally in the soil and groundwater in parts of California and is a known carcinogen that may also damage the developing brains of children and cause other health problems.[2] Many of the people drinking excessive levels of arsenic are poor and/or Latino or African-American, with a cluster in the San Joaquin Valley.[3] Nearly all have been exposed to excessive arsenic levels for at least five years and probably longer.[4]

California requires public water systems to notify their customers when arsenic fails to meet federal health standards. But strangely, the state's language for mailed advisories suggests the water is still safe to drink no matter how high the contimation levels or how long they persist, with the notices telling residents: "You do not need to use an alternative water supply (e.g., bottled water)." [5] That advice conflics with what California tells private well owners (who aren't covered by federal standards) on a state website: "If you suspect that your well may have arsenic, you should not use the water until it is tested, and you take appropriate measures to protect yourself and your family from potential chronic health effects if arsenic is present."[6] Whatever the intention, California's language for people on public water systems is likely to encourage them to drink contaminated water. (For the full text of the California's language, see Appendix A). As the state continues a multi-year effort to solve the contamination problem, it should immediately fix a communications problem so that it clearly warns people not to drink arsenic-tainted tap water.

The highest levels of arsenic in drinking water in California from 2011 through 2015 were in a group home for troubled teenage boys, the Valley Teen Ranch in Madera County. About 50 boys assigned by the courts to the facility have been living in a home with water that has arsenic at concentrations averaging more than 12 times the federal limit (10 parts per billion, or ppb) over these five years, according to state records.[7] "Nobody wants to drink the water because it's brown and nasty,"said Connie R. Clendenan, CEO of the nonprofit organization that runs the group home.[8] "It looks bad."

It is bad. Although California has made substantial progress in addressing drinking water problems, the state still has 13 school districts, serving a total of 8,822 students, with arsenic in their drinking water that exceeded the federal limit from 2011 to 2015.[9] Twelve mobile home parks in California, serving 889 people, had arsenic in their tap water that averaged up to five times the legal limit. The average annual concentrations of arsenic in the drinking water of 58 residential communities (other than trailer parks) exceeded the legal limit during this time period, as did a military base, three wineries, two food preparation businesses and two campgrounds.

In many of the schools, the group home and military base, administrators say they verbally warn people not to drink tap water. They also provide bottled water as an alternative. But in the residential neighborhoods and trailer parks, it is not clear what warning – if any -- people are receiving. "There is no warning not to drink it. There is no 'non-drink' order out there," said Robert Johnson, President of the Shaver Lake Point 2 Mutual Water Company, which supplies 210 homes in Fresno County with tap water that has seven times the legal limit of arsenic. When asked if these residents should drink bottled water instead of his arsenic-tainted tap water, Johnson said: "It's one of those things, if you want to do it, that's your deal. It's not being recommended. We're not suggesting it. This is per the state of California. We are following their guidance."

The drinking water crisis in Flint, Michigan, was a reminder of how important it is for state governments to issue clear warnings to people with unhealthy tap water. California's mixed message is nearly identical to the one issued by Texas to homeowners with illegal levels of arsenic in their drinking water. Texas also tells consumers with excessive levels of arsenic: "You do not need an alternative water supply."[10] Many other states, however, are more direct in warning people not to drink water with excessive amounts of arsenic, at least for private well owners. Wisconsin, Michigan, Maine, and Washington, for example, simply tell residents not to consume water with more than 10 ppb arsenic (a health standard set by EPA in 2001). Wisconsin advises private well owners: "If your arsenic level is more than 10 ppb, the Wisconsin Department of Health Services recommends that you stop using your water for drinking or food preparation."[11] Florida advises its consumers to avoid water where arsenic contamination persists.[12] The U.S. Department of Health and Human Services makes similar recommendations.[13] If anything, the most recent science suggests that the current 10 ppb arsenic standard is not protective enough and that the IQ of children may be damaged at much lower exposures.[14]

In the wake of a 2013 EPA notice of noncompliance to California over its failure to invest enough money in its drinking water systems, the state has taken several important steps to fix its problems. Over the last three years, the state has more than doubled the amount of funding to build water treatment plants, pipelines, and new wells. The state and counties have filed compliance orders with local utilities to push them to upgrade their systems and are directing small, underfunded water systems to merge with larger utilities. Because of these measures, EPA announced in May 2016 that California was back in compliance with the federal Safe Drinking Water Act.

But in fact, the work is far from done – as witnessed by the 55,985 people in 95 communities across California who still have illegal levels of the carcinogen in their tap water, according to state records.[15] Why the delays? Local officials say that in some cases, bureaucratic negotiations are holding up projects, which are sometimes stalled because of conflicts between county and state rules. In other cases, local water districts struggle with indecision or a lack of money.

Until these important water system improvements are complete, California and EPA must do a better job of warning consumers to stop drinking water that fails federal health standards. This report recommends:

- California and EPA should revise their regulations and guidance to require that local utilities warn people to stop drinking or cooking with water that fails to meet federal arsenic standards (10 ppb), especially when the contamination persists over several years. The advice should be sensitive to the additional risks posed when children and other sensitive populations drink contaminated water. If there is no reason for consumers to take precautions, there is no reason for Safe Drinking Water Act standards in the first place.

- Public notices mailed to consumers should inform them of options for treating contaminated water at home, e.g., through filtration systems that have proven to be effective. Conversely, the public should be told what doesn't work. For example, boiling water will not reduce arsenic concentrations.

- Federal and state authorities should provide enough money to these 95 California communities to allow them to install water filtration systems or take other steps to eliminate contamination problems. Although the state has already boosted its funding, it still faces a projected $30 billion plus in needed capital improvement projects to help its inadequate systems provide safe drinking water trough 2026.[16]

The big picture is that stepped-up investment in crumbling public infrastructure is sorely needed across the U.S., and it should be regarded as a top priority for both Congress and California lawmakers. But the state also needs to improve its efforts to better inform consumers so people can protect their own health. California does not have to wait for EPA action to strengthen its warnings because the state is already empowered to act independently of EPA.

Public health advisories that are contradictory and confusing – as they are in California -- are as bad as no warnings at all, because they undermine action and weaken public confidence in government.

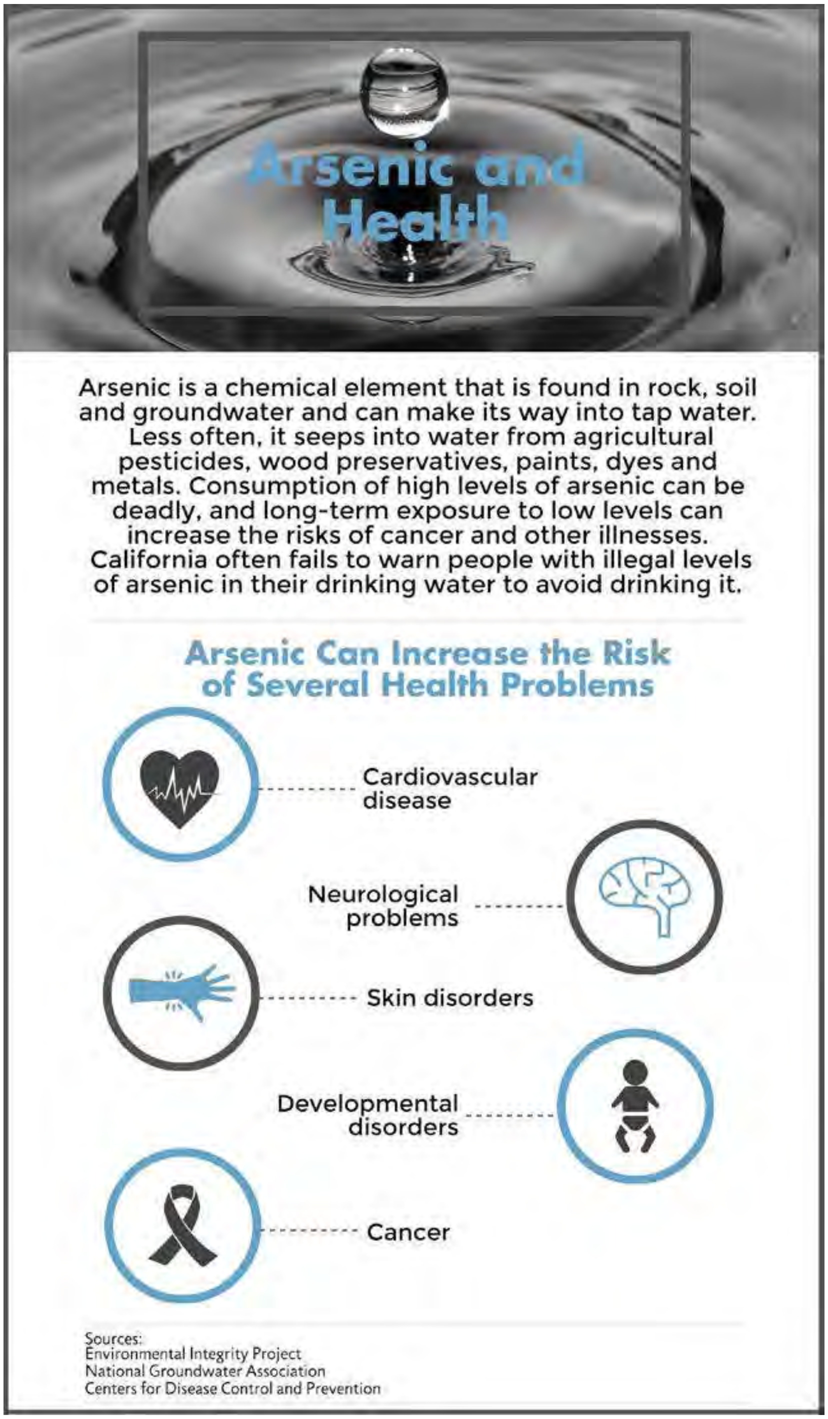
Table 1. Top 20 Arsenic Concentrations in California Public Water Systems

Water System (in Order of Arsenic Levels)	County	Pop. Served	2014-2015 avg (ppb)	2011-2015 avg (ppb)
Lakeview Improvement Association #1	Fresno	160	86.88	86.88*
Fountain Trailer Park Water	Kern	68	85.75	83.90
Hungry Gulch Water System	Kern	33	72.56	70.04
Corral De Tierra Estates WC	Monterey	45	72.50	78.40
Keeler Community Service District	Inyo	50	71.25	75.63
Quail Valley Water District- Eastside System	Kern	60	70.06	69.11
CSA 70 W-4 Pioneertown	San Bernardino	625	64.52	61.55
MD #06 Lake Shore Park	Madera	130	64.25	71.94
Valley Teen Ranch	Madera	50	62.00	120.80
Sierra East Mobile Home Community	Mono	50	54.63	47.03*
Shaver Lake Point #2	Fresno	210	52.31	42.88*
Winterhaven Mobile Estates	Los Angeles	40	52.13	53.35
Olam Spices And Vegetables Inc.	Kings	75	48.38	46.70
The Village Mobile Home Park	Los Angeles	70	45.05	47.04
Callier Water System	San Bernardino	1000	42.13	49.21*
Black Stallion Winery	Napa	25	41.75*	41.75*
Ironwood Camp	San Bernardino	1000	38.38	38.55
Boron CSD	Kern	2500	38.07	37.98
Edgewater Mobile Home Park	Sacramento	40	38.00	37.59
Prunedale MWC	Monterey	252	35.7	32.0

Note: The federal limit for arsenic is 10 ppb. * Average concentrations do not include concentrations from every year. For example, Lakeview Improvement Assn. #1 changed from a non-community water system to a community water system in 2013, and sampling data was only available from 2014 and 2015. Sampling results for Black Stallion Winery were only available for 2015. See Appendix B for annual concentrations in all systems that averaged above 10 ppb.

Health Risks Posed by Arsenic

Arsenic is a chemical element that occurs naturally in geological formations in California and elsewhere, and is also used in a variety of industrial products, including pesticides, paint, and wood preservatives.[17] It is a well-known poison at high doses. At lower doses, researchers have concluded it can cause cancers of the lung, kidney, bladder, skin, and other



organs with prolonged exposure. Any level of exposure, however, carries some risk.[18] According to EPA, the risk of developing cancer after drinking water containing 10 ppb arsenic over a lifetime is 1 in 2,000.[19] This level of risk is almost never 'acceptable' from a regulatory perspective. The agency usually tries to limit lifetime cancer risk to no more than 1 in 10,000, at most. EPA's risk estimate assumes that the cancer risk is linear, meaning if water contains 20 ppb arsenic, those who drink it over a long period of time have a 1 in 1,000 chance of developing cancer. People exposed over shorter periods of time have lower risks, but exposure during childhood may have a greater impact than exposure during adulthood.[20]

Morever, these risk calculations reflected the old thinking. New evidence suggests that the actual cancer risk may be much higher. EPA is currently revising its assessment of cancer risks from arsenic to incorporate more recent science. A 2010 draft of the assessment indicated that the risk of getting cancer from drinking water containing 10 ppb of arsenic is closer to 1 in 136, more than 17 times higher than current assumptions.[21] In addition to causing cancer, arsenic is also a neurotoxin that can harm developing brains at levels at or below the allowable limit.[22] One recent study in Maine, for example, found significant reductions in IQ and other problems in children exposed to arsenic concentrations of 5 to 10 ppb.[23] Specifically, children in homes with more than 5 ppb arsenic in the tap water tested roughly 6 points lower on a full-scale IQ test.[24] While EPA's

Scientific Advisory Board and the most recent studies suggest that the 'safe' level of arsenic is likely much lower than 10 ppb, any concentration higher than 10 is clearly unsafe.

Background on California's Problem

On April 19, 2013, EPA sent a letter to the California Department of Public Health notifying the state that it was out of compliance with the federal Safe Drinking Water Act.[25] The reason was that California's drinking water system was inadequate – providing contaminated water in many poor, rural communities – and the state was not investing enough money to fix the problem. A state investigation that year revealed that 680 community water systems serving 21 million people relied on groundwater that was compromised by one or more contaminants, with the most common being arsenic.[26]

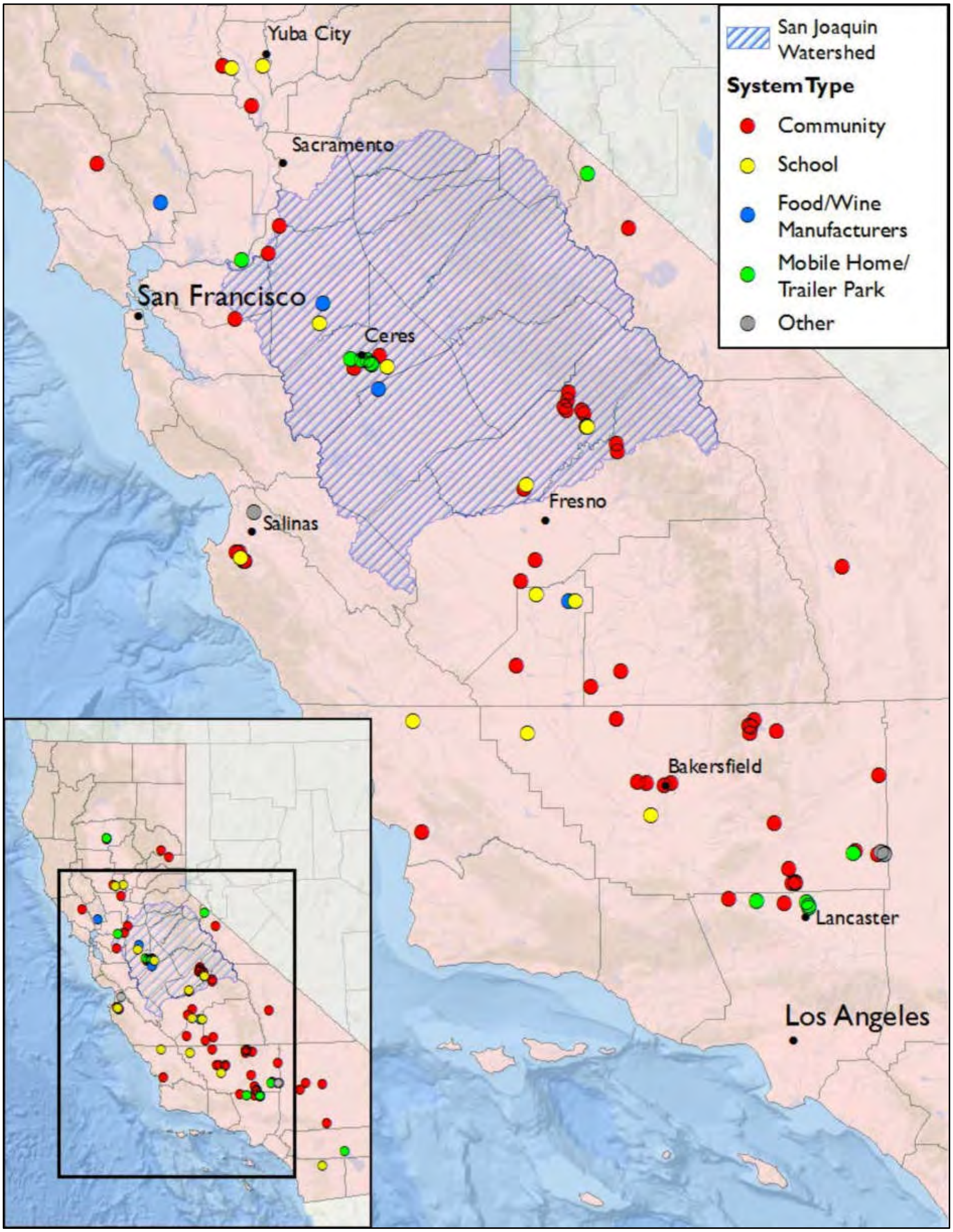
Not all of these 680 water systems provided tap water that had levels of contaminants in excess of federal health standards. In most wealthier and urban communities, the local water utilities treated the groundwater or diluted it with clean water from other wells so that it met the requirements of the federal Safe Drinking Water Act. But in 265 of these communities – often with small populations in rural, isolated areas – the tap water provided to customers had at least one violation of federal standards from 2002 to 2010 for a variety of contaminants, including nitrates from farm fertilizer, according to a 2013 report by the California Department of Health.[27]

In a separate study, researchers at the University of California, Berkeley, examined 464 community water systems serving 1.1 million people in California's San Joaquin Valley, one of the poorest regions in the state, and found that 15 percent of the systems and 14 percent of the people had tap water with arsenic above the federal limit.[28] Of the people exposed, 61 percent were either Latino or African-American. "Community water systems serving higher percentages of people of color had a 260 percent higher chance of having at least one (arsenic) violation," researcher Dr. Carolina L. Balazs and colleagues wrote.[29]

In response to the chronic drinking water problem, Congress had approved $1.5 billion to California over a decade to upgrade its water systems through a program called the Safe Drinking Water State Revolving Fund.[30] Yet because of bureaucratic obstacles and inefficiencies, the state by 2013 had not spent $455 million of those funds – the largest unspent balance of any state. According to EPA's 2013 letter of noncompliance to the California Department of Health, this violated a federal requirement that the state "make *timely* loan or grants using *all available* drinking water funds."[31]

EPA ordered the state to accelerate its efforts to fix public water systems. California Governor Jerry Brown's administration took action in several steps. These included switching control of the state's drinking water program from the Department of Health (where policy focus was dispersed among numerous problems, including drug abuse and AIDS), to the California State Water Resources Control Board (whose only focus is water) under the California Environmental Protection Agency. Since the EPA issued its

Map 1. Public Water Systems with Illegal Levels of Arsenic, 2014-2015



2013 letter of noncompliance, the state has more than doubled the amount of money it is distributing for water system upgrade projects, to an average of $738 million per year, compared to $366 million per year in the period of 2008 to 2012.[32] The unspent balance in the drinking water fund dropped to about $100 million.[33] As a result, EPA in May 2016 decided that California's system was back in compliance.[34]

Recent Analysis of California Records

The problem, however, is still far from fixed. An examination of California's online records by the Environmental Integrity Project (EIP) in May 2016 revealed that there were still 95 community water systems in the state, serving 55,985 people, providing drinking water with levels of arsenic that exceed the federal standard of 10 ppb in 2014 and 2015, according to two-year averages over those years. [35]

Over a longer period of time, 2011 through 2015, state records show 70 systems serving 46,772 residents, that each year have averaged higher than the limit in the Safe Drinking Water Act. These do not include homes on individual private wells, which are not covered by the federal Safe Drinking Water Act.

For a detailed discussion of the methods used to arrive at these numbers, please see Appendix C.

Examples of Drinking Water Contamination

Some of the worst water in community systems in California can be found in the Lakeview Community Association, which serves 160 residents in Shaver Lake (northeast of Fresno, in Fresno County). This community had an average arsenic concentration of nearly nine times the federal limit – 87 ppb – in 2014 and 2015, according to state data.[36]

Four water systems in the unincorporated community of Boron, in San Bernardino County, provided water to about 5,200 residents that had at least three times the safe limit of arsenic in 2014 and 2015.[37] In the city of Keyes in Stanislaus County, 4,891 people have tap water with arsenic concentrations that averaged above the federal limit each year for the last five years. The Pixley Public Utilities District, serving 3,310 residents, had arsenic levels in its drinking water that averaged 50 percent higher than health standards in 2011-2014.

Twelve school districts, serving a combined total of 5,462 students, had arsenic levels that averaged from 30 percent higher to three times the federal limit over the last five years. (See Table 4. Some of these school districts provided explanations, which will be discussed on pages 15 and 16 of this report).

Across California, there were 12 mobile home parks serving 889 people that had average arsenic levels ranging from 20 percent over legal limits to five times the federal standards from 2011 through 2015.[38]

Table 2: Top 10 Mobile Home Parks for Arsenic Contamination

Water System	County	People Served	2014-2015 Avg. (ppb)	2011-2015 Avg. (ppb)
Fountain Trailer Park Water	Kern	68	85.8	83.9
Sierra East Mobile Home Community	Mono	50	54.6	47.0*
Winterhaven Mobile Estates	Los Angeles	40	52.1	53.4
The Village Mobile Home Park	Los Angeles	70	45.1	47.0
Edgewater Mobile Home Park	Sacramento	40	38.0	37.6
Mitchell's Avenue E Mobile Home Park	Los Angeles	26	21.3	21.0
Millstream Mobile Home Park	Tehama	80	20.5	20.0
Country Western Mobile Home Park	Stanislaus	120	20.4	22.2
Saint Anthony Trailer Park	Riverside	300	19.7	21.5
New Orchard Mobile Home Park LLC	Tehama	125	19.6	19.0

Note: federal limit is 10 ppb arsenic. The 2011-2015 average for Sierra East Mobile Home Community reflects fewer than 5 years.

Response from California Officials

The Environmental Integrity Project asked the California State Water Resources Control Board why so many people are still exposed to contaminated drinking water after the state supposedly returned its system to compliance. Officials at the state agency replied in an interview and emails that they had issued orders to nearly all of the local utilities to fix the arsenic problem, but that some local government still need more time to upgrade their systems. In some cases, local utilities are building water filtration systems to remove arsenic, or digging new wells in an effort to extract cleaner water.

"The State Water Board Division of Drinking Water is working with each of these communities to return them to compliance," said Cindy Forbes, Deputy Director of the Division of Drinking Water at the Water Resources Board.[39] "District Office staff are working with these communities to evaluate alternative solutions, including new treatment options, new wells or modification of existing wells, and in some instances consolidation with larger water systems that can provide drinking water that meets all standards. The State Water Board is also helping communities that are struggling financially to reach compliance by offering financial assistance to solutions through low-interest loans and grants."

Public Notification of Drinking Water Violations

As the work continues to upgrade the drinking water systems, however, many citizens of California have not been given warnings to avoid drinking contaminated water.

The background is this: As part of the federal Safe Drinking Water Act, local water utilities are required to periodically test public drinking water systems that serve at least 25 people. When those results show more than 10 ppb arsenic (a standard imposed by EPA in 2001), the utilities must notify residents of the violation in writing by mail "as soon as practical, but within 30 days."[40] In California, however, the warning notices provide a mixed message, stating: "Our water system recently violated a drinking water standard," but also, "you do not need to use an alternative water supply (e.g., bottled water). This is not an emergency…. However, some people who drink water containing arsenic in excess of the (federal limit) over many years may experience skin damage or circulatory system problems, and may have an increased risk to getting cancer."[41] (For the full text of California's notice template for local utilities to use, see Appendix A)

This advisory says two contradictory things: Warning, you have a problem with your water. But don't worry – keep drinking it. If consumers are being told to ignore the federal health standards and keep drinking the contaminated water, there is no reason for the federal Safe Drinking Water standards for arsenic to exist. As stated previously in this report, California is much more clear about warning private well owners to "protect yourself and your family" from arsenic-tainted tap water. And other states – including Wisconsin, Michigan, Maine, and Washington – bluntly advise people not to drink private well water with more than 10 ppb arsenic.

In addition to receiving advisories about violations when they occur, customers also receive annual reports from their local water utilities called "Consumer Confidence Reports." These reports list the levels of more than a dozen different potential contaminants, including bacteria, lead, copper, nitrates and arsenic. When arsenic levels exceed the limit of 10 ppb, these reports provide the numbers and say: "Some people who drink water containing arsenic in excess of the MCL (maximum contaminant level) over many years may experience skin damage or circulatory system problems, and may have an increased risk of getting cancer."[42] But the reports do not tell consumers to stop drinking water with excessive levels of arsenic, and instead hint that it might not be a problem, saying: "Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants."

We asked the California State Water Resources Control Board why the agency doesn't tell people to avoid drinking water with illegal levels of arsenic. In response, Forbes, the deputy director for water, said that the state does provide this kind of blunt and immediate warning for other contaminants that can make consumers sick immediately, such as fecal bacteria. But for arsenic, she said, the threat is more long term. "Arsenic is categorized as a chronic contaminant that poses possible health risks after long-term exposure – 70-plus years of drinking two liters of arsenic-contaminated water a day above the maximum contaminant level," Forbes said. "There are no known acute/immediate health effects that would cause consumers to immediately stop drinking the water."

This answer, however, ignores the fact that many of these California residents have been drinking arsenic-contaminated water for decades. For example, Drs. Carolina Balazs and Isha Ray in 2014 published a study in the American Journal of Public Health in which they interviewed residents with contaminated tap water and found that the current notification requirements are poorly serving people with long-term exposure to pollutants.[43] "A resident from the community of Cutler explained that for years she had received Consumer Confidence Reports indicating that dibromochloropropane levels in the water exceeded the MCL (maximum contaminant level)," Balazs and Ray wrote. "These reports noted that residents should not worry because health impacts were not based on immediate exposure, but rather on lifetime exposure... She had lived in her community for nearly 30 years—so, she asked, should she worry or not? In these situations, water systems simply leave residents to cope with contaminated drinking water as best they can.…In these instances, Safe Drinking Water Act regulations ultimately fail the (low-income) household."[44]

California's records identify more than 46,772 people whose tap water has had average levels of arsenic that have exceeded the federal standards for at least five years, from 2011 to 2015. But there is no reason to believe that these people received cleaner water before this. The longer a person drinks water contaminated with excessive levels of arsenic, the higher the increased risk of cancer. In much the same way, smoking a single cigarette is not an immediate health threat, in that it will instantly kill a person. But the longer a person smokes, the worse the health threat. For this reason, California would better protect public health if it told people to stop drinking arsenic-tainted water now, just as health warnings on tobacco required by the U.S. Food and Drug Administration advise, "WARNING: Quitting smoking now greatly reduces serious risks to your health." These advisories do not state, "WARNING: You do not need to change your smoking habits."

Evolution of the Science on Arsenic

One reason for stronger warning language is that scientific research continues to show that arsenic causes health problems – including brain damage in children -- at lower levels than previously thought.

The history of EPA's arsenic rule reflects the continuing evolution of scientific knowledge about the harms that even low levels of the element can cause. Back in 1996, Congress amended the Safe Drinking Water Act and directed EPA to establish new limits for arsenic to replace the old standard of 50 ppb. Based on the best available research, EPA proposed a limit of 5 ppb in 2000. Because arsenic is a carcinogen, some public health experts consider any level above zero to pose some risk. EPA then revised its proposal, based in part on cost considerations, and finalized a new arsenic standard of 10 ppb in 2001.

The EPA Administrator at the time, Christine Todd Whitman, explained that "the 10 ppb protects public health based on the best available science and ensures that the cost of the standard is achievable."[45] The new regulations required that public water systems across the U.S. meet the new standard by January 23, 2006.[46] The law allowed states to grant exemptions until January 23, 2015, for some small community water systems that had trouble complying.[47]

The 2014 Maine study discussed earlier in this report found found significant reductions in IQ in children exposed to arsenic concentrations of 5 to 10 ppb.[48] With this new information, EPA should change its own guidance for notification language so that people – especially parents of young children -- receive a clearer warning not to drink contaminated water. A template for warning language on the federal agency's website for drinking water systems with chemical contaminants such as arsenic advises utilities to tell their customers: "Some people who drink water containing arsenic in excess of the MCL (maxiumum contaminant level) over many years may have an increased risk of getting cancer." But the notices also say: "There is nothing you need to do….If you have specific health concerns, consult your doctor."[49] This is a problem, because many lower-income people do not have doctors with whom they can regularly consult about questions like water quality.

Responses from Local Drinking Water Systems

When asked about their drinking water violations by EIP, some of the utilities in California with illegal levels of arsenic replied that their attempts to fix the problem have been hindered by bureaucratic obstacles at the local level. Others indicated they are taking steps to solve the problem, but simply need more time or money. Not all public systems were contacted by EIP or provided answers.

Table 3. Top 10 Residential Water Systems for Arsenic Contamination (Excluding Mobile Home Parks)

System	County	Population Served	2014-2015 avg (ppb)	2011-2015 avg. (ppb)
Lakeview Improvement Association #1	Fresno	160	86.9	86.9*
Corral De Tierra Estates WC	Monterey	45	72.5	78.4
Keeler Community Service District	Inyo	50	71.3	75.6
Quail Valley Water District-Eastside System	Kern	60	70.1	69.1
MD #06 Lake Shore Park	Madera	130	64.3	71.9
Valley Teen Ranch	Madera	50	62.0	120.8
Shaver Lake Point #2	Fresno	210	52.3	42.9
Boron Community Service District	Kern	2500	38.1	38.0
Monterey Park Tract Comm. Service District	Stanislaus	186	31.9	34.3
North Edwards Water District	Kern	600	31.5	31.6

Note: The federal limit is 10 ppb arsenic. Lakeview had fewer than five years of data available.

At the **Lakeview Improvement Association** in Fresno County, 160 people have been receiving drinking water with more than eight times the legal limit of arsenic on average for at least the last five years, according to state data. State records show that on May 16, 2016, the California Water Resources Control Board issued a citation to the association's water system, imposing a fine of $1,000 for its failure to follow the directives of two earlier compliance orders, in 2014 and 2015. "The water system continues to violate the arsenic maximum contaminant level (MCL) and does not appear to be making progress toward the compliance deadline," says the most recent letter from the state. "Additionally, the water system has failed to routinely conduct the public notification of the arsenic MCL violation, as required."

Philip Dutton, an engineer for surrounding Fresno County, said that the Lakeview Association's plan, as expressed verbally, is to test some in-home water filtration systems and see how well they perform.[50] "They've got a few of these (filtration systems) installed in homes, but they are sampling from different technologies to try and identify what is going to be the best long-term alternative," Dutton said. The California State Water Resources Control Board's website already lists which types of filtration technologies work well to remove arsenic.[51]

In **Kettleman City**, in Kings County, 1,450 residents have had tap water with excessive levels of arsenic for decades. The average from 2011 to 2015 was 20 percent above the legal limit, according to state data. "I have a daughter, a little one, who's still brushing her teeth with contaminated water, taking a bath in contaminated water," said Maricela Mares-Alatorre, a city resident, during a recent public hearing of the state water board.[52] The Kettleman City Community Services District has promised local residents that it will build a $9 million water treatment plant, but the project has been repeatedly delayed – with a target to open in the fall of 2016 recently pushed back to 2018.[53]

At the **Corral De Tierra Estates** subdivision in Monterey County, 45 people have been exposed to drinking water with arsenic levels almost eight times the legal limit from at least 2011 through 2016, state records indicate. This small water system has received 10 violations notices from the state for excessive levels of arsenic over the last decade, with the most recent in the first quarter of 2016, when it had 77 ppb of the contaminant (compared to the 10 ppb limit).

The manager of Monterey County's drinking water program, Cheryl Sandoval, said Corral De Tierra Estates is among at least five privately-owned water systems that have been issued corrective orders by the county because they are in violation of the arsenic standard. Solving the problem is taking longer than expected, Sandoval said, and some of the local water utilities are still debating the best path forward. "Dealing with the problem is very complicated," Sandoval said.[54] "They haven't made a lot of progress toward compliance, but they are going to have to." One challenge is that a water treatment plant for even a small system can cost hundreds of thousands of dollars and cause new waste disposal problems, because the plants produce concentrated arsenic sludge that must be handled carefully as a hazardous material. Corral De Tierra Estates and other subdivisions want to try in-home water treatment systems as a systemic solution, but county rules don't allow that, Sandoval said. However, debate over this in-home option continues, because new state regulations may open the door for in-home filtration as a systemic solution in the future.

Meanwhile, as the bureaucratic discussions continue, residents are receiving confusing advice about whether they should drink the water pouring from their taps with illegal levels of arsenic. One recent report from Corral de Tierra Estates to local water consumers, displayed on the state website and sent to homeowners in July 2014, advised people that arsenic levels were eight times above the legal limit.[55] But that fact was buried in the middle of a dense report with lots of numbers that also gave the impression that the exceedance was not a problem. The report told homeowners: "The presence of contaminants does not necessarily indicate that the water poses a health risk."[56]

At the **Quail Valley Water District-Eastside System** in Kern County, 60 residents have been receiving drinking water with seven times the legal limit of arsenic over the last five years, state records show. In April 2015, the state issued a compliance order to the local utility and mandated that it fix the problem by April 2018.

Randy Hardenbrook, Director of the Quail Valley Water District, said the problem should be solved within the next two years because a $5.8 million grant from the state is allowing the district to build a new pipeline. The pipe will be about 8.5 miles long and will connect a part of the system with arsenic-tainted water to a well that has good water.[57] In the interim, local residents receive quarterly letters with data on the arsenic exceedances but are not being provided with bottled water. More importantly, they are not being told to refrain from consuming the contaminated water. "We're not telling them not to drink it," Hardenbrook said, "but we are telling them there are long-term health effects."[58]

At the **Shaver Lake Point #2** subdivision in Fresno County, 210 people have been receiving tap water with more than four times legal levels of arsenic for at least the last five years, according to state data. In January 2015, the state wrote to the water system's administrators and ordered them to come into compliance with the federal and state arsenic limits by December 31, 2016.

With only four months left until the deadline, the arsenic levels remain illegally high and Robert Johnson, President of the Shaver Lake Point Mutual Water Company, said he is still thinking about what to do about the problem.[59] "Currently, it's being researched. We have engineers involved. We have water experts involved, and we are trying to figure it out," Johnson said. He added that building a water filtration system could cost as much as $250,000, so the subdivision is considering trying to blend water from its arsenic-tainted wells with cleaner water from different wells.

Meanwhile, nobody in the community is being warned to avoid the contaminated water. "There is no warning not to drink it. There is no 'non-drink' order out there," said Johnson.[60] When asked if his customers should drink bottled water as a precaution instead of the arsenic-tainted tap water, Johnson said: "It's one of those things, if you want to do it, that's your deal. It's not being recommended. We're not suggesting it. This is per the state of California."

Group Home for Troubled Children

The **Valley Teen Ranch**, a Christian residential treatment group home for 32 court-referred abused and neglected boys in Madera County, has arsenic in its tap water that averaged more than 12 times the federal limit from 2011 through 2015, according to state records.[61] "We've been out of compliance, but no children have gotten sick, no adults have gotten sick," said Connie R. Clendenan, CEO of the nonprofit organization that runs the group home. "Nobody wants to drink the water here because it's brown and nasty."[62]

About five years ago, the state approved a $5 million grant to help the group home solve the problem by linking its small water system to a larger one run by the county. But the work has not started yet. Because of ongoing negotiations at the county level, the fix could still be three years or more away, Clendanan said. Meanwhile, children are being given bottled water and are verbally warned not to drink tap water, although there are no warning signs posted above sinks.

"I want to get out of the water business. I'm in the kid business," Clendenan said. Of the continuing delays in fixing the problem with contaminated water, she said: "Nobody's mad. But it's government, and it takes a lot of time. It's just the stupid county."

Table 4. Schools with Excessive Arsenic in Drinking Water

System	County	Population Served	2014-2015 avg. (ppb)	2011-2015 avg. (ppb)
Kit Carson Elem. School	Kings	510	34.7	34.7*
Washington School WS	Monterey	250	26.1	27.7
MUSD-Nile Garden School	San Joaquin	804	20.9	22.8
Liberty High School	Madera	1340	17.9	20.5*
Island Union School	Kings	300	11.9	18.8
Winship Elementary School	Sutter	38	16.4	17.3*
Lakeside School	Kern	800	16.3	16.9
Barry Elementary School	Sutter	650	15.2	15.3
Pleasant Valley Elementary	San Luis Obispo	100	13.8	14.1
Gratton School	Stanislaus	110	13.5	13.5
North Fork Union School	Madera	350	12.9	12.4
Warner Unified School District	San Diego	250	10.9	11.4
Central Union Elementary	Kings	320	10.1	13.5

*Note: federal limit is10 ppb arsenic. *Indicates systems with monitoring gaps (less than five years available data)*

Arsenic in School Drinking Water

At the **Washington School in Salinas,** California, the tap water serving about 250 students has had almost three times the federal limit of arsenic for the last five years, 28 ppb on average over this time period, compared to the limit of 10 ppb.[63] School Principal Whitney Meyer said that the local school district has been discussing the problem for several years but does not yet have a solution. Meanwhile, students are given bottled water, she said.

"We remind them over and over that they cannot drink the water," Meyer said.[64] "Many of the students live out in this area and their homes are similarly impacted (with arsenic), so they also hear the message at home. We have drinking stations with clean water in every classroom, teaching space, and hallway. The fountains have all been shut down."

At the **Barry Elementary School in Yuba City**, California, the arsenic levels have averaged 50 percent above the federal limit for arsenic over the last five years. Because of the violations, the state issued a compliance order to the school in May 2015. Tom Butcher, Director of Maintenance and Facilities for the school system, said that the school has not yet solved the problem, but is giving bottled water to students as officials try to figure out a solution.[65] Adminstrators of the water system are discussing a consolidation with a larger neighboring system that has better water. "The (state) Water Board indicates a best case scenario of a consolidation in approximately 1.5 years," Butcher said. "Until the consolidation is completed (the school district) will continue to provide bottled drinking water."

At the **Kit Carson Elementary School**, in Hanford, Ca., arsenic levels in drinking water averaged more than three times the legal limit in 2011 through 2014, according to state records. In January 2015, the school solved the problem by connecting its pipes to the water system of the surrounding city,[66] whose arsenic levels are below the federal limits.

At the **Lakeside School in Bakersfield,** California, the arsenic levels in the drinking water averaged more than 70 percent above the federal limit for arsenic over the last five years, 17 ppb compared to the limit of 10 ppb. Ty Bryson, District Superintendent, said that the school notified all families by sending home notice letters with the students and by posting warnings in the office. "We provide bottled drinking water for students and staff," Bryson said. "We drilled an alternate well, but that also had unacceptable levels of contaminant. We are now pursuing an alternative source of drinking water by connecting to a local municipal water source via pipeline."

At the **Gratton School in Denair,** California, the drinking water system has had arsenic levels that averaged 40 percent above the federal limit for arsenic over the last five years, state records indicate. The school's superintendent, Shannon Sanford, said that students have been provided bottled water for the last two years. "Students were initially warned (not to drink the water) and signs were used until fountains were disabled," Sanford said. More recently, the school drilled a new well that will be used for the 2016-2017 school year that should solve the problem.

At the **Island Union School in Lemoore,** California, arsenic levels in the drinking water were nearly twice the federal limit from 2011 to 2015, averaging 18.8 ppb compared to federal limit of 10 ppb, according to state records. Superintendent Charlotte Hines said the school dug a new well in 2015, and provided students and warnings and bottled water in the interim. "We know that bottled water is only a temporary solution," Hines said. "And in an effort to find a permanent solution, the school requested -- and was awarded -- state funding to drill a new well that would meet all primary drinking water standards."[67]

Military Base with Contaminated Water

At the **U.S. Army Base Fort Irwin** in San Bernardino County, 16,000 soldiers live in facilities that have had arsenic in some tap water at levels 50 percent higher than the federal limit from 2011 through 2015, state records indicate. For the last three years, the Army Corps of Engineers has been building a new $100 million water treatment plant at the base to solve the problem. The plant is now undergoing testing and is scheduled to go online in October 2016, base officials indicate.

"The new plant will treat all Fort Irwin water to comply with Safe Drinking Water act Standards for ALL pollutants of concern including …arsenic," said Muhammad A. Bari, Director Public Works at Fort Irwin.[68]

In the interim, soldiers have been provided with bottled water and warned which faucets to avoid, according to base managers.

Vineyards with High Arsenic Levels

In San Joaquin County, the **Delicato Family Vineyards** had arsenic levels in the tap water that averaged 18 ppb from 2011 through 2014, which was 80 percent higher than the federal limits, state records indicate. Kylie Barnett, a spokeswoman for the company, said that the vineyards worked with county officials in 2014 to build a new drinking water system, including by digging two new wells, which brought the arsenic levels down below the federal standard in 2015 and 2016.[69] "The drinking water is not used in production of our wine," Barnett noted. Before the repair, people working at the vineyards and visiting were provided bottled water, she said.

In Napa County, the **Larkmead Vineyards** had drinking water with six times more arsenic than allowed from 2011 through 2013, according to state records. No results were listed for 2014 or 2015, and it is unclear if the drinking water system, which serves 25 people, is used for workers or guests. (Wine making does not generally use tap water.) Emails sent to managers of the vineyard asking about the water were not returned. The researchers of this report also received no response from the **Black Stallion Winery** in Napa County, whose tap water had four times legal limits of arsenic from 2011 through 2015, according to state records.

Conclusion

California is making progress toward solving its drinking water contamination problem. The state has reorganized its drinking water agency, and increased its financial assistance to local utilities to build water treatment systems, dig new wells, and take other steps to resolve the issue. The work, however, is expected to take many more years. In the meantime, tens of thousands of people continue to be exposed to drinking water with illegal levels of arsenic, a carcinogen that could damage the developing brains of children and cause other health problems. And yet, the warnings that some of these residents receive from the government are contradictory and confusing.

Both California and the federal government need to do more to protect consumers, especially the young. This report recommends:

1) California and EPA should both revise the language for written notifications of violations of arsenic standards, so that people are clearly advised to stop drinking contaminated water. If the violations are in schools or group homes, warning signs should also be posted over all sinks and drinking fountains. The state should help provide bottled water as an interim solution.

2) Consumers should be provided more information through the mail about what works and what does not work to remove arsenic from tap water. Residents need to know, for example, that boiling water will not help, but that certain filtration systems can remove the carcinogen. In some cases, residents may need technical help from the state in understanding how to use filtration systems properly.

3) Both Congress and the state government should increase investments in upgrades to California's drinking water systems. This is not only an environmental justice issue, but also a sensible strategy to boost the local economy through the hiring of engineers, construction workers and others to improve local infrastructure.

Counter arguments made by California officials – that the state is already taking action, and that arsenic is not an immediate threat to public health – do not hold water. Although the state has issued enforcement orders to local utilities, some local officials clearly still need more prodding and money to upgrade their water systems. A growing amount of scientific research suggests that arsenic increases the risk of cancer and other diseases and may do so at a lower level than expressed in current federal regulations. Years more of exposure to arsenic-tainted water will only raise the risk of cancer or neurological damage for California residents.

The state and federal governments should advise people to stop drinking contaminated water immediately, just as public health experts urge smokers to change their habits sooner rather than later because it will increase their odds of survival.

With public health warnings, simple and direct is better than bureaucratic and complex, because safe is better than sorry when people's lives and minds are at risk.

APPENDIX A: California's Language for Public Notices about Arsenic Violations

IMPORTANT INFORMATION ABOUT YOUR DRINKING WATER

Este informe contiene información muy importante sobre su agua potable.
Tradúzcalo o hable con alguien que lo entienda bien.

[System] Has Levels of Arsenic Above the Drinking Water Standard

Our water system recently violated a drinking water standard. Although this is not an emergency, as our customers, you have a right to know what you should do, what happened, and what we are doing to correct this situation.

We routinely monitor for the presence of drinking water contaminants. Water sample results received on [date] showed arsenic levels of [level and units]. This is above the standard, or maximum contaminant level (MCL), of 0.010 milligrams per liter.

What should I do?

- **You do not need to use an alternative water supply (e.g., bottled water).**
- This is not an emergency. If it had been, you would have been notified immediately. However, *some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage or circulatory system problems, and may have an increased risk to getting cancer.*
- If you have other health issues concerning the consumption of this water, you may wish to consult your doctor.

What happened? What is being done?

[Describe corrective action]. We anticipate resolving the problem within [estimated time frame].

For more information, please contact [name of contact] at [phone number] or [mailing address].

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, *nursing homes, schools, and businesses). You can do this by posting this public notice in a public place or distributing copies by hand or mail.*

Secondary Notification Requirements

Upon receipt of notification from a person operating a public water system, the following notification must be given within 10 days [Health and Safety Code Section 116450(g)]:

- SCHOOLS: Must notify school employees, students, and parents (if the students are minors).
- RESIDENTIAL RENTAL PROPERTY OWNERS OR MANAGERS (including nursing homes and care facilities): Must notify tenants.
- BUSINESS PROPERTY OWNERS, MANAGERS, OR OPERATORS: Must notify employees of businesses located on the property.

This notice is being sent to you by [system].

State Water System ID#: ___________. Date distributed: ___________.

APPENDIX B: Listing of All California Public Drinking Water Systems with Arsenic Levels that Averaged Over the Federal Limit over the Last Five Years

System Name	County	Pop. Served	2014-2015 Avg (ppb)	2011-2015 Avg (ppb)	
Lakeview Improvement Association #1	Fresno	160	86.9	86.9	^
Fountain Trailer Park Water	Kern	68	85.8	83.9	*
Hungry Gulch Water System	Kern	33	72.6	70.0	*
Corral De Tierra Estates WC	Monterey	45	72.5	78.4	*
Keeler Community Service District	Inyo	50	71.3	75.6	*
Quail Valley Water District-Eastside System	Kern	60	70.1	69.1	*
CSA 70 W-4 Pioneertown	San Bernardino	625	64.5	61.6	*
MD #06 Lake Shore Park	Madera	130	64.3	71.9	*
Valley Teen Ranch	Madera	50	62.0	120.8	*
Sierra East Mobile Home Community	Mono	50	54.6	47.0	^
Shaver Lake Point #2	Fresno	210	52.3	42.9	^
Winterhaven Mobile Estates	Los Angeles	40	52.1	53.4	*
Olam Spices And Vegetables Inc.	Kings	75	48.4	46.7	*

System Name	County	Pop. Served	2014-2015 Avg (ppb)	2011-2015 Avg (ppb)	
The Village Mobile Home Park	Los Angeles	70	45.1	47.0	*
Callier Water System	San Bernardino	1000	42.1	49.2	^
Black Stallion Winery	Napa	25	41.8	41.8	^
Ironwood Camp	San Bernardino	1000	38.4	38.6	*
Boron CSD	Kern	2500	38.1	38.0	*
Edgewater Mobile Home Park	Sacramento	40	38.0	37.6	*
Prunedale MWC	Monterey	252	35.7	32.0	
Kit Carson Elem. School	Kings	510	34.7	34.7	^
Darr Water Co.	San Bernardino	1000	34.3	36.0	*
Monterey Park Tract Community Service District	Stanislaus	186	31.9	34.3	*
North Edwards WD	Kern	600	31.5	31.6	*
Desert Lake Community Service District	Kern	700	31.0	32.5	*
Locke Water Works Co [SWS]	Sacramento	80	29.5	29.1	*
Lucky 18 On Rosamond, LLC.	Kern	73	28.0	24.3	*
Washington School WS	Monterey	250	26.1	27.7	*
Rancho Marina	Sacramento	250	24.0	30.1	*
Colusa Co. WWD #1 - Grimes	Colusa	500	23.9	24.7	*
Bridgeport PUD	Mono	850	23.3	24.0	*
Country Hills Estates	San Luis Obispo	60	23.0	26.8	^
Doubletree Ranch Water System	Contra Costa	49	21.6	22.4	*
Mitchell's Avenue E Mobile Home Park	Los Angeles	26	21.3	21.0	*
Vista Del Toro WS	Monterey	87	21.0	20.4	*
MUSD-Nile Garden School	San Joaquin	804	20.9	22.8	*
Country Villa Apts.	Stanislaus	30	20.8	21.1	*
Millstream Mobile Home Park	Tehama	80	20.5	20.0	*
Country Western Mobile Home Park	Stanislaus	120	20.4	22.2	*
Saint Anthony Trailer Park	Riverside	300	19.7	21.5	*
New Orchard Mobile Home Park LLC	Tehama	125	19.6	19.0	*
MD #24 Teaford Meadow Lakes	Madera	150	19.0	12.5	
William Fisher Memorial Water Company	Kern	53	19.0	18.4	*
Ceres West Mobile Home Park	Stanislaus	161	18.9	18.0	*
Boulder Canyon Water Association	Kern	28	18.4	17.9	*
Lakeview Ranchos Mutual Water Company	Kern	120	18.1	22.4	*
Liberty High School	Madera	1340	17.9	20.5	^
Sutter Co. WWD #1 (Robbins)	Sutter	350	17.9	18.1	*
MD #42 Still Meadow	Madera	100	17.7	17.7	^
Maher Mutual Water Company	Kern	150	17.7	20.8	*
Cedar Valley Mutual Water Co.	Madera	137	17.6	18.6	^
First Mutual Water System	Kern	35	17.5	15.1	*
Sierra Co. W.W.D #1 Calpine	Sierra	225	17.0	14.1	*
Bar-Len MWC	San Bernardino	124	16.6	16.2	*

System Name	County	Pop. Served	2014-2015 Avg (ppb)	2011-2015 Avg (ppb)	
Winship Elementary School	Sutter	38	16.4	17.3	^
Lakeside School	Kern	800	16.3	16.9	*
Lanare Community Services Dist	Fresno	660	16.2	17.3	*
Delicato Vineyards	San Joaquin	25	15.6	18.3	^
Fourth Street Water System	Kern	56	15.6	14.0	*
Barry Elementary School	Sutter	650	15.2	15.3	*
Rand Communities Water District	Kern	450	15.1	15.3	*
US Army Fort Irwin	San Bernardino	16000	14.9	15.4	*
Pond Mutual Water Company	Kern	48	14.7	14.4	^
Alpaugh Community Services District	Tulare	1026	14.5	17.8	
Lands Of Promise Mutual Water Associatio	Kern	190	14.4	15.0	*
Pixley Public Util Dist	Tulare	3310	14.4	15.0	*
Caruthers Comm Serv District	Fresno	2497	14.3	15.4	*
Nord Road Water Association	Kern	32	14.2	15.0	*
Lancaster Park Mobile Home Park	Los Angeles	53	14.2	15.0	*
Mesa Del Toro MWC	Monterey	90	14.2	13.1	*
Green Run Mobile Estates	Stanislaus	100	14.0	15.1	*
Pleasant Valley Elementary	San Luis Obispo	100	13.8	14.1	*
Loch Haven Mutual Water Company	Sonoma	50	13.8	13.1	*
Gratton School	Stanislaus	110	13.5	13.5	*
Hillview Water Co-Raymond	Madera	290	13.4	17.8	
Mettler Valley Mutual	Los Angeles	100	13.0	13.1	*
Mobile Plaza Park	Stanislaus	125	13.0	12.7	*
Hilmar Cheese Company	Merced	1000	13.0	13.3	
North Fork Union School	Madera	350	12.9	12.4	*
Yosemite Forks Est Mutual	Madera	110	12.8	11.6	
MD #08 North Fork Water System	Madera	264	12.8	13.9	^
Keyes Community Services Dist.	Stanislaus	4891	12.3	12.8	*
Countryside Mobile Home Park	Stanislaus	60	12.1	12.5	*
Land Project Mutual Water Co.	Los Angeles	1500	12.1	13.5	*
El Adobe POA, Inc.	Kern	200	12.1	12.1	*
Island Union School	Kings	300	11.9	18.8	
Plumas Eureka CSD	Plumas	325	11.6	11.4	*
Kettleman City CSD	Kings	1450	11.4	12.0	*
Laguna Seca WC	Monterey	162	11.1	11.7	*
Los Molinos Comm. Services Dist.	Tehama	1500	11.1	9.0	
R.S. Mutual Water Company	Kern	67	11.0	11.1	*
Oasis Property Owners Association	Kern	100	10.9	10.8	^
Warner Unified School District	San Diego	250	10.9	11.4	^
MD #07 Marina View Heights	Madera	200	10.5	9.3	
Central Union Elementary	Kings	320	10.1	13.5	^

Note: Click on the hyperlink in the name of the system to view the state records for each water system.

** Indicates a system that has had annual concentrations averaging over the federal limit (10 ppb) each year 2011-2015*

^ Indicates that the 2011-2015 average includes years for which data was not available.

APPENDIX C:

Methods

This report is based on public data available from the California Environmental Protection Agency's State Water Resources Control Board (SWRCB) as of May 2016. We downloaded the SWRCB's Water Quality Analyses Database Files for 2011-2016 and identified public water systems that had arsenic concentrations that exceeded the 10 ppb Maximum Contaminant Level, targeting the systems with frequent exceedances between 2011 and 2015. The SWRCB database contained results for each water source used by a drinking water system, such as wells, treated or blended water, and standby wells that are only allowed to be used for a few days during a year. SWRCB warns users of its database that results in the database may not reflect the quality of water that systems actually served their customers.

Calculating average arsenic concentrations

- We calculated the average arsenic concentration from each individual water source at each water system using the sampling results available in SWRCB's database as of May 2016. Some sampling results from the end of 2015 may not have been available in the database at the time we downloaded the data in May.

- We reviewed each water system's source descriptions to determine which sources represented water served to consumers and whether the source should be included in the system-wide average arsenic concentration. For example, if the database showed that a system had two groundwater wells and a 'treated' source, we assumed that consumers would be served the treated source if results for that treated source were available each year. If the database listed a treated source in 2011, for example, but contained no data from that source for the following years, we excluded that source from the average because it was not clear if the system continued treating water for arsenic. If a system listed a source as inactive or as a 'standby' option, we excluded that source from the analysis because we could not determine when or if the water was used. We compared the selected sources with available Consumer Confidence Reports available through California's Drinking Water Watch system and narrative information in public SWRCB enforcement action documents to verify, to the extent possible, that the sources we selected represented water that was provided to consumers. If no information was available for a particular system, we relied on the assumptions described above (i.e. inactive and standby sources were not used, treated sources were used instead of untreated sources when concentrations were available for each year). We did not include purchased water sources.

- After identifying individual sources, we calculated the system's annual average arsenic concentration using the annual average concentrations from each source. The average concentrations during the two-year period between 2014 and 2015 and the five year period between 2011 and 2015 are time-weighted average concentrations (i.e. we averaged the annual average concentrations from each year). This method is similar to how the California EPA's Office of Environmental Health Hazard Assessment calculated average concentrations at drinking water systems for use in it's 2014 CalEnviroScreen 2.0 tool, except we focused on annual average concentrations from 2011-2015, rather than a single average concentration from 2005-2013.

- We excluded entire systems from the analysis if a) they were inactive, b) the available data and source descriptions did not allow us to confidently assume that customers received the sampled water at their taps, and c) the average concentration over the most recent two years (2014-2015) fell below the MCL.

Mapping Public Water Systems

To map water system locations, we found the centroids of public water system boundaries from the California Environmental Health Tracking Program's Water Systems Geographic Reporting Tool, or Water Boundary Tool (WBT). For systems without boundaries in the WBT, we determined coordinates from the addresses in the SWRCB Water Quality Analysis database files and the California Drinking Water Watch system.

Notes

[1] Based on averages for 2014-2015. Numbers in this report from the California State Water Control Resources Board online database, "Drinking Water Watch," https://sdwis.waterboards.ca.gov/PDWW/ Records accessed May, 2016.
[2] U.S. EPA (1998), Integrated Risk Information System, Inorganic Arsenic, available at http://www.epa.gov/iris/subst/0278.htm.
[3] Carolina L. Balazs, Rachel Morello-Frosch, Alan E. Hubbard and Isha Ray, "Environmental justice implications of arsenic contamination in California's San Joaquin Valley: a cross-sectional, cluster-design examining exposure and compliance in community drinking water systems," Environmental Health, 2012. Link: https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-11-84
[4] California State Water Control Resources Board online database, "Drinking Water Watch," https://sdwis.waterboards.ca.gov/PDWW/ Records accessed May. Records show 51,306 residents receiving drinking water from 2011-2015 with annual averages of more than 10 ppb.

[5] California Code of Regulations Title 22, Chapter 15, Section 64463.4(b)] reglations require notifications for arsenic exceedances. The California State Water Resources Board template for the language in notifications to be sent out by local water utilities is available on state agency's website at: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Notices.shtml.

[6] California State Water Resources Control Board website, link: http://www.waterboards.ca.gov/drinking_water/certlic/device/watertreatmentdevices.shtml
[7] Ibid.
[8] Telephone interview with Connie R. Clendenan, CEO of the Valley Teen Ranch nonprofit organization, on August 1, 2016.
[9] Ibid.
[10] Texas Commission on Environmental Quality Notice of Drinking Water Arsenic Violation. Available at https://www.tceq.texas.gov/assets/public/permitting/watersupply/pdw/notices/chemical/arsenic.pdf
[11] Wisconsin Department of Natural Resources, Arsenic, Available at: http://dnr.wi.gov/topic/groundwater/arsenic/, accessed 3/7/2016.
[12] Florida Department of health, Brueau of Environmental Health, "Chemicals in Private Drinking Water Wells Fact Sheet- Arsenic," Available at: http://www.floridahealth.gov/environmental-health/drinking-water/_documents/arsenic-fs.pdf. Accessed 3/7/2016.
[13] See e.g. U.S. Department of Health and Human Services, (2004), "Health Consultation: Arsenic in Private Drinking Water Wells, Cornville, Yavapai County, Arizona," available at: http://www.atsdr.cdc.gov/HAC/pha/ArsenicInPrivate061504-AZ/ArsenicInPrivateHC061504.pdf, accessed 3/8/2016.
[14] Wasserman et al. (2014), A Cross-Sectional Study of Well Water Arsenic and Child IQ in Maine Schoolchildren, Environ Health 13:23-32.
[15] Based on averages for 2014-2015. Numbers from California State Water Control Resources Board online database, "Drinking Water Watch," https://sdwis.waterboards.ca.gov/PDWW/ Records accessed July 28, 2016.
[16] Letter from Jared Blumenfeld, Director of EPA's Region 9 office, to California Department of Public Health Director Dr. Ron Chapman, April 19, 2013. Link: https://www3.epa.gov/region9/water/grants/pdf/CDPHNoticeofNonCompliance.pdf
[17] U.S. Centers for Disease Control, fact sheet on arsenic. Available at http://www.cdc.gov/biomonitoring/pdf/Arsenic_FactSheet.pdf
[18] U.S. EPA (1998), Integrated Risk Information System, Inorganic Arsenic, available at http://www.epa.gov/iris/subst/0278.htm.

[19] The EPA describes arsenic's cancer-causing potency with a 'slope factor' (because it describes the slope of the dose-response curve). The current EPA slope factor for arsenic is 1.5 per mg/kg-d. This number represents the risk that can be expected from consuming one milligram of arsenic per kilogram of body weight per day. The EPA also translates the slope factor into a 'drinking water unit risk' of 5 x 10^{-5} per µg/L. For carcinogens, the formal MCL Goal is always zero. Zero is an unattainable goal, so in most cases the EPA will reduce exposure to carcinogens to a level of 'acceptable risk,' something between 10^{-6} (1 in 1,000,000) to 10^{-4} (1 in 10,000).[19] One way of looking at this range is to assume that risks less than 1 in 1,000,000 are always 'acceptable,' while risks greater than 1 in 10,000 never are. The risks of drinking arsenic at the MCL of 10 µg /L are much higher than 1 in 10,000.

[20] See, e.g., National Research Council, Critical Aspects of EPA's IRIS Assessment of Inorganic Arsenic – Interim Report, 82 – 83 (2013). For health endpoints like childhood IQ, the critical window of exposure is obviously much less, encompassing in utero development and childhood.

[21] EPA web page, "Drinking Water Arsenic Rule History," available at: https://www.epa.gov/dwreginfo/drinking-water-arsenic-rule-history.
[22] ATSDR (2007), Toxicological Profile for Arsenic; Grandjean and Landrigan (2014), Neurobehavioural Effects of Developmental Toxicity, *Lancet Neurol* 13:330-338.

[23] Wasserman et al. (2014), A Cross-Sectional Study of Well Water Arsenic and Child IQ in Maine Schoolchildren, *Environ Health* 13:23-32.

[24] Ibid.

[25] Ibid.
[26] California Water Resources Board report to the California legislature, "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," January 2013. Link: http://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/docs/ab2222.pdf
[27] California Water Resources Board report to the California legislature, "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," January 2013. Link: http://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/docs/ab2222.pdf
[28] Carolina L. Balazs and colleagues, "Environmental Justice Implications of Arsenic Contamination In California's San Joaquin Valley: a Cross-Sectional, Cluster-Design Examining Exposure and Compliance in Community Drinking Water Systems," Environmental Health, November 14, 2012. Link: https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-11-84
[29] Ibid.
[30] Letter from Jared Blumenfeld, Director of EPA's Region 9 office, to California Department of Public Health Director Dr. Ron Chapman, April 19, 2013. Link: https://www3.epa.gov/region9/water/grants/pdf/CDPHNoticeofNonCompliance.pdf
[31] Ibid.
[32] California Water Boards press release, "State Water Board, Drinking Water Revolving Fund Return to Safe Drinking Water Act Compliance," May 26, 2016. Link: http://www.waterboards.ca.gov/press_room/press_releases/2016/pr052616_cap_release.pdf
[33] Ibid.
[34] Ibid.
[35] Based on averages for 2014-2015. Numbers from California State Water Control Resources Board online database, "Drinking Water Watch," https://sdwis.waterboards.ca.gov/PDWW/ Records accessed July 28, 2016.
[36] Ibid.
[37] Ibid.
[38] Ibid.
[39] Email from Andrew DiLuccia, Public Information Officer for the California State Water Resources Control Board, containing quote from Cindy Forbes, Deputy Director of the Division of Drinking Water, on August 8, 2016. Telephone interview with Forbes on August 4, 2016.
[40] California State Water Resources Board, template for public notification of Arsenic MCL Exceedance, Link: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Notices.shtml
[41] Ibid.
[42] Example of Consumer Confidence Report for a California system can be found on the state website: https://sdwis.waterboards.ca.gov/PDWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=370&tinwsys_st_code=CA&wsnumber=CA1000071#
[43] Carolina L. Balazs and Isha Ray, "The Drinking Water Disparities Framework: On the Origins and Persistence of Inequities in Exposure," American Journal of Public Health, April 2014, Vol 104, No. 4. Link: http://www.ncbi.nlm.nih.gov/pubmed/24524500.
[44] Ibid.
[45] Ibid.
[46] Ibid.
[47] 40 CFR 142.20(a)(2)
[48] Wasserman et al. (2014), A Cross-Sectional Study of Well Water Arsenic and Child IQ in Maine Schoolchildren, Environ Health 13:23-32.
[49] U.S. EPA public notification template on EPA website: https://www.epa.gov/dwreginfo/public-notification-templates-community-and-non-transient-non-community-water-systems
[50] Telephone interview on August 25, 2016 with Philip Dutton, engineer for Fresno County.
[51] California State Water Resources Control Board website, http://www.waterboards.ca.gov/drinking_water/certlic/device/watertreatmentdevices.shtml
[52] KFSN-TV, ABC-30 in Fresno, report "Kettleman City Residents Get Answers to Questions about Construction of Water Treatment Plant," August 31, 2016. Link: http://abc30.com/society/kettleman-city-residents-get-answers-to-questions-about-construction-of-water-treatment-plant/1493726/
[53] Ibid.

[54] Telephone interview on August 26, 2016, with Cheryl Sandoval, Supervising Environmental Health Specialist and Manager of Monterey County's drinking water program.
[55] Corral de Tierra Water Company 2013 Consumer Confidence Report, dated July 11, 2014.
[56] Ibid.
[57] Telephone interview on August 26, 2016, with Randy Hardenbrook, Director of the Quail Valley Water District.
[58] Ibid.
[59] Telephone interview on August 25, 2016, with Robert Johnson, President of the Shaver Lake Point 2 Mutual Water Company.
[60] Ibid.
[61] Numbers from California State Water Control Resources Board online database, "Drinking Water Watch," https://sdwis.waterboards.ca.gov/PDWW/ Records accessed July 28, 2016.
[62] Telephone interview with Connie R. Clendenan, CEO of the Valley Teen Ranch nonprofit organization, on August 1, 2016.
[63] Numbers from California State Water Control Resources Board online database, "Drinking Water Watch," https://sdwis.waterboards.ca.gov/PDWW/ Records accessed July 28, 2016
[64] Email from Whitney Meyer, Principal of the Washington School in Salinas, California, on August 1, 2016.
[65] Email from Robert Shemwell, Assistant Superintendent of Business Services of the Yuba City Unified School District, containing quote from Tom Butcher,Director of Maintenance and Facilities, on August 12, 2016.
[66] Email on August 24, 2016, from Liliana Stransky of the Kings County Department of Public Health.
[67] Email from Superintendent Charlotte Hines of the Island Union School in Lemoore, California, August 4, 2016.
[68] Email from Kenneth Drylie, Public Affairs Specialist at Fort Irwin, containing quotes from Muhammad A. Bari, Director Public Works at the forst, on August 11, 2016.
[69] Email from Kylie Barnett, Director Public Relations at Delicato Family Vineyards, August 10, 2016.

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From:	Ben King
To:	Mary Fahey
Cc:	Gosselin, Paul; Buck, Christina; Ben King
Subject:	FW: Hydrogeology of the Sutter Basin, California 1971
Date:	Monday, November 18, 2019 2:44:12 PM
Attachments:	George Curtin Sutter Basin.pdf USGS Sacramento Valley Tectonism.pdf

---

Hi Mary,

Here is the cite of the first paragraph of the Abstract for Hydrogeology of the Sutter Basin by George Curtin:

"***A mound of saline water exists in continental sediments between two fresh water rivers in the Sutter Basin of the Sacramento Valley, California. This saline water has moved from the marine sediments, at depth, upward along the Sutter Basin Fault and then through 2,000 feet of alluvium."***

I have also attached the USGS Sacramento Valley Tectonism Study published in 1987. This USGS report explains the faults surrounding the ancient Sutter Buttes volcano and the fact that the faults are still active.

As I mentioned, I am concerned about the potential for further later movement of the salt water northward towards the Butte Sink that may be cause by future groundwater substitution on east side of the Sacramento River near Colusa. As you know Colusa, Grimes, Sutter and Meridian use groundwater. The other issue that came to my mind was the potential for further deterioration due to future earthquake activity.

Perhaps – this area might be a good candidate for an Aerial mapping if the mapping could detect higher chloride levels in the groundwater?

Thanks again

Ben King

Orchard Irrigation in Sutter-Yuba Area

STATE OF CALIFORNIA
EARL WARREN
GOVERNOR

PUBLICATION OF
STATE WATER RESOURCES BOARD

Bulletin No. 6

SUTTER-YUBA COUNTIES INVESTIGATION

September, 1952

Additional copies of this publication may be obtained from Documents Section, Division of Printing, 11th and O Streets, Sacramento

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EARL WARREN
GOVERNOR

STATE OF CALIFORNIA

STATE WATER RESOURCES BOARD

PUBLIC WORKS BUILDING
SACRAMENTO 5, CALIFORNIA

August 27, 1952

ADDRESS ALL COMMUNICATIONS TO THE SECRETARY

HONORABLE EARL WARREN, *Governor, and*
Members of the Legislature of
the State of California

GENTLEMEN: I have the honor to transmit herewith Bulletin No. 6 of the State Water Resources Board, entitled "Sutter-Yuba Counties Investigation," as authorized by Chapter 1514, Statutes of 1945, as amended.

Under provisions of the cited statute, an agreement dated October 7, 1947, was entered into between the State Water Resources Board, the Counties of Sutter and Yuba, and the Department of Public Works acting through the agency of the State Engineer. The agreement provided for

> ". . . investigation and report on the underground water supply of the valley floor in the Counties of Sutter and Yuba, including quality, replenishment and utilization thereof, and, if possible, a method or methods of solving the problems involved . . .",

and authorized funds to meet the costs of the investigation for one year. A supplemental agreement executed by the same parties on December 3, 1948, authorized funds to complete the investigation and report.

The Sutter-Yuba Counties Investigation was conducted and Bulletin No. 6 was prepared by the Division of Water Resources of the Department of Public Works, under the direction of the State Water Resources Board. Funds to meet the cost of investigation and report were provided as follows: State of California (State Water Resources Board), $20,000; County of Sutter, $10,000; and County of Yuba, $10,000. Additional funds provided by the Legislature have been expended by the State Water Resources Board in connection with the current State-Wide Water Resources Investigation, certain results of which were used in connection with the Sutter-Yuba Counties Investigation.

Bulletin No. 6 contains an inventory of the underground and surface water resources of the valley floor in the Counties of Sutter and Yuba, estimates of present and probable ultimate water utilization, estimates of present and probable ultimate supplemental water requirements, and preliminary plans and cost estimates for water development works.

Very truly yours,

C. A. Griffith
Chairman

ACKNOWLEDGMENT

Valuable assistance and data used in the investigation were contributed by agencies of the Federal Government, cities, counties, public districts, and by private companies and individuals. This cooperation is gratefully acknowledged.

Special mention is also made of the helpful cooperation of the Boards of Supervisors of the Counties of Sutter and Yuba, the Sutter County Water Council, the Yuba County Water Development Association, the Yuba County Farm Advisor, the California Water Service Company, and the Pacific Gas and Electric Company.

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CHAPTER I

INTRODUCTION

In common with many other parts of California, the area under this investigation has recently experienced an increase in water utilization, and as a result is confronted with a need for more complete conservation of its water resources. An accelerated increase in ground water use in recent years, combined with progressive lowering of pumping levels and deterioration in quality of water at a number of wells, has brought about local concern regarding the adequacy of the ground water resources of Sutter and Yuba Counties.

AUTHORIZATION FOR INVESTIGATION

In consideration of the adverse ground water situation in Sutter and Yuba Counties, members of the Sutter County Water Council and the Yuba County Water Development Committee appeared before the State Water Resources Board at Sacramento on August 1, 1947, and proposed a state-county cooperative survey of ground water supplies of valley floor lands of the two counties. The Board referred the request to the State Engineer for preliminary examination and report on the need for such an investigation, and an estimate of its scope, duration, and cost.

The State Water Resources Board on September 5, 1947, approved a recommendation by the State Engineer, based on findings of the preliminary examination, for a two-year cooperative investigation, and authorized negotiation of an agreement with local agencies. The agreement, between the State Water Resources Board, the Counties of Sutter and Yuba, and the State Department of Public Works acting through the agency of the State Engineer, was executed on October 7, 1947. It provided that the work under the agreement "shall consist of investigation and report on the underground water supply of the valley floor lands in the Counties of Sutter and Yuba, including quality, replenishment and utilization thereof, and, if possible, a method or methods of solving the problems involved." This agreement authorized the provision of funds to meet the costs of investigation for one year. A supplemental agreement executed by the same parties on December 3, 1948, authorized funds to complete the investigation and report.

Funds to meet the costs of the investigation and report to the extent of $40,000 were provided as follows: State of California (State Water Resources Board), $20,000; County of Sutter, $10,000; and County of Yuba, $10,000. Additional funds have been expended in investigation of the Sutter-Yuba Area by the State Water Resources Board in connection with the current State-wide Water Resources Investigation, certain results of which have been used in connection with the Sutter-Yuba Counties Investigation.

Copies of the two agreements between the State Water Resources Board, the Counties of Sutter and Yuba, and the Department of Public Works, are included in Appendix A.

RELATED INVESTIGATIONS AND REPORTS

The following reports of prior investigations, containing information pertinent to evaluation of ground water problems in Sutter and Yuba Counties, were reviewed in connection with the current investigation:

"Soil Survey of the Marysville Area, California, 1909," by A. T. Strahorn, W. W. Mackie, L. C. Holmes, H. L. Westover, and Cornelius Van Duyne. Bureau of Soils, United States Department of Agriculture. October 25, 1911.

"Geology and Ground Water Resources of the Sacramento Valley, California," by Kirk Bryan. United States Geological Survey, Water-Supply Paper 495. 1923.

"Preliminary Report on the Proposed Sutter Irrigation District," by Milo B. Williams, Consulting Engineer. Typewritten. March 12, 1931.

"Report on Ground Water Conditions in the Proposed Sutter Irrigation District," by S. T. Harding, Consulting Engineer. Unpublished. November, 1931.

"Sacramento River Basin," Bulletin No. 26, Division of Water Resources, California State Department of Public Works. 1931.

"Memorandum on Ground Water Conditions in Area of Proposed Sutter Irrigation District During 1932," by S. T. Harding, Consulting Engineer. Unpublished. February, 1933.

"Sacramento Valley Water Investigations — Agricultural Aspects," Bureau of Agricultural Economics, United States Department of Agriculture. Mimeographed. March, 1944.

"Salt-Balance Conditions of Reclamation District No. 1500 in Sutter Basin for the Year Ending December 31, 1946," by L. V. Wilcox. Mimeographed. June, 1947.

"Salt-Balance Conditions of Reclamation District No. 1500 in Sutter Basin for the Year Ending December 31, 1947," by L. V. Wilcox. Mimeographed. April, 1948.

"Water Resources of California," Bulletin No. 1, California State Water Resources Board. 1951.

The Division of Water Resources is presently conducting surveys and studies for the State-wide Water Resources Investigation, authorized by Chapter 1541, Statutes of 1947. This investigation, under direction of the State Water Resources Board, has as its objective the formulation of The California Water Plan for full conservation, control, and utilization of the State's water resources to meet present and future water needs for all beneficial purposes and uses in all parts of the State insofar as practicable. Surveys and studies are also being conducted by the Division of Water Resources for the Survey of Mountainous Areas, authorized by Chapter 30, Statutes of 1947. This investigation, which is coordinated with the state-wide investigation, has as its primary objective the determination of probable ultimate water requirements of certain counties of the Sierra Nevada, and the formulation of plans for projects which will meet those requirements. Results of both of the foregoing investigations will have direct bearing on solutions to the water problems of the Sutter-Yuba Area, particularly with regard to plans to meet supplemental water requirements of the area under ultimate conditions of cultural development.

SCOPE OF INVESTIGATION AND REPORT

It has been stated that under provisions of the authorizing agreements the general objectives of the Sutter-Yuba Counties Investigation included investigation and study of the underground water supply of valley floor lands in the investigational area, including quality, replenishment and utilization thereof, and, if possible, a method or methods of solving the water problems involved. In attaining these objectives it was necessary that the scope of the investigation include full consideration of surface as well as ground water supplies, and that it involve determination of present and ultimate water utilization and supplemental water requirements.

Field work in the investigational area, and office studies, as authorized by the initial and supplemental cooperative agreements, commenced in October, 1947, and continued into 1952.

In the course of the investigation, available precipitation and stream flow records were collected and compiled in order to evaluate water supplies available to the investigational area. Five new stream gaging stations were installed and maintained to supplement the available hydrographic data. These stations were on Pleasant Grove Creek at Lincoln Road, Auburn Ravine at Highway 99E, Coon Creek at Highway 99E, Dry Creek near Waldo, and South Honcut Creek at La Porte Road.

In order to determine ground water storage capacity and yield, geologic features of the ground water basin underlying the investigational area were investigated and reported on by the Ground Water Branch of the United States Geological Survey, under terms of a cooperative agreement with the Department of Public Works. This survey included the collection and study of about 700 well logs throughout the area. The report of the Geological Survey is included as Appendix B.

The effects of draft on and replenishment of the ground water basin were determined by measurements of static ground water levels made at about 850 wells during each spring and fall of the period of investigation. These wells were chosen to form a comprehensive measuring grid over the entire area. In addition, measurements to determine monthly fluctuations of water levels were made at approximately 90 control wells.

Present land use in the investigational area was determined by a complete survey of all culture on valley floor lands. This survey was conducted in 1948, and checked in 1949 to determine changes. The total area surveyed was about 327,000 acres. The cultural survey data were used in conjunction with available data on unit water use to determine total present water utilization in the investigational area.

In order to determine future water utilization, all valley floor lands were classified with regard to their suitability for irrigated agriculture. This involved collection, field checking, and re-evaluation of land classification data from the United States Bureau of Reclamation, supplemented by data from field surveys conducted by the Division of Water Resources.

Current irrigation practices in the investigational area were surveyed in order to determine unit application of water to important crops on lands of various soil types. During the 1948 irrigation season records of application of water were collected at 35 plots, and during the following season at 21 plots. The data collected included records of pump discharge, acreage served, crops irrigated, number and period of irrigations, and amount of water applied.

Studies were made of the mineral quality of surface and ground waters, in order to evaluate their suitability for irrigation use, and to determine the cause of degradation in their mineral quality during recent years. Data used in these studies included some 200 partial and 38 complete mineral analyses of ground water from wells. In addition, a large number of analyses of surface water supplies, covering the period since 1943, were collected and studied.

Field reconnaissance surveys, including geologic examinations, were made to locate and evaluate possible dam and reservoir sites for conservation of surface runoff. Reconnaissance surveys were also made of possible routes for conveyance of water to areas of use.

Results of the Sutter-Yuba Counties Investigation are presented in this report in the four ensuing chapters. Chapter II, "Water Supply," contains evaluations of precipitation, surface and subsurface inflow and outflow, and imports of water. It also includes results of investigation and study of the ground water basin, and contains data regarding mineral quality of surface and ground waters. Chapter III, "Water Utilization and Supplemental Requirements," includes data and estimates of present and probable ultimate land use and water utilization, and contains estimates of present and probable ultimate supplemental water requirements. It also includes available data on demands for water with respect to rates, times, and places of delivery. Chapter IV, "Plans for Water Development," describes preliminary plans for conservation and utilization of available water supplies to meet supplemental water requirements, including operation and yield studies, design considerations and criteria, and cost estimates. Chapter V, "Conclusions and Recommendations," includes conclusions and recommendations resulting from the investigation and studies.

AREA UNDER INVESTIGATION

The area under investigation comprises those portions of the valley floor of Sutter and Yuba Counties which are in whole or in part served by ground water, and has been designated the "Sutter-Yuba Area." It includes the portions of Sutter County situated east of Feather River, Sutter By-pass, and a north-south line through the center of Sutter Buttes. It includes the portion of Yuba County lying on the Sacramento Valley floor from Feather River on the west to a line marking the approximate limit of the ground water service area near the base of the foothills on the east.

The Sutter-Yuba Area is situated on the east side of the central portion of the Sacramento Valley, and its southern boundary is about 10 miles north of the City of Sacramento. The area extends north and south for a distance of about 39 miles, varying in width from about 6 to about 19 miles. Its location is indicated on Plate 1, "Location of Sutter-Yuba Area," and the area is shown in greater detail on Plate 2, entitled "Hydrologic Zones and Organized Water Agencies, 1952."

In order to facilitate reference to its several parts, the Sutter-Yuba Area was divided into four principal zones, based on geographical considerations and on respective types of water service and sources of water supply. These were designated "West Side Zone," "Northeast Zone," "East Central Zone," and "South Side Zone," and are shown on Plate 2. The West Side Zone embraces the area between the Butte-Sutter county line and Nicolaus, and west of Feather River. The Northeast Zone consists of lands between Honcut Creek and Yuba River, and east of Feather River. Similarly, the East Central Zone consists of lands between the Yuba and Bear Rivers, and east of Feather River. The South Side Zone comprises those lands lying between Bear River and the Sutter-Sacramento county line, and east of the Feather and Sacramento Rivers. As shown on Plate 2, the West Side Zone was further subdivided into the area generally devoted to orchards and served by ground water, herein designated the "Peach Bowl," and the remainder of the zone which is largely served by surface water.

Drainage Basin

The eastern portion of the Sutter-Yuba Area comprises a gently rolling plain, which merges into nearly flat land over a large part of the central and western portions. The general ground surface slopes gently from east to west. Included valley floor lands lie below an elevation of about 100 feet. The Sutter Buttes, located in the northwest corner of the area, rise to 2,132 feet above sea level.

All watersheds on the west slope of the Sierra Nevada that head between Donner and Fredonyer Passes are tributary to the Sutter-Yuba Area. Their combined drainage areas total about 5,600 square miles. In order of importance, the principal tributary stream systems are those of the Feather, Yuba, and Bear Rivers. Minor tributary streams include Honcut, Dry, Coon, and Pleasant Grove Creeks, and Markham and Auburn Ravines. The extent of the various drainage basins is shown in the following tabulation:

Drainage basin	*Area, in square miles*
Feather River, above Oroville gaging station	3,611
Yuba River, above Smartville gaging station	1,194
Bear River, above gaging station near Wheatland	294
Minor streams, above valley floor, from Wyman Ravine to Pleasant Grove Creek	500
TOTAL	5,600

The tributary watersheds are in a zone of relatively heavy precipitation, and their aggregate mean seasonal natural runoff during the 53-year period from 1894-95 to 1946-47 is estimated to have approximated 1,360 acre-feet per square mile.

The Feather River traverses and roughly bisects the Sutter-Yuba Area from north to south, and joins the Sacramento River near Verona. The Yuba and Bear Rivers are tributary to the Feather within this reach, as are Honcut Creek and Nigger Jack Slough. Reeds, Hutchinson, and Dry Creeks, drain the East Central Zone and are tributary to Bear River within the area. Coon and Pleasant Grove Creeks and Markham and Auburn Ravines drain into Sacramento River near Verona by way of the Cross Canal. Gilsizer Slough, which flows more or less parallel to the Feather River through the West Side Zone and into Sutter By-pass, and Nigger Jack Slough are important as natural surface drains. Wadsworth Canal and its tributaries, together with other minor channels, drain the portion of the West Side Zone outside the Peach Bowl, discharging into Sutter By-pass.

Climate

The climate of the Sutter-Yuba Area is characterized by dry summers with high daytime temperatures and warm nights, and wet winters with moderate temperatures. More than 80 percent of the precipitation occurs during the five-month period from November to March, inclusive. The growing season is long, the 40-year recorded average for Marysville, centrally located in the area, being 273 days between killing frosts. Temperatures at Marysville have ranged from 16° F. to 118° F., and the monthly average for the period from 1871 to 1948 ranges from 46.9° F. in January to 79.3° F. in July.

Geology

The geologic formations of the Sutter-Yuba Area include pre-Cretaceous metamorphic and igneous rocks of the Sierra Nevada block, which extends beneath the valley fill, overlain principally by Tertiary sedimentary formations derived from these and other rocks which are exposed in the Sierra Nevada to the east. The sedimentary rocks are of both marine and continental origin and are frequently interbedded with tuff-breccias. Volcanic rocks are also represented in the area in and about the Sutter Buttes, which are erosional remnants of an extinct Pliocene volcano. Only the sedimentary rocks can be considered as being water-bearing to any appreciable degree. The principal aquifers are composed of continental sediments of Pleistocene and Recent age. These consist of as much as 100 feet of Pleistocene sands and gravels overlain by up to 125 feet of Recent alluvial fan, flood plain, and stream channel deposits.

Soils

Soils of the Sutter-Yuba Area vary in their chemical and physical properties in accordance with differences in parent material, drainage, and age or degree of development since their deposition. The soils may be divided into two broad groups: (1) those derived from recent alluvial depositions, and (2) those derived from old alluvial fans or terraces. The first group may be further divided into stream bottom soils and basin soils.

Stream bottom soils occupy the flood plains immediately adjacent to stream channels generally throughout the area. They consist of unmodified to slightly modified alluvial deposits. These soils are highly productive and suited to a wide variety of crops, and have the highest agricultural value.

Basin soils of the Sutter-Yuba Area occupy large flat basin-like areas in the southwest portion of the West Side Zone and western portion of the South Side Zone. These basin soils are derived largely from fine-grained depositions by flood flows, and have developed under poor drainage conditions. Those areas of basin soils that have been drained and protected by levees from flooding are suitable for production of rice and other shallow-rooted crops.

Soils that have developed from old alluvial fans or terraces occupy most of the remainder of the Sutter-Yuba Area. These soils have undergone considerable physical and chemical change since their deposition and are entirely underlain by hardpan. They are restricted in their agricultural use by the depth of soil over the hardpan, and are only suited to the production of shallow-rooted crops.

Present Development

Development of the eastern portion of the Sacramento Valley has centered in the Sutter-Yuba Area since the first settlements early in the Nineteenth Century. Marysville became an important transportation center during the Gold Rush period, being the head of river traffic to the mining areas. The Counties of Sutter and Yuba embrace a rich agricultural region, and both irrigation and dry farming are of major importance.

The 1950 federal census showed that the population of Sutter County was 26,140, and that of Yuba County 24,240. The principal urban centers, Marysville and Yuba City, are situated only about two miles apart, near the confluence of the Yuba and Feather Rivers, and account for some 31 percent of the total population of the two counties. The 1950 census enumerated 7,856 persons in Yuba City, while 7,777 were counted in Marysville. Wheatland and Live Oak are the largest of a number of small communities, and the rural population is distributed generally throughout the area.

Agricultural development in the Sutter-Yuba Area is said to have begun with the growing of grain about 1845 near the site of Captain John A. Sutter's Hock Farm, south of Yuba City. Early agriculture on the valley floor was stimulated by the influx of settlers during and after the gold rush, but for many years was largely restricted to the growing of dry-farmed grain crops and stock raising. By 1865, a large portion of the area was given over to the production of wheat. Irrigation developed slowly, but it is probable that the first lands on the east side of the Sacramento Valley to receive irrigation water were near the confluence of Honcut Creek and Feather River. Diminishing profits from grain farming, together with the development of more satisfactory pumping plants, gave impetus to the increase in irrigated acreage after 1910. The transition from dry farming to irrigated cropping has continued to this time.

A survey conducted in 1949 as a part of the current investigation showed that irrigated lands in the Sutter-Yuba Area totaled about 149,000 acres, while approximately 140,000 acres were dry-farmed or fallow. Principal irrigated crops, in order of acreage devoted to each crop, were deciduous orchard consisting largely of peaches, and rice, permanent pasture, beans, and alfalfa. Principal dry-farmed crops were barley and wheat.

Industry in the Sutter-Yuba Area is supported largely by agricultural production. About 100 plants are operated during the harvest seasons to can and dehydrate fruits and vegetables, and to dry fruits, nuts, rice, and seed crops. Packing houses for packing fresh fruits and melons, and cold storage and refrigeration plants, have also been established. Several lumber reprocessing and molding plants near Marysville produce finished lumber and by-products. Sand and gravel works supply local demand for aggregates, while concrete pipe, generally used in irrigation distribution systems, is manufactured locally. A large gold dredging field is situated near the edge of the valley floor at Hammonton, south of Yuba River. Electric energy is available from nearby hydroelectric installations.

Water service agencies in the Sutter-Yuba Area are described in Chapter III. However, many public agencies have been organized in the area to deal with the problems of land reclamation and drainage. The provisions of California reclamation district laws have been used extensively to effect the unwatering of low lands and their protection from overflow. Active reclamation districts in the area and data concerning them are listed in the following tabulation:

Reclamation district	*Year organized*	*County*	*Gross area of district, in acres*
No. 10	1913	Yuba	11,300
No. 777	1907	Sutter	12,500
No. 784 (Plumas Lake)	1908	Yuba	19,600
No. 803 (Rideout)	1909	Sutter	2,000
No. 817	1910	Yuba	3,120
No. 823 (Marcuse)	1911	Sutter	2,800
No. 1000 (Natomas)	1911	Sutter, Sacramento	55,100
No. 1001 (Natomas)	1911	Sutter, Placer	31,200
No. 2054	1921	Sutter, Butte	12,300
No. 2056	1921	Sutter, Butte	9,100
No. 2066 (Abbott Lake)	1924	Sutter	603

Portions of Sutter and Yuba Counties are within the boundaries of the Sacramento and San Joaquin Drainage District, which comprises practically all swamp and overflow lands of both the Sacramento and San Joaquin Valleys. This large district was formed in 1911. Two levee districts in Sutter County, organized during the period of early agricultural development, built levees to protect eastern Sutter Basin lands from floods and overflow of Feather River. These districts, Sutter County Levee District No. 1, organized in 1873, and Sutter County Levee District No. 2, organized in 1879, contain 44,000 and 17,500 acres, respectively. The Sutter By-pass, and levees of the Feather and Yuba Rivers, are parts of the Sacramento River Flood Control Project. The function of Sutter By-pass is to receive and convey excess flood waters of Sacramento River and Butte Basin through Sutter Basin.

Areas included within the boundaries of the foregoing agencies, together with water service agencies in the Sutter-Yuba Area, are shown on Plate 2.

CHAPTER II
WATER SUPPLY

The sources of water supply of the Sutter-Yuba Area are direct precipitation on overlying lands, tributary surface and subsurface inflow, and imports by surface canals of water for irrigation. The water supply of the area is considered and evaluated in this chapter under the general headings "Precipitation," "Runoff," "Imported and Exported Water," "Underground Hydrology," and "Quality of Water."

The following terms are used as defined in connection with the discussion of water supply in this report:

Annual—This refers to the 12-month period from January 1st of a given year through December 31st of the same year, sometimes termed the "calendar year."

Seasonal—This refers to any 12-month period other than the calendar year.

Precipitation Season—This refers to the 12-month period from July 1st of a given year through June 30th of the following year.

Runoff Season—This refers to the 12-month period from October 1st of a given year through September 30th of the following year.

Investigational Seasons—This is used in reference to the two runoff seasons of 1947-48 and 1948-49, during which most of the field work on the Sutter-Yuba Counties Investigation was performed.

Mean Period—This is used in reference to periods chosen to represent conditions of water supply and climate over a long period of years.

Base Period—This is used in reference to periods chosen for detailed hydrologic analysis because prevailing conditions of water supply and climate were approximately equivalent to mean conditions, and because adequate data for such hydrologic analysis were available.

In studies for the current State-wide Water Resources Investigation it was determined that the 50 years from 1897-98 to 1946-47, inclusive, constituted the most satisfactory period for estimating mean seasonal precipitation generally throughout California. Similarly, the 53-year period from 1894-95 to 1946-47, inclusive, was selected for determining mean seasonal runoff. In studies for the Sutter-Yuba Area, conditions during these periods were considered representative of mean conditions of water supply and climate.

Studies were made to select a base period for hydrologic analysis of the Sutter-Yuba Area during which conditions of water supply and climate would approximate mean conditions, and for which adequate data on inflow, outflow, and ground water levels would be available. It was determined that the nine-year period from 1939-40 to 1947-48, inclusive, was the most satisfactory in this respect. Conditions during this chosen base period so closely approached conditions prevailing during the mean period that they were considered to be equivalent. For this reason, determined relationships between base period water supply and present and probable ultimate water utilization were assumed to be equivalent to corresponding relationships which might be expected under mean conditions of water supply and climate.

PRECIPITATION

The Sutter-Yuba Area lies within the southern fringe of storms which periodically sweep inland from the North Pacific during winter months. Although the rainfall resulting from these storms is moderate on the average, direct precipitation provides a substantial portion of the water supply of the area.

Precipitation Stations and Records

Fifteen precipitation stations in or adjacent to the Sutter-Yuba Area have unbroken records of 10 years duration or longer. These stations are fairly well distributed areally and their records were sufficient to provide an adequate pattern of precipitation. All of the records of precipitation have been published in bulletins of the United States Weather Bureau, with exception of the record obtained by the Sutter Basin Corporation for the station at Robbins. The Robbins record is included as Appendix C to this report. Locations of the precipitation stations are shown on Plate 3, "Lines of Equal Mean Seasonal Precipitation," with map reference numbers corresponding to those utilized in State Water Resources Board Bulletin No. 1, "Water Resources of California." The stations and map reference numbers are listed in Table 1, together with elevations of the stations, periods and sources of record, and mean, maximum, and minimum seasonal precipitation. In those instances where it was necessary, precipitation records were extended to cover the 50-year mean period by comparison with records of nearby stations having records covering this period.

Precipitation Characteristics

Because of the uniformity of the general precipitation pattern in the Sutter-Yuba Area, as indicated on Plate 3, and the central location of Marysville, precipitation at Marysville was considered to be fairly representative of rainfall over the area. A record of precipitation at Marysville was available from a United States Weather Bureau station maintained since

TABLE 1

MEAN, MAXIMUM, AND MINIMUM SEASONAL PRECIPITATION AT SELECTED STATIONS IN OR NEAR SUTTER-YUBA AREA

Map reference number	Station	Elevation, in feet	Period of record	Source of record	Mean seasonal precipitation, in inches	Maximum and minimum seasonal precipitation	
						Season	Inches
5-69	Biggs	98	1899-1916	USWB	*21.04	1913-1914 1911-1912	21.20 12.29
5-76	Camptonville	2,850	1907-1951	USWB	*64.17	1908-1909 1923-1924	108.30 30.13
5-75	Chute Camp	1,250	1907-1940	USWB	*54.74	1937-1938 1923-1924	78.17 23.87
5-73	Colgate	700	1907-1951	USWB	*39.92	1940-1941 1923-1924	56.61 18.51
5-82	Colusa	60	1871-1951	USWB	15.89	1940-1941 1938-1939	31.65 6.78
5-74	Dobbins	1,650	1904-1946	USWB	*41.03	1906-1907 1923-1924	64.28 20.13
5-70	Gridley	97	1884-1951	USWB	24.00	1889-1890 1897-1898	47.00 12.34
5-97	Marysville	61	1871-1951	USWB	20.68	1889-1890 1884-1885	38.91 8.15
5-107	Nicolaus	46	1912-1951	USWB	*18.32	1940-1941 1912-1913	32.46 7.07
5-62	Oroville	250	1884-1951	USWB	27.27	1889-1890 1930-1931	49.64 14.71
5-71	Palermo	213	1891-1914	USWB	*23.29	1904-1905 1897-1898	32.77 10.94
5-106	Robbins	20	1926-1951	SBCo	*16.81	1940-1941 1930-1931	31.93 9.51
5-120	Rocklin	239	1870-1951	USWB	23.14	1906-1907 1923-1924	38.63 10.42
5-131	Sacramento	69	1849-1951	USWB	16.37	1852-1853 1850-1851	36.35 4.71
5-98	Wheatland	84	1887-1945	USWB	*20.84	1889-1890 1887-1888	33.69 11.07

* Estimated.
SBCo—Sutter Basin Corporation.
USWB—United States Weather Bureau.

1871-72. Recorded seasonal precipitation at this station is presented in Table 2 and shown on Plate 4, "Recorded Seasonal Precipitation at Marysville, 1871-72 Through 1950-51."

Precipitation in the Sutter-Yuba Area consists almost entirely of rainfall and snowfall is rare. It increases generally from west to east, as is shown on Plate 3, except on the Sutter Buttes where a sharp rise in elevation probably results in relatively heavy precipitation. Mean seasonal depth of precipitation ranges from about 18 inches along the western boundary of the area to about 23 inches at its extreme easterly limit. At Nicolaus in the southern portion of the area mean seasonal precipitation is about 18 inches, whereas at Biggs, about eight miles north of the area, it is approximately 21 inches.

Precipitation varies over wide limits from season to season, ranging from less than 40 percent of the seasonal mean to nearly 200 percent. Maximum seasonal precipitation at Marysville occurred in 1889-90 when 38.91 inches of rain were recorded. In 1884-85, the minimum season at this station, precipitation was only 8.15 inches. Long-term trends in precipitation in the Sutter-Yuba Area are indicated on Plate 5, "Accumulated Departure From Mean Seasonal Precipitation at Marysville."

More than 80 percent of the seasonal precipitation in the Sutter-Yuba Area occurs during the five months from November through March on the average, and the summers are dry. Mean monthly distribution of precipitation as recorded at Marysville is presented in Table 3.

TABLE 2

RECORDED SEASONAL PRECIPITATION AT MARYSVILLE 1871-72 THROUGH 1950-51

(In inches)

Season	Precipitation	Season	Precipitation	Season	Precipitation
1871-1872	21.57	1899-1900	28.07	1929-1930	20.81
73	13.10	01	24.02	31	12.40
74	27.74	02	20.54	32	17.35
		03	21.26	33	12.64
1874-1875	13.68	04	22.50	34	14.10
76	17.36				
77	12.16	1904-1905	26.50	1934-1935	23.33
78	23.74	06	27.76	36	22.79
79	15.76	07	32.25	37	21.88
		08	16.91	38	28.26
1879-1880	18.93	09	20.72	39	9.76
81	17.43				
82	14.38	1909-1910	19.48	1939-1940	27.32
83	15.25	11	26.42	41	33.28
84	15.28	12	11.76	42	29.13
		13	13.76	43	21.43
1884-1885	8.15	14	28.54	44	20.02
86	22.27				
87	12.80	1914-1915	27.57	1944-1945	19.72
88	14.28	16	21.69	46	17.33
89	23.28	17	16.17	47	15.21
		18	12.56	48	17.60
1889-1890	38.91	19	21.52	49	15.51
19	15.72				
92	18.99	1919-1920	12.90	1949-1950	16.96
93	22.93	21	25.08	51	23.21
94	10.27	22	21.02		
		23	22.20	Average for 9-year base period, 1939-40 through 1947-48: 22.31	
1894-1895	26.83	24	11.53		
96	19.61				
97	17.77	1924-1925	25.82		
98	12.74	26	21.26	Mean for 50-year period, 1897-98 through 1946-47: 20.68	
99	16.53	27	26.59		
		28	17.28		
		29	14.04		
				Average for 80-year period of record, 1871-72 through 1950-51: 19.82	

TABLE 3

MEAN MONTHLY DISTRIBUTION OF PRECIPITATION AT MARYSVILLE

Month	Precipitation		Month	Precipitation	
	In inches	In percent of seasonal total		In inches	In percent of seasonal total
July	0.00	0.0	January	4.16	20.1
August	0.00	0.0	February	3.97	19.2
September	0.27	1.3	March	2.67	12.9
October	0.93	4.5	April	1.34	6.5
November	2.23	10.8	May	0.74	3.6
December	4.14	20.0	June	0.23	1.1
			TOTALS	20.68	100.0

Quantity of Precipitation

The mean seasonal quantity of precipitation in the Sutter-Yuba Area was estimated by plotting recorded or estimated mean seasonal depth of precipitation at stations in or near the area on a map. Lines of equal mean seasonal precipitation, or isohyets, were then drawn, as are shown on Plate 3. By planimetering the areas between these isohyets, the weighted mean seasonal depth and total quantity of precipitation were estimated.

In order to determine seasonal depth and quantity of precipitation during the base period and investigational seasons, the foregoing estimates for the mean period were adjusted on the basis of recorded precipitation at Marysville. The results of the estimates are presented in Table 4, which also shows the precipitation index for the base period and each of the investigational seasons. The term "precipitation index" refers to the ratio of the amount of precipitation during a given season to the mean seasonal amount, and is expressed as a percentage.

TABLE 4

ESTIMATED WEIGHTED SEASONAL DEPTH AND TOTAL QUANTITY OF PRECIPITATION ON SUTTER-YUBA AREA

Season	Precipitation index	Precipitation	
		Depth, in inches	Quantity, in acre-feet
1947-48	89	18.2	529,000
1948-49	76	15.4	448,000
Average for 9-year base period, 1939-40 through 1947-48	107	21.8	635,000
Mean for 50-year period, 1897-98 through 1946-47	100	20.3	592,000

RUNOFF

Runoff from the highly productive watersheds of the Sierra Nevada constitutes the most important source of water supply available to the Sutter-Yuba Area. The Feather River, which traverses the area from north to south, is the principal tributary of the Sacramento River. The Feather River system, including the Yuba and Bear Rivers which join the Feather within the area, is largely unregulated and undeveloped and is a potential source of water to meet future requirements not only in the Sutter-Yuba Area but in water-deficient areas in other parts of California.

Stream Gaging Stations and Records

Available records of runoff of the principal streams of the Sutter-Yuba Area were sufficient in number, length, and reliability for purposes of required hydrographic studies. With respect to certain of the smaller streams, however, records of runoff were nonexistent or confined principally to measurements made during the investigational seasons. By comparison with records of nearby stations on major streams, adequate estimates were made of runoff of these smaller streams.

Table 5 lists those stream gaging stations pertinent to the hydrography of the Sutter-Yuba Area, together with their map reference numbers, drainage areas above stations where significant, and periods and sources of records. These stations are also shown on Plate 3. The map reference numbers for the first 11 stations listed correspond to those used in State Water Resources Board Bulletin No. 1, "Water Resources of California." New map reference numbers were assigned to the remaining stations listed. The last five stations listed in Table 5 were installed, operated, and maintained as a part of the Sutter-Yuba Counties Investigation. Most of the runoff records listed in Table 5 have been published by the United States Geological Survey in its Water-Supply Papers or by the Division of Water Resources in its Reports of Sacramento-San Joaquin Water Supervision. The following records have not been published elsewhere and are included in Appendix D to this report:

- Coon Creek at Highway 99E—November, 1947–December, 1948
- Auburn Ravine at Highway 99E—November, 1947–December, 1948
- Dry Creek near Waldo—November, 1947–May, 1949
- South Honcut Creek at La Porte Road—November, 1947–December, 1948

Runoff Characteristics

An excellent continuous record of flow of the Feather River at or near Oroville is available for the period since January, 1902, when a stream gaging station was established at Oroville by the United States Geological Survey. The station was moved five miles upstream in October, 1934, but without appreciable effect on characteristics of the record. Although this record does not provide an exact measure of flow of the Feather River into the Sutter-Yuba Area, it is the most important record of the Feather River system, and does reflect characteristics of tributary mountain runoff to the Sutter-Yuba Area.

Flow of the Feather River to the valley floor is impaired by operation of Lake Almanor and several smaller upstream reservoirs, and by operation of hydroelectric power plants. An estimate of the natural runoff of the Feather River at Oroville, as it would be if unaltered by upstream diversion, storage, importation, and exportation, is included in State Water Resources Board Bulletin No. 1, "Water Resources of California." This estimate, together with recorded seasonal runoff of the Feather River at or near Oroville, is presented in Table 6. The

TABLE 5

STREAM GAGING STATIONS IN OR NEAR SUTTER-YUBA AREA

Map reference number	Stream	Station	Drainage area, in square miles	Period of record	Source of record
5-192	Feather River	at Oroville	3,640	1902-1934	USGS
5-191	Feather River	near Oroville	3,611	1934-1951	USGS and DWR
5-193	Feather River	near Gridley		1944-1951	DWR
5-244	Feather River	at Nicolaus		1921-1942 1943-1951	USGS and DWR
5-234	Feather River	below Shanghai Bend		1944-1951	DWR
5-194	Feather River	at Yuba City		1944-1951	DWR
5-222	Yuba River	at Narrows Dam	1,110	1941-1951	USGS and DWR
5-233	Yuba River	at Marysville		1939-1951	USGS and DWR
5-228	Yuba River	at Smartville	1,201	1903-1941	USGS
5-227	Deer Creek	near Smartville	83.5	1935-1951	USGS and DWR
5-238	Bear River	near Wheatland	295	1928-1951	USGS and DWR
SY-1	Sutter Butte Canal	at Diversion		1923-1951	DWR
SY-2	Wadsworth Canal	near Sutter		1929-1951	DWR
SY-3	Pleasant Grove Creek	at Lincoln Road	12.5	1950-1951	DWR
SY-4	Auburn Ravine	at Highway 99E	34.6	1947-1951	DWR
SY-5	Coon Creek	at Highway 99E	82.5	1947-1951	DWR
SY-6	Dry Creek	near Waldo	69.4	1947-1949	DWR
SY-7	South Honcut Creek	at La Porte Road	68.6	1947-1949	DWR

USGS—United States Geological Survey.
DWR—Division of Water Resources.

estimate of natural flow is also shown graphically on Plate 6, "Estimated Seasonal Natural Runoff of Feather River at Oroville."

Estimates of natural flow of streams of the Feather River system indicate that average seasonal runoff during the nine-year base period approximated the seasonal mean during the 53-year period. For the Feather, Yuba, and Bear Rivers these estimates were obtained from State Water Resources Board Bulletin No. 1. Natural flow of minor streams, including those tributary to the Sutter-Yuba Area but not in the Feather River system, were estimated during the current investigation. The estimates of natural flow are presented in Table 7, together with runoff indices for the combined natural flow of the Feather River system. The term "runoff index" refers to the ratio of the amount of runoff during a given season to the mean seasonal amount, and is expressed as a percentage.

Discharge of streams of the Sierra Nevada which are tributary to the Sutter-Yuba Area varies between wide limits from season to season, and within the season. This is indicated by flow of the Feather River at

TABLE 6

RECORDED SEASONAL AND ESTIMATED NATURAL SEASONAL RUNOFF OF FEATHER RIVER AT OROVILLE

(In acre-feet)

Season	Recorded runoff at or near Oroville	Estimated natural runoff at Oroville	Season	Recorded runoff at or near Oroville	Estimated natural runoff at Oroville
1894-1895		7,093,000	1924-1925	2,780,000	3,114,000
1895-1896		7,786,000	1925-1926	2,870,000	3,126,000
1896-1897		5,440,000	1926-1927	5,000,000	5,679,000
1897-1898		2,304,000	1927-1928	3,650,000	4,142,000
1898-1899		2,872,000	1928-1929	2,010,000	1,910,000
1899-1900		6,788,000	1929-1930	3,590,000	3,984,000
1900-1901		6,281,000	1930-1931	1,490,000	1,485,000
1901-1902		4,048,000	1931-1932	2,810,000	3,351,000
1902-1903	4,430,000	4,555,000	1932-1933	1,640,000	1,986,000
1903-1904	9,330,000	9,451,000	1933-1934	1,840,000	2,071,000
1904-1905	4,490,000	4,606,000	1934-1935	3,864,000	4,253,000
1905-1906	6,710,000	6,833,000	1935-1936	4,079,000	4,328,000
1906-1907	9,340,000	9,504,000	1936-1937	2,821,000	3,175,000
1907-1908	3,490,000	3,651,000	1937-1938	8,175,000	8,547,000
1908-1909	7,380,000	7,527,000	1938-1939	1,773,000	1,912,000
1909-1910	4,500,000	4,651,000	1939-1940	5,275,000	5,672,000
1910-1911	6,980,000	7,136,000	1940-1941	6,116,000	6,516,000
1911-1912	2,090,000	2,276,000	1941-1942	6,258,000	6,662,000
1912-1913	2,600,000	2,785,000	1942-1943	5,296,000	5,638,000
1913-1914	6,540,000	6,928,000	1943-1944	2,622,000	2,830,000
1914-1915	5,200,000	5,422,000	1944-1945	3,412,000	3,767,000
1915-1916	5,910,000	6,156,000	1945-1946	3,996,000	4,185,000
1916-1917	4,380,000	4,637,000	1946-1947	2,273,000	2,579,000
1917-1918	2,450,000	2,684,000	1947-1948	3,368,000	3,401,000
1918-1919	3,390,000	3,621,000	1948-1949	2,495,000	2,590,000
1919-1920	2,050,000	2,231,000	1949-1950	3,465,000	3,837,000
1920-1921	5,600,000	5,940,000	1950-1951	5,403,000	5,676,000
1921-1922	4,730,000	5,040,000			
1922-1923	2,890,000	3,112,000	Mean seasonal natural runoff for 53-year mean period, 1894-95 through 1946-47: 4,596,000		
1923-1924	1,180,000	1,317,000			

TABLE 7

ESTIMATED SEASONAL NATURAL FLOW OF STREAMS OF THE FEATHER RIVER SYSTEM, 1939-40 THROUGH 1947-48

(In acre-feet)

Season	Runoff index	Feather River at Oroville	Yuba River at Smartville	Bear River at Wheatland	Minor streams	Combined flow
1939-1940	124	5,672,000	2,860,000	406,000	293,000	9,231,000
1940-1941	142	6,516,000	3,209,000	483,000	339,000	10,547,000
1941-1942	145	6,662,000	3,407,000	502,000	355,000	10,926,000
1942-1943	123	5,638,000	3,133,000	464,000	328,000	9,563,000
1943-1944	62	2,830,000	1,395,000	191,000	141,000	4,557,000
1944-1945	82	3,767,000	2,112,000	289,000	211,000	6,379,000
1945-1946	91	4,185,000	2,401,000	323,000	239,000	7,148,000
1946-1947	56	2,579,000	1,365,000	170,000	131,000	4,245,000
1947-1948	74	3,401,000	1,510,000	216,000	156,000	5,283,000
Average for 9-year base period, 1939-40 through 1947-48	100	4,583,000	2,377,000	339,000	244,000	7,542,000
Mean for 53-year period, 1894-95 through 1946-47	100	4,596,000	2,415,000	356,000	248,000	7,615,000

or near Oroville, where the maximum recorded seasonal runoff occurred in 1906-07 and amounted to more than 9,300,000 acre-feet. The minimum seasonal runoff recorded at this station occurred in 1923-24 and was less than 1,200,000 acre-feet. Maximum recorded instantaneous discharge was 230,000 second-feet on March 19, 1907, and the estimated minimum discharge was about 300 second-feet on November 9, 1931. Estimated mean monthly distribution of natural flow of the Feather River at Oroville is presented in Table 8.

TABLE 8

ESTIMATED MEAN MONTHLY DISTRIBUTION OF NATURAL FLOW OF FEATHER RIVER AT OROVILLE

Month	Runoff, in acre-feet	Percent of seasonal total
October	101,000	2.2
November	188,000	4.1
December	290,000	6.3
January	423,000	9.2
February	556,000	12.1
March	722,000	15.7
April	873,000	19.0
May	744,000	16.2
June	368,000	8.0
July	152,000	3.3
August	101,000	2.2
September	78,000	1.7
TOTALS	4,596,000	100.0

Quantity of Runoff

Available records of stream flow, including those obtained from measurements made in connection with the investigation, were sufficient to permit fairly reliable determination of surface inflow to and surface outflow from the Sutter-Yuba Area during the nine-year base period and during the two seasons of the investigation.

Surface inflow to the Sutter-Yuba Area from the Feather and Bear Rivers was directly measured at the stations near Gridley and near Wheatland, respectively. Inflow from Yuba River was determined by recorded flow at Smartville until the season of 1940-41, after which season that station was discontinued and inflow was determined as the combined flow of Yuba River at Narrows Dam and Deer Creek near Smartville. For seasons when records of inflow from South Honcut Creek at La Porte Road and French Dry Creek near Browns Valley were not available, inflow was estimated by correlation with the combined flow of Yuba River at Narrows Dam and Deer Creek near Smartville. Inflow to the area from Dry Creek near Waldo, Coon Creek at Highway 99E, Auburn Ravine at Highway 99E, and Pleasant Grove Creek at Lincoln Road, was estimated for seasons when records were not available by correlation with the flow of Bear River near Wheatland. Inflow to the area through the Sutter

TABLE 9

MEASURED AND ESTIMATED SEASONAL SURFACE INFLOW TO AND OUTFLOW FROM SUTTER-YUBA AREA, 1939-40 THROUGH 1948-49

(In acre-feet)

Source	Season										Average for 9-year base period, 1939-40 through 1947-48
	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	
Inflow											
Feather River	4,634,000	5,103,000	5,581,000	4,326,000	1,536,000	2,208,000	3,106,000	1,724,000	2,751,000	1,742,000	3,441,000
Yuba River	2,364,000	2,550,000	2,778,000	2,562,000	948,000	1,583,000	1,877,000	924,000	1,503,000	1,063,000	1,899,000
Bear River	411,000	505,000	516,000	494,000	149,000	314,000	368,000	151,000	208,000	197,000	346,000
Deer Creek	125,000	137,000	162,000	155,000	72,000	111,000	105,000	54,000	52,000	50,000	108,000
South Honcut Creek*	48,000	53,000	57,000	52,000	23,000	35,000	40,000	23,000	25,000	29,000	40,000
French Dry Creek†	91,000	102,000	108,000	100,000	45,000	67,000	76,000	44,000	48,000	35,000	76,000
Dry Creek*	39,000	46,000	18,000	44,000	18,000	28,000	31,000	16,000	21,000	18,000	32,000
Coon Creek*	35,000	42,000	43,000	40,000	17,000	25,000	28,000	15,000	19,000	36,000	29,000
Auburn Ravine*	71,000	85,000	88,000	81,000	34,000	51,000	57,000	30,000	38,000	47,000	59,000
Pleasant Grove Creek†	9,000	11,000	12,000	11,000	4,000	7,000	8,000	4,000	5,000	4,000	8,000
Snake Slough†	49,000	49,000	55,000	40,000	44,000	49,000	47,000	39,000	38,000	39,000	46,000
Sutter Butte Canal†	111,000	112,000	130,000	153,000	161,000	167,000	186,000	163,000	136,000	160,000	147,000
Minor Drainage†	10,000	11,000	12,000	11,000	4,000	7,000	8,000	4,000	5,000	5,000	8,000
TOTALS	7,997,000	8,806,000	9,590,000	8,069,000	3,055,000	4,652,000	5,937,000	3,191,000	4,849,000	3,425,000	6,239,000
Outflow											
Feather River	7,104,000	9,827,000	9,703,000	7,268,000	3,326,000	5,026,000	5,999,000	2,784,000	1,737,000	3,234,000	6,197,000
Wadsworth Canal	95,000	119,000	105,000	72,000	93,000	106,000	102,000	67,000	53,000	62,000	90,000
Drainage into Sutter By-Pass†	13,000	18,000	19,000	17,000	0	7,000	10,000	0	0	0	9,000
Cross Canal†	32,000	35,000	37,000	34,000	0	18,000	25,000	0	0	0	20,000
TOTALS	7,244,000	9,999,000	9,864,000	7,391,000	3,419,000	5,157,000	6,136,000	2,851,000	1,790,000	3,296,000	6,316,000

* Partially estimated.
† Estimated.

Butte Canal was estimated by adjusting measured diversions from Feather River on the basis of acreages of crops served each season within and outside the area. Inflow to the area from Snake Slough at Sanders Road during seasons of no record was estimated by correlation with flow in the Sutter Butte Canal. Inflow from minor unmeasured drainage areas was estimated by correlation with the flow of Bear River near Wheatland.

Surface outflow from the Sutter-Yuba Area in Feather River and the Wadsworth Canal was directly measured during the nine-year base period and during the investigational seasons at the stations at Nicolaus and near Sutter, respectively. Estimates of the net amount of outflow as drainage to the Sutter By-pass were based on partial records of pumping to and from the by-pass at pumping plants operated by the Division of Water Resources. Outflow from the Cross Canal was estimated by correlation with measured runoff of streams tributary to the canal, corrected for measured pumping diversions from the canal.

Measured and estimated seasonal surface inflow to and outflow from the Sutter-Yuba Area during the base period and during 1948-49 are presented in Table 9.

IMPORTED AND EXPORTED WATER

Water is imported to the Sutter-Yuba Area through the Sutter Butte Canal system for irrigation of lands in that portion of the West Side Zone outside of the Peach Bowl. This water is diverted from the Feather River at a point about 14 miles upstream from the north boundary of the area, and is conveyed in unlined canals through a service area situated along the right bank of the Feather River both inside and outside the Sutter-Yuba Area. The estimated amount of the import was 160,000 acre-feet during the 1948-49 season, and the estimated seasonal average during the base period was 147,000 acre-feet. These estimates are shown in Table 9. For purposes of current studies the Sutter Butte Canal import was considered to be a part of surface inflow to the Sutter-Yuba Area.

So far as was determined during the investigation, there is no record of export of water from the Sutter-Yuba Area.

UNDERGROUND HYDROLOGY

The Sutter-Yuba Area overlies a portion of the ground water basin of the Sacramento Valley, and water pumped from storage in the basin presently serves nearly two-thirds of the lands irrigated in the area. Percolation of rainfall, stream flow, and drainage from adjacent hills, and of the unconsumed portion of applied irrigation water, is the most important source of ground water replenishment.

The term "free ground water," as used in this report, generally refers to a body of ground water not overlain by impervious materials and moving under control of the water table slope. "Confined ground water" refers to a body of ground water overlain by material sufficiently impervious to sever free hydraulic connection with overlying water, and moving under pressure caused by the difference in head between intake and discharge areas of the confined water body. In areas of free ground water, the ground water basin provides regulatory storage to smooth out fluctuations in available water supplies, and changes in ground water storage are indicated by changes in ground water levels.

Data and information collected during the Sutter-Yuba Counties Investigation indicated that free ground water exists in present zones of pumping, although there may be some temporary or partial confinement in certain depth zones. Study of historic fluctuation of the water table in the Sutter-Yuba Area, under varying conditions of draft and replenishment, permitted a determination of changes in ground water storage in the basin, and its safe yield of water under stated conditions. Underground hydrology is discussed in this section under the following headings: "Ground Water Geology," "Specific Yield and Ground Water Storage Capacity," "Ground Water Levels," "Change in Ground Water Storage," "Subsurface Inflow and Outflow," "Yield of Wells," "High Water Table Areas," and "Safe Ground Water Yield."

Ground Water Geology

Geologic features of the ground water basin underlying the Sutter-Yuba Area were investigated by the Ground Water Branch of the United States Geological Survey, under terms of an agreement between that agency and the State Department of Public Works. Appendix B comprises a detailed report by the Geological Survey on ground water storage capacity, within given pumping lifts, and on geologic features of the Sutter-Yuba Area, with a general geologic map, four geologic cross-sections, and a map showing ground water storage units, prepared under the direction of Joseph F. Poland, District Geologist, by G. H. Davis and F. H. Olmsted. Portions of an abstract of the geologic report follow:

"The Sutter-Yuba area occupies the east-central Sacramento Valley and part of the western foothills of the Sierra Nevada. The Sacramento Valley is a trough that has been receiving sediments from both sides since the middle part of Cretaceous time. Most of the sediments in the Sutter-Yuba area have been derived from the Sierra Nevada on the east, which is a block mountain range tilted about 1½° westward. Evidence indicates that the block continues westward beneath the sediments of the valley trough.

"The Sutter Buttes, erosional remnants of a Pliocene volcano, occupy a circular area about 10 miles in diameter near the center of the Sacramento Valley.

"Rocks exposed in the Sutter-Yuba area range in age from pre-Cretaceous metamorphic and igneous rocks of the Sierra Nevada block to Recent alluvium still undergoing deposition. The rocks may be divided into two general categories: (1) the basement complex of the Sierra Nevada, which extends beneath the Sacramento Valley at depth, and (2) the superjacent rocks; a sedimentary blanket of marine and continental deposits transported from the Sierra Nevada and deposited in the Great Valley trough.

Deep Well and Turbine Pump Installation in Sutter-Yuba Area

"The water-bearing deposits considered in this report are included in the superjacent rocks, although weathered and fractured zones in the basement complex contain small quantities of ground water. The marine sediments of Cretaceous and Tertiary age are penetrated by water wells in only a few places in the Sutter-Yuba area. Where marine sediments are encountered they are generally impervious and contain water of poor chemical quality.

"Volcanic activity in the Sierra Nevada during the Tertiary period produced tuff-breccia of mud-flow origin which are impermeable and yield little water, but interbedded volcanic sands and gravels are moderately permeable and yield water to deep wells in the Marysville, Wheatland, Roseville, and Camp Beale districts.

"Local volcanic activity at Sutter Buttes during the Pliocene epoch produced two principal groups of rocks: (1) intrusive rhyolite and andesite and vent tuffs of the central core; and (2) andesitic tuff-breccias that encircle the core. The core is hard and impervious, but sands and gravels interbedded with the tuff-breccias yield some water to wells in the Pennington and Sutter City district.

"Following the close of volcanic activity in the Sierra Nevada the streams deposited predominantly fine-grained sediments during the remainder of the Pliocene epoch. These old alluvial deposits underlie the dissected uplands or 'red lands' along the valley margin and extend westward beneath younger alluvial deposits. Poorly sorted alluvium composed of silt, clay, and cemented sand and gravel as much as 350 feet thick represent this time interval. Many wells penetrate thick sections of these materials, but well yields are low to moderate.

"Uplift of the Sierra block at the beginning of the Pleistocene epoch caused the deposition of coarser materials. Alluvium of Pleistocene age as much as 100 feet thick underlies the low plains of the Sutter-Yuba area. These deposits are moderately permeable throughout and tongues of sand and gravel provide large supplies of water to irrigation wells.

"Recent alluvium, defined as those materials undergoing deposition, falls into three general categories: (1) alluvial fans of the Sutter Buttes, (2) basin deposits, and (3) stream-channel deposits. Most of the alluvial-fan deposits of Sutter Buttes are poorly sorted and groundwater yields from them are low. Basin deposits consist of an accumulation of relatively impermeable clays and silts which have been laid down by overflow waters of the Sacramento and Feather Rivers. Generally these deposits produce little water. Stream-channel deposits of the major streams contain well sorted sands and gravels to depths of 125 feet. Well defined channels are found beneath the flood plains of the Feather, Yuba, and Bear Rivers. Wells penetrating these coarse deposits are highly productive."

Specific Yield and Ground Water Storage Capacity

The term "specific yield," when used in connection with ground water, refers to the ratio of the volume of water a saturated soil will yield by gravity to its own volume, and is commonly expressed as a percentage. Ground water storage capacity is estimated as the product of the specific yield and the volume of material in the depth intervals considered.

In its investigation of the Sutter-Yuba ground water basin, the United States Geological Survey estimated specific yield of different depth zones after study of some 700 well logs. The estimates were based on previously determined characteristics of the various types of material classified in the well logs. Ground water storage capacity of the Sutter-Yuba Area was determined by the Geological Survey for depth intervals from 20 to 50 feet, 50 to 100 feet, 100 to 200 feet, and for the entire interval from 20 to 200 feet below ground surface. However, in an area of saline ground water centered near the southern end of the West Side Zone, where storage capacity in the 100- to 200-foot depth interval was considered not usable under present conditions, the determination was limited to the 20- to 50-foot, and 50- to 100-foot depth intervals.

Storage capacity of the ground water basin underlying the Sutter-Yuba Area and the weighted average specific yield, as estimated by the United States Geological Survey, are shown in Table 10.

TABLE 10

ESTIMATED SPECIFIC YIELD AND GROUND WATER STORAGE CAPACITY, SUTTER-YUBA AREA

Depth interval, in feet from ground surface	Weighted average specific yield, in percent	Ground water storage capacity, in acre-feet
20 to 50	7.4	840,000
50 to 100	6.9	1,290,000
100 to 200	6.0	1,760,000
20 to 200	6.6	3,890,000

Ground Water Levels

The first indication of a cone of depression in the water table in the Sutter-Yuba Area was found by Kirk Bryan and reported in 1913 in United States Geological Survey Water-Supply Paper 495. At that time a small cone had developed along Gilsizer Slough southwest of Shanghai Bend.

In 1931, in a "Report on Proposed Sutter Irrigation District," S. T. Harding described a study of ground water conditions in the eastern portion of Sutter County. A fully developed depression cone was found in the water table existing at that time. In discussing the growth of pumping draft in the Peach Bowl up to 1931, the author wrote:

"Draft in 1920 was probably double that in 1913, much of the orchards being young in 1920 less water would be used. From 1920 there has been a continual increase in area and draft. Since 1924 the annual draft has probably varied more largely with variations in rainfall than of area. For the past five years there has been little new orchard planting and the existing orchards have been sufficiently mature to represent full draft.

"These conclusions correspond generally with the ground water record. Some lowering occurred prior to 1920 but this was not sufficient to cause concern. Lowering appears to have attracted attention in 1924 and to have increased in below normal years since 1924 being particularly marked in the last 3 years."

The Division of Water Resources has measured fall water levels at a series of control wells throughout the Sacramento Valley during most years from 1929 through 1940, and each year from 1947 to date. Forty of these control wells are in or adjacent to the Sutter-Yuba Area. The Sutter County Farm Adviser furnished data on water levels at 25 additional wells in the area which were measured several times annually from 1931 through 1941. The Pacific Gas and Electric Company has made frequent measurements since 1946 at approximately 25 wells in or adjacent to the Sutter-Yuba Area. This company also furnished records of

TABLE 11

MEASURED FALL DEPTHS TO GROUND WATER AT REPRESENTATIVE WELLS IN ZONES OF SUTTER-YUBA AREA

(In feet)

Year	West Side Zone			Northeast Zone		East Central Zone		South Side Zone	
	Well number								
	17N/3E-30F1	14N/3E-3P1	13N/3E-14C2	16N/4E-8A1	16N/4E-27N1	14N/4E-15C3	14N/4E-28N1	13N/4E-33R1	12N/4E-33L3
1929	4.7	28.3	15.4	18.4	10.4	15.4	10.5	20.7	15.4
1930	3.3	32.4	15.6	17.6	7.8	14.9	10.4	20.1	16.0
1931	6.2	33.8	15.4	19.5	10.8	15.4	11.0	20.8	16.4
1932	5.4	32.4	15.2	19.2	------	14.7	11.1	20.1	12.7
1933	5.6	33.4	16.3	19.6	------	10.0	11.2	20.5	15.6
1934	5.4	34.1	16.7	19.8	------	------	11.5	20.5	16.3
1936	------	28.4	13.4	18.1	------	9.7	11.9	22.7	12.5
1937	3.7	26.2	11.8	17.8	------	14.8	12.0	24.8	9.4
1938	6.4	20.4	10.8	15.7	------	11.1	9.2	19.0	8.9
1940	3.1	24.0	8.2	16.8	4.8	14.3	10.9	------	3.4
1947	7.8	33.8	14.8	18.1	7.5	23.2	13.1	23.4	11.5
1948	9.3	34.2	14.2	21.0	12.0	24.3	13.4	25.3	11.0
1949	7.6	36.0	15.5	22.1	11.7	28.2	15.5	19.6	13.4
1950	8.6	39.1	15.5	23.6	8.8	29.7	14.6	28.1	13.0
1951	------	32.0	------	23.0	10.5	33.1	------	23.3	------

standing and operating water levels measured during pump tests, together with results of the tests.

A complete series of measurements of static ground water levels at approximately 850 wells in the Sutter-Yuba Area was made in the spring and fall of each year during the period of investigation, beginning with the fall of 1947 and continuing through 1951. The wells were chosen to form a comprehensive grid covering the entire area. In addition, monthly measurements were made at approximately 90 control wells during the first half of 1948 and through 1949, in order to observe behavior of the ground water table under conditions of draft and recharge. Available records of depth to ground water at wells in or adjacent to the Sutter-Yuba Area are included as Appendix E to this report.

Depths to ground water throughout the Sutter-Yuba Area, as measured each fall from 1947 through 1951, were plotted on maps and lines of equal depth drawn. These are shown on Plates 7 to 11, inclusive, "Lines of Equal Depth to Ground Water," Plate 12, "Lines of Equal Elevation of Ground Water, Fall 1949," was prepared from the data used for Plate 9, depths to ground water being subtracted from elevations of the measuring points above sea level to obtain elevations of the water table.

Table 11 shows depths from the surface of the ground to the water table at selected representative wells in the several zones of the Sutter-Yuba Area during the fall of most years from 1929 through 1951. The measurements were made following the summer period of irrigation pumping draft and prior to recovery in ground water storage resulting from winter rains. The wells are numbered in accordance with the system utilized by the United States Geological Survey, and described in Appendix B. Fluctuations in depth to ground water at a representative well in each zone of the Sutter-Yuba Area are depicted graphically on Plate 13, "Measured Fall Depths to Ground Water at Representative Wells."

From study of all available well measurements, estimates were made of the approximate average depth to ground water in the Sutter-Yuba Area in the fall of each year from 1929 through 1951. These estimates, which constitute arithmetical averages of available measurements, are presented in Table 12 and are illustrated graphically in Plate 14, entitled "Average Fall Depth to Ground Water."

TABLE 12

ESTIMATED AVERAGE FALL DEPTH TO GROUND WATER IN SUTTER-YUBA AREA

(In feet)

Year	Depth to ground water	Year	Depth to ground water
1929	15.9	1940	12.3
		1941	12.0
1930	16.1	1942	11.9
1931	17.7	1943	11.6
1932	16.6	1944	13.1
1933	17.6		
1934	17.2	1945	14.2
		1946	16.2
1935	16.8	1947	17.6
1936	16.4	1948	18.3
1937	15.2	1949	19.8
1938	15.2		
1939	14.5	1950	21.7
		1951	21.8

It is indicated that a moderate lowering of the water table over the Sutter-Yuba Area occurred from 1929 until 1931, followed by a slight rise in 1932, and a lowering again in 1933. Although 1935 marked the end of a series of dry years, ground water levels rose in 1934 because of reduced pumping. The water table continued to rise during a generally wet series of years until 1943, and in that year the estimated average depth to ground water was the least during the entire period from 1929 through 1951. Since 1943, coincidental with dry years and expansion of irrigation, a continuous lowering of the water table has occurred, reaching its greatest average depth during the entire period in the fall of 1951.

In order to estimate weighted average changes in ground water elevations in the Sutter-Yuba Area during the nine-year base period and each investigational season, maps were drawn showing lines of equal change in elevation during these periods. An example of these maps is presented as Plate 15, "Lines of Equal Change in Ground Water Elevation from Fall of 1947 to Fall of 1951." By planimetering the areas between lines of equal change, the weighted average change in elevation of water levels was estimated for each zone of the Sutter-Yuba Area. The results of these estimates are presented in Table 13.

TABLE 13

ESTIMATED WEIGHTED AVERAGE SEASONAL CHANGES IN FALL GROUND WATER ELEVATION IN ZONES OF SUTTER-YUBA AREA

(In feet)

Zone	1939-40 to 1947-48	1947-48	1948-49
West Side			
Peach Bowl	—0.7	—0.7	—1.5
Outside Peach Bowl	+0.1	+0.1	—0.2
Northeast	+0.1	+0.3	—1.0
East Central	—0.7	—1.2	—2.3
South Side	—0.6	—1.3	—2.1

Change in Ground Water Storage

In an area of free ground water, the volume of soil unwatered or resaturated over a period of time, when multiplied by the specific yield, measures the change in ground water storage during that time. Available data on fluctuations of water levels at wells in the Sutter-Yuba Area were sufficient to estimate the volume of soil unwatered or resaturated during the base period, and during the two investigational seasons. Changes in ground water storage were estimated for each zone of the area by multiplying changes in elevation of ground water, presented in Table 13, by the area of each zone and by the average value of specific yield of 7.4 percent, found by the Geological Survey for the depth interval from 20 to 50 feet below ground surface. The results of these estimates are presented in Table 14.

TABLE 14

ESTIMATED WEIGHTED AVERAGE SEASONAL CHANGES IN GROUND WATER STORAGE IN ZONES OF SUTTER-YUBA AREA

(In acre-feet)

Zone	Area, in acres	1939-40 to 1947-48	1947-48	1948-49
West Side				
Peach Bowl	61,400	—3,000	—3,000	—7,000
Outside Peach Bowl	62,370	+500	0	—1,000
Northeast	42,860	+300	+1,000	—3,000
East Central	77,870	—4,000	—7,000	—13,000
South Side	82,460	—4,000	—8,000	—13,000
TOTALS	326,960	—10,200	—17,000	—37,000

It is indicated that an average seasonal net decrease in ground water storage in the Sutter-Yuba Area of about 10,000 acre-feet occurred during the nine-year base period, in which conditions of water supply and climate were approximately equivalent to conditions during the mean periods. The estimated net decrease in ground water storage during the two investigational seasons was approximately 17,000 acre-feet in 1947-48, and 37,000 acre-feet in 1948-49. It may be noted that the decrease in storage was substantial in the Peach Bowl portion of the West Side Zone, and in the East Central and South Side Zones. In the high water table lands of the Sutter Butte Canal service area in the West Side Zone, and in the Northeast Zone, changes in ground water storage were of minor importance.

Subsurface Inflow and Outflow

Lines of equal elevation of ground water in the Sutter-Yuba Area in the fall of 1949 are shown on Plate 12. Slopes of the water table as defined by these ground water contours, together with information on the permeabilities of the various subsurface geologic formations, indicate that the greater portion of subsurface inflow to the area probably came from the east, and a smaller amount from the north between Sutter Buttes and the eastern foothills. It is probable that about half of the subsurface inflow from the east entered from Placer County south of the historic Bear River flood plain, and that the other half moved across the investigational boundary from the east in Yuba

County, including the whole of the historic Bear River flood plain.

The ground water gradients shown on Plate 12 indicate that there was little subsurface outflow from the Sutter-Yuba Area during or immediately following the 1949 season of heavy pumping draft. Sufficient data were not available to depict ground water contours in the area during the wet years from 1939 to 1943, when there was substantial ground water replenishment and when subsurface outflow may have been significant. Study of available data, however, does show that average seasonal subsurface outflow from the Sutter-Yuba Area during the nine-year base period was probably small.

The ground water contours shown on Plate 12 indicate the presence of a depression cone in the water table extending approximately north and south through the Peach Bowl during 1949. There was a general convergence of ground water around the perimeter of the depression and into the trough, showing that such ground water movement as may have occurred was inflow to the cone, rather than outflow.

The northern and western portions of the West Side Zone, and adjacent areas outside of the Sutter-Yuba Area, are served with surface water supplies, and ground water levels have been fairly stable and close to the ground surface even in dry years. However, during dry years, ground water levels in the Peach Bowl have lowered as a result of increased pumping. These conditions have probably resulted in relatively greater subsurface inflow to the Peach Bowl during such dry years, owing to the steeper gradients existing in the water table.

An indirect method was used to estimate the net effect of subsurface inflow to and outflow from the Sutter-Yuba Area. This involved evaluation of the difference between subsurface inflow and outflow as the item necessary to effect a balance between water supply and disposal. The sum of the items comprising the water supply of a given hydrologic unit or area must be equal to the sum of the items of water disposal. This is a statement of what is referred to as the "equation of hydrologic equilibrium." In the case of the Sutter-Yuba Area, values for pertinent items other than the difference between subsurface inflow and outflow, including surface inflow and outflow, precipitation, change in ground water storage, and consumptive use of water, were quantitatively measured or estimated. Determination of values for consumptive use of water is explained in Chapter III. Retention of subsurface inflow, or the difference between subsurface inflow and outflow, was the remaining unknown quantity in the equation of hydrologic equilibrium. Table 15 sets forth this equation for the Sutter-Yuba Area.

Certain of the values in the equation of hydrologic equilibrium presented in Table 15 are of large magnitude as compared to the derived excess of subsurface inflow over subsurface outflow. Small percentage errors in these larger quantities might introduce relatively large errors in the derived remainders. In this connection, independent geologic analysis of the cross section of the perimeter of the Sutter-Yuba ground water basin, including consideration of the porosity of the aquifers, indicated that with existing slopes of the water table the derived values for net subsurface inflow might be excessive. However, study of disposal of water supplies in areas adjacent to the Sutter-Yuba Area tended to corroborate the derived values.

TABLE 15

ESTIMATED EXCESS OF SEASONAL SUBSURFACE INFLOW OVER SUBSURFACE OUTFLOW IN SUTTER-YUBA AREA

(In acre-feet)

Item	Average for 9-year base period 1939-40 through 1947-48	1947-48	1948-49
WATER SUPPLY			
Precipitation	635,000	529,000	448,000
Surface inflow	6,239,000	4,849,000	3,425,000
Decrease in ground water storage	10,000	17,000	37,000
TOTALS	6,884,000	5,395,000	3,910,000
WATER DISPOSAL			
Surface outflow	6,316,000	4,790,000	3,296,000
Consumptive use of water	710,000	764,000	794,000
TOTALS	7,026,000	5,554,000	4,090,000
REMAINDER—EXCESS OF SUBSURFACE INFLOW OVER SUBSURFACE OUTFLOW	142,000	159,000	180,000

Yield of Wells

Yield of wells is an important factor in the use of ground water in the Sutter-Yuba Area. In certain small portions of the area ground water is not utilized for irrigation because of inability to obtain wells of adequate capacity to meet the agricultural requirements. On the other hand, throughout most of the area adequate agricultural wells can generally be obtained.

Yield of wells in the Sutter-Yuba Area was analyzed by the United States Geological Survey, as reported in Appendix B, utilizing data obtained from well pumping tests made by the Pacific Gas and Electric Company during the period from 1933 through 1948. Results of the Geological Survey's analysis are summarized in Table 16, which shows for each zone of the Sutter-Yuba Area the number of wells tested, and their average discharge, specific capacity, depth, and yield factor. The term "specific capacity" refers to the number of gallons of water per minute produced by a pumping well per foot of drawdown. "Drawdown" refers to the lowering of the water level in a well caused by pumping, and is measured in feet. The "yield factor" reflects the production of water per foot of depth of well, and is determined by multiplying the specific capacity by 100 and dividing by the depth of the well, in feet.

TABLE 16

ESTIMATED AVERAGE YIELD OF WELLS IN ZONES OF SUTTER-YUBA AREA

Zone	Number of wells tested	Average discharge, in gallons per minute	Average specific capacity, in gallons per minute per foot of drawdown	Average depth of wells, in feet	Average yield factor
West Side					
Peach Bowl	249	728	47	182	25.7
Outside Peach Bowl	48	878	54	320	16.8
Northeast	28	838	60	201	29.8
East Central	109	846	48	292	16.7
South Side	104	960	47	324	14.7

Insofar as may be determined from consideration of Table 16, it is indicated that the better wells of the Sutter-Yuba Area are located in the Peach Bowl and in the Northeast Zone. While wells of adequate capacity may generally be obtained throughout the remainder of the area, it is usually necessary to drill to greater depths for equivalent yields. However, although not apparent from the foregoing data, it was determined during the investigation that in the southeastern portion of the East Central Zone there is an area of approximately 3,400 acres of irrigable land upon which efforts to obtain wells of sufficient capacity to support irrigation demands have been unsuccessful.

High Water Table Areas

Under about 8,000 acres in the Northeast Zone, ground water was less than 10 feet from the ground surface continuously from November, 1947, through 1951, as was also the case under about 23,000 acres in the West Side Zone north of the East and West Intercepting Canals. Under about 1,000 acres of such lands in the Northeast Zone, and 4,500 acres in the West Side Zone, depth to the water table ranged from 0 to 5 feet from the ground surface.

The foregoing high water table lands were entirely irrigated by surface waters. It was indicated that the perennially high water table was largely caused by heavy applications of the abundant surface water supply to crops of rice and permanent pasture. The geologic investigations showed that the lands overlie good water-bearing formations which are capable of being developed by wells of relatively high yield, and that increase in use of ground water would probably result in lowering of ground water levels.

Studies indicated that the high water table lands would be suitable for a much wider range of crops than at present, if ground water levels were held at greater depths, and that an existing drainage problem would be eliminated. Furthermore, it is probable that consumptive use of water on these lands, as evidenced by heavy growth of native vegetation, is substantially in excess of such use on similar nearby lands where ground water levels are lower. The term "consumptive use of water," as used in this report, refers to water consumed by vegetative growth in transpiration and building of plant tissue, and to water evaporated from adjacent soil, from water surfaces, and from foliage. It also refers to water similarly consumed and evaporated by urban and nonvegetative types of culture.

Safe Ground Water Yield

The term "safe ground water yield" refers to the maximum rate of extraction of water from a ground water body which, if continued over an indefinitely long period of years, will result in the maintenance of certain desirable fixed conditions. Commonly, safe ground water yield is determined by one or more of the following criteria:

1. Mean seasonal extraction of water from the ground water body does not exceed mean seasonal replenishment to the body.

2. Water levels are not so lowered as to cause harmful impairment of the quality of the ground water by intrusion of other water of undesirable quality, or by accumulation and concentration of degradants or pollutants.

3. Water levels are not so lowered as to imperil the economy of ground water users by excessive costs of pumping from the ground water body.

Safe ground water yield, as derived in this report, was measured by net extraction of water from the Sutter-Yuba ground water basin, as differentiated from total pumpage from the basin. Since the Sutter-Yuba Area overlies a free ground water body, the unconsumed portion of total pumpage may return to the ground water body and become available for re-use. The net rate of extraction, therefore, was considered to be only that portion of total pumpage from the ground water basin which was consumptively used.

Under natural conditions, ground water is expended by consumptive use from seep lands and from lands where the water table is close to the ground surface, by effluent stream flow, and by subsurface outflow. Artificial development and utilization of ground water salvages all or a portion of such natural disposal, by lowering ground water levels. This, in turn, affords opportunity for additional replenishment of ground water.

With the present general patterns of water utilization in the Sutter-Yuba Area, the extraction of water from the ground water basin might be increased. Such increase in draft would undoubtedly be accompanied by recession of ground water levels in areas of pumping. However, this lowering of the water table would induce increased subsurface inflow to the areas of pumping and reduce natural disposal of the ground water, the probable effects of which would be to increase replenishment in an amount approximately equal to the increase in draft. This would probably hold true even in a series of dry years because of the continuous availability of large amounts of ground water in adjacent areas, maintained by percolation from relatively large surface water supplies. For this reason, the first of the foregoing criteria for determination of safe yield was not considered to be applicable in the Sutter-Yuba Area.

Because of expressed local concern over recent progressive lowering of pumping levels and deterioration in mineral quality of the ground water, the second and third of the foregoing criteria for determination of safe ground water yield were adopted as applicable to the Sutter-Yuba Area. It was therefore arbitrarily assumed that seasonal net extraction of ground water in 1948-49, with ground water levels prevailing at that time, defined the desirable limit beyond which net extraction should not be increased at the expense of further lowering of ground water levels.

As previously stated, consumptive use of ground water was considered to be equal to net extraction of water from the Sutter-Yuba ground water basin. An estimate of average seasonal consumptive use of ground water in the area during the nine-year base period is presented and explained in Chapter III. After correction for average seasonal change in ground water storage, this value was considered to represent average seasonal replenishment of the ground water basin during the base period. When further corrected for the increase in replenishment during 1948-49, over and above the base period average, as measured by increase in subsurface inflow, the value was considered to be equal to safe seasonal ground water yield.

The estimate of safe seasonal ground water yield is presented in Table 17.

Certain of the items included in the estimate of safe ground water yield are based on the assumption that present practice of irrigation by surface water supplies in and adjacent to the Sutter-Yuba Area will continue indefinitely. Under such circumstances adjacent ground water basins will remain the sources of sufficient subsurface inflow to areas of ground water pumping in the Sutter-Yuba Area to meet increases in pumping draft. While there is no assurance that surface irrigation practices will continue indefinitely as at present, there is reason to believe that any changes will not be of material significance to the estimated yield for many years in the future.

TABLE 17

ESTIMATED SAFE SEASONAL GROUND WATER YIELD IN SUTTER-YUBA AREA

Item	Acre-feet
Average seasonal consumptive use of ground water for 9-year base period, 1939-40 through 1947-48	158,100
Average seasonal decrement in ground water storage for base period	10,000
Average seasonal replenishment of ground water basin for base period	148,100
Increase in replenishment in 1948-49 over base period seasonal average	38,000
SAFE SEASONAL GROUND WATER YIELD	186,100

The foregoing estimate of safe seasonal ground water yield may be considered to represent the net seasonal extraction from the ground water basin that might be maintained without permanent lowering of the water table and degradation of mineral quality of the ground water beyond conditions prevailing in 1948-49. Having so chosen the determining criteria, estimated safe seasonal ground water yield may be considered to be a property of the ground water basin, not affected by changes in irrigation efficiency, patterns, or practices.

QUALITY OF WATER

The surface water supplies of the Sutter-Yuba Area are of excellent mineral quality and well suited from that standpoint for irrigation and other beneficial uses. With respect to ground water supplies, however, salinity sufficient to impair use of the ground water for irrigation, domestic, and many industrial uses has been observed at scattered wells throughout the area for many years. In the Peach Bowl, in the adjacent southern portion of the West Side Zone, and in the western portion of the South Side Zone this salinity of ground water has been general. The principal objectives of the water quality investigation, therefore, were to evaluate these conditions and to determine the extent of the area presently affected and the source of the saline ground waters.

It is desirable to define certain terms commonly used in connection with discussion of quality of water:

Contamination—This refers to impairment of the quality of water by sewage or industrial waste to a degree which creates a hazard to public health through poisoning or spread of disease.

Degradation—This refers to any impairment in the quality of water due to causes other than disposal of sewage and industrial wastes.

Pollution—This refers to impairment of the quality of water by sewage or industrial waste to a degree which does not create a hazard to public health, but which adversely and unreasonably affects such water for beneficial uses.

Quality of Water—This refers to those inherent characteristics of water affecting its suitability for beneficial uses.

The term "mineral analysis" refers to the quantitative determination of inorganic impurities or dissolved mineral constituents in the water. The complete mineral analysis included a determination of three cations, consisting of calcium, magnesium, and sodium; four anions, consisting of bicarbonate, chloride, sulphate, and nitrate; total soluble salts; boron; and computation of percent sodium. The partial analysis included determination of chlorides and total mineral solubles only.

With the exception of boron, the concentrations of cations and anions in a water sample are expressed in this report in terms of "equivalents per million." This was done because ions combine with each other on an equivalent basis, rather than on basis of weight, and a chemical equivalent unit of measurement provides a better and more convenient expression of concentration. This is especially true when it is desired to compare the composition of waters having variable concentration of mineral solubles. In the case of boron, concentrations are expressed on a weight basis of "parts per million" of water. In order to convert equivalents per million to parts per million, the concentration, expressed in equivalents per million, should be multiplied by the equivalent weight of the cation or the anion in question. Equivalent weights of the common cations and anions are presented in the following tabulation:

Cation	*Equivalent weight*	*Anion*	*Equivalent weight*
Calcium	20.0	Bicarbonate	61.0
Magnesium	12.2	Chloride	35.5
Sodium	23.0	Sulphate	48.0
		Nitrate	62.0

Data used to determine the quality of water in the Sutter-Yuba Area included complete mineral analyses of eight surface water samples and complete mineral analyses of water samples collected from 38 wells. The data also included partial analyses of water samples collected from 226 wells during the 1948 irrigation season and partial analyses of samples collected from 296 wells during the 1949 irrigation season. Other data used during the course of the investigation included well water analyses that were obtained from the Federal Land Bank in Berkeley and the Rubidoux Laboratory of the United States Department of Agriculture at Riverside, California.

Standards of Quality for Water

Investigation and study of the quality of surface and ground waters of the Sutter-Yuba Area, as reported herein, were largely limited to consideration of mineral constituents of the waters, with particular reference to their suitability for irrigation use. However, it may be noted that, within the limits of the mineral analyses herein reported, a water which is determined to be suitable for irrigation may also be considered as being either generally suitable for municipal and domestic use, or susceptible to such treatment as will render it suitable for that purpose.

The major criteria which were used as a guide to judgment in determining suitability of water for irrigation use comprised the following: (1) chloride concentration, (2) total soluble salts, (3) boron concentration, and (4) percent sodium.

1. The chloride anion is usually the most troublesome element in most irrigation waters. It is not considered essential to plant growth, and excessive concentrations will inhibit growth.

2. Total soluble salts furnishes an approximate indication of the over-all mineral quality of water. It may be approximated by multiplying specific electrical conductance ($Ec \times 10^6$ at 25° C.) by 0.7. The presence of excessive amounts of dissolved salts in irrigation water will result in reduced crop yields.

3. Crops are sensitive to boron concentration, but require a small amount (less than 0.1 per million) for growth. They will usually not tolerate more than 0.5 to 2 parts per million, depending on the crop in question.

4. Percent sodium reported in the analyses is the proportion of the sodium cation to the sum of all cations, and is obtained by dividing sodium by the sum of calcium, magnesium, and sodium, all expressed in equivalents per million, and multiplying by 100. Water containing a high percent sodium has an adverse effect upon the physical structure of the soil by dispersing the soil colloids and making the soil "tight," thus retarding movement of water through the soil, retarding the leaching of salts, and making the soil difficult to work.

The following excerpts from a paper by Dr. L. D. Doneen, of the Division of Irrigation of the University of California at Davis, may assist in interpreting water analyses from the standpoint of their suitability for irrigation:

"Because of diverse climatological conditions, crops, and soils in California, it has not been possible to establish rigid limits for all conditions involved. Instead, irrigation waters are divided into three broad classes based upon work done at the University of California, and at the Rubidoux, and Regional Salinity laboratories of the U. S. Department of Agriculture.

"Class 1. *Excellent to Good*—Regarded as safe and suitable for most plants under any condition of soil or climate.

"Class 2. *Good to Injurious*—Regarded as possibly harmful for certain crops under certain conditions of soil or climate, particularly in the higher ranges of this class.

"Class 3. *Injurious to Unsatisfactory*—Regarded as probably harmful to most crops and unsatisfactory for all but the most tolerant.

"Tentative standards for irrigation waters have taken into account four factors or constituents, as listed below.

Factor	*Class 1 excellent to good*	*Class 2 good to injurious*	*Class 3 injurious to unsatisfactory*
Conductance ($Ec \times 10^6$ at 25° C.)	Less than 1000	1000–3000	More than 3000
Boron, ppm	Less than 0.5	0.5–2.0	More than 2.0
Percent sodium	Less than 60	60–75	More than 75
Chloride, epm	Less than 5	5–10	More than 10

(End of quotation)

Quality of Surface Water

Analyses of surface water samples, collected in March, 1949, from the Feather River and four of its tributaries, showed that at that time the waters in these streams were of excellent mineral quality and well suited for irrigation and other beneficial uses. The waters were characterized by a very low content of total mineral solubles, chloride, and boron, and by low percent sodium. The occurrence of excellent quality water in the Feather River is also indicated by analyses of water from that stream which are presented in the Sacramento-San Joaquin Water Supervision Reports of the Division of Water Resources dating from 1946. Analyses of drainage water samples collected from Sutter By-pass and Snake Slough indicated that both drainage waters contain higher concentrations of mineral solubles than waters of Feather River and its tributaries, but that they are well within the limits of Class 1 irrigation waters. Analyses of representative surface waters of the Sutter-Yuba Area, sampled in 1949, are presented in Table 18.

Quality of Ground Water

Although in the course of the present investigation surveys were made of the mineral quality of ground water throughout the Sutter-Yuba Area, particular emphasis was placed on those areas where saline degradation has been general, and of a degree sufficient to limit beneficial use of the ground water. Results of the surveys are presented and discussed in this section under the headings "Area of Degraded Ground Water" and "Source of Ground Water Salinity."

Area of Degraded Ground Water. Two comprehensive surveys of the average mineral quality of ground water in the Sutter-Yuba Area were made during the irrigation seasons of 1948 and 1949. Both surveys involved the partial analysis of water samples collected from numerous wells to determine total mineral solubles and chlorides. Results of the two surveys are summarized in Table 19, and show that in 1948 and 1949 the mineral quality of native ground water supplies was excellent or good in all zones of the Sutter-Yuba Area, except in that portion of the West Side Zone south of Oswald Road where abnormally high concentrations of chloride were found in many of the well water samples. The 1949 survey embraced a larger area than the 1948, and included lands south and west of Sutter By-pass. Results of this extended survey showed that high chloride salinity of ground water also occurred locally near the town of Robbins, some seven miles westerly from Nicolaus.

The foregoing present areas of comparatively high chloride salinity are shown on Plate 16, "Lines of Equal Concentration of Chlorides in Ground Water, July 1949." It may be noted that the concentration of chlorides in the ground water decreased progressively with distance from both of the affected areas, in the

TABLE 18

COMPLETE MINERAL ANALYSES OF REPRESENTATIVE SURFACE WATERS OF SUTTER-YUBA AREA

	Date of sample	Conductance, $Ec \times 10^6$ at 25° C.	Boron, in ppm	Mineral constituents in equivalents per million							Percent sodium
				Ca	Mg	Na	$HCO_3 + CO_3$	Cl	SO_4	NO_3	
Tributary Streams											
Feather River at Rednal Road	3/15/49	99	0.0	0.39	0.47	0.27	0.91	0.06	0.09	Trace	24
Feather River at Nicolaus	3/14/49	92	0.0	0.43	0.46	0.40	0.77	0.03	0.20	0.09	31
South Honcut Creek at La Porte Road	3/15/49	124	0.0	0.43	0.62	0.36	1.08	0.12	0.15	Trace	26
Dry Creek near Waldo	3/21/49	164	0.0	0.71	0.85	0.40	1.37	0.13	0.31	Trace	20
Coon Creek at Highway 99E	3/11/49	175	0.0	0.70	0.93	0.36	1.51	0.16	0.32	0.06	18
Auburn Ravine at Highway 99E	3/11/49	143	0.0	0.54	0.69	0.39	1.04	0.16	0.28	0.10	24
Drainage Waters											
Sutter By-pass at Colusa Highway	7/19/49	400	0.09	1.19	1.79	1.35	3.94	0.52	0.21	Trace	28
Snake Slough at Sanders	7/19/49	380	0.09	1.29	1.80	1.80	3.88	0.38	0.08	Trace	26

TABLE 19

SUMMARY OF PARTIAL MINERAL ANALYSES OF GROUND WATERS IN ZONES OF SUTTER-YUBA AREA, SUMMERS OF 1948 AND 1949

Zone	Number of samples		Chlorides, in equivalents per million				Conductance, $Ec \times 10^6$ at 25° C.	
			Average		Range			
	1948	1949	1948	1949	1948	1949	1948	1949
West Side								
North of Oswald Road	41	25	1.5	0.84	0.3- 4.8	0.3- 2.1	600	730
South of Oswald Road	129	159	5.13	6.10	0.3-28.7	0.3-62.5	1,010	1,300
Northeast	4	2	0.8	0.73	0.3- 1.1	0.3- 1.1	340	280
East Central	31	14	0.7	0.7	0.3- 1.7	0.3- 1.7	300	210
South Side	21	6	1.1	1.0	0.6- 4.8	0.5- 2.0	500	380

West Side Zone south of Oswald Road and near the town of Robbins. It may be inferred from this condition that, when hydraulic conditions are favorable, saline ground water from these two areas may move laterally, thus causing degradation in the mineral quality of remaining fresh ground water resources of surrounding areas.

The areas delimited by the lines of equal chloride concentration on Plate 16 indicate that at the present time wells on approximately 4,500 acres of land in the West Side Zone south of Oswald Road yield water containing chlorides in amounts exceeding 10 equivalents per million, which amount is considered to be the upper limit for safe irrigation use. When such saline waters are used for irrigation, quantities of water exceeding normal crop demands are commonly applied in order to dilute the soil solution and leach accumulations of excess salts away from the root zone.

Source of Ground Water Salinity. The presence of saline ground waters in and adjacent to the Sutter-Yuba Area has been observed to exist for many years, and was remarked upon in reports of salt balance studies conducted by the Division of Soil Management and Irrigation of the United States Department of Agriculture. These studies, which were made in cooperation with the Sutter Mutual Water Company during 1931, 1932, 1933, 1946, and 1947, showed that the amount of dissolved solids in water drained from lands adjacent to and west of the southern portion of the Sutter-Yuba Area greatly exceeded the amount brought onto the lands in irrigation water. The salt output during each of the five years, expressed as a proportion of the input, is reported to have ranged between 248 and 655 percent, and the average was about 407 percent.

The opinion was expressed in a report on the foregoing 1947 salt balance study that the salt in the drainage waters was probably derived from saline waters underlying the area. Preliminary studies made by the Division of Water Resources similarly indicated that the chloride salinity in many of the wells was due to admixture of deep-seated brines with native fresh ground waters. There is evidence that such brines may underlie aquifers of good quality water throughout large areas of the Sacramento and San Joaquin Valleys, and that they may have originated during past geologic time when the floor of the valley was inundated by the ocean. Such brines sometimes appear in water pumped from the deeper wells in the two valleys, or from areas wherein the fresh ground water levels are markedly lowered through overdraft. In many instances these relatively deep-seated brines are under considerable pressure and readily rise to the surface through defective, abandoned, or improperly constructed wells. A case in point is a natural gas well located near the town of Robbins which yields water under artesian and/or gas pressure, at a rate of about 200 gallons a minute. The water from this well, No. 12N/2E-18, has a conductivity of about 8,600, a chloride content of about 100 equivalents per million, and about 10.8 parts per million of boron.

A geochemical study was made to determine whether salinity of ground water in the Sutter-Yuba Area was caused principally by a common degradant, and whether the foregoing deep-seated brines constituted that degradant. The study to identify the degradant was made on the basis of complete mineral analyses of water samples collected from 38 scattered wells located in the West Side Zone south of Oswald Road and in adjacent lands to the west. These water samples were first classified into eight groups according to the range in concentration of total anions. For purposes of the study it was considered that native fresh ground waters contained total anions in amounts less than about 7 equivalents per million, chlorides in amounts less than about 2.5 equivalents per million, and that degradation had occurred if these amounts were exceeded. A discussion of the characteristics of each group follows:

Group 1. This comprised unaltered normal ground water. Four analyses were available for Group 1 water. The wells which yielded this water were located within the present zone of high chloride concentration, and the samples were taken and analyses made in 1934 and 1935 prior to recent degradation of ground water in the zone. The water had total anions ranging from 4.72 to 6.31 equivalents per million, and chlorides from 0.85 to 2.06 equivalents per million. Its mineral quality was excellent.

Group 2. This group comprised waters containing a trace of salinity. Total anions ranged from 8.95 to 10.68 equivalents per million, and chlorides from 5.45 to 6.39 equivalents per million. Four analyses repre-

TABLE 20

COMPLETE MINERAL ANALYSES OF GROUND WATERS IN AREA OF SALINE DEGRADATION IN AND ADJACENT TO SUTTER-YUBA AREA, GROUPED IN ACCORDANCE WITH TOTAL ANIONS

Ground water group	Well location or number	Date of sample	Conductance, $Ec \times 10^6$ at 25° C.	Boron, in ppm	Mineral constituents, in equivalents per million							Percent sodium
					Ca	Mg	Na	$HCO_3 + CO_3$	Cl	SO_4	NO_2	
1	N½ Sec. 9, T13N, R3E	5/31/34	483	....	1.40	1.81	1.51	3.30	1.33	0.09	....	32
	S½ Sec. 10, T14N, R3E	1/ 2/35	543	....	1.70	1.97	1.43	4.25	0.85	Trace	....	28
	NE¼ Sec. 15, T14N, R3E	1/15/35	515	....	1.50	2.13	1.54	3.70	1.47	Trace	....	30
	NW¼ Sec. 28, T14N, R3E	4/30/34	635	....	2.10	2.30	1.91	4.20	2.06	0.05	....	30
	Average	----	544	....	1.67	2.05	1.59	3.86	1.43	0.03	....	30
2	11N/3E-2B1	7/ /49	944	0.16	2.80	2.24	4.31	3.02	5.90	0.03	0.0	46
	13N/3E-3D1	7/ /49	980	0.09	3.59	5.02	2.05	4.20	6.39	0.09	0.0	19
	14N/3E-28R1	7/ /49	1,000	0.12	2.71	5.62	2.58	3.94	6.38	0.13	Trace	24
	14N/3E-33A2	7/ /49	1,037	0.0	2.98	4.29	3.32	5.09	5.45	0.03	0.0	31
	Average	------	990	0.09	3.02	4.29	3.06	4.06	6.03	0.07	Trace	30
3	13N/3E-2P3	7/ /49	1,317	0.17	3.13	3.39	6.46	3.78	9.21	0.04	0.0	50
	13N/3E-5K1	7/ /49	1,353	0.07	3.70	5.53	4.07	4.15	9.14	0.09	0.0	31
	13N/3E-10A1	7/ /49	1,190	0.05	4.40	5.83	2.13	3.91	8.06	0.22	0.0	17
	14N/3E-27E1	7/ /49	1,361	0.0	4.51	5.94	3.38	5.53	7.86	0.45	Trace	24
	14N/3E-29Q1	7/ /49	1,390	0.14	4.14	5.33	4.47	3.23	10.15	0.02	Trace	32
	14N/3E-34J1	7/ /49	1,087	0.0	4.05	5.76	2.57	6.84	3.40	2.01	0.10	21
	Average	-------	1,283	0.07	3.99	5.31	3.85	4.54	7.97	0.14	0.02	29
4	13N/3E-2E1	7/ /49	1,503	0.49	2.96	3.05	8.75	3.78	11.11	0.03	0.0	59
	13N/3E-11D1	7/ /49	1,408	0.06	5.21	7.34	1.96	4.17	9.34	0.81	0.0	13
	13N/3E-14G1	7/ /49	1,307	0.06	4.43	6.85	3.44	6.20	7.49	0.71	0.06	23
	13N/3E-23H1	7/ /49	1,408	0.03	5.45	6.73	2.92	4.98	10.23	0.17	0.0	19
	13N/3E-24D1	7/ /49	1,460	1.64	3.23	2.15	9.05	3.90	11.68	0.03	0.0	63
	14N/3E-33A1	7/ /49	1,460	0.0	4.88	6.99	2.82	5.11	9.44	0.09	0.0	19
	Average	------	1,425	0.36	4.36	5.52	4.86	4.52	9.88	0.31	0.01	33
5	13N/3E-5C1	7/ /49	1,835	0.21	4.83	6.00	6.70	3.52	14.08	0.03	0.0	38
	13N/3E-11F1	7/ /49	1,710	0.85	3.29	4.51	9.40	3.26	13.04	0.28	0.0	55
	13N/3E-14J1	7/ /49	1,710	0.31	4.68	8.18	4.87	4.12	12.78	0.43	0.0	27
	14N/3E-28G2	7/ /49	1,653	0.0	5.18	6.92	4.51	5.21	10.95	0.37	0.0	27
	14N/3E-32F1	7/ /49	1,640	0.24	4.90	7.36	4.77	4.35	12.37	0.03	0.0	28
	Average	----	1,709	0.32	4.58	6.59	6.05	4.09	12.64	0.23	0.0	35
6	11N/3E-3B1	7/ /49	2,162	0.93	4.63	2.98	13.94	3.42	18.08	0.03	0.0	65
	13N/3E-2N1	7/ /49	1,802	0.07	5.71	6.31	6.02	4.63	13.61	0.15	Trace	33
	13N/3E-14R1	7/ /49	1,870	0.72	5.35	6.68	6.89	4.88	14.06	0.26	0.0	36
	13N/3E-16R1	7/ /49	2,222	0.03	5.96	8.25	7.27	4.24	17.42	0.03	0.0	34
	13N/3E-32L1	7/ /49	2,062	0.21	5.27	10.09	5.75	2.64	17.26	0.30	0.0	27
	Average		2,059	0.39	5.38	6.86	7.97	3.95	16.09	0.15	Trace	39
7	13N/3E-6K1	7/ /49	2,550	0.28	6.62	11.33	8.81	5.08	20.42	0.05	0.0	33
	13N/3E-23B1	7/ /49	3,390	0.0	11.83	16.80	6.71	5.50	29.01	0.34	Trace	19
	14N/3E-31J1	7/ /49	2,425	0.0	7.28	11.08	6.20	5.06	19.26	0.26	Trace	25
	14N/3E-31R1	7/ /49	2,552	0.07	7.36	11.09	6.97	4.98	20.44	0.12	0.0	27
	14N/3E-32L2	7/ /49	2,776	0.27	7.40	9.30	9.81	2.82	23.52	0.04	0.0	37
	14N/5E-21A1	8/ 3/49	2,702	1.71	10.78	4.17	12.60	1.72	22.94	2.01	Trace	46
	Average		2,732	0.39	8.55	10.63	8.52	4.19	22.60	0.47	Trace	31
8	SE¼ Sec. 2, T12N, R2E	7/ 9/49	10,000	0.60	30.37	35.30	39.90	4.10	99.45	0.05	0.0	38
	SW¼ Sec. 18, T12N, R2E	3/14/47	8,600	10.8	19.83	7.22	76.12	2.71	99.92	0.08		74
	Average		9,300	5.7	25.10	21.26	58.01	3.40	99.67	0.05		56

senting wells yielding Group 2 waters were available. These waters were classed as of good mineral quality and suitable for general irrigation use.

Group 3. This group comprised slightly saline ground waters. Total anions ranged from 12.19 to 13.40 equivalents per million, and chlorides ranged from 3.40 to 10.15 equivalents per million. Six analyses were available for wells yielding Group 3 waters. These waters were considered to be generally satisfactory for irrigation use.

Group 4. This group comprised moderately saline ground waters, with total anions ranging from 14.32 to 15.38 equivalents per million, and chlorides ranging from 7.49 to 11.68 equivalents per million. Six analyses were available for wells yielding Group 4 waters. These waters were classed as usable with caution for general irrigation under most conditions.

Group 5. This group comprised saline ground waters with total anions ranging from 16.53 to 17.63 equivalents per million, and chlorides ranging from 10.95 to 14.08 equivalents per million. Five analyses were available for wells yielding Group 5 waters. These waters would normally be considered usable for irrigation only after dilution with water of better mineral quality.

Group 6. This group comprised saline ground waters having total anions ranging from 18.35 to 21.69 equivalents per million, and chlorides ranging from 13.61 to 18.08 equivalents per million. Five analyses were available for wells yielding Group 6 water. This water was classed as unsuitable for irrigation use.

Group 7. This group comprised highly saline ground waters, having total anions ranging from 25.54 to 34.88 equivalents per million, and chlorides ranging from 19.26 to 29.04 equivalents per million. Analyses were available for six wells yielding Group 7 waters. These waters were not considered usable for irrigation or domestic purposes.

Group 8. This group comprised briny ground waters. Group 8 waters were yielded in June 1949 by a reputedly shallow well, and in April 1930 and March 1947 by a nearly 1500-foot abandoned gas well, both located near Robbins to the west of the Sutter-Yuba Area. These waters had total anions in excess of 100 equivalents per million. Chlorides accounted for about 95 per cent or more of the anions.

Results of complete mineral analyses of ground waters in the zone of degradation, segregated into the foregoing groups, are presented in Table 20.

The character formula of a water expresses the percent of each cation and anion of mineral constituents of the water with respect to their total, and is useful in comparing mineral quality characteristics of several waters. In order to compare the groups of saline ground waters in and adjacent to the Sutter-Yuba Area, the average equivalents per million of each cation and anion in unaltered normal ground water, represented by Group 1, were first subtracted from corresponding average mineral constituents in ground water of each of the other groups, with exception of those of Group 8. The character formulae of waters of Groups 2 to 7 were then derived as determined by use of these remainders. Both the character formulae of these differences and the mineral constituents are shown in Table 21. They may be considered to represent the mineral characteristics of the ground water degradant as they were prior to alteration through mingling of the degradant with fresh ground water, but after being subjected to base exchange during movement of the degradant from its source. It may be noted that both the concentration and composition of waters in Group 8 were taken directly from the average analysis presented in Table 20. This was done on the assumption that the brines of that group were not significantly diluted with fresh water.

TABLE 21

AVERAGE MINERAL CHARACTER AND CONSTITUENTS OF SALINE GROUND WATERS IN AND ADJACENT TO SUTTER-YUBA AREA

(Corrected for effects of dilution with unaltered normal ground water)

Ground water group	Mineral constituents in equivalents per million and character formulae in percent					
	Ca	Mg	Na	HCO_3	Cl	SO_4
2	1.35 13.3%	2.24 22.2%	1.47 14.5%	0.20 2.0%	4.60 47.6%	0.04 0.4%
3	2.32 14.0%	3.26 20.8%	2.26 14.4%	0.68 4.6%	6.54 44.6%	0.11 0.8%
4	2.69 14.3%	3.47 18.4%	3.27 17.3%	0.66 3.5%	8.45 45.0%	0.28 1.5%
5	2.91 12.2%	4.54 19.1%	4.46 18.7%	0.23 1.0%	11.21 48.1%	0.20 0.9%
6	3.71 13.7%	4.81 15.6%	6.38 20.7%	0.09 0.3%	14.66 49.3%	0.12 0.4%
7	6.88 15.4%	8.58 19.1%	6.93 15.5%	0.33 0.8%	21.17 48.2%	0.44 1.0%
8	25.10 21.0%	21.26 10.0%	58.01 28.0%	3.40 1.7%	99.67 48.0%	0.06 0.3%

Table 21 shows that, irrespective of variations in concentration, the character formula of the degradant in each of the ground water Groups 2 through 7 is strikingly similar to that of the brines comprising Group 8. This is especially true of the anions which are not subject to base exchange reactions. This similarity in composition, together with apparent absence of any other like degradant, indicates that degradation of the native ground waters is due to admixture of deep-seated brines of the type exemplified by Group 8.

Although the chloride content of water from wells in the area of saline ground water is generally high, it is quite variable with respect to the depth of wells. Examination of analyses of water from 33 wells of known depth in the West Side Zone south of Oswald Road did not indicate any correlation between chloride content of the water and depth. The wells studied for this purpose ranged in depth from about 50 to 300 feet, and the average depth was of the order of 145 feet. The lack of any significant correlation in this matter cannot be fully explained on the basis of data compiled during the course of the present investigation. However, it is probable that the explanation may lie in precise identification of the aquifers which contribute water to the respective wells. For example, wells pumping from both fresh and saline aquifers would probably yield water containing lower concentrations of chlorides than wells pumping only from saline aquifers. In this connection it is noted that additional more detailed investigation of the quality of the water resources of the Sutter-Yuba Area is in progress under the provisions of Section 229 of the Water Code. This work is being conducted by the Division of Water Resources in connection with its assigned responsibilities for a state-wide survey of quality of surface and ground waters, the results of which will be published at a later date.

Studies to date of saline ground water conditions in the Sutter-Yuba Area indicate that the brines of Group 8 may migrate upward into fresh water aquifers both through permeable zones in the alluvium and through unplugged test wells and abandoned, defective, or improperly constructed water wells. Furthermore, when the water table is lowered by heavy irrigation pumping, it is probable that upward movement of the brines is accelerated. Possible subsequent lateral movement of the brines may be inferred from the observed progressive decrease in ground water chloride concentrations with distance from the two areas of high chloride salinity, in the West Side Zone south of Oswald Road and near Robbins.

CHAPTER III

WATER UTILIZATION AND SUPPLEMENTAL REQUIREMENTS

The nature and extent of water utilization and requirements for supplemental water in the Sutter-Yuba Area, both at the present time and under probable conditions of ultimate development, are considered in this chapter. In connection with the discussion, the following terms are used as defined:

Water Utilization—This term refers to the sum of consumptive use of water and those irrecoverable losses of water incidental to its beneficial use.

Consumptive Use of Water—This term refers to water consumed by vegetative growth in transpiration and building of plant tissue, and to water evaporated from adjacent soil, from water surfaces, and from foliage. It also refers to water similarly consumed and evaporated by urban and nonvegetative types of culture.

Supplemental Requirement—This term refers to the amount of water, over and above the sum of safe ground water yield and safe surface water yield, which must be developed to satisfy water utilization.

Ultimate—This term refers to an unspecified but long period of years into the future when cultural development will be essentially stabilized. (It is realized that any present forecasts of the nature and extent of such ultimate cultural development, and resultant water utilization, are inherently subject to possible large errors in detail and appreciable error in the aggregate. However, such forecasts, when based upon best available data and present judgment, are of value in establishing long-range objectives for development of water resources. They are so used herein, with full knowledge that their re-evaluation after the experience of a period of years may result in considerable revision.)

Present water utilization in the Sutter-Yuba Area was estimated by the application of appropriate unit consumptive use of water factors to the present cultural pattern. Probable ultimate water utilization was similarly estimated, by the use of an ultimate cultural pattern projected from the present pattern on the basis of land classification data, the assumption being made that under ultimate conditions of cultural development all irrigable lands would be irrigated. As indicated by the foregoing definition, supplemental requirements for water were estimated as the differences between derived values of safe yield and utilization, under both present and ultimate conditions of cultural development.

Water utilization is considered and evaluated in this chapter under the general headings "Present Water Supply Development," "Land Use," "Unit Use of Water," "Past and Present Water Utilization," "Probable Ultimate Water Utilization," and "Demands for Water." Supplemental water requirements are similarly treated under the two general headings "Present Supplemental Requirements" and "Probable Ultimate Supplemental Requirements."

WATER UTILIZATION

Of the total amount of water presently utilized in the Sutter-Yuba Area, approximately 65 percent is consumed in the production of irrigated crops, while the remainder is consumed by dry-farmed crops and fallow lands, native vegetation, and miscellaneous culture including domestic and municipal. It is considered probable that the predominant importance of irrigated agriculture, as related to utilization of water in the area, will continue to prevail in the future.

Present Water Supply Development

Approximately two-thirds of the acreage under water service in the Sutter-Yuba Area is presently supplied by water pumped from the underlying ground water basin. Irrigated lands utilizing ground water are generally served by individually owned wells and pumps. Because of this fact and the extensive ground water utilization, the amount of water developed for irrigation use by individuals is larger than by organized agencies. As of April 1, 1949, there were 2,198 wells and pumping plants of heavy draft, powered with motors of more than five horsepower, and of this number 2,159 were used for irrigation. The 39 remaining wells supplied water for urban and industrial uses. A number of additional wells of light draft supplied limited amounts of water for noncommercial gardens and orchards, and for domestic purposes. Lands served principally with ground water comprise the Peach Bowl, the East Central Zone, and the portion of the South Side Zone adjacent to and south of Bear River.

Surface diversions for irrigation in the Sutter-Yuba Area are made from the Sacramento and Feather Rivers and tributary streams, and from the Wadsworth and Natomas Canals, various surface drains, and the Sutter By-pass. The major diversions are made by irrigation companies and districts, with service to the lands being largely by means of open ditch transmission and distribution systems. Minor surface diversions are made for the most part by individuals whose lands are adjacent to the surface supplies. The Sutter Butte Canal Company is the principal diverter of water from Feather River, serving lands in the West Side Zone outside of the Peach Bowl. The joint diversion of the Hallwood Irrigation Company and the

Cordua Irrigation District is the largest of a number of irrigation diversions from Yuba River, and serves water to lands in the Northeast Zone. The Nevada Irrigation District supplies some surface water to lands in the South Side Zone through ditches diverting from Auburn Ravine. Lands served principally by surface waters comprise the Northeast Zone, the West Side Zone outside the Peach Bowl, and the west portion of the South Side Zone.

Water used for municipal, industrial, and domestic purposes in the Sutter-Yuba Area is obtained almost entirely from wells. The greater part of such use is in the Cities of Marysville and Yuba City, and is scattered and of relatively minor significance throughout the remainder of the area.

The City of Marysville is served by the California Water Service Company, a public utility which pumps water from wells into storage tanks, from which it is delivered to consumers by gravity. Water services are metered. The quantity of water pumped for use in Marysville in the calendar year 1948 was 506,000,000 gallons, or 1,550 acre-feet. With an approximate population of 7,500 in July, 1948, the daily production averaged about 185 gallons per capita.

Yuba City is served by the Yuba City Municipal Water Works, which charges for water on a flat-rate basis. It was estimated that the quantity of water pumped for use in Yuba City in the calendar year 1948 was about 750,000,000 gallons, or 2,300 acre-feet. With an approximate population of 6,300 in March, 1948, the daily per capita production was about 330 gallons.

In addition to the foregoing figures regarding ground water pumped in 1948 under the municipal systems of Marysville and Yuba City, it was estimated that approximately 1,000 acre-feet was pumped and used by industries operating their own wells within the cities. Wheatland has a community water system that distributes water from a storage tank supplied by two wells. The estimated amount of water pumped in Wheatland during the calendar year 1948 was approximately 200 acre-feet. Assuming that the per capita water production in remaining small towns and communities in the Sutter-Yuba Area was about 200 gallons per day, it was estimated, on the basis of 1948 population estimates, that total annual pumpage from ground water for these communities was about 700 acre-feet.

The respective areas within the several zones of the Sutter-Yuba Area served by ground water and surface water are shown in Table 22. The data presented for the two investigational seasons resulted from field surveys during the current investigation, while the averages for the base period were largely based on records of crop surveys made by the Division of Water Resources in connection with the Sacramento-San Joaquin Water Supervision, and on pumping power consumption records furnished by the Pacific Gas and Electric Company.

TABLE 22

GROUND AND SURFACE WATER SERVICE AREAS IN ZONES OF SUTTER-YUBA AREA

(In acres)

Zone	Ground water		Surface water	
	1948	1949	1948	1949
West Side	48,990	44,050	18,750	21,590
Northeast	6,050	8,240	11,540	11,850
East Central	24,230	33,140	2,500	990
South Side	11,280	10,770	15,420	18,070
TOTALS	90,550	96,800	48,210	52,500
Averages for 9-year base period, 1939-40 through 1947-48	68,490		42,810	

Table 23 lists the principal water service agencies, together with notations on their sources of water supply, locations of service areas within the Sutter-Yuba Area, and acreages within the area irrigated by water served by each agency in 1948. Areas included within the boundaries of these agencies are shown on Plate 2.

TABLE 23

PRINCIPAL WATER SERVICE AGENCIES SUTTER-YUBA AREA

Agency	Source of water supply	Service area by zones	Acreage irrigated in 1948
California Water Service Company	Ground water	Northeast	Municipal use in Marysville
Camp Far West Irrigation District	Bear River	East Central	1,580
Cordua Irrigation District	Yuba River	Northeast	4,736
Farm Lands Investment Company	Feather River	East Central	1,833
Feather River Water Company	Feather River	West Side	0
Garden Highway Mutual Water Company	Feather River	West Side	2,075
Hallwood Irrigation Company	Yuba River	Northeast	6,365
Natomas Central Mutual Water Company	Sacramento River	South Side	11,298
Natomas Northern Mutual Water Company	Sacramento River	South Side	*
Nevada Irrigation District	Yuba and Bear Rivers	South Side	1,240
Oswald Water District	Feather River	West Side	608
Sutter Butte Canal Company	Feather River	West Side	12,840
Sutter Extension Water District	Feather River	West Side	Formed in 1949
Yuba City Municipal Water Works	Ground water	West Side	Municipal use

* Included in acreage of Natomas Central Mutual Water Company.

Rice Field in Sutter-Yuba Area

Land Use

As a first step in estimating the amount of water utilization in the Sutter-Yuba Area during the base period and investigational seasons, determinations were made of the nature and extent of land use prevailing during these periods. Similarly, the probable nature and extent of ultimate land use, as related to water utilization, was forecast on the basis of land classification survey data which segregated lands of the area in accordance with their suitability for irrigated agriculture.

Past and Present Cultural Patterns. In connection with the Sacramento-San Joaquin Water Supervision, the Division of Water Resources for some 25 years has made annual crop surveys of those lands in the Sutter-Yuba Area utilizing surface water. In 1946 the United States Bureau of Reclamation made a complete crop survey of the area. A comprehensive cultural survey was made during the season of 1947-48 as a part of the current investigation. Additional data on culture were obtained in 1948-49 from a supplementary survey made in order to determine any changes in land use since the preceding season.

Data available from the foregoing surveys were sufficient to estimate the average cultural pattern in the Sutter-Yuba Area during the nine-year base period. For purposes of this report, the cultural pattern existing during the 1948-49 season was considered to represent "present" conditions of culture and development in the area, and is so referred to in subsequent discussion.

Summaries of the results of the cultural surveys of 1947-48 and 1948-49 and the estimated average cultural pattern for the base period are presented in Table 24. The Sutter Buttes, comprising some 22,300 acres of waste land in the West Side Zone, are not included in the tabulation. Lands irrigated in the Sutter-Yuba Area during the 1947-48 season are shown on Plate 17, "Irrigated and Irrigable Lands, 1948."

The most significant indicated recent trend in irrigated agriculture in the Sutter-Yuba Area is toward increased plantings of rice and permanent pasture. The data presented in Table 24 show that the area of rice increased from an estimated average of some 25,500 acres during the base period to over 44,000 acres in 1948-49. At the same time, permanent pasture increased from some 17,500 to 25,500 acres. Deciduous orchard, which had long been the largest irrigated crop in the area on an acreage basis, showed an increase of less than 3,000 acres in 1948-49 over the base period average, and was surpassed by the acreage of rice during the latter season. The foregoing increases in irrigated agriculture were largely reflected by corresponding decreases in acreage of dry-farmed and fallow lands. Table 24 shows that there was moderate increase in farmstead and urban development in 1948-49 over the base period averages, but no very significant changes in remaining types of culture in the Sutter-Yuba Area.

Probable Ultimate Cultural Pattern. Classification of lands of the Sutter-Yuba Area with respect to their suitability for irrigated agriculture was largely accomplished by other agencies prior to the Sutter-Yuba Counties Investigation. Many valuable data on land classification were available from and furnished by the United States Bureau of Reclamation. The available data were supplemented and checked as required in the course of field surveys conducted as a part of the investigation.

On the basis of their suitability for irrigation, agricultural lands of the Sutter-Yuba Area were segregated into the following five classes:

Class 1. This class comprises lands that are highly desirable in every respect for continuous irrigated agricultural use, and capable of producing all climatically adapted crops. The soils are deep, with good surface and subsoil drainage, of medium to fairly fine texture, and of good water-holding capacity. The soil structure is such as to permit easy penetration of roots, air, and water, and the land surface is smooth and gently sloping.

Class 2. This class comprises lands that are generally limited in their use to climatically adapted crops of medium root depths. Restrictive features with regard to use of the lands are soil depth and, to some extent, topography or drainage.

Class 3. This class comprises lands that are generally limited in their use to climatically adapted shallow-rooted crops, owing to deficiencies in soil depth, topography, or drainage characteristics. This class of lands is suitable for development under irrigation, but because of shallow soil depths, greater care and skill are required in the application of water than are necessary in the case of lands of Classes 1 and 2.

Class 4. This class comprises lands that fail to meet the standards of Classes 1, 2, and 3, as to topography, drainage, and depth of soil. These lands are generally suitable only for permanent pasture or similar crops.

Class 6. This class comprises all lands that do not meet the minimum requirements of suitability for irrigation use.

In addition to agricultural lands, 5,550 acres in the Sutter-Yuba Area were classified as urban, and 22,270 acres comprising the waste lands of the Sutter Buttes were not otherwise classified. Results of the land classification of the Sutter-Yuba Area, summarized by zones, are presented in Table 25.

By use of the land classification data a probable ultimate cultural pattern for the Sutter-Yuba Area was forecast. The general assumption was made that under

TABLE 24

PAST AND PRESENT CULTURAL PATTERNS IN ZONES OF SUTTER-YUBA AREA

(In acres)

Class and type of culture	West Side Zone			Northeast Zone			East Central Zone			South Side Zone			Totals		
	Estimated base period average, 1939-40 through 1947-48	1947-48	Present, 1948-49	Estimated base period average, 1939-40 through 1947-48	1947-48	Present, 1948-49	Estimated base period average, 1939-40 through 1947-48	1947-48	Present, 1948-49	Estimated base period average, 1939-40 through 1947-48	1947-48	Present, 1948-49	Estimated base period average, 1939-40 through 1947-48	1947-48	Present, 1948-49
Irrigated lands															
Deciduous orchard	30,610	32,660	31,820	3,830	4,380	4,410	3,190	3,970	4,080	3,050	3,220	3,190	40,680	44,230	43,500
Rice	9,200	13,480	13,120	1,170	3,440	4,320	3,350	7,800	12,080	11,800	13,630	14,920	25,520	38,350	44,440
Permanent pasture	5,750	8,760	8,530	5,030	6,710	7,580	3,860	5,130	5,860	2,800	3,330	3,560	17,440	23,940	25,530
Beans	3,470	3,610	3,700	1,270	1,460	1,140	3,640	4,190	5,680	1,330	1,390	1,870	9,700	10,650	12,390
Alfalfa	3,100	3,780	3,770	780	1,030	1,630	1,430	1,940	2,210	2,760	3,310	3,530	8,070	10,060	11,140
Truck	2,950	3,060	3,010	210	230	250	510	600	650	680	1,000	930	4,350	4,890	4,840
Tomatoes	980	1,020	1,000	70	80	140	180	210	600	320	70	140	1,550	1,370	1,880
Corn	350	370	300	190	220	270	310	350	550	370	390	410	1,230	1,330	1,530
Hops	520	540	540				560	650	650				1,090	1,190	1,190
Sugar beets	240	250	190	10	10	180	560	640	640	210		40	1,020	900	1,050
Olives	50	40	40	20	20	20	240	290	280				310	350	340
Vines	140	150	150				70	80	80		10	10	200	240	240
Miscellaneous	20	20	70			150	810	890	770	310	350	240	1,140	1,260	1,230
Subtotals	57,380	67,740	66,240	12,580	17,580	20,090	18,710	26,740	34,130	23,630	26,700	28,840	112,300	138,760	149,300
Dry-farmed and fallow lands	53,980	42,610	44,110	24,700	19,150	16,640	47,440	38,440	31,050	53,810	50,120	47,980	179,920	150,310	139,770
Native vegetation	3,580	3,580	3,580	2,750	2,750	2,750	5,280	5,280	5,280	1,400	1,400	1,400	13,010	13,010	13,010
Miscellaneous															
Farmsteads	2,320	2,690	2,690	460	590	590	1,080	1,460	1,460	1,070	1,380	1,380	4,930	6,120	6,120
Roads	2,320	2,690	2,690	460	590	590	1,080	1,460	1,460	1,070	1,380	1,380	4,930	6,120	6,120
Urban	1,840	2,110	2,110	900	1,190	1,190	1,850	2,060	2,060	190	190	190	4,780	5,550	5,550
Water surface	1,350	1,350	1,350	470	470	470	1,040	1,040	1,040	130	130	130	2,990	2,990	2,990
Railroads and highways	720	720	720	380	380	380	660	660	660	690	690	690	2,450	2,450	2,450
Airfields				160	160	160	590	590	590				750	750	750
By-pass overflow lands										470	470	470	470	470	470
Tules	160	160	160				20	20	20				180	180	180
By-pass levees	120	120	120										130	130	130
Waste lands							120	120	120				120	120	120
Subtotals	8,830	9,840	9,840	2,380	3,380	3,380	6,440	7,410	7,410	3,620	4,240	4,240	21,730	24,880	24,880
TOTALS	*123,770	*123,770	*123,770	42,860	42,860	42,860	77,870	77,870	77,870	82,460	82,460	82,460	*326,960	*326,960	*326,960

* Excluding 22,270 acres of waste lands in Sutter Buttes.

TABLE 25

CLASSIFICATION OF LANDS IN ZONES OF SUTTER-YUBA AREA

(In acres)

Zone	Land classes						
	1	2	3	4	6	Urban	Totals
West Side	45,520	41,040	27,440	220	7,440	2,110	*123,770
Northeast	4,240	18,420	13,190	190	5,630	1,190	42,860
East Central	8,330	14,070	44,450	1,270	7,690	2,060	77,870
South Side	10,200	30,880	36,770	-----	4,420	190	82,460
TOTALS	68,290	104,410	121,850	1,680	25,180	5,550	*326,960

* Excluding 22,270 acres of waste lands in Sutter Buttes.

an increasing pressure of demand for agricultural products all irrigable but presently dry lands would eventually be provided with irrigation service. Provision was also made for probable increase in lands devoted to farmsteads, roads, urban, and other miscellaneous purposes under conditions of probable ultimate development.

The estimated ultimate cultural pattern of the Sutter-Yuba Area, summarized by general classes of culture and by zones of the area, is presented in Table 26. Irrigable lands, as determined by the land classification survey data and as indicated by the probable ultimate cultural pattern, are shown on Plate 17.

TABLE 26

PROBABLE ULTIMATE CULTURAL PATTERN IN ZONES OF SUTTER-YUBA AREA

(In acres)

Class of culture	West Side Zone	North-east Zone	East Central Zone	South Side Zone	Totals
Irrigated lands	100,000	31,200	54,000	64,700	249,900
Dry-farmed lands	9,600	5,100	9,300	11,100	35,100
Native vegetation	3,600	2,700	5,300	1,400	13,000
Miscellaneous	10,600	3,900	9,300	5,200	29,000
TOTALS	*123,800	42,900	77,900	82,500	*327,000

* Excluding waste lands in Sutter Buttes.

Unit Use of Water

The second step in evaluation of water utilization involved the determination of unit values of consumptive use of water for each type of water consuming culture. Estimates of these unit values were largely based on the results of prior investigations and studies in other areas.

A procedure suggested by Harry F. Blaney and Wayne D. Criddle of the Soil Conservation Service, United States Department of Agriculture, in their reports entitled "A Method of Estimating Water Requirements in Irrigated Areas from Climatological Data," dated December, 1947, and "Determining Water Requirements in Irrigated Areas from Climatological and Irrigation Data," dated August, 1950, was generally utilized for adjustment of available data on unit consumptive use by irrigated crops in other localities to correspond with conditions existing in the Sutter-Yuba Area. This method involved correlation of the data on the basis of variations in average monthly temperatures, monthly percentages of annual daytime hours, precipitation, and lengths of growing season. It disregarded certain generally unmeasured factors such as wind movement, humidity, etc. Average monthly temperatures at Marysville were considered representative of the Sutter-Yuba Area. Monthly percentages of annual daytime hours were determined for latitude 39° N., which passes approximately through the center of the area.

The following is an outline of the procedure utilized for estimating unit values of consumptive use:

1. The unit value for each irrigated cultural type during its growing season was taken as the product of available heat and an appropriate coefficient of consumption, where: (a) the available heat was the product of average monthly temperature and monthly percent of daytime hours, and (b) the coefficient of consumption was one which had been selected as appropriate for California by Harry F. Blaney as a result of his studies for the Soil Conservation Service. Certain exceptions involved the use of coefficients estimated from consumptive use data available from other sources.

2. The unit value for each irrigated cultural type during its nongrowing season was taken as the amount of precipitation available, but not exceeding one to two inches of depth per month, depending upon the type of culture and cover crop.

3. The seasonal unit value for each irrigated cultural type was taken as the summation of values determined under items 1 and 2 for that type.

4. Unit seasonal values for native annual grasses were taken as equal to the available precipitation up to but not exceeding 1.3 feet in depth.

5. Unit seasonal values for native vegetation other than annual grasses were estimated on the basis of available data on corresponding consumptive use in similar localities, due consideration being given to density and type of vegetation and depth to ground water.

6. Unit seasonal values for free water surfaces were estimated from available records of evaporation at Gridley.

7. Unit seasonal values for remaining miscellaneous types of culture were estimated on the basis of available data on corresponding consumptive use in similar localities.

Estimated unit seasonal values of consumptive use of water in the Sutter-Yuba Area, including consumption of precipitation, are presented in Table 27. In view of the indicated water supply and climatological similarities of the mean and base periods, the estimated average unit seasonal values of consumptive use for the base period were considered to approximate corresponding values for the mean period.

TABLE 27

ESTIMATED UNIT VALUES OF SEASONAL CONSUMPTIVE USE OF WATER IN SUTTER-YUBA AREA

(In feet of depth)

Class and type of culture	Average for 9-year base period, 1939-40 through 1947-48	1947-48	1948-49
Irrigated lands			
Deciduous orchard	2.7	2.5	2.7
Rice	5.0	5.0	5.0
Permanent pasture	3.7	3.3	3.6
Beans	2.0	2.0	1.8
Alfalfa	4.0	3.6	3.9
Truck	2.3	2.3	2.2
Tomatoes	2.3	2.3	2.2
Corn	2.8	2.7	2.6
Hops	3.0	2.9	3.0
Sugar beets	3.1	3.0	3.0
Olives	2.7	2.5	2.7
Vines	2.0	2.0	1.9
Miscellaneous	2.4	2.3	2.2
Dry-farmed and fallow lands	1.3	1.3	1.2
Native vegetation			
Heavy brush, trees, grass	4.5	4.5	4.5
Medium brush, trees, grass	3.8	3.8	3.8
Light brush, grass	2.8	2.8	2.8
Sparse brush, grass	1.3	1.3	1.3
Miscellaneous			
Farmsteads	2.0	2.0	2.0
Roads	1.0	1.0	1.0
Urban	2.0	2.0	2.0
Water surfaces	5.0	5.0	5.0
Railroads, highways	1.0	1.0	1.0
Airfields	1.3	1.3	1.3
By-pass overflow lands	4.0	4.0	4.0
Tules	5.0	5.0	5.0
By-pass levees	1.0	1.0	1.0
Waste lands	0.5	0.5	0.5

Past and Present Water Utilization

The total amount of utilization of water in the Sutter-Yuba Area was estimated by multiplying the acreage of each type of culture by its respective unit value of consumptive use of water. The results of the estimates of seasonal water utilization during the base period and investigational seasons are presented in Table 28, summarized by general classes of culture. These estimates include consumptive use of precipitation.

TABLE 28

ESTIMATED SEASONAL UTILIZATION OF WATER IN SUTTER-YUBA AREA DURING BASE PERIOD AND INVESTIGATIONAL SEASONS

(In acre-feet)

Class of culture	Average for 9-year base period, 1939-40 through 1947-48	1947-48	1948-49
Irrigated lands	382,000	469,000	524,000
Dry-farmed and fallow lands	234,000	195,000	171,000
Native vegetation	49,000	49,000	49,000
Miscellaneous	45,000	51,000	50,000
TOTALS	710,000	764,000	794,000

Mean seasonal water utilization in the Sutter-Yuba Area was also estimated as it would be with present cultural development but under mean conditions of water supply and climate. The estimate was based on the cultural pattern determined by the 1949 survey, and on estimated average unit seasonal values of consumptive use of water for the nine-year base period which were considered to approximate those for the mean period. The estimate, which includes consumptive use of precipitation, is presented in Table 29, summarized for the four zones of the area and segregated by general cultural classes.

In order to facilitate certain phases of the analysis of ground water hydrology, presented in Chapter II, it was desirable to estimate seasonal utilization of ground water in the Sutter-Yuba Area. Unit seasonal values of consumptive use of ground water were derived by subtracting the amount of available precipitation, up to but not exceeding 1.3 feet of depth, from the appropriate unit seasonal values presented in Table 27. The corrected values were then multiplied by the acreages of each cultural type served by ground water during the respective periods. These included native vegetation in high water table areas. The 1949 cultural pattern was considered representative of present conditions, and average unit seasonal values of consumptive use for the base period were considered to be equal to corresponding mean period values. The estimates of utilization of ground water are summarized by general classes of culture in Table 30.

TABLE 29

ESTIMATED MEAN SEASONAL UTILIZATION OF WATER IN ZONES OF SUTTER-YUBA AREA UNDER PRESENT CULTURAL DEVELOPMENT

(In acre-feet)

Class of culture	West Side Zone	North-east Zone	East Central Zone	South Side Zone	Totals
Irrigated lands	219,100	73,400	125,500	120,100	538,100
Dry-farmed and fallow lands	57,300	21,600	40,400	62,400	181,700
Native vegetation	13,600	10,400	20,000	5,300	49,300
Miscellaneous	20,700	7,100	15,300	5,900	49,000
TOTALS	310,700	112,500	201,200	193,700	818,100

TABLE 30

ESTIMATED SEASONAL UTILIZATION OF GROUND WATER IN SUTTER-YUBA AREA

(In acre-feet)

Class of culture	Average for 9-year base period, 1939-40 through 1947-48	1947-48	1948-49	With present culture under mean conditions of water supply and climate
Irrigated lands	119,400	165,600	222,400	224,600
Native vegetation	31,900	31,900	31,900	31,900
Miscellaneous	6,800	8,200	8,200	8,200
TOTALS	158,100	205,700	262,500	264,700

Probable Ultimate Water Utilization

The total seasonal amount of water utilization in the Sutter-Yuba Area was estimated as it would be under probable ultimate conditions of cultural development and under mean conditions of water supply and climate. This was accomplished by multiplying acreages of cultural types derived in the forecast of the ultimate cultural pattern by corresponding average unit seasonal values of consumptive use of water for the base period. It was considered that unit consumptive use during the base period was equal to that under mean conditions of water supply and climate. The estimate of probable ultimate water utilization is summarized in Table 31 by general cultural classes and by zones of the Sutter-Yuba Area. The estimate includes consumptive use of precipitation.

TABLE 31

PROBABLE ULTIMATE MEAN SEASONAL UTILIZATION OF WATER IN ZONES OF SUTTER-YUBA AREA

(In acre-feet)

Class of culture	West Side Zone	North-east Zone	East Central Zone	South Side Zone	Totals
Irrigated lands	336,300	111,500	205,000	249,300	902,100
Dry-farmed lands	12,400	6,700	12,100	14,400	45,600
Native vegetation	13,600	10,400	20,000	5,300	49,300
Miscellaneous	22,000	7,600	18,400	9,300	57,300
TOTALS	384,300	136,200	255,500	278,300	1,054,300

Demands for Water

The term "demands for water," as used in this report, refers to those factors pertaining to rates, times, and places of delivery of water, imposed by the control, development, and use of the water for any and all beneficial purposes. Certain possible present or future nonconsumptive demands for water in the Sutter-Yuba Area, such as those for hydroelectric power generation, flood control, conservation of fish and wildlife, recreation, etc., were considered to be outside the scope of the current investigation. Since they would have little significance in preliminary design of works to meet supplemental requirements for water in the Sutter-Yuba Area, they are not further discussed herein.

Irrigation practice in the Sutter-Yuba Area, as determined by rates of application, gross diversions, monthly demands, and permissible deficiencies in application of water, must be given consideration in preliminary design of works to meet supplemental water requirements. These demand factors, which were not measured or considered in the foregoing estimates of water utilization, are discussed in the following sections.

Application of Water. The term "applied water," as used in this report, refers to that water other than precipitation which is delivered to a farmer's headgate in the case of irrigation use, or to an individual's meter in the case of urban use, or its equivalent. During each of the two seasons of the investigation measurements were made of the amount of water applied for irrigation of selected plots of principal crops grown on various soil types in the Sutter-Yuba Area. Records of such application of water pumped from wells were obtained for 35 plots during 1948, and 21 plots during 1949. For each well the pump discharge, acreage of each type of crop irrigated, number of irrigations, periods of irrigation, and amounts of water applied in each irrigation were recorded. From these data, monthly and total seasonal applications of water to each crop were determined. Results of these studies, which may be considered representative of prevailing irrigation practice in the Sutter-Yuba Area, are summarized in Table 32. Detailed results of the plot studies are presented in Appendix F, and location of the plots is indicated on Plate 17.

TABLE 32

MEASURED AVERAGE SEASONAL APPLICATION OF IRRIGATION WATER ON REPRESENTATIVE PLOTS OF PRINCIPAL CROPS IN SUTTER-YUBA AREA

Crop	Number of plots			Applied water, in feet of depth		
	1948	1949	Total	1948	1949	Weighted average for the two seasons
Alfalfa	2	3	5	5.69	6.14	5.98
Almonds	3	2	5	1.07	1.71	1.29
Beans	2	1	3	1.21	0.95	1.15
Cherries	2	0	2	2.29		2.29
Clover	1	0	1	4.29		4.29
Corn	1	1	2	2.62	1.76	1.91
Flax	1	0	1	0.87		0.87
Hops	1	1	2	0.92	0.87	0.89
Irrigated pasture	1	3	4	2.18	6.50	5.19
Peaches	9	5	14	2.46	2.68	2.53
Prunes	4	1	5	1.04	3.02	1.21
Rice	3	3	6	5.14	5.56	5.36
Sugar beets	1	0	1	1.45		1.45
Walnuts	4	1	5	2.04	1.90	2.00

Studies were made to determine the approximate average irrigation efficiency realized from application of ground water in the Sutter-Yuba Area during the 1947-48 season. "Irrigation efficiency" is defined as the ratio of consumptive use of applied water to the total amount of applied water, and is commonly expressed as a percentage.

In order to estimate the total amount of ground water applied for irrigation in the Sutter-Yuba Area in 1947-48, appropriate crop acreages, as mapped in the cultural survey, were multiplied by average seasonal values of depth of applied water for the several crops, as measured at the representative plots listed in Table 32. This computation resulted in an estimate of 347,000 acre-feet. As a check on this figure, the Pacific Gas and Electric Company furnished a corresponding estimate of 317,000 acre-feet based on records of electric power consumption for pumping. The company's estimate gave consideration to the relationship between pumping plant horsepower, drawdown, and power consumption per unit of water pumped at various lifts, as determined by pump performance tests conducted in the area by the company. In view of the nature of the basic data, the check furnished was believed to have been reasonably close.

By dividing the estimated value of 165,600 acre-feet for consumptive use of ground water on irrigated lands in the Sutter-Yuba Area in 1947-48, presented in Table 30, by the foregoing estimated value of 347,000 acre-feet, it was estimated that the irrigation efficiency realized from application of ground water in the Sutter-Yuba Area during 1947-48 was approximately 48 percent. This efficiency may be considered to be indicative of average irrigation practice in the Sacramento Valley. It was impracticable to make a corresponding estimate of irrigation efficiency realized from use of surface water in the Sutter-Yuba Area because of lack of sufficient data regarding application of surface water for irrigation purposes.

Gross Diversion of Water. The amount of the gross diversion for irrigation by ground water in the Sutter-Yuba Area was considered to be equivalent to the amount of applied ground water. As discussed in the preceding section, this was estimated to have totaled 347,000 acre-feet during 1947-48.

The gross diversion for irrigation by surface water in the Sutter-Yuba Area was estimated to have totaled about 362,000 acre-feet during 1947-48. This estimate was based on records of measurement of all surface diversions in the area, plus the estimate of importation by the Sutter Butte Canal system presented in Chapter II.

By subtracting from total consumptive use of water on irrigated lands the corresponding consumptive use of ground water and precipitation, the approximate amount of consumptive use of applied surface water was estimated. An estimate of total consumptive use of water on irrigated lands of the Sutter-Yuba Area in 1947-48, in the amount of 469,000 acre-feet, was presented in Table 28. Consumptive use of ground water on irrigated lands was estimated to have been 165,600 acre-feet in 1947-48, as shown in Table 30. It was further estimated that consumptive use of precipitation on the 138,700 acres of irrigated lands in the Sutter-Yuba Area in 1947-48 was equal to 1.3 feet of depth, or a total amount of 180,400 acre-feet. It follows that the estimated amount of consumptive use of surface water applied for irrigation in the area was approximately 123,000 acre-feet in 1947-48.

It is indicated from the foregoing that only about 123,000 acre-feet, or about 34 percent of the estimated 362,000 acre-feet of gross surface diversion for irrigation in the Sutter-Yuba Area in 1947-48, was actually consumed in production of crops. It should be noted that this figure is not comparable with estimated irrigation efficiency attained in connection with use of ground water in the area, evaluated in the preceding section, since it is based on the amount of gross diversion rather than the amount of applied water. Insufficient data were available to permit evaluation of transmission and other losses encountered in connection with use of surface water between points of diversion and places of use.

Monthly Demands for Irrigation Water. Because of the wide variety of crops produced in the Sutter-Yuba Area there is considerable variation in both rate and period of demand for irrigation water. On the average, the irrigation demand occurs during the months of April through October. Studies of irrigation practice in the Sutter-Yuba Area indicated that for certain crops the maximum monthly demand might be as much as 45 percent of the seasonal total. Based on these studies, and on similar studies made in other areas, the estimated average monthly distribution of demand for irrigation water in the West Side Zone and in the remainder of the Sutter-Yuba Area is set forth in Table 33. Because of the predominance of orchard and truck crops in the West Side Zone, monthly distribution in that zone varies somewhat from that in the remainder of the area. Early applications to rice and irrigated pasture account for the greater part of the demand for water in April and May.

TABLE 33
ESTIMATED AVERAGE MONTHLY DISTRIBUTION OF DEMAND FOR IRRIGATION WATER IN SUTTER-YUBA AREA
(In percent of seasonal total)

	West Side Zone	Remainder of Sutter-Yuba Area
April	2	10
May	13	16
June	21	17
July	27	22
August	21	17
September	12	11
October	4	5
November		2
	100	100

Permissible Deficiencies in Application of Irrigation Water. Studies to determine deficiencies in the supply of irrigation water that might be endured without permanent injury to perennial crops were not made in connection with the Sutter-Yuba Counties Investigation. However, the results of past investigation and study of endurable deficiencies in the Sacramento River Basin are believed to be applicable to the Sutter-Yuba Area. In this respect, the following is quoted from Division of Water Resources Bulletin No. 26, "Sacramento River Basin," 1931.

"* * * A full irrigation supply furnishes water not only for the consumptive use of the plant but also for evaporation from the surface during application and from the moist ground surface, and for water which is lost through percolation to depths beyond the reach of the plant roots. Less water can be used in years of deficiency in supply by careful application and by more thorough cultivation to conserve the ground moisture. In these ways the plant can be furnished its full consumptive use with much smaller amounts of water than those ordinarily applied and the yield will not be decreased. If the supply is too deficient to provide the full consumptive use, the plant can sustain life on smaller amounts but the crop yield will probably be less than normal.

"It is believed from a study of such data as are available that a maximum deficiency of 35 per cent of the full seasonal requirement can be endured, if the deficiency occurs only at relatively long intervals. It is also believed that small deficiencies occurring at relatively frequent intervals can be endured. * * *"

SUPPLEMENTAL WATER REQUIREMENTS

The previously presented data, estimates, and discussion regarding water supply and utilization in the Sutter-Yuba Area indicate that present and probable future water problems of the area are largely limited to those connected with ground water and that their effects are largely related to irrigated agriculture. It is further indicated that ground water problems, including those created in various portions of the area by progressive lowering of water levels, degradation of mineral quality of ground water, and low yield of wells, may be eliminated or prevented if adequate supplemental water supplies are developed and utilized in the area. The estimated present and probable ultimate requirements for supplemental water in the Sutter-Yuba Area are discussed and evaluated in the following sections. As previously defined, requirement for supplemental water refers to the amount of water, over and above the sum of safe ground water yield and safe surface water yield, which must be developed to satisfy water utilization. Water utilization in turn refers to the sum of consumptive use of water and those irrecoverable losses of water incidental to its beneficial use.

Present Supplemental Requirement

The present requirement for supplemental water in the Sutter-Yuba Area was evaluated as the difference between safe yield of ground water and present consumptive use of ground water. It might be argued that this evaluation fails to give consideration to possible inadequacies in service of surface water to portions of the area. However, in the solution of the equation of hydrologic equilibrium, presented in Table 15, upon which the estimate of safe ground water yield was based, the unit consumptive use factors chosen assumed a full and sufficient application of water on all irrigated lands whether from surface sources or ground water. It follows that any possible present inadequacy in surface water service was taken into account and provided for in the estimate of safe ground water yield.

It was estimated in Chapter II that safe seasonal ground water yield in the Sutter-Yuba Area amounted to 186,100 acre-feet. This was determined as the seasonal net extraction of water from the ground water basin that might be maintained, under mean conditions of water supply and climate, without further progressive lowering of the water table below levels prevailing in 1948-49. Seasonal consumptive use of ground water in the area, with present culture and under mean conditions of water supply and climate, was estimated to be 264,700 acre-feet, as shown in Table 30. The estimated present requirement for supplemental water in the Sutter-Yuba Area, therefore, is 78,600 acre-feet per season. This estimate is presented in Table 34, which shows distribution of the supplemental water requirement among the several zones of the area. The distribution was based on the assumption that lowering of water levels which occurred during the season of 1948-49 would have been proportionately the same had mean water supply and climatic conditions prevailed.

TABLE 34

ESTIMATED PRESENT MEAN SEASONAL SUPPLEMENTAL WATER REQUIREMENT IN ZONES OF SUTTER-YUBA AREA

Zone	Acre-feet
West Side	
Peach Bowl	14,900
Outside Peach Bowl	2,100
Northeast	6,400
East Central	27,600
South Side	27,600
TOTAL	78,600

It was shown in Chapter II that an area of about 4,500 acres in the West Side Zone south of Oswald Road was irrigated in the summer of 1950 with ground water containing chlorides at or above the upper limit of safe use for irrigation. A substitute water supply is presently required for these lands, the amount of which may be determined by the required amount of applied water. This is true because any unconsumed portion of applied water would be so degraded after percolating to the underlying saline ground water as to preclude its re-use. Seasonal application of water to the orchard and truck crops grown in the Peach Bowl averages about 3.0 feet of depth, as determined by plot studies conducted during the investigation. However, if water of good mineral quality were substituted for the inferior ground water now used, leaching irrigations would not be required. It was estimated that under such conditions the seasonal application of water would be about 2.5 feet of depth, corresponding to average good practice in the Sutter-Yuba Area for irrigation of orchard and truck crops. On this basis the estimated amount of the substitute water supply presently required in the West Side Zone in lieu of ground water of excessive salinity is about 11,300 acre-feet per season. This is less than the estimated present supplemental requirement of 17,000 acre-feet per season required to prevent progressive and permanent lowering of water levels in the West Side Zone. Therefore, by furnishing a supplemental surface water supply to the West Side Zone sufficient to prevent progressive and permanent lowering of the water table, the present problem with respect to inferior mineral quality of the ground water would be eliminated.

Probable Ultimate Supplemental Requirement

The probable ultimate requirement for supplemental water in the Sutter-Yuba Area was evaluated as the difference between present and probable ultimate utilization of water, plus the present requirement for supplemental water. Development and utilization of a supplemental water supply in the amount of this forecast would assure an adequate supply of water for lands presently irrigated in the area, as well as for those irrigable lands not presently served with water. Furthermore, present problems resulting from progressive and permanent lowering of water levels, degradation of mineral quality of ground water, and low yield of wells would be eliminated.

Estimates of present and probable ultimate utilization of water in the Sutter-Yuba Area, under mean conditions of water supply and climate, were presented in Tables 29 and 31, respectively, and a corresponding estimate of the present requirement for supplemental water was developed in the preceding section. Utilizing these estimates, the forecast of probable ultimate seasonal requirement for supplemental water by zones of the Sutter-Yuba Area, under mean conditions of water supply and climate, is presented in Table 35.

TABLE 35

PROBABLE ULTIMATE MEAN SEASONAL SUPPLEMENTAL WATER REQUIREMENT IN ZONES OF SUTTER-YUBA AREA

(In acre-feet)

Zone	1 Present water utilization	2 Probable ultimate water utilization	3 Probable increase in water utilization (2 − 1)	4 Present supplemental water requirement	5 Probable ultimate supplemental water requirement (3 + 4)
West Side	310,700	384,300	73,600	17,000	90,600
Northeast	112,500	136,200	23,700	6,400	30,100
East Central	201,200	255,500	54,300	27,600	81,900
South Side	193,700	278,300	84,600	27,600	112,200
TOTALS	818,100	1,054,300	236,200	78,600	314,800

CHAPTER IV
PLANS FOR WATER DEVELOPMENT

It has been shown heretofore that the present basic water problems in the Sutter-Yuba Area are progressive and permanent lowering of ground water levels and attendant degradation of mineral quality of the ground water. Elimination of these problems, prevention of their recurrence in the future, and irrigation of irrigable lands not presently served with water will require further conservation development of available water supplies. In the preceding chapter, estimates were presented as to the amount of supplemental water required for these purposes both at the present time and under probable ultimate conditions of cultural development.

It has been shown that large surplus flows of water are presently available to the Sutter-Yuba Area from the highly productive watershed of the Feather River system, including the Yuba and Bear Rivers and minor tributary streams. This surface water is available during the snowmelt period of every season, and, in all but very dry seasons, flows sufficient to meet present supplemental requirements of the area are available into the summer months. Studies which are described in this chapter indicate that the surplus flows, if properly controlled and regulated, would more than supply the probable ultimate water requirements of the Sutter-Yuba Area.

As was stated in Chapter I, the Division of Water Resources is presently conducting surveys and studies for the State-wide Water Resources Investigation, under direction of the State Water Resources Board. This investigation has as its objective the formulation of The California Water Plan, for full conservation, control, and utilization of the State's water resources, to meet present and future water needs for all beneficial purposes and uses in all parts of the State, insofar as practicable. Surveys and studies are also being conducted by the Division of Water Resources for the Survey of Mountainous Areas. This investigation, which is coordinated with the state-wide investigation, has as its primary objective the determination of probable ultimate water requirements of certain counties of the Sierra Nevada, and the formulation of plans for projects which will meet those requirements. Although these investigations are still in progress, they are sufficiently advanced to permit tentative description of certain major features of The California Water Plan which would provide supplemental water to meet the probable ultimate requirements of the Sutter-Yuba Area. The projects would also provide supplemental water supplies for other water-deficient areas of California. In addition, benefits from the projects would include hydroelectric power, flood and salinity control, mining debris storage, and incidental benefits in the interests of recreation and the preservation of fish and wildlife.

In general, the major features of The California Water Plan, which were mentioned in the preceding paragraph, would be large multipurpose projects requiring relatively large capital expenditures. Their scope, with regard to both location of the works and benefits derived from their operation, would not be limited to the Sutter-Yuba Area, but would embrace other portions of California. Much additional study will be required to estimate costs and to determine possible means of financing these large projects. Under the Sutter-Yuba Counties Investigation, therefore, numerous surveys and studies were made in order to estimate costs of supplemental water supplies for the Sutter-Yuba Area under more localized plans that might be suitable for current financing, construction, and operation by appropriate local public agencies. These plans for initial development generally are such that the works could be integrated into future major projects. Their purposes are largely limited to conservation of new water supplies sufficient to meet the present requirements of the Sutter-Yuba Area and to provide for limited future growth in water demands of the area.

Major features of The California Water Plan which would be pertinent to solution of the ultimate water problems of the Sutter-Yuba Area are described in general terms in this chapter under the heading "The California Water Plan." These projects will be more specifically described in future reports of the State Water Resources Board. The several plans for possible initial local development of supplemental water supplies which were given consideration in connection with the Sutter-Yuba Counties Investigation are described in this chapter under the heading "Plans for Initial Local Development." All such plans considered would be subject to vested rights. Specific plans are presented for the more favorable of these local projects, together with estimates of capital and annual costs and unit costs of the developed supplemental water supplies. Location of the principal features of the several possible plans, for both initial and future construction, are shown on Plate 18, "Potential Water Storage Developments."

THE CALIFORNIA WATER PLAN

The Feather River Project, an adopted feature of The California Water Plan, is described in the following section, where it is shown that it will provide supplemental water to meet the probable ultimate requirement of the West Side Zone. Several other major projects, which would involve multipurpose water resources developments on the Yuba and Bear Rivers and other tributaries of the Feather River, are briefly described in an ensuing section. These latter projects would provide supplemental water to meet the probable ultimate requirements of the Northeast, East Central, and South Side Zones, and are tentatively being considered as possible features of The California Water Plan.

Feather River Project

The probable ultimate supplemental water requirement in the West Side Zone could be met under a plan which would provide upstream regulatory storage on the Feather River to enhance and firm the summer flow of the stream. Such storage will be made available by construction of Oroville Dam and Reservoir, units of the Feather River Project, which are described in detail in a publication of the State Water Resources Board entitled "Report on Feasibility of Feather River Project and Sacramento-San Joaquin Delta Diversion Projects Proposed as Features of The California Water Plan," dated May, 1951. These projects were authorized and adopted by the 1951 Legislature in an act which authorized their construction, operation, and maintenance by the Water Project Authority of the State of California. Provision was made in the authorizing act for financing construction of the proposed works through issuance and sale of revenue bonds and through receipt of contributions from other sources. In May, 1952, the Legislature provided $800,000, by budgetary appropriation to the Division of Water Resources, for necessary investigations, surveys, and studies, and preparation of plans and specifications for the Feather River and Sacramento-San Joaquin Delta Diversion Projects.

The multipurpose Feather River Project contemplates construction of a gravity concrete dam, 710 feet in height above stream bed, at a point on the Feather River 1.7 miles below the junction of the North and Middle Forks and 5.5 miles above the City of Oroville. The dam will have an overpour spillway. It will create a reservoir of 3,500,000 acre-foot storage capacity, and will provide a large measure of control of the runoff of the Feather River for purposes of conservation, flood control, hydroelectric power generation, and other beneficial uses. Provision will be made for a power plant located at the dam, of 440,000 kilowatt capacity, and for an afterbay dam, and power plant of 25,000 kilowatt capacity, located four miles downstream from the main dam. The foregoing features of the Feather River Project are shown on Plate 18. The project also includes construction of a power transmission line from the Oroville power plants to Bethany, near Tracy in San Joaquin County, and a switch yard at the terminal. A channel crossing of the Sacramento-San Joaquin Delta will be required to carry Oroville Reservoir releases from the Sacramento River to the San Joaquin River Delta for subsequent transmission to water-deficient areas in other parts of California.

In studies for the cited feasibility report of the State Water Resources Board, Oroville Reservoir was operated to first meet the water requirements of the Feather River Service Area, shown on Plate 18. The West Side Zone of the Sutter-Yuba Area is contained within the described Feather River Service Area.

Under the plan of operation of Oroville Reservoir described in the foregoing feasibility report, releases of water would be made sufficient to meet gross demands of the Feather River Service Area under ultimate conditions of irrigation development. The estimate of seasonal gross demand for water under such conditions was 970,000 acre-feet, which, with an assumed irrigation efficiency of 65 percent, would provide for consumptive use of water, over and above effective rainfall, in the amount of 631,000 acre-feet per season. Of this estimated ultimate consumptive use of applied water in the Feather River Service Area, 311,000 acre-feet per season would be new water over and above present utilization. Studies indicate that the probable ultimate supplemental water requirement of the West Side Zone, estimated to be some 90,000 acre-feet per season, could readily be supplied from the foregoing 311,000 acre-feet of new water from Oroville Reservoir.

Detailed estimates of cost of the Feather River Project are presented in the feasibility report. A summary of estimated capital costs of the project is given in Table 36. The estimates of capital cost were based on prices prevailing in 1951, and included allowances of 10 percent for administration and engineering, 15 percent for contingencies, and 3 percent for interest during one-half of the estimated construction period.

TABLE 36

SUMMARY OF ESTIMATED CAPITAL COSTS OF FEATHER RIVER PROJECT

Oroville Dam and Reservoir	$342,626,000
Oroville Power Plant	64,509,000
Oroville Afterbay and Power Plant	14,146,000
Oroville Transmission Line	17,124,000
Terminal Switchyard	2,610,000
Delta Cross Channel	3,798,000
TOTAL	$444,813,000

It was assumed in the cost analyses presented in the feasibility report that the Federal Government would contribute to the Feather River Project the sum of $50,000,000, without reimbursement, in the interest of flood control. Substantial flood control benefits to land

and communities along the Feather River would result from operation of the project. There is well-established federal policy for such financial participation in projects of this character. It was also assumed that the State of California would contribute to the Feather River Project the sum of $86,926,000 in the interests of flood control and water development. This contribution would likewise be without reimbursement, and would be accomplished by assuming the costs of lands and improvements flooded and of necessary relocation of utilities. Such financial participation by the State would be justified under the policy set forth in the State Water Resources Act of 1945, as amended. If these federal and state contributions to the Feather River Project were forthcoming, capital costs shown in Table 36 would be reduced to $307,887,000. Based on this estimated capital cost, it was further estimated that annual costs of the project would be about $14,-791,000 based upon 2 percent interest, and about $16,272,000 based on 3 percent interest. The annual costs included interest, repayment, replacement, operation and maintenance, insurance, and general expenses. In the cost analysis it was shown that annual costs based upon the 2 percent interest rate could be met under the schedule of revenues shown in the following tabulation, but that an annual deficit of some $1,426,000 would occur with the 3 percent rate.

Item	*Unit charge*	*Annual revenue*
311,000 acre-feet of new water delivered to Feather River Service Area (includes West Side Zone)	$1.00	$311,000
2,845,000 acre-feet of new water delivered to Delta	1.00	2,845,000
1,670,000,000 kilowatt-hours of electrical energy at terminal substation	0.007	11,690,000
TOTAL		$14,846,000

Based on the foregoing assumptions, the estimated cost of water from the Feather River Project to water users in the West Side Zone would be about $1 per acre-foot at the streamside. This estimate does not include costs for diverting the water from the Feather River and conveying it to and distributing it in areas of use in the West Side Zone. Studies indicate that a practicable means for diverting the water from the river would be by pumping plants strategically located along the river, discharging into appropriate conveyance and distribution systems. Diversion also could be made by gravity with construction of a diversion weir and headgates at a suitable upstream site.

Other Major Projects Under Consideration

Surveys and studies in connection with the Statewide Water Resources Investigation and the Survey of Mountainous Areas indicate that it would be feasible from the engineering standpoint to so regulate and conserve the relatively large flood flows of the Yuba and Bear Rivers and other tributaries of the Feather River as to yield firm water supplies considerably in excess of the probable ultimate supplemental water requirements of the Northeast, East Central, and South Side Zones. Existing water resources developments on these streams, together with tentative locations of possible future dams and reservoirs, are shown on Plate 18.

In addition to the studies by the Division of Water Resources, the Oroville-Wyandotte Irrigation District is currently investigating a plan for multipurpose development of the water resources of the South Fork of the Feather River. Principal features of this project, which is in an advanced planning phase, are delineated on Plate 19, "Plans for Development of South Fork of Feather River." The district is considering the diversion of waters of both the South Fork of the Feather River and Slate Creek through tunnels to the proposed Lost-Sly Creek Reservoir, to be created by construction of a dam immediately above the flow line of the existing Lost Creek Reservoir on the stream of that name. Conservation and regulatory storage would be created on the South Fork by construction of Little Grass Valley Reservoir, and on Slate Creek by construction of the small Slate Creek Reservoir. Water released from Lost-Sly Creek Reservoir would flow into Lost Creek Reservoir, and then through a proposed pressure tunnel to the penstock of the proposed Woodleaf Power House, to be located on the South Fork about one mile below its junction with Lost Creek. From the afterbay of this plant the water would flow through another tunnel to the penstock of the proposed Forbestown Power House, also to be located on the South Fork. Construction of a canal is proposed from the Forbestown Power House afterbay along the left or south bank of the South Fork of the Feather River to a point about two miles west of Lake Wyandotte, to serve lands of the Oroville-Wyandotte Irrigation District to the west of the canal. It is feasible from an engineering standpoint to extend the canal in a southerly direction a distance of some 25 miles to South Honcut Creek.

As a possible alternative to the Oroville-Wyandotte Irrigation District's project, the Division of Water Resources is studying another plan for multipurpose development of the South Fork of the Feather River. This plan contemplates construction of the proposed Little Grass Valley Reservoir on the South Fork, and diversion of the conserved water at a point about 1½ miles below the dam through a tunnel to Fall River. Water would also be diverted from South Branch of Middle Fork of Feather River to Fall River through a tunnel. A dam on Fall River would divert its own flows and water from the two foregoing diversions through a tunnel to the penstock of the proposed Lumpkin Power House on the South Fork of Feather River. A tunnel would convey the water from the afterbay of this plant to an enlarged Lost Creek Reservoir, which would be created by construction of a higher dam approximately at the site of the existing structure. The plan also contemplates construction of a small reservoir on Canyon Creek, and a diversion tunnel to the proposed Slate Creek Diversion Dam. From this dam the Slate Creek water and water from Canyon Creek would be diverted through a tunnel to a point on Lost Creek above the proposed enlarged reservoir. Releases from Lost Creek Reservoir would be made through a tunnel to a diversion dam on Grizzly Creek and from this dam through a canal and siphons to the penstock of the proposed Golden Gate Power House, to be located on Golden Gate Canyon at the headwaters of French Dry Creek. From the afterbay of this plant, a conduit, including canal and siphon sections, would lead to the penstock of the proposed Brownsville Power House, to be located on French Dry Creek at Brownsville. A canal would lead from the afterbay of the Brownsville plant to a saddle between the drainage areas of French Dry and South Honcut Creeks. At this point the canal would divide, with one branch bearing generally westerly and discharging into the existing Forbestown Ditch and thence into Lake Wyandotte. The other branch would bear southwesterly and terminate at the penstock of the proposed Honcut Power House, to be located on South Honcut Creek below its confluence with Natchez Creek. From the afterbay of the Honcut Power House a canal would extend along the right bank of South Honcut Creek and then bear northerly, terminating east of Oroville. This canal would serve lands of the Oroville-Wyandotte Irrigation District and adjacent irrigable lands lying to the west of the canal. Construction of a dam on South Honcut Creek is contemplated under the plan to create a reservoir the flow line of which would extend to the Honcut Power House afterbay. Water released from South Honcut Creek Reservoir would be diverted at appropriate downstream points on South Honcut Creek to serve lands in Browns Valley and on the Sacramento Valley floor east of the Feather River. Other diversions for irrigation and other beneficial uses in remaining water service areas between the Feather and Yuba Rivers could be made from the system.

Tentative plans for ultimate development of the Yuba River contemplate increasing the storage capacity of the existing Bullards Bar Reservoir on the North Yuba River, or providing equivalent increased capacity upstream at Kellys Bar, together with hydroelectric power development of the upper North Yuba River. Construction of a dam and reservoir on the Middle Yuba River at Granite Point is also under consideration, together with a diversion tunnel to the existing afterbay of the Bullards Bar Power House. Waters of the South Yuba River would be diverted at Edwards Crossing and conveyed by a proposed tunnel to the Granite Point Reservoir. Both the Middle and South Yuba Rivers offer possibilities for construction of dams and reservoirs, principally in the interests of mining debris storage and flood control.

The State Water Plan, as adopted by the Legislature in 1941, contemplates a storage capacity in the Englebright Reservoir on the Yuba River of about 850,000 acre-feet, as compared to the 70,000 acre-foot capacity of the existing Englebright Reservoir. This additional capacity would provide substantial conservation, flood control, and hydroelectric power, but would inundate the existing Colgate Power House, recently enlarged by the Pacific Gas and Electric Company. As a possible alternative, construction of offstream storage for waters of the Yuba River at the Waldo site, on Dry Creek, about nine miles northeast of Wheatland, is under consideration. This plan would involve construction of a conduit, diverting from Englebright Reservoir at the spillway elevation, to convey flood waters of the Yuba River to the proposed Waldo Reservoir. Under the plan, Waldo Reservoir in turn would spill into the proposed enlarged Camp Far West Reservoir on Bear River, which is hereinafter described. Consideration is also being given to possible construction of one or more additional reservoirs at the Garden Bar, Parker, or Rollins sites, upstream from the Camp Far West site on the Bear River, to effect more complete conservation of flood waters of that stream.

Studies indicate that the Northeast Zone could be served with an ultimate supplemental water supply either from the South Fork of the Feather River under the plan of development hereinbefore described, or from the Yuba River. Service from the Yuba River could be made by enlargement of the existing Hallwood-Cordua system or by diversion from the Yuba River at a suitable site in the vicinity of Parks Bar, and distribution by gravity from a main conduit bearing in a northerly direction roughly along the eastern boundary of the zone. It has been estimated that the amount of the probable ultimate mean seasonal supplemental water requirement of the Northeast Zone will be about 30,000 acre-feet. A water supply in this amount, under an appropriate schedule of demands, could be made available to the Northeast Zone by construction of one or more of the previously described major upstream projects.

It is indicated that under ultimate conditions of development the East Central Zone could also be served with supplemental water from the Yuba River. It has been estimated that the amount of the probable ultimate mean seasonal water requirement of the zone will be about 82,000 acre-feet. A portion of the required supplemental supply could be diverted, under an appropriate schedule of demands, directly from the Yuba River above Hammonton, and conveyed in a southerly direction to Hutchinson Creek, by rehabilitation and extension of the abandoned Yuba River Ditch of the Yuba Consolidated Gold Fields. Conserved water of the Yuba River to meet the remainder of the ultimate supplemental water requirement of the East Central Zone could be released from the proposed Waldo Reservoir for downstream diversion and conveyance to areas of use.

Studies also indicate that under ultimate conditions of development the South Side Zone could be served with a supplemental water supply released, under an appropriate schedule of demands, from the proposed Camp Far West Reservoir. It has been estimated that the amount of the probable ultimate mean seasonal supplemental water requirement of the zone will be about 112,000 acre-feet. A supply in this amount would be available in Camp Far West Reservoir, and would consist of waters of the Yuba and Bear Rivers and Dry Creek conserved jointly by the proposed Waldo Reservoir, Camp Far West Reservoir, and upstream reservoirs on the Bear River. It could be conveyed to points of use in the South Side Zone by an enlarged system similar to that described hereinafter in connection with the Camp Far West Project.

PLANS FOR INITIAL LOCAL DEVELOPMENT

Possible plans for initial local development of supplemental water supplies for the Sutter-Yuba Area, together with cost estimates, are described in this section. Design of features of the plans was necessarily of a preliminary nature and primarily for cost estimating purposes. More detailed investigation, which would be required in order to prepare plans and specifications, might result in designs differing in detail from those presented in this report. However, it is believed that such changes would not be significant.

Capital costs of dams, reservoirs, diversion works, conduits, pumping plants, and appurtenances, included in the considered conservation, conveyance, and distribution systems, were estimated from preliminary designs based largely on data from surveys made during the current investigation. Approximate construction quantities were estimated from these preliminary designs. Unit prices of construction items were determined from recent bid data on projects similar to those in question, or from manufacturers' cost lists, and are considered representative of prices prevailing in April, 1952. The estimates of capital cost included costs of rights of way and construction, and interest during one-half of the estimated construction period at 3 percent per annum, plus 10 percent for engineering, and 15 percent of construction costs for contingencies. Estimates of annual costs included interest on the capital investment at 3 percent, amortization over a 50-year period on a 3 percent sinking fund basis, replacement, operation, and maintenance costs, and costs of electrical energy for pumping.

Because of geographical considerations, and respective types of water service and water supplies in the several zones of the Sutter-Yuba Area, possible plans for initial water development are presented in this section separately for the West Side, Northeast, East Central, and South Side Zones.

West Side Zone

In Chapter III it was shown that the present requirement for supplemental water in the West Side Zone is about 17,000 acre-feet per season. However, in the design of projects for initial local development to meet this requirement, it was considered desirable to provide some capacity for future growth in water demand which would occur through development of irrigable lands not presently irrigated. This additional capacity was estimated at about 7,000 acre-feet per season, giving consideration to the extent of undeveloped irrigable lands that might readily be served, and to the available sources of water supply. For reasons hereinafter discussed it was considered that the new water supply would be applied to about 7,000 acres of land in the Peach Bowl, of which about 4,500 acres are presently irrigated by ground water containing chlorides at or above the safe limit for irrigation use, and 2,500 acres are irrigable lands not presently served with water. These lands are contained within a service area lying generally to the south of Oswald Road, and delineated on Plate 20, "Peach Bowl Project."

Three possible alternative plans of works for initial construction to provide supplemental water to the West Side Zone were considered. For reasons hereinafter mentioned, after preliminary investigation and study the first two plans were given no further consideration for present cost estimating purposes, but may warrant future study. The third plan is described in some detail later in this section.

Alternative Plans Considered. The first of the alternative plans considered for initial construction included salvage of water in high water table lands of the Sutter Butte Canal service area, and its conveyance to and use in the Peach Bowl. This would involve the installation of batteries of wells in the high water table area, conveyance of the pumped ground water to the Peach Bowl either in conduits or in the channel of the Feather River, and distribution of the water in a strategically situated service area of heavy ground water pumping draft in the Peach Bowl. The new water supply would largely replace ground water presently used in the Peach Bowl service area, thereby preventing progressive and permanent lowering of ground water levels and attendant degradation of mineral quality of the ground water throughout the Peach Bowl and adjacent ground water service areas. However, preliminary investigation and study indicated that changes in the crop pattern and in irrigation practice in the Sutter Butte Canal service area, which would be necessary for consummation of this plan, would be difficult to effect, and that cost of the salvaged water would be greater than for water yielded under the third plan

Feather River in the Vicinity of Starr Bend, Looking Upstream herein described. For these reasons, this plan was given no further present consideration.

Consideration was also given to the provision of a supplemental water supply to the Peach Bowl service area from the Feather River, by extension of the conveyance and distribution system of the Sutter Butte Canal. As in the case of the first plan described, use of the new surface water supply would prevent progressive and permanent lowering of water levels, and attendant degradation of mineral quality of ground water, in the area served and in adjacent areas. Preliminary investigation and study of this second plan for initial construction indicated that existing diversion facilities might be adequate for such purpose, but that conveyance facilities would require enlargement. Furthermore, a canal to serve lands requiring supplemental water in the Peach Bowl would have to be constructed on a relatively flat slope over a long distance through highly developed orchard lands. The canal would also pass through urban areas lying immediately south and west of Yuba City. It was indicated from investigation and study that cost of the new water supply would be greater than under the third plan hereinafter described. For these reasons, this plan was given no further present consideration.

The third of the alternative plans considered for initial construction would provide for the present supplemental water requirement in the West Side Zone, and for growth in water utilization for a number of years in the future. It would include the construction of facilities for pumping water directly from the Feather River and for its conveyance to and distribution in the service area in the Peach Bowl. As in the case of the two previous plans, use of the new surface water supply would prevent progressive and permanent lowering of ground water levels and degradation of mineral quality of the ground water, in the area served and in adjacent areas. This plan is hereinafter referred to as the "Peach Bowl Project," and its principal features are delineated on Plate 20.

Peach Bowl Project. Satisfactory sites for a pumping plant to divert flow of the Feather River exist on the right or west bank of the river along the reach one-half mile north and south of the prolongation of Hutchinson Road. The site selected for cost estimating purposes is at a point about four miles south of Shanghai Bend, near the center of Section 26, Township 13 North, Range 3 East, M.D.B. & M. Conveyance and distribution of water pumped from the Feather River to the area of use would be accomplished by means of a combination system including lined and unlined canals, and ditches, and the utilization of existing individual distribution systems insofar as possible. The lands which would be irrigated with the new water supply comprise the aforementioned 7,000 acres within the service area shown on Plate 20, ranging in elevation from approximately 45 feet at the north boundary to approximately 30 feet in the southerly portion.

Since the Peach Bowl constitutes a free ground water area, water losses in conveyance and distribution of the new water supply would largely percolate to the ground water. For this reason it was assumed that these losses, plus the unconsumed portion of the new water supply applied to irrigation would be effective in preventing progressive and permanent lowering of ground water levels and degradation of mineral quality of the ground water. The acreage to be irrigated by the supplemental supply would depend on the amount of the gross diversion, water losses encountered in conveyance and distribution, and the requirement for application of water to the lands irrigated.

For cost estimating purposes the Peach Bowl Project was designed to provide a gross seasonal supplemental surface water supply of approximately 24,000 acre-feet, of which about 17,000 acre-feet is necessary to meet the present supplemental requirement, and the remainder would be available for additional development of irrigable lands. An estimate of the monthly distribution of demand for irrigation water in the West Side Zone was presented in Table 33. Based on these data, the monthly gross demand for water for the Peach Bowl Project would be as shown in Table 37.

TABLE 37

ESTIMATED MONTHLY DISTRIBUTION OF GROSS DEMAND FOR WATER FOR THE PEACH BOWL PROJECT

Month	Percent of seasonal total	Demand for water, in acre-feet
April	2	480
May	13	3,120
June	21	5,040
July	27	6,480
August	21	5,040
September	12	2,880
October	4	960
TOTALS	100	24,000

Based upon known soil characteristics in the Peach Bowl and upon irrigation experience elsewhere, it was assumed that water losses in conveyance and distribution of a new surface water supply would amount to about 25 percent of the gross diversion, leaving about 18,000 acre-feet per season for application to irrigated lands. Lands in the Peach Bowl to be served with the new water supply and presently irrigated by ground water comprise about 4,500 acres of highly developed orchard. From results of the plot studies of water application described in Chapter III, it was estimated that these orchard lands would require a seasonal application of irrigation water in an amount of about 2.5 acre-feet per acre, or a total of about 11,000 acre-feet. The remaining 7,000 acre-feet of water per season available under the Peach Bowl Project, as designed, would serve about 2,500 acres of irrigable lands, presently not served with water, lying to the west of the foregoing orchard lands. If developed, it was considered that these irrigable lands would probably largely be devoted to truck and general row crops, with limited amounts of rice and irrigated pasture. Based on results of the cited plot studies, it was estimated that these lands would require a seasonal application of irrigation water in an amount of about 2.8 acre-feet per acre.

No record was available of flow in the Feather River at the proposed point of pumping diversion. However, records were available of monthly flow at Shanghai Bend some four miles upstream from the proposed diversion point, and at Nicolaus some 11 miles downstream therefrom. The Shanghai Bend record dated from 1940, while that for Nicolaus was continuous since 1921, although prior to 1939 records of stream flow at the latter station were obtained only during summer months of low flow. Studies were made of these records and of measurements of diversions from the Feather River in the reach between the two stations. These studies indicated that during the irrigation season probable flow at the proposed diversion for the Peach Bowl Project was greater than recorded flow in the Feather River at Nicolaus. Therefore, the assumption that flows available for the pumping diversion were equal to those measured at Nicolaus was considered to be conservative.

It was determined that during the critical months of July, August, and September, tributary inflow to the Feather River from the Bear River was negligible. For this reason, any future conservation development on this tributary would not adversely affect the assumption as to flow in the Feather River at the proposed point of diversion during the critical summer months. Furthermore, records of the Sacramento-San Joaquin Water Supervision indicated that the amount of existing diversions from the Feather River between Nicolaus and the confluence with the Sacramento River, during the critical summer months of low flow, is insufficient to materially affect the estimates of water supply available in the Feather River for diversion to the Peach Bowl.

Available records of monthly stream flow of the Feather River at Nicolaus during the irrigation season are presented in Table 38. Comparison of these recorded flows with the estimated monthly gross demands of the Peach Bowl Project, presented in Table 37, indicates that during the period from 1921 through 1950 ample water was available from the Feather River to meet demands of the project, as designed, except during the two seasons of 1924 and 1931. During these seasons irrigation deficiencies of approximately 40 and 25 percent, respectively, would have occurred. From past experience in the Sacramento Valley, it is considered probable that such deficiencies could be endured without permanent damage.

TABLE 38

MEASURED MONTHLY FLOW OF FEATHER RIVER AT NICOLAUS DURING THE IRRIGATION SEASON, 1921 THROUGH 1950

(In acre-feet)

Year	Runoff index	April	May	June	July	August	September	October
1921	129				61,870	23,195	25,035	49,140
1922	109				181,000	48,300	49,200	19,200
1923	67				111,000	52,100	72,000	126,000
1924	28			6,780	1,780	609	20,900	93,500
1925	67				55,600	33,400	49,000	106,000
1926	67			57,500	24,900	24,300	60,100	109,000
1927	122				99,000	43,600	61,300	131,000
1928	90			89,300	54,800	30,700	60,700	104,000
1929	40		371,000	160,000	49,700	70,100	104,000	132,000
1930	85		536,000	183,000	52,000	57,300	112,000	163,000
1931	32		68,900	17,700	935	5,070	32,800	68,200
1932	72		904,000	453,000	75,600	29,900	26,700	40,100
1933	42		418,000	331,000	34,900	18,300	25,100	61,100
1934	44		114,000	40,500	21,800	19,600	39,200	67,710
1935	93				84,430	69,850	70,070	123,400
1936	94			385,200	81,780	63,020	82,050	110,000
1937	69				66,950	18,130	38,780	129,000
1938	186				217,000	83,360	90,100	149,800
1939	41	359,700	107,800	27,070	9,870	19,660	57,700	77,200
1940	123	1,593,900	711,200	200,100	43,700	36,760	92,230	128,700
1941	111	1,416,200	1,467,000	548,000	191,300	52,800	54,500	99,400
1942	145	1,480,000	1,254,000	793,600	166,500	44,140	67,200	137,600
1943	122	1,220,600	663,300	314,800	57,350	22,040	32,360	119,000
1944	61	597,600	633,000	179,800	33,300	13,280	32,190	83,300
1945	82	726,800	736,100	262,900	40,890	27,620	53,160	106,800
1946	90	836,000	679,900	171,900	38,500	30,040	53,690	87,650
1947	55	573,300	124,000	74,330	16,780	24,640	40,820	135,600
1948	74	1,326,000	1,091,000	590,200	73,600	16,170	48,190	132,900
1949	57	809,700	533,500	98,060	13,920	9,230	27,480	39,430
1950	84	1,099,000	834,900	327,200	40,030	18,230	71,500	163,500

Studies indicated that the maximum monthly diversion for the Peach Bowl Project would occur in July, and that it would amount to about 27 percent of the total seasonal diversion of 24,000 acre-feet, equivalent to a continuous flow of about 105 second-feet throughout the month. For cost estimating purposes the pumping plant for the project was designed with a total pumping capacity of 135 second-feet. This installation would meet the estimated maximum rate of demand, provide additional capacity for shorter-term peaking in excess of the average monthly rate, and provide stand-by capacity to assure continuous service in case of breakdown.

Features of the pumping plant considered for the Peach Bowl Project are shown on Plate 29. In order to permit flexibility in operation of the project, design of the pumping plant was based on the installation of three electrically driven vertical axial-flow propellor type pumping units. Each of the units would comprise a 36-inch diameter pump with capacity of 45 second-feet, driven by a 100-horsepower motor. The pumps would operate at a maximum pumping head of about 15 feet, pumping from an estimated minimum water surface elevation in the river of about 31 feet to a discharge elevation of about 46 feet. The pumping units would be of the all-weather type, mounted on steel beams, and supported on concrete piles driven into the stream bed at the toe of the river face of the right bank levee of the Feather River. The battery of pumps would be operated from a corrugated metal control house, also mounted on the concrete piles, and would be served by a steel trestle from the levee crest. The units would pump from a reinforced-concrete sump into three 30-inch diameter steel pipes supported by ring girders and reinforced-concrete piers on the slopes of the levee. The pipes would pass through the levee five feet beneath the crest, and discharge into a reinforced-concrete sand trap at the landward base of the levee.

From the sand trap the water would be conveyed by gravity to areas of use by the system of lined and unlined canals shown on Plate 20. The main canal extending in a southerly direction along the levee would be concrete-lined, in order to prevent seepage which might otherwise damage orchards or the toe of the Feather River levee. This canal would be approximately 6.1 miles in length, and would be of trapezoidal section, with 1.5:1 side slopes, bottom width of 8.0 feet, depth of 3.4 feet, and 1.0 foot freeboard. The slope would be approximately 1.0 foot per mile, the velocity about 2.5 feet per second, and the capacity would be 100 second-feet. A second main canal would extend from the sand trap in a westerly direction a distance of approximately 0.7 mile to a concrete division box near the Southern Pacific Railroad right of way. This canal would have characteristics similar to the one already described. From the division box a lateral would extend south along the railroad right of way a distance of approximately 4.8 miles. This lateral would also be concrete-lined, to prevent possible damage by seepage to adjacent orchards and to the railroad. It would be of trapezoidal section, with 1.5:1 side slopes, bottom width of 6.0 feet, depth of 2.4 feet, and freeboard of 1.0 foot. The slope would be approximately 1.5 feet per mile, the velocity about 2.3 feet per second, and the capacity 50 second-feet. A second lateral from the division box would extend in a westerly and then southerly direction a distance of approximately 5.2 miles. This canal would be unlined, since seepage from it would probably result in no damage. The canal would be of trapezoidal section, with 2:1 side slopes, bottom width of 6.0 feet, depth of 3.2 feet, and freeboard of 1.0 foot. Its slope would be approximately 1.5 feet per mile, its velocity about 1.3 feet per second, and its capacity 50 second-feet. Cost estimates for the conveyance canals were based on preliminary designs utilizing data from field location surveys.

Detailed design of works for distribution of water from the conveyance canals was considered to be outside the scope of the current investigation. Existing pressure irrigation systems of individuals and agencies could be adapted to use of the new surface water supply by means of gravity diversions or individual low-head pumps, as required. Cost estimates for the distribution systems were based on known costs of similar irrigation works elsewhere in California, adjusted to correspond with conditions prevailing in the Sutter-Yuba Area.

Pertinent data with respect to general features of the Peach Bowl Project, as designed for cost estimating purposes, are presented in Table 39.

TABLE 39

GENERAL FEATURES OF PEACH BOWL PROJECT

Pumping Plant

- Pumps—3 each, vertical, propeller type, axial-flow, 45 second-foot capacity
- Estimated minimum water surface elevation in Feather River—31 feet
- Discharge elevation—46 feet
- Estimated maximum pumping head—15 feet
- Installed pumping capacity—135 second-feet
- Estimated maximum monthly demand—105 second-feet
- Estimated gross seasonal diversion—24,000 acre-feet
- Motors—3 each, all-weather type, 100 horsepower
- Pump support—steel beams on concrete pile structure
- Pumping sump—reinforced-concrete, 13 feet by 65 feet, 5 feet deep, equipped with trash racks
- Discharge lines—3 each, 30-inch diameter, welded-steel, supported on concrete piers by ring girders
- Sand trap—reinforced-concrete, 10 feet by 40 feet, 6 feet deep, equipped with baffles and sluice gates

Conveyance System

	Main canals	Central lateral	West lateral
Type	Trapezoidal, concrete-lined	Trapezoidal, concrete-lined	Trapezoidal, unlined
Length, in miles	6.8	4.8	5.2
Side slopes	1.5:1	1.5:1	2:1
Bottom width, in feet	8.0	6.0	6.0
Depth, in feet	3.4	2.4	3.2
Freeboard, in feet	1.0	1.0	1.0
Slope, in feet per mile	1.0	1.5	1.5
Velocity, in feet per second	2.5	2.3	1.3
Capacity, in second-feet	100	50	50

Daguerre Point Weir on Yuba River

Capital cost of the Peach Bowl Project, based on prices prevailing in April, 1952, was estimated to be about $1,384,900. Corresponding annual costs of the Peach Bowl Project were estimated to be about $100,900. Resultant estimated average unit cost of the 24,000 acre-feet of water per season diverted at the river was about $4.20 per acre-foot. The estimated average unit cost of the 18,000 acre-feet of water per season actually applied for irrigation was about $5.60 per acre-foot.

Estimated capital and annual costs of the Peach Bowl Project are summarized in the following tabulation. Detailed cost estimates are presented in Appendix H.

	Estimated costs	
	Capital	*Annual*
Pumping plant	$107,900	$16,000
Conveyance system	813,900	43,800
Distribution system	463,100	41,100
TOTALS	$1,384,900	$100,900

Northeast Zone

In Chapter III it was shown that the present requirement for supplemental water in the Northeast Zone is about 6,000 acre-feet per season. However, in the design of projects for initial local development to meet this requirement, it was considered desirable to provide some capacity for future growth in water demand which would occur through development of irrigable lands not presently irrigated. This additional capacity was estimated at about 6,000 acre-feet per season, giving consideration to the extent of undeveloped irrigable lands that might readily be served, and to the available sources of water supply as determined by engineering and economic limitations on size of the proposed conservation works. For reasons hereinafter discussed, it was considered that the new water supply would be applied to about 2,300 acres in the Northeast Zone, of which about 1,700 acres are presently irrigated by ground water and 600 acres are irrigable lands not presently served with water. These lands are contained within a service area adjoining and lying to the east and north of the Cordua Irrigation District, and delineated on Plate 21, "South Honcut Creek Project."

Three possible alternative plans of works for initial construction to provide supplemental water to the Northeast Zone were considered. For reasons hereinafter mentioned, after preliminary investigation and study, the first two plans were given no further consideration for present cost estimating purposes, but may warrant future study. The third plan is described in some detail in this section.

Alternative Plans Considered. The first of the alternative plans considered for initial construction involved the substitution of surface water from the Yuba River to replace ground water presently utilized in the foregoing service area. The substitute supply would be furnished by extension and enlargement of portions of the Cordua Irrigation District canal system. Its use would prevent progressive and permanent lowering of ground water levels in the described service area and in adjacent areas. The Cordua Irrigation District and the Hallwood Canal Company jointly divert from the Yuba River through a 1,200-foot tunnel with capacity of 325 second-feet, heading at the northwest end of the Daguerre Point Weir. Surface flow in the Yuba River at Daguerre Point during the peak of the irrigation season is generally not greater than present demands of the Cordua and Hallwood systems, and at times these demands cannot be met. Much of the surface flow in the Yuba River during such periods as measured at Marysville does not occur on the surface at the Daguerre Point Weir. Measurements indicate that this water is lost to surface flow by percolation in an extensive area of dredger tailings above the weir, and reappears at the Marysville gaging station. For this reason, a preliminary survey was made to determine the feasibility of diverting the Cordua-Hallwood water supply from the Yuba River at a site upstream from the area of dredger tailings. This would be excessively expensive because of the necessity for increasing capacity of the Cordua-Hallwood system, providing a diversion structure, and providing a closed conduit for the diverted water for a considerable distance until stable bank could be reached. For these reasons, and because of uncertainty regarding the available water supply, this plan was given no further present consideration.

The second of the alternative plans considered for initial construction involved the purchase of Feather River water from the Oroville-Wyandotte Irrigation District at a point of delivery on South Honcut Creek, diversion of the water from South Honcut Creek, and its conveyance to and distribution in the Northeast Zone. As in the case of the first plan described, use of the new surface water supply would prevent progressive and permanent lowering of ground water levels in the area served and in adjacent areas. The water purchased and utilized would be a portion of that which the district proposes to develop on the South Fork of the Feather River under the multipurpose project described earlier in this chapter, principal features of which are shown on Plate 19. The water would be delivered to South Honcut Creek at an elevation of about 600 feet, by the district. The amount of water that might be made available to the Northeast Zone would depend upon design of features of the proposed Oroville-Wyandotte Irrigation District project, and in turn upon the outcome of possible negotiations between the district and an agency representing interests of the Northeast Zone. For these reasons, features of the plan were not surveyed and studied in detail, nor estimates of cost prepared.

The third plan considered for initial construction would include the construction of a dam and reservoir on South Honcut Creek, facilities for diversion of flood

South Honcut Creek Dam Site Viewed From Point Within Reservoir Area waters of French Dry Creek to the reservoir, and facilities for diversion of the conserved waters from South Honcut Creek below the dam, and for their conveyance to and distribution in both the Northeast Zone and the Browns Valley service area. This latter area, lying to the east of the Northeast Zone, is also in need of a supplemental water supply and could be advantageously served as indicated. As in the case of the two previous plans, use of the new surface water supply would prevent progressive and permanent lowering of ground water levels in the area served in the Northeast Zone and in adjacent areas. This plan is hereinafter referred to as the "South Honcut Creek Project," and its principal features are delineated on Plate 21.

South Honcut Creek Project. The proposed dam would be an earthfill structure with side channel spillway, located on South Honcut Creek near Sugar Loaf, in Section 25, Township 18 North, Range 5 East, M. D. B. & M., some 20 miles upstream from the confluence of Honcut Creek with the Feather River. The stream bed elevation at this point is about 730 feet. Flood waters of French Dry Creek would be diverted at a point on that stream at an elevation of approximately 2,125 feet, about one-half mile below Brownsville, and conveyed a distance of about two miles in a canal, discharging into a tributary of South Honcut Creek above the reservoir. The conserved waters of both South Honcut and French Dry Creeks, after release from the reservoir, would be diverted from South Honcut Creek at a point about two miles downstream from the dam and 300 feet downstream from the county bridge southeast of Bangor, at an elevation of about 600 feet. From this diversion point the waters would be conveyed by a conduit a distance of about 4.7 miles to a point about one mile northeast of Loma Rica, where the elevation is about 500 feet. Diversions could be made for the Browns Valley service area along the conduit and at its terminus. Water for the Northeast Zone would be conveyed from this terminus in a natural drainage channel, a short canal section, and the natural channel of Prairie Creek to a diversion point for the Northeast Zone on Prairie Creek about one mile upstream from its confluence with South Honcut Creek, at an elevation of approximately 135 feet. From this point the waters would be conveyed to and distributed in the Northeast Zone by means of an unlined canal and ditch system. The lands which would be served by the new water supply comprise the aforementioned 2,300 acres contained within the service area shown on Plate 21, ranging in elevation from about 150 feet along its eastern boundary to about 75 feet on the west.

As a first step in determination of size of the project, estimates were made of yield of the proposed works for various reservoir storage capacities. It was estimated that mean seasonal runoff of South Honcut Creek, from the approximately 24 square miles of watershed above the dam site, was about 23,400 acre-feet. Estimated mean seasonal runoff of French Dry Creek at the proposed point of diversion to South Honcut Creek was about 27,100 acre-feet, from some 22 square miles of watershed. Of these French Dry Creek waters, studies indicated that flood flows in an estimated mean seasonal amount of about 22,000 acre-feet could be diverted to the proposed South Honcut Creek Reservoir through a 200 second-foot capacity conduit, during the months from November to April, inclusive.

Based upon records and estimates of runoff during the critical dry period which occurred in the Sacramento Valley from 1920-21 through 1934-35, yield studies were made for five sizes of reservoir at the South Honcut Creek site. It was assumed that a seasonal irrigation deficiency up to 35 percent could be endured in one season of the period. Monthly demands on the reservoir were assumed to be proportional to the estimated distribution of irrigation demands in the Sutter-Yuba Area, as presented in Table 33. A summary of results of the yield studies is presented in Table 40.

TABLE 40

ESTIMATED SAFE SEASONAL YIELD OF SOUTH HONCUT CREEK RESERVOIR WITH FRENCH DRY CREEK DIVERSION, BASED ON CRITICAL DRY PERIOD FROM 1920-21 THROUGH 1934-35

(In acre-feet)

Reservoir storage capacity	Safe seasonal yield
12,000	12,800
20,000	16,400
30,000	20,900
38,000	24,300
70,000	27,100

After consideration of the results of the yield studies, together with topography of the dam site and cost analyses hereinafter discussed, a reservoir of 38,000 acre-foot storage capacity, with estimated safe seasonal yield of 24,300 acre-feet, was chosen for purposes of cost estimates to be presented in this report. The yield study for this size of reservoir is included in Appendix G.

Although the estimate of the present requirement for supplemental water in the Northeast Zone was only about 6,000 acre-feet per season, essentially all irrigable but presently nonirrigated lands in the zone would be physically susceptible of irrigation under the South Honcut Creek Project. However, a substantial acreage of irrigable lands lying in the Browns Valley service area could be developed with water from the South Honcut Creek Project. For this reason, studies of present utilization of water from the South

Honcut Creek Project were based on an assumed release of water for the Northeast Zone equal to approximately one-half of the estimated safe yield of the project. It was assumed that remaining safe yield of the project would be made available to the Browns Valley service area.

For design purposes it was assumed that minor losses of water released from South Honcut Creek Reservoir would occur in the stream channel between the dam and the downstream point of diversion and in the lined canal leading to the point of release north of Loma Rica, and would amount to about 300 acre-feet per season. Thus a gross supplemental water supply of approximately 12,000 acre-feet per season would be made available to the Browns Valley service area. It was estimated that losses in conveyance and distribution of this supply would be about 25 percent, leaving some 9,000 acre-feet per season for application to irrigation. On the assumption that the imported water would be largely used on irrigated pasture, with an estimated average unit seasonal application of about 3.5 acre-feet per acre, about 2,600 acres of irrigable but presently nonirrigated lands in the Browns Valley service area could be served by the new water supply.

It was assumed that seasonal losses by transpiration, evaporation, and percolation in conveying the new water supply to the point of diversion on Prairie Creek would be about 10 percent of the gross reservoir release, or about 1,200 acre-feet, leaving approximately 10,800 acre-feet for distribution in the zone. Since the Northeast Zone constitutes a free ground water area, water losses in the unlined canal and ditch system would largely percolate to the ground water. For this reason it was assumed that these losses, plus the unconsumed portion of the new water supply applied to irrigation, would be effective in preventing progressive and permanent lowering of ground water levels.

The acreage to be irrigated by the supplemental supply in the Northeast Zone would depend on the gross amount of the import, water losses encountered in conveyance and distribution, and the requirement for application of water to the lands irrigated. It was assumed that losses to be encountered in conveyance and distribution within the zone would be 25 percent of the gross import, or about 2,700 acre-feet per season, leaving some 8,100 acre-feet for application to irrigated lands. It was also assumed that water imported to the Northeast Zone would largely be used on irrigated pasture, and that the average seasonal application of the new water would be 3.5 acre-feet per acre. On this basis it was estimated that the imported supply would be applied to some 2,300 acres in a service area adjoining and lying to the east and north of the Cordua Irrigation District. Of the lands which would be served with the new water supply, about 1,700 acres are presently irrigated by ground water and 600 acres are irrigable lands not presently irrigated.

An estimate of the monthly distribution of demand for irrigation water in the Sutter-Yuba Area was presented in Table 33. Based on these data, the monthly demand on the South Honcut Creek Project would be as shown in Table 41.

TABLE 41

ESTIMATED MONTHLY DISTRIBUTION OF DEMAND FOR WATER FROM SOUTH HONCUT CREEK PROJECT

(In acre-feet)

Month	Percent of seasonal total	Reservoir release	Gross import to Northeast Zone	Gross import to Browns Valley
April	10	2,430	1,080	1,200
May	16	3,890	1,730	1,920
June	17	4,130	1,830	2,040
July	22	5,350	2,380	2,640
August	17	4,130	1,830	2,040
September	11	2,670	1,190	1,320
October	5	1,210	540	600
November	2	490	220	240
TOTALS	100	24,300	10,800	12,000

Plane table topographic surveys were made of the South Honcut Creek dam and reservoir sites by the Division of Water Resources in 1949. The reservoir site was mapped at a scale of 1 inch to 400 feet, and the dam site at a scale of 1 inch to 100 feet, both with 10-foot contour intervals. Storage capacities of South Honcut Creek Reservoir at various stages of water surface elevation are given in Table 42.

Based upon preliminary geological reconnaissance, the South Honcut Creek dam site is considered suitable for an earthfill dam of any height up to a maximum of 200 feet. Foundation rock at the site consists of a slightly metamorphosed series of igneous rocks, chiefly of volcanic origin. The original nature of the rocks ranged from basalt to gabbro. The bulk of the material is a blue-gray, hard, very slightly metamorphosed basalt. The entire mass has been intruded by a number of small dikes, of later origin, consisting of unmetamorphosed andesite and/or basalt. The foundation bedrock as a whole is relatively hard and unweathered where exposed in outcrops. Joints are prominently developed in several sets. The predominant set has a strike approximately parallel to the stream course and apparently controls the primary drainage pattern in the vicinity. Small shears are common throughout the rock mass but these have generally been recemented. Some of the joints also have been recemented by deposition of minerals from percolating waters. Seepage may be observed from remaining open seams in the bedrock in several places.

TABLE 42

AREAS AND CAPACITIES OF SOUTH HONCUT CREEK RESERVOIR

Depth of water at dam, in feet	Water surface elevation, USGS datum, in feet	Water surafce area, in acres	Storage capacity, in acre-feet
0	730	0	0
20	750	3	25
40	770	26	226
60	790	62	1,090
80	810	132	2,980
100	830	256	6,530
119	849	344	12,000
120	850	355	12,300
138	868	484	20,000
140	870	512	20,900
156	886	634	30,000
160	890	691	32,800
168	898	720	38,000
180	910	801	47,600
200	930	933	65,000
205	935	976	70,000
220	950	1,070	85,100

Three hundred feet downstream from the axis a fault zone is encountered which follows the base of the right abutment longitudinally for an additional 200 feet before lensing out. The plane of this fault apparently has a dip of 55 degrees into the left abutment. The zone appears to die out rapidly in both upstream and downstream directions but at the point of maximum development it is eight feet in width. There is some gouge and much crushed rock along this fault. The inconsistency of the zone on the surface would seem to indicate that it may also lens out vertically at a relatively shallow depth. Indications are that there has been no recent movement on the fault. Special treatment of the dam foundation in the area of this fault would undoubtedly be necessary.

Stripping for the foundation of an earthfill type of dam at this site should not exceed, for the right abutment, five feet of overburden, consisting chiefly of soil, plus three feet of weathered bedrock, and for the left abutment, three feet of overburden plus three feet of weathered bedrock. These estimates apply only under the impervious section of an earthfill type of dam and are for any height of dam up to a maximum of 200 feet. Only the overburden would have to be stripped from under the pervious sections of such a dam. The stated depths are estimated normal to the surface. Stripping in the channel section should consist of about two feet of gravel and one foot of weathered bedrock.

A satisfactory location for a spillway for an earthfill dam at this site would be around the end of the structure, with the excavation being largely in hard bedrock. The material from such excavation, as well as the weathered rock stripped from the abutments, should prove about 80 percent recoverable for construction use as pervious fill, rockfill, or riprap. Tailings from former hydraulic mining operations which choke the channel one mile upstream from the dam site could also be used as pervious fill material. A small quantity of concrete aggregate could be recovered locally for use in appurtenant structures for an earthen dam, but large amounts would either have to be crushed at the site or imported. Soil suitable for use in the construction of an impervious embankment is available in limited quantities from sloping flats of the reservoir area. Although the depth of this material is probably not great, it is believed that enough could be obtained from this source to provide for a minimum impervious earth section.

As a result of yield studies, geologic reconnaissance, and preliminary economic analysis, an earthfill dam, 168 feet in height from stream bed to spillway lip, and with a crest elevation of 910 feet, was selected to illustrate estimates of cost of the South Honcut Creek Project. The dam would have a crest length of about 670 feet and a crest width of 30 feet, and 2.5:1 upstream and down-stream slopes. The central impervious core would have a top width of 10 feet and 0.8:1 slopes, and would be blanketed with sand and gravel filters. The outer pervious zones of the dam would consist of dredger tailings and materials excavated in construction of the spillway. The volume of the fill would be an estimated 919,000 cubic yards. The maximum depth of water above the spillway lip would be 8 feet, and an additional 4 feet of freeboard would be provided. The spillway would be of the side channel type, excavated from rock of the right abutment and concrete-lined. It would have a capacity of 10,000 second-feet, required for an assumed discharge of 400 second-feet per square mile of drainage area, and would discharge into South Honcut Creek below the dam. Outlet works would consist of a 42-inch diameter steel pipe placed in a trench excavated in rock beneath the dam, and encased in concrete. Releases from the dam would be controlled at the upstream end by two 30-inch hydraulically controlled high pressure slide gates located at a submerged inlet upstream from the dam, and operated by hydraulic controls from the crest of the dam. The outlet would be controlled at the downstream end by a Howell-Bunger valve.

The diversion works on French Dry Creek would be located approximately at the site of a former diversion weir, portions of which are still in existence. The site was examined and cross sections taken during the course of the investigation. The proposed diversion weir would consist of a concrete gravity overpour section and apron, 7 feet in height above stream bed and some 55 feet in length. An opening at the right end of the weir would provide entrance to a side channel leading downstream about 100 feet to the headworks of the diversion canal. The side channel would have a concrete gravity parapet wall of the overpour type, and a 5- by 4-foot sluice gate would be provided for sand clearance. The headworks would consist of a concrete headwall across the end of the side channel, in which there would be two 5- by 4-foot slide gates. The diversion canal, which for a portion of its route would be aligned roughly along an abandoned canal, would be about 2.0 miles in length, discharging into an unnamed tributary of South Honcut Creek. Location of the canal was based on a map study, and was checked in the field. The canal chosen for cost estimating purposes would have a capacity of 200 second-feet, a shotcrete-lined trapezoidal section with 1:1 side slopes, bottom width and depth of 4.0 feet, and freeboard of 1.0 foot, and a slope of approximately 7.0 feet per mile. The velocity would be about 6.3 feet per second.

The diversion works on South Honcut Creek to serve Browns Valley and the Northeast Zone would be similar to those described for the French Dry Creek diversion, except that the weir would be 9 feet high and 84 feet in length, and the headworks would be located at the left end of the weir. The site was examined and cross-sectioned during the course of the investigation. The diversion conduit chosen for cost estimating purposes would have a capacity of 150 second-feet and would bear in a general southerly direction a distance of approximately 4.7 miles. Location of the conduit was based on a map study, and was checked in the field. For the most part the conduit would consist of a shotcrete-lined canal, but would include a steel pipe siphon, 5.5 feet in diameter and about 1,500 feet in length, across Tennessee Creek. The canal portion would have a trapezoidal section with 1:1 side slopes, bottom width of 5.0 feet, depth of 4.0 feet, and freeboard of 1.0 foot. Its slope would be approximately 4.0 feet per mile, and the velocity would be about 4.2 feet per second. Releases of water for use in Browns Valley could be made along the conduit and at its terminus.

From the terminus, about one mile northeast of Loma Rica, water for the Northeast Zone would be released to flow southerly in a tributary of Little Dry Creek for about 6,000 feet, and then would be diverted by temporary earthen works into a short unlined canal leading westerly and discharging into an unnamed tributary of Prairie Creek. The water would flow in Prairie Creek and its tributary a distance of about six miles to the point of diversion for the Northeast Zone. This diversion site and the route of the conduit to serve the Northeast Zone were surveyed during the course of the investigation. The diversion works would consist merely of a temporary earthen structure, replaced each season. The conduit from the diversion to the Northeast Zone would bear in a general southerly direction a distance of approximately 6.3 miles, terminating in a tributary of Nigger Jack Slough. It would be an unlined canal, having capacities of 75 second-feet at the diversion point and 25 second-feet at the terminus. At the diversion point the canal would have a trapezoidal section with 2:1 side slopes, bottom width of 4.0 feet,

TABLE 43

GENERAL FEATURES OF SOUTH HONCUT CREEK PROJECT

Earthfill Dam
- Crest elevation—910 feet
- Crest length—670 feet
- Crest width—30 feet
- Height, spillway lip above stream bed—168 feet
- Side slopes—2.5:1
- Freeboard, above spillway lip—12 feet
- Elevation of stream bed—730 feet
- Volume of fill—919,000 cubic yards

Reservoir
- Surface area at spillway lip—720 acres
- Capacity at spillway lip—38,000 acre-feet
- Drainage area
  - Honcut Creek—24 square miles
  - French Dry Creek—22 square miles
- Estimated mean seasonal runoff
  - Honcut Creek—23,400 acre-feet
  - French Dry Creek—27,100 acre-feet
- Estimated mean seasonal diversion from French Dry Creek—22,000 acre-feet
- Estimated safe seasonal yield—24,300 acre-feet
- Type of spillway—Side channel, concrete-lined
- Spillway capacity—10,000 second-feet
- Type of outlet—12-inch diameter steel pipe beneath dam

Diversion Works
- French Dry Creek ..... Concrete gravity weir, with ogee overpour section, 55 feet in length, and 7 feet high above stream bed elevation of about 2,125 feet; side channel diversion box, with overpour parapet wall, and 5- by 4-foot slide sluice gate; two 5- by 4-foot slide headgates in concrete headwall.
- South Honcut Creek ..... Concrete gravity weir, with ogee overpour section, 84 feet in length, and 9 feet high above stream bed elevation of 600 feet; side channel diversion box, with overpour parapet wall, and 5- by 4-foot slide sluice gate; two 5- by 4-foot slide headgates in concrete headwall.
- Prairie Creek ..... Temporary earthen structure, at stream bed elevation of 135 feet.

Conduits

	French Dry Creek Diversion	South Honcut Creek Diversion	Prairie Creek Diversion
Type	Trapezoidal, shotcrete-lined canal	Trapezoidal, shotcrete-lined canal, and 1,500 feet of 5.5-foot diameter steel pipe siphon	Trapezoidal, unlined canal
Length, in miles	2.0	4.7	6.3
Side slopes	1:1	1:1	2:1
Bottom width, in feet	4.0	5.0	4.0 (maximum)
Depth, in feet	4.0	4.0	3.7 (maximum)
Freeboard, in feet	1.0	1.0	1.0
Slope, in feet per mile	7.0	4.0	2.5
Velocity, in feet per second	6.3	4.2	1.7
Capacity, in second-feet	200	150	75 to 25

depth of 3.7 feet, and freeboard of 1.0 foot. Its slope would be approximately 2.5 feet per mile, and the velocity would be about 1.7 feet per second.

Cost estimates for the canals to convey water to the service areas in Browns Valley and the Northeast Zone were based on designs utilizing data obtained by reconnaissance field location surveys. Detailed design of the distribution systems in Browns Valley and the Northeast Zone, however, was considered to be outside the scope of the current investigation. Cost estimates for the systems were based on known costs of similar irrigation works elsewhere in California, adjusted to correspond with conditions prevailing in the Sutter-Yuba Area.

Pertinent data with respect to the general features of the South Honcut Creek Project, as designed for cost estimating purposes, are presented in Table 43.

The capital cost of the South Honcut Creek Project, based on prices prevailing in April, 1952, was estimated to be about $3,009,600. Corresponding annual costs of the South Honcut Creek Project were estimated to be about $154,200. The resultant estimated average unit cost of the 24,300 acre-feet of water per season conserved by South Honcut Creek Reservoir was about $6.40 per acre-foot. The estimated unit costs of water applied for irrigation in the Northeast Zone and in the Browns Valley service area were about $9.70 and $8.40 per acre-foot, respectively.

Estimated capital and annual costs of the South Honcut Creek Project are summarized in the following tabulation. Detailed cost estimates are presented in Appendix H.

	Estimated costs	
	Capital	*Annual*
Dam and reservoir	$2,225,600	$94,400
French Dry Creek diversion and conduit	151,100	8,100
South Honcut Creek diversion and conduit	379,100	20,500
Prairie Creek diversion and conduit	131,300	7,100
Browns Valley distribution system	65,000	14,400
Northeast Zone distribution system	57,500	9,700
TOTALS	$3,009,600	$154,200

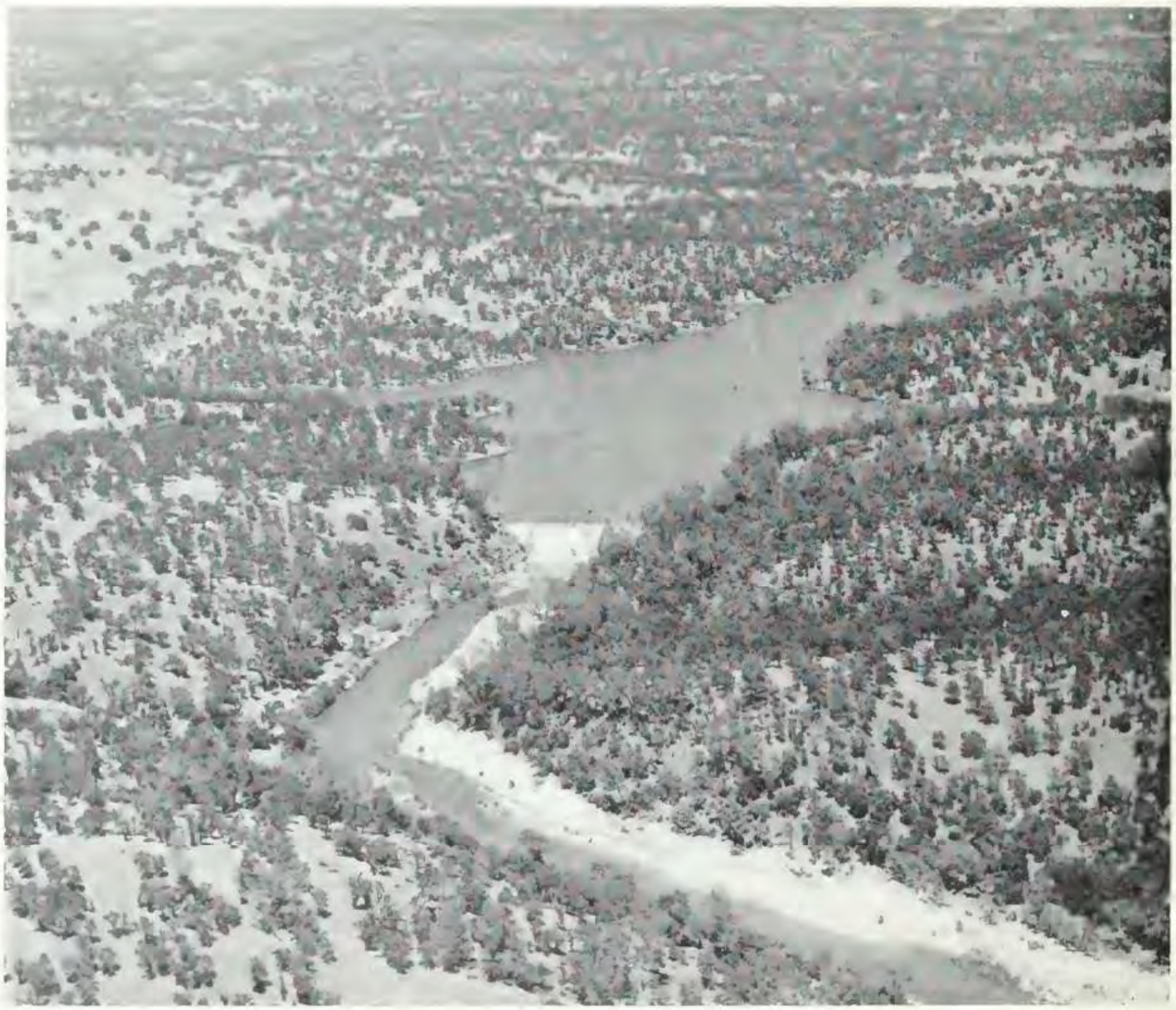
East Central Zone

In Chapter III it was shown that the present requirement for supplemental water in the East Central Zone is about 28,000 acre-feet per season. However, in the design of projects for initial local development to meet this requirement, it was considered desirable to provide some capacity for future growth in water demand which would occur through development of irrigable lands not presently irrigated. This additional capacity was estimated at about 12,000 acre-feet per season, giving consideration to the extent of undeveloped irrigable lands that might readily be served, and to the available sources of water supply. For reasons hereinafter discussed it was considered that the new water supply would be applied to about 8,500 acres in the East Central Zone, of which about 3,300 acres are presently irrigated by ground water and 5,200 acres are irrigable lands not presently served with water. These lands are contained within a service area lying generally south of Hutchinson Creek and east of the Western Pacific Railroad, and delineated on Plate 22, "Camp Far West Project."

Four possible alternative plans of works for initial construction to provide supplemental water to the East Central Zone were considered. For reasons hereinafter mentioned, after preliminary investigation and study the first three plans were given no further consideration for present cost estimating purposes, but may warrant future study. The fourth plan is described in some detail in this section.

Alternative Plans Considered. The first of the alternative plans considered for initial construction involved the substitution of surface water from the Yuba River to replace ground water presently utilized in an area in the East Central Zone. The substitute supply would be diverted at a point on the Yuba River about four miles upstream from Daguerre Point by means of existing headworks of the Yuba River Ditch, owned by the Yuba Consolidated Gold Fields. The Yuba River Ditch, an abandoned canal some four miles in length, with a designed capacity of approximately 115 second-feet, would be rehabilitated and extended in a southerly direction to Hutchinson Creek. Use of the new surface water supply would prevent progressive and permanent lowering of ground water levels in the area served and in adjacent areas. During study of the plan it was determined that surplus flows are available in the Yuba River at the proposed point of diversion during the snowmelt period and into summer months in all but the driest years. However, during the peak of the irrigation season in many years, flows at the diversion point are no more than adequate to maintain the required downstream diversion at Daguerre Point for the Cordua and Hallwood systems. Until such time as additional upstream conservation storage and regulation of flood flows of the Yuba River are accomplished, excessive irrigation deficiencies would be experienced under this plan. For this reason the plan was given no further present consideration for initial construction.

The second of the alternative plans considered for initial construction would include the construction of a dam and reservoir at the Waldo site on Dry Creek, facilities for release of the conserved waters from the reservoir, and facilities for their downstream diversion, conveyance, and distribution in the East Central Zone. Preliminary studies indicated that this plan would not provide sufficient yield to meet the present requirement for supplemental water in the East Central Zone, and that the unit cost of the conserved water would be greater than the corresponding unit cost with the fourth plan described in this section. For these reasons the plan was given no further present consideration. Studies were also made of a plan which included a



Existing Camp Far West Dam and Reservoir larger dam and reservoir at the Waldo site, together with facilities for diversion of flood waters of Yuba River to the larger reservoir. Yield studies and preliminary cost estimates indicated that this plan should probably be deferred for future development. It was indicated that only a portion of the yield of the enlarged project could be readily utilized in the Sutter-Yuba Area at the present time. The capital cost of the larger project would be more than twice that of the fourth plan for initial construction described in this section. Costs of developed water would be excessive until such time as the major portion of the yield could be put to beneficial use. For these reasons this plan was given no further present consideration for initial construction.

The third of the alternative plans considered for initial construction involved the possible purchase of water from the Nevada Irrigation District and conveyance to places of use in the natural channel of Dry Creek. Preliminary studies indicated that additional water could be supplied to the East Central Zone by development and extension of existing facilities of the district, including the China and Tarr Ditches. As in the case of the first plan described, use of the new surface supply would prevent progressive and permanent lowering of ground water levels in the area served and in adjacent areas. The amount of water that might be made available to the East Central Zone would depend upon construction and enlargement of works of the Nevada Irrigation District, and, in turn, upon the outcome of possible negotiations between the district and an agency representing interests of the Northeast Zone. For these reasons, features of the plan were not surveyed and studied in detail, nor estimates of cost prepared.

The fourth plan considered for initial construction would provide for the present supplemental water requirement in the East Central Zone and for growth in water utilization for a number of years in the future. In addition, it would provide corresponding benefits to the South Side Zone. The plan would include the construction of a larger dam and reservoir on the Bear River at the site of the existing Camp Far West Dam and Reservoir, and facilities for conveyance of the conserved water to and its distribution in both the East Central and South Side Zones. Use of the new surface water supply would prevent progressive and permanent lowering of ground water levels in the areas served and in adjacent areas. This plan is hereinafter referred to as the "Camp Far West Project," and its principal features are delineated on Plate 22.

Camp Far West Project. The proposed dam would be an earthfill structure with chute spillway, located on the Bear River, in Section 21, Township 14 North, Range 6 East, M. D. B. & M., some 16 miles upstream from the confluence with the Feather River, and 6.6 miles upstream from Highway 99E. Stream bed elevation at the site is 145 feet. The proposed dam would be superimposed upon an existing curved concrete gravity dam, 62 feet in height from stream bed to dam crest, which creates a reservoir of about 5,000 acre-foot capacity, and is owned by the Camp Far West Irrigation District. Flood waters of the Bear River conserved by the proposed reservoir would be released at an elevation of approximately 180 feet to canals serving the East Central and South Side Zones, respectively. The lands which would be served by the new water supply comprise the aforementioned 8,500 acres in the East Central Zone, and an additional 8,500 acres in the South Side Zone, in the respective service areas shown on Plate 22. Both service areas range in elevation from about 150 feet along their eastern boundaries to about 50 feet on the west.

In Chapter III it was estimated that the present requirement for supplemental water in the East Central Zone is about 28,000 acre-feet per season and in the South Side Zone an additional 28,000 acre-feet, a total of about 56,000 acre-feet per season. In the design of the Camp Far West Project for cost estimating purposes, it was considered necessary to provide about 10,000 acre-feet of water per season for the Camp Far West Irrigation District to replace yield of the existing reservoir. Based upon the area of lands irrigated by the district, this estimate is believed to be adequate. As has been stated, it was also considered desirable to provide some capacity for future growth in demand on the project, which would occur through development of irrigable lands not presently irrigated.

As a first step in determination of size of the project, estimates were made of yield of the proposed works for various storage capacities. It was estimated that mean seasonal runoff of the Bear River, from the approximately 280 square miles above the dam site, was 347,000 acre-feet. Based upon records and estimates of runoff during the critical dry period which occurred in the Sacramento Valley from 1920-21 through 1934-35, yield studies were made for three sizes of reservoirs at the Camp Far West site. It was assumed that a seasonal irrigation deficiency up to 35 percent could be endured in one season of the period. A summary of results of the yield studies is presented in Table 44.

TABLE 44

ESTIMATED SAFE SEASONAL YIELD OF CAMP FAR WEST RESERVOIR, BASED ON CRITICAL DRY PERIOD FROM 1920-21 THROUGH 1934-35

(In acre-feet)

Reservoir storage capacity	Safe seasonal yield
55,000	55,000
104,000	90,000
151,000	122,000

After consideration of the results of the yield studies, together with topography of the dam site and cost analyses hereinafter discussed, a reservoir of 104,000 acre-foot storage capacity, with estimated safe seasonal yield of 90,000 acre-feet was chosen for purposes of cost estimates to be presented in this report. The yield study for this size of reservoir is included in Appendix G.

For cost estimating purposes a tentative distribution of yield of the proposed Camp Far West Reservoir was made. Of the estimated 90,000 acre-feet of safe seasonal yield, 10,000 acre-feet per season was assigned to the Camp Far West Irrigation District. The remaining yield was divided equally between the East Central and South Side Zones, in the amount of 40,000 acre-feet per season to each zone.

Since the East Central Zone constitutes a free ground water area, water losses in the proposed canal and ditch system would largely percolate to the ground water. For this reason it was assumed that these losses, plus the unconsumed portion of the new water supply applied to irrigation would be effective in preventing progressive and permanent lowering of ground water levels. It was estimated that losses in conveyance and distribution of the 40,000 acre-feet of safe seasonal yield assigned to the East Central Zone would be about 25 percent, leaving some 30,000 acre-feet per season for application to irrigation. It was also assumed that water imported to the East Central Zone would be used largely on irrigated pasture, and that the average seasonal application of the new water would be 3.5 acre-feet per acre. On this basis it was estimated that the imported supply would be applied to some 8,500 acres in a service area lying generally south of Hutchinson Creek and east of the Western Pacific Railroad. Of the lands which would be served with the new water supply, about 3,300 acres are presently irrigated by ground water and about 5,200 acres are irrigable lands not presently irrigated.

An estimate of the monthly distribution of demand for irrigation water in the Sutter-Yuba Area was presented in Table 33. Based on these data, monthly demands on the Camp Far West Project would be as shown in Table 45.

A topographic survey of the Camp Far West reservoir site up to an elevation of 225 feet was made by the Camp Far West Irrigation District in 1922. This survey was extended to an elevation of 320 feet by the Division of Water Resources in 1930, and a map was drawn from both surveys at a scale of 1 inch equals 500 feet, with a contour interval of 10 feet. Storage capacities of the Camp Far West Reservoir at various stages of water surface elevation are given in Table 46.

Based upon preliminary geological reconnaissance, the Camp Far West dam site is considered suitable for an earthfill dam of any height up to a maximum of 180 feet. Bedrock at the site consists of a slightly porphyritic, compact, and massive dark greenstone with gradations into coarse-grained plutonic rock. A complex joint system exists in this vicinity with joint cracks opened a few inches on the surface by weathering. The joints probably do not persist to appreciable depths other than as hairline cracks in the rock. However, some moderate grouting would be necessary. Shears are not abundant in the bedrock, and no serpentine was found locally. While slopes up to an elevation of about 160 feet above stream bed on

TABLE 45

ESTIMATED MONTHLY DISTRIBUTION OF DEMAND FOR WATER FROM CAMP FAR WEST PROJECT

Month	Percent of seasonal total	Gross release to Camp Far West Irrigation District, in acre-feet	Gross import to East Central Zone, in acre-feet	Gross import to South Side Zone, in acre-feet
April	10	1,000	4,000	4,000
May	16	1,600	6,400	6,400
June	17	1,700	6,800	6,800
July	22	2,200	8,800	8,800
August	17	1,700	6,800	6,800
September	11	1,100	4,400	4,400
October	5	500	2,000	2,000
November	2	200	800	800
TOTALS	100	10,000	40,000	40,000

TABLE 46

AREAS AND CAPACITIES OF CAMP FAR WEST RESERVOIR

Depth of water at dam, in feet	Water surface elevation, USGS datum, in feet	Water surface area, in acres	Storage capacity, in acre-feet
0	145	0	0
25	170	100	1,400
45	190	180	4,200
65	210	380	9,800
85	230	600	19,400
105	250	890	34,200
125	270	1,260	55,500
145	290	1,750	85,600
155	300	2,020	104,400
165	310	2,330	126,100
175	320	2,620	151,000

both abutments consist essentially of barren bedrock with scattered patches of overlying soil, the abutment slopes above 100 feet show only occasional bedrock outcrops with a much heavier mantle of overburden. Stripping under the impervious section of an earthfill type of dam at this site should not exceed four feet of depth of loose material up to 100 feet above stream bed on both abutments, and eight feet of depth above 100 feet on the abutments. Topographic considerations indicate that the spillway should be located across the ridge forming the right abutment of the dam, utilizing a natural saddle and drainage channel.

The material stripped from the foundation and abutments and excavated from the spillway should prove largely recoverable for construction use as pervious fill, rockfill, or riprap. Deposits of dredger tailings about two miles downstream from the dam, as well as sands and gravels accumulated in the existing reservoir, could be used as pervious fill material for the proposed dam. Soil suitable for use in the construction of an impervious embankment is available in limited quantities within a radius of about two miles from the dam. Although the depth of this material is probably not great, it is believed that enough could be obtained from several sources to provide for a minimum impervious earth section.

As a result of yield studies, geologic reconnaissance, and preliminary economic analysis, an earthfill dam, 155 feet in height from stream bed to spillway lip, and with a crest elevation of 311 feet, was selected to illustrate estimates of costs of the Camp Far West Project. The dam would have a crest length of about 2,980 feet and a crest width of 30 feet, and 3:1 upstream and 2.5:1 downstream slopes. The central impervious core would have a top width of 10 feet and 0.8:1 slopes. The outer pervious zones of the dam would consist of stream bed gravels, dredger tailings, and salvaged material from stripping and excavation. A 3-foot blanket of gravel riprap would protect the upstream face of the dam. The volume of the fill would be an estimated 2,070,000 cubic yards. The spillway would be of the chute type, located across the ridge forming the right abutment, and concrete-lined. The maximum depth of water above the spillway lip would be 7 feet, and an additional 4 feet of freeboard would be provided. The spillway would have a capacity of 60,000 second-feet, required for an assumed discharge of 215 second-feet per square mile of drainage area. The spillway would discharge into a draw that joins the Bear River about 900 feet downstream from the toe of the dam. The outlet works would include a horseshoe type tunnel, 10 feet in diameter and 880 feet in length, excavated through the left abutment and concrete-lined. The tunnel would be used to divert flow of the Bear River during the construction period. After completion of the dam a concrete plug would be placed in the tunnel at the axis of the dam, and a 5- by 5-foot high pressure slide gate would be installed to control releases from the reservoir. A 66-inch diameter steel pipe, with capacity of 440 second-feet, would convey the water through the tunnel and terminate in a 60-inch diameter needle valve at a location about 250 feet downstream from the tunnel portal. This needle valve would discharge into a concrete-lined stilling basin, from which water would enter a concrete-lined canal at an elevation of 187 feet. Another needle valve, of 36-inch diameter, would be installed in the steel outlet pipe just outside of the tunnel portal, and would discharge directly into the Bear River.

The canal from the stilling basin would be of trapezoidal section, with 1:1 side slopes, bottom width of 7.0 feet, depth of 6.0 feet, and freeboard of 1.0 foot. Its slope would be about 2.5 feet per mile, its velocity about 5.1 feet per second, and its capacity 400 second-feet. The canal would extend along the left bank of the Bear River a distance of about 8,000 feet, terminating in a concrete division box at an elevation of 183 feet. From this structure a steel pipe siphon, 66 inches in diameter and about 800 feet in length, with capacity of 200 second-feet, would convey water across the Bear River, discharging into a canal to serve the East Central Zone. The division box would also contain an outlet to a canal to serve the South Side Zone, and another outlet to a wasteway emptying into the Bear River.

The canals to serve both the East Central and South Side Zones would have capacities at their intakes of 200 second-feet. The canal to serve the East Central Zone would extend from the siphon outlet in a northwesterly direction a distance of approximately 3.6 miles, where about one-half of the water would be discharged into the channel of South Dry Creek to be diverted by downstream users. The remaining water would be carried a distance of about 0.8 mile and discharged into the channel of North Dry Creek for similar downstream rediversion. For an initial distance of about 3,500 feet from the Bear River siphon the canal would be shotcrete-lined and of trapezoidal section, with 1:1 side slopes, bottom width of 6.0 feet, depth of 4.5 feet, and freeboard of 1.0 foot. The slope would be about 2.5 feet per mile, and the velocity about 4.3 feet per second. For the remainder of the distance to South Dry Creek the canal would be unlined and of trapezoidal section, with 2:1 side slopes, bottom width of 8.0 feet, depth of 5.0 feet, and freeboard of 1.0 foot. The slope would be about 2.5 feet per mile, and the velocity about 2.2 feet per second. From South Dry Creek to North Dry Creek the canal would be unlined and of trapezoidal section, with 2:1 side slopes, bottom width of 7.0 feet, depth of 3.7 feet, and freeboard of 1.0 foot. The slope would be about 2.5 feet per mile, and the velocity about 1.9 feet per second. Capacity of this portion of the canal would be 100 second-feet.

The canal to serve the South Side Zone would extend from the division box in a southerly direction a distance of approximately 10.0 miles to Coon Creek, where about one-half of the flow would be discharged for rediversion by downstream users. The remaining water would be carried in a canal with capacity reduced to 100 second-feet, a distance of about 5.5 miles in a general southerly direction, where it would be similarly discharged into and conveyed in the natural channel of Markham Ravine for a distance of about 1.1 miles. The conserved water would be diverted from Markham Ravine by a flashboard dam and conveyed in a canal for a distance of about 1.2 miles where it would be discharged into Auburn Ravine for rediversion by downstream users. For an initial distance of about 1.0 mile from the division box the canal would be shotcrete-lined and of trapezoidal section, with 1:1 side slopes, bottom width of 6.0 feet, depth of 4.5 feet, and freeboard of 1.0 foot. The slope would be about 2.5 feet per mile, and the velocity about 4.3 feet per second. For the remainder of the distance to Coon Creek the canal would be unlined. It would be of trapezoidal section, with 2:1 side slopes, bottom width of 8.0 feet, depth of 5.0 feet, and freeboard of 1.0 foot. Its slope would be about 2.5 feet per mile, and its velocity about 2.2 feet per second. From Coon Creek to Auburn Ravine the constructed canal would be unlined and of trapezoidal section, with 2:1 side slopes, bottom width of 7.0 feet, depth of 3.7 feet, and freeboard of 1.0 foot. Its slopes would be about 2.5 feet per mile, and its velocity about 1.9 feet per second.

TABLE 47

GENERAL FEATURES OF CAMP FAR WEST PROJECT

Earthfill Dam
- Crest elevation—311 feet
- Crest length—2,980 feet
- Crest width—30 feet
- Height, spillway lip above stream bed—155 feet
- Side slopes—3:1 upstream
  2.5:1 downstream
- Freeboard, above spillway lip—11 feet
- Elevation of stream bed—145 feet
- Volume of fill—2,070,000 cubic yards

Reservoir
- Surface area at spillway lip—2,020 acres
- Capacity at spillway lip—101,000 acre-feet
- Drainage area—280 square miles
- Estimated mean seasonal runoff—347,000 acre-feet
- Estimated safe seasonal yield—90,000 acre-feet
- Type of spillway—Chute, concrete-lined
- Spillway capacity—60,000 second-feet
- Type of outlet—10-foot diameter pressure tunnel and 66-inch diameter steel pipe through left abutment

Conduits

	Outlet	Bear River Canal	Bear River Siphon	East Central Zone Conduit			South Side Zone Conduit		
Type	66-inch diameter steel pipe	Trapezoidal, concrete-lined	66-inch diameter	Trapezoidal			Trapezoidal		
				Lined section	Unlined section		Lined section	Unlined section	
Length, in miles	0.21	1.5	0.15	0.7	2.9	0.8	1.0	10.0	6.7
Side slopes		1:1		1:1	2:1	2:1	1:1	1:1	2:1
Bottom width, in feet		7.0		6.0	8.0	7.0	6.0	8.0	7.0
Depth, in feet		6.0		4.5	5.0	3.7	4.5	5.0	3.7
Freeboard, in feet		1.0		1.0	1.0	1.0	1.0	1.0	1.0
Slope, in feet per mile		2.5		2.5	2.5	2.5	2.5	2.5	2.5
Velocity, in feet per second	18.5	5.1	8.1	4.3	2.2	1.9	4.3	2.2	1.9
Capacity, in second-feet	440	100	200	200	200	100	200	200	100

Cost estimates for the canals to convey water to the service areas in the East Central and South Side Zones were based on designs utilizing data obtained by field location surveys. Detailed design of the distribution systems in the East Central and South Side Zones, however, was considered to be outside the scope of the current investigation. Cost estimates for the distribution systems were based on known costs of similar irrigation works elsewhere in California, adjusted to correspond with conditions prevailing in the Sutter-Yuba Area.

Pertinent data with respect to general features of the Camp Far West Project, as designed for cost estimating purposes, are presented in Table 47.

The capital cost of the Camp Far West Project, based on prices prevailing in April, 1952, was estimated to be about $5,592,900. The corresponding annual costs of the Camp Far West Project were estimated to be about $299,600. The resultant estimated unit cost of the 80,000 acre-feet per season of new water conserved by the Camp Far West Reservoir was about $3.70 per acre-foot. The estimated unit cost of water applied for irrigation in the East Central Zone was about $4.70 per acre-foot, and the estimate for water applied for irrigation in the South Side Zone was about $5.30 per acre-foot.

Estimated capital and annual costs of the Camp Far West Project are summarized in the following tabulation. Detailed cost estimates are presented in Appendix H.

	Estimated costs	
	Capital	*Annual*
Dam and reservoir	$3,979,900	$170,000
Bear River canal	233,000	12,600
East Central Zone canal and siphon	286,600	15,400
South Side Zone canal	668,400	36,000
East Central Zone distribution system	212,500	32,800
South Side Zone distribution system	212,500	32,800
TOTALS	$5,592,900	$299,600

South Side Zone

Three possible alternative plans of works for initial construction to provide supplemental water to the South Side Zone were considered. The first of these plans was the Camp Far West Project, which, as described in the preceding section, would provide supplemental water for both the East Central and South Side Zones. The second of the alternative plans considered for initial construction involved the possible purchase of water from the Nevada Irrigation District and conveyance to places of use in the natural channels of Coon Creek and Auburn Ravine. The amount of water that might be made available to the South Side Zone would depend upon design and construction of additional works of the Nevada Irrigation District, and in turn upon the outcome of possible negotiations between the district and an agency representing interests of the South Side Zone. For these reasons, features of the plan were not surveyed and studied in detail, nor estimates of cost prepared.

The third of the plans involved the construction of a dam and reservoir on Coon Creek, at a site approximately seven miles northeast of Lincoln, the utilization of an existing diversion works and ditch to convey flood flows of the Bear River to the reservoir, the reconstruction of existing abandoned facilities for diversion of the conserved waters from Coon Creek below the dam, and the construction of facilities for conveyance of the waters to and their distribution in the South Side Zone. This plan is hereinafter referred to as the "Coon Creek Project," and its principal features are delineated on Plate 23, "Coon Creek Project."

Under each of the alternative plans use of the new surface water supplies would prevent progressive and permanent lowering of ground water levels in the areas served and in adjacent areas. Each plan would provide for the present supplemental water requirement of the South Side Zone and for growth in water utilization for a number of years in the future.

Camp Far West Project. In the earlier description of the Camp Far West Project a reservoir of 104,000 acre-foot capacity, with estimated safe seasonal yield of 90,000 acre-feet, was chosen at the Camp Far West site on the Bear River for cost estimating purposes. A tentative distribution of this yield was made that would provide 40,000 acre-feet per season to the South Side Zone, some 12,000 acre-feet per season greater than the present requirement for supplemental water in the zone, which was estimated in Chapter III to be about 28,000 acre-feet per season. The 12,000 acre-feet per season of indicated present surplus yield was assigned to irrigation of irrigable lands not now served with water.

Since the South Side Zone constitutes a free ground water area, water losses in the proposed conveyance and distribution system for the new water supply would largely percolate to the ground water. For this reason it was assumed that these losses, plus the unconsumed portion of the new water supply applied to irrigation, would be effective in preventing progressive and permanent lowering of ground water levels. It was assumed that losses in conveyance and distribution of the 40,000 acre-feet per season of safe seasonal yield assigned to the South Side Zone would be about 25 percent, leaving some 30,000 acre-feet per season for application to irrigation. It was also assumed that water imported to the South Side Zone would largely be used on irrigated pasture and that the average seasonal application of the new water would be 3.5 acre-feet per acre. On this basis it was estimated that the imported supply would be applied to some 8,500 acres in a service area lying generally adjacent to Coon Creek and Auburn Ravine and easterly of the boundaries of Reclamation Districts 1000 and 1001. Elevation of this service area ranges from about 150 feet along the eastern boundary to about 50 feet on the west. Of the lands which would be served with the new water supply, about 3,300 acres are presently irrigated by ground water, and 5,200 acres are irrigable lands not presently irrigated. An estimate of monthly distribution of demand for the 40,000 acre-feet of gross seasonal import to the South Side Zone from the Camp Far West Project was presented in Table 45.

As described in the preceding section, direct releases would be made from Camp Far West Reservoir to the intake of a canal to serve the South Side Zone. The intake would be at a concrete division box, located on the left bank of the Bear River, about 1.5 miles downstream from Camp Far West Dam, at an elevation of 183 feet. From the intake the canal, with capacity of 200 second-feet, would extend in a southerly direction approximately 10.0 miles to Coon Creek. At this point about one-half of the flow would be discharged into Coon Creek for rediversion by downstream users. The remaining water would be carried in a general southerly direction an additional 5.5 miles, in a canal with capacity reduced to 100 second-feet, where it would be similarly discharged into and conveyed in the natural channel of Markham Ravine for a distance of about 1.1 miles. The conserved water would be diverted from Markham Ravine by a flashboard dam and conveyed in a canal for a distance of about 1.2 miles where it would be discharged into Auburn Ravine for rediversion by downstream users. Additional pertinent data with respect to general features of the Camp Far West Project, as designed for cost estimating purposes, were presented in Table 47.

The cost estimate for the canal to convey water to the South Side Zone was based on designs utilizing data obtained by field location surveys. Detailed design of the distribution system for the South Side Zone was considered to be outside the scope of the current investigation. The cost estimate for the distribution system was based on known costs of similar irrigation works elsewhere in California, adjusted to correspond with conditions prevailing in the Sutter-Yuba Area.

As stated in the preceding section, the capital cost of the Camp Far West Project, based on prices prevailing in April, 1952, was estimated to be about $5,592,900. Corresponding annual costs of the Camp Far West Project were estimated to be about $299,600. The resultant estimated unit cost of new water conserved by Camp Far West Reservoir was about $3.70 per acre-foot of safe seasonal yield. The estimated unit cost of water applied for irrigation in the South Side Zone was about $5.30 per acre-foot, and the estimate for water applied for irrigation in the East Central Zone was about $4.70 per acre-foot. Detailed cost estimates for the Camp Far West Project are presented in Appendix H.

Coon Creek Project. The proposed Coon Creek Dam would be an earthfill structure, with two earthen auxiliary saddle dikes and a chute spillway. It would be located in Sections 8 and 17, Township 13 North, Range 6 East, M.D.B. & M., at a site on Coon Creek some 7.5 miles northeast of Lincoln and 8.3 miles upstream from Highway 99E. Stream bed elevation at this site is 345 feet. For cost estimating purposes, it was assumed that flood waters of the Bear River would be diverted by existing works, conveyed in the existing Upper Gold Hill and Combie-Ophir Canals for a distance of about 2.4 miles, and discharged into a tributary of Coon Creek above the proposed reservoir. These diversion works and the canals belong to the Nevada Irrigation District. The conserved waters of both Coon Creek and Bear River, after release from the proposed reservoir, would flow down Coon Creek for a distance of approximately six miles to an existing abandoned diversion structure. At this point about one-half of the released water would be diverted into a canal, and conveyed in a general southerly direction for a distance of some 5.5 miles where it would be discharged into and conveyed in the natural channel of Markham Ravine for a distance of about 1.1 miles. The conserved water would be diverted from Markham Ravine by a flashboard dam and conveyed in a canal for a distance of about 1.2 miles where it would be discharged into Auburn Ravine. The new water supply would be available in the natural channels of Coon Creek and Markham and Auburn Ravines for downstream diversion and use.

The lands which would be served by the new water supply comprise some 12,000 acres in a service area lying generally adjacent to Coon Creek and Auburn Ravine and easterly of the boundaries of Reclamation Districts 1000 and 1001. A portion of this service area, shown on Plate 23, is in Placer County and outside of the Sutter-Yuba Area. For reasons hereinafter discussed, it was assumed that water yielded by the Coon Creek Project would be entirely applied to irrigable lands not presently served with water. Use of the new surface water supply would prevent progressive and permanent lowering of ground water levels in the area served and in adjacent areas in the South Side Zone.

In Chapter III it was estimated that the present requirement for supplemental water in the South Side Zone is about 28,000 acre-feet per season. However, in design of projects for initial local development to meet this requirement, it was considered desirable to provide some capacity for future growth in water demand which would occur through development of irrigable lands not presently irrigated. In the case of the Camp Far West Project, described in the preceding section, this additional capacity was estimated to be 12,000 acre-feet per season. However, in connection with the Coon Creek Project, giving consideration to the extent of undeveloped irrigable lands that might readily be served, and to the available source of water supply, the corresponding additional capacity was estimated to be 28,000 acre-feet per season.

As a first step in determination of the size of the Coon Creek Project, estimates were made of yield of the proposed works for various reservoir storage capacities. It was estimated that mean seasonal runoff of Coon Creek, from the approximately 40 square miles of watershed above the dam site, was about 32,800 acre-feet. Of the Bear River waters, studies indicated that flood flows in an estimated mean seasonal amount of about 35,700 acre-feet could be diverted to the proposed Coon Creek Reservoir, through the existing Combie-Ophir Canal of about 106 second-foot capacity, during the months of November through April.

Based on records and estimates of runoff during the critical dry period which occurred in the Sacramento Valley from 1920-21 through 1934-35, yield studies were made of two sizes of reservoir at the Coon Creek site. The limited number of yield studies was largely determined by topographic considerations. It was assumed that a seasonal irrigation deficiency up to 35 percent could be endured in one season of the period. Monthly demands on the reservoir were assumed to be proportional to the estimated distribution of irrigation demands in the Sutter-Yuba Area, as presented in Table 33. A summary of the results of the yield studies is presented in Table 48.

TABLE 48

ESTIMATED SAFE SEASONAL YIELD OF COON CREEK RESERVOIR WITH BEAR RIVER DIVERSION, BASED ON CRITICAL DRY PERIOD FROM 1920-21 THROUGH 1934-35

(In acre-feet)

Reservoir storage capacity	Safe seasonal yield
25,500	34,000
59,000	56,000

After consideration of the results of the yield studies, together with topography of the dam site and cost analyses hereinafter discussed, a reservoir of 59,000 acre-foot capacity with estimated safe seasonal yield of 56,000 acre-feet was chosen for purposes of cost estimates to be presented in this report. The yield study for this size of reservoir is included in Appendix G.

Since the considered service area constitutes a free ground water area, water losses in the proposed canal and ditch system would largely percolate to the ground water. For this reason it was assumed that these losses, plus the unconsumed portion of the new water supply applied to irrigation, would be effective in preventing progressive and permanent lowering of ground water levels in the area served and in adjacent areas in the South Side Zone.

It was assumed that seasonal losses in conveyance and distribution of the 56,000 acre-feet of safe seasonal yield would be about 25 percent, or 14,000 acre-feet, leaving some 42,000 acre-feet for application to irrigation. It was also assumed that the new water supply from the Coon Creek Project would largely be used on irrigated pasture, and that the average seasonal application of water would be 3.5 acre-feet per acre. On this basis it was estimated that the imported supply would be applied to some 12,000 acres in a service area lying generally adjacent to Coon Creek and Auburn Ravine and easterly of the boundaries of Reclamation Districts 1000 and 1001. Of the assumed average seasonal application of 3.5 acre-feet per acre, it was estimated that seasonal consumptive use would be about 2.3 acre-feet per acre, and that about 1.2 acre-feet per acre would be unconsumed. This unconsumed portion would aggregate about 14,400 acre-feet per season for the 12,000 acres which would be irrigated.

From the foregoing it was estimated that losses in conveyance and distribution of the new water supply, plus the unconsumed portion of the water actually applied to irrigation, both of which would largely percolate to ground water, would total about 28,400 acre-feet per season. Since the estimated present seasonal water requirement to prevent progressive and permanent lowering of ground water levels in the South Side Zone is about 28,000 acre-feet per season, no substitute water supply would have to be furnished lands presently irrigated by ground water in order to prevent such lowering. It was assumed, therefore, that lands to which the water supply from the Coon Creek Project would be applied would consist entirely of irrigable lands not presently served with water. In this connection, certain irrigable but unirrigated lands in Placer County lying immediately adjacent to the South Side Zone could readily and logically be served with water from the Coon Creek Project. For this reason the water service area shown on Plate 23 was extended outside the South Side Zone to include these lands.

An estimate of the monthly distribution of demand for irrigation water in the Sutter-Yuba Area was presented in Table 33. Based on these data, monthly demands on the Coon Creek Project would be as shown in Table 49.

A topographic map of the Coon Creek dam and reservoir sites, at a scale of 1 inch equals 425 feet, with contour interval of 20 feet, was made by the Division of Water Resources in 1951, using photogrammetric methods. Topography of the dam site was shown on the map up to an elevation of 580 feet, while topography of the reservoir site was shown up to an elevation of 500 feet. Reservoir topography above that elevation was estimated. Storage capacities of Coon Creek Reservoir at various stages of water surface elevation are given in Table 50.

TABLE 49

ESTIMATED MONTHLY DISTRIBUTION OF DEMAND FOR WATER FROM COON CREEK PROJECT

Month	Percent of seasonal total	Gross release to South Side Zone, in acre-feet
April	10	5,600
May	16	9,000
June	17	9,500
July	22	12,300
August	17	9,500
September	11	6,200
October	5	2,800
November	2	1,100
TOTALS	100	56,000

TABLE 50

AREAS AND CAPACITIES OF COON CREEK RESERVOIR

Depth of water at dam, in feet	Water surface elevation, USGS datum, in feet	Water surface area, in acres	Storage capacity, in acre-feet
0	345	0	0
15	360	5	50
35	380	25	300
55	400	65	1,200
75	420	110	3,000
95	440	180	5,800
115	460	260	10,300
135	480	360	16,600
155	500	500	25,500
175	520	610	37,600
195	540	740	51,000
205	550	810	58,000
207	552	820	59,000
215	560	880	65,000

Based upon preliminary geological reconnaissance, the Coon Creek dam site is considered suitable for an earthfill dam of any height up to a maximum of 220 feet. Foundation rock at the site consists essentially of amphibolite schist. In the vicinity of the site the rock varies between schistose and massive material, striking across the channel and dipping vertically. The foundation bedrock as a whole is relatively hard and unweathered where exposed in outcrops. Joints are prominently developed in several sets, with a horizontal joint set predominating. Minor faulting may be involved at this site, as evidenced by the sharp change in attitude of the joint sets of the rock slightly downstream from the tentative axis position. The trend of such a possible fault may strike obliquely upstream into the right abutment where considerable talus material exists. There are no indications of recent movement in this area.

The stream at this site has cut through the resistant rib of rock, forming a narrow gorge with steep side slopes to an elevation of about 150 feet above stream bed. A dam of the height considered for cost estimating purposes would require a dike across the saddle south of the left abutment, and two dikes across smaller saddles north and east of the right abutment. However, it is indicated that the spillway could be located across the ridge forming the right abutment of the dam, utilizing one of the saddles and eliminating the need for construction of a dike therein.

It is probable that stripping under the impervious section of an earthfill dam at the Coon Creek site would be relatively heavy, due to the jointed blocky nature of the rock. On the left abutment no removal of overburden would be required for a height of about 50 feet above stream bed, while above that height stripping of overburden, consisting of earth and loose rock, should not exceed two feet of depth. On the right abutment for a height of about 60 feet above stream bed stripping of overburden, consisting of loose talus rocks but including occasional blocks in place, should not exceed 15 feet of depth. Above that height on the right abutment stripping of overburden, consisting of loose rock and earth, should not exceed three feet of depth. Beneath the described overburden on both abutments it is anticipated that required stripping would involve the removal of blocky hard rock to a maximum of 20 feet of depth.

For an earthfill dam at this site, a large proportion of the material obtained from stripping operations could be salvaged for use in the pervious sections of the dam or as riprap. Aggregates, particularly fines, are lacking in the area and might require hauling from the vicinity of the Bear River. Soil suitable for use in the construction of an impervious core is available in only limited quantities. Deposits of residual clay overburden are scattered and thin in the vicinity. However, based on a preliminay sampling program, sufficient material is believed to be available within two to three miles of the dam site to provide for a minimum impervious earth section. Materials for the pervious sections of the dam could be obtained from salvage from stripping, and from stream bed gravels of Coon Creek and the Bear River.

As a result of yield studies, geologic reconnaissance, and preliminary economic analysis, an earthfill dam 207 feet in height from stream bed to spillway lip, and with a crest elevation of 560 feet, was selected to illustrate estimates of cost of the Coon Creek Project. The dam would consist of three earthfill structures, a main dam across Coon Creek and two auxiliary saddle dams. The main dam would have a crest length of about 1,420 feet, a crest width of 30 feet, and 3:1 upstream and 2.5:1 downstream slopes. The south saddle dam would have a crest length of about 1,450 feet and a maximum height of about 64 feet. The north saddle dam would have a crest length of about 550 feet and a maximum height of about 39 feet. Both saddle dams would have crest widths of 20 feet, and 2.5:1 upstream and downstream slopes. The central impervious cores of all dams would have top widths of 10 feet and 0.8:1 slopes, and would be blanketed with sand and gravel filters. The outer pervious zones of the dams would consist of stream bed gravels and materials salvaged from stripping and excavation. The upstream face of the main dam would be protected by a 3-foot blanket of riprap, and similar blankets 2 feet in depth would protect the upstream faces of the saddle dams. The main dam would have an estimated volume of fill of 2,201,000 cubic yards, and the estimated volume of fill of the two saddle dams would be 449,000 cubic yards.

The concrete spillway would be of the ogee weir type, located in a saddle between the main dam and the north saddle dam. It would have a capacity of 14,000 second-feet, required for an assumed discharge of 350 second-feet per square mile of drainage area, and would discharge into a tributary of Coon Creek. The maximum depth of water above the spillway lip would be 4 feet, and an additional 4 feet of freeboard would be provided. Outlet works would consist of a 48-inch diameter steel pipe placed in a trench excavated in rock beneath the dam, and encased in concrete. Releases from the reservoir would be controlled at the upstream end by two 30-inch hydraulically controlled high-pressure slide gates, located at a submerged inlet upstream from the dam, and operated by hydraulic controls from a house on the left abutment. The outlet would be controlled at the downstream end by a Howell-Bunger valve.

The proposed diversion works on Coon Creek would incorporate remaining features of an abandoned diversion structure at a site approximately 3.3 miles upstream from Highway 99E. The site was examined and surveyed during the course of the investigation. The existing works consist of a concrete gate structure with concrete abutments. An earthen dike which formerly completed stream closure of the left abutment has been destroyed. Stream bed elevation at the site is 140 feet, and the gate structure is 17 feet in height above stream bed. The gate opening is 35 feet in width, and contains seven bays to hold flashboards, each with an opening four feet in width.

For cost estimating purposes, it was planned to utilize the old concrete gate structure by installing removable flashboards to a height of 7 feet above stream bed elevation. The earthen dike would be replaced from the left abutment of the gate structure to the natural bank of Coon Creek, a distance of about 100 feet, to complete the stream closure. This embankment would be approximately 10 feet in height, with 2:1 side slopes and a crest elevation of 150 feet. A similar dike with crest elevation of 155 feet, portions of which are already in place, would extend upstream along the low left bank of Coon Creek for a distance of approximately 1,000 feet. At a point about 50 feet upstream from the main axis of the diversion structure a concrete headwall would be placed in the left side embankment, containing a 4- by 4-foot slide gate to control releases into a proposed canal. It was estimated that spillway capacity of the existing gate structure, after removal of the flashboards, would be in excess of 2,000 second-feet. It was considered that infrequent flood flows in Coon Creek in excess of this amount would wash out the closing earth embankment, and that the embankment would have to be replaced after such floods.

The proposed canal, with a capacity of 100 second-feet, would extend from the headgate in a general southerly direction a distance of approximately 5.5 miles to Markham Ravine. The conserved water would be conveyed in the natural channel of Markham Ravine for a distance of about 1.1 miles where it would be diverted by a flashboard dam and conveyed in a canal for a distance of about 1.2 miles and discharged into Auburn Ravine. For an initial distance of about 0.5 mile from the headgate the canal would be shotcrete-lined and of trapezoidal section, with 1:1 side slopes, bottom width of 4.0 feet, depth of 4.0 feet, and freeboard of 1.0 foot. Its slope would be approximately 2.5 feet per mile, and the velocity would be about 3.5 feet per second. The remaining portion of the constructed canal would be of an unlined trapezoidal section, with 2:1 side slopes, bottom width of 7.0 feet, depth of 3.7 feet, and freeboard of 1.0 foot. Its slope would be approximately 2.5 feet per mile, and the velocity would be about 1.9 feet per second. At a distance of about 1.3 miles before reaching Markham Ravine the conduit would cross Highway 99E and the Southern Pacific Railroad. The structure to carry the water underneath the highway and railroad tracks would be a steel pipe 48 inches in diameter.

Cost estimates for the canal were based on designs utilizing data obtained by a reconnaissance field location survey. Detailed design of the distribution system, however, was considered to be outside the scope of the current investigation. Cost estimates for the system were based on known costs of similar irrigation works elsewhere in California, adjusted to correspond with conditions prevailing in the Sutter-Yuba Area.

Pertinent data with respect to general features of the Coon Creek Project, as designed for cost estimating purposes, are presented in Table 51.

TABLE 51

GENERAL FEATURES OF COON CREEK PROJECT

Main Earthfill Dam
- Crest elevation—560 feet
- Crest length—1,420 feet
- Crest width—30 feet
- Height, spillway lip above stream bed—207 feet
- Side slopes—3:1 upstream
  2.5:1 downstream
- Freeboard, above spillway lip—8 feet
- Elevation of stream bed—345 feet
- Volume of fill—2,201,000 cubic yards

Auxiliary Earthfill Dams
- South saddle dam
  - Crest length—1,450 feet
  - Crest width—20 feet
  - Side slopes—2.5:1
  - Maximum height—64 feet
- North saddle dam
  - Crest length—550 feet
  - Crest width—20 feet
  - Side slopes—2.5:1
  - Maximum height—39 feet
- Volume of fill, both dams—449,000 cubic yards

Reservoir
- Surface area at spillway lip—820 acres
- Capacity at spillway lip—59,000 acre-feet
- Drainage area, Coon Creek—40 square miles
- Estimated mean seasonal runoff, Coon Creek—32,800 acre-feet
- Estimated seasonal diversion of Bear River water through Combie-Ophir Canal—35,700 acre-feet
- Estimated safe seasonal yield—56,000 acre-feet
- Type of spillway—Ogee weir, concrete-lined
- Spillway capacity—14,000 second-feet
- Type of outlet—48-inch diameter steel pipe beneath dam

Diversion Works
- Bear River........ Existing concrete gravity weir, with overpour section, approximately 300 feet in length, and approximately 15 feet high above stream bed elevation of about 1,500 feet; side channel diversion box, with overpour parapet wall and sluice gate; headgates in concrete headwall.
- Coon Creek........ Existing concrete diversion structure for flashboard control, with opening 35 feet in width and 17 feet in height above stream bed elevation of 140 feet; to be rehabilitated by installation of flashboards to height of 7 feet, construction of auxiliary earthen dikes, and installation of concrete headwall and 4- by 4-foot slide headgate.

Conduits
- Bear River Diversion.. Existing conduit with estimated capacity of 106 second-feet, 2.4 miles in length, comprised of concrete-lined and unlined canal sections, wooden flume, and steel pipe siphons.
- Coon Creek Diversion

Type	Trapezoidal, shotcrete-lined canal	Trapezoidal, unlined canal
Length, in miles	0.5	5.0
Side slopes	1:1	2:1
Bottom width, in feet	4.0	7.0
Depth, in feet	4.0	3.7
Freeboard, in feet	1.0	1.0
Slope, in feet per mile	2.5	2.5
Velocity, in feet per second	3.5	1.9
Capacity, in second-feet	100	100

The capital cost of the Coon Creek Project, based on prices prevailing in April, 1952, was estimated to be $5,303,500. The corresponding annual cost of the Coon

Creek Project was estimated to be about $254,100. The resultant estimated average unit cost of the 56,000 acre-feet per season of new water conserved by the Coon Creek Reservoir was about $4.50 per acre-foot. The estimated unit cost of water applied for irrigation in the service area considered for cost estimating purposes was about $6.10 per acre-foot. These estimates of cost do not include possible charges for use of the existing diversion works on the Bear River and the canals of the Nevada Irrigation District. They do, however, include estimated costs for acquiring the existing abandoned diversion structure on Coon Creek below the dam.

Estimated capital and annual costs of the Coon Creek Project are summarized in the following tabulation. Detailed cost estimates are presented in Appendix H.

	Estimated costs	
	Capital	*Annual*
Dam and reservoir	$4,773,700	$196,200
Coon Creek diversion and conduit	229,800	12,300
Distribution system	300,000	45,600
TOTALS	$5,303,500	$254,100

CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

As a result of field investigation, and study and analyses of available data on the water resources and water problems of the Sutter-Yuba Area, the following conclusions and recommendations are made.

CONCLUSIONS

It is concluded that:

1. The present basic water problems in the Sutter-Yuba Area are progressive and permanent lowering of ground water levels and attendant degradation of mineral quality of ground water. Elimination of these problems, prevention of their recurrence in the future, and irrigation of irrigable lands not presently served with water will require further development of available water supplies.

2. Mean seasonal depth of precipitation over the Sutter-Yuba Area is about 20.7 inches, and precipitation contributes water to the area in a mean seasonal amount of about 590,000 acre-feet.

3. The highly productive tributary watersheds of the Sierra Nevada constitute the most important source of water supply available to the Sutter-Yuba Area, and mean seasonal surface inflow of water to the area from these sources is about 6,240,000 acre-feet.

4. The ground water basin underlying the Sutter-Yuba Area functions as a natural regulatory reservoir, and at the present time about two-thirds of the lands irrigated in the area are irrigated with water pumped from this reservoir. The gross extraction of ground water in the Sutter-Yuba Area during 1948 was about 350,000 acre-feet.

5. The storage capacity of the ground water basin underlying the Sutter-Yuba Area is about 3,890,000 acre-feet between the levels of 20 and 200 feet below the ground surface.

6. Because of the continuing development and extensive use of ground water in the Sutter-Yuba Area, a substantial cone of depression exists in the ground water plane, and the average level of ground water has fallen about 10 feet since 1943. This lowering of the ground water level has resulted in increased agricultural production costs, and in saline degradation of the ground water in portions of the area.

7. Hydraulic gradients existing in the plane of ground water at the present time result in a seasonal excess of subsurface inflow over subsurface outflow from the Sutter-Yuba Area of about 180,000 acre-feet. This water is an important source of replenishment to the ground water basin.

8. Satisfactory wells with yields sufficient for irrigation purposes may be obtained in all but certain small portions of the Sutter-Yuba Area.

9. High water table lands in certain portions of the Sutter-Yuba Area served with surface water would be suitable for a wider range of crops than at present if ground water levels were held at greater depths. Furthermore, existing drainage problems in these areas would be eliminated and some salvage of water now excessively consumed would result.

10. Safe seasonal yield of the ground water basin underlying the Sutter-Yuba Area, with average maintenance of ground water levels prevailing in 1949, is about 190,000 acre-feet.

11. The surface water supplies of the Sutter-Yuba Area are of excellent mineral quality.

12. The ground water supplies of the Sutter-Yuba Area are generally of excellent to good mineral quality. However, salinity sufficient to impair use of ground water for irrigation, domestic, and many industrial uses, has been observed at scattered wells throughout the area for many years. This condition is particularly prevalent in the Peach Bowl. Saline degradation of ground water in the Sutter-Yuba Area probably results from the upward migration and diffusion of deep saline brines through permeable zones in the alluvium, and through unplugged test wells and abandoned, defective, or improperly constructed wells. This upward and lateral movement of degraded water is probably accelerated when the ground water plane is lowered by heavy irrigation pumping.

13. Due to geographic and water service considerations, the Sutter-Yuba Area is naturally divided into four principal zones. These have been designated "West Side Zone," "Northeast Zone," "East Central Zone," and "South Side Zone," and are shown on Plate 2.

14. At the present time there are approximately 150,000 acres of irrigated land in the Sutter-Yuba Area. The present distribution of the irrigated land among the several zones is as follows: West Side Zone, 66,200 acres; Northeast Zone, 20,100 acres; East Central Zone, 34,100 acres; and South Side Zone, 28,800 acres.

15. The probable ultimate cultural pattern of the Sutter-Yuba Area will include about 250,000 acres of irrigated land. The probable ultimate distribution of irrigated land among the several zones is as follows: West Side Zone, 100,000 acres; Northeast Zone, 31,000 acres; East Central Zone, 54,000 acres; and South Side

Zone, 65,000 acres. This and subsequent conclusions set forth with reference to future conditions are based upon the general assumptions that: (a) All irrigable lands in the Sutter-Yuba Area will ultimately be brought under irrigation; (b) The type of irrigated crops and irrigation practice will not alter materially; (c) There will be no significant changes in irrigation practice in adjacent areas served with surface supplies; (d) Rainfall, water supply, and climatic conditions will have annual and secular variations as in the past.

16. Of the total amount of water, including rainfall, presently utilized in the Sutter-Yuba Area, approximately 65 percent is consumed in the production of irrigated crops. Dry-farmed and fallow lands, native vegetation, and miscellaneous culture including urban areas, consume the remaining 35 percent. At the present time mean seasonal utilization of water in the area is about 820,000 acre-feet. The estimated distribution of seasonal water utilization among the several zones is as follows: West Side Zone, 311,000 acre-feet; Northeast Zone, 113,000 acre-feet; East Central Zone, 201,000 acre-feet; and South Side Zone, 194,000 acre-feet.

17. Under conditions of ultimate development the mean seasonal utilization of water will probably increase to about 1,050,000 acre-feet. The probable distribution of this use among the several zones is as follows: West Side Zone, 384,000 acre-feet; Northeast Zone, 136,000 acre-feet; East Central Zone, 256,000 acre-feet; and South Side Zone, 278,000 acre-feet.

18. The present requirement for supplemental water in the Sutter-Yuba Area, in order to prevent progressive and permanent lowering of ground water levels and attendant degradation of mineral quality of the ground water, is about 79,000 acre-feet per season. The estimated distribution of the supplemental seasonal water requirement among the several zones is as follows: West Side Zone, 17,000 acre-feet; Northeast Zone, 6,400 acre-feet; East Central Zone, 27,600 acre-feet; and South Side Zone, 27,600 acre-feet. The distribution among the zones was based on the assumption that lowering of water levels which occurred during the season of 1948-49 would have been proportionately the same had mean water supply and climatic conditions prevailed.

19. Under ultimate conditions of development the corresponding requirement for supplemental water probably will be about 315,000 acre-feet per season. The estimated distribution of ultimate mean seasonal supplemental water requirement among the several zones is as follows: West Side Zone, 90,600 acre-feet; Northeast Zone, 30,100 acre-feet; East Central Zone, 81,900 acre-feet; and South Side Zone, 112,200 acre-feet. The estimate for each zone was determined as the sum of the probable increase in water utilization and the present supplemental water requirement.

20. Major features of The California Water Plan, which is presently being formulated under direction of the State Water Resources Board, will provide supplemental water to meet the probable ultimate requirements of the Sutter-Yuba Area. The Feather River Project, an adopted feature of The California Water Plan, will provide supplemental water to meet the probable ultimate supplemental water requirements of the West Side Zone. It is feasible from an engineering standpoint to so regulate and conserve the relatively large flood flows of the Yuba and Bear Rivers and other tributaries of the Feather River as to yield firm water supplies considerably in excess of the probable ultimate supplemental water requirements of the Northeast, East Central, and South Side Zones.

21. New water sufficient to meet the present supplemental requirement of the West Side Zone, together with additional water for growth in water demand for a number of years in the future, could be furnished by construction of facilities for pumping water directly from the Feather River and for its conveyance to and distribution in the Peach Bowl. Cost estimates indicate that the average unit cost of water diverted at the river would be about $4.20 per acre-foot, and that applied to irrigation would be about $5.60 per acre-foot.

22. Preliminary studies indicate that supplemental water could be furnished the Northeast Zone from a multipurpose development of the South Fork of the Feather River and tributaries of the North Fork of the Yuba River.

23. New water sufficient to meet the present supplemental requirement of the Northeast Zone, together with additional water for growth in water demands for a number of years in the future in both the Northeast Zone and the Browns Valley service area, could be furnished by construction of a dam and reservoir on South Honcut Creek, facilities for diversion of flood waters of French Dry Creek to the reservoir, and facilities for conveyance to and distribution of the conserved waters in the Northeast Zone and the Browns Valley service area. The estimated average unit cost of the water so developed and applied to irrigation would be about $9.70 per acre-foot in the Northeast Zone, and about $8.40 per acre-foot in the Browns Valley service area.

24. Preliminary studies indicate that supplemental water could be furnished both the East Central and South Side Zones from a development involving enlargement and extension of facilities of the Nevada Irrigation District.

25. New water sufficient to meet the present supplemental requirements of the East Central and South Side Zones, together with additional water for growth in water demands for a number of years in the future, could be furnished by construction of a larger dam and reservoir on the Bear River at the site of the existing Camp Far West Dam and Reservoir, and

facilities for conveyance of the conserved water to and its distribution in both the East Central and South Side Zones. The estimated average unit cost of the water so developed and applied to irrigation would be about $4.70 per acre-foot in the East Central Zone, and about $5.30 per acre-foot in the South Side Zone.

26. New water sufficient to meet the present supplemental requirement of the South Side Zone, together with additional water for growth in water demand for a number of years in the future, could be furnished by construction of a dam and reservoir on Coon Creek, utilization of existing facilities of the Nevada Irrigation District for diversion of flood waters of the Bear River to the proposed reservoir, and facilities for conveyance to and distribution of the new water in the South Side Zone. The estimated average unit cost of the water so developed and applied to irrigation would be about $6.10 per acre-foot.

27. The unit costs of water as given in the foregoing paragraphs are based on current prices of construction, and are illustrative of the cost of new water for the various zones of the Sutter-Yuba Area developed by works exclusively for water conservation purposes. The costs exceed that of surface water presently served within the area, and it is probable that under present conditions ground water pumping costs are somewhat less than the estimated costs of water developed by the considered conservation projects. It is indicated that in order to obtain new water at lower unit costs in the Sutter-Yuba Area, multipurpose developments providing other benefits and revenues in addition to water conservation will be required.

RECOMMENDATIONS

It is recommended that:

1. Public districts endowed with appropriate powers be created for the purposes of proceeding with further study of the local water problems and with financing, construction, and operation of projects found financially feasible.

2. Local development of water resources be accomplished by an orderly progression of phases of development, and in accordance with The California Water Plan. Successive steps in proposed plans should first develop those projects with indicated lowest capital and unit cost of water, and thence proceed in order of expense to phases of greater unit cost.

3. Additional engineering investigation and study be made for design, financing, and construction of the Peach Bowl Project.

4. Additional engineering investigation and study be made as required for design, financing, and construction of other local projects for initial development outlined in this report, when the financial feasibility of these projects has been determined.

5. A program be initiated for the acquisition of lands, easements, and rights of way necessary for construction of required local water conservation works.

6. Consideration be given to the implementation of plans for securing a firm ultimate supplemental water supply for the West Side Zone from the Feather River Project.

7. Continuing support be given to the investigation and study of major multipurpose developments under The California Water Plan, including those on the Feather, Yuba, and Bear river systems.

APPENDIX A

AGREEMENT, AND ITS SUPPLEMENT, BETWEEN THE STATE WATER RESOURCES BOARD, THE COUNTIES OF SUTTER AND YUBA, AND THE DEPARTMENT OF PUBLIC WORKS

AGREEMENT BETWEEN THE STATE WATER RESOURCES BOARD, THE COUNTIES OF SUTTER AND YUBA, AND THE DEPARTMENT OF PUBLIC WORKS

THIS AGREEMENT, executed in quintuplicate, entered into by the State Water Resources Board, hereinafter referred to as the "Board"; the Counties of Sutter and Yuba, hereinafter referred to as the "Counties"; and the Department of Public Works, acting through the agency of the State Engineer, hereinafter referred to as the "State Engineer."

WITNESSETH:

WHEREAS, in the State Water Resources Act of 1945, as amended, the Board is authorized to make investigations, studies, surveys, hold hearings, prepare plans and estimates, and make recommendations to the Legislature in regard to water development projects, including flood control plans and projects; and

WHEREAS, by said act, the State Engineer is authorized to cooperate with any county, city, State agency or public district on flood control and other water problems and when requested by any thereof may enter into a cooperative agreement to expend money in behalf of any thereof to accomplish the purposes of said act; and

WHEREAS, each of the Counties desires and hereby requests the Board to enter into a cooperative agreement for the making of an investigation and report on the underground water supply of the valley floor lands in the Counties of Sutter and Yuba, including quality, replenishment and utilization thereof, and if possible, to incorporate findings in said report as to a method or methods of solving the problems involved; and

WHEREAS, the Board hereby requests the State Engineer to cooperate in making an investigation and report on the underground water supply of said valley floor lands in said Counties, including quality, replenishment and utilization thereof, and, if possible, to incorporate in said report a method or methods of solving the problems involved;

NOW THEREFORE, in consideration of the premises and of the several promises to be faithfully performed by each as hereinafter set forth, the Board, the Counties, and the State Engineer do hereby mutally agree as follows:

ARTICLE I—WORK TO BE PERFORMED:

The work to be performed under this agreement shall consist of investigation and report on the underground water supply of the valley floor lands in the Counties of Sutter and Yuba, including quality, replenishment and utilization thereof, and, if possible, a method or methods of solving the problems involved.

The Board by this agreement authorizes and directs the State Engineer to cooperate by making said investigation and report and by otherwise advising and assisting in making an evaluation of present and ultimate underground water problems in the valley floor lands of said Counties, and in formulating a solution or solutions of said problems.

During the progress of said investigation and report all maps, plans, information, data and records pertaining thereto which are in the possession of any party hereto shall be made fully available to any other party for the due and proper accomplishment of the purposes and objects hereof.

The work under this agreement shall be diligently prosecuted with the objective of completion of the investigation and report on or before December 31, 1949, or as nearly thereafter as possible.

ARTICLE II—FUNDS:

Each of the Counties, upon execution by it of this agreement, shall transmit to the State Engineer the sum of Five Thousand Dollars ($5,000) for deposit, subject to the approval of the Director of Finance, into the Water Resources Revolving Fund (also known as the Water Resources Fund) in the State Treasury, for expenditure by the State Engineer in performance of the work provided for in this agreement. Also, upon execution of this agreement by the Board, the Director of Finance is requested to approve the transfer of the sum of Ten Thousand Dollars ($10,000) from funds appropriated either by the Budget Act of 1947, or by Chapter 1541, Statutes of 1947, or in part from each of said appropriations, to said Water Resources Board for expenditure by the State Engineer in performance of the work provided for in this agreement and the State Controller is requested to make such transfer.

If the Director of Finance, within thirty (30) days after receipt by the State Engineer of said sums from the Counties, shall not have approved the deposit thereof into said Water Resources Revolving Fund, together with the transfer of said sum of Ten Thousand Dollars ($10,000) from funds appropriated to said Board either by the Budget Act of 1947, or by Chapter 1541, Statutes of 1947, or in part from each of said appropriations, said Water Resources Revolving Fund for expenditure by the State Engineer in performance of the work provided for in this agreement, said sums contributed by said Counties shall be returned thereto by the State Engineer.

It is understood by and between the parties hereto that the sum of Twenty Thousand Dollars ($20,000) to be made available as hereinbefore provided is adequate to perform approximately half of the above specified work and it is the present intention of each of said Counties to make a further sum of Five Thousand Dollars ($5,000) available at the commencement of the second year of said investigation which will be subject to a matching or contribution in equal sums by said Board for the completion of said investigation and report.

The Board and the State Engineer shall under no circumstances be obligated to expend for or on account of the work provided for under this agreement any amount in excess of the sum of Twenty Thousand Dollars ($20,000) as made available hereunder and when said funds are exhausted, the Board and the State Engineer may discontinue the work provided for in this agreement and shall not be liable or responsible for the resumption and completion thereof until the further sums as specified in the preceding paragraph are made available.

Approved:

/s/ C. H. Purcell
Director of Public Works

Approval Recommended:

/s/ Spencer Burroughs
Principal Attorney
Division of Water Resources

Approved as to Form:

/s/ Loyd E. Hewitt
District Attorney
County of Sutter

/s/ Joseph L. Hennan
District Attorney
County of Yuba

Approved:

/s/ James S. Dean
Director of Finance

Approved as to Legality:

/s/ C. C. Carleton
Chief Attorney
Department of Public Works

Upon completion of and final payment for the work provided for in this agreement, the State Engineer shall furnish the Board and each of the Counties a statement of all expenditures made under this agreement. One-half of the total amount of all said expenditures shall be deducted from the sum advanced from funds appropriated to said Board, and one-fourth of the total amount of all said expenditures shall be deducted respectively, from the sum advanced by each of the Counties and any balances which may remain shall be returned to the Board, and to the counties, respectively.

ARTICLE III—EFFECTIVE DATE

This agreement shall become effective immediately upon its execution by all the parties hereto.

In Witness Whereof, the parties hereunto have affixed their signatures, the County of Sutter on the 22nd day of September, 1947, the County of Yuba on the 22nd day of September, 1947, the Board on the 6th day of October, 1947, and the State Engineer on the 7th day of October, 1947.

COUNTY OF SUTTER

By /s/ Ed. F. DaCosse
Chairman, Board of Supervisors
/s/ Albert B. Brown
Clerk, Board of Supervisors

COUNTY OF YUBA

By /s/ James R. Brown
Chairman, Board of Supervisors
/s/ Adrienne Conley
Clerk, Board of Supervisors

STATE WATER RESOURCES BOARD

By /s/ Royal Miller
Chairman

DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

By /s/ Edward Hyatt
State Engineer

(Initialled)

LJK	HA		
Form	Budget	Value	Descript.

DEPARTMENT OF FINANCE
APPROVED
Oct. 23, 1947

SUPPLEMENTAL AGREEMENT BETWEEN THE STATE WATER RESOURCES BOARD, THE COUNTIES OF SUTTER AND YUBA, AND THE DEPARTMENT OF PUBLIC WORKS

THIS AGREEMENT, executed in sextuplicate, entered into by the State Water Resources Board, hereinafter referred to as the "Board"; the Counties of Sutter and Yuba, hereinafter referred to as the "Counties"; and the Department of Public Works of the State of California, acting through the agency of the State Engineer, hereinafter referred to as the "State Engineer":

WITNESSETH:

WHEREAS, by agreement heretofore entered into by and between the parties hereto, executed by the Counties on the 22nd day of September, 1947, by the Board on the 6th day of October, 1947, and by the State Engineer on the 7th day of October, 1947, the making by the State Engineer of an investigation and report on the underground water supply of the valley floor lands in the Counties of Sutter and Yuba, including quality, replenishment and utilization thereof and, if possible, a method or methods of solving the problems involved, was provided for; and

WHEREAS, it was the expressed intention in said agreement that at the commencement of the second year of said investigation said Counties would make available in equal proportion a further sum of Ten Thousand Dollars ($10,000) subject to a matching or contribution in equal amount by the Board for the completion of said investigation and report; and

WHEREAS, said additional funds are required to complete said investigation and report, and it is the desire of the parties hereto that an additional sum of Twenty Thousand Dollars ($20,000) shall be provided, Five Thousand Dollars ($5,000) by each of the Counties, and Ten Thousand Dollars ($10,000) by the Board;

NOW THEREFORE, in consideration of the premises and of the several promises to be faithfully performed by each as hereinafter set forth, the Board, the Counties, and the State Engineer do hereby mutually agree as follows:

1. Each of the Counties, upon execution by it of this agreement, shall transmit to the State Engineer the sum of Five Thousand Dollars ($5,000) for deposit, subject to the approval of the Director of Finance, into the Water Resources Revolving Fund in the State Treasury for expenditure by the State Engineer in continuing performance of the work provided for in said prior agreement to which this agreement is supplemental.

2. Upon execution of this agreement by the Board, the Director of Finance will be requested to approve the transfer of the sum of Ten Thousand Dollars ($10,000) from funds appropriated to the Board by Item 335 of the Budget Act of 1948 for expenditure by the State Engineer in continuing performance of the work provided for in said prior agreement to which this agreement is supplemental, and the State Controller will be requested to make such transfer.

3. The Board and the State Engineer shall under no circumstances be obligated to expend for or on account of the work provided for in said prior agreement to which this agreement is supplemental any amount in excess of the sum of Forty Thousand Dollars ($40,000) as made available under said prior agreement and this supplemental agreement and if funds are exhausted before completion of said work the Board and the State Engineer may discontinue said work and shall not be liable or responsible for the completion thereof.

4. In so far as consistent herewith and to the extent adaptable hereto, all of the terms and provisions of said prior agreement to which this agreement is supplemental are hereby made applicable to this agreement and are hereby confirmed, ratified, and continued in effect.

5. This agreement shall become effective immediately upon its execution by all of the parties hereto.

In Witness Whereof, the parties hereunto have affixed their signatures, the County of Sutter on the 4th day of October, 1948, the County of Yuba on the 22nd day of November, 1948, the Board on the 3rd day of December, 1948, and the State Engineer on the 30th day of November, 1948.

Approved as to form:

/s/ Loyd E. Hewitt
District Attorney
County of Sutter

/s/ Joseph L. Hennan
District Attorney
County of Yuba

Approval Recommended:

/s/ Spencer Burroughs
Principal Attorney
Division of Water Resources

Approved as to Legality:

/s/ C. C. Carleton
Chief Attorney
Department of Public Works

Approved:

/s/ James S. Dean
Director of Finance

COUNTY OF SUTTER

By /s/ Ed. F. DaCosse
Chairman, Board of Supervisors

/s/ Albert B. Brown
Clerk, Board of Supervisors

COUNTY OF YUBA

By /s/ James P. Brown
Chairman, Board of Supervisors

/s/ Adrienne Conley
Clerk, Board of Supervisors

STATE WATER RESOURCES BOARD

By /s/ C. A. Griffith
Vice-Chairman

DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

By /s/ C. H. Purcell
Director of Public Works

/s/ Edward Hyatt
State Engineer

APPENDIX B

GEOLOGIC FEATURES AND GROUND-WATER STORAGE CAPACITY OF THE SUTTER-YUBA AREA, CALIFORNIA

By G. H. DAVIS and F. H. OLMSTED, under the
direction of J. F. POLAND, District Geologist

Ground Water Branch, Water Resources Division
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the California Department of
Public Works, Division of Water Resources

Dated May, 1950

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UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GROUND WATER BRANCH
2520 Marconi Avenue
SACRAMENTO 21, CALIFORNIA

May 22, 1950

MR. A. D. EDMONSTON, *State Engineer*
Division of Water Resources
P. O. Box 1079, Sacramento 5, California

DEAR SIR: I take pleasure in transmitting herewith a report on "Geologic features and ground-water storage capacity of the Sutter-Yuba area, California" by G. H. Davis and F. H. Olmsted. This report has been prepared by the Geological Survey as a part of the program of cooperative ground-water investigations with the California Division of Water Resources.

The report has been approved by the Director of the Geological Survey for publication by the State Water Resources Board as an appendix to its Bulletin No. 6 entitled "Sutter-Yuba Counties Investigation."

Very truly yours,

(Signed) JOSEPH F. POLAND
District Geologist

GEOLOGIC FEATURES AND GROUND-WATER STORAGE CAPACITY OF THE SUTTER-YUBA AREA, CALIFORNIA

By G. H. Davis and F. H. Olmsted

INTRODUCTION

Purpose and Scope of Report

The Sutter-Yuba Area, as identified in this report, includes the parts of Sutter and Yuba Counties that are within the Sacramento Valley and the lower foothills of the Sierra Nevada, an area of 750 square miles. Its general physical and geomorphic features are shown by Plate 1. It is bounded on the east by the rugged Sierra Nevada, on the west by the Sacramento River, and is divided into two nearly equal parts by the southward flowing Feather River. Its importance as an agricultural area and its dependence on surface-water and ground-water supplies for existence and future development have been discussed in the main report by the California Division of Water Resources.

This report on the geology and ground-water storage capacity of the Sutter-Yuba Area has been prepared at the request of the Division of Water Resources, as one of the investigations of ground-water basins of the State now being made by the Geological Survey in accordance with the cooperative agreement with the State Water Resources Board entered into in March, 1948.

The geologic investigation of the Sutter-Yuba Area is in essence a part of a broader reconnaissance investigation of the geology and ground-water storage capacity of the Sacramento Valley which was begun by the Geological Survey in the spring of 1948 at the request of and in cooperation with the California Division of Water Resources. The findings of the valley-wide study are to be published in a separate bulletin under the title of "Geologic features and ground-water storage capacity of the Sacramento Valley, California." That bulletin is now being written.

This appendix has two principal purposes:

First, to describe the geology and general water-bearing character of the rocks. Treatment of the older, nonwater-bearing rocks is general and brief, but is a necessary element of the story because the sediments making up the water-bearing rocks are derived from the weathering and erosion of these older rocks and from their transportation from the Sierra Nevada to the Sacramento Valley. The water-bearing rocks of Tertiary and Quaternary age are described in considerable detail; those deposits are the important sources of ground water. Furthermore, certain geologic events which have uplifted, tilted, or folded the rocks or have produced volcanic deposits have been described because they have caused changes in the texture of sediments being transported to the valley by streams, by mud flows, or through the atmosphere, and thus have been primary factors in deposition of the coarse-grained water-bearing deposits.

Second, to describe the methods used and the results obtained in estimating the water-holding capacity of the water-bearing deposits considered to be within ultimate economic limits for pumping—that is, the deposits constituting the part of the underground reservoir that may be capable of dewatering and resaturation.

This appendix does not treat ground-water occurrence and movement, perennial yield, or chemical character of the ground waters because the hydrologic and water-quality phases of the problem have been carried out entirely by the State Division of Water Resources.

The investigation, which began in October, 1949, has been under the general direction of A. N. Sayre, geologist in charge of the Ground Water Branch, and under the immediate supervision of J. F. Poland, district geologist for California. The field work by the Geological Survey in the Sutter-Yuba area was confined chiefly to geologic mapping, which was done by G. H. Davis and F. H. Olmsted in October and November 1949. The geologic contacts actually traced in the field include the boundaries of the basement complex and of the Tertiary and Quaternary deposits near the basement-complex outcrop. The boundaries of the alluvial deposits of late Tertiary and Quaternary age were mostly drawn or modified on the basis of physiography, and from significant soil-type boundaries mapped by the United States Department of Agriculture, Bureau of Soils. The geology of the Sutter Buttes was taken from H. R. Johnson (1943) * "Marysville Buttes (Sutter Buttes) gas field."

Most of the information on subsurface geology and ground-water storage capacity of the water-bearing deposits was obtained from about 700 logs of water wells supplied by well drillers to the Bureau of Reclamation and the Geological Survey. The logs were turned over to the Division of Water Resources for field location. The cooperation of the well drillers in making available the well logs is greatly appreciated.

Numbers Applied to Wells

In its recent cooperative programs in California, the Geological Survey commonly has assigned well numbers that indicate locations according to the rectangular land surveys. For well 15 N 3E-21C1, for example, the

* References are listed at the end of this appendix alphabetically by the author's name and the year of publication.

first part of the number indicates the township and range (T. 15 N., R. 3 E., Mt. Diablo base line and meridian), the two digits following the hyphen indicate the section (Sec. 21), and the letter indicates the 40-acre subdivision as shown on the accompanying diagram.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Within each 40-acre tract the wells are numbered serially as indicated by the final digit or digits of the number. Thus well 21C1 is in the NE ¼ NW ¼ Sec. 21 and is the first well in that tract to be listed.

In the parts of the area that once were public lands, the official Federal land survey is followed. In the few areas that never were Federally surveyed, the net is projected.

GEOLOGY

General Features

North-central California, which includes the Sutter-Yuba Area, comprises parts of four geomorphic provinces as delimited by Jenkins (1943, pp. 83-88): the Great Valley of California, the Sierra Nevada, the Coast Ranges, and the Cascade Range. The area described in this report lies mostly within the Great Valley of California province, but includes a narrow strip of the Sierra Nevada province to the east. The southernmost extension of the Cascade Range lies more than 20 miles to the north, and the eastern margin of the Coast Ranges lies 20 miles to the west of the Sutter-Yuba Area.

The rocks exposed in the area range from Recent alluvial deposits to Mesozoic and Paleozoic crystalline rocks. Their areal extent is shown on Plate B-1 and their subsurface character on Plates B-2, B-3, and B-4. Their stratigraphy and physical and water-bearing character are summarized in the following table. These rocks may be assigned to two broad categories: the basement complex and the superjacent rocks. The basement complex is exposed in the Sierra Nevada and extends beneath the superjacent rocks in the Sacramento Valley. The superjacent rocks cap many of the interstream divides in the Sierra and comprise the thick and extensive deposits of the valley. The water-bearing rocks considered in this report are entirely within the superjacent rocks, although the basement complex yields small amounts of water to wells in weathered and fractured zones.

Pre-Cretaceous Crystalline Rocks

The basement complex consists of metamorphosed igneous and sedimentary rocks of late Paleozoic and early Mesozoic age and a series of igneous rocks ranging in composition from granite to peridotite which were intruded during the late Jurassic or early Cretaceous Nevadan orogeny.

The rocks exposed immediately east of the Sutter-Yuba Area are predominantly greenstones that probably are metamorphosed basic igneous rocks.

Cretaceous and Tertiary Nonwater-bearing Rocks

The older superjacent rocks are Upper Cretaceous and early Tertiary sediments. A section of unnamed Upper Cretaceous siltstone and sandstone totaling 4,350 feet thick crops out in the Sutter Buttes and has been found in gas wells in the Sacramento Valley. These sediments were deposited in a sea which at times extended eastward to or beyond the present western edge of the basement complex outcrop.

Eocene and possible Paleocene sediments underlie most of the Sutter-Yuba Area. A lower and middle Eocene marine section is exposed in the Sutter Buttes. Stewart (1949) has assigned the 300 feet of lower Eocene in the Buttes to the Meganos formation, and the 130 feet of middle Eocene to the Ione formation. The Ione formation, described in some detail by Allen (1929) is exposed in places along the east side of the valley. There it is usually a brackish-water or deltaic deposit consisting largely of light-colored anauxitic clays and sands, dark reddish or brownish ferruginous sandstones, and minor amounts of lignitic material.

The Ione formation interfingers to the east with river gravels deposited by old Sierra Nevada streams. The ancient Yuba River was the main stream entering the Sutter-Yuba Area in Eocene time.

About 250 to 300 feet of upper Eocene or Oligocene rocks, called the Wheatland formation by Clark and Anderson (1938), are exposed along the southeast bank of the Dry Creek flood plain northeast of Wheatland. A fossiliferous conglomerate containing andesitic pebbles is near the base of the formation which lies unconformably on basement complex. Some of the finer-grained sediments above the conglomerate also contain volcanic detritus.

The Upper Cretaceous and Eocene sediments are not significant as ground-water reservoirs in the Sutter-Yuba Area. Probably none of the water wells in the area penetrates Upper Cretaceous rocks. Several water wells near Wheatland apparently penetrate Eocene rocks, but impermeable shale, siltstone, and sandstone predominate, and the water in the more permeable zones is generally of poor quality. How much of the chloride contamination in parts of the area comes from connate waters in the Eocene rocks is not known. In

STRATIGRAPHY OF THE SUTTER-YUBA AREA AND VICINITY, CALIFORNIA

(Generalized section[1])

Geologic age		Rock unit and symbol on pl. B-1		Thickness (feet)	Physical and water-bearing character
QUATERNARY	Recent	Young alluvial deposits	Stream-channel deposits (Qrc)	0 - 130	Sand, gravel, and silt, in large part well-sorted, in present stream channels and beneath flood plains; yield water in large quantities to irrigation wells. Where the Feather and Sacramento Rivers border the Sutter Basin, they have constructed natural levees composed largely of silt and fine sand deposited during flood stages.
QUATERNARY	Recent	Young alluvial deposits	Basin deposits (Qrb)	0 - 100 ±	Largely impervious clays and silts deposited in the overflow basins during flood stages of the Feather and Sacramento Rivers. Thin, discontinuous sands supply small domestic and stock wells in the northern part of Sutter Basin; in the southern part of the basin brackish waters are likely to be encountered in wells of any depth.
QUATERNARY	Recent	Young alluvial deposits	Alluvial fans of the Sutter Buttes (Qrf)	0 - 80	Poorly sorted alluvial deposits of gravel and clay, sandy clay, or silt, of low to moderate permeability; yield small supplies of good quality water to stock and domestic wells along the flanks of Sutter Buttes.
QUATERNARY	Pleistocene	Local unconformity Intermediate alluvial deposits (Qpal) Unconformity		0 - 110+	Silt, sand, and gravel, in part well-sorted; moderately permeable throughout. Tongues and layers of fluviatile sand and gravel are highly permeable and supply large quantities of irrigation water. Deposits are coarsest and most permeable near the present major streams and along abandoned Pleistocene channels of the Yuba and Feather Rivers.
QUATERNARY		Old alluvial deposits (TQal)		0 - 350 ±	Poorly-sorted silt, clay, sand, and gravel of moderate to low permeability supply water of good chemical quality to domestic, stock, and a few small irrigation wells. Essentially impervious strata of cemented sand and gravel are common. Well-sorted permeable alluvial materials are rare.
TERTIARY	Pliocene	Volcanic rocks of the Sutter Buttes	Andesite tuff-breccia (Tat) Unconformity	0 - 800 ±	Andesitic tuffs and tuff-breccias, unsorted and generally of low permeability; some beds may be impermeable. Permeable tongues and stringers of volcanic sand and gravel interbedded with mudflow tuffs and tuff-breccias yield water of good quality to irrigation wells in the Pennington and Sutter City areas.
TERTIARY	Pliocene	Volcanic rocks of the Sutter Buttes	Rhyolite and andesite (Tra) Unconformity		Impervious, hard lavas forming core of Sutter Buttes; possibly could provide small water supplies from fractured zones. No wells are known in these rocks.
TERTIARY	Pliocene Miocene Oligocene	Volcanic rocks from the Sierra Nevada (Tfa) Unconformity		0 - 1,800 ±	Andesitic and rhyolitic tuffs, tuff-breccias, conglomerates, sands, and gravels deposited by inter-volcanic streams from the Sierra Nevada. Sands and gravels yield water of good quality to deep wells in the Marysville and Bear River areas. Fluviatile "black sands" are prolific water producers at many places in the Sacramento Valley. Tuff and tuff-breccia have low permeability and yield little water.
TERTIARY	Eocene	Undivided Eocene sediments (Te) Unconformity		0 - 700 ±	Marine and non-marine clay, shale and sandstone beneath the Sacramento Valley interfingering along the eastern margin of the valley with Eocene river gravels. These gravels ordinarily are cemented and partially decomposed and probably would yield little water. Coarser sediments in southern Yuba and northwestern Placer counties yield saline waters of probable marine origin to some deep wells. In structurally high positions the marine connate waters have been flushed out of the permeable strata and fresh water is found.
CRETACEOUS	Upper Cretaceous	Unnamed Upper Cretaceous sediments (Ku) Unconformity		0 - 4,350	Sandstone, siltstone, and shale; not penetrated by water wells in Sutter-Yuba area. Connate marine water high in chloride could be expected in wells penetrating these sediments in the Sacramento Valley.
PRE-CRETACEOUS		Pre-Cretaceous crystalline rocks (pK)			Hard, impervious metamorphic and igneous rocks. Stock and domestic wells produce small supplies of water of good chemical quality from fractured and partly decomposed zones near the land surface.

[1] Dotted lines are used to separate units that are considered to be contemporaneous.

structurally high positions, for example just west of the outcrops of Wheatland formation, the marine connate waters have been flushed out, and fresh water is found in the more permeable strata.

Tertiary and Quaternary Water-bearing Rocks

Volcanic Rocks From the Sierra Nevada (Eocene-Pliocene)

Tertiary fragmental volcanic rocks having a source near the present crest of the northern Sierra Nevada are exposed at several localities and are encountered in many of the deep wells in the Sutter-Yuba Area. The exposures are found at three principal localities: south of the Yuba River and about 10 miles east of Marysville, on the Camp Beale Military Reservation; at the clay quarries one to two miles northwest of Lincoln; and in an extensive area east of the Southern Pacific railroad and U. S. Highway 99E between Lincoln and Roseville. The last two areas are in Placer County.

Tertiary volcanic rocks do not crop out in the foothill region between Lincoln and the Camp Beale exposure south of the Yuba River. However, many water wells farther west penetrate volcanic rocks, and the original eastward extent of those volcanics was probably greater than it is at present.

GEOLOGIC EVENTS IN SIERRA NEVADA AND ON EAST SIDE OF SACRAMENTO VALLEY

(Read from bottom up)

Recent	Hydraulic mining in Sierra Nevada in late 19th century chokes channels of Feather, Yuba and Bear Rivers with debris. Deposition of stream-channel, alluvial-fan, and basin deposits contemporaneous with mild dissection of intermediate alluvial deposits (Qpal).
Pleistocene	Deposition of intermediate alluvial deposits (Qpal), contemporaneous with moderate to severe dissection of old alluvial deposits (TQal). Several stages of glaciation in Sierra. Truncation and planation of Pliocene alluvial deposits and older rocks, and deposition of thin blanket of course gravel in many areas adjacent to the Sierra Nevada (uppermost part of TQal). Last major uplift of Sierra Nevada with additional regional westward tilting.
Pliocene	Eruptions of Sutter Buttes volcano cover slopes with tuff-breccia deposits from mud-flows. Deposition of old alluvium from Sierra continues. Deposition of old alluvial deposits by streams of low gradient from Sierra Nevada. May be in part contemporaneous with deposition of uppermost Sutter formation and with subsequent volcanic activity at Sutter Buttes. Intrusion of Sutter Buttes central area as plug of plastic andesite porphyry. Andesite mass subsequently intruded by rhyolite porphyry. Valley sediments pierced by volcanic plug are folded and fractured around central area. Great andesitic volcanic activity in Sierra wanes; consequent streams erode volcanic materials and deposit them in Sacramento Valley.
Miocene and Oligocene	Great mud flows of andesitic detritus originating near the crest of the Sierra cover most of the western slope. Old drainage in Sierra almost completely disrupted. Streams begin to erode detritus and deposit it in valley. Faulting and westward tilting of Sierra block during andesite eruptions. Volcanic eruptions near present Sierra crest continue; rhyolitic debris moves westward down canyons, locally damming and diverting streams. Deposition of Sutter formation (non-marine) begins in Sacramento Valley; continues until uplift of Sutter Buttes.
Oligocene or Eocene	Earliest volcanic activity in Sierra Nevada (andesitic and some rhyolitic); sea finally withdraws from Sacramento Valley after extending as far northeast as Wheatland during uppermost Eocene or Oligocene.
Eocene	Marine sedimentation in Sacramento Valley during middle and lower Eocene. Middle Eocene Ione formation, largely non-marine clay and quartzose sand, deposited on the lower slopes of the Sierra Nevada and as deltaic deposits in Sacramento Valley embayment. Moderate uplift of Sierra Nevada or change of base level causes dissection of weathered rocks on west slope of Sierra. Tropical climate and gentle slopes cause deep weathering of rocks in place on west slope of Sierra Nevada.
Upper Cretaceous	Regional upwarping at end of Upper Cretaceous interrupts marine deposition on east side of Sacramento Valley. Great erosion in Sierra Nevada; shallow-water marine deposition in Sacramento Valley.
Lower Cretaceous	At end of Lower Cretaceous—ancestral Coast Ranges formed by folding, faulting, and uplift; Sacramento Valley trough first outlined, though axis somewhat west of present valley. Erosion in ancestral Sierra Nevada.
Lower Cretaceous and/or Upper Jurassic	Formation of folded mountain range of great height, the ancestral Sierra Nevada, by Nevadan orogeny.

The volcanic deposits are chiefly andesitic stream-laid conglomerate and sandstone, and tuff-breccia of mud-flow origin, together with some fine-grained rhyolitic material, all from the Sierra Nevada. As encountered in wells, the conglomerate and sandstone often are loosely consolidated and in such cases are logged by drillers as gravel and sand.

The large area of volcanic rocks at Camp Beale is underlain by andesitic conglomerate, sandstone, and tuff-breccia with interbedded rhyolitic ash. The age of these deposits is probably Eocene, which is somewhat older than most of the other volcanic deposits in the Sutter-Yuba Area on the east side of the Sacramento Valley (Clark and Anderson, 1938).

Andesite tuff-breccia one mile northwest of Lincoln overlies altered rhyolitic ash, and also clay of the Ione formation. The extensive volcanic surface east of U. S. Highway 99E between Lincoln and Roseville is underlain by the same andesite tuff-breccia interbedded with andesitic sandstone and conglomerate. The age of these deposits is not certainly known, but they are believed to be equivalent in age to andesitic deposits in the Mokelumne River Area (the Mehrten formation), which is probably Miocene and may be in part Pliocene (Piper and others, 1939).

The Sutter formation of the Sutter Buttes unconformably overlies Eocene rocks and is in turn overlain unconformably by andesitic and rhyolitic tuffs and breccias of Pliocene age derived from the Buttes volcano. The lower part of the Sutter formation is probably correlative with the volcanic rocks from the Sierra Nevada, although the upper portion may consist of later reworked deposits. The maximum exposed thickness of the Sutter formation is approximately 1,800 feet (Johnson, 1943, p. 614)—considerably thicker than the volcanics from the Sierra Nevada farther east which are probably not over 250 feet thick in outcrop (see Plate B-1). The Sutter rocks are thin-bedded to massive tuff, conglomerate, sand, and clay.

The permeable sand and gravel in the volcanic rocks from the Sierra Nevada probably yield water to deep wells in the Sutter-Yuba Area. Deep wells in Marysville obtain some water from the volcanic sediments, and wells on the Camp Beale Military Reservation 10 miles east of Marysville obtain yields of several hundred gallons a minute from volcanic sands and gravel. Several wells south of the Bear River also produce water from the volcanic rocks from the Sierra Nevada.

Volcanic Rocks of the Sutter Buttes (Pliocene)

The Pliocene volcanic rocks of the Sutter Buttes may be divided into two principal groups: the intrusive rhyolite and andesite and the vent tuffs of the central core; and the andesitic and rhyolitic tuff-breccia that forms the ring encircling the core.

The rocks of the first group are principally porphyritic rhyolite and andesite. These rocks form the sharp peaks in the central area. They are unimportant as a source of ground water.

The tuff-breccia consists of angular blocks of rhyolite and andesite that were swept down the slopes of the old volcano in great mud flows. Many water wells near the periphery of the Buttes encounter the tuff-breccia and intercalated volcanic sediments (see Plates B-1 and B-2). The estimated maximum thickness of the deposits is about 800 feet.

In general, the volcanic sand and gravel yields some water, but the tuff-breccia is tight and nonwater-bearing. North of the Buttes, in the vicinity of Pennington, irrigation wells obtain part of their yield from the volcanic sands and gravels.

Old Alluvial Deposits (Pliocene-Pleistocene)

Location and Extent. The old alluvial deposits, which overlie the volcanics from the Sierra Nevada and older rocks, are exposed in a semicontinuous belt along the east side of the valley, between the outcrop of the basement complex and the volcanics to the east and the younger sediments to the west. A few scattered outliers of old alluvium extend west of the main outcrop from the northern edge of the Sutter-Yuba Area to Wheatland.

Physical Character. The old alluvial deposits are identified physiographically as dissected uplands near the eastern valley margin. Peculiar "hog wallow" topography, consisting of small mounds and undrained or poorly drained depressions often less than 100 feet across, is a common and striking characteristic.

A capping gravel, presumably early Pleistocene in age, and seldom more than 30 feet thick, is extensive near the eastern edge of the outcrops of old alluvium. The underlying silts and sands are presumably Pliocene in age and may be correlative with the Laguna formation to the south, in the Mokelumne Area, described by Gale (Piper and others, 1939).

The gravels almost always have a silty or fine sandy matrix with a distinctive reddish color. Silty and fine-sandy loams, usually with a hardpan layer, are typical soils.

The old alluvial deposits are extremely heterogeneous, and it is difficult to distinguish them in most well logs from younger and older sediments.

Reddish to yellowish-brown silt and silty sand are abundant, but light-gray moderately well-bedded indurated siltstone and fine sandstone are more distinctive and diagnostic. Many of the sand and gravel beds are cross-bedded, indicating fluviatile origin. The gravel is rarely clean or well-sorted; the silty matrix greatly reduces the permeability and porosity. This gravel may be distinguished from that in the underlying volcanics from the Sierra Nevada by the relative scarcity of volcanic rocks, but this distinction is often hard to make, and many drillers do not mention the composition of the pebbles and cobbles.

Water-bearing Character. The poorly-sorted sediments of the old alluvium generally do not yield as much water as the younger deposits. Cementation of the sand and gravel strata is a common feature and many wells are left uncased in the older alluvium; the cemented silt, sand, and gravel strata being sufficiently consolidated to stand without support.

Throughout the Sutter-Yuba Area, enough water can be obtained from the old alluvial deposits to supply domestic and stock wells. It is doubtful, however, that large-capacity irrigation wells could be developed in these deposits. Few wells tap only the old alluvium for sure and yields of these are not known. In the area between the Bear and Yuba Rivers, several irrigation wells produce between 1,000 and 2,000 gallons a minute, but these wells are several hundred feet deep and penetrate the intermediate alluvium, the old alluvium, and presumably the volcanic deposits from the Sierra Nevada. It is believed that the bulk of their yield comes from the volcanic deposits below and the intermediate alluvium above.

Intermediate Alluvial Deposits (Pleistocene)

Location and Extent. The intermediate alluvial deposits which rest on the old alluvium and in places are overlain by the young alluvium of Recent age crop out along a broad belt between the old alluvium on the east and the basin deposits on the west. A few small outliers of intermediate alluvium occur in the American Basin east of the Feather-Sacramento junction.

Physical Character. Topographically these deposits underlie moderately to slightly dissected low plains with a gentle westerly to southwesterly slope. Soils are quite variable but all have some hardpan development. The soils adjacent to the flood basins are fine-grained and dark in color. Soils farther east are coarser, frequently reddish, but almost never gravelly. (See soil surveys, U. S. Dept. Agriculture, in references.)

The intermediate alluvium consists of sand, silt, and gravel, in part well-sorted and well-stratified, deposited by the Feather River and its tributaries in building the low alluvial planes. These deposits are heterogeneous and lenticular in character because of their extremely varied mode of formation. In the eastern part of the area they are largely of alluvial-fan origin; the coarse sand and gravel beds extending 3 to 5 miles west from the present course of the Feather River are probably Pleistocene (Feather) river-channel deposits; and the predominantly fine-grained deposits farther west are chiefly of flood basin or lacustrine origin. Well logs indicate that the material penetrated in the top 100 feet becomes progressively finer toward the Sutter and Butte Basins. Sand and gravel give way to sandy clays and clays, and dark colors predominate. The proportion of sand and gravel to fine sediments in the upper 50 feet decreases from maxima of 80 to 90 percent to 5 to 10 percent. The proportion of blue and dark-gray fine-grained materials—indicative of a non-oxidizing environment—possibly flood-basin or lacustrine deposition—becomes greater as the proportion of fine sediments increases.

In general, the intermediate alluvium is not appreciably consolidated. The beds that are indurated have a high proportion of clay and silt which act as a binder. Hardpan layers, representing buried soil zones, are encountered at various depths. These hard layers usually are cemented with hydrous iron and aluminum silicates, although calcareous cementation is common in areas of high water table adjacent to the flood basins.

The intermediate alluvial deposits are inferred to be correlative with the Victor formation of Pleistocene age in the Mokelumne area described by Gale and Piper (Piper and others, 1939).

Thickness. From drillers' logs, it is inferred that the intermediate alluvial deposits do not exceed 110 feet in thickness in the Sutter-Yuba Area. West of the Feather River, these deposits consist of 50 to 110 feet of sandy clay, sand, and gravel. (See Plate B-2, Section B-B1.) North of Yuba City they overlie brown cemented sands and hard brown clays of the old alluvium. South of Yuba City and in the Marysville area the underlying old alluvium usually is blue clay.

In the area east of the Feather River and north of the Yuba River the intermediate alluvium reaches thicknesses of 70 to 100 feet and rests upon cemented sand, gravel, and clay of the old alluvium that crop out in the dissected uplands to the east.

Few wells penetrate the intermediate alluvium south of the Yuba River but the thickness does not appear to exceed 50 feet.

Water-bearing Character. The intermediate alluvium is moderately permeable throughout, but the tongues and layers of well-sorted sand and gravel are highly permeable and yield large quantities of water to wells. Nearly all the domestic and many small irrigation wells located on the low plains are completed in these deposits. Large wells for irrigation and municipal supply obtain much of their water from this material, but also obtain water from the older deposits at greater depths.

Deposits of this age are coarsest and most permeable near the Yuba and Feather Rivers, and less permeable close to the flood basins where dark colored silt and clay predominate.

Young Alluvial Deposits (Recent)

The Recent deposits of the Sacramento Valley may be defined as those sediments that are still accumulating, or would be accumulating under natural conditions. These deposits would include: silt, sand, and gravel laid down in stream channels during times of decreasing flood flow; silt and sand deposited on natural levees at times of overflow; silt and clay deposited in the flood basins; detritus of the alluvial fans surrounding the Sutter Buttes. In this report, the natural levee sediments are grouped with the stream-channel deposits. The other two types of sediments are called "basin deposits" and "alluvial-fan deposits," respectively. Each of these subdivisions of the Recent sediments has certain unique physiographic, lithologic, and hydrologic characteristics which are discussed below.

Alluvial-fan Deposits of the Sutter Buttes. Alluvial fans of Pleistocene and Recent age form a ring surrounding the Sutter Buttes and extending toward their center in narrow valleys cut into andesite tuff-breccia. Small isolated patches of alluvium occupy valleys high in the Buttes. This alluvium is probably thin and is not continuous with the deposits farther down the flanks.

The fan material consists of volcanic and sedimentary detritus eroded from the Buttes and deposited around their perimeter. The deposits are usually poorly sorted and contain many volcanic fragments as large as boulder size. An average of several logs of wells near Pennington and Sutter City indicates the following proportion of materials: "clay," 70 percent; clay and gravel (including clay and volcanics), 20 percent; sand and gravel, 10 percent. The "clay" is usually yellow and is probably largely silt and fine sand.

Most of the alluvial-fan deposits are poorly sorted and ground-water yields are low. Moderately permeable sand strata yield water of good quality to wells near Pennington and Sutter City, but chances for developing large irrigation wells are generally poor.

Basin Deposits. The basins are nearly flat, poorly drained lands subject to natural overflow of the Sacramento and Feather Rivers during floods. The deposits have formed from the accumulation of silt and clay that were carried in suspension by the flood waters and settled slowly when the current slackened.

Dark-gray clays and clay adobes, often with more than 50 percent clay-size particles, are the chief basin soils. Depth of the soils is usually from three to six feet, and the underlying material is stratified and of lighter color.

Few water wells have been drilled in the basins, so it is difficult to work out the pattern of the subsurface geology from the meager data. Only eight water-well logs were available in Sutter Basin and four logs in the American Basin.

In Sutter Basin soil and yellow clay as much as 48 feet thick are reported above blue clay, blue sand, gray clay, or gravel. The change in color from yellow to blue indicates that the deeper sediments have been in a nonoxidizing environment since deposition. If the blue clay and coarse-grained deposits are Pleistocene in age the basin deposits of Recent age attain a thickness of at least 48 feet in the Sutter Basin and 100 feet in the American Basin.

The Recent basin deposits nearly all consist of relatively impermeable clay and silt. The older sediments, usually at least 50 to 100 feet below land surface, frequently include thin sand and gravel strata which yield moderate amounts of water. Generally, yields from the Sutter Basin deposits are too small to permit economic use of the ground-water for irrigation; and even in the deep wells penetrating permeable strata, poor quality (high chloride content) precludes use of the water. Locally, however, satisfactory deep wells might be developed by casing off strata containing the high-chloride water. Wells in the northern part of the American Basin get fair yields from deep permeable strata (probably in the intermediate alluvial deposits) and apparently do not encounter the chloride contamination present in the Sutter Basin.

Stream-channel Deposits. The stream-channel deposits comprise those sediments which under natural conditions of stream flow would still be in the process of accumulation. They include the sand and gravel deposited in the river channels during times of decreasing flow and the fine sediments deposited on the flood plains and natural levees during floods. The stream-channel deposits range in width from less than one mile to as much as six miles and extend as narrow bands along the major streams of the area.

The river channels are floored with sand and gravel, the flood plains by sand and silt. During stages of moderate flow the rivers occupy only their channels and roll sand and gravel along their beds. During floods muddy water spreads over the flood plain and deposits fine sediments. Flood channels, abandoned river channels, and lakes characterize the flood-plain surface. Natural levees bordering the Sacramento and lower Feather Rivers were deposited during flood stages along the boundary between high velocity flows in the river channels and still waters occupying the flood basins.

The Yuba and Bear Rivers offer a special case. The natural channel deposits of both streams have been completely buried by 15 to 20 feet of hydraulic mining debris deposited since 1870. Levees now confine this debris, which stands as raised channelways subdivided into braided gravelly channels. (See Pl. B-3.) Large quantities of debris choke the lower Feather below the Yuba junction, although the flood plain has not been altered to the same extent as those of the Yuba and Bear Rivers.

Well defined channels of coarse gravel, deposited in trenches excavated in the intermediate alluvial deposits and older sediments, underlie the flood plains of the Feather, Yuba, and Bear Rivers. Coarse gravel deposits from one to two miles in width can be traced beneath the Feather River flood plain from Oroville south 10 miles to the highway bridge east of Gridley. The depth of the base of the gravel is about 30 feet near Oroville, increasing to 105 feet at the Gridley bridge. No subsurface information is available on the river channel deposits between the Gridley bridge and the Feather-Yuba junction. Wells on the Feather River flood plain south of the Yuba-Feather junction encounter gravel between depths of 35 and 90 feet that may correspond to the Recent gravel deposits upstream.

Records of wells drilled on the Yuba River flood plain two miles east of Marysville show coarse gravel deposits to a depth of 110 to 130 feet. (See Pl. B-3.)

Sand and gravel underlies the Bear River flood plain for eight miles downstream from the canyon mouth. This gravel deposit which occurs between 25 and 65 feet beneath the surface near Wheatland is terminated rather abruptly about three miles southeast of Wheatland.

Little is known of the subsurface extent of the Recent deposits of the Sacramento River. Wells drilled on the natural levees pass through varicolored sand, gravel, silt, and clay. Well logs show no systematic changes either laterally or vertically. Lateral discontinuity of beds is a marked feature—even closely spaced wells penetrate completely different sections.

Clean, well-sorted sand and gravel of the stream-channel deposits yield water in large quantity and of good chemical quality to irrigation wells on the flood plains of the Feather, Yuba, and Bear Rivers. A few irrigation wells are bottomed in the Recent deposits but wells of large capacity commonly penetrate older sediments as well.

Wells drilled in the natural-levee deposits of the Feather and Sacramento Rivers obtain large supplies of water from thin, discontinuous tongues of gravel and sand which are buried stream-channel deposits. The fine sand and silt of these deposits supply some small stock and domestic wells.

Yields of Wells

Data on yields of wells in the Sutter-Yuba Area for the period 1933 to 1949 have been furnished by the Pacific Gas and Electric Company. The results of tests are summarized in the following table, which shows averages of discharge and specific capacity for 595 wells in five areas within the area. Specific capacity is obtained by dividing the yield in gallons per minute by the drawdown from static to pumping level in feet. It is a measure of the productivity of the well per foot of drawdown.

Area	*Average discharge (gpm)*	*Average specific capacity (gpm/ft. dd)*	*Number of wells*
1. Eastern Sutter County	728	47	261
2. Northwestern Sutter County	878	54	82
3. Southeastern Sutter County	960	47	121
4. Southern Yuba County	846	48	108
5. Northern Yuba County	838	60	23

The table shows that the wells having the highest specific capacities are in areas two and five. A hasty conclusion (based on this relation) might be drawn that the best irrigation wells are to be obtained in the areas of highest average specific capacity. However, a study of well depths in relation to specific capacity changes the picture somewhat. Drillers' logs of 528 irrigation wells were used to obtain a yield factor that would give a reasonable idea of production per foot of well. The yield factor was computed by the following formula:

$$\text{Yield factor} = \frac{\text{Average specific capacity x 100.}}{\text{Average well depth}}$$

The results are summarized in the following table.

Area	*Number of irrigation wells*	*Total footage drilled*	*Average depth (feet)*	*Yield factor*
1	249	45,270	182	25.7
2	48	15,341	320	16.8
3	104	33,709	324	14.7
4	109	31,828	292	16.7
5	28	5,623	201	29.8

It can be seen from comparison of yield factors that the ratio of well production to depth of wells is higher in areas 1 and 5 than in areas 2, 3, and 4. Plate B-4, showing ground-water storage units, and well-yield areas indicates that areas 1 and 5 lie largely in group A (river flood-plain and channel deposits). Area 2 comprises the Sutter Buttes, the alluvial fans surrounding the Buttes (storage group B) and a large area of basin deposits (storage group D). Only a small part of this area is within storage group A. Most of the wells in area 2 are in the Pennington-Live Oak district, where many wells are 500 feet or more deep.

The other two areas with low yield factors are areas 3 and 4 east of the Feather River in southeastern Sutter and southern Yuba Counties; they embrace extensive areas of low alluvial-plain deposits (storage group B), and smaller areas of basin deposits (storage group D) and dissected alluvial deposits (storage group C). Although area 4 includes large areas of river flood-plain deposits (storage group A) the yield factor approximates that of the poor-yield areas rather than that of high-yield areas as might be expected.

In conclusion, generally speaking, areas of high-yield factor generally correspond to areas of high specific yield as determined from statistical analysis of drillers' logs.

GROUND-WATER STORAGE CAPACITY

Most of the information on ground-water storage capacity of the Sutter-Yuba Area was derived from well logs obtained from water well drillers. In connection with their Sutter-Yuba investigation the Division of Water Resources located in the field about 700 water wells for which drillers' logs were available. The Geological Survey located about 50 wells in western and northwestern Sutter County.

Clay, gravel, sand, and volcanic rocks are usually recognized in the drillers' logs, and the more complete logs mention color, hardness, degree of cementation, and other readily identified lithologic features.

A peg model based on drillers' logs was used to subdivide the shallow sediments of the area into hydrologic units. In constructing the model only the deeper well records were used where wells were located within 1,500 feet of each other. In this way 576 well logs were selected. In order to smooth out the effect of close well spacing in residential districts supplied by domestic wells, only the wells selected for the peg model were used in computing storage capacity.

Selection of Depth Zones

The storage capacity of the Sutter-Yuba Area has been estimated for three depth zones: 20 to 50 feet, 50 to 100 feet, and 100 to 200 feet below the land surface. The only exception to this three-zone treatment was in the area south of Yuba City between the natural levee deposits of the Sacramento River and the channel of the Feather River (storage units A 5 and D 2). Water of poor quality underlies that area at relatively shallow depths, and the California Division of Water Resources believes that it would be impractical in general to draw down the water level below 100 feet without causing saline intrusion. Accordingly, in that area the storage capacity was calculated only for the deposits between depths of 20 and 100 feet.

It is believed that for the Sutter-Yuba Area it would be inefficient to store water in the deposits less than 20 feet below land surface, even where permeable. Also, for economic reasons, it is unlikely that water levels will be lowered below 200 feet. In the near future, drawdown of the water table in the Sutter-Yuba Area probably will not extend below the 100-foot depth.

Classification of Materials in Drillers' Logs

In order to estimate the ground-water storage capacity of the water-bearing deposits it was necessary to classify the drillers' logs into a few general categories to which specific-yield values could be assigned. Although many logs reported only gravel, sand, and clay or gradations between these units, some logs reported as many as 10 to 20 different types of materials. It was decided to group the sediments logged into five general classes, namely: (1) gravel; (2) sand, including gravelly sand and gravel and sand; (3) tight sand, hard sand, sandstone and other materials of similar hydrologic character; (4) cemented gravel, clay and gravel, etc.; and (5) "clay," which included silt, clay, shale, and related materials of low permeability including "lava."

Assignment of Specific-yield Values

The specific yield of a rock is the ratio of (1) the volume of water which, after being saturated, it will yield by gravity to (2) its own volume. This ratio is customarily expressed in percent. The procedure followed in assigning specific-yield values to the various types of material classified in the well logs of the Sacramento Valley is discussed in detail in the valley-wide report now in preparation and has been summarized in an appendix to Bulletin 1 of the State Water Resources Board (Poland and others, 1950). The table below indicates the values assigned:

Material	*Specific yield (percent)*
Gravel	25
Sand, including sand and gravel, and gravel and sand	20
Fine sand, hard sand, tight sand, sandstone, and related deposits	10
Clay and gravel, gravel and clay, cemented gravel, and related deposits	5
"Clay," silt, sandy clay, lava rock, and related fine-grained deposits	3

Subdivision of Sutter-Yuba Area Into Storage Units

For the purpose of estimating underground storage capacity, the Sutter-Yuba Area was divided into four storage groups, and these in turn were subdivided into 14 storage units. (See Pl. B-4). Boundaries of the storage units were first drawn on significant soil and physiographic changes, then were modified on the basis of the subsurface character of the deposits above a depth of 200 feet below land surface. Special emphasis was placed on the hydrologic character of the sediments in the top 100 feet. There are three reasons for this. First, it is believed that the storage units should be representative for the depth range most widely subject to unwatering or resaturation under present conditions. Second, for nearly all the storage units in the valley except the basin deposits, the specific yield is greater above the 100-foot depth than below it. Lastly, with reference to natural or artificial recharge at or near the land surface, the distribution of water-bearing beds in the near-surface deposits is of primary importance. In this respect, the coarse sand and gravel tongues or blankets that are so well defined at shallow depths beneath or near the channels of the Feather, Yuba, and Bear Rivers are noteworthy.

In the table summarizing the ground-water storage capacity of the Sutter-Yuba Area, the 14 storage units have been assembled within the four groups. Briefly summarized, the groups are:

A. River Flood-plain and Channel Deposits. These deposits contain a high proportion of sand and gravel deposited by streams mostly during the Pleistocene and Recent epochs, although some of the sands and gravels in the 100- to 200-foot depth zone may be of Pliocene age. In general, the river flood-plain and channel deposits have the highest specific yield of the four groups in all three depth zones. The specific yield decreases markedly in the 100- to 200-foot depth zone, but still is higher than in the other three storage groups.

B. Low Alluvial-plain and Alluvial-fan Deposits. These deposits are variable in physical character but are generally much less permeable than the river flood-plain and channel deposits, particularly in the top two depth zones. The near-surface sediments in this group include the alluvial fans of the Sutter Buttes, intermediate alluvial deposits (Pleistocene), old alluvial deposits (Pliocene and Pleistocene) and smaller areas of

Recent stream-channel deposits. Most of the low alluvial-plain deposits above the 200-foot depth are old and intermediate alluvial deposits, however.

C. Dissected Alluvial Deposits. This group is represented in Sutter and Yuba Counties by two widely separated small areas—the northern between Honcut Creek and the Yuba River on the east margin of the valley, and the southern in Sutter County east of the American Basin. The specific yield and physical character of the dissected alluvial deposits and the low alluvial-plain and alluvial-fan deposits are similar, and the geologic units contained are essentially the same, although the dissected alluvial deposits contain a somewhat greater percentage of old alluvium.

D. Basin Deposits. These sediments to a depth of 200 feet include the Recent basin deposits, the intermediate alluvial deposits of Pleistocene age and probably some old alluvium. Silt and clay predominate and permeability and specific yield are correspondingly low. The 100- to 200-foot depth zone in the northern part of the American Basin (D1) contains a rather high proportion of sand which may represent buried Sacramento River channels, but the deep zone in the Butte Basin (D3) has fine-grained material of low permeability. The specific yield of the deep zone in the Sutter Basin (D2) was not calculated because of salt-water contamination, but the well logs record mostly fine-grained material.

Summary of Results

The following table summarizes the estimated ground-water storage capacity of the Sutter-Yuba Area for the four storage groups. This summary is followed by a tabulation of storage capacity for each of the 14 storage units, listed by groups.

The summary for the Sutter-Yuba Area by storage groups first gives total storage capacities for all deposits, including those beneath the basin lands. The totals are then given with the storage capacity of the basin deposits eliminated. There are several reasons for omitting the storage capacity of these deposits from consideration. The deposits in the Sutter and Butte Basins are relatively impermeable in all three depth zones, and those in the American Basin in the top two depth zones. Therefore, well yields would be low and it would be difficult to draw down the water level extensively within the basins unless many closely spaced wells were drilled. Although the basin water levels are close to the surface, the altitude of land surface in the basins is lower than that in all the surrounding lands. Because of the low altitude and the low permeability of the basin deposits, it is believed there would not be appreciable dewatering by lateral drainage to adjacent pumped areas. For the same reasons, recharging the basin deposits would be slow and costly. Because of low well yields and the availability of surface water, it is ordinarily more economical to use surface water than ground water for irrigation of the basin lands.

Excluding the basin storage, the estimated ground-water storage capacity for the Sutter-Yuba Area between limits of 20 and 200 feet below the land surface is about 3,900,000 acre-feet. More than half this storage is in the deposits 20 to 100 feet below the surface. As discussed previously, how much of this ground-water storage capacity is economically usable is not known.

ESTIMATED TOTAL GROUND-WATER STORAGE CAPACITY OF SUTTER-YUBA AREA IN ACRE-FEET

Storage unit	Area[1] (acres)	Depth zone						All zones 20-200 feet	
		20-50 feet		50-100 feet		100-200 feet			
		Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)
A. River flood-plain and channel deposits	204,590 (164,430)	10.4	640,000	9.4	960,000	7.0	1,140,000	8.4	2,740,000
B. Low alluvial-plain and alluvial-fan deposits	101,590	5.4	160,000	4.9	250,000	4.7	470,000	4.9	880,000
C. Dissected alluvial deposits	30,600	4.5	40,000	5.5	80,000	4.7	150,000	4.9	270,000
D. Basin deposits	143,590 (29,080)	5.4	230,000	5.1	370,000	6.4	180,000	5.4	780,000
TOTALS	480,370 (325,700)	7.4	1,070,000	6.9	1,660,000	6.0	1,940,000	6.6	4,670,000
Percent of total			22.9		35.5		41.6		

ESTIMATED GROUND-WATER STORAGE CAPACITY, EXCLUDING BASIN DEPOSITS

Total (A+B+C) Percent of total	336,780 (296,620)	810,000 21.6	1,290,000 33.2	1,760,000 45.2	3,890,000

[1] Figures in parentheses indicate acreage utilized for computing storage in zone 100 to 200 feet below land surface.

SUTTER AND YUBA COUNTIES
ESTIMATED GROUND-WATER STORAGE CAPACITY OF RIVER FLOOD-PLAIN AND CHANNEL DEPOSITS (A)

Storage unit	Area[1] (acres)	Depth zone						All zones 20-200 feet	
		20-50 feet		50-100 feet		100-200 feet			
		Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)
1. Sacramento River	35,680	9.0	96,000	9.8	176,000	8.6	308,000	9.0	580,000
2. East of Feather River north of Yuba River	39,240	10.3	121,000	8.7	170,000	6.0	235,000	7.5	526,000
3. West side Feather River north of Yuba City	35,920	9.8	105,000	8.4	151,000	5.9	214,000	7.3	470,000
4. East side Feather River south of Yuba River and Bear River	53,590	11.8	189,000	10.8	289,000	7.2	384,000	8.9	862,000
5. West of Feather River south of Yuba City	(40,160)	10.4	126,000	8.9	179,000			9.5	305,000
TOTALS	204,590 (164,430)	10.4	637,000	9.4	965,000	7.0	1,143,000	8.4	2,744,000

[1] Figures in parentheses indicate acreage utilized for computing storage in zone 100 to 200 feet below land surface.

SUTTER AND YUBA COUNTIES
ESTIMATED GROUND-WATER STORAGE CAPACITY OF LOW ALLUVIAL-PLAIN AND ALLUVIAL-FAN DEPOSITS (B)

Storage unit	Area (acres)	Depth zone						All zones 20-200 feet	
		20-50 feet		50-100 feet		100-200 feet			
		Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)
1. Low plains south of Bear River	36,030	6.5	70,000	5.2	93,000	4.2	151,000	4.8	314,000
2. Low plains north of Bear River	47,070	4.7	67,000	4.5	105,000	5.4	253,000	5.0	425,000
3. Low plains west of Feather River	2,560	5.2	4,000	5.6	7,000	4.0	10,000	4.6	21,000
4. Alluvial plains enclosing Sutter Buttes	15,930	4.8	23,000	5.8	46,000	3.7	59,000	4.5	128,000
TOTALS	101,590	5.4	164,000	4.9	251,000	4.7	473,000	4.9	888,000

SUTTER AND YUBA COUNTIES
ESTIMATED GROUND-WATER STORAGE CAPACITY OF DISSECTED ALLUVIAL DEPOSITS (C)

Storage unit	Area (acres)	Depth zone						All zones 20-200 feet	
		20-50 feet		50-100 feet		100-200 feet			
		Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)
1. Deposits between American and Bear Rivers	20,070	4.8	29,000	4.8	48,000	5.2	105,000	5.0	182,000
2. Deposits south of Oroville	10,530	3.9	12,000	7.0	37,000	3.8	40,000	4.7	89,000
TOTALS	30,600	4.5	41,000	5.6	85,000	4.7	145,000	4.9	271,000

SUTTER AND YUBA COUNTIES
ESTIMATED GROUND-WATER STORAGE CAPACITY OF BASIN DEPOSITS (D)

Storage unit	Area[1] (acres)	Depth zone						All zones 20-200 feet	
		20-50 feet		50-100 feet		100-200 feet			
		Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)	Specific yield (percent)	Storage (acre-feet)
1. American Basin	17,860	4.6	25,000	5.0	45,000	7.7	137,000	6.4	207,000
2. Sutter Basin	114,510 (0)	5.5	189,000	5.2	295,000			5.3	484,000
3. Butte Basin	11,220	5.1	17,000	4.6	26,000	4.3	48,000	4.8	91,000
TOTALS	143,590 (29,080)	5.4	231,000	5.1	366,000	6.4	185,000	5.4	782,000

[1] Figures in parentheses indicate acreage utilized for computing storage in zone 100 to 200 feet below land surface.

Best Areas for Ground-water Storage

As can be seen from the ground-water storage table, the best areas for storing water underground are the five river flood-plain and channel deposits units. Excluding basin deposits, about 70 percent of the total storage capacity is in these five areas which include about 40 percent of the Sutter-Yuba Area, and most of the soils and near-surface sediments are sufficiently permeable to permit recharge from the surface. Sand and gravel beds are most continuous in the river-channel deposits of the Feather River, and the deposits west of the river from Yuba City south to the vicinity of Nicolaus seem to be especially favorable for storing ground-water (See Pl. B-2). Unfortunately, however, this area is contaminated with salt water in the lower depth zone, and storage in this zone may not be practicable.

The low alluvial-plain and alluvial-fan deposits and the dissected alluvial deposits are both rather unfavorable for ground-water storage. Soils are generally tight and impervious hardpan is prevalent, and recharge from land surface would be difficult.

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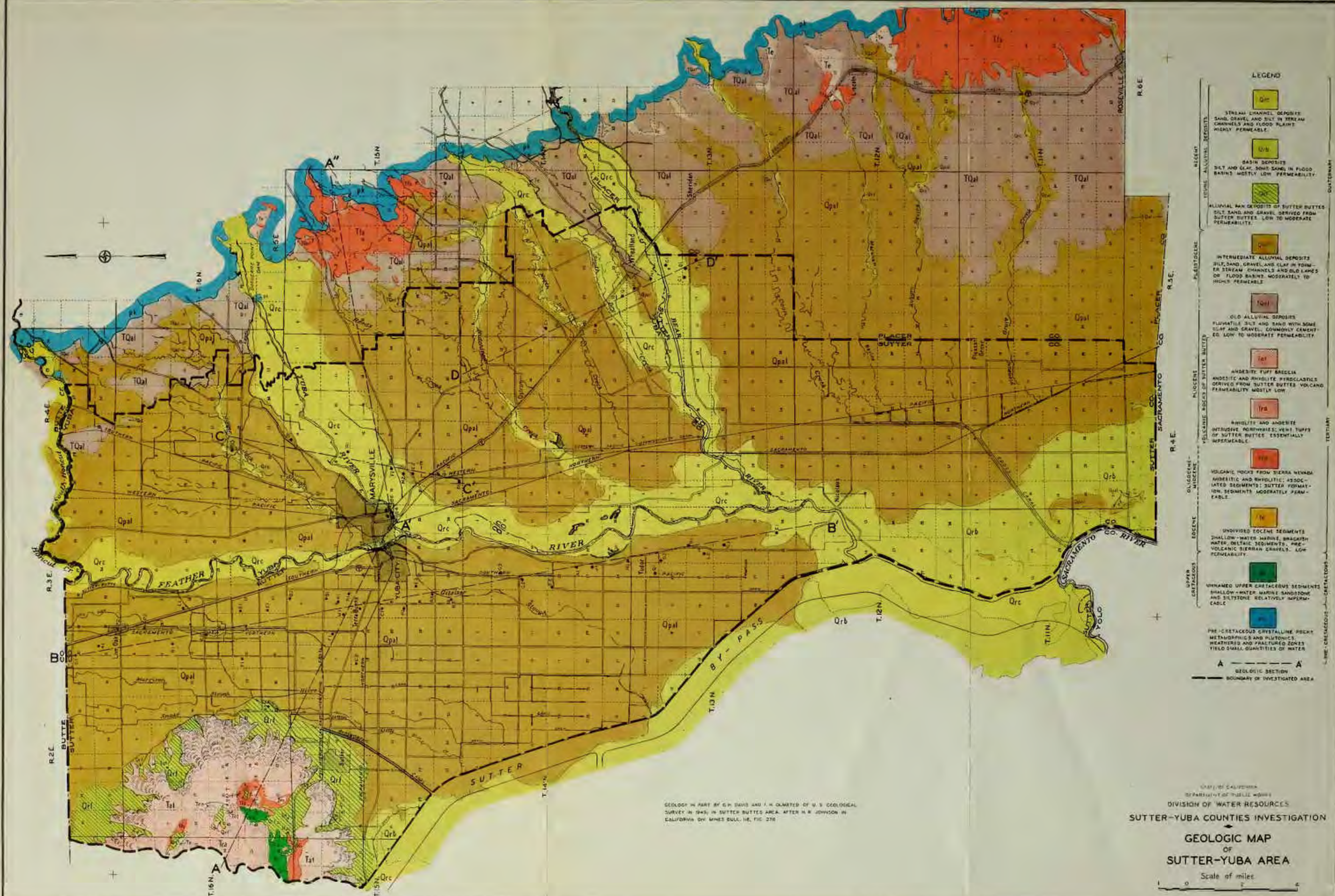
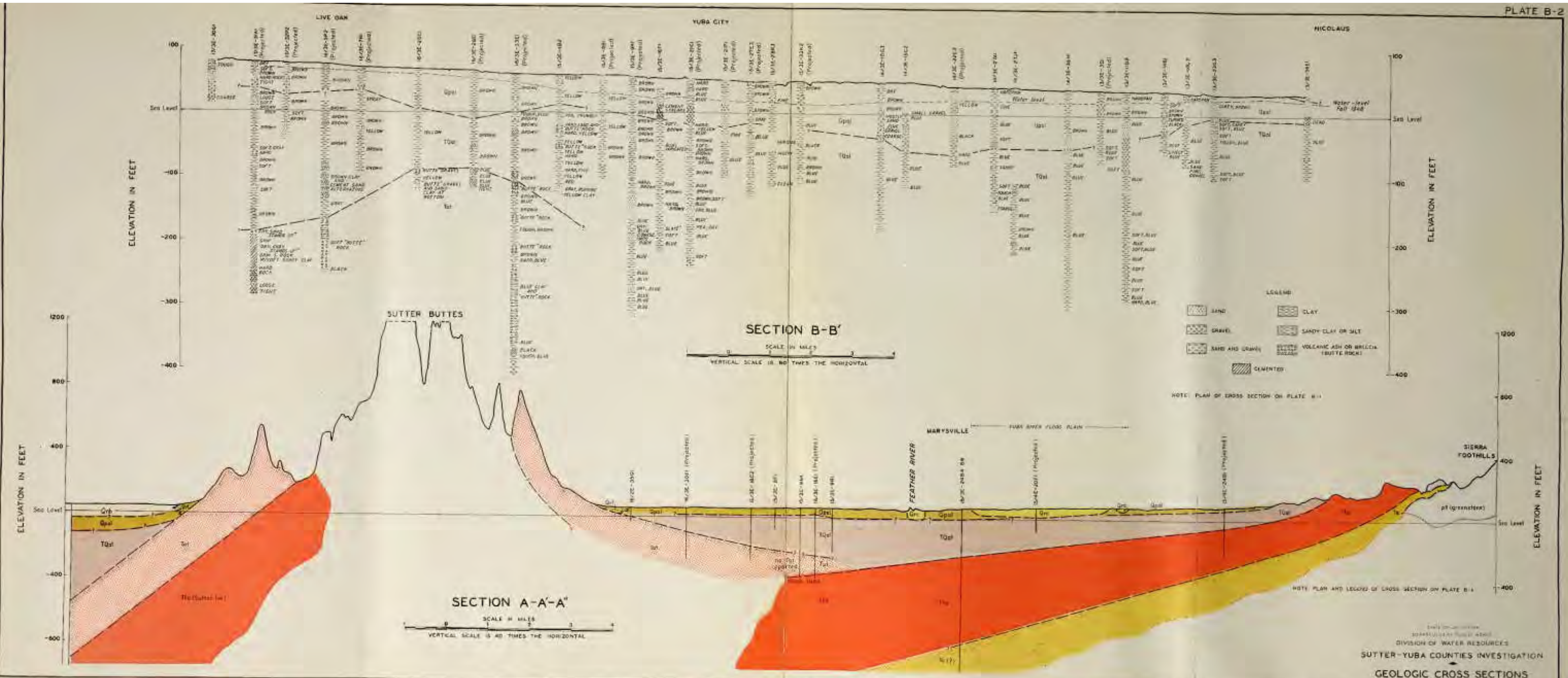
PLATE B-1

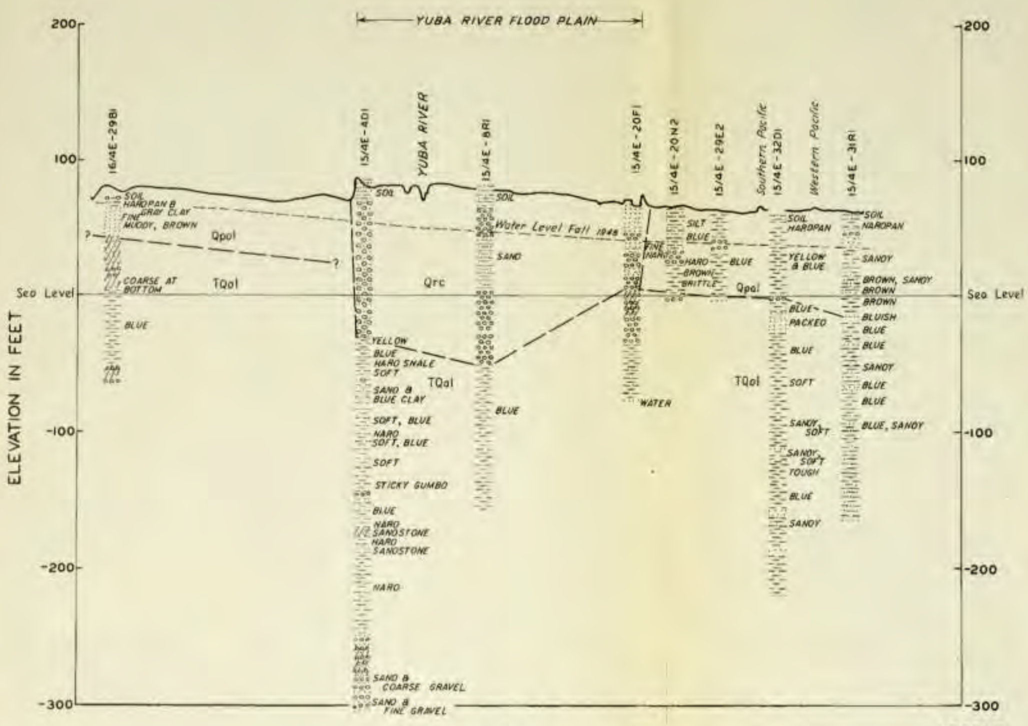

LEGEND
STREAM CHANNEL DEPOSITS
SAND, GRAVEL, AND SILT IN STREAM CHANNELS AND FLOOD PLAINS. HIGHLY PERMEABLE.
BASIN DEPOSITS
SILT AND CLAY, SOME SAND, IN FLOOD BASINS. MOSTLY LOW PERMEABILITY.
ALLUVIAL FAN DEPOSITS OF SUTTER BUTTES
SILT, SAND AND GRAVEL DERIVED FROM SUTTER BUTTES. LOW TO MODERATE PERMEABILITY.
INTERMEDIATE ALLUVIAL DEPOSITS
SILT, SAND, GRAVEL AND CLAY IN FORMER STREAM CHANNELS AND OLD LAKES OR FLOOD BASINS. MODERATELY TO HIGHLY PERMEABLE.
OLD ALLUVIAL DEPOSITS
FLUVIATILE SILT AND SAND WITH SOME CLAY AND GRAVEL, COMMONLY CEMENTED. LOW TO MODERATE PERMEABILITY.
ANDESITE TUFF BRECCIA
ANDESITIC AND RHYOLITE PYROCLASTICS DERIVED FROM SUTTER BUTTES VOLCANO. PERMEABILITY MOSTLY LOW.
RHYOLITE AND ANDESITE
INTRUSIVE PORPHYRIES; VENT TUFFS OF SUTTER BUTTES. ESSENTIALLY IMPERMEABLE.
VOLCANIC ROCKS FROM SIERRA NEVADA
ANDESITIC AND RHYOLITIC; ASSOCIATED SEDIMENTS; SUTTER FORMATION. SEDIMENTS MODERATELY PERMEABLE.
UNDIVIDED EOCENE SEDIMENTS
SHALLOW-WATER MARINE, BRACKISH WATER, DELTAIC SEDIMENTS, PRE-VOLCANIC SIERRAN GRAVELS. LOW PERMEABILITY.
UNNAMED UPPER CRETACEOUS SEDIMENTS
SHALLOW-WATER MARINE SANDSTONE AND SILTSTONE. RELATIVELY IMPERMEABLE.
PRE-CRETACEOUS CRYSTALLINE ROCKS
METAMORPHICS AND PLUTONICS. WEATHERED AND FRACTURED ZONES YIELD SMALL QUANTITIES OF WATER.
RECENT
YOUNG ALLUVIAL DEPOSITS
PLEISTOCENE
PLIOCENE
VOLCANIC ROCKS OF SUTTER BUTTES
OLIGOCENE-MIOCENE
EOCENE
UPPER CRETACEOUS
QUATERNARY
TERTIARY
CRETACEOUS
PRE-CRETACEOUS
A — — — A'
GEOLOGIC SECTION
BOUNDARY OF INVESTIGATED AREA
GEOLOGY IN PART BY G.H. DAVIS AND F.H. OLMSTED OF U. S. GEOLOGICAL SURVEY IN 1945; IN SUTTER BUTTES AREA, AFTER H.R. JOHNSON IN CALIFORNIA DIV. MINES BULL. 118, FIG. 278
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
GEOLOGIC MAP
OF
SUTTER-YUBA AREA
Scale of miles
0
2
4



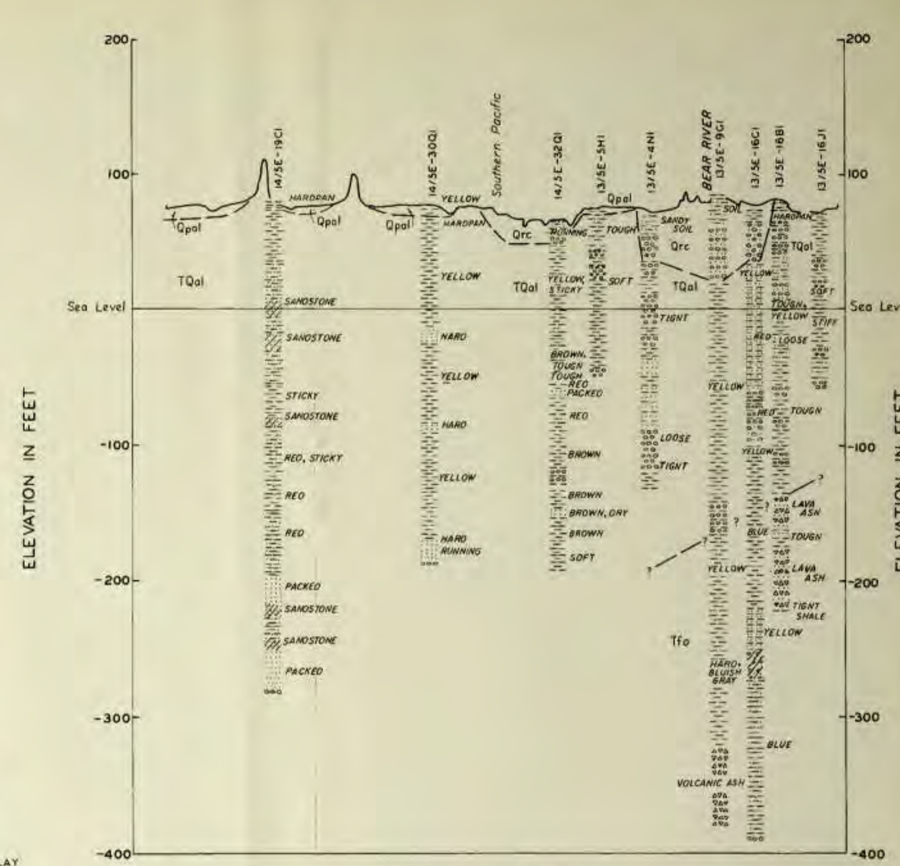
DIVISION OF WATER RESOURCES

SUTTER-YUBA COUNTIES INVESTIGATION

GEOLOGIC CROSS SECTIONS

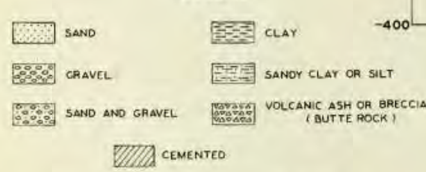


SECTION C-C′



SECTION D-D′

LEGEND



NOTE: PLAN OF CROSS SECTIONS ON PLATE B-1

SCALE OF MILES

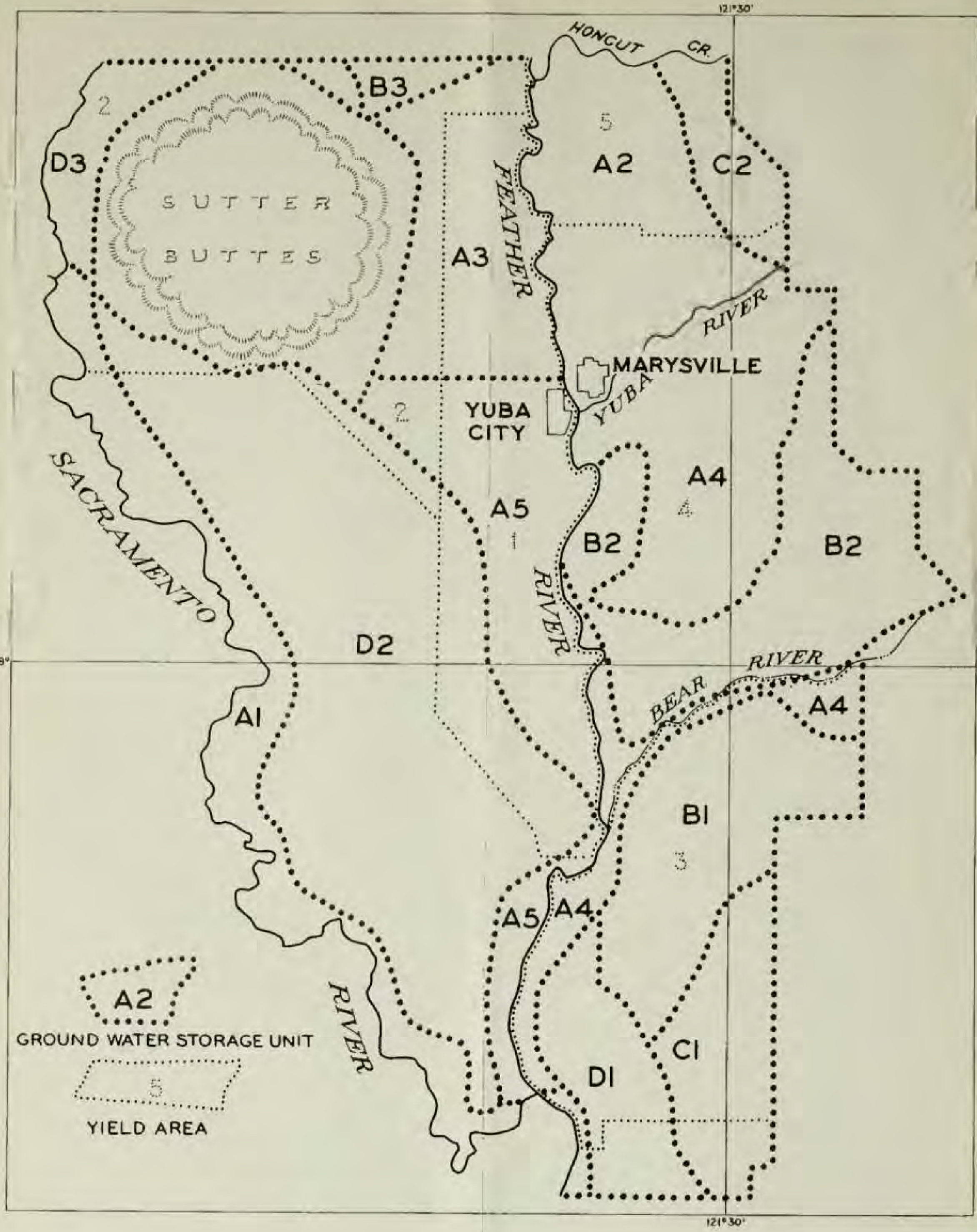
1 0 1 2 3 4

VERTICAL SCALE IS 80 TIMES THE HORIZONTAL

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

SUTTER-YUBA COUNTIES INVESTIGATION

GEOLOGIC CROSS SECTIONS



GROUND WATER STORAGE UNITS IN SUTTER AND YUBA COUNTIES

APPENDIX C

RECORD OF MONTHLY PRECIPITATION AT ROBBINS, CALIFORNIA

RECORD OF MONTHLY PRECIPITATION AT ROBBINS, CALIFORNIA

County: Sutter
Date established: 1926
Type of gage: Not recording
Elevation: 20 feet, U.S.G.S. datum

Latitude: 38° 52'
Longitude: 121° 43'
Record obtained from: Reclamation District 1500, Kirkville

(In inches)

Season	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
1925-26											0.55		
1926-27		0.05	Tr.	1.58	7.43	0.81	2.43	5.39	1.69	0.96	0.34	0.45	21.13
1927-28		Tr.	Tr.	1.81	2.05	0.68	1.72	1.61	3.68	0.64	0.03	0.05	12.27
1928-29				0.26	2.51	2.61	0.73	2.01	1.20	0.55	Tr.	1.51	11.38
1929-30				0.10	0.00	4.53	4.12	1.43	2.64	1.07	0.52		14.41
1930-31			0.19	0.42	1.21	1.50	2.65	1.25	0.97	0.20	1.04	0.87	10.30
1931-32		0.02		0.26	2.69	7.65	1.72	1.52	0.49	0.88	0.70		15.93
1932-33	0.05			Tr.	0.27	2.59	3.13	0.65	1.69	0.10	0.48		8.96
1933-34			Tr.	0.76	0.00	5.90	0.24	2.73	0.33	0.54	0.16	0.22	10.88
1934-35			Tr.	1.06	2.62	2.29	5.40	1.56	2.77	3.95	Tr.		19.71
1935-36	Tr.			0.89	1.05	1.71	2.95	5.90	1.01	1.24	0.42	0.43	15.60
1936-37				0.30	0.06	2.50	2.78	5.96	5.39	0.48	0.00	0.14	17.61
1937-38				0.56	2.58	2.97	3.76	7.27	3.77	1.89	0.14	0.05	22.99
1938-39			0.59	1.19	0.58	1.25	2.69	0.63	2.14	0.16	0.44		9.67
1939-40	Tr.		0.27	0.67	0.04	1.71	6.24	7.06	4.11	0.86	0.81		21.77
1940-41			0.06	0.92	1.41	7.76	6.04	6.49	3.31	3.90	2.04	Tr.	31.93
1941-42	Tr.		0.02	1.54	1.77	6.25	4.00	3.75	3.28	5.12	0.59		26.32
1942-43				0.38	2.08	2.87	5.72	2.36	2.73	1.91	0.06	0.05	18.19
1943-44				0.24	0.80	2.42	2.22	7.29	0.55	1.53	1.00	0.01	16.06
1944-45				0.94	4.13	2.31	2.02	1.86	2.97	0.08	0.88	0.16	15.35
1945-46				3.29	2.19	4.75	0.91	0.95	1.64	0.08	0.36		14.17
1946-47	0.09		0.20	0.28	2.27	3.03	0.36	2.24	2.35	0.30	0.29	0.51	11.92
1947-48				2.06	1.06	1.01	0.90	1.41	3.32	3.92	1.82	0.57	16.07
1948-49		0.03	0.30	1.11	0.49	3.97	1.26	1.19	4.67		1.17		14.16
1949-50				0.01	0.70	1.18	3.51	3.28	0.86	1.00	0.15	0.11	10.83
1950-51			0.22	2.48	3.49	4.58	2.24	2.04	0.53	0.76	0.76		17.10
1951-52			0.11	3.01	3.96	3.03	6.57	1.35	2.36	1.05	Tr.	0.43	21.87

APPENDIX D

RECORDS OF DAILY RUNOFF IN SUTTER-YUBA AREA NOT PREVIOUSLY PUBLISHED

TABLE OF CONTENTS

RECORDS OF DAILY RUNOFF IN SUTTER-YUBA AREA NOT PREVIOUSLY PUBLISHED

COON CREEK AT HIGHWAY 99E
1947 AND 1948

(Daily mean flow, in second-feet)

Date	1947		1948											
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	14	12	15	21	34	76	64	6	6	9	24	21	26
2	....	14	16	15	18	33	54	40	6	6	10	24	42	18
3	....	13	39	17	15	77	47	31	7	6	10	22	58	30
4	....	13	32	18	16	80	38	33	8	5	10	22	65	44
5	26	14	30	21	15	113	34	35	10	5	10	22	52	34
6	22	15	29	49	12	125	30	34	15	4	10	26	50	57
7	21	15	46	56	12	49	22	32	12	4	10	21	46	38
8	20	14	178	34	12	55	28	31	17	5	9	21	43	44
9	18	13	54	72	15	101	28	34	21	7	8	21	44	39
10	17	13	42	87	18	490	36	31	27	10	9	24	43	31
11	16	12	34	44	12	157	29	25	25	7	8	24	40	26
12	15	13	29	34	12	96	19	23	22	13	9	31	37	23
13	14	13	25	29	34	71	20	22	20	10	9	31	34	68
14	14	13	22	25	89	65	37	21	13	10	8	30	34	95
15	18	14	21	25	81	58	42	19	7	10	7	32	37	67
16	23	15	20	25	64	61	38	18	7	9	10	33	44	47
17	22	18	18	24	89	156	31	16	7	8	12	30	44	138
18	19	20	13	23	57	81	38	14	8	7	12	21	45	92
19	17	20	18	23	86	55	46	13	9	9	19	17	45	53
20	16	18	17	21	63	44	96	11	7	10	18	14	41	43
21	15	19	16	21	48	42	160	10	6	10	18	15	38	38
22	14	18	16	19	39	96	115	9	4	10	20	15	34	33
23	14	17	15	17	54	57	86	8	3	13	23	15	31	30
24	15	15	18	16	719	43	71	7	4	12	23	15	19	28
25	18	11	17	15	299	36	61	8	6	10	24	11	18	29
26	17	11	15	15	108	32	43	10	7	10	24	11	18	46
27	15	12	15	16	74	30	32	9	6	10	22	11	17	240
28	14	15	15	21	55	31	32	10	5	10	22	12	17	123
29	13	14	15	25	50	57	33	9	5	16	26	12	18	67
30	13	13	15	....	43	107	31	7	4	18	24	13	26	50
31	....	13	15	....	38	....	46	....	5	9	....	17	....	47
Mean	....	14.6	28.2	28.4	73.2	84.4	48.4	21.1	10.0	9.0	14.4	10.6	36.8	56.3
Runoff, in acre-feet	....	897	1,730	1,630	4,499	5,022	2,973	1,258	613	553	859	1,263	2,184	3,459

AUBURN RAVINE AT HIGHWAY 99E
1947 AND 1948

(Daily mean flow, in second-feet)

Date	1947		1948											
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1		7	36	54	57	81	37	85	69	69	62	11	12	12
2		7	49	52	62	85	15	70	76	76	62	12	17	25
3		7	56	52	56	117	9	54	71	67	62	9	21	39
4		9	42	57	51	118	16	55	66	67	62	7	13	39
5		11	42	66	55	98	15	51	65	67	62	8	10	31
6		11	43	96	50	80	10	52	61	67	72	6	11	47
7		11	75	74	45	62	9	48	60	67	62	3	10	31
8		12	133	64	49	51	14	48	62	69	62	2	10	44
9		14	81	98	54	66	12	52	57	68	63	2	9	31
10		11	78	81	50	64	11	60	60	67	63	2	9	29
11		11	72	68	48	61	7	63	65	68	63	4	8	27
12		11	68	66	48	54	16	56	70	69	62	6	9	28
13	7	9	62	64	68	56	52	47	82	68	61	5	9	70
14	9	8	62	62	86	54	61	49	80	66	61	5	6	32
15	22	8	58	61	89	63	70	57	79	67	63	5	11	71
16	22	8	58	61	86	46	68	58	78	67	62	4	9	52
17	14	44	56	61	82	66	67	62	77	67	50	4	16	108
18	12	42	54	61	70	44	80	62	79	66	51	3	11	70
19	11	37	53	59	102	38	107	66	78	63	52	8	11	51
20	11	44	54	56	77	35	115	62	75	59	45	16	11	47
21	10	44	55	53	61	32	53	58	71	58	24	17	11	43
22	11	40	56	54	55	62	44	55	70	60	22	15	10	41
23	11	38	55	51	56	38	58	63	70	50	23	6	13	40
24	11	35	52	52	289	29	57	55	69	59	22	5	25	40
25	9	32	51	55	192	26	54	59	70	58	15	8	23	38
26	7	33	48	54	117	23	50	71	70	58	16	8	22	52
27	8	33	51	54	83	20	48	67	69	58	15	7	26	108
28	6	33	51	68	53	20	50	67	70	58	12	11	27	70
29	6	34	51	58	82	55	56	66	70	60	11	9	23	54
30	6	35	50		104	56	61	63	69	62	13	9	13	54
31		35	52		92		89		69	62		11		51
Mean	10.7	23.0	58.3	62.5	79.8	56.9	45.5	59.3	70.2	64.3	45.5	7.4	13.4	47.6
Runoff, in acre-feet	386	1,416	3,578	3,594	4,897	3,382	2,799	3,531	4,318	3,947	2,707	452	825	2,926

DRY CREEK NEAR WALDO
1947 AND 1948

(Daily mean flow, in second-feet)

Date	1947		1948											
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-----	2	2	5	16	37	95	36				e 1	14	8
2	-----	2	33	5	10	32	67	30				e 2	26	8
3	-----	2	62	5	9	28	58	28				e 3	24	9
4	-----	2	20	6	9	27	51	28				e 4	28	16
5	-----	2	43	6	9	44	43	28				e 5	14	13
6	-----	2	20	26	9	156	38	25				e 6	12	35
7	-----	2	388	28	9	105	34	20				e 7	9	24
8	-----	2	312	11	9	80	37	19				e 7	8	22
9	-----	2	78	66	9	130	38	16				e 8	7	37
10	5	2	37	84	9	556	36	16				e 8	7	23
11	5	3	26	37	9	292	30	16				e 9	7	18
12	5	4	20	24	9	146	27	16				e 9	7	14
13	5	5	18	19	107	100	23	e16				e10	7	73
14	5	6	15	16	189	90	20	e15				e10	7	106
15	5	7	14	14	146	89	20	e14				e11	7	57
16	5	9	13	14	136	101	19	e13	NO FLOW	NO FLOW	NO FLOW	e11	7	42
17	4	9	12	13	159	407	18	e12				e12	7	79
18	4	8	11	13	88	156	33	e11				e12	7	115
19	3	7	10	13	136	100	64	e10				12	7	42
20	3	6	10	12	86	84	103	e10				12	7	23
21	2	5	9	12	56	67	73	e 9				12	7	17
22	2	4	9	11	39	222	44	e 8				12	6	14
23	2	3	8	10	131	174	38	e 7				12	6	12
24	2	2	7	10	727	95	30	e 6				12	6	10
25	2	2	6	9	316	74	28	e 5				12	7	10
26	2	2	6	9	142	67	28	e 4				12	7	10
27	2	2	6	9	92	58	26	e 3				12	7	138
28	2	2	5	9	71	59	26	e 2				12	7	132
29	2	2	5	12	58	112	28	e 1				12	8	48
30	2	2	5	-----	44	130	67	e 1				12	8	30
31	-----	2	5	-----	41	-----	49	-----				12	-----	24
Mean	-----	13.6	39.2	18.1	93.0	127.0	41.7	14.2				9.4	9.6	38.9
Runoff, in acre-feet	-----	222	2,410	1,008	5,712	7,575	2,561	843				577	571	2,398

e—Estimated.

DRY CREEK NEAR WALDO—1949

(Daily mean flow, in second-feet)

Date	January	February	March	April	May
1	57	15	34	51	16
2	80	15	187	38	12
3	40	17	580	32	16
4	28	26	475	18	NO RECORD
5	23	130	390	14	
6	19	112	335	35	
7	18	147	220	37	
8	16	132	154	16	
9	14	78	171	15	
10	13	71	780	12	
11	12	306	780	8	
12	12	130	278	5	
13	12	73	187	5	
14	12	52	137	5	
15	11	42	120	6	
16	11	36	162	8	
17	10	33	120	7	
18	10	32	86	4	
19	11	28	171	4	
20	18	28	137	4	
21	17	38	103	5	
22	53	32	122	5	
23	63	57	148	5	
24	37	67	187	5	
25	29	59	137	4	
26	26	44	122	3	
27	24	57	119	4	
28	22	48	114	4	
29	20	------	103	5	
30	17	------	68	9	
31	15	------	51	------	
Mean	24.2	69.9	222.9	12.6	
Runoff, in acre-feet	1,488	3,878	13,756	728	

SOUTH HONCUT CREEK AT LA PORTE ROAD

1947 AND 1948

(Daily mean flow, in second-feet)

Date	1947		1948											
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	------	5	6	5	16	46	118	47				------	25	5
2		5	122	9	17	38	90	38				------	54	5
3		6	104	10	14	95	78	34				------	66	13
4		11	114	11	11	122	70	37				------	32	34
5		15	132	24	10	147	65	44				------	15	31
6	------	11	61	50	9	132	61	38				------	9	90
7		8	472	46	7	80	52	34				------	8	48
8	6	7	224	28	4	73	48	28				------	6	67
9	7	7	77	48	12	430	43	25				------	5	46
10	6	8	130	70	9	580	40	23				------	5	27
11	5	8	38	44	3	271	35	22				------	5	19
12	5	8	34	33	2	158	32	21				8	4	15
13	5	7	30	28	50	118	27	20				5	4	78
14	6	8	27	24	252	115	27	19				3	3	89
15	9	9	25	23	122	132	26	18				4	12	61
16	14	10	24	22	168	127	26	17	NO FLOW	NO FLOW	NO FLOW	5	27	49
17	13	20	22	21	342	406	26	16				6	27	66
18	10	27	21	20	171	158	40	15				7	24	82
19	6	18	20	18	171	115	69	14				6	17	47
20	5	12	19	17	93	95	104	13				6	15	34
21	5	15	19	16	69	85	81	12				5	12	28
22	5	17	25	15	51	250	52	11				5	9	24
23	5	16	21	11	120	143	40	10				5	8	22
24	5	13	21	10	619	101	34	9				5	7	20
25	5	12	21	10	283	81	34	8				5	7	17
26	4	10	13	10	136	70	32	7				6	6	25
27	4	10	12	10	95	64	27	6				5	6	216
28	5	10	11	15	73	73	35	5				3	6	113
29	4	10	10	28	64	132	34	3				5	7	61
30	4	8	7		54	184	63	1				9	7	46
31		7	5		16		69					10	------	38
Mean	6.2	10.9	60.2	24.1	94.5	154.2	51.0	19.9				5.7	14.6	49.0
Runoff, in acre-feet	284	670	3,703	1,341	5,796	9,166	3,130	1,180				226	869	3,007

APPENDIX E

RECORDS OF DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

TABLE OF CONTENTS

RECORDS OF DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

The wells are numbered in accordance with a system adopted by the United States Geological Survey. The numbering system indicates the well locations according to the rectangular land surveys. An explanation of the numbering system is given on page 93 of Appendix B.

Reference point elevations given to the nearest foot have been estimated from United States Geological Survey topographic maps. Reference point elevations given to the nearest 0.1 foot have been established by field surveys.

TABLE 1

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

10N/3E-1A1—Reference point—top of 12-inch casing, elevation 23 feet. West side of Garden Highway at toe of levee, 0.75 mile southwest of Riego Road. 12/7/48, 15.1; 4/6/49, 10.7; 11/30/49, 15.7; 3/30/50, 6.4; 11/9/50, 15.6; 4/5/51, 10.2; 12/4/51, 14.0; 4/4/52, 0.0.

10N/4E-6K1—Reference point—top of 14-inch casing under pump, elevation 20 feet, 0.06 mile south of Riego Road, 0.47 mile west of Power Line Road. 12/23/47, 10.9; 3/4/48, 11.0; 12/7/48, 10.0; 4/6/49, 5.0; 12/1/49, 8.2; 3/30/50, 6.9; 1/9/50, 8.0; 12/4/51, 7.7; 4/4/52, 6.3.

10N/4E-12A1—Reference point—top of casing, elevation 43.1 feet, 0.10 mile west of Pleasant Grove Road, 0.70 mile south of Riego Road. 12/23/47, 22.0; 3/3/48, 20.6; 12/7/48, 28.1; 4/6/49, 23.2; 11/23/49, 36.1; 12/1/49, 27.2; 3/15/50, 29.5; 3/30/50, 28.7; 11/9/50, 35.0; 4/5/51, 25.9; 12/5/51, 26.7; 4/4/52, 24.4.

10N/5E-6J1—Reference point—top of wooden shoring for pit, 12.5 feet above casing, elevation 46 feet, 0.12 mile south of Riego Road, 0.82 mile east of Pleasant Grove Road. 12/24/47, 27.1; 3/3/48, 27.0; 12/7/48, 33.9 (operating); 4/6/49, 29.6; 12/1/49, 33.6; 3/30/50, 34.9; 11/9/50, 40.3; 4/5/51, 38.2; 12/5/51, 33.1; 4/8/52, 42.4 (operating).

10N/5E-8N1—Reference point—top of casing, elevation 37 feet, 1.5 miles south of Riego Road, 1.06 miles east of Pleasant Grove Road. 12/24/47, 25.3.

11N/3E-1D1—Reference point—hole in side of pump base, elevation 25.6 feet. South side of West Catlett Road, 0.18 mile east of Garwood Road. 12/19/47, 12.0; 3/4/48, 11.6; 12/15/48, 11.0; 3/30/49, 6.5; 5/26/49, 20.1; 6/29/49, 23.4; 7/28/49, 23.1; 8/26/49, 23.4; 12/5/49, 14.5; 3/24/50, 8.3; 11/16/51, 12.5; 4/7/52, 5.9.

11N/3E-2B1—Reference point—top of concrete base, elevation 23.8 feet. South side of West Catlett Road, 0.37 mile west of Garwood Road. 12/19/47, 11.0; 3/4/48, 10.8; 12/15/48, 12.3; 3/3/49, 5.9; 12/5/49, 14.1; 3/24/50, 7.4; 11/6/50, 12.4; 4/2/51, 5.1; 11/16/51, 11.7; 4/8/52, 6.1.

11N/3E-2Q1—Reference point—top of casing, elevation 20 feet. 0.50 mile east of Vernon Road, 0.89 mile south of West Catlett Road. 12/9/48, 11.9; 4/6/49, 5.7; 11/28/49, 14.0; 3/30/50, 7.1; 11/8/50, 11.2; 4/3/51, 5.1; 12/5/51, 11.0.

11N/3E-3C2—Reference point—west side of pump base, elevation 26.1 feet. South side of West Catlett Road, 1.57 miles north of Garwood Road. 12/19/48, 13.4; 3/4/48, 11.4; 12/15/48, 13.1; 3/30/49, 7.5; 12/5/49, 15.2; 3/24/50, 7.6; 11/6/50, 13.0; 4/2/51, 5.0; 4/8/52, 1.7.

11N/3E-3N1—Reference point—hole in pump base, elevation 25 feet, 0.85 mile west of Vernon Road, 0.93 mile south of West Catlett Road. 12/9/48, 13.1; 3/31/49, 6.2; 11/28/49, 14.9; 3/30/50, 5.9; 11/18/50, 13.1; 4/1/52, 0.0.

11N/3E-3P1—Reference point—hole in pump base, elevation 22 feet, 0.74 mile west of Vernon Road, 0.82 mile south of West Catlett Road. 12/9/48, 12.4; 11/8/50, 13.1; 4/3/51, 6.2, 12/5/51, 11.9; 4/1/52, 5.3.

11N/3E-10N1—Reference point—pipe in pump base, elevation 26 feet, 0.80 mile west of Vernon Road, 1.75 miles south of West Catlett Road. 3/31/49, 11.3; 11/28/49, 19.1.

11N/3E-11D1—Reference point—top of casing, elevation 21 feet. 0.14 mile east of Vernon Road, 1.08 miles south of West Catlett Road. 12/9/48, 8.3; 4/6/49, 4.5; 11/28/49, 12.2; 3/30/50, 4.9; 11/8/50, 7.7; 4/3/51, 2.7; 4/2/52, 1.9.

11N/3E-13A1—Reference point—top of casing, elevation 20 feet. 0.70 mile north of north levee of Natomas Cross Canal, 1.15 miles northeast of Garden Highway. 12/9/48, 7.6; 4/6/49, 3.3; 11/29/49, 9.4; 3/30/50, 3.6; 11/8/50, 10.0; 4/2/51, 3.0; 12/5/51, 9.5.

11N/3E-13D1—Reference point—hole in pump base, elevation 20 feet. 1.10 miles north of north levee of Natomas Cross Canal. 0.86 mile northeast of Garden Highway. 12/9/48, 11.9; 4/6/49, 7.4; 11/29/49, 13.0; 3/30/50, 8.5; 11/8/50, 13.5; 4/2/51, 7.5; 12/5/51, 13.0.

11N/3E-13F1—Reference point—hole in pump base, elevation 20 feet, 0.75 mile north of north levee of Natomas Cross Canal, 1.13 miles northeast of Garden Highway. 12/9/48, 12.5; 4/6/49, 8.3; 14/29/49, 14.2.

11N/3E-13P1—Reference point—hole in pump base, elevation 20 feet. At toe of north levee of Natomas Cross Canal, 1.37 miles northeast of Garden Highway, 4/6/49, 7.7; 11/29/49, 11.8.

11N/3E-14N1—Reference point—hole in pump base, elevation 25 feet, 0.14 mile east of Vernon Road, 0.60 mile north of Garden Highway. 12/9/48, 12.7.

11N/3E-15C1—Reference point—hole in pump base, elevation 25 feet. 1.50 miles north of Garden Highway, 0.78 miles west of Vernon Road. 12/24/47, 16.9; 3/4/48, 16.2; 12/9/48, 16.1; 3/31/49, 9.9; 11/28/49, 17.9; 3/30/50, 7.9; 11/8/50, 16.1; 4/3/51, 10.3; 12/4/51, 15.0; 4/1/52, 1.1.

11N/3E-22H1—Reference point—top of casing, elevation 27 feet. North side of Garden Highway, 0.23 mile northwest of Verona 12/24/47, 18.8; 3/4/48, 18.2; 12/9/48, 18.0; 3/31/49, 11.6; 11/28/49, 18.2; 3/30/50, 9.9; 11/8/50, 16.2; 4/3/51, 11.4; 12/5/51, 15.7; 4/1/52, 3.3.

11N/3E-22H2—Reference point—top of casing, elevation 29 feet. Northeast side of Garden Highway, east side of Vernon Road. 11/7/29, 24.3; 9/27/30, 24.3; 12/15/31, 24.3; 11/23/32, 25.2; 12/21/33, 21.6; 10/27/34, 27.3; 11/28/34, 20.3; 11/25/36, 24.8; 11/6/37, 23.8; 1/10/39, 20.8.

11N/3E-22H3—Reference point—top of casing, elevation 29 feet. 300 feet north of Garden Highway, west side of Vernon Road. 12/20/40, 19.9.

11N/3E-23E2—Reference point—top of casing, elevation 27 feet. 100 feet north of Garden Highway, 0.07 mile east of Vernon Road. 11/11/47, 19.7; 12/16/48, 19.0; 12/9/49, 19.0; 11/13/50, 19.3; 12/6/51, 5.9.

11N/3E-23L1—Reference point—top of casing, elevation 29 feet. 0.12 mile north of Garden Highway, 0.47 mile southeast of Vernon Road. 12/23/47, 12.3; 3/4/48, 11.9; 12/9/48, 10.9; 3/31/49, 3.9; 11/28/49, 12.9.

11N/3E-23R1—Reference point—top of casing, elevation 20 feet. At toe of south levee of Natomas Cross Canal, 0.11 mile north of Garden Highway. 12/23/47, 12.1; 3/4/48, 16.0; 12/8/48, 15.2; 3/31/49, 6.9; 11/28/49, 16.1.

11N/3E-25C1—Reference point—top of casing, elevation 23 feet. 0.24 mile south of Sankey Road, 0.44 mile east of Garden Highway. 12/9/48, 11.3; 4/6/49, 7.3; 3/30/50, 7.6; 11/9/50, 10.9; 4/5/51, 5.6; 12/5/51, 11.3; 4/4/52, 4.4.

11N/3E-25P1—Reference point—top of casing, elevation 25 feet. 265 feet northwest of Garden Highway, 1.27 miles north of Riego Road. 11/7/29, 19.0; 9/27/30, 19.3; 12/15/31, 19.5; 11/23/32, 20.2; 12/21/33, 16.6; 10/27/34, 18.1; 11/28/34, 15.6; 11/25/36, 19.2; 11/6/37, 14.7; 1/10/39, 15.6; 12/20/40, 15.0; 11/11/47, 15.5; 12/23/47, 16.6; 3/4/48, 16.0; 12/1/49, 15.6; 4/6/49, 11.9; 11/13/50, 13.5; 12/6/51, 8.3.

11N/4E-1F1—Reference point—top of casing, elevation 49.3 feet, 0.80 mile south of Catlett Road, 0.25 mile east of Pleasant Grove Road. 12/22/47, 21.5; 3/22/48, 19.3; 12/18/48, 23.3; 3/29/49, 19.5; 12/2/49, 25.9; 3/27/50, 22.8; 11/8/50, 27.0; 11/16/51, 27.0; 4/8/52, 17.5.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

11N/4E-1M1—Reference point—concrete floor of pump house, elevation 45 feet, 0.55 mile north of Howsley Road, 0.12 mile east of Pleasant Grove Road. 11/8/29, 13.8; 9/26/30, 13.3; 12/10/31, 14.9; 11/23/32, 14.3; 12/20/33, 15.9; 10/27/34, 16.2; 11/23/36, 13.9; 11/1/37, 12.3; 1/10/39, 11.3; 1/4/41, 11.4; 11/11/47, 22.9; 12/16/48, 22.1; 12/9/49, 24.4; 11/13/50, 24.2; 12/6/51, 27.8.

11N/4E-1R1—Reference point—joint in cover plate around casing, elevation 50 feet. North side of Howsley Road, 1.0 mile east of Pleasant Grove Road. 12/23/47, 24.7; 3/3/48, 22.6; 12/8/48, 25.1; 3/31/49, 22.8; 11/30/49, 25.9; 11/14/50, 28.7.

11N/4E-2M1—Reference point—top of casing, elevation 40 feet. West side of Western Pacific Railroad, 0.29 mile north of Howsley Road. 3/15/48, 11.9; 12/8/48, 15.5; 3/29/49, 9.5; 12/2/49, 16.4.

11N/4E-3P1—Reference point—hole in base of pump, elevation 33 feet, 0.15 mile north of Howsley Road, 0.47 mile east of Pacific Avenue. 12/22/47, 19.8; 3/15/48, 18.1; 12/18/48, 21.1; 3/29/49, 14.4; 12/2/49, 21.3; 3/24/50, 16.3; 11/8/50, 21.6; 4/2/51, 12.3; 11/19/51, 20.8; 4/8/52, 13.2.

11N/4E-4R1—Reference point—top of casing, elevation 30 feet. 0.03 mile north of Howsley Road, 0.16 mile west of Pacific Avenue. 12/23/47, 14.7; 3/15/48, 13.1; 12/15/48, 10.2; 2/30/49, 3.9; 12/2/49, 15.9; 3/24/50, 9.8; 11/8/50, 16.0; 4/2/51, 8.0; 11/19/51, 14.7; 4/6/52, 6.1.

11N/4E-5A1—Reference point—top of casing, elevation 27 feet. 1.10 miles north of Natomas Cross Canal. 12/18/47, 9.9; 12/15/48, 9.9; 3/30/49, 3.8; 5/26/49, 18.1; 7/29/49, 20.1.

11N/4E-6B1—Reference point—hole in pump base, elevation 30 feet. South side of West Catlett Road, 1.50 miles west of Electric Avenue. 12/18/47, 11.5; 12/15/48, 15.1; 3/24/50, 7.9; 11/19/51, 14.0.

11N/4E-7H1—Reference point—edge of pump base, elevation 23 feet. 0.47 mile north of Natomas Cross Canal, 3 miles northeast of Garden Highway. 4/6/49, 10.1; 11/30/49, 12.3; 3/30/50, 10.6; 11/8/50, 14.5; 4/2/51, 9.3.

11N/4E-9C1—Reference point—top of casing, elevation 27 feet. 0.56 mile west of Sacramento Northern Railroad, 0.21 mile south of Howsley Road. 5/5/48, 37.0 (operating); 5/31/48, 10.8; 7/2/48, 49.0 (operating); 7/23/48, 50.5 (operating); 4/6/49, 7.7; 11/30/49, 14.0.

11N/4E-9L1—Reference point—top of casing, elevation 26 feet. 0.45 mile west of Sacramento Northern Railroad crossing on Howsley Road, 0.57 mile south of Howsley Road. 5/5/48, 48.2 (operating) 5/31/48, 12.7; 7/23/48, 50.5 (operating); 4/6/49, 8.8; 11/30/49, 14.2.

11N/4E-11C1—Reference point—top of casing, elevation 41 feet. 0.35 mile east of Western Pacific Railroad, 0.16 mile south of Howsley Road. 3/3/48, 19.9; 3/31/49, 18.8.

11N/4E-11C2—Reference point—top of casing, elevation 45 feet. 0.18 mile south of Howsley Road, 0.40 mile east of Western Pacific Railroad. 12/22/47, 23.1; 12/8/48, 25.1; 3/31/49, 21.0; 11/30/49, 25.8; 3/30/50, 21.2; 11/9/50, 28.1; 4/5/51, 19.2; 12/4/51, 27.1; 1/4/52, 17.6.

11N/4E-11N1—Reference point—top of casing, elevation 38 feet. North side of Fifield Road, west side of Western Pacific Railroad. 12/23/47, 21.2; 3/3/48, 18.6; 12/8/48, 25.5; 4/6/49, 18.0; 11/30/49, 25.1.

11N/4E-12C1—Reference point—top of casing, elevation 46 feet. 0.03 mile east of Pleasant Grove Road, 0.03 mile south of Howsley Road. 11/26/48, 27.2.

11N/4E-12C2—Reference point—top of casing, elevation 50.0 feet. 0.12 mile east of Pleasant Grove Road, 0.02 mile south of Howsley Road. 12/22/47, 23.4; 3/3/48, 20.9; 12/8/48, 23.6; 3/31/49, 22.1; 11/30/49, 23.9.

11N/4E-12H1—Reference point—top of casing, elevation 56.8 feet. 0.76 mile east of Pleasant Grove Road, 0.57 mile south of Howsley Road. 12/7/48, 27.8.

11N/4E-12J2—Reference point—top of casing, elevation 56.8 feet. 0.58 mile south of Howsley Road, 0.78 mile east of Pleasant Grove Road. 12/23/47, 27.3; 3/3/48, 25.2; 12/8/48, 28.2; 3/31/49, 24.7; 11/17/49, 30.8; 11/30/49, 28.9; 3/30/50, 28.0; 4/11/50, 26.9; 11/8/50, 32.5; 11/14/50, 32.4; 4/5/51, 28.9; 11/15/51, 34.0; 4/3/52, 29.2; 4/4/52, 29.6.

11N/4E-12M1—Reference point—slot in base, elevation 44.7 feet. 0.62 mile south of Howsley Road, 0.07 mile west of Pleasant Grove Road. 12/23/47, 22.8; 3/3/48, 19.8; 12/8/48, 24.6; 3/31/49, 20.4; 5/26/49, 26.2; 6/29/49, 25.1; 7/28/49, 32.8; 11/30/49, 27.2; 3/30/50, 23.1; 11/6/50, 28.2; 4/10/51, 23.5; 11/14/51, 35.0; 4/4/52, 23.2.

11N/4E-13D1—Reference point—top of casing, elevation 47.6 feet. West side of Pleasant Grove Road, 0.09 mile south of Fifield Road. 12/8/48, 28.5; 4/6/49, 18.0; 11/30/49, 27.0; 3/15/50, 23.3; 3/30/50, 24.1; 11/8/50, 30.1; 4/5/51, 25.0; 11/14/51, 32.6; 4/4/52, 29.5; 4/10/52, 25.2.

11N/4E-13M1—Reference point—top of casing in pit, elevation 46 feet. 0.12 mile west of Pleasant Grove Road, 0.37 mile north of Keys Road. 12/23/47, 15.9; 12/8/48, 19.1; 3/31/49, 14.0; 11/30/49, 21.7.

11N/4E-14B1—Reference point—top of casing, elevation 40 feet. 0.10 mile south of Howsley Road, 0.52 mile west of Pleasant Grove Road. 12/23/47, 25.8; 3/3/48, 21.8; 12/8/48, 27.8; 3/31/49, 21.1; 11/30/49, 29.6.

11N/4E-14D1—Reference point—top of casing, elevation 36.5 feet. 0.21 mile west of Western Pacific Railroad, 0.26 mile south of Fifield Road. 12/23/47, 21.2; 3/3/48, 18.6; 12/8/48, 25.5; 4/6/49, 18.0; 11/30/49, 25.1.

11N/4E-15C1—Reference point—top of casing, elevation 31.2 feet. South side of Fifield Road, 0.11 mile west of Sacramento Northern Railroad. 12/23/47, 16.9; 3/3/48, 14.9; 12/8/48, 20.0; 4/6/49, 12.9; 11/30/49, 18.8; 3/30/50, 14.4; 11/8/50, 19.5; 4/3/51, 11.0; 12/4/51, 19.1; 4/4/52, 7.2.

11N/4E-15Q1—Reference point—hole in pump base, elevation 33.6 feet. 0.80 mile west of Sacramento Northern Railroad, 0.22 mile north of Keys Road. 12/23/47, 18.5; 3/3/48, 16.8; 12/8/48, 23.5; 4/6/49, 16.0; 11/30/49, 22.2; 3/30/50, 17.9; 11/8/50, 23.5; 4/3/51, 14.7; 12/5/51, 23.0; 4/4/52, 12.6.

11N/4E-21R1—Reference point—top of casing, elevation 24.9 feet. 1.06 miles east of Burns Road, 0.22 mile north of Sankey Road. 12/23/47, 9.9; 3/3/48, 9.6; 12/8/48, 12.3; 4/6/49, 8.0.

11N/4E-22A1—Reference point—top of casing, elevation 32.7 feet. 0.18 mile west of Sacramento Northern Railroad crossing. 12/8/48, 23.5; 4/6/49, 15.2; 11/30/49, 22.6.

11N/4E-23C1—Reference point—top of casing, elevation 37 feet. 0.09 mile south of Keys Road, 0.09 mile east of Western Pacific Railroad. 12/23/47, 21.0; 3/3/48, 18.6; 11/30/49, 26.6; 3/30/50, 22.1; 11/8/50, 28.7; 4/3/51, 20.3; 12/4/51, 28.0; 4/4/52, 20.1.

11N/4E-23H1—Reference point—top of casing, elevation 53.1 feet. 0.02 mile west of Pleasant Grove Road, 0.46 mile south of Keys Road. 12/23/47, 19.5; 3/3/48, 18.0; 12/8/48, 24.1; 4/6/49, 19.8; 11/30/49, 32.2; 3/30/50, 24.6; 11/8/50, 30.7; 4/5/51, 21.6; 12/4/51, 29.2.

11N/4E-23N1—Reference point—top of concrete pit wall, elevation 33 feet. 0.06 mile west of Sacramento Northern Railroad, 0.11 mile north of Sankey Road. 12/23/47, 21.3.

11N/4E-25M1—Reference point—hole in base, elevation 37 feet. 0.58 mile south of Sankey Road, 0.06 mile east of Pleasant Grove Road. 12/23/47, 19.0; 3/3/48, 20.2; 12/8/48, 24.9; 4/6/49, 21.0; 12/1/49, 34.6; 3/30/50, 29.9; 4/4/50, 34.9.

11N/4E-26F1—Reference point—hole in base of pump, elevation 37 feet. 0.40 mile south of Sankey Road, 0.05 mile west of Sacramento Northern Railroad. 12/8/48, 28.0; 4/6/49, 23.0; 12/8/48, 11.9; 3/30/50, 29.9; 11/9/50, 29.1; 12/6/51, 37.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

11N/4E-28J1—Reference point—top of casing, elevation 34.3 feet. 0.70 mile south of Sankey Road, 0.40 mile west of Pacific Avenue. 3/4/48, 20.4; 12/8/48, 23.6; 4/6/49, 19.2; 12/1/49, 25.3; 3/30/50, 22.5; 11/9/50, 29.1; 4/5/51, 21.4; 12/6/51, 30.5; 4/4/52, 22.8.

11N/4E-33J1—Reference point—top of casing, elevation 25.6 feet. 0.03 mile west of Pacific Avenue, 0.28 mile north of Riego Road. 3/4/48, 13.4; 12/7/48, 15.7; 4/6/49, 12.2; 5/26/40, 11.0; 12/1/49, 17.4; 3/30/50, 14.0; 11/9/50, 14.6; 4/5/51, 12.7; 12/6/51, 14.1; 4/4/52, 14.9.

11N/4E-36E1—Reference point—top of concrete pit wall, elevation 39 feet. 0.07 mile east of Pleasant Grove Road, 0.70 mile north of Riego Road. 12/24/47, 22.3; 3/3/48, 23.0; 12/7/48, 28.9; 4/6/49, 24.9; 12/1/49, 38.7; 3/30/50, 23.2; 11/9/50, 44.4; 4/4/52, 19.0.

11N/5E-6N1—Reference point— top of casing, elevation 50 feet. North side Howsley Road, 0.80 mile east of Pleasant Grove Road. 12/23/47, 24.7; 3/3/48, 22.6; 12/8/48, 25.1; 3/31/49, 22.8; 11/30/49, 25.9; 11/14/50, 28.7; 3/22/51, 26.2.

11N/5E-18N1—Reference point— top of casing, elevation 50 feet. North side of Keys Road, 0.85 mile east of Pleasant Grove Road. 12/24/47, 27.3; 3/3/48, 26.5; 12/8/48, 30.1; 11/30/49, 31.8; 11/14/50, 33.1; 3/22/51, 31.2.

11N/5E-30M1—Reference point—top of casing, elevation 47 feet. 1.05 miles east of Pleasant Grove Road, 0.59 mile south of Sankey Road. 12/24/47, 18.8; 3/3/48, 18.7; 12/8/48, 22.4; 12/1/49, 23.4; 3/30/50, 24.4; 11/9/50, 23.4; 12/5/51, 23.4; 4/4/52, 32.5.

12N/3E-1E1—Reference point—top of casing, elevation 33 feet. 0.10 mile northeast of Garden Highway, 0.20 mile northwest of Sutter Avenue. 12/4/47, 13.6; 3/10/48, 10.0; 12/11/48, 13.2; 3/16/49, 8.3; 12/6/49, 12.6; 3/29/50, 7.5; 11/15/51, 11.1; 4/4/52, 5.9.

12N/3E-1L1—Reference point—top of casing, elevation 31 feet. 150 feet northwest of Sutter Avenue, 0.12 mile northeast of Garden Highway. 12/4/47, 12.6; 3/10/48, 12.1; 12/11/48, 12.9; 3/16/49, 8.0; 12/6/49, 12.5; 11/3/50, 13.2; 4/2/51, 5.3; 11/3/51, 13.2; 4/4/52, 3.3.

12N/3E-2B1—Reference point—top of casing, elevation 31 feet. 0.08 mile east of Garden Highway, 0.49 mile north of Chandler Road. 12/4/47, 9.1; 3/10/48, 9.4; 12/11/48, 9.7; 3/16/49, 6.5; 12/6/49, 8.6.

12N/3E-2E1—Reference point—top of casing, elevation 29 feet. North side of Chandler Road, 0.48 mile west of Garden Highway. 12/4/47, 9.9; 3/10/48, 5.8; 5/11/48, 4.7; 12/11/48, 8.8; 3/16/49, 4.1; 5/26/49, 3.1; 6/29/49, 3.2; 7/27/49, 2.6; 8/25/49, 3.3. Well destroyed.

12N/3E-2J1—Reference point—top of casing, elevation 30 feet. South side of Garden Highway, 0.30 mile northwest of Sutter Avenue. 12/4/47, 12.2; 3/10/48, 8.9; 12/11/48, 12.8; 3/16/49, 8.3; 12/6/49, 11.7.

12N/3E-2K1—Reference point—top of casing, elevation 30 feet. South side of Garden Highway, 0.54 mile west of Sutter Avenue. 12/4/47, 12.2; 3/10/48, 4.9; 5/11/48, 6.7; 3/16/49, 4.8; 12/6/49, 7.5.

12N/3E-3K1—Reference point—top of casing, elevation 25 feet. 0.89 mile west of Garden Highway, 0.08 mile south of Chandler Road. 11/7/29, 8.0; 9/27/30, 6.4; 12/12/31, 6.5; 11/25/32, 10.1; 12/20/33, 8.3; 11/10/34, 9.1; 11/25/36, 10.8; 11/24/37, 5.0; 1/25/39, 9.6; 1/13/41, 4.6; 11/7/47, 8.5; 12/15/48, 8.3; 12/6/49, 9.2.

12N/3E-3K2—Reference point—top of casing, elevation 25 feet. 0.20 mile south of Chandler Road, 0.89 mile west of Garden Highway. 11/13/50, 24.7; 12/6/51, 3.9.

12N/3E-3Q1—Reference point—hole in base of pump, elevation 32 feet. 0.32 mile south of Chandler Road, 0.89 mile west of Garden Highway. 11/6/50, 27.4; 4-2-51, 4.8.

12N/3E-12C1—Reference point—top of casing, elevation 30 feet. 0.15 mile southwest of west end of Nicolaus bridge. 12/9/47, 14.9; 3/11/48, 11.9; 12/11/48, 15.0; 12/6/49, 14.7.

12N/3E-13G1—Reference point—top of casing, elevation 30 feet. 0.68 mile north of Lee Road, 0.38 mile southeast of Garden Highway. 12/5/47, 14.3; 3/15/48, 12.4; 12/14/48, 13.8; well destroyed.

12N/3E-13M1—Reference point—top of pit wall, elevation 29 feet. 0.45 mile southwest of Garden Highway, 0.37 mile northwest of Lee Road. 12/5/47, 14.4; 3/11/48, 13.8; 3/25/49, 12.5; well destroyed.

12N/3E-14H1—Reference point—top of pit wall, elevation 30 feet. East side of Garden Highway, 0.99 mile northeast of Lee Road. 12/5/47, 14.7; 3/15/48, 14.2; 12/11/48, 15.0; 3/25/49, 10.1; 12/6/49, 16.1.

12N/3E-14Q1—Reference point—top of casing, elevation 26 feet. South side of Lee Road, 0.12 mile southeast of Garden Highway. 12/5/47, 14.2; 3/11/48, 13.1; 12/11/48, 14.1; 3/25/49, 9.3; 12/6/49, 14.7; 3/29/50, 9.8.

12N/3E-22R1—Reference point—top of casing, elevation 26 feet. East side of Garden Highway, 1.30 miles south of Lee Road. 11/7/29, 12.0; 9/27/30, 12.7; 12/15/31, 13.0; 11/25/32, 14.9; 12/21/33, 11.3; 10/27/34, 14.5; 11/25/36, 14.1; 11/6/37, 13.5; 1/10/39, 11.1; 12/20/40, 8.4; 11/10/47, 14.1.

12N/3E-22R2—Reference point—top of casing, elevation 26 feet. East side of Garden Highway, 1.30 miles south of Lee Road. 12/16/48, 12.3; 12/9/49, 14.0.

12N/3E-22R3—Reference point—top of casing, elevation 26 feet, 0.15 mile southeast of Garden Highway, 1.30 miles south of Lee Road. 11/13/50, 12.8; 12/6/51, 5.5.

12N/3E-23N1—Reference point—top of casing, elevation 25 feet. 0.09 mile east of Garden Highway, 1.10 miles south of Lee Road. 12/19/47, 12.6; 3/4/48, 11.2; 12/15/48, 12.3; 3/30/49, 6.6; 12/5/49, 15.9; 3/24/50, 5.8; 11/6/50, 12.6; 4/2/51, 6.6; 11/16/51, 11.4.

12N/3E-24A1—Reference point—top of casing, elevation 25 feet. South side of Lee Road, 0.58 mile west of Power Line Road. 12/5/47, 12.4; 3/11/48, 11.2; 12/11/48, 12.6; 3/25/49, 9.4; 12/6/49, 13.3.

12N/3E-24Q1—Reference point—top of casing, elevation 25 feet. 0.10 mile north of Striplin Road, 0.30 mile east of Garwood Road. 12/18/47, 11.6; 3/4/48, 10.8; 12/15/48, 12.9; 3/30/49, 7.9; 12/5/49, 14.1; 3/24/50, 9.1; 11/8/50, 12.1; 4/2/51, 4.3; 11/16/51, 12.8; 4/7/52, 3.5.

12N/3E-26N1—Reference point—lower end of flange around discharge pipe, elevation 22 feet. 0.08 mile southwest of Worth Road, 0.90 mile west of Garwood Road. 12/19/47, 11.1; 3/4/48, 9.9; 12/15/48, 14.1; 3/30/49, 7.9; well destroyed.

12N/3E-27Q1—Reference point—hole in base of pump, elevation 22 feet. 0.10 mile east of Garden Highway, 1.30 miles north of Catlett Road. 11/6/50, 12.5; 4/2/51, 7.0.

12N/4E-1B1—Reference point—top of casing, elevation 58 feet. South side of Cornelius Avenue, 0.54 mile east of Pleasant Grove Road. 12/22/47, 21.7; 3/11/48, 20.0; 12/15/48, 21.4; 3/18/49, 20.3; 12/7/49, 26.2.

12N/4E-2B1—Reference point—hole in base of pump, elevation 53 feet. 0.05 mile south of Cornelius Avenue, 0.50 mile north of Pleasant Grove Road. 12/22/47, 19.8; 3/11/48, 21.8; 12/13/48, 27.2; 3/29/49, 20.8; 12/7/49, 26.2; 3/27/50, 22.1; 11/6/50, 30.9; 4/5/51, 24.0; 4/4/52, 24.0.

12N/4E-2Q1—Reference point—hole in base of pump, elevation 51 feet. 0.46 mile north of Trowbridge Road, 0.34 mile west of Pleasant Grove Road. 3/11/48, 15.7; 5/5/48, 13.3; 5/31/48, 14.7; 6/17/48, 35.2; 6/23/48, 38.0; 7/2/48, 20.3; 12/15/48, 17.9; 3/28/49, 11.6; 5/26/49, 19.5; 6/29/49, 20.9; 7/28/49, 21.7; 8/26/49, 21.2; 12/7/49, 19.0; 3/27/50, 15.4; 11/6/50, 23.9; 4/5/51, 15.5; 4/4/52, 13.2.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Meosurements Mode by Division of Woter Resources
(Depths to woter in feet meosured from reference point)

12N 4E-3A1—Reference point—top of casing, elevation 52.4 feet. Southwest corner of intersection of Cornelius Avenue and Pleasant Grove Road. 3/11/48, 19.9; 12/14/48, 22.5; 3/29/49, 19.8; 12/7/49, 21.5.

12N 4E-3B1—Reference point—top of casing, elevation 49 feet. South side of Cornelius Avenue, 0.55 mile east of Pacific Avenue. 12/22/47, 21.4; 12/14/48, 23.7; 3/29/49, 19.9; 12/7/49, 24.2.

12N 4E-4A1—Reference point—top of casing, elevation 47 feet. Southwest corner of intersection of Cornelius Avenue and Pacific Avenue. 12/21/40, 19.1; 12/4/47, 24.5; 12/16/48, 26.0; 12/8/51, 31.4.

12N 4E-4A2—Reference point—top of casing, elevation 47 feet. 70.0 feet south of southwest corner of Cornelius Avenue and Pacific Avenue. 11/7/47, 23.7; 12/16/48, 24.8; 12/9/49, 26.0; 11/10/50, 30.0; 12/8/51, 29.8.

12N 4E-4D1—Reference point—top of casing, elevation 42 feet. 0.06 mile south of Cornelius Avenue, 0.12 mile east of Electric Avenue. 12/9/47, 24.1; 3/11/48, 24.2; 5/11/48, 22.4; 12/14/48, 24.9; 3/28/49, 23.4; 12/6/49, 25.8.

12N 4E-4M1—Reference point—top of casing, elevation 40 feet. 0.24 mile east of Electric Avenue, 0.25 mile north of Watts Avenue. 3/11/48, 21.9; 12/14/48, 24.6; 3/28/49, 21.8; 12/7/49, 24.8.

12N 4E-5B1—Reference point—top of wooden pit, elevation 38 feet. South side of Cornelius Avenue, 0.36 mile west of Electric Avenue. 12/9/47, 20.9; 3/11/48, 20.8; 12/14/48, 22.1; 3/28/49, 19.4; 12/6/49, 22.5.

12N/4E-6B1—Reference point—top of wooden pit, elevation 32 feet. 0.29 mile west, 0.14 mile south of west end of Cornelius Avenue. 12/8/47, 14.2; 3/25/48, 12.0; 12/18/48, 13.9; 3/28/49, 8.4; 12/7/49, 15.2.

12N/4E-6Q1—Reference point—top of casing, elevation 30 feet. 1.50 miles west of Electric Avenue, 0.18 mile north of Nicolaus Avenue. 12/8/47, 15.7; 3/25/48, 14.1; 3/16/49, 12.9; 12/6/49, 16.8.

12N/4E-6R1—Reference point—top of casing, elevation 36 feet. 0.22 mile north of Nicolaus Avenue, 1.16 miles west of Electric Avenue. 12/8/47, 6.8; 12/14/48, 7.5; 3/16/49, 4.7; 12/6/49, 8.7.

12N/4E-7B1—Reference point—hole in base of pump, elevation 30 feet. South side of Nicolaus Avenue, 1.41 miles west of Electric Avenue. 12/8/47, 14.8; 5/11/48, 9.8; 12/13/48, 14.5; 3/16/49, 11.4; 6/30/49, 15.0; 7/27/49, 17.1; 12/6/49, 15.8; 3/25/50, 11.1; 11/6/50, 16.5; 4/2/51, 6.6; 11/16/51, 15.7; 4/4/52, 5.5.

12N/4E-7N2—Reference point—bottom of 6″ x 14″ plank bridge over pit, elevation 30 feet. 0.41 mile southeast of Garden Highway, 0.19 mile southwest of Markham Road. 12/5/47, 14.6; 3/15/48, 12.8; 12/11/48, 14.3; 3/25/49, 10.8; 12/6/49, 15.0.

12N 4E-7P2—Reference point—top of wooden pit, elevation 28 feet. 0.67 mile southeast of Garden Highway, 0.06 mile southwest of Markham Road. 12/5/47, 11.1; 3/11/48, 13.0; 5/11/48, 11.1; 12/11/48, 14.2; 3/25/49, 11.0; 12/6/49, 15.0.

12N 4E-8A1—Reference point—top of casing, elevation 37 feet. South side of Nicolaus Avenue, 0.07 mile west of Electric Avenue. 12/8/47, 19.2; 3/11/48, 17.4; 12/14/48, 19.6; 3/16/49, 17.4; 12/6/49, 20.4.

12N 4E-8C1—Reference point—top of casing, elevation 36 feet. 0.05 mile south of Nicolaus Avenue, 0.50 mile west of Electric Avenue. 12/8/47, 18.6; 3/11/48, 17.3; 5/11/48, 16.0; 12/14/48, 19.0; 3/16/49, 17.1; 12/6/49, 20.2; 3/29/50, 17.0; 11/6/50, 23.1; 4/2/51, 13.8; 11/16/51, 22.2; 4/4/52, 13.1.

12N/4E-8D1—Reference point—hole in base of pump, elevation 32 feet. 0.16 mile south of Nicolaus Avenue, 0.80 mile west of Electric Avenue. 12/8/47, 20.8; 3/25/48, 18.2; 12/11/48, 22.0.

12N/4E-9A1—Reference point—top of casing, elevation 44 feet. West side of Pacific Avenue, 0.24 mile south of Nicolaus Avenue. 12/23/47, 19.4; 3/11/48, 18.1; 12/14/48, 20.9; 3/28/49, 16.6; 12/7/49, 20.3; 3/27/50, 17.5; 11/6/50, 27.6; 4/2/51, 16.7; 11/16/51, 26.0; 4/4/52, 16.6.

12N/4E-9D1—Reference point—hole in pump base, elevation 40 feet. South side of Nicolaus Avenue, 0.13 mile east of Electric Avenue. 3/11/48, 17.9; 12/14/48, 20.0; 3/28/49, 17.3; 5/25/49, 21.0; 6/29/49, 22.7; 7/27/49, 23.9; 8/31/49, 25.1; 12/7/49, 20.6; 3/27/50, 18.2; 11/6/50, 24.8; 4/2/51, 16.1; 11/16/51, 24.0; 4/4/52, 15.8.

12N/4E-9J1—Reference point—top of casing, elevation 42 feet. 0.11 mile west of Pacific Avenue, 0.53 mile south of Nicolaus Avenue. 3/11/48, 18.7; 12/14/48, 21.1; 3/28/49, 16.7; 12/7/49, 20.5.

12N/4E-9J2—Reference point—top of casing, elevation 42 feet. 0.13 mile west of Pacific Avenue, 0.53 mile south of Nicolaus Avenue. 3/11/48, 19.1; 12/14/48, 21.4; 3/28/49, 16.9; 12/7/49, 20.8.

12N/4E-10A1—Reference point—hole in base of pump, elevation 50 feet. 0.09 mile south of Nicolaus Avenue, 0.90 mile east of Pacific Avenue. 3/11/48, 17.4; 4/2/48, 15.8; 5/5/48, 15.6; 5/31/48, 17.0; 6/17/48, 42.5; 7/2/48, 23.2; 12/15/48, 20.0; 3/28/49, 14.1; 7/1/49, 46.7 (operating); 8/1/49, 47.0 (operating); 8/31/49, 46.8 (operating); 12/7/49, 20.6; 3/27/50, 15.3; 11/6/50, 26.1; 4/5/51, 17.5; 4/4/52, 17.5.

12N/4E-10C1—Reference point—top of casing, elevation 47 feet. South side of Nicolaus Avenue, 0.51 mile east of Pacific Avenue. 3/11/48, 18.6; 12/14/48, 21.3; 3/28/49, 16.6; 12/7/49, 21.1.

12N/4E-11H1—Reference point—hole in base of pump, elevation 46 feet. 0.04 mile south of Trowbridge Road, 0.20 mile west of Pleasant Grove Road. 11/19/51, 22.9.

12N/4E-12D1—Reference point—top of casing, elevation 52 feet. West side of Pleasant Grove Road, 0.24 mile north of Trowbridge Road. 12/22/47, 13.4; 3/11/48, 12.5; 12/14/48, 14.0; 3/28/49, 6.9; 12/7/49, 15.8.

12N/4E-13C1—Reference point—hole in base of pump, elevation 51 feet. 0.11 mile south of Marcum Road, 0.53 mile east of Pleasant Grove Road. 3/11/48, 13.4; 12/14/48, 14.3; 12/22/48, 12.6; 3/29/49, 9.3; 11/10/49, 18.0; 3/15/50, 13.9; 3/27/50, 13.8; 4/10/50, 13.4; 11/6/50, 19.6; 11/14/50, 19.9; 3/23/51, 12.3; 11/19/51, 23.5; 4/4/52, 14.6; 4/10/52, 14.6.

12N/4E-13D1—Reference point—top of casing, elevation 50 feet. Southeast of intersection of Pleasant Grove Road and Marcum Road. 12/22/47, 12.1; 3/11/48, 12.3; 12/14/48, 12.2; 3/29/49, 6.6; 2/7/49, 13.9.

12N/4E-14P1—Reference point—top of casing, elevation 43 feet. 1.72 miles south of Trowbridge Road, 0.53 mile west of Pleasant Grove Road. 3/11/48, 9.1; 12/18/48, 8.8; 3/29-49, 3.3; 12/7/49, 10.8; 3/27/50, 7.1; 11/6/50, 4.3; 4/5/51, 5.3; 4/4/52, 4.3.

12N/4E-16A2—Reference point—top of casing, elevation 40 feet. 0.07 mile west of Pacific Avenue, 1.30 miles south of Nicolaus Avenue. 12/23/47, 16.1; 3/11/48, 15.2; 5/11/48, 17.7; 12/14/48, 16.5; 3/28/49, 12.0; 3/27/50, 13.8; 11/6/50, 22.6; 4/2/51, 11.8; 11/16/51, 26.6; 4/4/52, 11.6.

12N/4E-16L1—Reference point—top of 16-inch casing, elevation 34 feet. 0.50 mile east of Electric Avenue, 0.60 mile south of Markham Road. 3/11/48, 13.1; 12/14/48, 12.9; 3/28/49, 8.7; 12/7/49, 16.1; 11/6/50, 19.9; 4/2/51, 8.4.

12N 4E-16L2—Reference point—top of casing, elevation 34 feet. 0.25 mile east of Electric Avenue, 0.50 mile south of Markham Road. 3/11/48, 11.0; 12/13/48, 21.6; 3/28/49, 7.2; 12/7/49, 13.9.

12N 4E-17C1—Reference point—top of 16-inch casing under pump, elevation 35 feet, 0.25 mile south of Markham Road, 0.50 mile west of Electric Avenue. 12/8/47, 16.5; 3/25/48, 15.0; 12/11/48, 16.1; 3/28/49, 13.1; 12/7/49, 17.5.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

12N/4E-17J1—Reference point—top of 16-inch casing, elevation 32 feet. 300 feet west of Electric Avenue, 0.52 mile south of Markham Road. 12/8/47, 13.0; 3/11/48, 12.6; 5/11/48, 12.6; 12/11/48, 13.2; 3/28/49, 9.1; 5/26/49, 14.2; 6/29/49, 15.7; 7/27/49, 16.4; 8/26/49, 17.2; 12/7/49, 15.3; 11/16/51, 18.2; 4/4/52, 6.1.

12N/4E-18A1—Reference point—top of 12-inch casing under pump, elevation 30 feet. 600 feet south of Markham Road, 0.50 mile east of Power Line Road. 12/5/47, 14.3; 3/11/48, 14.9; 12/11/48, 14.7; 3/28/49, 12.4; 12/7/49, 15.6; 3/29/50, 13.3; 11/6/50, 17.1; 4/2/51, 6.4; 11/16/51, 16.4; 4/4/52, —3.0.

12N/4E-18D1—Reference point—top of concrete pit wall, south side, elevation 30 feet. 0.56 mile southeast of Garden Highway, 300 feet southwest of road. 12/5/47, 16.2; 12/11/48, 15.9; 3/25/49, 13.1; 12/6/49, 16.5; 11/6/50, 18.1; 4/2/51, 6.4.

12N/4E-18P1—Reference point—bottom of 4" x 12" plank across wooden pit, elevation 25 feet. 0.27 mile west of Power Line Road, 400 feet north of Lee Road. 12/5/47, 13.4; 3/11/48, 12.2; 12/11/48, 15.2; 3/25/49, 10.8; 12/6/49, 13.9.

12N/4E-19A1—Reference point—top of 14-inch casing, elevation 28 feet. 0.44 mile east of junction of Power Line and Lee Roads. 12/5/47, 12.9; 3/15/48, 12.1; 12/11/48, 13.1; 3/28/49, 10.0; 12/6/49, 14.2; 3/29/50, 11.9; 11/6/50, 13.1; 4/2/51, 4.5; 11/16/51, 15.5.

12N/4E-19C1—Reference point—hole in pump base, elevation 25 feet. 100 feet south of Lee Road, 200 feet west of Power Line Road. 12/5/47, 15.6; 3/11/48, 14.3; 3/25/49, 11.8; 12/6/49, 14.8.

12N/4E-19F1—Reference point—top of casing, elevation 27 feet. 300 feet west of Power Line Road, 0.40 mile south of Lee Road. 12/20/47, 14.6; 3/4/48, 14.0; 12/15/48, 14.8; 3/31/49, 11.3; 12/5/49, 15.9.

12N/4E-20A1—Reference point—top of casing, elevation 30 feet. 150 feet east of Electric Avenue, 0.76 mile north of Striplin Road. 12/20/47, 12.6; 3/4/48, 12.5; 12/15/48, 13.8; 3/30/49, 8.1; 12/2/49, 19.3.

12N/4E-20J1—Reference point—slot in concrete base, elevation 30 feet. 100 feet west of Electric Avenue, 0.42 mile north of Striplin Road. 5/5/48, 11.9; 5/31/48, 63.0 (operating); 7/2/48, 62.0 (operating); 12/15/48, 12.8; 4/13/49, 8.5; 6/30/49, 31.4; 8/1/49, 57.0 (operating); 8/31/49, 56.0 (operating); 12/7/49, 16.6; 3/24/50, 12.3; 11/8/50, 19.6; 4/2/51, 8.2; 11/19/51, 19.0; 4/7/52, 5.7.

12N/4E-20Q1—Reference point—top of 14-inch casing, elevation 30 feet. 0.35 mile west of Electric Avenue on Striplin Road. 5/5/48, 9.9; 5/31/48, 16.2; 12/15/48, 10.8; 4/13/49, 7.0; 6/2/49, 20.6; 8/1/49, 47.6 (operating); 8/31/49, 62.0 (operating); 12/7/49, 14.9.

12N/4E-20R1—Reference point—slot in concrete base, elevation 30 feet. 100 feet west of Electric Avenue, 0.21 mile west of Striplin Road. 5/5/48, 12.4; 5/31/48, 42.0 (operating); 7/2/48, 43.0 (operating); 12/15/48, 13.3; 4/13/49, 9.6; 6/2/49, 28.9; 6/30/49, 33.3; 8/1/49, 52.0 (operating); 8/31/49, 66.0 (operating); 12/7/49, 18.6.

12N/4E-21M1—Reference point—top of 16-inch casing outside of pump house, elevation 32 feet. 0.25 mile east of Electric Avenue, 0.80 mile north of Striplin Road. 12/23/47, 12.4; 3/15/48, 12.4; 12/15/48, 12.8; 3/30/49, 6.7; 12/2/49, 17.9.

12N/4E-24A1—Reference point—top of 14-inch casing, elevation 56 feet. South side of Lee Road, 0.5 mile west of Power Line Road. 12/20/48, 16.5; 4/1/49, 13.4; 11/10/49, 21.8; 3/15/50, 18.0; 4/10/50, 17.8; 10/2/50, 29.5; 11/13/50, 23.8; 3/21/51, 17.8; 5/9/51, 26.6; 11/14/51, 27.9; 3/13/52, 21.1.

12N/4E-24F1—Reference point—top of 14-inch casing, elevation 49 feet. 0.50 mile east of Pleasant Grove Road, 0.75 mile north of Striplin Road. 5/31/48, 11.3; 12/18/48, 13.1; 3/29/49, 8.7; 12/2/49, 16.2; 4/10/50, 13.2; 11/13/50, 18.2; 3/21/51, 11.7; 11/16/51, 21.4.

12N/4E-24M1—Reference point—top of 14-inch casing, elevation 50.9 feet. 75 feet east of Pleasant Grove Road, 0.25 mile north of Striplin Road. 12/22/47, 12.9; 3/22/48, 13.1; 12/18/48, 14.2; 3/29/49, 9.2; 5/26/49, 14.0; 6/29/49, 19.4; 7/28/49, 17.6; 8/26/49, 18.0; 12/2/49, 17.2; 3/15/50, 14.4; 3/27/50, 14.6, 11/6/50, 18.8; 4/5/51, 12.1; 11/16/51, 20.9; 11/19/51, 20.9; 4/8/52, 12.5; 4/10/52, 12.2.

12N/4E-25F1—Reference point—top of 16-inch casing, elevation 50 feet. 0.50 mile east of Pleasant Grove Road, 0.44 mile south of Striplin Road. 11/16/51, 27.1.

12N/4E-25M1—Reference point—hole in pump base, elevation 51.3 feet. 250 feet east of Pleasant Grove Road, 0.70 mile south of Striplin Road. 12/22/47, 15.7, 3/22/48, 15.1; 12/18/48, 17.4; 3/29/49, 13.3; 12/2/49, 20.6; 3/27/50, 17.5; 11/8/50, 22.8; 4/5/51, 15.7; 11/19/51, 29.0; 4/8/52, 19.8.

12N/4E-26M1—Reference point—hole in pump base, elevation 41 feet. 0.75 mile west of Pleasant Grove Road, 1.0 mile north of Catlett Road. 3/22/48, 12.9; 12/18/48, 14.8; 3/29/49, 10.6; 12/2/49, 18.5; 11/8/50, 19.4; 4/5/51, 12.7; 4/8/52, 11.3.

12N/4E-28F1—Reference point—hole in pump base, elevation 32 feet. 0.50 mile west of Pacific Avenue, 0.36 mile south of Striplin Road. 3/15/48, 11.0; 12/18/48, 12.5.

12N/4E-28H1—Reference point—hole in top of discharge pipe, elevation 36 feet. West of Pacific Avenue, 0.36 mile south of Striplin Road. 12/22/47, 11.1; 3/15/48, 11.0; 12/18/48, 11.2; 3/24/50, 11.1; 11/8/50, 15.7; 4/2/51, 8.1; 11/19/51, 11.9; 4/7/52, 8.0.

12N/4E-29A1—Reference point—north side base of pump, elevation 31 feet. 200 feet south of Striplin Avenue, 450 feet west of Electric Avenue. 12/18/47, 12.3; 3/14/48, 12.7; 12/15/48, 11.7; 3/30/49, 6.2; 12/2/49, 17.6; 3/24/50, 12.4; 11/8/50, 18.2; 4/2/51, 9.4; 11/19/51, 19.9; 4/7/52, 4.9.

12N/4E-29R1—Reference point—pump base at hole in concrete, elevation 30 feet, 300 feet west of Electric Avenue, 0.75 mile north of Catlett Road. 12/18/47, 10.2; 3/4/48, 10.8; 12/5/49, 20.8; 3/24/50, 8.0; 11/8/50, 13.5; 4/2/51, 5.6; 11/19/51, 14.0; 4/7/52, 3.9.

12N/4E-30F1—Reference point—pump base, elevation 25 feet. 100 feet east of Power Line Road, 0.50 mile south of Striplin Road. 12/20/47, 11.1; 3/4/48, 10.4; 12/15/48, 11.8; 3/30/49, 4.9; 12/5/49, 12.2; 3/27/50, 8.1; 11/8/50, 10.6; 4/2/51, 3.7; 11/16/51, 10.9; 4/8/52, 4.8.

12N/4E-32K1—Reference point—top of 16-inch casing, elevation 28 feet. 1,500 feet west of Electric Avenue, 0.52 mile north of West Catlett Road. 3/30/49, 3.2.

12N/4E-33E1—Reference point—top of 18-inch casing, elevation 30 feet. 150 feet north of Catlett Road, 1,000 feet east of Electric Avenue. 3/15/48, 10.6; 12/18/48, 10.4.

12N/4E-33L3—Reference point—top of casing, elevation 31 feet. At dwelling south side of road, 300 feet east of Catlett Station, Sacramento Northern Railroad. 11/8/29, 15.4; 9/28/30, 16.0; 12/10/31, 16.4; 12/5/32, 12.2; 12/20/33, 15.6; 9/27/34, 16.3; 11/23/36, 12.5; 11/24/37, 9.4; 1/10/39, 8.9; 1/13/41, 3.4; 11/10/47, 11.5; 12/16/48, 11.0; 12/9/49, 13.4; 11/10/50, 13.0; 12/6/51, 12.0.

12N/4E-33R1—Reference point—top of 8-inch casing, elevation 31 feet. 100 feet west of Pacific Avenue, 0.32 mile south of Catlett Road. 12/22/47, 11.2; 3/18/48, 10.9; 12/18/48, 11.9; 3/30/49, 6.0; 12/2/49, 13.2; 3/24/50, 9.3; 11/8/50, 12.7; 4/2/51, 7.9; 11/19/51, 13.9; 4/8/52, 5.1.

12N/4E-34J1—Reference point—top of 4-inch casing, elevation 36 feet. Windmill 100 feet south of Catlett Road, 1.0 mile east of Pacific Avenue. 12/22/47, 14.8; 3/22/48, 13.7; 12/18/48, 15.9; 3/29/49, 9.8; 12/2/49, 17.9; 3/27/50, 13.8; 11/8/50, 16.7; 4/5/51, 10.2; 11/19/51, 22.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

12N 4E-35H1—Reference point—top of 16-inch casing, elevation 48.8 feet, 0.1 mile west of Pleasant Grove Road, 0.2 mile north of Catlett Road. 12/22/47, 13.3; 3/22/48, 12.0; 12/18/48, 15.2; 3/29/49, 12.0; 12/2/49, 18.3; 3/27/50, 16.4; 11/8/50, 20.1; 4/5/51, 13.3; 5/10/51, 16.7; 7/11/51, 25.1; 8/22/51, 28.2; 9/26/51, 27.3; 11/16/51, 22.2; 11/19/51, 24.7; 4/8/52, 15.2; 4/10/52, 13.6

12N 4E-36Q1—Reference point—top of casing in bottom of pit, elevation 48 feet, ground surface, 0.47 mile south of Catlett Road, 0.63 mile east of Pleasant Grove Road. 4/11/51, 22.0; 11/16/51, 28.9

12N 5E-18P1—Reference point—top of 14-inch casing, elevation 61 feet, 0.50 mile west of Brewer Road, 1.0 mile south of Marcum Road. 3/22/48, 15.4.

13N 3E-2C1—Reference point—top of air gage hole, elevation 42.7 feet 50 feet west of Garden Highway, 0.25 mile north of Tudor Road. 11/13/47, 25.6; 3/24/48, 21.0; 3/29/48, 19.7; 11/10/48, 20.4; 1/24/49, 19.2; 3/23/49, 16.9; 6/30/49, 30.3; 7/27/49, 29.0; 8/25/49, 25.2; 12/6/49, 21.2; 3/29/50, 17.5; 11/7/50, 23.1; 3/25/51, 12.2; 11/15/51, 22.6; 4/3/52, 9.1.

13N 3E-2H1—Reference point—hole in pump base, elevation 43.4 feet, 150 feet south of Shannon Road, 0.5 mile east of Garden Highway. 11/13/47, 21.4; 3/8/48, 19.4; 11/10/48, 18.0; 3/23/49, 14.5; 12/6/49, 19.5; 3/29/50, 13.4; 11/7/50, 19.0; 3/29/51, 12.2; 11/15/51, 18.3; 4/3/52, 6.2.

13N 3E-2L1—Reference point—top of 10-inch casing, elevation 41.2 feet 0.5 mile west of Garden Highway, 0.1 mile south of Tudor Road. 1/19/48, 18.3; 5/6/48, 15.9; 6/1/48, 15.1; 6/3/48, 25.8; 8/2/48, 16.1; 9/1/48, 21.8; 3/23/49, 16.9.

13N 3E-2P1—Reference point—hole in pump base, elevation 39.9 feet, 200 feet west of Garden Highway, 0.3 mile south of Tudor Road. 11/13/47, 19.9; 3/8/48, 26.0; 11/10/48, 18.0; 3/23/48, 15.9; 12/6/49, 19.8

13N 3E-3D1—Reference point—hole in pump base, elevation 38.9 feet, 50 feet east of State Highway 24, 0.3 mile north of Tudor Road. 11/11/47, 20.9; 3/8/48, 20.8; 3/29/48, 19.5; 11/10/48, 21.1; 1/24/49, 19.7; 3/25/49, 18.1; 6/1/49, 28.6; 6/28/49, 25.4; 7/29/49, 32.3; 8/30/49, 26.1; 12/6/49, 23.3.

13N 3E-3F1—Reference point—hole in pump base, elevation 38.9 feet, 0.15 mile north of Tudor Road, 0.4 mile east of State Highway 24. 11/14/47, 20.8; 3/18/48, 22.9; 11/10/48, 21.3; 3/25/49, 19.2; 12/6/49, 23.4; 3/29/50, 20.6; 11/7/50, 24.6; 3/29/51, 19.0; 11/15/51, 22.9; 4/3/52, 9.0.

13N 3E-4B1—Reference point—top of wood pit east edge, elevation 36 feet, 0.45 mile west of State Highway 24, 0.4 mile north of Tudor Road. 11/14/47, 18.1; 3/8/48, 14.8; 11/10/48, 20.7; 3/25/49, 17.5; 12/6/49, 23.1.

13N 3E-4P1—Reference point—top of 12-inch casing, elevation 31.7 feet, 0.05 mile west of Hobbs Road, 0.3 mile south of Tudor Road. 12/12/47, 14.6; 3/10/48, 14.7; 3/12/48, 14.6; 11/18/48, 16.5; 3/24/49, 13.8; 3/29/50, 15.9.

13N 3E-4P2—Reference point—top of casing, elevation 34 feet. 100 feet west of Hobbs Road, 0.4 mile south of Tudor Road. 11/7/50, 22.9; 3/29/51, 15.8.

13N 3E-5B1—Reference point—top of 4" x 12" plank bridge over earth pit, elevation 39.1 feet, 50 feet east of Bailey Road, 750 feet south of Tudor Road. 12/12/47, 14.3; 3/10/48, 16.9; 3/12/48, 17.1; 3/29/48, 16.7; 11/8/48, 18.3; 3/21/49, 15.4; 12/5/49, 18.6.

13N 3E-5E1—Reference point—top of 2" x 6" sill, north wall of wooden pit, elevation 38.4 feet, 300 feet east of George Washington Boulevard, 1,000 feet north of Tudor Road. 12/12/47, 14.2; 3/10/48, 11.8; 11/8/48, 13.0; 3/21/49, 12.5; 3/29/50, 12.5; 11/7/50, 17.8; 3/29/51, 13.1; 11/15/51, 15.8; 4/3/52, 10.4

13N 3E-5J1—Reference point—top of 16-inch casing, elevation 27 feet 0.1 mile south of Tudor Road, 0.5 mile west of Hobbs Road. 12/12/47, 13.7; 3/10/48, 12.8; 3/12/48, 12.8; 12/5/49, 17.0.

13N 3E-5L1—Reference point—top of 12-inch casing, elevation 37.4 feet, 50 feet south of State Highway 24, 650 feet west of Bailey Road. 12/12/47, 15.6; 3/10/48, 15.6; 3/12/48, 15.6; 5/12/48, 15.1; 11/8/48, 16.3; 1/19/49, 14.8; 3/24/49, 14.9; 6/1/49, 16.7; 6/28/49, 21.2; 7/27/49, 22.0; 8/25/49, 20.4; 12/2/49, 17.3.

13N 3E-6K1—Reference point—top of 16-inch casing, elevation 34 feet. South side of Tudor Road, 0.5 mile west of George Washington Boulevard. 12/15/48, 9.0; 12/9/49, 9.7; 11/10/50, 12.7; 12/6/51, 13.3.

13N 3E-6M1—Reference point—top of 12-inch casing, elevation 34 feet, 400 feet south of Tudor Road, 0.34 mile east of Roberts Road. 12/11/47, 9.9; 3/10/48, 8.2; 3/12/48, 8.3; 11/8/48, 6.2; 3/24/49, 6.6; 12/2/49, 9.0.

13N 3E-7A1—Reference point—top of casing, 20 feet north of pump house, elevation 35.2 feet, 250 feet south of Thompson Road, 300 feet west of State Highway 24. 12/12/47, 10.8; 3/10/48, 11.1; 3/12/48, 11.2; 11/8/48, 11.7; 3/24/49, 10.5; 12/2/49, 12.3.

13N 3E-7J1—Reference point—top of 8-inch casing, elevation 35.1 feet, 0.45 mile north of Everglade Road, 0.15 mile west of George Washington Boulevard, 250 feet south to well. 12/11/47, 9.7; 3/10/48, 10.5; 3/12/48, 10.7; 11/3/48, 12.0; 1/24/49, 11.7; 3/24/49, 10.3; 12/2/49, 12.8.

13N 3E-8B1—Reference point—top of 16-inch casing, elevation 35 feet, 0.05 mile south of Thompson Road, 0.8 mile west of Hobbs Road. 12/12/47, 10.8; 3/10/48, 13.9; 3/12/48, 14.0; 11/18/48, 15.1; 3/25/49, 13.0; 12/5/49, 17.1.

13N 3E-8M1—Reference point—top of wood floor under pump, elevation 35.9 feet, 0.2 mile east of George Washington Boulevard, 0.7 mile south of Thompson Road. 12/11/47, 10.3; 3/10/48, 10.8; 3/12/48, 10.8; 11/8/48, 13.1; 3/24/49, 11.0; 12/2/49, 13.8

13N 3E-9C1—Reference point—hole in pump base, elevation 36.2 feet, 150 feet west of Hobbs Road, 0.60 mile south of State Highway 24. 12/12/47, 15.4; 3/10/48, 15.8; 3/12/48, 15.7; 11/8/48, 17.7; 1/24/49, 16.3; 3/24/49, 14.8; 6/1/49, 19.1; 6/28/49, 20.9; 7/27/49, 21.8; 8/30/49, 22.4; 12/5/49, 19.8.

13N 3E-9H1—Reference point—top of east wall of concrete pit, elevation 35 feet, 200 feet west of Sawtelle Avenue, 0.57 mile south of Tudor Road. 12/12/47, 16.8; 3/10/48, 17.9; 3/17/48, 18.0; 11/8/48, 19.2; 3/24/49, 16.3.

13N 3E-11A1—Reference point—hole in pump base, elevation 40 feet, 350 feet north of O'Conner Road, 0.55 mile east of Garden Highway. 11/13/47, 20.1; 3/8/48, 20.8; 11/10/48, 19.0; 1/24/49, 18.6; 3/23/49, 15.5; 12/5/49, 20.7

13N 3E-11L1—Reference point—top of casing, elevation 38 feet, 0.05 mile west of Garden Highway, 1.1 miles south of Tudor Road. 11/14/47, 16.4

13N 3E-11M1—Reference point—top of casing, elevation 36 feet, 0.4 mile west of Garden Highway, 0.2 mile north of Wilkie Avenue. 1/20/48, 17.5.

13N 3E-11Q2—Reference point—hole in pump base, elevation 39.3 feet 50 feet west of Garden Highway, 0.15 mile south of Wilkie Avenue. 11/19/47, 16.5; 3/9/48, 19.8; 5/11/48, 13.4; 11/4/48, 16.1; 1/19/49, 15.3; 3/8/49, 14.8; 6/1/49, 17.2; 6/29/49, 23.9; 8/3/49, 23.7; 8/25/49, 19.1; 12/8/49, 17.2.

13N 3E-12L1—Reference point—hole in pump base, elevation 41 feet, 300 feet north of Wilkie Avenue, 0.7 mile east of Garden Highway. 11/14/47, 18.2; 3/8/48, 19.0; 11/10/48, 16.7; 3/23/49, 12.1; 12/5/49, 17.9; 11/7/50, 17.1; 3/29/51, 11.3; 11/15/51, 16.3; 4/3/52, 6.9.

13N 3E-12N1—Reference point—top of casing, elevation 39.5 feet, 0.2 mile south of Wilkie Avenue, 0.45 mile east of Garden Highway. 11/19/47, 15.4; 3/9/48, 18.2; 5/12/48, 10.3; 11/4/48, 16.3; 3/8/49, 13.7; 12/8/49, 16.2.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N/3E-13C1—Reference point—hole in pump base, elevation 42.3 feet, 0.7 mile east of Garden Highway, 0.25 mile south of Wilkie Avenue. 11/19/47, 16.9; 3/9/48, 20.3; 11/4/48, 17.0; 3/8/49, 13.8; 12/8/49, 17.9; 3/29/50, 10.8; 11/7/50, 17.1; 3/29/51, 16.7; 11/15/51, 16.7; 4/2/52, 7.3.

13N/3E-13D1—Reference point—edge of pump base, elevation 39 feet, 0.55 mile east of Garden Highway, 0.25 mile south of Wilkie Avenue. 5/5/48, 9.4; 6/1/48, 9.3; 2/6/52, 6.0.

13N/3E-13E1—Reference point—hole in pump base, elevation 37 feet, 0.5 mile east of Garden Highway, 0.75 mile south of Wilkie Avenue. 11/19/47, 15.4; 3/25/48, 14.7; 11/4/48, 15.1; 3/8/49, 13.3; 12/8/49, 15.9.

13N/3E-13L1—Reference point—top of casing, elevation 38 feet, 0.75 mile east of Garden Highway, 0.95 mile south of Wilkie Avenue. 11/19/47, 15.5; 3/9/48, 19.0; 11/4/48, 14.1; 3/8/49, 13.3; 12/7/49, 16.0.

13N/3E-14C1—Reference point—hole in pump base, elevation 35 feet, 0.25 mile west of Garden Highway, 0.35 mile south of Wilkie Avenue. 11/26/29, 15.4; 9/27/30, 15.6; 12/12/31, 15.4; 12/2/32, 15.2; 12/20/33, 16.3; 11/10/34, 16.7; 11/25/36, 13.4; 11/24/37, 11.8; 1/25/39, 10.8; 1/13/41, 8.2; 11/6/47, 15.3; 11/19/47, 15.9; 5/12/48, 13.9; 11/4/48, 15.7; 12/16/48, 14.7; 3/8/49, 14.9; 12/8/49, 16.6; 12/9/49, 16.0; 11/10/50, 16.0; 12/6/51, 13.4.

13N/3E-14G1—Reference point—hole in pump base, elevation 30.8 feet, 50 feet west of Garden Highway, 0.65 mile south of Wilkie Avenue. 3/25/48, 8.8; 11/4/48, 8.9; 3/8/49, 7.9; 12/8/49, 9.9; 3/29/50, 7.5; 11/7/50, 10.3; 3/39/51, 6.7; 11/15/51, 8.9; 4/2/52, 0.2.

13N/3E-14L3—Reference point—hole in pump base, elevation 34.9 feet, 50 feet south of Wilson Road, 0.1 mile west of Garden Highway. 11/19/47, 12.1; 3/25/48, 12.2; 11/4/48, 10.2; 3/8/49, 10.9; 12/7/49, 13.0; 4/2/52, 3.8.

13N/3E-14M2—Reference point—hole in pump base, elevation 35.7 feet, 0.1 mile south of Wilson Road, 0.4 mile west of Garden Highway. 11/19/47, 16.9; 3/9/48, 16.2; 11/5/48, 14.1; 3/8/49, 12.9; 12/7/49, 14.8.

13N/3E-14P1—Reference point—top of casing, elevation 35.6 feet, 0.25 mile west of Garden Highway, 0.4 mile south of Wilson Road. 11/19/47, 11.1; 3/9/48, 14.1; 11/4/48, 12.9; 3/8/49, 11.7; 12/7/49, 13.8.

13N/3E-14Q1—Reference point—top of casing, elevation 35.1 feet, 350 feet west of Garden Highway, 0.45 mile south of Wilson Road. 11/19/47, 14.9; 3/8/49, 11.0; 12/7/49, 12.8.

13N/3E-14R1—Reference point—hole in pump base, elevation 38.4 feet, 0.4 mile east of Garden Highway, 1.0 mile south of Wilkie Avenue. 11/19/47, 15.9; 3/9/48, 17.8; 11/4/48, 14.2; 3/8/49, 12.5; 12/7/49, 14.8.

13N/3E-15C2—Reference point—top of casing, elevation 36.1 feet, 0.3 mile north of Wilson Road, 100 feet west of Southern Pacific Railroad tracks. 12/18/47, 15.1; 3/11/48, 15.6; 11/4/48, 18.2; 3/16/49, 15.0.

13N/3E-15H1—Reference point—top of wooden pit, north side, elevation 37.8 feet, 0.2 mile north of Wilson Road, 0.6 mile west of Garden Highway. 12/18/47, 16.2; 3/11/48, 17.8; 11/4/48, 17.0; 3/8/49, 15.5.

13N/3E-15P1—Reference point—bottom of 2" x 12" over pit, elevation 34.0 feet, 0.25 mile east of Sawtelle Avenue, 100 feet southeast of most southerly corner of Wilson Road. 12/18/47, 13.2; 3/11/48, 13.0; 11/4/48, 6.7; 3/8/49, 12.9; 12/7/49, 14.7; 3/29/50, 12.8. Well destroyed.

13N/3E-15Q1—Reference point—top of casing, elevation 37 feet, 0.15 mile east of Southern Pacific Railroad tracks, 0.5 mile south of Wilson Road. 3/11/48, 13.2; 11/4/48, 13.6; 3/16/49, 11.7; 12/7/49, 13.1.

13N/3E-15R1—Reference point—top of plug in "T" discharge pipe, elevation 36 feet, 0.65 mile west of Garden Highway, 0.5 mile south of Wilson Road. 3/11/48, 14.5; 11/4/48, 13.6; 3/16/49, 13.2; 12/7/49, 11.3.

13N/3E-16A1—Reference point—top of casing, elevation 35 feet. South of Everglade Road, west of Sawtelle Avenue at intersection. 12/12/47, 15.7; 3/10/48, 14.7; 3/12/48, 14.7; 11/8/48, 17.1; 3/25/49, 11.6; 12/5/49, 16.3; 3/29/50, 15.1; 11/7/50, 17.0; 3/29/51, 11.7; 11/15/51, 15.4; 4/3/52, 9.5.

13N/3E-16H1—Reference point—hole in pump base, elevation 36.8 feet, 0.25 mile south of Everglade Road on west side of Sawtelle Ave. 12/18/47, 16.6; 3/4/48, 17.8; 11/4/48, 18.7; 1/24/49, 16.5; 3/8/49, 15.7; 12/7/49, 18.2.

13N/3E-16R1—Reference point—hole in pump base, elevation 38.1 feet, 60 feet west of Sawtelle Avenue, 0.9 mile south of Everglade Road. 12/18/47, 16.4; 3/11/48, 17.3; 11/4/48, 16.3; 3/16/49, 15.2; 12/7/49, 17.7; 3/29/50, 14.7; 11/7/50, 15.2; 3/29/51, 10.8; 11/15/51, 14.0; 4/2/52, 8.0.

13N/3E-17A1—Reference point—top of casing, elevation 31 feet, 0.1 mile south of Everglade Road, 0.9 mile east of George Washington Boulevard. 12/18/47, 9.4; 3/11/48, 9.8; 11/4/48, 8.3; 3/16/49, 6.6; 12/7/49, 10.3.

13N/3E-17B1—Reference point—top of casing, elevation 34.1 feet, 200 feet south of Everglade Road, 0.7 mile east of George Washington Boulevard. 12/12/47, 6.7; 3/10/48, 8.1; 3/12/48, 8.1; 11/8/48, 12.2; 12/5/49, 12.0.

13N/3E-17D1—Reference point—top of casing, elevation 30 feet. South side of Everglade Road, 0.2 mile east of George Washington Boulevard. 12/18/47, 7.9; 3/11/48, 8.7. Well destroyed.

13N/3E-18A1—Reference point—top of casing, elevation 30 feet, 0.25 mile south of Everglade Road, 0.2 mile west of George Washington Boulevard. 12/18/47, 10.2; 3/11/48, 10.7; 11/4/48, 10.7. Well destroyed.

13N/3E-23B1—Reference point—top of concrete pit, elevation 34 feet, 0.1 mile east of Garden Highway, 0.15 mile north of Central Avenue. 11/19/47, 12.3; 3/25/48, 12.3; 11/4/48, 11.9; 3/8/49, 11.2; 12/7/49, 12.7.

13N/3E-23D1—Reference point—top of concrete, elevation 38.3 feet, 0.4 mile west of Garden Highway, 0.25 mile north of Central Avenue. 11/19/47, 14.8; 3/9/48, 16.7; 5/11/48, 13.0; 11/4/48, 16.0; 3/8/49, 14.6.

13N/3E-23F1—Reference point—hole in pump base, elevation 34 feet, 0.15 mile west of Garden Highway, 0.1 mile south of Central Avenue. 11/20/47, 12.8; 3/10/48, 15.1; 11/4/48, 13.7; 3/8/49, 11.3; 12/7/49, 13.1.

13N/3E-23L1—Reference point—hole in pump base, elevation 35 feet, 0.15 mile west of Garden Highway, 0.4 mile south of Central Avenue. 11/20/47, 13.3; 3/10/48, 16.0; 5/11/48, 11.0; 11/4/48, 13.7; 1/24/49, 13.6; 3/8/49, 12.7; 6/7/49, 16.3; 6/29/49, 17.2; 7/27/49, 16.9; 8/25/49, 17.8; 12/7/49, 14.6; 3/29/50, 12.2; 11/7/50, 14.1; 3/29/51, 9.4; 11/15/51, 11.6; 4/2/52, 6.0.

13N/3E-24C2—Reference point—bottom of pump base, elevation 39.6 feet, 0.25 mile north of Central Avenue, 0.8 mile east of Garden Highway. 11/20/47, 15.4; 3/9/48, 16.0; 11/4/48, 14.7; 3/8/49, 13.1; 3/29/50, 11.5; 11/7/50, 15.3; 3/29/51, 7.6; 11/16/51, 14.6; 4/2/52, 7.6.

13N/3E-24D1—Reference point—hole in concrete base, elevation 36.5 feet, 0.45 mile east of Garden Highway, 0.45 mile south of Wilson Road. 11/19/49, 12.2; 3/25/48, 11.9; 5/11/48, 9.1; 11/4/48, 11.9; 3/8/49, 10.6; 6/1/49, 12.0; 8/25/49, 15.4; 12/7/49, 13.1

13N/3E-24E1—Reference point—top of casing, elevation 35 feet, 0.2 mile south of Central Avenue, 0.6 mile east of Garden Highway. 11/20/47, 10.8; 3/9/48, 11.4; 11/5/48, 11.4.

13N/3E-24G1—Reference point—top of casing, elevation 39 feet, 100 feet south of Central Avenue, 1.05 miles east of Garden Highway. 11/20/47, 24.2; 3/9/48, 18.9; 11/4/48, 20.7; 1/24/49, 18.8; 3/8/49, 17.1; 12/7/49, 19.9.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N 3E-25N1—Reference point—top of casing, elevation 35 feet. 200 feet north of Oak Avenue, 0.7 mile east of Garden Highway. 11/20/47, 10.9; 3/10/48, 11.9; 11/4/48, 9.3; 1/24/49, 9.3; 3/8/49, 7.6; 12/7/49, 11.0.

13N 3E-26J1—Reference point—top of casing, elevation 35 feet. 300 feet south of Cypress Avenue, 0.4 mile east of Garden Highway. 11/20/47, 9.2; 3/10/48, 9.9.

13N 3E-35H1—Reference point—hole in casing, elevation 32 feet. 0.1 mile north of Laurel Avenue, 0.45 mile east of Garden Highway. 11/20/47, 9.7; 3/10/48, 8.0; 11/4/48, 8.8; 1/24/49, 9.0; 3/8/49, 7.0; 12/7/49, 10.1.

13N 3E-36N1—Reference point—top of 2" x 4" at top of west side of pit, elevation 33 feet. 0.3 mile south of Laurel Avenue, 0.55 mile east of Garden Highway. 12/5/47, 11.9; 3/10/48, 12.2; 5/11/48, 7.0; 12/11/48, 11.6; 3/16/49, 8.2; 12/6/49, 12.8; 3/29/50, 7.7; 11/3/50, 12.0; 4/3/51, 5.2; 11/16/51, 10.2; 4/4/52, 3.6.

13N 4E-1P1—Reference point—top of 14-inch casing, elevation 62 feet. 100 feet west of farm road, 1.1 miles south of Dairy Road. 11/28/47, 18.8.

13N 4E-1Q1—Reference point—bottom of slot inside of casing by air line, elevation 63.2 feet. 800 feet east of farm road, 1.1 miles south of Dairy Road. 11/28/47, 19.4; 2/11/48, 17.5; 2/21/48, 18.1; 3/29/48, 17.4; 5/5/48, 15.2; 6/3/48, 17.9; 7/2/48, 66.0 (operating); 11/12/48, 21.0; 3/24/49, 17.0; 11/28/49, 24.2.

13N 4E-2A1—Reference point—top of 12-inch casing, bottom of pit, elevation 52 feet. Ground elevation 66 feet, 300 feet south of Dairy Road, 2.2 miles southwest of U. S. Highway 99E. 11/28/47, 13.4; 3/2/48, 11.0; 11/12/48, 14.8; 3/25/49, 11.3; 11/23/49, 17.3; 3/28/50, 14.3; 11/8/50, 19.1; 4/4/51, 12.8; 11/30/51, 29.4.

13N 4E-2C1—Reference point—top of 14-inch casing, elevation 64 feet. West of Pleasant Grove Road (Forty Mile Road) about 1.5 miles southeast of Plumas School. 11/28/47, 28.0; 3/1/48, 26.2; 3/22/48, 28.3; 3/29/48, 26.4; 5/5/48, 24.5; 8/13/48, 78.8 (operating); 11/8/48, 29.4; 1/25/49, 27.7; 3/25/49, 26.1; 11/23/49, 31.8.

13N 4E-2K1—Reference point—lower left hole in pump base, elevation 66 feet. 100 feet southeast of Leach Road, 200 feet west of Pleasant Grove Road (Forty Mile Road). 11/29/47, 29.0; 3/1/48, 26.6; 4/8/48, 29.9; 3/25/49, 26.7; 11/23/49, 26.7; 3/28/50, 32.3; 11/6/50, 34.0; 4/3/51, 26.9; 11/30/51, 33.1; 4/1/52, 30.0.

13N 4E-3F1—Reference point—top of concrete pit, elevation 57 feet. West of Hoffman Road, 1.4 miles south of Plumas School. 11/8/48, 30.1.

13N 4E-3G1—Reference point—slot in side of casing, elevation 58 feet. East of Hoffman Road, 1.4 miles south of Plumas School. 11/28/47, 25.6; 11/8/48, 27.0; 11/25/49, 28.7; 3/28/50, 26.0; 11/6/50, 30.1; 4/4/51, 26.0; 12/5/51, 32.8; 4/1/52, 25.9.

13N 4E-4J1—Reference point—top of casing, bottom of pit, elevation 47 feet, ground elevation 52.0 feet. 250 feet west of farm road, 0.75 mile north of Leach Road. 11/29/47, 18.3; 3/1/48, 16.8; 11/8/48, 20.5; 3/25/49, 15.9; 11/26/49, 21.1.

13N 4E-4J2—Reference point—hole in side of casing, elevation 52 feet. 100 feet west of farm road, 0.75 mile north of Leach Road. 11/8/48, 26.1; 3/25/49, 21.1; 11/26/49, 26.0.

13N 4E-7E1—Reference point—hole in pump base, elevation 39 feet. 0.05 mile west of Feather River Boulevard, 2.9 miles south of Country Club Avenue. 11/17/47, 14.3; 3/9/48, 13.1; 5/5/48, 9.1; 5/31/48, 9.1; 7/2/48, 42.0 (operating); 8/1/48, 49.1 (operating); 9/2/48, 44.0 (operating); 9/30/48, 13.5; 11/10/48, 13.9; 1/21/49, 13.8; 3/22/49, 10.8; 6/1/49, 10.8; 6/29/49, 12.8; 7/28/49, 14.2; 8/26/49, 15.8; 12/2/49, 15.3; 3/29/50, 9.7; 11/6/50, 11.7; 3/30/51, 7.8; 11/16/51, 13.7; 4/1/52, 5.5.

13N 4E-9A1—Reference point—top of 14-inch casing, elevation 52 feet. West of farm road, 0.45 mile north of Leach Road. 11/29/47, 19.8; 3/1/48, 17.9; 11/8/48, 20.5; 3/25/49, 17.0; 11/26/49, 22.1; 3/28/50, 19.0; 11/6/50, 23.0; 4/3/51, 16.4; 12/6/51, 22.4; 4/1/52, 18.0.

13N 4E-9R1—Reference point—top of casing, elevation 50 feet. 0.30 mile south of Leach Road. 11/8/48, 21.4; 3/25/49, 17.2; 11/26/49, 24.1; 3/28/50, 18.7; 11/6/50; 25.4; 4/4/51, 14.8; 12/5/51, 23.0; 4/1/52, 14.9.

13N 4E-10D1—Reference point—top of 14-inch casing, elevation 54 feet. 0.25 mile east of farm road, 0.50 mile north of Leach Road. 11/29/47, 25.0; 3/1/48, 23.0; 11/8/48, 26.5; 3/25/49, 22.4; 11/26/49, 27.4; 4/1/52, 24.6.

13N 4E-10J1—Reference point—slot in side of casing, elevation 55 feet. 200 feet south of Leach Road. 11/8/48, 25.6; 3/25/49, 23.0; 11/26/49, 27.6; 3/28/50, 23.5; 11/6/50, 29.6; 4/3/51, 21.5; 4/1/52, 21.0.

13N 4E-11J1—Reference point—bottom of slot in top of casing, elevation 61.3 feet. 200 feet west of Pleasant Grove Road, 0.75 mile north of Four Corners. 12/2/47, 19.6; 2/11/48, 17.8; 2/21/48, 17.7; 3/8/48, 26.5; 3/22/48, 26.4; 3/29/48, 17.8; 5/5/48, 16.0; 6/3/48, 17.8; 9/30/48, 27.2; 11/15/48, 21.2; 1/26/49, 19.5; 3/31/49, 18.3; 12/2/49, 23.6; 3/29/50, 19.6; 11/8/50, 25.5; 4/3/51, 18.6; 11/20/51, 24.4; 4/4/52, 15.7.

13N 4E-12C2—Reference point—top of flange in bottom of pit, elevation 44 feet. Ground elevation 55 feet, 1,000 feet north of Wheatland-Rio Oso Road, 0.45 mile east of Pleasant Grove Road (Forty Mile Road). 11/25/47, 9.2; 2/11/48, 6.9; 2/21/48, 6.0; 3/29/48, 4.8; 11/12/48, 10.5; 3/24/49, 5.5; 6/6/49, 14.0; 7/1/49, 17.4; 8/1/49, 21.6; 8/31/49, 45.0 (operating); 11/26/49, 13.4.

13N 4E-12E1—Reference point—top of 14-inch casing, elevation 60 feet. 150 feet west of Wheatland-Rio Oso Road, 300 feet east of Pleasant Grove Road (Forty Mile Road). 11/29/47, 18.9.

13N 4E-12E2—Reference point—bottom of slot in top of 14-inch casing, elevation 60.8 feet. 100 feet west of Wheatland-Rio Oso Road, 400 feet east of Pleasant Grove Road (Forty Mile Road). 11/29/47, 18.5; 2/11/48, 16.2; 2/21/48, 16.0; 3/2/48, 16.6; 3/11/48, 16.6; 3/29/48, 14.9; 5/18/48, 13.2; 11/12/48, 19.7; 3/24/49, 15.2; 11/23/49, 24.5; 3/29/50, 16.6; 11/8/50, 23.0; 4/3/51, 14.0; 12/3/51, 24.2; 4/2/52, 10.8.

13N 4E-12G1—Reference point—hole in pump base, elevation 65 feet. North of Wheatland-Rio Oso Road, 0.85 mile east of Pleasant Grove Road (Forty Mile Road). 11/28/47, 22.1.

13N 4E-12H1—Reference point—hole in pump base, elevation 67.3 feet. 100 feet north of Wheatland-Rio Oso Road, 1.0 mile east of Pleasant Grove Road (Forty Mile Road). 11/28/47, 22.6; 2/11/48, 20.5; 2/21/48, 21.0; 3/29/48, 21.0; 11/12/48, 23.8; 3/24/49, 19.4; 11/26/49, 26.8.

13N 4E-12H2—Reference point—top of slot in pump base, elevation 67.2 feet. 100 feet north of Wheatland-Rio Oso Road, 0.90 mile east of Pleasant Grove Road (Forty Mile Road). 11/28/47, 22.2; 3/29/48, 19.8; 11/12/48, 23.4; 3/24/49, 19.0; 11/26/49, 26.6.

13N 4E-12H3—Reference point—top of 8-inch casing, elevation 68 feet. 200 feet south of Wheatland-Rio Oso Road, 1.0 mile east of Pleasant Grove Road (Forty Mile Road). 12/2/47, 21.2; 3/8/48, 25.4.

13N 4E-12K1—Reference point—groove in base plate, elevation 69.4 feet. 0.30 mile south of Wheatland-Rio Oso Road, 0.50 mile east of Pleasant Grove Road (Forty Mile Road). 12/2/47, 24.6; 3/8/48, 28.2; 3/29/48, 22.4; 11/15/48, 25.7; 3/31/49, 21.9; 12/2/49, 28.4.

13N 4E-12K2—Reference point—top ridge on base plate, elevation 70 feet. 1,000 feet south of Wheatland-Rio Oso Road, 0.75 mile east of Pleasant Grove Road (Forty Mile Road). 12/2/47, 24.4; 3/8/48, 29.6.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N/4E-12L1—Reference point—pipe in base, elevation 65.6 feet, 1,100 feet south of Wheatland-Rio Oso Road, 0.25 mile east of Pleasant Grove Road (Forty Mile Road). 12/2/47, 23.2; 3/8/48, 30.9; 3/22/48, 32.7; 3/29/48, 21.6; 5/5/48, 19.2; 6/3/48, 21.2; 9/30/48, 30.7; 11/15/48, 24.8; 1/26/49, 23.0; 12/2/49, 27.6.

13N/4E-12L2—Reference point—slot in top of casing, elevation 65.1 feet, 800 feet south of Wheatland-Rio Oso Road, 0.30 mile east of Pleasant Grove Road (Forty Mile Road). 12/2/47, 21.6; 3/8/48, 28.3; 3/22/48, 29.0; 3/29/48, 19.9; 9/30/48, 29.3; 11/15/48, 23.4; 3/31/49, 22.8.

13N/4E-12Q1—Reference point—pipe in concrete base, elevation 70.5 feet, 0.30 mile north of Bear River Drive, 0.70 mile east of Pleasant Grove Road. 12/3/47, 26.0; 3/30/48, 24.4; 11/4/48, 27.9; 3/31/49, 23.5; 12/2/49, 30.2.

13N/4E-12R1—Reference point—hole in pump base, elevation 72.4 feet, 0.30 mile north of Bear River Drive, 0.90 mile east of Pleasant Grove Road. 12/3/47, 45.5; 3/30/48, 24.9; 11/4/48, 28.9; 1/26/49, 26.6; 3/31/49, 24.4; 12/2/49, 31.3.

13N/4E-13A1—Reference point—hole in pump base, elevation 71.6 feet, 1,200 feet north of Bear River Drive, 0.75 mile east of Pleasant Grove Road. 12/3/47, 26.5; 3/8/48, 31.6; 3/30/48, 24.9; 11/4/48, 28.3; 3/31/49, 24.0; 12/2/49, 30.8.

13N/4E-13B1—Reference point—hole in pump base, elevation 70 feet, 850 feet north of Bear River Drive, 0.60 mile east of Pleasant Grove Road. 11/4/48, 28.3.

13N/4E-13C1—Reference point—top of 14-inch casing, elevation 69.2 feet, 900 feet north of Bear River Drive, 0.40 mile east of Pleasant Grove Road. 12/3/47, 25.7; 11/4/48, 27.7; 3/31/49, 23.3; 12/2/49, 30.0.

13N/4E-13E1—Reference point—top of 14-inch casing, elevation 60.7 feet, 150 feet south of Bear River Drive, 700 feet east of Four Corners. 12/3/47, 19.5; 3/8/48, 24.2; 3/30/48, 18.1; 11/4/48, 21.6; 3/31/49, 17.0; 12/2/49, 23.6; 3/30/50, 19.8; 11/8/50, 25.4; 11/20/51, 23.1; 4/4/52, 16.7.

13N/4E-13F1—Reference point—bottom of pump base, elevation 62.9 feet, 150 feet south of Bear River Drive, 0.25 mile east of Four Corners. 12/2/47, 21.2; 3/10/48, 31.2; 11/4/48, 23.5; 3/31/49, 19.0; 12/2/49, 25.6.

13N/4E-13F2—Reference point—top of casing, elevation 65.5 feet. North side Bear River Drive, 0.30 mile east of Four Corners. 12/2/47, 23.2; 3/30/48, 21.8; 5/14/48, 19.5; 11/4/48, 25.5; 1/26/49, 23.0; 3/31/49, 21.0.

13N/4E-13F3—Reference point—top of 12-inch casing, elevation 66.9 feet, South side Bear River Drive, 0.50 mile east of Four Corners. 12/2/47, 23.6; 3/8/48, 28.2; 11/4/48, 25.5; 3/31/49, 21.2; 12/2/49, 27.9.

13N/4E-13G1—Reference point—top of 12-inch casing, elevation 67.8 feet, 200 feet south of Bear River Drive, 0.50 mile east of Four Corners. 12/2/47, 24.2; 3/8/48, 27.3; 11/4/48, 25.7; 3/31/49, 21.6; 12/2/49, 28.2.

13N/4E-13G2—Reference point—top of 14-inch casing, elevation 69.1 feet. South side Bear River Drive, 0.70 mile east of Four Corners. 12/2/47, 24.6; 3/10/48, 28.1; 3/30/48, 23.2; 11/4/48, 25.9; 3/31/49, 22.0; 12/2/49, 28.5; 3/30/50, 24.8; 11/8/50, 30.9; 4/3/51, 20.7; 11/20/51, 24.4; 4/4/52, 16.7.

13N/4E-13H1—Reference point—slot in concrete base, elevation 66 feet, 150 feet south of Bear River Drive, 0.95 mile east of Four Corners. 12/3/47, 22.4; 11/4/48, 24.4; 3/31/49, 21.7; 12/2/49, 27.1.

13N/4E-13K1—Reference point—top of twin holes in pump base, elevation 63 feet, 0.40 mile north of Gallagher Road, 0.50 mile east of Pleasant Grove Road. 12/5/47, 18.7.

13N/4E-13M1—Reference point—top of concrete foundation, elevation 60.8 feet, 700 feet east of Pleasant Grove Road, 0.30 mile north of Gallagher Road. 12/5/47, 19.6; 3/8/48, 25.7; 11/15/48, 21.6; 3/31/49, 17.7; 11/30/49, 25.1.

13N/4E-13M2—Reference point—top of casing, elevation 62.2 feet, 0.25 mile east of Pleasant Grove Road, 0.30 mile north of Gallagher Road. 12/5/47, 21.9; 3/8/48, 22.5; 3/31/48, 20.1; 11/15/48, 22.9; 4/1/49, 17.5; 11/30/49, 25.5.

13N/4E-13P1—Reference point—top of 14-inch casing, elevation 20.2 feet, 900 feet north of Gallagher Road, 0.40 mile east of Pleasant Grove Road. 12/5/47, 18.2; 3/8/48, 23.4; 11/5/48, 20.8; 4/1/49, 17.2; 11/30/49, 23.2.

13N/4E-13R1—Reference point—top of 14-inch casing, elevation 69.3 feet, 0.50 mile east of end of Gallagher Road, 1.00 mile east of Pleasant Grove Road. 12/8/47, 25.6; 3/10/48, 27.8; 3/31/48, 24.3; 11/5/48, 28.4; 4/1/49, 24.0; 11/30/49, 31.3; 3/30/50, 27.1; 11/9/50, 34.0; 4/4/51, 25.9; 11/21/51, 33.7.

13N/4E-14A1—Reference point—bottom of cutout in top of casing, elevation 59.28 feet, 900 feet north of Bear River Drive, 1,000 feet west of Pleasant Grove Road. 12/3/47, 19.1; 11/15/48, 20.4; 3/31/49, 16.7; 12/1/49, 22.9.

13N/4E-14D1—Reference point—bottom edge of pump base, elevation 55.0 feet, 900 feet east of Warren Road, 0.25 mile north of Bear River Drive. 12/3/47, 14.8; 2/10/48, 14.6; 3/31/48, 12.4; 11/15/48, 15.3; 3/31/49, 10.5; 12/1/49, 17.2.

13N/4E-14F1—Reference point—top of 12-inch casing, elevation 55.0 feet, 350 feet north of Bear River Drive, 0.30 mile east of Warren Road. 12/3/47, 17.7; 3/8/48, 20.0; 11/15/48, 18.6; 3/31/49, 14.2; 12/1/49, 20.8; 3/30/50, 15.9; 11/9/50, 22.2; 4/3/51, 13.0; 11/20/51, 19.2; 4/4/52, 6.0.

13N/4E-14F3—Reference point—top of casing, elevation 55.2 feet, 250 feet south of Bear River Drive, 0.40 mile east of Warren Road. 12/4/47, 17.4; 11/15/48, 18.9; 3/31/49, 14.8; 12/1/49, 21.3.

13N/4E-14J1—Reference point—hole in pump base, elevation 54 feet, 1,000 feet west of Pleasant Grove Road, 0.30 mile south of Bear River Drive. 12/4/47, 17.4; 11/15/48, 19.4; 3/31/49, 15.4; 12/1/49, 22.3.

13N/4E-14N1—Reference point—top of 14-inch casing in bottom of pit, elevation 48.5 feet, 400 feet east of Warren Road, 0.40 mile south of Bear River Drive. 12/4/47, 14.5; 3/31/48, 12.9; 11/15/48, 15.2; 3/31/49, 10.7; 12/1/49, 17.1.

13N/4E-14N2—Reference point—top of 14-inch casing, elevation 54.4 feet, 1,200 feet east of Warren Road, 0.35 mile south of Bear River Drive. 12/4/47, 21.0; 3/31/48, 19.5; 11/15/48, 21.8; 3/31/49, 17.2; 12/1/49, 23.9.

13N/4E-14Q1—Reference point—top of 14-inch casing, elevation 56 feet, 0.45 mile west of Pleasant Grove Road, 0.50 mile south of Bear River Drive. 12/4/47, 22.5; 11/15/48, 23.9; 3/31/49, 18.7; 12/1/49, 26.3.

13N/4E-14Q2—Reference point—top of 12-inch casing, elevation 59.1 feet, 0.25 mile west of Pleasant Grove Road, 0.25 mile north of Betz Road. 12/5/47, 23.2; 3/10/48, 33.3; 11/15/48, 24.6.

13N/4E-14R1—Reference point—hole in pump base, elevation 60.4 feet. West side Pleasant Grove Road, 1,000 ft. north of Gallagher Road. 12/5/47, 21.2; 3/8/48, 25.1; 3/31/48, 19.5; 5/8/48, 17.3; 11/5/48, 23.6; 11/15/48, 22.4; 1/26/49, 20.3; 3/31/49, 18.1; 11/30/49, 25.4.

13N/4E-14R2—Reference point—top of concrete pit, elevation 60.1 feet. West side Pleasant Grove Road, 1,100 feet north of Gallagher Road. 12/5/47, 21.8; 3/8/48, 21.5; 11/5/48, 23.6.

13N/4E-15A1—Reference point—top of pump base, elevation 54.7 feet, 350 feet west of Warren Road, 0.30 mile north of Bear River Drive. 12/3/47, 17.9; 3/8/48, 19.5; 3/31/48, 16.2; 11/15/48, 19.1; 3/31/49, 14.2; 12/1/49, 21.1.

13N/4E-15J2—Reference point—bottom edge of pump base, elevation 53.2 feet. South side Bear River Drive, 100 feet west of Warren Road. 12/4/47, 19.2; 3/10/48, 19.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Meosurements Mode by Division of Water Resources
(Depths to woter in feet meosured from reference point)

13N 4E-15K1—Reference point—hole in pump base, elevation 51.8 feet. North side Bear River Drive, 1,200 feet northeast of Swanson Road. 12/4/47, 16.4; 3/30/48, 14.2; 5/5/48, 12.2; 6/3/48, 13.8; 7/2/48, 56.2; 11/15/48, 17.2; 1/26/49, 15.3; 3/31/49, 12.0; 5/25/49, 18.1; 6/29/49, 25.9; 8/26/49, 24.7; 12/1/49, 19.4.

13N 4E-15N1—Reference point—bottom of pump base, elevation 50.8 feet. North side Bear River Drive, 0.40 mile southwest of Swanson Road. 12/4/47, 19.2; 3/10/48, 18.2; 11/15/48, 19.0; 3/31/49, 12.5; 12/1/49, 21.3.

13N 4E-15N2—Reference point—hole in pump base, elevation 52.9 feet, 350 feet south of Bear River Drive, 0.30 mile southwest of Swanson Road. 12/4/47, 21.2; 3/10/48, 20.0; 11/15/48, 21.0; 3/31/49, 14.4; 12/1/49, 23.2.

13N 4E-15P1—Reference point—bottom of pump base, elevation 54.3 feet, 350 feet west of Swanson Road, 1,090 feet south of Bear River Drive. 12/4/47, 22.3; 3/10/48, 21.4; 11/15/48, 22.2; 3/31/49, 15.9; 12/1/49, 24.4.

13N 4E-15P2—Reference point—hole in pump base, elevation 51 feet, 200 feet north of junction of Swanson Road and Bear River Drive. 12/4/47, 17.0; 3/31/48, 14.2; 11/15/48, 17.0; 3/31/49, 11.1; 12/1/49, 18.8; 3/30/50, 11.6; 11/20/50, 19.1; 4/4/52, 5.9.

13N 4E-15R1—Reference point—bottom of slot in concrete base, elevation 54 feet, 100 feet west of Warren Road, 0.45 mile south of Bear River Drive. 12/4/47, 21.4; 3/8/48, 24.0; 11/15/48, 21.7; 3/31/49, 17.0; 12/1/49, 24.0.

13N 4E-16N1—Reference point—hole in pump base, elevation 43.7 feet, 600 feet west of Fourth Avenue, 0.75 mile north of Rio Oso Road. 12/6/47, 14.4; 3/30/48, 9.8; 5/5/48, 7.3; 5/31/48, 7.4; 11/16/48, 12.7; 4/1/49, 6.0; 5/25/49, 11.3; 6/2/49, 9.3; 7/1/49, 11.6; 8/1/49, 17.0; 8/31/49, 16.7; 11/30/49, 16.0; 3/30/50, 7.0; 11/9/50, 15.8; 4/3/51, 4.9; 11/20/51, 13.7; 4/4/52, 3.4.

13N 4E-17A1—Reference point—hole in base of pump, elevation 41 feet, 250 feet west of farm road, 1.25 miles north of Feather River Boulevard at Bear River Bridge. 11/21/47, 11.9; 3/10/48, 10.5; 12/8/49, 14.4.

13N 4E-17G2—Reference point—hole in base of pump, elevation 40 feet, 0.35 mile northeast of Feather River Boulevard at a point 0.60 mile northwest of Bear River Bridge. 11/21/47, 14.1; 3/10/48, 11.9; 11/5/48, 13.6; 3/15/49, 8.3; 12/7/49, 15.8.

13N 4E-17P1—Reference point—bottom of pump base, elevation 39 feet, 300 feet south of Feather River Boulevard, 0.60 mile northwest of Bear River Bridge. 11/20/47, 13.9; 3/10/48, 11.9; 5/8/48, 6.9; 11/5/48, 11.2; 1/24/49, 10.4; 3/15/49, 7.9; 6/1/49, 7.9; 7/29/49, 15.0; 8/26/49, 15.2; 12/8/49, 13.8; 3/29/50, 6.9; 11/6/50, 13.7; 3/30/51, 11.9; 11/16/51, 11.9.

13N 4E-17Q1—Reference point—top of floor board, elevation 42 feet, 800 feet east of Feather River Boulevard at a point 0.45 mile northwest of Bear River Bridge. 11/21/47, 13.1; 3/10/48, 11.9; 3/15/49, 7.2; 12/8/49, 14.9.

13N 4E-18F1—Reference point—hole in base of pump, elevation 35 feet. South side of curve in Feather River Boulevard, approximately 2.0 miles northwest of Bear River Bridge. 3/9/48, 13.0; 5/5/48, 9.0; 5/31/48, 9.9; 11/5/48, 14.5; 1/24/49, 13.0; 3/15/49, 11.3; 12/8/49, 15.9; 3/29/50, 10.6; 11/6/50, 15.1; 3/30/51, 7.5; 11/16/51, 13.8.

13N 4E-18L1—Reference point—top of tin casing, elevation 35 feet, 100 feet south of farm road, 1,200 feet southwest of Feather River Boulevard. 11/20/47, 11.8; 3/9/48, 13.3; 11/5/48, 14.7; 3/15/49, 11.1; 12/8/49, 15.8.

13N 4E-19Q1—Reference point—top of concrete under pump, elevation 35 feet, 0.25 mile northwest of Levee Road, 1.1 miles southwest of Feather River Boulevard at Bear River Bridge. 11/21/47, 13.7; 11/5/48, 15.7; 3/15/49, 9.9; 12/7/49, 17.0; 3/29/50, 10.1; 11/8/50, 15.6; 3/30/51, 10.2.

13N 4E-20B1—Reference point—top of casing, elevation 42 feet. Northeast of Feather River Boulevard just across Bear River Bridge. 11/21/47, 16.4; 3/10/48, 15.8; 11/5/48, 15.0.

13N 4E-20F1—Reference point—top of concrete under pump, elevation 39 feet, 900 feet west of Levee Road, 0.30 mile southwest of Feather River Boulevard at Bear River Bridge. 11/21/47, 12.3; 11/5/48, 12.2; 3/15/49, 7.0; 12/7/49, 13.7.

13N 4E-20G1—Reference point—base of pump, elevation 41 feet, 300 feet west of Levee Road, 700 feet southwest of Feather River Boulevard at Bear River Bridge. 11/21/47, 13.6; 11/5/48, 15.1; 3/15/49, 8.2; 12/7/49, 15.7.

13N 4E-20J1—Reference point—top of casing, elevation 41 feet, 400 feet south of Feather River Boulevard, 500 feet west of Sacramento Northern Railroad. 11/21/47, 12.9; 3/10/48, 11.9; 11/5/48, 11.8; 1/24/49, 10.4; 3/15/49, 6.6; 12/8/49, 14.3; 3/29/50, 6.9; 11/8/50, 14.4; 3/30/51, 3.8; 11/16/51, 12.2.

13N 4E-20N1—Reference point—top of casing, elevation 37 feet, North side of the west levee of Bear River, 0.99 mile south of Feather River Boulevard at Bear River Bridge. 11/21/47, 14.8; 11/5/48, 14.3; 3/15/49, 8.6; 12/7/49, 16.0.

13N 4E-20R2—Reference point—hole in pump base, elevation 41 feet. West of Sacramento Northern Railroad, 0.35 mile south of Rio Oso Road. 11/21/47, 15.9; 3/10/48, 14.9; 5/11/48, 11.4; 3/15/49, 11.0; 12/8/49, 16.3.

13N 4E-21A1—Reference point—bottom edge of pump base, elevation 50 feet, 500 feet south of west end of Bear River Drive. 12/4/47, 19.2; 3/10/48, 18.3; 3/31/48, 15.9; 11/15/48, 19.9; 1/26/49, 17.6; 3/31/49, 11.8; 12/1/49, 21.4; 3/30/50, 12.0; 11/9/50, 21.0; 4/3/51, 9.2; 11/20/51, 18.7; 4/4/52, 6.6.

13N 4E-21B1—Reference point—pipe elbow in casing, elevation 47.8 feet, 0.25 mile west of west end of Bear River Drive. 12/4/47, 16.7; 3/10/48, 19.0; 11/15/48, 16.6; 3/31/49, 9.8; 12/1/49, 18.8; 11/20/51, 16.3; 4/4/52, 5.9.

13N 4E-21C1—Reference point—bottom of flanged coupling, elevation 45.1 feet, 630 feet east of Fourth Avenue, 0.25 mile north of Rio Oso Road. 12/6/47, 17.0; 3/9/48, 15.3; 11/16/48, 15.9; 4/1/49, 8.9; 11/30/49, 18.4.

13N 4E-21D1—Reference point—top of flanged coupling, elevation 43 feet. West side of Fourth Avenue, 0.25 mile north of Rio Oso Road. 12/6/47, 15.0; 3/9/48, 12.8; 3/31/48, 11.7; 11/16/48, 13.5; 4/1/49, 7.9; 11/30/49, 16.4.

13N 4E-21E1—Reference point—top of 12-inch casing, elevation 42 feet, 250 feet north of Rio Oso Road, 800 feet west of Fourth Avenue. 12/6/47, 17.1; 3/11/48, 16.3.

13N 4E-21F1—Reference point—top of 14-inch casing, elevation 43 feet, 600 feet north of Rio Oso Road, 0.2 mile east of Fourth Avenue. 12/6/47, 17.4.

13N 4E-21H1—Reference point—hole in pump base, elevation 46.2 feet, 250 feet north of Rio Oso Road, 800 feet west of Pacific Avenue. 12/5/47, 17.1; 3/9/48, 15.4; 3/31/48, 14.6; 5/8/48, 11.5; 11/16/48, 16.9; 4/1/49, 10.0; 11/29/49, 18.8.

13N 4E-21L1—Reference point—top of 12-inch casing, elevation 42.5 feet. East side of Fourth Avenue, 250 feet south of Rio Oso Road. 12/8/47, 15.6; 3/9/48, 13.8; 11/15/48, 14.7; 4/1/49, 9.6; 11/30/49, 17.0.

13N 4E-21P1—Reference point—bottom of flanged coupling, elevation 36.1 feet, 250 feet east of Fourth Avenue, 300 feet north of Kempton Road. 12/8/47, 9.6; 3/9/48, 8.6.

13N 4E-21P2—Reference point—edge of pump base, elevation 44.7 feet, 600 feet north of Kempton Road, 0.25 mile east of Fourth Avenue. 12/8/47, 17.4; 3/9/48, 16.5; 3/31/48, 15.3; 11/16/48, 17.2; 4/1/49, 12.1; 11/30/49, 19.2; 3/30/50, 13.4; 11/9/50, 20.1; 4/3/51, 9.1; 11/21/51, 18.1; 4/4/52, 8.3.

13N 4E-21R1—Reference point—top of 8-inch casing, elevation 45 feet, 350 feet north of Kempton Road, 650 feet west of Pacific Avenue. 12/16/47, 20.7; 3/10/48, 19.9; 11/16/48, 21.2; 4/1/49, 17.0; 11/29/49, 23.2.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N/4E-22A1—Reference point—top of 16-inch casing, elevation 51 feet. 350 feet west of Warren Road, 700 feet north of Betz Road. 12/5/47, 22.6; 3/31/48, 21.1.

13N/4E-22E1—Reference point—top of 12-inch casing, bottom of pit, elevation 10.4 feet. 1,000 feet north of Rio Oso Road, 0.35 mile west of Swanson Road. 12/5/47, 10.4; 3/9/48, 8.8.

13N/4E-22F1—Reference point—hole in pump base, elevation 53.1 feet. 300 feet west of Swanson Road, 500 feet north of Rio Oso Road. 12/5/47, 22.2; 3/10/48, 21.6; 11/16/48, 22.1; 4/1/49, 16.9; 11/30/49, 24.4.

13N/4E-22G1—Reference point—top of 12-inch casing, elevation 55.1 feet. North side of Rio Oso Road, 700 feet east of Swanson Road. 12/5/47, 23.9; 3/9/48, 23.6; 11/16/48, 23.8; 4/1/49, 19.8; 11/30/49, 26.5; 3/30/50, 21.5; 11/9/50, 27.5; 4/4/51, 18.7; 11/20/51, 25.7; 4/3/52, 16.9.

13N/4E-23B1—Reference point—bottom of pump base, elevation 58.6 feet. South side of Gallagher Road, 0.30 mile west of Pleasant Grove Road. 12/5/47, 21.3; 3/10/48, 27.8; 3/31/48, 20.8; 11/15/48, 23.0; 3/31/49, 19.0; 11/30/49, 25.7.

13N/4E-23C1—Reference point—hole in pump base, elevation 55 feet. 0.25 mile north of Betz Road, 0.30 mile east of Warren Road. 12/5/47, 22.7; 3/8/48, 26.9; 3/31/48, 21.9; 11/15/48, 23.6; 3/31/49, 19.6; 11/30/49, 26.2.

13N/4E-23D1—Reference point—bottom of pump base, elevation 51 feet. East side of Warren Road, 1,000 feet north of Betz Road. 12/5/47, 23.4; 3/10/48, 27.6; 11/15/48, 23.8; 3/31/49, 19.5; 11/30/49, 26.4.

13N/4E-23Q1—Reference point—top of 14-inch casing, elevation 62.7 feet. 500 feet north of Kempton Road, 0.25 mile west of Pleasant Grove Road. 12/16/47, 26.2; 3/9/48, 26.2; 5/8/48, 22.9; 11/5/48, 27.3; 1/26/49, 25.4; 4/1/49, 24.0; 11/30/49, 30.0; 3/30/50, 26.9; 11/9/50, 33.1; 4/3/51, 26.5; 11/20/51, 31.4; 4/3/52, 26.8.

13N/4E-24D1—Reference point—top of 14-inch casing, elevation 61.8 feet. 800 feet south of Gallagher Road, 1,000 feet east of Pleasant Grove Road. 12/5/47, 21.0; 3/10/48, 25.2; 3/31/48, 19.8; 11/5/48, 23.8; 3/31/49, 19.4; 11/30/49, 26.1; 3/30/50, 22.4; 11/9/50, 28.5; 4/4/51, 20.6; 11/21/51, 26.4; 4/4/52, 18.0.

13N/4E-24Q1—Reference point—top of 12-inch casing, bottom of pit, elevation 53.8 feet. 100 feet north of Kempton Road, 0.75 mile east of Pleasant Grove Road. 12/8/47, 11.8.

13N/4E-26B1—Reference point—top of 14-inch casing, elevation 58 feet. 200 feet south of Kempton Road, 0.45 mile west of Pleasant Grove Road. 3/9/48, 25.3; 11/5/48, 25.6; 4/1/49, 21.3; 11/30/49, 27.4.

13N/4E-26H1—Reference point—hole in pump base, elevation 57 feet. 350 feet west of Pleasant Grove Road, 0.45 mile south of Kempton Road. 11/8/47, 24.2; 3/9/48, 24.6; 11/16/48, 26.4; 4/4/49, 22.0; 11/30/49, 28.5.

13N/4E-26R1—Reference point—top of 14-inch casing, elevation 59 feet. West side of Pleasant Grove Road, 0.85 mile south of Kempton Road. 12/8/47, 25.5; 3/8/48, 24.9; 3/31/48, 24.2; 11/16/48, 28.1; 1/26/49, 26.5; 4/4/49, 23.7; 5/25/49, 34.0; 6/29/49, 42.4; 7/29/49, 48.8; 8/26/49, 49.0; 11/30/49, 29.6; 3/30/50, 26.4; 11/9/50, 33.9; 11/21/51, 33.7; 4/3/52, 26.9.

13N/4E-27C1—Reference point—bottom of flanged coupling, bottom of pit, elevation 46 feet. 400 feet south of Kempton Road, 0.40 mile east of Pacific Avenue. 12/16/47, 18.0.

13N/4E-27N1—Reference point—hole in pump base, elevation 51 feet. 250 feet east of Pacific Avenue, 0.90 mile south of Kempton Road. 12/16/47, 24.0; 3/11/48, 25.2.

13N/4E-28D1—Reference point—top of 12-inch casing, bottom of pit, elevation 27.7 feet. 600 feet south of Kempton Road, 700 feet west of Fourth Avenue. 12/8/47, 2.7; 3/11/48, 1.3; 3/31/48, 0.4; 11/16/48, 2.4; 4/1/49, −2.8; 11/30/49, 3.9.

13N/4E-28F1—Reference point—access hole to casing in bottom of pit, elevation 32.7 feet. 100 feet east of Fourth Avenue, 0.25 mile south of Kempton Road. 12/8/47, 6.8; 4/1/49, 2.6.

13N/4E-28R1—Reference point—hole in base, elevation 46 feet. 250 feet west of Pacific Avenue, 0.80 mile south of Kempton Road. 12/16/47, 23.2; 3/10/48, 22.4; 11/16/48, 25.1; 4/5/49, 21.5; 11/29/49, 26.1; 11/21/51, 27.9; 4/3/52, 22.5.

13N/4E-29F1—Reference point—top of east concrete wall, elevation 36 feet. 400 feet west of junction of Mark Hopkins Avenue and Berry Road. 11/21/47, 14.7; 3/10/48, 13.1; 11/5/48, 14.3; 1/24/49, 12.5; 3/15/49, 9.5; 5/25/49, 10.5; 6/29/49, 14.5; 7/28/49, 18.3; 8/26/49, 18.4; 12/7/49, 15.7; 3/29/50, 9.5; 11/8/50, 16.4; 3/30/51, 6.2; 11/16/51, 14.8.

13N/4E-29G1—Reference point—top of casing, elevation 37 feet. 0.10 mile southeast of Berry Road, 0.20 mile northeast of Mark Hopkins Avenue. 11/21/47, 13.2; 3/10/48, 11.8; 5/11/48, 8.9; 11/5/48, 13.1; 3/15/49, 8.4; 12/8/49, 14.4.

13N/4E-29M2—Reference point—bottom 2″ x 6″ floor, elevation 34 feet. 150 feet northwest of Berry Road, 0.25 mile southwest of Mark Hopkins Avenue. 11/21/47, 15.4; 3/10/48, 13.1; 11/5/48, 14.5; 12/7/49, 16.0.

13N/4E-30R2—Reference point—top of casing, elevation 33 feet. 400 feet south of southwest end of Berry Road. 11/21/47, 15.1; 3/11/48, 13.8; 11/5/48, 15.1; 3/16/49, 13.6; 12/8/49, 16.0.

13N/4E-31J1—Reference point—top of casing, elevation 52 feet. 0.25 mile north of Cornelius Avenue, 0.70 mile west of Mark Hopkins Avenue. 12/8/47, 14.8; 3/11/48, 13.1; 5/11/48, 9.2; 12/14/48, 15.6; 3/28/49, 10.2; 12/7/49, 15.8.

13N/4E-32B1—Reference point—top of south concrete wall, elevation 34 feet. 100 feet north of Cramer Road, 150 feet west of Mark Hopkins Avenue. 12/9/47, 14.9; 3/11/48, 13.2; 12/15/48, 16.9; 3/16/49, 12.9; 12/7/49, 16.1.

13N/4E-32D1—Reference point—top of east concrete wall, elevation 34 feet. 200 feet north of Cramer Road, 0.50 mile west of Mark Hopkins Avenue. 12/9/47, 15.1; 3/11/48, 13.2; 12/15/48, 16.9; 3/16/49, 12.3; 12/7/49, 16.1.

13N/4E-32H1—Reference point—top of north concrete wall, elevation 40 feet. East side of Mark Hopkins Avenue, 0.55 mile north of Cornelius Avenue. 12/8/47, 13.6; 3/11/48, 12.8; 5/11/48, 11.1; 12/13/48, 13.9; 3/16/49, 20.3; 12/6/49, 18.0; 3/29/50, 14.6; 11/6/50, 21.0; 3/30/51, 13.5; 11/16/51, 20.8; 4/4/52, 13.4.

13N/4E-32L1—Reference point—top of south concrete wall, elevation 35 feet. 0.25 mile west of Mark Hopkins Avenue, 0.40 mile north of Cornelius Avenue. 12/8/47, 20.6; 3/11/48, 19.4; 12/14/48, 21.9; 3/28/49, 18.4; 12/7/49, 22.3.

13N/4E-33A2—Reference point—pipe in base, elevation 50 feet. 200 feet west of Pacific Avenue, 0.9 mile north of Cornelius Avenue. 12/16/47, 25.6; 3/10/48, 24.6; 3/31/48, 25.7; 11/16/48, 27.9; 1/26/49, 26.0; 4/5/49, 24.4; 11/29/49, 28.7; 3/30/50, 25.7; 11/9/50, 31.6; 4/3/51, 24.0; 11/21/51, 31.8; 4/3/52, 24.1.

13N/4E-33G1—Reference point—bottom of pump base, elevation 47 feet. 0.4 mile west of Pacific Avenue, 0.5 mile north of Cornelius Avenue. 12/16/47, 28.6; 3/10/48, 27.5; 3/31/48, 27.3; 5/11/48, 26.7; 11/16/48, 30.9; 4/5/49, 27.5; 11/29/49, 31.3.

13N/4E-33L1—Reference point—top of casing, elevation 45 feet. 0.3 mile north of Cornelius Avenue, 0.5 mile east of Electric Avenue. 3/29/49, 24.1.

13N/4E-33P1—Reference point—hole in pump base, elevation 45 feet. 0.5 mile east of Electric Avenue, 0.2 mile north of Cornelius Avenue. 3/11/48, 22.1; 12/14/48, 24.7; 3/29/49, 22.3; 12/7/49, 22.6; 3/27/50, 25.7; 11/6/50, 32.0; 4/2/51, 25.9; 11/16/51, 30.6; 4/3/52, 24.6.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N 4E-33R1—Reference point—top of concrete pit, elevation 46 feet. 200 feet west of Pacific Avenue, 600 feet north of Cornelius Avenue. 11/8/29, 21.5; 9/8/30, 20.6; 12/30/30, 20.9; 12/10/31, 21.6; 12/11/32, 20.9; 12/20/33, 21.3; 10/27/34, 21.3; 11/23/36, 23.5; 11/24/37, 25.6; 1/30/39, 19.8; 12/22/47, 24.2; 3/11/48, 22.5; 3/31/48, 22.6; 12/14/48, 26.1; 3/29/49, 23.6; 12/7/49, 26.1; 3/27/50, 24.2; 11/6/50, 29.7; 4/2/51, 23.5; 11/16/51, 23.3; 12/6/51, 31.4; 1/4/52, 24.3.

13N 4E-34L1—Reference point—top of casing, elevation 48 feet. 0.2 mile east of Pacific Avenue, 0.4 mile north of Cornelius Avenue. 12/16/47, 23.6; 3/10/48, 22.8; 3/31/48, 22.7; 10/16/48, 26.1; 4/5/49, 23.2; 11/29/49, 27.1; 3/30/50, 24.5; 11/9/50, 30.6; 4/3/51, 24.1; 11/21/51, 30.5; 4/3/52, 24.5.

13N 4E-35J1—Reference point—top of floor of pit, elevation 42 feet. 0.4 mile north of Cornelius Avenue, 0.02 mile west of Pleasant Grove Road. 12/8/47, 8.8; 3/31/48, 7.2; 11/16/48, 11.6; 4/4/49, 8.4; 11/30/49, 13.8; 3/30/50, 11.3; 11/9/50, 19.0.

13N 4E-35Q1—Reference point—top of casing, elevation 56.6 feet. 0.4 mile west of Pleasant Grove Road, 132 feet north of Cornelius Avenue. 3/11/48, 19.9; 12/13/48, 25.1; 3/29/49, 21.1; 12/7/49, 26.0; 11/19/51, 30.4

13N 4E-36G1—Reference point—top of casing, elevation 58 feet. 528 feet north of Hicks Road, 0.6 mile east of Pleasant Grove Road. 12/16/47, 23.8; 3/9/48, 22.6; 11/16/48, 26.7; 4/4/49, 24.2; 11/30/49, 29.1.

13N 5E-3Q1—Reference point—top of casing at bottom of 10.6-foot pit, elevation 84 feet. 0.25 mile northeast of U. S. Highway 99E, 0.20 mile southeast of Bear River. 11/25/47, 4.4; 3/5/48, 5.5; 11/7/49, 6.0; 4/4/50, 4.9; 11/14/50, 5.7; 3/27/51, 2.9; 11/19/51, 6.3.

13N 5E-4J1—Reference point—top of pump base, elevation 83 feet. 0.2 mile southwest of U. S. Highway 99E at a point 0.45 mile northwest of Bear River bridge. 11/24/47, 14.8; 3/29/48, 12.7; 5/14/48, 11.9; 11/12/48, 15.6; 3/23/49, 12.9; 11/26/49, 17.3; 3/29/50, 14.1; 11/8/50, 17.5; 4/4/51, 12.5; 12/3/51, 16.6; 4/2/52, 11.3.

13N 5E-4J2—Reference point—top of casing, elevation 80 feet. 0.25 mile southwest of U. S. Highway 99E at a point 0.3 mile northwest of Yuba-Placer county line. 4/1/48, 9.2; 5/5/48, 7.9; 6/3/48, 8.5; 7/2/48, 64.0 (operating); 7/1/49, 60.7 (operating); 8/1/49, 65.8 (operating); 8/31/49, 28.8.

13N 5E-4L1—Reference point—hole in pump base, elevation 82.6 feet. 0.3 mile southwest of U. S. Highway 99E in Wheatland on south side of T. H. Richards' farm road. 11/24/47, 19.9; 3/4/48, 21.1; 11/12/48, 21.0; 3/24/49, 27.0; 11/26/49, 22.7.

13N 5E-4N1—Reference point—top of concrete base, elevation 79.9 feet. At T. H. Richards' ranch house, 0.8 mile southwest of Wheatland. 11/25/47, 17.7; 3/5/48, 21.6; 3/29/48, 15.4; 11/12/48, 18.7; 3/24/49, 14.9; 11/26/49, 20.4.

13N 5E-4R1—Reference point—top of concrete crib, south of pump, elevation 81 feet. 0.35 mile southwest of U. S. Highway 99E at a point 0.2 mile northwest of Yuba-Placer county line. 11/24/47, 13.7; 5/14/48, 10.2; 11/12/48, 14.1; 1/26/49, 13.4; 3/23/49, 10.8; 11/26/49, 15.3.

13N 5E-5B1—Reference point—top of casing, elevation 69.9 feet. 0.4 mile northeast of Oakley Avenue, 0.45 mile northwest of Wheatland Avenue. 11/24/47, 15.2; 3/5/48, 14.1.

13N 5E-5C1—Reference point—hole in pump base, elevation 68.1 feet. 0.25 mile northeast of Oakley Avenue, 0.45 mile northwest of Wheatland Road. 11/22/47, 14.5; 3/5/48, 13.1; 3/29/48, 12.2; 5/14/48, 11.6; 11/11/48, 16.0; 1/26/49, 14.2; 3/23/49, 12.1; 11/28/49, 18.5; 3/29/50, 14.9; 11/8/50, 20.7; 4/4/51, 11.5; 11/29/51, 19.3; 4/2/52, 8.2.

13N 5E-5C2—Reference point—top of pump base, elevation 72.2 feet. 0.15 mile northeast of Oakley Avenue, 0.35 mile northwest of Wheatland Road. 11/20/47, 18.5; 3/5/48, 17.4.

13N 5E-5D1—Reference point—top of concrete pit, elevation 66.5 feet. 0.1 mile southwest of Oakley Avenue, 0.6 mile northwest of Wheatland Road. 11/20/47, 15.7; 3/5/48, 15.1.

13N 5E-5L1—Reference point—top of casing, elevation 80.6 feet. Southeast side of Wheatland Road, 0.15 mile southwest of Oakley Avenue. 11/20/47, 27.5; 3/8/48, 27.5; 11/11/48, 30.6; 3/24/49, 24.1; 11/26/49, 31.1.

13N 5E-5L2—Reference point—top of concrete curb around casing, elevation 68.1 feet. Southeast side of Wheatland Road, 0.15 mile southwest of Oakley Avenue. 11/20/47, 15.6; 3/8/48, 14.3; 11/11/48, 17.3; 3/24/49, 11.7.

13N 5E-5L3—Reference point—top of casing, elevation 78.1 feet. 300 feet southwest of Oakley Avenue, 0.1 mile northwest of Wheatland Road. 11/20/47, 24.3; 3/5/48, 23.2; 11/11/48, 25.9; 3/25/49, 21.0; 11/28/49, 28.6.

13N 5E-5N1—Reference point—top of concrete crib nearest pump, elevation 70.4 feet. 0.2 mile southeast of Wheatland Road, 0.45 mile southwest of Oakley Avenue. 11/21/47, 19.2; 3/29/48, 16.0; 11/12/48, 21.9; 3/24/49, 15.2; 11/26/49, 23.5.

13N 5E-5P1—Reference point—top of pump base, elevation 71.1 feet. 0.2 mile southwest of Oakley Avenue, 0.25 mile southeast of Wheatland Road. 11/20/47, 17.6; 3/8/48, 18.3; 3/24/49, 14.2; 11/26/49, 21.2.

13N 5E-5Q1—Reference point—top of casing, elevation 75 feet. Southwest side of Oakley Avenue, 0.3 mile southeast of Wheatland Road. 11/20/47, 23.4; 3/8/48, 21.1; 3/24/49, 18.0.

13N 5E-6E1—Reference point—hole in west side pump base, elevation 63.0 feet. 0.7 mile northwest of Wheatland Road, 1.05 miles southwest of Oakley Avenue. 11/21/47, 17.8; 2/21/48, 15.6; 11/12/48, 19.5; 1/26/49, 17.0; 3/24/49, 15.1; 11/23/49, 22.9; 3/20/50, 18.4; 11/8/50, 25.2; 4/3/51, 14.8; 11/30/51, 24.3; 4/2/52, 23.1.

13N 5E-6E2—Reference point—hole in pump base, elevation 63.3 feet. 0.9 mile northwest of Wheatland Road, 1.0 mile southwest of Oakley Avenue. 11/21/47, 19.4; 2/21/48, 16.7; 5/5/48, 13.7; 6/3/48, 15.1; 7/2/48, 21.4; 11/12/48, 21.0; 3/24/49, 16.5; 5/3/49, 21.2; 6/2/49, 22.0; 7/1/49, 51.6 (operating); 8/1/49, 30.1; 8/31/49, 28.8; 11/28/49, 24.3.

13N 5E-6J1—Reference point—top of casing, elevation 67.6 feet. 0.15 mile northwest of Wheatland Road, 0.55 mile southwest of Oakley Avenue. 11/21/47, 19.1; 11/12/48, 21.0; 3/24/49, 15.4; 11/26/49, 23.5.

13N 5E-6L1—Reference point—top of casing, elevation 61.9 feet. 0.5 mile northwest of Wheatland Road, 0.8 mile southwest of Oakley Avenue. 11/21/47, 20.1; 3/5/48, 20.1; 11/12/48, 21.7; 3/24/49, 16.6; 11/26/49, 24.8.

13N 5E-7B1—Reference point—notch in concrete casing, elevation 72.2 feet. Northwest side of Wheatland Road, 0.9 mile southwest of Oakley Avenue. 11/21/47, 24.5; 3/5/48, 26.1; 11/12/48, 25.7; 3/24/49, 20.5; 11/26/49, 28.8; 3/9/50, 23.4; 11/18/50, 30.0; 1/3/51, 19.3; 12/3/51, 29.3; 4/2/52, 16.5.

13N 5E-7C1—Reference point—top of casing, elevation 71.4 feet. Northwest side of Wheatland Road, 1.3 mile southwest of Oakley Avenue. 11/28/47, 24.3; 3/2/48, 25.9; 11/12/48, 25.4; 3/24/49, 20.9.

13N 5E-7C2—Reference point—hole in top of pump base, elevation 68.3 feet. Northwest side of Wheatland Road, 1.2 miles southwest of Oakley Avenue. 11/21/47, 21.5; 3/8/48, 25.1; 3/29/48, 18.6; 5/5/48, 16.3; 6/3/48, 17.5; 7/2/48, 33.0; 11/12/48, 22.7; 3/24/49, 18.1; 6/2/49, 29.8; 8/1/49, 48.1; 8/31/49, 36.3; 11/26/49, 25.7.

13N 5E-7E1—Reference point—slot in casing, elevation 69 feet. Northwest side of Wheatland Road, 1.5 miles southwest of Oakley Avenue. 11/28/47, 23.6; 3/2/48, 26.9; 11/12/48, 24.8; 3/24/49, 20.2; 11/23/49, 28.9.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N/5E-7G1—Reference point—top of casing, elevation 80.5 feet. At Bear River north levee, 0.35 mile southeast of Wheatland Road, 1.1 miles southwest of Oakley Avenue. 11/21/47, 31.7; 3/5/48, 37.6; 3/29/48, 28.4; 5/14/48, 25.5; 11/12/48, 31.5; 1/26/49, 29.5; 3/24/49, 27.2; 11/23/49, 34.4.

13N/5E-7F1—Reference point—top of concrete base, elevation 77.3 feet. At Bear River north levee, 0.35 mile southeast of Wheatland Road, 1.3 miles southwest of Oakley Avenue. 11/21/47, 29.3; 3/8/48, 33.7; 11/12/48, 30.3; 3/24/49, 26.1; 11/23/49, 34.9; 3/29/50, 28.6; 11/6/50, 35.9; 4/3/51, 25.0; 12/3/51, 33.7; 4/2/52, 22.7.

13N/5E-7H1—Reference point—bottom of pump base, elevation 80.4 feet. 0.3 mile southeast of Wheatland Road, 0.9 mile southwest of Oakley Avenue. 11/21/47, 31.1; 3/5/48, 35.7; 11/12/48, 31.8; 3/24/49, 27.3; 11/23/49, 34.0

13N/5E-7K1—Reference point—hole in pump base, elevation 74.9 feet. West side of Huffaler Road, 0.55 mile north of Bear River Drive. 12/3/47, 26.4; 3/8/48, 29.4; 11/8/48, 27.9; 3/31/49, 23.2; 12/6/49, 30.3; 3/30/50, 26.0; 11/8/50, 33.0; 4/3/51, 21.7; 4/3/52, 18.7.

13N/5E-7L1—Reference point—edge of pump base, elevation 74.8 feet. 0.5 mile north of Bear River Drive on west side of Hudson Road extended. 12/3/47, 27.5; 3/30/48, 25.2; 11/4/48, 29.5; 3/30/49, 25.0; 12/2/49, 33.9.

13N/5E-7M1—Reference point—top of casing, elevation 73.4 feet. At Bear River north levee, 0.25 mile south of Wheatland Road, 1.1 miles east of Pleasant Grove Road. 12/24/47, 28.1; 3/8/48, 33.7; 3/29/48, 25.9; 11/15/48, 29.1; 3/31/49, 25.1; 12/2/49, 31.9.

13N/5E-8B1—Reference point—hole in pump base, elevation 76.7 feet. 0.1 mile southwest of Oakley Avenue, 0.5 mile southeast of Wheatland Road. 11/21/47, 20.6; 3/5/48, 21.3; 11/11/48, 23.3; 3/24/49, 17.3; 11/26/49, 24.2; 3/29/50, 20.1; 11/8/50, 24.5; 4/3/51, 16.6; 12/3/51, 22.2; 4/2/52, 13.2.

13N/5E-8G1—Reference point—hole in pump base, elevation 81.3 feet. At Bear River north levee, 0.1 mile southwest of Oakley Avenue, 11/21/37, 20.1; 3/5/48, 19.3; 11/11/48, 20.1; 3/24/49, 16.3. Well filled.

13N/5E-8H1—Reference point—hole in pump base, elevation 83.7 feet. At Bear River north levee, 0.1 mile northeast of Oakley Avenue. 11/25/47, 21.5; 3/5/48, 21.4; 3/29/48, 19.4; 11/12/48, 22.3; 3/24/49, 18.2; 11/26/49, 23.8.

13N/5E-8J1—Reference point—hole in pump base, elevation 84.4 feet. 0.7 mile north of Bear River Drive, 0.85 mile east of Brewer Road. 11/26/47, 26.6; 3/22/48, 25.5; 11/4/48, 28.5; 3/30/49, 24.0; 12/6/49, 30.3; 3/30/50, 17.9; 11/9/50, 31.0; 4/3/51, 24.0; 11/20/51, 29.8; 4/3/52, 14.6.

13N/5E-8L1—Reference point—hole in pump base, elevation 75 feet. 0.25 mile east of Brewer Road, 0.75 mile north of Bear River Drive. 11/26/47, 26.7; 3/22/48, 23.9; 11/4/48, 26.8; 3/30/49, 22.3; 12/6/49, 29.2.

13N/5E-8N1—Reference point—bottom of pump base by air line, elevation 76.4 feet. 0.15 mile east of Brewer Road, 0.5 mile north of Bear River Drive. 11/26/47, 25.0; 3/22/48, 23.0; 11/4/48, 25.8; 3/30/49, 21.8; 12/6/49, 28.0.

13N/5E-8P1—Reference point—top of casing, elevation 76.6 feet. 0.4 mile north of Bear River Drive, 0.5 mile east of Brewer Road. 11/26/47, 20.6; 3/22/48, 19.0; 3/30/48, 18.2; 11/4/48, 22.1; 3/30/49, 17.7; 12/6/49, 24.6.

13N/5E-8R1—Reference point—pipe in concrete base, elevation 75 feet. 0.5 mile north of Bear River Drive, 0.75 mile east of Brewer Road. 11/4/48, 25.1; 3/30/49, 20.4; 12/6/49, 27.1.

13N/5E-9C1—Reference point—slot in concrete base, elevation 76.8 feet. 0.1 mile north of Bear River north levee, 0.3 mile southeast of T. H. Richards' ranch house, 0.8 mile southwest of Wheatland. 11/25/47, 11.9; 3/5/48, 12.1; 3/29/48, 9.7; 11/12/48, 12.5; 3/24/49, 9.4; 11/26/49, 14.0.

13N/5E-9D1—Reference point—top of base under air line, elevation 82.3 feet. At Bear River north levee, 0.4 mile southeast of T. H. Richards' ranch house, 0.8 mile southwest of Wheatland. 11/25/47, 13.9; 3/5/48, 13.4; 3/29/48, 12.3; 11/12/48, 14.0; 3/24/49, 11.5; 11/26/49, 14.6; 3/29/50, 11.2; 11/8/50, 14.0; 4/3/51, 9.9; 12/3/51, 13.7; 4/2/52, 8.6.

13N/5E-9E1—Reference point—inside edge of tapered base, elevation 83.5 feet. At Bear River north levee, 0.45 mile south of T. H. Richards' ranch house, 0.8 mile southwest of Wheatland. 11/25/47, 18.1; 3/5/48, 17.6; 11/12/48, 18.2; 3/24/49, 15.2. Well destroyed.

13N/5E-9G1—Reference point—hole in pump base, elevation 85.1 feet. 0.3 mile west of Placer Road, 0.75 mile north of Bear River Drive. 11/26/47, 15.9; 11/4/48, 17.2; 3/30/49, 14.2; 12/6/49, 20.4.

13N/5E-9H1—Reference point—top of casing, elevation 86.4 feet. 1.0 mile north of Bear River Drive, 500 feet west of Placer Road extended. 11/26/47, 15.3; 11/4/48, 15.8; 3/30/49, 14.4; 11/7/49, 18.8; 12/6/49, 18.4; 11/9/50, 19.8. Well destroyed.

13N/5E-9H2—Reference point—hole in pump base, elevation 86.4 feet. 1.0 mile north of Bear River Drive, 600 feet west of Placer Road extended. 11/20/51, 20.1; 4/3/52, 13.5.

13N/5E-9P1—Reference point—hole in pump base, elevation 80.4 feet. 0.5 mile north of Bear River Drive, 0.7 mile west of Placer Road. 12/26/47, 17.6; 11/4/47, 19.5; 3/30/49, 15.6; 12/6/49, 21.0.

13N/5E-9R1—Reference point—hole in pump base, elevation 83.6 feet. West side of Placer Road, 0.5 mile north of Bear River Drive. 11/26/47, 15.7; 3/22/48, 14.5; 3/30/48, 13.8; 5/8/48, 12.9; 11/4/48, 17.2; 1/26/49, 16.7; 2/18/49, 16.3; 3/16/49, 15.7; 3/30/49, 14.8; 7/29/49, 50.5 (operating); 11/7/49, 19.9; 12/6/49, 19.6; 2/15/50, 17.6; 3/15/50, 17.2; 4/4/50, 16.7; 5/9/50, 18.1; 6/7/50, 20.0; 8/3/50, 21.9; 10/3/50, 22.2; 11/14/50, 20.3; 12/14/50, 16.5; 1/4/51, 15.2; 2/7/51, 13.2; 3/7/51, 12.8; 3/27/51, 12.6; 7/16/51, 23.7; 8/22/51, 24.9; 9/26/51, 19.5; 11/19/51, 19.6; 2/28/52, 13.5; 4/4/52, 12.0.

13N/5E-16D1—Reference point—hole in casing, elevation 78 feet. North side of Bear River Drive, 0.8 mile west of Placer Road. 11/26/47, 18.1; 3/22/48, 17.8; 3/30/48, 16.2; 5/8/48, 15.0; 11/4/48, 21.2; 1/26/49, 18.3; 3/30/49, 16.0; 6/29/49, 26.3; 7/27/49, 28.4; 8/26/49, 27.8; 12/6/49, 22.9; 3/30/50, 18.7; 11/9/50, 24.6; 4/3/51, 15.9; 11/20/51, 22.2; 4/3/52, 12.9.

13N/5E-16E1—Reference point—hole in pump base, elevation 75.9 feet. 0.1 mile south of Bear River Drive, 0.85 mile west of Placer Road. 11/26/47, 16.5; 3/22/48, 18.2; 11/4/48, 19.9; 3/30/49, 14.3; 12/6/49, 21.4.

13N/5E-17D1—Reference point—top of concrete base, elevation 71.2 feet. 0.15 mile east of Brewer Road, 0.2 mile north of Bear River Drive. 11/26/47, 18.3; 3/22/48, 19.7; 11/4/48, 22.3; 3/30/49, 18.9; 12/6/49, 25.1; 3/30/50, 22.2; 11/9/50, 27.2; 4/3/51, 18.9; 11/20/51, 25.6; 4/3/52, 15.6.

13N/5E-17J2—Reference point—hole in pump base, elevation 70 feet. 0.4 mile south of Bear River Drive, 1.0 mile west of Placer Road. 11/4/48, 19.3; 3/30/49, 13.4; 12/6/49, 21.1.

13N/5E-17R1—Reference point—hole in pump base, elevation 70 feet. 0.7 mile south of Bear River Drive, 0.8 mile east of Brewer Road. 11/4/48, 24.9; 3/30/49, 19.2; 12/6/49, 27.6; 3/30/50, 22.9; 11/9/50, 30.4; 4/4/51, 20.8; 11/20/51, 27.0; 4/3/52, 22.3.

13N/5E-18B1—Reference point—top of casing, elevation 70.8 feet. 1.5 miles east of Pleasant Grove Road, 0.25 mile north of Bear River Drive. 12/3/47, 23.3; 3/8/48, 27.4; 3/30/48, 21.1; 11/4/48, 25.1; 3/30/49, 20.6; 12/6/49, 28.0.

13N/5E-18B2—Reference point—hole in top of pump base, elevation 69.3 feet. North side of Bear River Drive, 0.3 mile west of Brewer Road. 12/17/47, 21.3; 3/22/48, 20.3; 3/30/48, 19.5; 5/14/48, 17.1; 11/4/48, 23.3; 1/26/49, 21.0; 3/30/49, 19.0; 11/30/49, 26.4.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

13N 5E-18C1—Reference point—top of casing, elevation 69.6 feet. 0.25 mile north of Bear River Drive, 0.7 mile west of Brewer Road. 12/3/47, 22.5; 3/30/48, 20.3; 11/4/48, 24.0; 3/31/49, 19.8.

13N 5E-18F1—Reference point—top of casing, elevation 60.8 feet. South side of Bear River Drive, 0.6 mile west of Brewer Road. 12/3/47, 14.3; 3/8/48, 15.2; 3/30/48, 12.1; 5/14/48, 14.0; 11/4/48, 20.3; 3/31/49, 15.9; 5/25/49, 21.3; 8/3/49, 31.1; 12/6/49, 23.4.

13N 5E-18R1—Reference point—hole in casing, elevation 69 feet. West side of Brewer Road, 0.75 mile south of Bear River Drive. 12/17/47, 24.2; 3/22/48, 23.7; 3/30/48, 23.0; 5/8/48, 21.4; 11/5/48, 28.4; 3/30/49, 23.5; 11/30/49, 32.8; 3/30/50, 28.0; 11/20/51, 31.4; 4/3/52, 25.7.

13N 5E-19C1—Reference point—bottom of pump base, elevation 71.6 feet. 0.75 mile south of Bear River Drive, 1.2 miles east of Pleasant Grove Road. 12/8/47, 27.7; 3/10/48, 27.0; 3/31/48, 26.0; 5/8/48, 24.5; 11/5/48, 30.0; 1/26/49, 27.4; 4/1/49, 25.2.

13N 5E-19N1—Reference point—top of casing, elevation 68.3 feet. North side of Kempton Road, 1.1 miles east of Pleasant Grove Road. 12/8/47, 24.8; 3/9/48, 25.9; 3/31/48, 23.6; 5/8/48, 22.2; 11/5/48, 28.6; 1/26/49, 25.9; 4/1/49, 24.0; 5/25/49, 42.0; 6/29/49, 54.2; 7/27/49, 45.0; 8/26/49, 58.0; 11/30/49, 31.1; 3/30/50, 27.3; 11/9/50, 34.3; 4/3/51, 26.8; 4/3/52, 22.4.

13N 5E-19P1—Reference point—top of casing, elevation 70.0 feet. North side of Kempton Road, 1.4 miles east of Pleasant Grove Road. 12/8/47, 25.5; 3/9/48, 25.5; 3/31/48, 24.1; 5/8/48, 23.7; 11/5/48, 29.6; 1/26/49, 27.0; 4/1/49, 25.1; 11/30/49, 32.3.

13N 5E-19R1—Reference point—top of casing, elevation 72.5 feet. 100 feet north of Kempton Road, 0.05 mile west of Brewer Road. 12/17/47, 26.6; 3/9/48, 26.8; 11/5/48, 30.5; 4/1/49, 25.9; 11/30/49, 33.3; 3/30/50, 29.7; 11/9/50, 37.1; 4/3/51, 28.5; 11/20/51, 35.7; 4/3/52, 28.5.

13N 5E-28A1—Reference point—slot in concrete base, elevation 80 feet. South side of Kempton Road, 1.8 miles east of Brewer Road. 11/5/48, 28.2; 4/4/49, 22.4; 5/12/49, 25.1; 7/1/49, 29.5; 7/29/49, 31.4; 8/25/49, 32.8; 9/29/49, 31.1; 11/10/49, 29.4; 11/30/49, 28.7; 2/15/50, 26.3; 3/14/50, 25.9; 3/30/50, 25.3; 4/5/50, 25.2; 5/8/50, 27.5; 6/7/50, 31.5; 7/7/50, 34.2; 8/1/50, 36.5; 9/6/50, 38.0; 10/3/50, 34.0; 11/9/50, 31.5; 11/14/50, 31.2; 1/4/51, 25.8; 2/7/51, 26.0; 3/27/51, 24.3; 5/9/51, 24.8; 11/15/51, 31.3; 11/20/51, 31.1; 2/28/52, 25.4; 3/31/52, 24.0; 4/3/52, 24.0.

13N 5E-28C1—Reference point—top of casing, elevation 76 feet. South side of Kempton Road, 1.3 miles east of Brewer Road. 12/17/47, 22.0; 3/9/48, 21.4; 11/5/48, 29.5; 4/4/49, 24.4; 11/10/49, 32.7; 11/30/49, 31.7; 3/30/50, 27.7; 11/9/50, 34.9; 3/27/51, 27.2; 11/20/51, 33.8; 4/3/52, 26.4.

13N 5E-23N1—Reference point—top of casing, elevation 80.7 feet. North side of Waltz Road, 1.25 miles east of Brewer Road. 11/5/48, 29.8; 1/26/49, 26.6; 4/1/49, 25.0; 11/10/49, 33.8; 3/15/50, 28.7; 3/30/50, 28.2; 4/5/50, 28.1; 9/5/50, 43.9; 10/3/50, 39.0; 11/10/50, 35.7; 11/14/50, 35.3; 12/14/50, 32.6; 1/4/51, 32.2; 3/23/51, 28.7; 11/15/51, 36.8; 11/21/51, 36.3; 3/31/52, 29.7; 4/3/52, 29.1.

13N 5E-23R1—Reference point—top of casing, elevation 84.7 feet. 0.1 mile north of Waltz Road, 2.0 miles east of Brewer Road. 11/5/48, 27.1; 4/1/49, 22.0; 9/29/49, 30.3; 11/9/49, 28.1; 2/15/50, 25.2; 3/15/50, 24.7; 4/5/50, 21.1; 5/9/50, 25.1; 6/7/50, 28.0; 7/7/50, 30.2; 8/1/50, 32.2; 9/5/50, 35.4; 10/3/50, 31.2; 11/14/50, 30.0; 12/11/50, 27.7; 1/4/51, 27.2; 3/23/51, 24.8; 5/9/51, 25.7; 6/5/51, 33.1; 7/16/51, 38.0; 8/22/51, 40.6; 9/26/51, 36.8; 11/15/51, 32.9; 2/28/52, 27.3; 3/31/52, 26.3.

13N 5E-29Q1—Reference point—top of casing, elevation 75.8 feet. North side of Waltz Road, 0.6 mile east of Brewer Road. 4/5/50, 28.5.

13N 5E-30A1—Reference point—top of casing, elevation 68 feet. Southwest of corner of Kempton and Brewer Roads. 4/1/49, 27.2.

13N 5E-30C1—Reference point—top of casing, elevation 70.3 feet. South side of Kempton Road, 0.6 mile west of Brewer Road. 12/8/47, 25.9; 3/9/48, 26.3; 3/31/48, 24.5; 11/5/48, 29.9; 4/1/49, 25.3; 11/30/49, 32.6.

13N 5E-30J1—Reference point—hole in pump base, elevation 69 feet. West side of Brewer Road, 0.3 mile north of Waltz Road. 3/22/49, 25.8.

13N 5E-30R1—Reference point—top of casing, elevation 70 feet. Northwest corner of Brewer and Waltz Roads. 11/5/48, 29.5; 4/4/49, 24.8; 11/9/49, 33.2; 11/30/49, 33.4; 2/15/50, 29.5; 3/14/50, 29.0; 3/30/50, 28.3; 4/5/50, 28.2; 11/10/50, 36.1; 11/15/51, 34.7; 11/21/51, 34.7; 3/31/52, 28.7; 4/3/52, 28.5.

13N 5E-31G1—Reference point—top of casing, elevation 69 feet. North side of Hicks Road, 0.35 mile west of Brewer Road. 12/16/47, 22.6; 3/9/48, 21.7; 3/31/48, 21.1; 11/5/48, 27.3; 1/26/49, 24.3; 4/4/49, 22.3; 11/10/49, 30.9; 11/30/49, 30.4; 2/16/50, 27.5; 3/14/50, 26.8; 3/30/50, 26.1; 11/3/50, 33.5; 11/10/50, 33.5; 4/3/52, 26.6.

13N 5E-32C1—Reference point—top of casing, elevation 74 feet. South side of Waltz Road, 0.35 mile east of Brewer Road. 2/25/49, 29.6; 4/1/49, 25.6; 5/12/49, 30.1; 6/27/49, 36.2; 7/29/49, 39.8; 8/25/49, 41.4; 9/29/49, 37.1; 11/9/49, 33.8; 2/15/50, 30.2; 3/15/50, 29.5; 4/5/50, 29.0; 5/9/50, 30.5; 6/7/50, 35.7; 7/7/50, 40.3; 8/1/50, 43.2; 9/5/50, 45.3; 10/3/50, 40.6; 11/14/50, 37.1; 12/14/50, 34.8; 1/4/51, 34.4; 3/23/51, 27.9; 5/9/51, 33.1; 6/5/51, 36.7; 7/11/51, 39.5; 3/22/51, 42.2; 9/26/51, 38.9; 11/15/51, 35.8; 2/28/52, 31.1; 3/31/52, 29.9.

13N 5E-33L1—Reference point—top of casing, elevation 80.1 feet. 0.35 mile north of Cornelius Avenue, 1.3 miles east of Brewer Road. 12/22/48, 27.5; 3/18/49, 25.3; 11/10/49, 34.3; 4/6/50, 28.2; 5/8/50, 28.9; 11/13/50, 35.0; 3/27/51, 29.1; 11/15/51, 37.8; 4/7/52, 30.6.

13N 5E-33P1—Reference point—top of casing, elevation 79.3 feet. 100 feet north of Cornelius Avenue, 1.3 miles east of Brewer Road. 12/22/48, 26.0; 3/18/49, 24.2; 11/10/49, 32.2; 4/6/50, 27.3; 11/13/50, 34.5; 3/27/51, 28.9; 11/15/51, 37.0; 4/7/52, 30.3.

14N 2E-2D2—Reference point—top of casing, elevation 39 feet. 0.15 mile south of Bogue Road, 0.6 mile east of Schlag Road. 12/15/47, 5.3; 3/8/48, 6.4; 11/12/48, 5.2; 3/21/49, 1.8; 11/29/49, 5.4; 3/24/50, 4.3; 11/2/50, 3.9; 3/28/51, 3.5; 11/16/51, 4.2; 4/1/52, 4.0.

14N 2E-10F1—Reference point—top of casing, elevation 35 feet. West side of Schlag Road, 0.55 mile north of Oswald Road. 11/27/29, 9.8; 10/6/30, 9.0; 12/12/31, 9.0; 11/30/32, 9.6; 11/10/34, 9.6; 11/28/36, 9.6; 1/25/39, 10.1; 1/13/41, 5.0.

14N 2E-10L1—Reference point—top of casing, elevation 37 feet. West side of Schlag Road, 0.5 mile north of Oswald Road. 12/20/33, 12.2; 11/10/34, 12.7; 11/11/36, 12.6; 11/24/37, 12.8.

14N 2E-10R1—Reference point—top of casing, elevation 30 feet. North side of Oswald Road, 0.45 mile east of Schlag Road. 11/6/47, 8.9; 12/15/48, 10.5; 12/9/49, 10.6; 11/10/50, 9.4; 12/8/51, 3.4.

14N 2E-12H1—Reference point—top of pipe in base, elevation 41 feet. 150 feet west of Township Road, 0.6 mile north of Oswald Road. 12/15/47, 9.5; 3/9/48, 10.6; 11/12/48, 9.7; 3/21/49, 8.2; 11/29/49, 10.6.

14N 2E-13A1—Reference point—top of casing, elevation 42.1 feet. 0.05 mile south of Oswald Road, 0.1 mile west of Township Road. 12/15/47, 8.9; 3/8/48, 10.3; 11/12/48, 6.1; 3/21/49, 7.0; 11/29/49, 8.1.

14N 2E-13C1—Reference point—top of casing, elevation 39 feet. 100 feet south of Oswald Road, 0.7 mile west of Township Road. 12/15/47, 5.5; 3/8/48, 6.6; 11/12/48, 4.7; 3/21/49, 3.1; 11/29/49, 6.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N/2E-13R1—Reference point—top of casing, elevation 37 feet. 0.1 mile west of Township Road, 0.4 mile south of Pierce Road. 12/15/47, 10.9; 3/8/48, 11.7; 10/8/48, 8.0; 11/12/48, 9.5; 1/18/49, 11.0; 3/21/49, 8.5; 6/6/49, 10.4; 6/30/49, 6.7; 7/27/49, 5.4; 8/25/49, 5.5; 11/29/49, 11.1; 3/24/50, 10.9; 11/2/50, 10.2; 3/28/51, 9.0; 11/16/51, 11.2; 4/1/52, 6.5.

14N/2E-14E1—Reference point—top of casing, elevation 34 feet. 0.4 mile south of Oswald Road, 0.4 mile west of Boulton Road. 12/15/47, 5.5; 3/8/48, 6.6; 11/12/48, 4.7; 3/21/49, 3.1; 11/29/49, 6.0.

14N/2E-14J1—Reference point—top of stone casing, elevation 36 feet. 0.1 mile south of Pierce Road, 0.3 mile east of Boulton Road. 12/15/47, 4.7; 3/8/48, 6.0; 10/8/48, 2.2; 11/12/48, 3.9.

14N/2E-26R1—Reference point—top of casing, elevation 33 feet. 0.2 mile north of O'Banion Road, 1.1 miles west of Township Road. 12/11/47, 7.4; 3/10/48, 7.6; 11/8/48, 6.4; 3/24/49, 3.9; 12/2/49, 7.7.

14N/3E-1H1—Reference point—top of casing, elevation 54 feet. 0.20 mile west of Feather River Boulevard, 1.70 miles north of Ella Avenue. 11/12/47, 21.2; 3/5/48, 20.0; 5/8/48, 15.8; 10/7/48, 23.8; 11/11/48, 22.3; 1/27/49, 20.9; 3/22/49, 17.6; 6/1/49, 25.2; 7/3/49, 25.5; 8/26/49, 25.5; 12/1/49, 23.5; 3/28/50, 17.2; 11/21/51, 22.7; 4/5/52, 10.8.

14N/3E-1R1—Reference point—top of casing, elevation 53 feet. 0.20 mile west of Feather River Boulevard, 1.20 miles north of Ella Avenue. 11/12/47, 20.5; 3/5/48, 20.2; 11/11/48, 20.1; 3/22/49, 17.9; 12/1/49, 23.5.

14N/3E-2G1—Reference point—hole in base of pump, elevation 49 feet. 0.36 mile north of Stewart Road, 0.45 mile east of Garden Highway. 11/11/47, 32.3; 3/24/48, 24.0; 10/6/48, 27.7; 11/15/48, 24.4; 3/17/49, 21.4; 11/30/49, 29.8.

14N/3E-2Q1—Reference point—hole in base of pump, elevation 53.9 feet. 0.07 mile south of Stewart Road, 0.10 mile east of Garden Highway. 11/10/47, 26.8; 3/4/48, 33.9; 11/15/48, 28.8; 3/17/49, 21.7; 11/30/49, 23.2; 3/27/50, 21.4; 11/3/50, 26.7; 3/29/51, 17.9; 11/20/51, 27.2.

14N/3E-3A1—Reference point—hole in side of pump, elevation 50 feet. 0.19 mile south of Bogue Road, 0.25 mile east of Highway 24. 11/10/47, 36.1; 3/23/48, 35.5; 10/6/48, 36.3; 11/15/48, 31.0; 3/7/49, 29.3; 11/30/49, 35.0; 3/27/50, 30.5; 11/3/50, 33.5; 3/28/51, 27.2; 11/16/51, 32.2.

14N/3E-3C2—Reference point—hole in base of pump, elevation 53.1 feet. 0.05 mile south of Bogue Road, 0.11 mile west of State Highway 24. 3/12/48, 43.8; 10/6/48, 35.6; 11/11/48, 33.9; 1/18/49, 32.8; 3/7/49, 32.1; 6/1/49, 37.6; 6/28/49, 45.0; 7/27/49, 47.5; 8/25/49, 42.3; 12/1/49, 35.4.

14N/3E-3C3—Reference point—bottom of pump base, elevation 53.1 feet. 0.27 mile south of Bogue Road, 0.06 mile west of State Highway 24. 3/29/48, 36.4; 11/15/48, 33.9; 3/7/49, 32.7; 11/30/49, 35.0.

14N/3E-3F1—Reference point—top of casing, elevation 51.3 feet. 0.2 mile west of State Highway 24, 0.45 mile south of Bogue Road. 11/18/47, 31.6; 3/23/48, 39.2; 10/6/48, 34.0; 11/11/48, 32.8; 3/17/49, 30.9; 11/30/49, 34.4.

14N/3E-3G1—Reference point—hole in pump base, elevation 52 feet. 0.17 mile east of State Highway 24, 0.54 mile south of Bogue Road. 3/4/48, 37.5; 11/16/48, 32.8; 3/17/49, 29.7; 11/30/49, 32.9.

14N/3E-3N1—Reference point—top of casing, elevation 55.4 feet. 0.09 mile south of Stewart Road, 0.40 mile west of State Highway 24. 11/10/47, 38.7; 3/4/48, 41.5; 11/15/48, 39.7; 3/17/49, 37.1; 11/30/49, 43.7.

14N/3E-3N2—Reference point—hole in base of pump, elevation 48 feet. South side of Stewart Road, 0.30 mile west of State Highway 24. 3/12/48, 40.4; 11/15/48, 34.7.

14N/3E-3P1—Reference point—top of pit, elevation 50 feet, 0.10 mile north of Reed Road, 0.17 mile west of State Highway 24. 11/26/29, 28.3; 9/27/30, 32.4; 12/12/31, 33.8; 12/1/32, 32.4; 12/15/33, 33.4; 11/10/34, 34.1; 11/25/36, 28.4; 11/24/37, 26.2; 1/26/39, 20.4; 1/13/41, 24.0; 11/6/47, 33.8; 12/15/48, 34.2; 12/9/49, 36.0; 11/10/50, 39.1.

14N/3E-3R2—Reference point—slot in base, elevation 51.3 feet. 0.19 mile south of Stewart Road, 0.35 mile east of Garden Highway. 11/10/47, 31.1; 11/15/48, 28.4; 3/17/49, 25.2; 11/30/49, 30.7.

14N/3E-4E3—Reference point—top of casing, elevation 47 feet. 0.05 mile south of Star Road, 0.20 mile east of Grove Avenue. 12/16/47, 30.6; 3/24/48, 31.7; 11/12/48, 33.3; 3/18/49, 30.0; 11/29/49, 35.8.

14N/3E-4G1—Reference point—hole in pump base, elevation 50.1 feet. 0.20 mile east of Walton Avenue, 0.48 mile south of Bogue Road. 11/18/47, 33.8; 3/12/48, 35.4; 10/6/48, 37.0; 11/11/48, 35.1; 3/18/49, 33.1; 11/30/49, 37.1.

14N/3E-4Q1—Reference point—hole in base of pump, elevation 47 feet, 0.10 mile north of Reed Road, 0.04 mile east of Walton Avenue. 11/10/47, 32.9; 3/4/48, 34.0; 3/12/48, 36.7; 3/29/48, 32.3; 11/15/48, 33.9; 3/18/49, 31.2; 11/29/49, 35.6; 3/27/50, 33.2; 11/3/50, 38.5; 3/28/51, 32.9; 11/16/51, 36.2.

14N/3E-5A2—Reference point—top of concrete pit, elevation 49 feet. West side of Grove Avenue, 0.15 mile south of Bogue Road. 12/16/47, 29.9; 3/9/48, 32.7; 10/7/48, 34.8; 11/12/48, 32.5; 3/18/49, 29.0; 11/29/49, 34.0.

14N/3E-5C1—Reference point—hole in base of pump, elevation 50 feet. 0.07 mile south of Bogue Road, 0.50 mile east of George Washington Boulevard. 12/16/48, 30.4; 3/9/48, 28.8; 10/7/48, 31.2; 11/12/48, 29.0; 3/18/49, 26.1; 6/1/49, 32.8; 7/27/49, 41.8; 8/25/49, 39.0; 11/29/49, 30.2; 3/27/50, 27.1; 11/3/50, 33.5; 3/28/51, 23.6; 4/1/52, 23.8.

14N/3E-5D1—Reference point—invert of pipe in base, elevation 48.1 feet. South side of Bogue Road, 0.15 mile east of George Washington Boulevard. 12/20/47, 23.4; 3/5/48, 25.3; 10/4/48, 26.6; 11/18/48, 24.8; 3/29/49, 22.0.

14N/3E-5K1—Reference point—hole in base of pump, elevation 46 feet. 0.14 mile north of Stewart Road, 0.47 mile west of Grove Avenue. 3/9/48, 27.3; 3/30/48, 28.4; 11/12/48, 31.0; 12/9/49, 31.7.

14N/3E-6G1—Reference point—slot in concrete base, elevation 45 feet. 0.45 mile west of George Washington Boulevard, 0.38 mile south of Bogue Road. 12/16/47, 13.9; 3/9/48, 14.7; 11/12/48, 14.6; 12/9/49, 15.0.

14N/3E-6M1—Reference point—hole in base of pump, elevation 40 feet. 0.50 mile north of Reed Road, 0.06 mile east of Township Road. 12/15/47, 10.8; 3/24/48, 13.2; 10/8/48, 7.3; 11/12/48, 9.3; 1/18/49, 10.9; 3/21/49, 9.2; 6/6/49, 6.1; 6/28/49, 6.7; 7/27/49, 6.6; 8/25/49, 6.0; 11/29/49, 10.1; 3/24/50, 9.9; 11/2/50, 10.0; 3/28/51, 8.7; 11/16/51, 9.2; 4/1/52, 7.9.

14N/3E-7A1—Reference point—hole in base of pump, elevation 45 feet. 0.12 mile south of Reed Road, 0.25 mile west of George Washington Boulevard. 12/17/47, 19.5; 3/9/48, 20.2; 11/12/48, 20.6; 3/21/49, 18.6; 11/29/49, 21.3.

14N/3E-7M1—Reference point—top of casing under pump, elevation 42 feet. 0.10 mile east of Township Road, 0.52 mile north of Oswald Avenue. 12/15/47, 11.2; 3/9/48, 12.3; 11/12/48, 11.8; 3/21/49, 10.2; 11/29/49, 11.2; 3/24/50, 10.8; 11/2/50, 11.8; 3/28/51, 9.0; 11/16/51, 11.1; 4/2/52, 10.1.

14N/3E-8B1—Reference point—hole in base of pump, elevation 45 feet. South side of Reed Road, 0.52 mile west of Walton Avenue. 12/17/47, 26.3; 3/9/48, 25.6; 11/12/48, 30.2; 3/21/49, 25.0; 11/29/49, 31.1; 3/27/50, 26.1; 11/3/50, 35.3; 3/28/51, 24.3; 11/16/51, 31.6; 4/2/52, 27.7.

14N/3E-8D1—Reference point—hole in base of pump, elevation 46.6 feet. South side of Reed Road, 0.15 mile east of George Washington Boulevard. 12/17/47, 23.2; 3/9/48, 23.5; 3/21/49, 21.6.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N 3E-8J1—Reference point—hole in base of pump, elevation 45 feet, 0.03 mile west of Grove Avenue, 0.15 mile north of Oswald Avenue. 12/16/47, 27.8; 3/4/48, 29.0; 11/12/48, 30.8; 3/18/49, 27.3; 11/29/49, 33.1; 3/27/50, 29.1; 11/3/50, 36.2; 3/28/51, 29.1; 11/19/51, 33.8; 4/2/52, 23.8.

14N 3E-8K1—Reference point—hole in base of pump, elevation 45 feet, 0.40 mile west of Grove Avenue, 0.35 mile north of Oswald Road. 12/16/47, 26.9; 3/24/48, 28.3; 11/12/48, 30.9; 3/18/49, 26.8; 11/29/49, 32.1.

14N 3E-8M3—Reference point—top of casing, elevation 45 feet, 0.20 mile east of George Washington Boulevard, 0.50 mile north of Oswald Road. 12/17/47, 22.7; 3/9/48, 21.1; 10/7/48, 28.0; 11/12/48, 25.6; 1/18/49, 23.1; 3/21/49, 21.8; 6/1/49, 25.0; 6/30/49, 26.3; 7/27/49, 31.5; 8/25/49, 31.5; 11/29/49, 26.7.

14N 3E-8N1—Reference point—top of casing, elevation 44.8 feet. North side of Oswald Avenue, 0.15 mile east of George Washington Boulevard. 12/16/47, 21.5; 3/9/48, 16.4; 3/12/48, 21.8; 11/12/48, 23.8; 3/21/49, 20.7; 11/29/49, 24.9; 3/24/50, 21.4; 11/2/50, 29.3; 3/28/51, 18.9; 11/19/51, 25.5; 4/2/52, 13.5.

14N 3E-9A2—Reference point—top of concrete pit, south edge, elevation 40 feet, 0.1 mile south of Reed Road, 0.35 mile east of Walton Avenue. 11/19/47, 32.0; 3/4/48, 32.3; 5/12/48, 31.1; 11/15/48, 32.1; 11/18/49, 32.1; 3/18/49, 31.0; 11/30/49, 35.2.

14N 3E-9D1—Reference point—hole in base of pump, elevation 46 feet, 0.10 mile south of Reed Road, 0.45 mile west of Walton Road. 12/16/47, 31.4; 3/9/48, 33.8.

14N 3E-9K1—Reference point—top of casing, elevation 45 feet. South side of Barry Road, 0.25 mile east of Walton Avenue. 11/8/47, 33.2; 3/4/48, 34.9; 3/12/48, 34.1; 3/29/48, 32.5; 10/6/48, 35.6; 11/15/48, 34.3; 3/17/49, 32.0; 11/30/49, 35.8.

14N 3E-9Q1—Reference point—hole in base of pump, elevation 42 feet. North side of Oswald Road, 0.25 mile east of Walton Avenue. 3/12/48, 29.0; 11/15/48, 23.4; 3/17/49, 21.3.

14N 3E-10B1—Reference point—top of casing, elevation 50 feet, 0.17 mile east of State Highway 24, 0.33 mile north of Barry Road. 11/19/47, 29.4; 10/6/48, 31.3; 11/30/49, 31.2; 11/3/50, 33.5; 11/20/51, 31.7.

14N 3E-10B2—Reference point—top of casing, elevation 49 feet, 0.32 mile south of Stewart Road, 0.18 mile east of State Highway 24. 11/19/47, 29.4; 3/4/48, 32.0; 10/6/48, 31.3; 11/15/48, 31.5; 3/7/49, 26.3; 11/30/49, 31.2; 3/27/50, 28.4; 11/3/50, 33.5; 3/29/51, 24.8; 11/20/51, 31.7.

14N 3E-10F1—Reference point—top of casing at bottom of pit, elevation 27 feet, 0.70 mile west of State Highway 24, 0.80 mile north of Barry Road. 11/18/47, 35.1; 3/4/48, 34.1; 3/12/48, 33.9; 11/15/48, 34.8; 3/17/49, 31.7; 11/29/49, 36.6.

14N 3E-10N1—Reference point—top of concrete base, elevation 18.6 feet, 0.08 mile north of Oswald Avenue, 0.36 mile west of State Highway 24. 11/8/47, 30.1; 3/12/48, 32.4; 3/29/48, 29.1; 5/12/48, 27.0; 10/6/48, 32.2; 11/15/48, 31.3; 1/18/49, 29.4; 3/17/49, 28.5; 11/30/49, 32.2; 3/29/50, 30.0; 11/3/50, 33.9; 3/29/51, 28.6; 11/20/51, 32.3.

14N 3E-11D2—Reference point—top of casing, elevation 49 feet, 0.10 mile north of Barry Road, 0.63 mile east of State Highway 24. 11/19/47, 27.3; 3/4/48, 30.6; 3/29/48, 31.3; 5/12/48, 23.4; 10/6/48, 34.1; 11/16/48, 27.7; 11/18/49, 25.8; 3/17/49, 24.4; 6/1/49, 31.6; 6/28/49, 39.2; 8/3/49, 38.9; 8/25/49, 31.8; 11/30/49, 29.1.

14N 3E-11F2—Reference point—hole in base of pump, elevation 51.7 feet, 0.47 mile north of Barry Road, 0.95 mile east of State Highway 24. 11/10/47, 27.4; 3/23/48, 27.8; 11/16/48, 24.2; 3/17/49, 20.7; 11/30/49, 26.1; 3/27/50, 19.6; 11/3/50, 26.1; 3/29/51, 16.0; 11/20/51, 25.0.

14N 3E-12F1—Reference point—top of casing, elevation 52 feet, 0.65 mile north of Ella Road, 0.50 mile east of Feather River Boulevard. 3/28/50, 17.0; 11/6/50, 23.6; 3/30/51, 18.4; 4/5/52, 20.6.

14N 3E-12M1—Reference point—hole in base of pump, elevation 50 feet, 0.22 mile north of Ella Avenue, 0.84 mile west of Feather River Boulevard. 11/12/47, 20.4; 3/6/48, 20.5; 11/15/48, 20.2; 3/22/49, 16.8; 12/1/49, 22.1; 3/28/50, 17.6; 11/6/50, 72.1; 11/21/51, 20.8; 4/5/52, 9.5.

14N 3E-12Q1—Reference point—hole in base of pump, elevation 53.6 feet, 0.23 mile north of Ella Avenue, 0.29 mile west of Feather River Boulevard. 11/11/49, 21.7; 3/5/48, 23.0; 5/8/48, 19.5.

14N 3E-13B1—Reference point—top of casing, elevation 50.9 feet, 0.17 mile south of Ella Avenue, 0.44 mile west of Feather River Boulevard. 11/12/47, 20.7; 3/5/48, 22.8; 11/11/48, 20.2; 3/2/49, 18.0; 12/1/49, 22.1; 3/28/50, 21.7; 11/6/50, 21.8; 3/30/51, 13.0; 11/20/51, 21.8; 4/5/52, 12.1.

14N 3E-13N1—Reference point—hole in base of pump, elevation 48.3 feet, 0.11 mile north of Plumas Road, 0.81 mile west of Feather River Boulevard. 3/6/48, 24.1; 5/8/48, 16.0; 11/11/48, 19.8; 1/27/49, 18.1; 3/21/49, 16.9; 12/1/49, 21.1; 3/29/50, 17.4; 11/6/50, 20.9; 4/5/52, 10.0.

14N 3E-14E1—Reference point—hole in base of pump, elevation 47 feet, 0.20 mile west of Garden Highway, 0.75 mile north of Messick Road. 11/18/47, 25.3; 3/23/48, 22.1; 11/15/48, 22.2; 3/17/49, 19.6; 11/29/49, 22.4.

14N 3E-14E2—Reference point—top of casing, elevation 47 feet, 0.11 mile west of Garden Highway, 0.75 mile north of Messick Road. 11/10/47, 20.6; 3/5/48, 23.7; 5/12/48, 13.9; 10/6/48, 21.6; 11/15/48, 20.2; 1/27/49, 19.2; 3/17/49, 17.1; 6/1/49, 19.5; 6/30/49, 26.7; 7/27/49, 28.0; 8/25/49, 25.7; 11/29/49, 23.3; 3/29/50, 16.4; 11/3/50, 23.3; 3/29/51, 12.7; 11/20/51, 20.8.

14N 3E-14N1—Reference point—hole in base of pump, elevation 46 feet, 0.27 mile north of Messick Road, 0.13 mile east of Garden Highway. 11/18/47, 19.1; 3/5/48, 27.7; 11/15/48, 19.4; 3/17/49, 16.6; 11/29/49, 21.6.

14N 3E-14R1—Reference point—hole in base of pump, elevation 49.4 feet, 1.07 miles west of Feather River Boulevard, 0.67 mile north of Broadway. 11/11/47, 24.3; 3/6/48, 25.8; 11/11/48, 20.9; 3/21/49, 17.9; 12/1/49, 22.1; 3/29/50, 17.9; 11/6/50, 22.3; 3/30/51, 13.4; 11/20/51, 21.1; 4/5/52, 10.9.

14N 3E-15A2—Reference point—slot in base of pump, elevation 47 feet, 0.57 mile south of Barry Road, 0.41 mile east of State Highway 24. 11/19/47, 27.6; 3/23/48, 27.8; 11/15/48, 29.7; 3/17/49, 24.8; 11/29/49, 28.8.

14N 3E-15B1—Reference point—top of casing, elevation 47 feet, 0.18 mile south of Oswald Avenue, 0.04 mile east of State Highway 24. 11/8/47, 39.0; 3/5/48, 33.8; 3/12/48, 32.5; 11/15/48, 28.5; 3/17/49, 35.1; 11/29/49, 33.2.

14N 3E-15B2—Reference point—top of casing, elevation 48 feet, 1.0 mile north of Messick Road, 0.17 mile east of State Highway 24. 11/18/47, 26.9.

14N 3E-15E1—Reference point—hole in base of pump, elevation 47.2 feet, 0.18 mile south of Oswald Road, 0.43 mile west of State Highway 24. 3/23/48, 27.9; 10/6/48, 29.0; 11/15/48, 27.0; 3/17/49, 25.9; 11/30/49, 29.4.

14N 3E-15P1—Reference point—top of casing, elevation 45 feet, 0.38 mile north of Messick Road, 0.02 mile west of State Highway 24. 3/23/48, 29.2; 11/15/48, 17.2; 3/17/49, 25.9; 11/29/49, 28.5.

14N 3E-16C1—Reference point—hole in base of pump, elevation 48.9 feet, 0.10 mile west of Walton Avenue, 0.22 mile south of Oswald Road. 12/16/47, 32.3; 3/20/48, 30.6; 3/26/48, 29.9; 3/30/48, 29.9; 5/12/48, 28.1; 11/15/48, 31.8; 3/18/49, 29.6; 11/29/49, 34.7.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N/3E-16E1—Reference point—top of casing, elevation 47.7 feet, 0.25 mile east of Carlson Road, 0.40 mile south of Oswald Road. 12/16/47, 27.1; 3/20/48, 29.0; 10/7/48, 30.2; 11/15/48, 28.9; 3/18/49, 26.8; 11/29/49; 35.8; 3/27/50, 28.6; 11/3/50, 32.6; 3/29/51, 30.2; 11/19/51, 30.6; 4/2/52, 22.2.

14N/3E-16J1—Reference point—top of casing, elevation 46.4 feet. 0.77 mile west of State Highway 24, 0.64 mile south of Oswald Avenue. 11/7/47, 28.4; 3/5/48, 25.2; 3/12/48, 25.3; 10/6/48, 28.2; 11/15/48, 26.8; 1/27/49, 26.1; 3/17/49, 25.4; 3/29/50, 26.6; 11/3/50, 24.2; 3/29/51, 25.1.

14N/3E-17B1—Reference point—top of "I" beam pump support, elevation 44 feet. 0.35 mile west of Carlson Road, 0.06 mile south of Oswald Road. 12/16/47, 31.9; 3/9/48, 24.2; 3/12/48, 24.7; 11/12/48, 26.9; 3/18/49, 24.0; 11/29/49, 29.0.

14N/3E-17Q1—Reference point—top of casing under pump, elevation 42.5 feet. 0.30 mile west of Carlson Road, 0.25 mile north of Best Road. 12/16/47, 22.7; 3/8/48, 23.5; 3/12/48, 23.2; 10/7/48, 26.3; 11/15/48, 24.9; 1/27/49, 23.9; 3/18/49, 23.1; 11/29/49, 29.7.

14N/3E-17R1—Reference point—top of casing, elevation 45.9 feet. West side of Carlson Road, 0.23 mile north of Best Road. 3/30/48, 24.5; 11/15/48, 27.3; 3/18/49, 25.8.

14N/3E-18D1—Reference point—top of casing, elevation 43 feet. Southeast corner of Oswald Avenue and Township Road. 11/26/29, 9.3; 10/6/30, 7.2; 12/12/31, 11.0; 11/30/32, 10.3; 12/20/33, 12.5; 11/10/34, 10.1; 11/28/36, 8.7; 11/24/37, 8.6; 1/25/39, 8.5; 1/13/41, 1.3; 11/6/47, 6.9; 12/15/48, 7.9; 12/9/49, 7.9; 11/10/50, 7.7; 12/8/51, 5.8.

14N/3E-18F1—Reference point—top of casing, elevation 40 feet. 0.41 mile south of Oswald Avenue, 0.23 mile east of Township Road. 12/15/47, 11.3; 3/8/48, 6.1; 10/8/48, 5.1; 11/12/48, 5.1; 3/2/49, 5.0; 11/29/49, 5.8; 3/27/50, 5.2; 11/2/50, 6.7; 3/28/51, 4.8; 11/16/51, 6.7; 4/2/52, 5.0.

14N/3E-18H3—Reference point—top of concrete pit, elevation 41 feet. West side George Washington Boulevard, 0.44 mile south of Oswald Avenue. 12/16/47, 19.6; 3/8/48, 18.2; 10/7/48, 20.9; 11/12/48, 20.1; 3/21/49, 18.0; 11/29/49, 20.6.

14N/3E-18R1—Reference point—top of casing, elevation 40 feet. 0.10 mile north of Best Road, 0.26 mile west of George Washington Boulevard. 12/15/47, 16.9; 3/8/48, 17.1; 11/12/48, 18.5; 3/21/49, 16.8; 11/29/49, 19.6.

14N/3E-19L1—Reference point—hole in pump base, elevation 37 feet. 0.50 mile west of George Washington Boulevard, 0.69 mile south of Best Road. 12/5/47, 10.9; 3/8/48, 11.6; 10/8/48, 15.8; 11/12/48, 13.8; 3/18/49, 12.7; 11/29/49, 14.9; 3/27/50, 13.1; 11/2/50, 15.8; 3/28/51, 10.6; 11/16/51, 14.5; 4/2/52, 6.0.

14N/3E-19P1—Reference point—top of pipe in base, elevation 38 feet. 0.50 mile west of George Washington Boulevard, 0.83 mile north of Best Road. 12/11/47, 13.2; 3/24/48, 14.0; 11/8/48, 13.7; 3/24/49, 12.2; 12/2/49, 14.6.

14N/3E-20A2—Reference point—hole in casing, elevation 44.5 feet, 0.10 mile south of Best Road, east side of George Washington Boulevard. 12/16/47, 22.7; 3/8/48, 21.6; 11/15/48, 25.3; 3/18/49, 24.0; 11/29/49, 26.9; 3/27/50, 25.4; 11/3/50, 32.6; 3/28/51, 25.2; 11/19/51, 26.4; 4/2/52, 18.4.

14N/3E-20E1—Reference point—top of casing, elevation 40 feet. 0.27 mile south of Best Road, 0.20 mile east of George Washington Boulevard. 12/16/47, 17.9; 3/8/48, 20.0; 3/29/48, 18.0; 11/12/48, 20.1; 3/18/49, 18.3; 11/29/49, 21.7.

14N/3E-20F1—Reference point—top of casing, elevation 40 feet. 0.49 mile east of George Washington Boulevard, 0.51 mile north of Hutchinson Road. 12/16/47, 20.8; 3/8/48, 23.7; 3/12/48, 23.6; 10/7/48, 24.0; 11/15/48, 23.1; 3/18/49, 21.4; 11/29/49, 24.8; 3/27/50, 22.6; 11/2/50, 26.4; 3/28/51, 20.6; 11/19/51, 24.2; 4/2/52, 15.7.

14N/3E-20Q1—Reference point—top of concrete pit, elevation 42 feet, 0.54 mile west of George Washington Boulevard, 0.14 mile north of Hutchinson Road. 12/13/47, 20.1; 3/10/48, 21.3; 3/12/48, 21.5; 11/8/48, 24.9; 3/23/49, 20.5; 12/5/49, 24.0; 3/24/50, 21.5; 11/7/50, 26.7; 3/28/51, 21.8; 11/15/51, 22.7; 4/3/52, 14.8.

14N/3E-21M1—Reference point—top of casing, elevation 44.3 feet, 0.46 mile north of Hutchinson Road, west side of Carlson Road. 12/16/47, 21.8; 3/8/48, 23.0; 3/20/48, 23.4; 3/26/48, 22.2; 3/30/48, 21.7; 10/7/48, 24.2; 11/15/48, 24.0; 3/18/49, 23.2; 11/29/49, 25.7.

14N/3E-21Q1—Reference point—hole in pump base, elevation 42 feet. North side of Hutchinson Road, 0.48 mile west of State Highway 24. 11/15/47, 21.9; 3/8/48, 23.9; 3/12/48, 27.4; 3/26/48, 22.0; 3/29/48, 21.9; 5/12/48, 21.2; 11/9/48, 25.0; 1/18/49, 24.0; 3/23/49, 22.8; 6/1/49, 21.8; 6/28/49, 30.4; 8/3/49, 20.1; 8/25/49, 28.6; 12/6/49, 26.0.

14N/3E-22B2—Reference point—bottom of pump base, elevation 48.3 feet. North side of Messick Road, 0.50 mile west of Garden Highway. 11/7/47, 25.9; 3/5/48, 26.1; 3/12/48, 26.6; 3/29/48, 25.2; 10/6/48, 28.5; 11/15/48, 25.8; 3/17/49, 24.4; 11/30/49, 27.6; 3/29/50, 25.2; 11/3/50, 28.0; 3/29/51, 22.3; 11/20/51, 26.3.

14N/3E-22E2—Reference point—bottom of pump base, elevation 47.8 feet, South of Messick Road, 0.1 mile east of State Highway 24, 11/7/47, 26.6; 3/5/48, 26.2; 3/12/48, 27.8; 11/15/48, 25.3; 3/17/49, 23.8; 11/29/49, 27.5.

14N/3E-22H1—Reference point—top of casing, elevation 47.2 feet, 0.03 mile west of Garden Highway, 0.16 mile south of Messick Road 3/5/48, 22.1; 10/6/48, 19.8; 11/15/48, 20.7.

14N/3E-22R1—Reference point—hole in concrete base, elevation 45.2 feet, West side Garden Highway, 0.15 mile north of Hutchinson Road. 11/15/47, 20.9; 3/8/48, 26.4; 3/29/48, 19.0; 5/12/48, 16.5; 11/10/48, 20.7; 1/24/49, 19.9; 3/23/49, 17.9; 12/6/49, 22.4.

14N/3E-23D2—Reference point—top of concrete base, elevation 48.1 feet, 0.2 mile east of Garden Highway, 0.03 mile south of Messick Road. 11/7/47, 20.6; 3/23/48, 21.1; 10/6/48, 23.3; 11/15/48, 22.2; 3/17/49, 20.9; 11/29/49, 23.0; 3/29/50, 18.8; 11/3/50, 22.9; 3/29/51, 16.3; 11/20/51, 22.3.

14N/3E-24B1—Reference point—hole in pump base, elevation 50.8 feet, 0.01 mile south of Plumas Road, 0.26 mile west of Feather River Boulevard. 11/11/47, 23.1; 3/6/48, 22.6; 5/8/48, 20.7; 10/7/48, 24.2; 11/11/48, 22.0; 3/21/49, 19.9; 6/1/49, 24.6; 7/3/49, 31.0; 7/28/49, 28.8; 8/26/49, 30.0; 12/1/49, 23.4; 3/29/50, 22.2; 11/6/50, 24.5; 3/30/51, 14.4; 11/20/51, 23.9; 4/5/52, 14.6.

14N/3E-24G1—Reference point—top of casing at pit bottom, elevation 39.4 feet, 0.10 mile north of Broadway, 0.31 mile east of Feather River Boulevard 11/11/47, 14.2; 3/6/48, 12.1, 11/11/48, 12.0; 3/21/49, 9.4; 12/1/49, 13.4.

14N/3E-25B2—Reference point—hole in side of pump, elevation 47 feet South of Anderson Road, 0.31 mile west of Feather River Boulevard. 11/17/47, 22.5; 3/8/48, 19.7; 5/8/48, 17.3; 11/10/48, 20.1; 1/24/49, 18.9; 3/23/49, 17.6; 12/2/49, 21.3.

14N/3E-25C1—Reference point—top of casing, elevation 49.5 feet, 0.15 mile south of Anderson Road, 0.71 mile west of Feather River Boulevard. 11/17/47, 22.3; 3/8/48, 19.8; 11/10/48, 22.0; 3/23/49, 19.8; 12/2/49, 22.7; 3/29/50, 18.6; 11/6/50, 22.6; 3/30/51, 15.9; 11/6/51, 21.5; 4/1/52, 15.4

14N/3E-25K2—Reference point—top of casing, elevation 46.1 feet, 0.01 mile south of Country Club Road, 0.26 mile west of Feather River Boulevard. 11/17/47, 17.8; 3/8/48, 18.5; 3/23/49, 15.6; 12/2/49, 19.1.

14N/3E-26M2—Reference point—hole in base of pump, elevation 44 feet. 0.32 mile north of O'Banion Road, 0.22 mile east of Garden Highway. 11/14/47, 21.0; 3/8/48, 23.4; 5/6/48, 14.4; 6/1/48, 14.7; 7/3/48, 52.4 (operating); 11/10/48, 20.9; 3/23/49, 16.8; 12/6/49, 22.4.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N 3E-27D1—Reference point—top of casing, elevation 42 feet. East side of State Highway 24, 0.10 mile south of Hutchinson Road. 11/15/47, 21.7; 3/8/48, 22.0; 3/12/48, 28.4; 5/12/48, 20.8; 11/9/48, 24.2; 3/23/49, 21.8; 12/6/49, 25.4; 3/29/50, 23.2; 11/7/50, 26.1; 3/29/51, 19.9; 11/15/51, 26.4; 4/3/52, 13.5

14N 3E-27J1—Reference point—hole in base of pump, elevation 13 feet. West side of Garden Highway, 0.36 mile north of O'Banion Road. 11/14/47, 21.4; 3/8/48, 30.7; 5/5/48, 15.0; 11/10/48, 20.6; 3/23/49, 17.1; 6/1/49, 21.5; 8/30/49, 26.6; 12/6/49, 22.1; 3/29/50, 17.6; 11/7/50, 22.3; 3/29/51, 13.8; 11/15/51, 21.1; 4/3/52, 9.0.

14N 3E-27M2—Reference point—hole in base of pump, elevation 41 feet, 0.06 mile east of State Highway 24, 0.33 mile north of O'Banion Road. 11/15/47, 22.3; 3/8/48, 24.1; 11/9/48, 23.1; 3/23/49, 20.6; 12/6/49, 24.8.

14N 3E-28G2—Reference point—top of casing, elevation 41 feet. 0.28 mile west of State Highway 24, 0.45 mile south of Hutchinson Road. 1/16/48, 21.4.

14N 3E-28M1—Reference point—top of wooden platform under pump, elevation 43.6 feet, 0.31 mile north of O'Banion Road, 0.15 mile east of Carlson Road. 12/13/47, 21.6; 3/9/48, 25.4; 3/12/48, 25.6; 11/8/48, 25.6; 3/24/49, 22.3; 12/5/49, 26.6.

14N 3E-28R1—Reference point—top of casing, elevation 40 feet. 0.16 mile west of State Highway 24, 0.16 mile north of O'Banion Road. 11/14/47, 21.3; 3/24/48, 21.9; 11/9/48, 23.8; 3/23/49, 20.4; 12/6/49, 30.3; 3/29/50, 22.5; 11/2/50, 26.7; 3/29/51, 19.5.

14N 3E-29A1—Reference point—hole in base of pump, elevation 43.5 feet, 0.16 mile west of Carlson Road, 0.24 mile south of Hutchinson Road. 12/13/47, 22.6; 3/10/48, 24.0; 3/12/48, 24.6; 11/8/48, 25.1; 3/24/49, 22.2; 12/5/49, 26.3.

14N 3E-29L1—Reference point—top of casing, elevation 41 feet. 0.48 mile east of George Washington Boulevard, 0.27 mile north of O'Banion Road. 12/13/47, 20.0; 3/9/48, 20.0; 11/8/48, 21.3; 3/24/49, 18.9; 5/31/49, 28.1; 6/30/49, 31.3; 8/1/49, 32.0; 12/5/49, 22.4.

14N 3E-29R1—Reference point—hole in pump base, elevation 43.5 feet. West side of Carlson Road, 0.19 mile north of O'Banion Road. 5/21/48, 22.1; 11/8/48, 25.6; 3/24/49, 22.5; 12/5/49, 26.4; 3/29/50, 23.5; 11/7/50, 28.0; 3/29/51, 21.6; 11/15/51, 26.9; 4/3/52, 16.0.

14N 3E-30E1—Reference point—top of casing, elevation 36 feet, 0.22 mile east of Township Road, 0.40 mile south of Hutchinson Road. 12/11/47, 12.4; 3/10/48, 8.6; 3/12/48, 8.5; 11/8/48, 8.3; 3/24/49, 6.4; 12/2/49, 9.1

14N 3E-30H1—Reference point—top of casing, elevation 38 feet. 0.28 mile south of Hutchinson Road, 0.03 mile west of George Washington Boulevard. 12/11/47, 14.9; 3/10/48, 14.6; 3/12/48, 14.5; 11/8/48, 16.4; 3/24/49, 14.0; 12/2/49, 17.5.

14N 3E-30M1—Reference point—top of concrete pit (west wall), elevation 37 feet, 0.38 mile north of O'Banion Road, 0.03 mile east of Township Road. 12/11/47, 8.5; 3/10/48, 9.6; 3/12/48, 9.6; 11/8/48, 9.3; 3/24/49, 6.0; 12/2/49, 9.0.

14N 3E-31B1—Reference point—top of casing, elevation 38 feet. 0.06 mile south of O'Banion Road, 0.36 mile west of George Washington Boulevard. 12/11/47, 12.6; 3/10/48, 13.1; 3/12/48, 13.1; 3/29/48, 12.9; 11/8/48, 12.2; 1/21/49, 13.1; 3/24/49, 11.4; 12/2/49, 13.4; 3/29/50, 12.0; 11/7/50, 15.3; 3/29/51, 10.7; 11/15/51, 14.3; 4/3/52, 7.7.

14N 3E-31L1—Reference point—top of casing, elevation 35 feet. 0.24 mile east of Township Road, 0.66 mile south of O'Banion Road. 12/11/47, 12.3; 3/10/48, 7.9; 3/12/48, 7.9; 11/8/48, 9.5; 3/25/49, 8.7.

14N 3E-31R1—Reference point—top of casing, elevation 36 feet. 0.12 mile west of George Washington Boulevard, 0.78 mile south of O'Banion Road. 12/12/47, 15.9; 3/10/48, 16.3; 3/12/48, 16.1; 11/8/48, 14.2; 3/24/49, 13.5; 12/5/49, 16.3.

14N 3E-32D1—Reference point—hole in base of pump, elevation 40 feet, 0.11 mile south of O'Banion Road, 0.09 mile east of George Washington Boulevard. 12/2/47, 16.7; 3/10/48, 17.5; 3/12/48, 17.4; 5/12/48, 16.2; 11/8/48, 16.7; 3/24/49, 14.8; 6/30/49, 20.8; 8/25/49, 19.2; 12/5/49, 17.9.

14N 3E-33D3—Reference point—hole in base of pump, elevation 40 feet 0.18 mile south of O'Banion Road, 0.03 mile west of Burch Road. 12/12/47, 26.1; 3/9/48, 21.2; 3/12/48, 20.8; 3/29/48, 19.7; 5/29/48, 18.2; 11/8/48, 12.7; 1/19/49, 20.6; 3/24/49, 19.0; 6/1/49, 21.7; 6/28/49, 44.2; 7/27/49, 28.4; 8/25/49, 23.6.

14N 3E-33M2—Reference point—top of 2" x 4" plank over earth pit, elevation 27.8, 0.67 mile south of O'Banion Road, 0.15 mile west of Burch Road. 12/12/47, 15.8; 3/24/48, 16.9.

14N 3E-34C1—Reference point—top of casing, elevation 39 feet. 0.21 mile east of State Highway 24, south side of O'Banion Road. 11/14/47, 20.4; 3/8/48, 24.2; 3/29/48, 21.4; 5/12/48, 19.4; 11/9/48, 23.5; 1/19/49, 21.7; 3/23/49, 20.6; 12/6/49, 25.3.

14N 3E-34L1—Reference point—hole in side of pump, elevation 40 feet, 0.43 mile east of State Highway 24, 0.51 mile south of O'Banion Road. 11/14/47, 26.9; 3/8/48, 24.5; 11/10/48, 28.4; 3/25/49, 22.7; 12/6/49, 21.7.

14N 3E-35Q1—Reference point—hole in side of pump, elevation 43 feet, 0.35 mile east of Garden Highway, 0.57 mile north of Tudor Road. 11/14/47, 21.2; 3/8/48, 17.2; 11/10/48, 17.3; 3/23/49, 11.4; 12/6/49, 18.9.

14N 3E-36C1—Reference point—top of casing, elevation 50 feet. 0.51 mile south of Country Club Road, 0.72 mile east of Feather River Boulevard. 11/17/47, 17.7; 3/9/48, 16.7; 5/8/48, 9.2; 11/10/48, 18.2; 1/24/49, 17.6; 3/23/49, 11.8; 12/2/49, 18.6; 3/29/50, 10.7; 11/6/50, 18.0; 3/30/51, 11.0; 11/16/51, 16.2; 4/1/52, 6.4.

14N 4E-2F1—Reference point—top of casing outside shed, elevation 67.8 feet. 0.1 mile west of Virginia Road, 0.3 mile south of junction of Earle and Spenceville Roads. 12/4/47, 20.8; 3/18/48, 19.6; 11/22/48, 23.4; 3/21/49, 22.3.

14N 4E-2K1—Reference point—top of casing under pump, elevation 65.9 feet. 200 feet east of Virginia Road, 0.7 mile south of Spenceville Road. 12/4/47, 17.2; 5/18/48, 16.7; 11/22/48, 21.0; 11/23/49, 26.8.

14N 4E-2R1—Reference point—top of casing under pump, elevation 68.9 feet. 250 feet north of Earle Road, 0.2 mile east of junction of Virginia Road and Spenceville Roads. 12/3/47, 21.5; 3/18/48, 21.3; 11/19/48, 25.9; 3/21/49, 24.2; 11/23/49, 32.3.

14N 4E-4A1—Reference point—hole in side of pump, elevation 65 feet, 0.9 mile north of Hale Road, 1.0 mile east of U. S. Highway 99E. 12/1/47, 29.1; 3/18/48, 27.4; 11/19/48, 31.3; 3/23/49, 29.2; 11/23/49, 35.0; 3/27/50, 32.3; 11/3/50, 36.2; 4/5/51, 30.8; 11/21/51, 37.2; 4/4/52, 32.1.

14N 4E-4C1—Reference point—vertical hole in side of pump, elevation 63 feet, 0.6 mile east of U. S. Highway 99E, 0.9 mile north of Hale Road. 11/19/48, 28.4; 3/23/49, 26.1; 11/23/49, 31.6.

14N 4E-4M1—Reference point—top of hole in pump base, elevation 60 feet, 0.2 mile west of U. S. Highway 99E, 0.7 mile north of McGowan Road. 12/1/47, 21.3; 3/17/48, 19.9; 11/19/48, 23.9; 3/21/49, 21.7; 12/7/49, 26.7; 3/27/50, 24.5; 11/3/50, 28.5; 4/5/51, 24.6; 11/21/51, 33.7; 4/2/52, 26.2.

14N 4E-5A1—Reference point—top of casing under pump, elevation 60 feet, 0.05 mile west of U. S. Highway 99E, 1.3 miles north of McGowan Road. 12/1/47, 23.2; 3/17/48, 21.4.

14N 4E-5C1—Reference point—top tin, casing under pump, elevation 58 feet, 1.3 miles north of McGowan Road, 0.5 mile west of U. S. Highway 99E. 12/1/47, 22.8; 3/15/48, 22.1.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N/4E-5J1—Reference point—top of casing under pump, elevation 62 feet, 0.3 mile west of U. S. Highway 99E, 0.8 mile north of McGowan Road. 12/1/47, 20.8; 3/15/48, 19.7.

14N/4E-5L1—Reference point—top of casing, elevation 60 feet, 0.1 mile west of U. S. Highway 99E, 1.9 miles north of McGowan Road. 12/1/47, 22.1; 3/15/48, 21.5; 11/19/48, 24.1; 3/21/49, 23.0; 12/7/49, 26.5; 4/3/52, 23.8.

14N/4E-7A1—Reference point—top of casing, 2.5 feet above ground, elevation 55 feet, 0.15 mile west of Arboga Road, 0.80 mile north of Ella Road. 11/12/47, 22.3; 3/15/48, 20.9; 5/14/48, 22.0; 10/17/48, 27.2; 11/11/48, 23.0; 3/21/49, 21.0; 12/1/49, 24.6; 3/29/50, 22.7; 11/6/50, 26.2; 3/30/51, 20.7; 11/20/51, 25.4; 4/5/52, 20.6.

14N/4E-7A2—Reference point, top of casing, elevation 58 feet, 264 feet west of Arboga Road, 0.81 mile north of Ella Road. 3/5/48, 21.5; 5/14/48, 21.6; 3/21/49, 19.5; 12/1/49, 25.0; 3/29/50, 21.2; 11/6/50, 27.9.

14N/4E-7D1—Reference point—top of casing at bottom of 9-foot pit, elevation 52 feet, 500 feet east of Feather River Boulevard, 0.85 mile north of Ella Road. 11/12/47, 12.3; 3/5/48, 11.0; 10/7/48, 13.8; 11/11/48, 11.5; 3/22/49, 10.5; 12/1/49, 15.2.

14N/4E-7F1—Reference point—top of discharge flange, elevation 53 feet, 0.4 mile east of Feather River Boulevard, 0.7 mile north of Ella Avenue. 11/12/47, 16.1; 3/5/48, 19.0; 11/11/48, 19.7; 3/22/49, 17.4; 12/1/49, 20.5.

14N/4E-8C1—Reference point—top of casing, concrete box, elevation 57 feet, 0.9 mile west of U. S. Highway 99E, 0.4 mile north of McGowan Road. 12/1/47, 28.2.

14N/4E-9B1—Reference point—top of casing, elevation 62 feet, 200 feet west of U. S. Highway 99E, 0.3 mile north of McGowan Road 12/2/47, 28.6; 3/17/48, 27.3; 11/19/48, 30.6; 3/21/49, 28.5; 11/23/49, 33.9.

14N/4E-9F1—Reference point—hole in pump base, elevation 60 feet, 50 feet north of McGowan Road, 0.7 mile west of U. S. Highway 99E. 11/19/48, 28.2; 1/25/49, 27.0; 3/18/49, 25.5; 11/23/49, 31.5; 3/28/50, 28.2; 11/3/50, 33.3; 4/5/51, 28.1.

14N/4E-9L1—Reference point—top of casing under pump, elevation 61 feet, 0.3 mile south of McGowan Road, 0.8 mile west of U. S. Highway 99E. 12/2/47, 23.7; 3/17/48, 21.4.

14N/4E-9Q1—Reference point—top of casing, elevation 52 feet, 0.7 mile west of U. S. Highway 99E, 0.3 mile south of McGowan Road. 12/2/47, 20.9; 3/17/48, 10.4; 11/19/48, 13.5; 3/18/49, 10.0; 11/23/49, 16.9; 4/2/52, 9.5.

14N/4E-10H2—Reference point—top of concrete pit, north edge, elevation 63 feet, 1.1 miles east of U. S. Highway 99E, 0.6 mile north of Ostrom Road. 12/3/47, 23.9; 3/18/48, 23.5; 11/19/48, 27.6; 3/21/49, 25.1; 11/23/49, 32.5; 3/22/50, 28.2; 11/3/50, 33.8; 4/5/51, 28.4; 11/23/51, 24.2; 4/4/52, 17.2.

14N/4E-10L1—Reference point—top of casing under pump, elevation 60 feet, 0.1 mile east of U. S. Highway 99E, 0.4 mile north of Slaughter House Road. 12/3/47, 16.9; 3/17/48, 15.4.

14N/4E-10M1—Reference point—top of casing 2 feet above ground line, elevation 58 feet, 0.2 mile west of U. S. Highway 99E, 0.4 mile north of Slaughter House Road. 11/19/48, 16.4.

14N/4E-10R1—Reference point—top of casing under pump, elevation 62 feet, 50 feet north of Ostrom Road, 0.5 mile east of U. S. Highway 99E. 12/3/47, 23.7; 3/18/48, 22.3; 11/19/48, 27.7; 11/23/49, 31.3.

14N/4E-11C1—Reference point—top of casing, elevation 68.6 feet, 2.0 miles east of U. S. Highway 99E, 0.7 mile south of Virginia Road. 11/18/48, 24.7.

14N/4E-11C2—Reference point—top of casing, elevation 68 feet, 1.9 miles east of U. S. Highway 99E, 0.7 mile south of Virginia Road. 11/18/48, 26.1; 3/21/49, 24.2; 11/23/49, 31.6.

14N/4E-11H1—Reference point—top of casing, elevation 72 feet, 1.0 mile west of Bradshaw Road, 0.6 mile north of Ostrom Road. 11/18/48, 29.4; 3/21/49, 27.7; 11/21/49, 35.9; 3/27/50, 33.2; 11/2/50, 38.6; 4/5/51, 34.6; 11/23/51, 40.6; 4/4/52, 37.2.

14N/4E-11J1—Reference point—top of casing, elevation 69.8 feet, 0.4 mile north of Ostrom Road, 1.1 miles west of Bradshaw Road. 11/18/48, 30.1; 3/21/49, 28.3; 11/23/49, 36.4.

14N/4E-11Q1—Reference point—top of casing, elevation 71 feet, 50 feet north of Ostrom Road, 1.5 miles west of Bradshaw Road. 11/18/48, 30.0; 11/23/49, 34.8.

14N/4E-12A1—Reference point—hole in pump base, elevation 75 feet, 100 feet west of Bradshaw Road, 1.0 mile north of Ostrom Road. 11/18/48, 31.4; 1/18/48, 28.8; 3/29/49, 28.1; 11/23/49, 36.6; 3/30/50, 33.6; 11/2/50, 40.5; 4/5/51, 43.2; 4/4/52, 37.1.

14N/4E-12B1—Reference point—hole in pump base, elevation 72 feet, 0.4 mile west of Bradshaw Road, 1.0 mile north of Ostrom Road. 11/18/48, 29.0; 4/5/51, 34.7.

14N/4E-12E1—Reference point—top of casing, elevation 70 feet, 0.7 mile north of Ostrom Road, 100 feet east of Virginia Road. 10/7/48, 29.55; 11/18/48, 28.9; 1/18/49, 28.0; 3/21/49, 27.15; 11/23/49, 35.4.

14N/4E-12R1—Reference point—top of casing, elevation 78 feet, 100 feet northwest of the intersection of Bradshaw and Ostrom Roads. 10/7/48, 35.0; 11/18/48, 33.0; 3/18/49, 30.8; 11/23/49, 39.8; 3/22/50, 36.7; 11/2/50, 44.2; 4/5/51, 39.0; 11/23/51, 47.4; 4/3/52, 40.8.

14N/4E-13A1—Reference point—top of casing, elevation 79.4 feet, 50 feet west of Bradshaw Road, 0.2 mile south of Ostrom Road. 3/24/48, 29.8; 10/7/48, 37.4; 11/18/48, 35.1; 1/18/48, 33.8; 3/18/49, 32.8; 11/23/49, 41.8; 3/27/50, 38.4.

14N/4E-13B1—Reference point—top of casing, elevation 75.5 feet, 0.3 mile west of Bradshaw Road, 100 feet south of Ostrom Road. 11/18/46, 31.6.

14N/4E-13C1—Reference point—top of casing, elevation 73.5 feet, 100 feet south of Ostrom Road, 0.6 mile west of Bradshaw Road. 10/7/48, 30.6; 11/18/48, 29.0; 1/18/49, 28.0; 3/18/49, 27.0; 11/23/49, 34.9; 3/27/50, 32.0; 11/2/50, 38.4; 4/5/51, 33.4; 11/23/51, 39.8; 4/3/52, 35.1.

14N/4E-13Q1—Reference point—top of casing under pump, elevation 71 feet, 0.9 mile south of Ostrom Road, 0.5 mile east of Virginia Road. 12/3/47, 30.4; 3/18/48, 29.1; 10/7/48, 34.7; 11/18/48, 33.6; 3/18/49, 31.6; 11/23/49, 39.0; 3/27/50, 36.7; 11/3/50, 41.8; 4/5/51, 37.9.

14N/4E-13R1—Reference point—top of casing, elevation 80 feet, 50 feet west of Bradshaw Road, 1 mile south of Ostrom Road. 11/18/48, 39.1; 3/18/49, 36.5; 11/24/49, 57.7.

14N/4E-14C1—Reference point—top of casing, elevation 70 feet, 20 feet south of Ostrom Road, 0.8 mile east of U. S. Highway 99E. 10/7/48, 30.7; 11/18/48, 29.0; 1/18/49, 28.0; 3/18/49, 29.1; 11/24/49, 33.9; 3/27/50, 31.5; 11/2/50, 36.2; 4/5/51, 31.6; 11/23/51, 38.4; 4/4/52, 33.6.

14N/4E-14J1—Reference point—top of casing, elevation 62 feet, 200 feet west of Virginia Road, 0.5 mile south of Ostrom Road. 12/3/47, 23.8; 3/18/48, 22.6; 10/7/48, 27.5; 11/18/48, 27.0; 3/18/49, 25.4.

14N/4E-14R1—Reference point—top of casing, elevation 70 feet, 200 feet west of Virginia Road, 0.4 mile north of U. S. Highway 99E. 3/18/49, 30.4.

14N/4E-15C1—Reference point—hole in pump base, elevation 64.6 feet, 200 feet south of Slaughter House Road, 0.4 mile west of U. S. Highway 99E. 12/2/47, 23.9; 3/17/48, 22.6; 10/7/48, 30.5; 11/19/48, 25.9; 3/18/49, 23.3; 11/23/49, 29.6; 3/28/50, 26.5; 11/3/50, 31.0; 4/5/51, 26.0; 11/21/51, 33.1; 4/2/52, 28.9.

14N/4E-15C2—Reference point—top of casing under pump, elevation 65 feet, 500 feet south of Slaughter House Road, 0.3 mile west of U. S. Highway 99E. 12/2/47, 23.1; 3/17/48, 20.8.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N 4E-15C3—Reference point—top of casing, 1 foot below ground, elevation 62.7 feet, 250 feet north of Slaughter House Road, 0.2 mile west of U. S. Highway 99E. 11/22/29, 16.4; 9/18/30, 15.9; 12/11/31, 16.4; 12/10/32, 15.7; 12/21/33, 11.0; 11/23/34, 10.7; 11/22/37, 15.8; 11/27/39, 12.1; 12/21/40, 15.3; 11/7/47, 23.2; 12/16/48, 24.3; 12/7/49, 28.2; 11/10/50, 29.7; 12/5/51, 31.3.

14N 4E-15C4—Reference point—top of 1-inch pipe to jet, elevation 65.2 feet, 0.1 mile north of Slaughter House Road, 0.3 mile west of U. S. Highway 99E. 11/19/48, 26.6; 3/18/49, 24.1; 11/23/49, 30.3.

14N 4E-15D1—Reference point—top of casing, elevation 55.9 feet, 200 feet southwest of Slaughter House Road, 0.7 mile due west of U. S. Highway 99E. 12/2/47, 15.8; 3/17/48, 14.1; 11/19/48, 17.5.

14N 4E-15L1—Reference point—top of casing under pump, elevation 66 feet, 0.8 mile west of U. S. Highway 99E, 0.4 mile south of Slaughter House Road. 12/2/47, 25.6; 3/17/48, 24.4; 10/7/48, 29.5; 11/19/48, 27.6; 1/25/49, 26.6; 3/18/49, 25.2; 5/25/49, 33.1; 6/29/49, 34.5; 7/29/49, 35.5; 11/23/49, 31.4; 3/28/50, 28.4; 11/3/50, 32.8; 4/5/51, 28.2; 11/21/51, 37.0; 4/2/52, 29.0.

14N 4E-16M1—Reference point—top of casing, elevation 55 feet, 1.3 miles south of McGowan Road, 0.4 mile east of Western Pacific Railroad tracks. 12/3/47, 22.5; 3/18/48, 20.3; 11/19/48, 20.9; 3/13/49, 18.4.

14N 4E-17C1—Reference point—top of casing under pump, elevation 55 feet, 0.5 mile south of McGowan Road, 100 feet west of Western Pacific Railroad. 12/2/47, 23.9; 3/18/48, 20.6; 11/19/48, 23.6; 3/18/49, 21.1; 11/22/49, 25.3; 3/28/50, 22.8; 11/3/50, 26.7; 4/5/51, 20.8.

14N 4E-17D1—Reference point—hole in side of casing, elevation 54 feet, 0.5 mile south of McGowan Road, 0.3 mile west of Western Pacific Railroad. 3/18/49, 21.0; 3/28/50, 22.5.

14N 4E-17D2—Reference point—top of casing under pump, elevation 54 feet, 0.5 mile south of McGowan Road, 0.3 mile west of Western Pacific Railroad. 12/1/47, 22.3.

14N 4E-17P1—Reference point—top of casing under pump, elevation 58.7 feet, 500 feet west of Western Pacific Railroad, 1.4 miles south of McGowan Road. 12/3/47, 23.2; 3/18/48, 21.8; 5/14/48, 23.2; 11/19/48, 24.1; 3/18/49, 21.9; 11/23/49, 25.8; 3/28/50, 23.0; 11/31/50, 26.6; 4/5/51, 20.9; 4/3/52, 23.2.

14N 4E-18C1—Reference point—hole in top of casing, elevation 53.1 feet, 200 feet south of Ella Road, 0.4 mile east of Feather River Boulevard. 11/11/47, 20.9; 3/5/48, 19.7; 10/7/48, 27.5; 11/11/48, 19.5; 1/27/49, 18.7; 3/21/49, 17.8; 12/1/49, 20.4; 3/28/50, 19.1; 11/6/50, 23.5; 3/30/51, 15.1; 11/20/51, 23.3; 4/5/52, 15.7.

14N 4E-18H1—Reference point—bottom of pump, elevation 54.1 feet, 400 feet west of Arboga Road, 0.5 mile south of Ella Road. 11/11/47, 21.2; 3/5/48, 19.8; 10/7/48, 24.9; 11/11/48, 21.0; 3/21/49, 19.6; 12/1/49, 21.6.

14N 4E-18J1—Reference point—top of suction flange, elevation 45.6 feet, 400 feet west of Arboga Road, 0.6 mile south of Ella Road. 11/11/47, 17.6; 3/5/48, 14.2; 11/11/48, 16.3; 3/21/49, 14.8; 12/1/49, 22.0.

14N 4E-19E1—Reference point—top of casing, 4 feet below ground in pit, elevation 52 feet, 0.2 mile east of Feather River Boulevard, 0.1 mile north of Broadway. 11/8/29, 8.0; 9/26/30, 8.7; 12/11/31, 8.6; 12/31/32, 8.6; 12/21/33, 8.9; 11/20/34, 9.1; 11/27/36, 9.1; 11/21/37, 11.1; 1/30/39, 6.6; 12/21/40, 8.1.

14N 4E-19L1—Reference point—top of casing, 0.6 foot above ground, elevation 48 feet, 0.4 mile east of Feather River Boulevard, 0.1 mile south of Broadway. 11/7/47, 20.6; 12/16/48, 20.7; 12/9/49, 21.8; 11/10/50, 23.6; 12/5/51, 21.2.

14N 4E-19P1—Reference point—top of casing, top of concrete floor, elevation 50.4 feet, 0.3 mile south of Broadway, 0.5 mile east of Feather River Boulevard. 11/17/47, 33.6; 3/9/48, 18.4; 11/10/48, 19.7; 3/23/49, 17.5; 12/2/49, 21.4; 3/29/50, 18.9; 11/6/50, 22.3; 3/30/51, 18.7; 11/16/51, 22.1; 4/1/52, 9.5.

14N 4E-20D1—Reference point—top of casing under pump, elevation 53 feet, 200 feet north of Broadway, 0.6 mile west of Arboga Road. 12/3/47, 24.9; 3/18/48, 23.3.

14N 4E-20E1—Reference point—pump base hole, elevation 54.3 feet, 150 feet north of Broadway, 1.0 mile east of Feather River Boulevard. 11/11/48, 20.9; 3/21/49, 18.2.

14N 4E-20M1—Reference point—bottom of pump mount, blocked up from concrete, elevation 52.2 feet, 50 feet south of Broadway, 0.95 mile east of Feather River Boulevard. 11/11/47, 22.4; 3/6/48, 20.0; 10/7/48, 22.8; 11/11/48, 21.5; 1/24/29, 20.6; 3/21/49, 19.7; 12/1/49, 23.0; 3/29/50, 20.9; 11/6/50, 23.1; 11/20/51, 23.3; 4/5/52, 17.4.

14N 4E-20M2—Reference point—hole in side of pump, elevation 52.8 feet, 400 feet south of Broadway, 1.0 mile east of Feather River Boulevard. 11/11/47, 18.7; 3/6/48, 20.0; 10/7/48, 21.7; 11/11/48, 19.5; 3/2/49, 16.9; 12/1/49, 21.2; 3/29/50, 18.5; 11/6/50, 22.1; 3/30/51, 18.0; 11/20/51, 21.7; 4/5/52, 16.1.

14N 4E-22F1—Reference point—hole in top of pump base, elevation 60 feet, 100 feet west of Forty Mile Road, 1.35 miles south of Slaughter House Road. 12/1/47, 22.6; 3/1/48, 21.3; 3/31/48, 20.8; 10/7/48, 25.6; 11/8/48, 24.0; 1/25/49, 23.0; 3/18/49, 21.5; 11/23/49, 27.7.

14N 4E-22F2—Reference point—hole in base of pump, elevation 58.4 feet, 200 feet west of Forty Mile Road, 1.2 miles south of Slaughter House Road. 12/2/47, 18.7; 3/17/48, 17.4.

14N 4E-22F3—Reference point—access pipe in concrete base, elevation 61.9 feet, 150 feet west of Forty Mile Road, 1.3 miles south of Slaughter House Road. 12/2/47, 23.6; 3/17/48, 22.2; 11/19/48, 24.9; 3/18/49, 21.9; 11/23/49, 27.0; 3/28/50, 25.6; 11/2/50, 30.1; 4/5/51, 28.9; 11/21/51, 32.4; 4/2/52, 25.5.

14N 4E-22M1—Reference point—top of casing, elevation 61.8 feet, 0.4 mile west of Forty Mile Road, 1.25 miles north of Plumas School. 12/1/47, 21.7; 3/1/48, 20.5; 10/7/48, 25.1; 11/8/48, 23.5; 3/25/49, 20.5; 11/23/49, 26.4; 3/28/50, 23.1; 11/3/50, 28.1; 12/3/51, 28.1; 4/1/52, 23.9.

14N 4E-22P1—Reference point—top of concrete curb around open pit well, elevation 64.9 feet, 50 feet west of Forty Mile Road, 1.2 miles north of Plumas School. 11/21/47, 26.9.

14N 4E-23A1—Reference point—top of casing, elevation 60 feet, 300 feet southwest of U. S. Highway 99E, 1.5 miles southeast of Slaughter House Road. 12/3/47, 31.7; 3/18/48, 30.2; 11/18/48, 33.8; 3/18/49, 32.2; 11/23/49, 38.2; 3/29/50, 36.5; 11/3/50, 40.4; 11/21/51, 43.4; 4/2/52, 41.0.

14N 4E-23B1—Reference point—top of casing, elevation 70 feet, 0.07 mile southwest of U. S. Highway 99E, 0.38 mile northwest of Virginia Road. 12/3/47, 30.7; 3/18/48, 29.5.

14N 4E-23G1—Reference point—top of pump base, elevation 70 feet, 0.70 mile west of U. S. Highway 99E, at a point 2.02 miles southeast of Slaughter House Road. 12/1/47, 30.9; 10/7/48, 33.2; 11/8/48, 32.9; 3/29/49, 30.9; 11/25/49, 37.2.

14N 4E-23Q1—Reference point—top of casing, elevation 72 feet, 1.98 miles south of Slaughter House Road, 1.05 miles east of Forty Mile Road. 11/21/47, 32.6; 3/3/48, 29.2.

14N 4E-23R1—Reference point—top of casing, elevation 67 feet, 1.98 miles south of Slaughter House Road, 1.48 miles east of Forty Mile Road. 11/21/47, 30.5; 3/31/47, 29.7; 11/11/48, 33.0; 3/29/49, 30.6; 11/25/49, 36.1.

14N 4E-24B1—Reference point—top of pump base, elevation 75 feet, 0.80 mile east of Virginia Road, 1 mile south of Ostrom Road. 3/18/49, 28.3.

14N 4E-24H1—Reference point—top of pump base, elevation 85 feet, 1.3 miles south of Ostrom Road, 0.14 mile west of Bradshaw Road. 11/18/48, 36.9; 3/18/49, 34.0; 11/23/49, 42.9; 3/27/50, 39.8; 11/2/50, 45.8; 4/5/51, 41.3; 11/30/51, 51.7; 4/3/52, 43.7.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N/4E-24M1—Reference point—top of casing, elevation 70 feet. 0.05 mile southwest of U. S. Highway 99E, 0.38 mile southeast of Virginia Road. 11/21/47, 22.5; 3/2/48, 28.7; 11/11/48, 31.1; 3/23/49, 28.3; 11/25/49, 34.5.

14N/4E-24P1—Reference point—top of pump base, elevation 70 feet. West side of U. S. Highway 99E, 0.68 mile southeast of Virginia Road. 11/21/47, 32.7; 3/2/48, 30.5; 11/9/48, 33.7; 1/25/49, 31.9; 3/23/49, 30.5; 5/25/49, 40.3; 7/1/49, 44.8; 11/25/49, 38.5; 3/28/50, 35.1; 11/3/50, 40.6; 4/4/51, 35.8; 12/6/51, 39.6; 4/2/52, 41.9.

14N/4E-25R1—Reference point—top of casing, elevation 74 feet. 0.53 mile northwest of Dairy Road, 0.67 mile southwest of U. S. Highway 99E. 12/2/47, 29.4; 3/2/48, 27.6; 10/7/48, 32.8; 11/11/48, 31.2; 3/29/49, 28.0; 11/23/49, 34.7.

14N/4E-26A1—Reference point—hole in base of pump, elevation 65 feet. 1.03 miles southeast of Virginia Road, 0.98 mile west of U. S. Highway 99E. 11/11/48, 33.2; 3/29/49, 30.2.

14N/4E-26C1—Reference point—top of casing, elevation 66 feet. 1.45 mile north of Levee Road, 0.95 mile east of Forty Mile Road. 12/1/47, 18.2; 3/3/48, 16.7; 11/11/48, 19.7; 3/29/49, 17.5; 11/25/49, 22.4; 3/29/50, 20.9; 11/8/50, 24.8; 4/4/51, 20.8; 5/5/51, 23.5; 4/2/52, 23.0.

14N/4E-27D1—Reference point—top of casing, elevation 60 feet. 1.20 miles north of Levee Road, 0.40 mile west of Forty Mile Road. 11/21/47, 24.8.

14N/4E-27L1—Reference point—pipe in base, elevation 64.1 feet. 2.60 miles south of Slaughter House Road, west side of Forty Mile Road. 12/1/47, 24.8; 3/1/48, 23.4; 3/29/48, 23.5; 10/7/48, 30.0; 11/8/48, 28.1; 1/25/49, 26.7; 3/25/49, 25.6; 11/23/49, 29.6; 3/28/50, 28.0; 11/3/50, 32.5; 11/30/51, 23.0; 4/1/52, 28.5.

14N/4E-27R1—Reference point—top of casing, elevation 60 feet. 2.85 miles south of Slaughter House Road, 0.52 mile east of Forty Mile Road. 12/2/47, 30.3; 3/1/48, 28.7; 11/8/48, 31.7; 3/25/49, 28.8; 11/23/49, 33.6.

14N/4E-28N1—Reference point—top of casing, elevation 49 feet. 2.05 miles south of Slaughter House Road, 1.50 miles west of Forty Mile Road. 11/8/29, 10.5; 9/26/30, 10.4; 12/11/31, 11.0; 12/5/32, 11.1; 12/21/33, 11.2; 11/20/34, 11.5; 11/27/36, 11.9; 11/24/37, 12.0; 11/30/39, 9.2; 12/21/40, 10.9; 11/7/47, 13.1; 12/16/48, 13.8; 12/9/49, 15.9; 11/10/50, 15.0; 12/5/51, 15.9.

14N/4E-28R1—Reference point—pipe in base of pump, elevation 60.2 feet. 0.55 mile north of Levee Road, 0.68 mile west of Forty Mile Road. 12/2/47, 25.2; 3/1/48, 24.1; 11/8/48, 25.6; 3/25/49, 23.6; 11/23/49, 27.4; 3/28/50, 25.6; 11/3/50, 29.1; 4/4/51, 21.7; 11/30/51, 34.1; 4/1/52, 24.6.

14N/4E-30E1—Reference point—hole in base of pump, elevation 48.6 feet. 0.11 mile east of Feather River Boulevard, 0.25 mile south of Anderson Road. 11/17/47, 23.5; 3/9/48, 19.3; 11/10/48, 20.3; 3/23/49, 18.1; 12/2/49, 21.8.

14N/4E-30F1—Reference point—top of casing, elevation 45 feet. 0.15 mile north of Country Club Road, 0.46 mile east of Feather River Boulevard. 11/17/47, 16.9; 3/9/48, 16.9; 11/10/48, 17.9.

14N/4E-30K1—Reference point—top of casing, elevation 45.0 feet. South side of Country Club Boulevard, 0.51 mile east of Feather River Boulevard. 11/17/47, 14.5; 3/8/48, 14.5; 5/8/48, 12.0; 11/10/48, 15.4; 1/29/49, 14.4; 3/23/49, 12.1; 6/1/49, 22.6; 6/29/49, 24.0; 7/28/49, 25.7; 8/26/49, 30.1; 3/29/50, 13.5; 11/6/50, 17.2; 3/30/51, 12.2; 11/16/51, 16.8; 4/1/52, 12.2.

14N/4E-31E1—Reference point—top of casing, elevation 38.5 feet. 0.06 mile east of Feather River Boulevard, 0.80 mile south of Country Club Road. 11/10/48, 11.9; 3/22/49, 8.9; 12/2/49, 11.8.

14N/4E-32L1—Reference point—top of casing, elevation 45 feet. 1.0 mile south of Country Club Avenue, 1.24 miles east of Feather River Boulevard. 11/17/47, 18.0; 3/9/48, 18.2; 11/10/48, 17.3; 3/29/49, 15.4; 12/2/49, 19.3.

14N/4E-33K1—Reference point—top of casing, elevation 51 feet. 1.50 mile west of Forty Mile Road, 0.55 mile north of Levee Road. 12/1/47, 19.7; 11/8/48, 20.6; 3/25/49, 18.0.

14N/4E-33M1—Reference point—top of casing, elevation 51 feet. 3.73 miles south of Slaughter House Road, 0.21 mile east of Western Pacific Railroad. 11/17/47, 14.3; 3/9/48, 13.1; 5/5/48, 9.1; 5/31/48, 9.1; 11/10/48, 13.9; 1/24/49, 13.8; 3/22/49, 10.8; 6/1/49, 10.8; 6/29/49, 12.8; 7/28/49, 14.2; 8/26/49, 15.8; 12/2/49, 15.3; 3/29/50, 9.7; 11/6/50, 14.7; 11/16/51, 13.7; 4/1/52, 5.5.

14N/4E-34C1—Reference point—top of concrete pit, elevation 63.4 feet, 3.05 miles south of Slaughter House Road, 0.05 mile west of Forty Mile Road. 12/1/47, 27.8; 3/1/48, 26.5; 5/5/48, 25.1; 6/3/48, 26.8; 6/24/48, 32.2 (operating); 7/8/48, 29.2 (operating).

14N/4E-35N1—Reference point—slot in base, elevation 62 feet. West side of Forty Mile Road, 0.60 mile northwest of Dairy Road. 11/28/47, 25.7; 3/1/48, 24.4; 3/21/48, 24.2; 3/29/48, 23.8; 5/5/48, 22.5; 5/13/48, 61.5 (operating); 11/8/48, 27.5; 1/26/49, 25.6; 3/25/49, 24.0; 11/23/49, 30.3; 3/28/50, 27.3; 11/6/50, 32.1; 4/4/51, 26.3; 11/30/51, 33.1; 4/1/52, 27.4.

14N/4E-36G1—Reference point—top of casing, elevation 70 feet. 0.20 mile northwest of U. S. Highway 99E. 12/2/47, 30.5; 3/2/48, 28.5; 3/29/48, 28.0; 10/7/48, 33.6; 11/11/48, 32.4; 1/25/49, 31.8; 3/25/49, 29.0; 11/23/49, 36.7; 3/28/50, 32.6; 11/8/50, 37.6; 4/4/51, 30.8; 12/3/51, 41.0.

14N/5E-5A1—Reference point—top of casing, elevation 90.2 feet. 400 feet south of Spenceville Road, 1.0 mile west of South Beale Road. 12/5/49, 39.1; 11/2/50, 46.9; 4/5/51, 41.9; 4/4/52, 41.5.

14N/5E-6B1—Reference point—top of 12-inch casing, elevation 78.5 feet, 150 feet south of Spenceville Road, 2.25 miles west of South Beale Road. 11/28/48, 26.0; 1/18/49, 25.2; 3/21/49, 24.9; 11/24/49, 32.4; 3/27/40, 30.3; 11/2/50, 37.6; 4/5/51, 32.8; 11/30/51, 37.6; 4/4/52, 34.6.

14N/5E-6D1—Reference point—top of 8-inch casing, elevation 76.4 feet, 600 feet south of Spenceville Road, 1.75 miles east of Virginia Road. 12/24/47, 22.4; 3/24/48, 22.3; 3/21/49, 23.7; 11/24/49, 33.7.

14N/5E-6D2—Reference point—top of 6-inch casing, elevation 73.6 feet, 800 feet south of Spenceville Road, 1.75 miles east of Virginia Road. 11/18/48, 23.9.

14N/5E-8A1—Reference point—top of 16-inch casing, elevation 90 feet, 0.40 mile northwest of South Beale Road at a point 0.70 mile northeast of Ostrom Road. 11/18/48, 24.7.

14N/5E-8D1—Reference point—top of casing, elevation 82 feet. 1.0 mile north of Ostrom Road, 1.0 mile east of Bradshaw Road. 3/18/49, 31.2.

14N/5E-8R1—Reference point—top of 14-inch casing, elevation 89.6 feet, 0.15 mile northeast of intersection of Ostrom Road and South Beale Road. 11/18/48, 30.5; 3/18/49, 30.1; 11/23/49, 39.7; 4/5/52, 39.2.

14N/5E-15D1—Reference point—top of casing, elevation 111 feet. 500 feet east of Ostrom Road, 0.25 mile south of Ostrom Road. 12/9/49, 42.3; 11/2/50, 46.4; 12/8/51, 47.3.

14N/5E-16C1—Reference point—top of brick casing, elevation 99 feet. 100 feet south of Ostrom Road, 100 feet west of Jasper Lane. 11/22/29, 26.3; 9/8/30, 25.5; 12/11/31, 27.5; 12/10/32, 26.7; 12/21/33, 27.6; 11/20/34, 27.8; 11/23/36, 26.4; 11/22/37, 25.6; 1/27/39, 25.5; 1/13/41, 30.0; 11/7/47, 30.0; 12/23/47, 29.7; 3/24/48, 30.0; 10/7/48, 31.2; 11/18/48, 31.2; 12/16/48, 31.9; 1/18/49, 31.7; 3/18/49, 31.2.

14N/5E-16C2—Reference point—top of casing, elevation 100 feet. 40 feet west of Jasper Lane, 40 feet south of Ostrom Road. 12/5/51, 41.9.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

14N 5E-17B1—Reference point—top of 12-inch casing, elevation 85.7 feet, 100 feet south of Ostrom Road, 0.30 mile west of South Beale Road. 12/23/47, 28.0; 3/24/48, 24.7; 10/7/48, 31.3; 11/18/48, 30.7; 3/18/49, 29.8; 11/23/49, 40.7; 4/3/52, 40.1.

14N 5E-17B2—Reference point—top of 16-inch casing, elevation 90.4 feet, Northwest side of South Beale Road, 1,000 feet southwest of Ostrom Road intersection. 11/19/48, 34.6; 3/18/49, 33.4; 11/23/49, 42.6.

14N 5E-17D1—Reference point—top of 12-inch casing, elevation 86.8 feet, 600 feet south of Ostrom Road, 0.80 mile west of South Beale Road. 11/18/48, 37.1; 1/18/49, 36.0; 3/18/49, 35.2; 11/23/49, 48.3.

14N 5E-18A1—Reference point—top of casing, elevation 87.0 feet, 750 feet south of Ostrom Road, 0.80 mile west of South Beale Road. 12/23/47, 33.7; 3/24/48, 32.9; 10/7/48, 39.0; 11/18/48, 37.5; 1/18/49, 36.4; 3/18/49, 35.6; 11/23/49, 45.1; 3/27/50, 41.8; 11/2/50, 50.1; 4/5/51, 44.4; 11/23/51, 50.5; 1/3/52, 45.8.

14N 5E-18B1—Reference point—top of 12-inch casing, elevation 78.1 feet, South side of Ostrom Road, 0.35 mile east of Bradshaw Road. 12/23/47, 25.7; 3/2/48, 28.5; 10/7/48, 33.5; 11/18/48, 31.7; 3/18/49, 28.0; 5/25/49, 36.6; 6/29/49, 40.4; 8/1/49, 42.7; 8/30/49, 51.2; 11/23/49, 39.7.

14N 5E-21R1—Reference point—top of casing, elevation 93 feet, 200 feet northeast of Jasper Lane at a point 1.9 miles south of Ostrom Road. 11/25/47, 21.5.

14N 5E-26P1—Reference point—top of concrete crib, elevation 119.7 feet, 0.25 mile southeast of Wheatland-Spenceville Road at a point 0.85 mile northeast of Jasper Lane. 11/25/47, 28.5; 3/6/48, 28.2; 11/9/48, 28.8; 3/23/49, 27.5; 12/9/49, 31.0; 3/29/50, 29.9; 11/8/50, 33.7; 4/5/51, 29.9.

14N 5E-27K1—Reference point—top of concrete crib, elevation 84.7 feet, 0.25 mile northeast of Jasper Lane at a point 0.85 mile northwest of Wheatland-Spenceville Road. 11/25/47, 12.0; 3/6/48, 11.8; 11/9/48, 13.2; 3/23/49, 11.3; 6/29/49, 12.7; 7/28/49, 13.3; 8/30/49, 13.9; 11/28/49, 16.8.

14N 5E-27L1—Reference point—top of 14-inch casing at bottom of pit, elevation 81.2 feet, 900 feet northeast of Jasper Lane at a point 1.1 miles northwest of Wheatland-Spenceville Road. 27L2 replaces 27L1 after 4/4/51. 11/25/47, 6.7; 3/6/48, 6.3; 11/9/48, 7.9; 3/23/49, 6.0; 11/28/49, 9.1; 3/29/50, 7.1; 11/8/50, 12.2; 4/4/51, 5.4.

14N 5E-27L2—Reference point—top of casing, elevation 92 feet, 900 feet northeast of Jasper Lane at a point 1.1 miles northwest of Wheatland-Spenceville Road. 11/21/51, 32.2; 4/2/52, 27.5.

14N 5E-28M1—Reference point—top of casing pit, elevation 86.5 feet, 1.0 mile southwest of Jasper Lane at a point 1.15 miles northwest of Wheatland-Spenceville Road. 11/26/47, 25.7; 3/6/48, 21.6; 11/9/48, 26.9; 3/29/49, 24.5; 11/28/49, 30.4; 3/29/50, 27.7; 11/28/49, 30.4; 3/29/50, 27.7; 11/8/50, 34.0; 4/4/51, 29.0; 11/21/51, 31.2; 4/2/52, 28.2.

14N 5E-30J1—Reference point—top of 14-inch casing, elevation 81.8 feet, 0.30 mile northeast of U. S. Highway 99E at a point 1.8 miles northwest of Wheatland Road. 11/25/47, 38.8; 11/9/48, 32.8; 3/29/49, 29.1; 12/8/49, 36.0.

14N 5E-30Q1—Reference point—top of 16-inch casing, elevation 76.6 feet, 100 feet southwest of Oakley Lane, 0.40 miles northwest of Dairy Road. 11/24/47, 30.4; 3/5/48, 28.6; 3/29/48, 27.9; 5/8/48, 27.0; 11/11/48, 32.5; 1/25/49, 31.0; 3/23/49, 29.5; 11/23/49, 35.9; 3/28/50, 35.7; 11/8/50; 39.5; 4/4/51, 34.5; 12/6/51, 39.0; 1/2/52, 36.1.

14N 5E-31B1—Reference point—hole in casing, elevation 76.8 feet, 150 feet northwest of Dairy Road, 500 feet southwest of Oakley Lane. 11/22/47, 28.1; 3/5/48, 27.1; 11/11/48, 30.2; 3/25/49, 26.8; 11/25/49, 33.6.

14N 5E-31J1—Reference point—top of 8-inch casing at bottom of pit, elevation 59.8 feet, 100 feet southwest of Oakley Lane, 0.45 mile southeast of Dairy Road. 11/22/47, 11.2; 3/5/48, 9.5; 11/11/48, 13.1; 3/25/49, 9.3; 11/28/49, 16.1.

14N 5E-32F1—Reference point—top of 14-inch casing, elevation 71.0 feet, Southwest of U. S. Highway 99E, 0.35 mile southeast of Dairy Road. 11/22/47, 17.1; 3/5/48, 16.6; 3/29/48, 15.6; 11/11/48, 19.4; 1/26/49, 18.0; 3/24/49, 16.0; 11/23/49, 22.5.

14N 5E-32M1—Reference point—top of 12-inch casing, elevation 67.2 feet, 0.25 mile northeast of Oakley Lane, 0.60 mile southeast of Dairy Road. 11/22/47, 14.7; 3/5/48, 13.6; 11/11/48, 16.2; 3/23/49, 12.5; 11/28/49, 19.7.

14N 5E-32N1—Reference point—top of casing at bottom of pit, elevation 63.2 feet, Southwest side of Oakley Lane, 0.70 miles southeast of Dairy Road. 11/20/47, 11.7; 3/5/48, 10.7; 11/11/48, 13.3; 3/25/49, 9.3; 11/23/49, 17.2; 3/29/50, 12.7; 11/8/50, 18.5; 4/4/51, 9.9; 12/3/51, 17.6; 4/2/52, 8.5.

14N 5E-32R1—Reference point—top of concrete base, elevation 73.8 feet, 400 feet southwest of U. S. Highway 99E at a point 0.55 mile northwest of Wheatland Road. 12/24/47, 16.9; 3/5/48, 15.7; 11/11/48, 17.5; 3/30/49, 15.0; 5/3/49, 16.9; 6/2/49, 19.8; 7/2/49, 21.1; 8/31/49, 24.0; 11/28/49, 20.3.

14N 5E-32R2—Reference point—top of 14-inch casing, elevation 74.8 feet, 100 feet southwest of U. S. Highway 99E, 0.55 mile northwest of Wheatland Road. 11/24/47, 17.3; 3/5/48, 16.2; 11/11/48, 18.5; 3/30/49, 15.2; 6/2/49, 24.9; 7/2/49, 27.6; 8/31/49, 28.0; 11/24/49, 21.1; 3/29/50, 18.0; 11/8/50, 23.1; 4/4/51, 15.1; 11/21/51, 23.2; 4/2/52, 13.0.

14N 5E-33K1—Reference point—bottom of slot in casing, elevation 78.3 feet, 0.40 mile northwest of Wheatland-Spenceville Road at a point 0.45 mile northeast of U. S. Highway 99E. 11/25/47, 14.0; 3/6/48, 13.3; 11/9/48, 15.5; 3/23/49, 11.4; 11/28/49, 17.6; 3/29/50, 13.9; 11/8/50, 19.5; 11/21/51, 19.5; 4/2/52, 10.4.

14N 5E-33M1—Reference point—top of casing at bottom of pit, elevation 65.8 feet, 0.15 mile northeast of U. S. Highway 99E at a point 0.55 mile northwest of Wheatland Road. 11/25/47, 6.0; 3/6/48, 5.6; 12/6/48, 6.8.

14N 5E-33Q1—Reference point—top of concrete well curb, elevation 86 feet, Northwest of the northeast corner of town of Wheatland, 1,000 feet north of school house east side. 11/22/29, 22.2; 9/18/30, 23.6; 12/11/31, 23.3; 12/10/32, 22.1; 12/21/33, 22.7; 11/20/34, 23.5; 11/23/36, 23.4; 11/22/37, 22.0; 1/27/39, 20.8; 1/2/40, 20.4; 11/7/47, 27.0; 12/16/48, 26.3; 12/9/49, 29.0; 11/8/50, 31.3; 12/5/51, 28.8.

14N 5E-34F1—Reference point—top of casing, elevation 90.2 feet, 500 feet northwest of Wheatland-Spenceville Road, 0.25 mile southwest of Jasper Lane. 11/25/47, 19.0; 3/6/48, 18.1; 11/9/48, 20.2; 3/23/49, 17.4; 11/28/49, 22.5.

14N 5E-34H1—Reference point—base of pump, elevation 99.7 feet, 600 feet southeast of Wheatland-Spenceville Road, 1,000 feet northeast of Jasper Lane. 11/25/47, 20.6; 3/6/48, 20.4; 11/9/48, 21.2; 3/23/49, 19.8; 11/28/49, 23.4.

15N 1E-12A1—Reference point—hole in pump base, elevation 150 feet, 1.05 miles north of South Butte Road, 2.1 miles west of Irwin Avenue. 12/2/48, 83.0 (operating).

15N 1E-12H1—Reference point—hole in pump base, elevation 80 feet, 0.75 mile north of South Butte Road, 2.1 miles west of Irwin Avenue. 12/2/48, 13.2.

15N 1E-3A1—Reference point—hole in pump base, elevation 57 feet, 0.1 mile north of South Butte Road, 2.1 miles west of Irwin Avenue. 12/22/49, 25.1; 3/4/48, 21.8; 3/29/49, 19.4; 11/15/49, 24.0; 3/23/50, 13.3; 11/2/50, 27.2; 4/3/52, 27.1.

15N 1E-13B1—Reference point—hole in cement pipe base, elevation 55 feet, 0.15 mile north of South Butte Road, 2.3 miles west of Irwin Avenue. 12/2/48, 31.8; 11/2/50, 33.2; 3/26/51, 63.8 (operating).

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N/1E-14F1—Reference point—bottom of 2" x 4" board under pump, elevation 54 feet, South side of South Butte Road, 0.3 mile east of Sutter Bypass east levee. 12/22/47, 18.5; 3/4/48, 18.3; 5/4/48, 15.5; 6/2/48, 15.8; 7/3/48, 16.6; 8/3/48, 17.7; 9/1/48, 17.9; 12/2/48, 18.9; 12/8/49, 19.0; 3/23/50, 10.9; 11/2/50, 19.6.

15N/1E-14F2—Reference point—top of concrete pit, elevation 47 feet, 0.05 mile south of South Butte Road, 0.2 mile east of Sutter Bypass east levee. 11/27/29, 16.8; 10/6/30, 15.0; 12/16/31, 14.8; 12/8/32, 15.0; 12/15/33, 15.1; 11/2/34, 14.8; 11/23/34, 14.3; 11/27/36, 14.4; 11/15/37, 15.6; 1/25/39, 14.8; 1/11/41, 10.7; 11/4/47, 15.4; 12/13/48, 15.7; 12/8/49, 16.1; 11/10/50, 16.8; 12/7/51, 14.3.

15N/2E-1A1—Reference point—top of concrete pit, elevation 58.0 feet, 100 feet south of Nuestro Road, 0.15 mile west of Township Road. 12/19/47, 11.9; 3/3/48, 12.7; 12/1/48, 12.5; 1/20/49, 12.2; 3/16/49, 12.2; 6/28/49, 10.2; 7/27/49, 9.4; 11/11/49, 13.2; 3/23/50, 13.2; 11/6/50, 13.5; 4/3/51, 9.7; 11/14/51, 12.1; 4/3/52, 6.5.

15N/2E-1C1—Reference point—top of casing, elevation 58.2 feet, 0.1 mile south of Nuestro Road, 0.65 mile west of Township Road. 12/19/47, 10.3; 12/2/48, 11.7; 11/11/49, 11.5.

15N/2E-1H1—Reference point—top of concrete pit, elevation 57.7 feet, 150 feet west of Township Road, 0.35 mile south of Nuestro Road. 12/22/47, 13.3; 3/3/48, 13.6; 12/1/48, 14.0; 3/16/49, 13.7; 11/11/49, 14.6.

15N/2E-2C1—Reference point—top of wooden platform under pump, elevation 60.4 feet, 50 feet west of East Butte Road, 0.15 mile north of Nuestro Road. 12/19/47, 11.8; 3/3/48, 11.8; 12/2/48, 9.5; 3/16/49, 8.0; 11/10/49, 6.5; 3/22/50, 9.4; 11/2/50, 6.8; 4/4/51, 8.6; 11/14/51, 8.1; 4/3/52, 6.3.

15N/2E-2H1—Reference point—top of casing, elevation 57.6 feet, 0.3 mile south of Nuestro Road, 1.1 miles west of Township Road. 12/19/47, 10.4; 3/3/48, 11.3; 12/2/48, 10.0; 3/16/49, 9.0; 11/11/49, 9.2; 3/23/50, 10.1; 11/2/50, 9.1; 4/4/51, 9.7; 11/14/51, 9.0; 4/3/52, 7.9.

15N/2E-3K1—Reference point—top of casing, elevation 57 feet, 0.1 mile east of Mallott Road, 0.8 mile north of Butte House Road. 12/22/47, 10.7; 3/4/48, 11.8; 12/2/48, 10.0; 11/16/49, 9.5.

15N/2E-4Q1—Reference point—top of casing, elevation 86 feet, 0.15 mile east of Acacia Avenue, 0.3 mile north of Butte House Road. 12/22/47, 35.7; 3/4/48, 36.2; 12/2/48, 35.6; 3/29/49, 36.0; 11/16/49, 36.6.

15N/2E-4R1—Reference point—base of pump, elevation 74 feet, 0.3 mile east of Acacia Avenue, 0.35 mile north of Butte House Road. 12/22/47, 34.2; 12/2/48, 35.0; 11/16/49, 37.0; 3/23/50, 36.0; 11/2/50, 38.0; 4/5/51, 34.0; 11/15/51, 37.0; 4/3/52, 31.0.

15N/2E-8J1—Reference point—hole in pump base, elevation 75 feet, 0.2 mile west of Irwin Avenue, 0.45 mile north of South Butte Road. 5/4/48, 33.6; 12/2/48, 34.7; 12/8/49, 34.8; 3/23/50, 34.2; 11/15/51, 35.8; 4/3/52, 34.7.

15N/2E-8Q1—Reference point—hole in pump base, elevation 62 feet, 250 feet north of South Butte Road, 0.25 mile west of Irwin Avenue. 12/22/47, 29.4; 12/2/48, 29.3; 3/29/49, 27.8; 11/15/49, 29.6; 3/23/50, 27.7; 11/2/50, 30.6; 4/5/51, 30.6; 11/15/51, 30.3; 4/3/52, 24.5.

15N/2E-10F1—Reference point—top of casing, elevation 56 feet, 0.1 mile south of Butte House Road, 0.2 mile west of Mallott Road. 12/22/47, 21.2; 3/5/48, 19.1; 3/29/49, 20.0; 11/16/49, 20.5; 3/23/50, 21.4; 11/2/50, 20.5; 3/26/51, 20.1; 11/15/51, 20.1; 4/2/52, 15.5.

15N/2E-11C1—Reference point—top of casing, elevation 53.6 feet, 200 feet north of Butte House Road, 0.15 mile west of East Butte Road. 12/22/47, 9.0; 3/3/48, 10.6; 12/2/48, 7.7; 3/16/49, 9.1; 11/10/49, 7.4; 3/23/50, 8.2; 11/2/50, 7.6; 4/4/51, 9.1; 11/14/51, 6.9; 4/3/52, 7.2.

15N/2E-11N1—Reference point—top of casing, elevation 50 feet, 50 feet west of Humphrey Road, 0.55 mile south of Butte House Road. 12/22/47, 9.9; 3/5/48, 10.8; 9/27/48, 5.1; 11/17/48, 8.9; 3/28/49, 9.1.

15N/2E-12A1—Reference point—top of casing, elevation 55.8 feet, 100 feet southwest of intersection of Township and Pease Roads. 12/21/47, 5.8; 3/3/48, 16.8; 12/1/48, 15.0; 3/16/49, 13.6; 11/11/49, 14.8.

15N/2E-12K1—Reference point—base of pump, elevation 53.8 feet, 100 feet north of Butte House Road, 0.45 mile west of Township Road. 12/22/47, 13.2; 3/3/48, 12.4; 12/2/48, 11.9; 1/20/49, 13.3; 3/17/49, 11.5; 11/10/49, 11.3; 3/23/50, 11.1; 11/1/50, 11.3; 4/4/51, 9.2; 11/14/51, 10.0; 4/3/52, 5.2.

15N/2E-12R1—Reference point—top of casing, elevation 52 feet, 0.1 mile west of Township Road, 0.3 mile south of Butte House Road. 12/19/47, 6.2; 3/24/48, 7.2; 11/18/48, 7.0; 3/28/49, 6.0; 11/23/49, 6.4.

15N/2E-13E1—Reference point—top of wooden planks under pump, elevation 50 feet, 0.3 mile south of Fortuna Road, 0.9 mile west of Township Road. 12/22/47, 7.8; 3/5/48, 9.5; 11/18/48, 11.3; 3/28/49, 7.5; 11/23/49, 9.4.

15N/2E-13J2—Reference point—top of casing at bottom of pit, elevation 46 feet, 250 feet west of Township Road, 0.4 mile north of State Highway 20. 12/19/47, 8.1; 3/5/48, 9.1; 9/27/48, 9.3; 11/18/48, 9.0; 3/28/49, 8.1; 5/26/49, 8.0; 6/28/49, 10.7; 7/27/49, 11.3; 8/26/49, 10.5; 11/23/49, 9.8; 3/23/50, 8.0; 3/27/51, 6.8; 11/14/51, 7.9; 4/1/52, 4.4.

15N/2E-14A1—Reference point—top of brick casing, elevation 51.7 feet, 200 feet south of Fortuna Road, 1 mile west of Township Road. 12/22/47, 10.8; 3/3/48, 10.2; 12/2/48, 10.1; 3/16/49, 9.2; 11/11/49, 9.3; 3/23/50, 9.7; 11/2/50, 9.6; 4/4/51, 7.4; 11/14/51, 7.9; 4/3/52, 5.8.

15N/2E-15C1—Reference point—top of casing at bottom of pit, elevation 39 feet, 200 feet south of South Butte Road, 0.85 mile east of Acacia Road. 12/23/47, 4.0; 3/4/48, 4.5; 12/2/48, 3.3; 12/8/49, 2.4.

15N/2E-15D1—Reference point—top of casing in pit, elevation 44 feet, South side of South Butte Road, 0.5 mile east of Acacia Avenue. 12/23/47, 5.4; 3/4/48, 6.2; 12/2/48, 6.2; 3/29/49, 6.1; 11/16/49, 4.4; 3/23/50, 4.7; 11/2/50, 4.1; 4/1/51, 4.3; 11/15/51, 3.6; 4/2/52, 1.1.

15N/2E-15R1—Reference point—top of casing, elevation 48 feet, 150 feet west of Humphrey Road, 0.1 mile north of State Highway 20. 12/22/47, 9.3; 3/5/48, 10.4; 9/27/48, 3.8; 11/17/48, 5.9; 3/28/49, 4.5; 11/23/49, 5.7; 3/24/50, 5.5; 10/31/50, 4.7; 3/26/51, 3.1; 11/15/51, 4.1; 4/1/52, 2.6.

15N/2E-16E1—Reference point—slot in casing, elevation 56 feet, 200 feet west of Third Avenue, 0.25 mile south of South Butte Road. 12/22/47, 21.4; 3/4/48, 22.2; 12/2/48, 21.15; 3/29/49, 20.7; 11/16/49, 20.0.

15N/2E-17E1—Reference point—slot in casing, elevation 46 feet, 0.3 mile south of South Butte Road, 0.7 mile west of Irwin Avenue. 12/22/47, 14.1; 3/4/48, 14.1; 12/2/48, 14.2; 3/29/49, 12.1; 11/15/49, 14.9; 3/23/50, 12.9; 11/2/50, 15.8; 3/26/51, 35.2 (operating); 11/15/51, 21.0; 4/3/52, 8.9.

15N/2E-21C1—Reference point—top of casing in pit, elevation 38 feet, South west corner of Acacia Road and State Highway 20. 12/22/47, 1.6; 3/4/48, 2.6; 12/2/48, 1.8; 3/29/49, 0.8; 11/16/49, 0.3; 3/24/50, 0.5; 11/2/50, —0.7; 3/26/51, —1.0; 11/15/51, 0.0; 4/2/52, —2.7.

15N/2E-22B1—Reference point—top of casing, elevation 46 feet, 0.2 mile south of State Highway 20, 0.3 mile west of Humphrey Road. 12/23/47, 10.2; 3/4/48, 11.2; 12/2/48, 9.5; 3/24/49, 4.9; 11/16/49, 8.9; 3/23/50, 9.5; 11/2/50, 9.1; 3/26/51, 8.5; 11/15/51, 8.3; 4/2/52, 6.8.

15N/2E-22R1—Reference point—top of casing, elevation 45 feet, 200 feet north of Franklin Road, 0.15 mile west of Humphrey Road. 12/22/47, 8.9; 3/5/48, 9.5; 9/27/48, 6.0; 11/17/48, 8.0; 3/28/49, 4.1.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N 2E-23B1—Reference point—top of casing, elevation 45 feet, 100 feet south of State Highway 20, 0.75 mile east of Humphrey Road. 12/22/47, 6.8; 3/5/48, 7.8; 11/17/48, 6.2; 3/28/49, 5.9; 11/23/49, 6.4; 3/24/50, 6.7; 10/31/50, 7.1; 3/26/51, 5.0; 11/15/51, 5.2; 4/1/52, 2.8.

15N 2E-24B1—Reference point—hole in pump base, elevation 51 feet, 300 feet south of State Highway 20, 0.3 mile west of Township Road. 12/22/47, 13.7; 3/5/48, 14.4; 9/27/48, 12.4; 11/17/48, 13.5; 3/28/49, 13.5; 11/23/49, 8.4; 3/24/50, 13.8; 10/31/50, 14.6; 3/27/51, 11.0; 11/14/51, 12.9; 4/1/52, 7.0.

15N 2E-24N1—Reference point—top of concrete foundation, elevation 47 feet, 0.1 mile north of Franklin Road, 0.8 mile west of Township Road. 11/27/29, 14.0; 10/6/30, 13.0; 12/15/31, 14.0; 11/30/32, 13.0; 12/14/33, 13.9; 11/10/34, 13.6; 11/28/36, 11.2; 11/24/37, 10.9; 1/25/39, 10.3; 1/11/41, 5.6; 11/4/47, 9.4; 12/14/48, 10.9; 12/8/49, 10.4; 11/10/50, 10.4; 12/7/51, 6.6.

15N 2E-25A1—Reference point—top of concrete pit, elevation 48 feet, 0.05 mile south of Franklin Road, 0.2 mile west of Township Road. 12/22/47, 13.4; 3/5/48, 14.6; 11/17/48, 13.5; 3/28/49, 12.2; 11/23/49, 13.5; 3/24/50, 13.1; 10/31/50, 13.4; 3/27/51, 10.7; 11/14/51, 12.0; 4/1/52, 6.9.

15N 2E-25N1—Reference point—top of casing, elevation 49 feet, 0.1 mile north of Lincoln Road, 0.85 mile west of Township Road. 12/22/47, 11.8; 3/5/48, 13.0; 11/17/48, 11.1; 3/28/49, 10.6; 11/23/49, 10.8.

15N 2E-26B1—Reference point—top of concrete pipe casing, elevation 46 feet, 50 feet south of Franklin Road, 0.6 mile east of Humphrey Road. 12/22/47, 7.3; 3/5/48, 8.2; 9/27/48, 3.0; 11/17/48, 6.0; 3/28/49, 5.5; 11/23/49, 6.4; 3/24/50, 6.9; 10/31/50, 5.6; 3/27/51, 5.3; 11/15/51, 5.2; 4/1/52, 4.1.

15N 2E-26E1—Reference point—top of wooden box casing, elevation 42 feet, 250 feet east of Humphrey Road, 0.45 mile south of Franklin Road. 12/22/47, 9.8; 3/5/48, 9.8; 11/17/48, 8.2; 3/28/49, 6.6; 11/23/49, 7.0; 3/24/50, 8.4; well destroyed.

15N 2E-28D1—Reference point—top of casing, elevation 41 feet, 500 feet south of Franklin Road, 0.1 mile west of Wadsworth Canal west levee. 12/22/47, 7.1; 3/4/48, 8.2; 12/2/48, 7.0; 3/29/49, 5.5; 11/16/49, 5.9; 3/23/50, 7.7.

15N 2E-28D2—Reference point—top of casing in pit, elevation 38 feet, 500 feet south of Franklin Road, 0.2 mile west of Wadsworth Canal west levee. 11/2/50, 2.5; 3/26/51, 11.6 (operating); 11/15/51, 2.4; 4/3/52, —0.8.

15N 2E-34D1—Reference point—top of casing, elevation 41 feet. Southeast of intersection of Lincoln and Clements roads. 12/22/47, 7.5; 3/4/48, 8.1; 12/2/48, 7.0; 11/15/49, 5.1.

15N 2E-35B1—Reference point—top of casing in pit, elevation 35 feet, 0.1 mile south of Lincoln Road, 1.4 miles west of Township Road. 12/22/47, 1.6; 3/5/48, 2.6; 10/4/48, 0.5; 11/17/48, 1.5; 3/28/49, —0.6.

15N 2E-35D1—Reference point—hole in pump base, elevation 42 feet, 0.1 mile south of Lincoln Road, 1.8 miles west of Township Road. 12/23/47, 8.7; 3/6/48, 9.5; 11/17/48, 8.1; 3/28/49, 6.2; 11/23/49, 8.3; 3/24/50, 6.8; 11/1/50, 7.2; 3/27/51, 6.8; 11/11/51, 6.2; 4/1/52, 1.7.

15N 2E-35Q1—Reference point—top of casing, elevation 41.6 feet, 0.1 mile north of Bogue Road, 1.3 miles west of Township Road. 12/22/47, 5.0; 3/5/48, 6.1; 10/4/48, 4.7; 11/17/48, 4.4; 3/29/49, 3.0; 11/25/49, 4.1; 3/24/50, 4.1; 11/1/50, 3.3; 3/27/51, 2.9; 11/14/51, 2.5.

15N 2E-36A1—Reference point—top of casing, elevation 46 feet, 100 feet south of Lincoln Road, 0.1 mile west of Township Road. 12/22/47, 12.3; 3/5/48, 13.3; 10/4/48, 10.6; 11/12/48, 11.6; 3/28/49, 11.6; 6/28/49, 6.7; 7/27/49, 7.4; 8/25/49, 7.0; 11/23/49, 11.2; 3/24/50, 11.3; 11/1/50, 10.9; 3/27/51, 9.4; 11/11/51, 10.2; 4/2/52, 6.3.

15N 2E-36H1—Reference point—top of plank in pit, elevation 40 feet, 0.15 mile west of Township Road, 0.45 mile south of Lincoln Road. 12/22/47, 6.3; 3/5/47, 7.5; 11/17/48, 4.1; 3/29/49, 5.0.

15N 2E-36P1—Reference point—top of casing, elevation 43.7 feet, 0.15 mile north of Bogue Road, 0.65 mile west of Township Road. 12/22/47, 7.6; 3/5/48, 8.9; 11/17/48, 6.0; 3/29/49, 3.6; 11/25/49, 5.8; 3/24/50, 6.8.

15N 3E-1C1—Reference point—top of 16-inch casing, elevation 63 feet, 0.3 mile east of State Highway 24, 1.0 mile south of Ellis Road. 11/6/47, 14.5; 3/17/48, 14.0; 11/30/48, 14.9; 1/26/49, 14.2; 3/17/49, 13.0; 11/17/49, 15.7; 3/21/50, 13.1; 11/6/50, 15.9; 3/29/51, 9.9; 11/27/51, 14.6; 4/6/52, 7.5.

15N 3E-1D1—Reference point—hole in pump base, elevation 64 feet, 0.1 mile east of State Highway 24, 0.75 mile south of Ellis Road. 11/6/47, 19.5; 3/20/48, 16.1; 11/30/48, 17.0; 3/17/49, 15.0; 11/16/49, 18.8.

15N 3E-2A1—Reference point—top of 16-inch casing, elevation 64 feet, 0.3 mile west of State Highway 24, 0.85 mile south of Ellis Road. 11/6/47, 25.1; 3/20/48, 18.9; 11/30/48, 21.6; 11/16/49, 22.3; 3/31/50, 16.3; 11/6/50, 22.1.

15N 3E-2A2—Reference point—top of 14-inch casing, elevation 63 feet, 0.25 mile west of State Highway 24, 1.05 miles south of Ellis Road. 11/6/47, 20.4; 11/30/48, 14.7; 3/17/49, 16.0; 11/17/49, 19.0.

15N 3E-2A3—Reference point—hole in base of pump, elevation 65 feet, 0.05 mile west of State Highway 24, 0.5 mile south of Ellis Road. 11/6/47, 18.4; 3/20/48, 18.2; 12/2/48, 17.7; 3/17/49, 15.5; 11/16/49, 19.8.

15N 3E-2B2—Reference point—hole in base of pump, elevation 64 feet, 0.35 mile west of State Highway 24, 0.75 mile south of Ellis Road. 11/6/47, 21.2; 11/30/48, 17.2; 3/17/49, 16.2; 11/16/49, 22.0; 3/29/51, 12.9.

15N 3E-2C1—Reference point—hole in base of pump, elevation 65 feet, 0.85 mile west of State Highway 24, 0.9 mile south of Ellis Road. 11/6/47, 24.5; 3/20/48, 23.5; 11/30/48, 23.3; 3/17/49, 20.4; 11/17/49, 25.3; 3/21/50, 19.2; 11/6/50, 24.3; 3/29/51, 15.1; 11/16/51, 23.5; 4/6/52, 10.2.

15N 3E-2H1—Reference point—bottom of pump base, elevation 63 feet, 0.3 mile west of State Highway 24, 1.25 miles south of Ellis Road. 11/6/47, 20.6; 3/17/48, 19.0; 5/7/48, 17.3; 11/30/48, 19.6; 3/17/49, 17.8; 11/17/49, 21.3.

15N 3E-2J1—Reference point—top of 16-inch casing, elevation 63 feet, 0.4 mile west of State Highway 24, 1.6 miles south of Ellis Road. 11/6/47, 17.8; 3/17/48, 16.8; 5/7/48, 14.8; 11/30/48, 17.4; 1/26/49, 16.7; 3/17/49, 15.5; 11/17/49, 18.4.

15N 3E-3D2—Reference point—top of casing, elevation 63.7 feet, 250 feet south of Eager Road, 0.1 mile west of U.S. Highway 99E. 11/4/47, 25.8.

15N 3E-3G1—Reference point—hole in base of pump, elevation 62 feet, 0.2 mile south of Rednall Road, 0.3 mile east of U.S. Highway 99E. 11/5/47, 28.6; 3/17/48, 28.1; 5/12/48, 23.6; 11/29/48, 28.5; 3/17/49, 25.7; 11/14/49, 30.6; 3/22/50, 24.9; 11/6/50, 29.6; 4/3/51, 21.2; 11/14/51, 27.7; 4/3/52, 19.1.

15N 3E-4C1—Reference point—top of casing, elevation 60.9 feet, 0.20 mile south of Eager Road, 0.65 mile west of Onstott Road. 12/19/47, 23.2; 3/2/48, 27.5; 12/1/48, 22.7; 3/17/49, 21.2; 11/11/49, 25.8; 4/3/51, 18.4.

15N 3E-4C2—Reference point—hole in pump base, elevation 61.5 feet, 0.25 mile south of Eager Road, 0.50 mile west of Onstott Road. 5/4/48, 22.9; 6/3/48, 22.0; 9/1/48, 30.3; 9/30/48, 27.2; 11/29/48, 23.7; 1/20/49, 23.2; 3/17/49, 22.5; 11/11/49, 27.1; 3/22/50, 23.7; 11/1/50, 27.5; 11/14/51, 23.7; 4/3/52, 11.9.

15N 3E-4H1—Reference point—top of concrete base, bottom of pit, elevation 47.2 feet, 0.1 mile west of Onstott Road, 0.6 mile south of Eager Road. 11/4/47, 17.9; 11/20/48, 15.5; 3/17/49, 12.4; 11/14/49, 16.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N/3E-4J1—Reference point—top of casing, bottom of pit, elevation 47.7 feet, 0.15 mile west of Onstott Road, 0.85 mile south of Eager Road. 11/4/47, 17.6; 11/29/48, 16.0; 3/17/49, 13.0; 11/14/49, 18.4; 11/14/50, 23.0.

15N/3E-4N1—Reference point—top of casing, elevation 59.4 feet, 0.1 mile north of Pease Road, 0.5 mile east of Terra Buena Road. 12/21/47, 27.1; 3/24/48, 27.1; 12/1/48, 27.6; 3/16/49, 26.5; 5/26/49, 27.0; 6/30/49, 34.0; 11/11/49, 29.6; 3/23/50, 25.9; 11/6/50, 30.7; 4/4/51, 22.6; 11/14/51, 26.8.

15N/3E-5B2—Reference point—hole in base of pump, elevation 62.5 feet, 0.15 mile south and 150 feet east of a point on Eager Road at intersection of Larkin Road. 12/19/47, 21.8; 3/2/48, 22.1; 12/1/48, 20.7; 1/20/49, 20.2; 3/17/49, 19.5; 11/11/49, 23.0.

15N/3E-5D2—Reference point—hole in base of pump, elevation 59.8 feet, 50 feet south of Nuestro Road, 0.4 mile west of Terra Buena Road. 12/19/47, 18.7; 3/24/48, 20.6; 12/1/48, 18.0; 3/16/49, 17.3; 11/11/49, 19.9; 3/23/50, 15.1; 11/6/50, 22.0; 4/3/51, 12.3; 11/14/51, 18.2; 4/3/52, 7.4.

15N/3E-5G1—Reference point—hole in base of pump, elevation 59.5 feet, 0.25 mile east of Terra Buena Road, 0.5 mile north of Pease Road. 12/19/47, 18.9; 3/3/48, 24.2; 12/1/48, 23.0; 3/16/49, 22.0; 11/11/49, 24.7.

15N/3E-6B1—Reference point—top of 2" x 6" bridge over concrete pit, elevation 59.8 feet, 200 feet east of Broadway, 0.15 mile west of Nuestro Road. 12/19/47, 16.8; 3/24/48, 17.4; 12/1/48, 16.1; 3/16/49, 13.7; 11/11/49, 18.2.

15N/3E-6C1—Reference point—top of 2" x 6" bridge over concrete pit, elevation 58.8 feet, 400 feet north of Nuestro Road, 0.2 mile east of Township Road. 12/19/47, 14.2; 3/3/48, 14.3; 12/1/48, 14.9; 3/16/49, 12.2; 5/26/49, 13.8; 6/28/49, 15.4; 7/27/49, 17.3; 8/25/49, 16.5; 11/11/49, 16.3.

15N/3E-6Q1—Reference point—slot in concrete base, elevation 56.4 feet, 0.2 mile north of Pease Road, 0.4 mile east of Township Road. 12/21/47, 17.8; 3/3/48, 17.6; 12/1/48, 18.2; 3/16/49, 17.0; 11/11/49, 18.7; 3/23/50, 21.9; 11/1/50, 20.8; 4/4/51, 12.0; 11/14/51, 17.4; 4/3/52, 7.5.

15N/3E-7H2—Reference point—top of casing, elevation 57.0 feet, 0.5 mile north of Butte House Road, 0.55 mile west of Terra Buena Road. 12/21/47, 23.9; 3/24/48, 23.6; 12/1/48, 24.8; 3/16/49, 22.5; 11/11/49, 26.1.

15N/3E-7P1—Reference point—hole in base of pump, elevation 55.4 feet, 500 feet south of Butte House Road, 0.35 mile east of Township Road. 12/21/47, 19.8; 3/3/48, 20.8; 12/1/48, 21.0; 3/16/49, 19.5; 11/10/49, 22.1.

15N/3E-7Q1—Reference point—hole in base of pump, elevation 56 feet, 150 feet south of Butte House Road, 0.45 mile east of Township Road. 12/19/47, 20.7; 3/24/48, 20.9; 11/18/48, 22.1; 3/28/49, 19.8; 11/23/49, 22.9; 3/23/50, 19.8; 10/31/50, 24.4; 3/27/51, 17.9; 11/14/51, 21.2; 4/1/52, 9.8.

15N/3E-7R1—Reference point—top of discharge pipe, elevation 55.8 feet, 0.1 mile north of Butte House Road, 0.7 mile west of Terra Buena Road. 12/21/47, 23.8; 3/3/48, 22.5; 12/1/48, 24.8; 3/16/49, 22.5; 11/11/49, 26.2; 3/23/50, 19.6; 11/1/50, 23.3; 4/4/51, 19.4; 11/14/51, 24.1; 4/3/52, 12.2.

15N/3E-8C1—Reference point—bottom of pump base, elevation 57.5 feet, 50 feet south of Pease Road, 0.15 mile west of Terra Buena Road. 12/22/47, 23.9; 3/3/48, 24.7; 12/1/48, 24.2; 1/20/49, 23.0; 3/16/49, 22.2; 11/11/49, 25.0; 3/23/50, 21.5; 11/1/50, 28.0; 4/4/51, 17.4; 11/14/51, 23.6; 4/3/52, 11.2.

15N/3E-8J4—Reference point—top of casing, elevation 56.8 feet, 200 feet west of Elmer Avenue, 0.7 mile north of Butte House Road. 12/22/47, 27.9; 3/3/48, 26.9; 3/16/49, 26.0; 11/11/49, 30.7.

15N/3E-9A1—Reference point—top of concrete floor, elevation 59.8 feet, 300 feet south of Pease Road, 0.1 mile west of Onstott Road. 11/4/47, 37.9; 5/12/48, 27.1; 6/1/48, 26.5; 6/30/48, 48.8 operating; 8/2/48, 45.0; 9/30/48, 33.2; 10/21/48, 31.8; 11/30/48, 29.3; 1/20/49, 27.4; 3/17/49, 26.4; 11/14/49, 31.3; 3/22/50, 22.2; 11/1/50, 31.0; 4/4/51, 24.1; 11/14/51, 27.3; 4/3/52, 19.7.

15N/3E-9C1—Reference point—top of casing, elevation 58.1 feet, 0.1 mile south of Pease Road, 0.55 mile west of Onstott Road. 11/4/47, 40.6; 3/17/48, 27.6; 11/29/48, 27.4; 3/17/49, 25.5; 11/14/49, 29.5.

15N/3E-9G1—Reference point—top of pneumatic gage hole, elevation 61.0 feet, 50 feet east of Stabler Lane, 0.45 mile south of Pease Road. 11/4/47, 32.8; 3/17/48, 34.2; 11/29/48, 32.5; 3/17/49, 29.4; 11/14/49, 34.8.

15N/3E-9N1—Reference point—bottom of pump base, elevation 57.6 feet, 100 feet east of Blevin Road, 0.55 mile north of Butte House Road. 12/22/47, 29.8; 3/3/48, 31.6; 12/1/48, 31.0; 3/16/49, 28.0; 11/11/49, 33.3.

15N/3E-9P3—Reference point—top of 12-inch casing, elevation 55 feet, 0.30 mile east of Blevin Road, 0.60 mile north of Butte House Road. 11/18/47, 27.7; 11/18/48, 28.2; 3/23/49, 26.6.

15N/3E-9R2—Reference point—bottom of pump base, elevation 200 feet. West of Onstott Road, 1.4 miles north of Butte House Road. 11/18/47, 35.0; 3/17/48, 35.5; 11/19/48, 36.4; 3/23/49, 32.0; 11/22/49, 37.9; 3/23/50, 34.0; 11/13/51, 34.4; 4/1/52, 32.6.

15N/3E-10G1—Reference point—hole in pump base, elevation 60 feet, 0.05 mile west of U. S. Highway 99E, 0.50 mile south of Pease Road. 11/19/47, 30.2; 3/17/48, 28.3; 11/19/48, 34.6; 3/23/49, 26.6; 11/22/49, 33.4; 3/23/50, 24.3; 11/30/50, 30.8; 3/27/51, 20.9; 11/14/51, 36.1; 4/1/52, 20.3.

15N/3E-11B1—Reference point—top of concrete base, elevation 60 feet, 0.80 mile west of State Highway 24, 2.50 miles south of Ellis Road. 11/7/49, 21.5; 3/7/48, 21.1; 5/19/48, 18.1; 11/30/48, 21.6; 3/17/49, 19.2; 11/17/49, 23.1; 3/21/50, 19.2; 11/6/50, 23.0; 3/29/51, 16.5; 11/16/51, 22.3; 4/6/52, 12.1.

15N/3E-11H1—Reference point—top of casing, elevation 61 feet, 0.45 mile west of State Highway 24, 2.70 miles south of Ellis Road. 11/6/47, 18.5; 3/17/48, 16.8; 11/30/48, 17.8; 3/17/49, 15.6; 11/17/49, 18.2.

15N/3E-11H2—Reference point—top of casing, elevation 61 feet, 0.40 mile west of State Highway 24, 2.70 miles south of Ellis Road. 11/6/47, 16.9; 3/17/48, 16.4; 11/30/48, 16.7; 3/17/49, 13.5; 11/17/49, 17.7.

15N/3E-14M1—Reference point—top of casing, elevation 57 feet, 0.35 mile east of U. S. Highway 99E at a point 0.70 mile north of State Highway 20. 11/19/47, 24.2; 3/17/48, 22.2. Well destroyed.

15N/3E-15B2—Reference point—hole in pump base, elevation 59 feet, 0.05 mile west of U. S. Highway 99E, 1.0 mile north of State Highway 20. 11/19/47, 31.4; 3/17/48, 30.2; 5/12/48, 26.7; 9/27/48, 31.1; 11/19/48, 33.6; 3/23/49, 28.8; 11/22/49, 32.9; 3/23/50, 28.4; 10/30/50, 32.9; 3/27/51, 30.8; 4/1/52, 24.1.

15N/3E-15E2—Reference point—base of pump, elevation 58.6 feet, 400 feet east of Onstott Road, 0.30 mile north of Butte House Road. 11/18/47, 35.3; 3/4/48, 34.8; 3/15/48, 34.8; 11/19/48, 41.8; 3/23/49, 32.7; 11/22/49, 39.3; 3/23/50, 34.6; 11/30/50, 38.7; 3/27/51, 33.9; 3/13/51, 36.1; 4/1/52, 29.7.

15N/3E-16C1—Reference point—hole in pump base, elevation 56 feet, 0.25 mile east of Blevin Road, 0.50 mile north of Butte House Road. 11/19/47, 33.6; 3/17/48, 33.6; 5/13/48, 30.8; 11/19/48, 39.0; 3/23/49, 32.2; 11/29/49, 36.4; 11/3/50, 36.6.

15N/3E-16L1—Reference point—concrete rim of pit, elevation 56 feet, 300 feet east of Tharp Road, 0.1 mile south of Butte House Road. 11/18/47, 34.8; 3/15/48, 34.8; 11/18/48, 37.9; 3/23/49, 32.0; 11/23/49, 36.1; 3/23/50, 33.6; 10/31/50, 38.2; 3/27/51, 31.4; 11/14/51, 35.2; 4/1/52, 24.5.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N 3E-16R2—Reference point—top of casing, elevation 57.1 feet, 300 feet east of Blevin Road, 0.35 mile north of Butte House Road. 12/19/47, 31.0; 3/24/48, 32.9; 9/27/48, 34.5; 11/18/48, 31.7; 3/28/49, 28.9; 11/23/49, 32.7; 3/23/50, 29.7; 11/23/49, 32.7; 3/23/50, 29.7; 10/30/50, 35.2; 3/27/51, 27.2; 11/11/51, 31.9; 4/1/52, 21.8.

15N 3E-17C1—Reference point—top of casing at bottom of pit, elevation 16.8 feet, 200 feet east of Hooper Road, 0.05 mile north of Butte House Road. 12/19/47, 17.5; 3/6/48, 16.0; 9/27/48, 20.9; 11/18/48, 19.0; 3/28/49, 16.0; 11/23/49, 19.3; 3/23/50, 21.8; 10/30/50, 20.7; 3/27/51, 13.5.

15N 3E-17P2—Reference point—top of flanged coupling at bottom of pit, elevation 11.0 feet, 0.05 mile north of State Highway 20, 0.25 mile east of Hooper Road. 12/19/47, 15.1; 3/6/48, 14.6; 9/27/48, 19.6; 11/18/48, 16.9; 3/28/49, 12.8. Well destroyed.

15N 3E-18R1—Reference point—top of casing, elevation 53 feet, 0.1 mile north of State Highway 20, 0.1 mile west of George Washington Boulevard. 12/19/47, 23.3; 3/6/48, 22.8; 11/18/48, 25.6; 3/28/49, 21.9; 11/23/49, 26.2; 10/31/50, 28.2; 3/27/51, 19.7; 11/11/51, 25.3; 4/1/52, 12.7.

15N 3E-19B1—Reference point—2" x 4" on top of concrete pit, elevation 57.3 feet, 0.21 mile south of State Highway 20, 0.54 mile east of Township Road. 12/21/47, 29.2; 3/3/48, 27.6; 12/1/48, 30.0; 1/20/49, 28.7; 3/16/49, 27.0; 11/11/49, 32.3; 3/23/50, 27.5; 11/4/50, 22.4; 4/4/51, 25.6; 11/14/51, 30.6.

15N 3E-20E1—Reference point—top of casing, elevation 37.5 feet, 0.48 mile west of El Margarita Road, 0.53 mile south of State Highway 20. 12/19/47, 9.6; 3/6/48, 9.5; 9/27/48, 13.8; 11/18/48, 11.7; 3/28/49, 8.4; 11/25/49, 11.3.

15N 3E-20G1—Reference point—hole in base of pump, elevation 52 feet, 0.25 mile east of El Margarita Road, 0.50 mile south of State Highway 20. 12/19/47, 30.8; 3/6/48, 31.0; 3/28/49, 28.7; 11/25/49, 29.1; 10/31/50, 36.6; 11/14/51; 39.4; 4/1/52, 23.6.

15N 3E-20R1—Reference point—top of casing, elevation 53.4 feet, 0.20 mile west of Harding Road, 0.05 mile north of Franklin Road. 12/19/47, 29.9; 3/24/48, 30.8; 11/18/48, 33.2; 3/28/49, 28.0; 5/26/49, 33.5; 6/28/49, 35.4; 7/27/49, 38.4; 8/25/49, 38.7; 11/25/49, 33.4; 3/27/50, 30.1; 10/31/50, 35.3; 3/27/51, 28.9; 11/14/51, 36.6; 1/1/52, 25.3.

15N 3E-21C1—Reference point—hole in concrete base, elevation 51 feet, 0.40 mile east of Harding Road, 0.12 mile south of State Highway 20. 3/17/48, 32.8; 11/18/48, 32.5; 3/23/49, 29.2; 11/25/49, 31.1.

15N 3E-21D1—Reference point—hole in concrete base, elevation 55.6 feet, 0.05 mile south of State Highway 20, 0.24 mile east Harding Road. 12/19/47, 30.8; 3/24/48, 31.2; 5/12/48, 31.1; 9/22/48, 37.1; 11/18/48, 32.8; 3/28/49, 28.8; 5/26/49, 37.8; 6/30/49, 45.0; 8/25/49, 41.8; 11/25/49, 31.1.

15N 3E-21F1—Reference point—hole in concrete base, elevation 55 feet, 0.28 mile east of Harding Road, 0.38 mile south of State Highway 20. 11/17/47, 34.3; 3/17/48, 34.8; 11/18/48, 39.3; 3/23/49, 31.5; 11/25/49, 38.9; 10/31/50, 39.0; 3/27/51, 32.5; 11/14/51, 37.3; 4/1/52, 28.4.

15N 3E-21L2—Reference point—top of casing, elevation 55.0 feet, 0.04 mile west of Walton Road, 0.61 mile south of State Highway 20. 12/19/47, 32.2; 3/24/48, 32.7; 11/18/48, 31.5; 3/28/49, 30.3; 11/25/49, 35.9.

15N 3E-21P2—Reference point—slot in casing, elevation 51.3 feet, 0.18 mile north of Franklin Road, 0.48 mile east of Harding Road. 11/18/47, 33.3; 3/15/48, 34.8; 11/18/48, 34.8; 3/23/49, 31.0; 11/25/49, 35.4.

15N 3E-21Q1—Reference point—top of pit, elevation 53 feet, North side of Franklin Road, 0.25 mile east of Walton Road. 1/4/41, 24.5; 11/4/47, 33.6; 12/15/48, 33.5; 12/8/49, 36.1; 11/17/50, 38.4; 12/7/51, 35.8.

15N 3E-21R1—Reference point—top of casing, elevation 53.3 feet, 0.1 mile west of Onstott Road, 0.13 mile north of Franklin Road. 11/17/47, 31.1; 3/17/48, 31.4; 3/29/48, 30.4; 5/12/48, 30.7; 9/27/48, 35.1; 11/18/48, 32.7; 3/23/49, 29.5; 11/25/49, 35.1; 3/27/50, 31.4; 10/31/50, 36.2; 3/27/51, 30.7; 11/13/51, 34.5; 4/1/52, 26.7.

15N 3E-22D1—Reference point—hole in base of pump, elevation 54.8 feet, 0.05 mile east of Onstott Road, 0.17 mile south of State Highway 20. 11/17/47, 31.2; 3/17/48, 31.5; 9/27/48, 31.2; 11/19/48, 32.2; 3/23/49, 29.2; 11/25/49, 34.7.

15N 3E-24N1—Reference point—top of casing, elevation 48.6 feet, 0.38 mile southwest of Western Pacific Railroad crossing of Yuba River, 0.50 mile west of U. S. Highway 99E. 11/14/47, 10.0; 3/19/48, 8.6; 11/23/48, 11.0; 3/24/49, 6.8; 11/22/49, 13.8; 3/28/50, 24.0; 11/20/51, 31.3; 4/2/52, 12.6.

15N 3E-24N2—Reference point—top of casing, elevation 70.9 feet, 0.35 mile southwest of Western Pacific Railroad crossing of Yuba River, 0.50 mile north of U. S. Highway 99E. 11/14/47, 31.5; 3/19/48, 29.9; 11/23/48, 31.7.

15N 3E-24Q1—Reference point—pipe in base, elevation 64.8 feet, 0.04 mile south of Riverside Boulevard, 0.04 mile west of Western Pacific Railroad. 11/12/47, 27.2; 3/19/48, 27.4; 11/22/48, 31.4; 3/24/49, 24.8; 12/13/49, 31.0.

15N 3E-25C1—Reference point—top of casing, elevation 53.4 feet, 0.15 mile west of Riverside Boulevard, 0.55 mile south of Western Pacific Railroad crossing on Yuba River. 11/14/47, 14.6; 3/19/48, 13.2; 3/30/48, 12.5; 11/23/48, 15.0; 3/24/49, 11.2; 11/22/49, 15.1.

15N 3E-25F1—Reference point—top of casing, elevation 61.0 feet, 0.85 mile south of Western Pacific Railroad crossing on Yuba River, 0.27 mile west of Riverside Boulevard. 11/12/47, 24.4; 3/19/48, 23.3; 11/23/48, 25.1; 3/24/49, 21.6; 11/22/49, 26.5; 3/28/50, 20.8; 11/9/50, 25.6; 3/28/51, 15.1; 11/20/51, 24.0; 4/3/52, 15.3.

15N 3E-25H1—Reference point—base of pump, elevation 59.9 feet, South side of Walnut Avenue, 0.15 mile southwest of Garden Avenue. 11/12/47, 22.3; 3/19/48, 22.5; 10/4/48, 24.2; 11/22/48, 23.2; 3/24/49, 19.5; 11/18/49, 23.8.

15N 3E-25H2—Reference point—hole in base of pump, elevation 57.1 feet, West side of Garden Avenue, 0.15 mile south of Walnut Avenue. 11/14/47, 19.3; 11/22/48, 20.8; 3/24/49, 18.0; 11/18/49, 21.5.

15N 3E-25K1—Reference point—hole in base of pump, elevation 61.5 feet, 0.11 mile east of Riverside Boulevard, 0.86 mile north of Feather River Boulevard. 11/12/47, 24.8; 3/19/48, 23.1; 11/23/48, 24.8.

15N 3E-25K2—Reference point—top of casing, elevation 48.0 feet, 0.15 mile east of Riverside Boulevard, 0.82 mile north of Feather River Boulevard. 11/12/47, 10.9; 3/19/48, 9.3; 3/30/48, 8.7; 10/4/48, 21.2; 11/22/48, 19.5; 3/24/49, 16.7; 11/22/49, 21.0.

15N 3E-26M1—Reference point—top of casing, elevation 52 feet, 0.31 mile north of Lincoln Road, 0.24 mile east of Garden Highway. 11/14/47, 23.8; 3/17/48, 23.6; 3/2/48, 20.8; 10/4/48, 26.8; 11/19/48, 24.7; 3/23/49, 21.8; 6/29/49, 29.8; 7/31/49, 32.8; 8/25/49, 31.4; 11/28/49, 25.9; 3/27/50, 21.1; 11/1/50, 26.4; 3/27/51, 23.2; 11/13/51, 28.0; 4/1/52, 17.0.

15N 3E-27C1—Reference point—hole in base of pump, elevation 53 feet, 0.10 mile west of Clark Avenue, 0.14 mile south of Franklin Road. 11/17/47, 29.7; 3/17/48, 29.9; 11/19/48, 31.6; 3/23/49, 30.5.

15N 3E-28B3—Reference point—top of pit, elevation 53 feet, 0.25 mile east of Walton Road, south side of Franklin Road. 11/27/29, 23.8; 9/27/30, 27.8; 12/15/31, 28.8; 12/1/32, 28.4; 12/14/33, 30.5; 11/10/34, 31.3; 11/25/36, 21.5; 11/24/37, 23.6; 1/26/39, 18.3.

15N 3E-28C1—Reference point—top of casing, elevation 54.2 feet, 0.18 mile west of Walton Road, 0.07 mile south of Franklin Road. 12/19/47, 33.1; 3/24/48, 33.4; 5/12/48, 31.3; 9/27/48, 36.4; 11/18/48, 36.6; 3/28/49, 31.5; 11/25/49, 37.1.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N/3E-28G1—Reference point—top of casing, elevation 54.3 feet, 0.09 mile east of Walton Road, 0.37 mile south of Franklin Road. 11/17/47, 33.7; 3/15/48, 33.5; 11/18/48, 36.4; 3/23/49, 32.0; 11/25/49, 36.6; 3/27/50, 34.3; 10/31/50, 39.6; 3/27/51, 33.2; 11/13/51, 37.4; 4/1/52, 28.5.

15N/3E-28Q1—Reference point—base of pump, elevation 52.9 feet, 0.10 mile north of Lincoln Road, 0.18 mile east of Walton Road. 11/17/47, 32.0; 3/15/48, 32.0; 3/29/48, 31.4; 10/4/48, 35.2; 11/18/48, 34.8; 3/23/49, 31.0; 11/28/49, 36.6.

15N/3E-29D1—Reference point—bottom of flange coupling in pit, elevation 40.2 feet, west side of Butte Avenue, 0.14 mile south of Franklin Road. 12/19/47, 13.3; 3/5/48, 14.2; 11/18/48, 17.9; 3/28/49, 13.0; 12/13/49, 17.3; 3/27/50, 14.9; 11/1/50, 19.7; 3/27/51, 11.1; 11/14/51, 19.0; 4/1/52, 16.7.

15N/3E-29N1—Reference point—top of casing, in pit, elevation 36.9 feet, 0.14 mile north of Lincoln Road, 0.13 mile east of George Washington Boulevard. 12/19/47, 10.4; 3/5/48, 10.6; 11/18/48, 12.0; 3/28/49, 9.1; 11/23/49, 14.3; 3/27/50, 9.6; 11/1/50, 14.9; 3/27/51, 7.6; 11/14/51, 15.3; 4/1/52, 14.0.

15N/3E-29R2—Reference point—top of pump base, elevation 51.9 feet, 0.57 mile west of Walton Avenue, 0.03 mile north of Lincoln Road. 12/19/47, 31.6; 3/24/48, 31.1; 10/4/48, 34.7; 11/18/48, 33.2; 11/25/49, 34.8.

15N/3E-30Q1—Reference point—top of discharge pipe, elevation 47 feet, North side Lincoln Road, 0.40 mile west of George Washington Boulevard. 12/22/47, 20.3; 3/5/48, 20.5; 10/4/48, 21.6; 11/17/48, 20.7; 3/28/49, 18.9; 11/23/49, 21.3.

15N/3E-32N1—Reference point—top of casing, elevation 48.4 feet, 0.05 mile north of Bogue Road, 0.20 mile east of George Washington Boulevard. 12/20/47, 23.7; 3/5/48, 27.9; 11/17/48, 25.4; 3/29/49, 23.5; 11/25/49, 24.3; 3/27/50, 22.9; 11/1/50, 30.5; 3/27/51, 20.4; 11/14/51, 27.6; 4/1/52, 15.8.

15N/3E-33D1—Reference point—hole in base of pump, elevation 51 feet, 0.08 mile south of Lincoln Road, 0.32 mile west of Walton Road. 5/4/48, 30.0; 6/1/48, 29.4; 11/18/48, 34.7; 3/29/49, 29.5; 11/25/49, 35.0; 3/27/50, 32.3; 11/1/50, 37.7; 3/27/51, 31.3; 11/14/51, 35.5; 4/1/52, 29.0.

15N/3E-33F1—Reference point—hole in base of pump, elevation 52.0 feet, 0.10 mile west of Walton Road, 0.27 mile south of Lincoln Road. 12/20/47, 29.7; 3/5/48, 34.5; 5/4/48, 28.3; 5/12/48, 29.2; 6/1/48, 28.2; 11/18/48, 35.0; 3/29/49, 31.8; 11/25/49, 33.7; 3/27/50, 30.5; 11/1/50, 36.0; 3/27/51, 29.9; 11/14/51, 36.3; 4/1/52, 26.0.

15N/3E-33K1—Reference point—hole in base of pump, elevation 52.1 feet, East side of Walton Road, 0.54 mile south of Lincoln Road. 3/12/48, 36.1; 5/6/48, 31.3; 6/1/48, 30.9; 11/11/48, 36.5

15N/3E-33K2—Reference point—hole in base of pump, elevation 49 feet, 0.20 mile east of Walton Road, 0.73 mile south of Lincoln Road. 11/17/47, 35.6; 3/15/48, 35.6; 11/25/49, 35.9.

15N/3E-33N2—Reference point—hole in base of pump, elevation 48.4 feet, 0.32 mile west of Walton Road, 0.06 mile north of Boque Road. 12/20/47, 27.9; 3/5/48, 33.8; 11/18/48, 30.0; 3/29/49, 26.7; 11/25/49, 31.4; 3/27/50, 20.6; 11/1/50, 34.4; 11/14/51, 32.9; 4/1/52, 23.8.

16N 3E-33P1—Reference point—top of concrete pit, elevation 50.5 feet, West side of Walton Road, 0.15 mile north of Bogue Road. 11/10/47, 30.3; 3/23/48, 32.7; 11/11/48, 32.1; 1/18/49, 29.8; 3/7/49, 29.0; 11/29/49, 33.2; 3/27/50, 30.6; 11/3/50, 35.7; 11/16/51, 33.3.

15N/3E-33C2—Reference point—hole in base of pump, elevation 48.6 feet, 0.20 mile north of Bogue Road, 0.10 mile east of Walton Avenue. 3/16/48, 34.0; 11/11/48, 31.6; 3/7/49, 29.1; 12/1/49, 23.4.

15N/3E-34L1—Reference point—top of casing, elevation 50 feet, 0.52 mile south of Lincoln Road, 0.96 mile east of Walton Road. 11/14/47, 31.3; 3/15/48, 33.9; 5/5/48, 29.2; 6/1/48, 29.2; 7/3/48, 57.0 (operating); 8/3/48, 48.1; 9/30/48, 37.8; 10/4/48, 41.5; 11/19/48, 37.7; 3/23/49, 31.0; 5/31/49, 33.7; 8/31/49, 38.6; 11/28/49, 36.8; 3/27/50, 31.5; 11/1/50, 35.7; 3/28/51, 30.3; 11/13/51, 33.9; 4/1/52, 32.0.

15N 3E-34N1—Reference point—top of casing, elevation 39.5 feet, 0.05 mile west of Phillips Road, 0.15 mile north of Bogue Road. 3/12/48, 21.2; 11/11/48, 37.0; 3/7/49, 34.2; 12/1/49, 36.5.

15N 3E-35E1—Reference point—top of casing, elevation 50 feet, 0.37 mile east of Garden Highway, 0.44 mile south of Lincoln Road. 11/14/47, 22.1; 3/17/48, 21.2; 11/23/48, 22.5; 3/23/49, 20.5; 11/28/49, 21.1; 3/27/50, 20.8.

15N/4E-3A1—Reference point—top of casing, elevation 95.0 feet 0.31 mile east of Hallwood Road, south side of Walnut Road. 11/25/47, 16.6; 3/3/48, 19.8; 4/1/48, 19.1; 11/29/48, 17.0; 3/22/49, 18.8; 11/18/49, 17.7.

15N 4E-3B1—Reference point—top of casing, elevation 95.4 feet, 0.47 mile south of Walnut Road, 0.03 mile west of Hallwood Road. 11/25/47, 23.5; 3/3/48, 26.2; 11/29/48, 24.0; 1/27/49, 25.2; 3/22/49, 23.9; 11/16/49, 23.7.

15N 4E-3D1—Reference point—top of casing, elevation 93.4 feet, 0.45 mile west of Hallwood Road, 0.01 mile south of Walnut Road. 11/25/47, 18.8; 3/3/48, 21.9; 4/1/48, 21.8; 11/29/48, 20.0; 1/27/49, 22.2; 3/22/49, 20.1; 11/18/49, 19.4.

15N/4E-3D2—Reference point—top of casing, elevation 90 feet, 0.56 mile west of Hallwood Road, southeast of curve in Walnut Road. 11/29/48, 22.2; 3/23/49, 22.0.

15N/4E-4A1—Reference point—top of casing, elevation 90.4 feet, South side of Walnut Road, 0.85 mile along Walnut Road from intersection with State Highway 20. 11/25/47, 19.9; 3/3/48, 20.9; 11/29/48, 19.8; 3/22/49, 19.0; 11/18/49, 19.2.

15N 4E-4C1—Reference point—top of casing, elevation 88.7 feet, 0.05 mile south of Walnut Road, 0.41 mile along Walnut Road from intersection with State Highway 20. 11/25/47, 19.4; 3/3/48, 21.1; 4/1/48, 20.4; 11/29/48, 20.4; 3/22/49, 18.8; 11/18/49, 20.0.

15N/4E-4D1—Reference point—hole in pump base, elevation 85 feet, 0.03 mile southeast of intersection of State Highway 20 and Walnut Road. 11/29/48, 26.1; 1/27/49, 26.0; 3/22/49, 23.2; 12/9/49, 27.1.

15N/4E-4E1—Reference point—top of 10-inch casing inside shed, elevation 87.5 feet, 0.17 mile east of State Highway 20, 0.38 mile south along State Highway 20 from intersection of Walnut Road. 11/25/47, 21.9; 3/2/48, 22.8; 4/1/48, 22.4; 11/26/48, 22.8; 1/27/49, 23.2; 3/22/49, 21.0; 11/18/49, 22.5; 3/23/50, 21.5; 10/31/50, 22.2; 3/30/51, 20.5; 11/14/51, 22.3.

15N 4E-4H1—Reference point—top of tin casing at suction line, elevation 85 feet, 0.9 mile east of State Highway 20, 0.5 mile south of Walnut Road. 11/28/47, 20.2; 3/2/48, 20.8; 4/1/48, 21.7; 3/22/49, 20.5; 11/18/49, 20.8.

15N 4E-4N1—Reference point—top of casing, elevation 85.6 feet, 0.55 mile east of State Highway 20, 0.82 mile south of intersection of State Highway 20 and Walnut Road. 11/25/47, 24.3; 3/2/48, 24.3; 4/1/48, 23.5; 11/26/48, 24.6; 3/22/49, 22.6; 12/9/49, 25.2.

15N/4E-4N2—Reference point—top of casing, elevation 85.3 feet, 0.61 mile east of State Highway 20, 0.91 mile south along State Highway 20 from intersection with Walnut Road. 11/25/47, 23.9; 3/2/48, 23.9; 3/22/49, 22.0.

15N 4E-4P1—Reference point—top of casing, elevation 86.5 feet, 0.72 mile east of State Highway 20, 0.73 mile south along State Highway 20 from intersection with Walnut Road. 11/25/47, 70.4; 3/2/48, 25.6.

15N 4E-4R1—Reference point—hole in side of pump, elevation 85.7 feet, 0.81 mile northwest of Dantoni Packing Shed on Dantoni Road, southeast of Yuba River. 11/24/47, 26.3; 3/4/48, 25.0; 3/31/48, 27.3; 10/4/48, 25.4; 11/24/48, 25.4; 1/17/49, 25.2; 3/16/49, 24.0; 5/24/49, 26.3; 6/29/49, 28.7; 7/28/49, 27.8; 8/26/49, 27.9; 11/21/49, 26.2; 3/23/50, 24.1; 10/31/50, 26.5; 4/2/51, 21.4; 11/21/51, 25.6; 4/5/52, 20.4.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N 4E-5D1—Reference point—top of tin casing, elevation 65 feet, 0.17 mile northwest of Kimball Lane at curve, 1.0 mile along Kimball Lane from intersection with Nigger Jack Slough Road. 11/26/47, 7.2; 3/4/48, 8.8; 11/30/48, 8.2; 3/23/49, 8.5; 12/9/49, 8.5.

15N 4E-6C1—Reference point—top of suction pipe flange, elevation 65 feet, 0.10 mile north of intersection of Kimball Lane and Nigger Jack Slough Road on west side of Nigger Jack Slough Road. 11/7/47, 8.3; 12/2/48, 6.0; 3/18/49, 1.5; 11/17/49, 5.1.

15N 4E-7J1—Reference point—top of casing, elevation 68 feet. North side of State Highway 20, 1.65 miles along State Highway 20 from Yuba Street. 11/19/47, 15.9; 3/19/48, 15.9; 11/21/48, 16.3; 3/28/48, 15.0; 11/17/49, 16.0; 3/28/50, 15.8; 11/2/50, 15.7; 3/28/51, 10.5; 11/16/51, 16.2; 4/2/52, 10.2.

15N 4E-7M1—Reference point—hole in base of pump, elevation 64 feet, 0.80 mile north of 15th Street, west side of Nigger Jack Slough Road. 11/19/47, 19.4; 3/19/48, 18.8; 10/5/48, 19.1; 11/22/48, 19.7; 3/28/49, 17.5; 11/17/49, 19.8; 3/28/50, 16.9.

15N 4E-8D1—Reference point—top of casing outside milk house, elevation 65 feet, 0.46 mile east of Nigger Jack Slough Road, 0.25 mile northwest of State Highway 20. 11/25/47, 15.4; 3/2/48, 16.1; 11/30/48, 15.9; 3/22/49, 14.7; 11/21/49, 15.1; 3/23/50, 14.3; 10/31/50, 15.0; 3/30/51, 14.7; 11/14/51, 15.8; 4/5/52, 12.6.

15N 4E-8M1—Reference point—top of casing, elevation 74 feet, 0.20 mile east of State Highway 20, 1.68 miles from intersection with Yuba Street. 11/25/47, 23.1; 3/2/48, 22.7; 11/26/48, 23.1; 3/22/49, 22.2; 12/9/49, 24.7.

15N 4E-8R1—Reference point—base of pump, elevation 80.3 feet, 1.58 miles north of intersection of Dantoni and Hammond Roads on south bank of Yuba River. 11/19/47, 26.7; 3/2/48, 26.7; 3/31/48, 25.7; 5/5/48, 23.3; 6/1/48, 23.2; 10/4/48, 26.8; 11/21/48, 26.9; 3/16/49, 25.4; 11/21/49, 27.7; 3/23/50, 25.0; 10/31/50, 27.7; 4/2/51, 22.2; 11/21/51, 26.9; 4/5/52, 23.4.

15N 4E-9G1—Reference point—top of casing, elevation 84.6 feet, 0.70 mile northwest of Dantoni Road, 0.10 mile southwest along road from Dantoni Packing Shed. 11/24/47, 29.6; 3/3/48, 24.9; 3/4/48, 25.1; 10/4/48, 25.9; 11/24/48, 25.5; 1/17/49, 24.9; 3/16/49, 23.7; 11/21/49, 26.0; 3/23/50, 23.2; 10/31/50, 25.9; 4/2/51, 21.1; 11/21/51, 25.0; 4/5/52, 20.3.

15N 4E-9R1—Reference point—hole in side of pump, elevation 77.2 feet, 0.23 mile northwest of Dantoni Road, 0.40 mile southwest along road from Dantoni Packing Shed. 11/24/47, 19.2; 3/1/48, 20.9; 3/3/48, 21.0; 11/24/48, 20.1; 3/16/49, 20.2; 11/21/49, 21.1.

15N 4E-10F1—Reference point—hole in base of pump, elevation 80.5 feet, 0.23 mile northwest of Dantoni Road, 0.20 mile northeast along road from Dantoni Packing Shed. 11/24/47, 21.5; 3/1/48, 19.8; 3/31/48, 25.7; 10/1/48, 20.9; 11/24/48, 20.6; 3/16/49, 19.7; 11/21/49, 21.5.

15N 4E-10L2—Reference point—pipe in concrete base, elevation 87.8 feet, 0.12 mile southeast from Dantoni Road, opposite Dantoni Packing Shed. 11/24/47, 26.2; 3/3/48, 31.0; 3/4/48, 26.9; 5/6/48, 25.0; 10/8/48, 27.4; 11/24/48, 27.3; 1/17/49, 26.8; 3/16/49, 26.1; 3/24/49, 31.0; 6/29/49, 29.5; 7/28/49, 30.3; 8/30/49, 30.5; 11/21/49, 28.6.

15N 4E-10N1—Reference point—hole in casing, elevation 84.1 feet, 0.16 mile southeast of Dantoni Road, 0.30 mile southwest along road from Dantoni Packing Shed. 11/24/47, 28.6; 3/1/48, 26.0; 3/31/48, 26.6; 5/6/48, 24.2; 10/4/48, 26.2; 11/24/48, 26.5; 3/16/49, 25.8; 11/21/49, 28.0; 12/7/49, 27.8; 3/23/50, 26.6; 10/31/50, 28.2; 4/2/51, 20.7; 11/21/51, 26.9; 4/5/52, 23.0.

15N 4E-11C1—Reference point—top of casing, elevation 90 feet, 1.60 miles north of Hammonton Road at a point 0.55 mile southwest along Hammonton Road from Brophy Road. 5/13/48, 25.0; 6/1/48, 24.7; 10/1/48, 27.5; 11/23/48, 27.5; 1/17/49, 26.9; 3/16/49, 26.5; 11/21/49, 28.8; 3/23/50, 25.4; 3/30/51, 18.8; 11/1/51, 27.1; 4/4/52, 18.4.

15N 4E-11G1—Reference point—hole in pump base, elevation 85 feet, 1.17 miles north of Hammonton Road at a point 0.35 mile southwest along Hammonton Road from Brophy Road. 5/13/48, 25.3; 6/1/48, 24.9; 9/1/48, 29.5; 10/1/48, 26.2; 11/23/48, 26.1, 1/17/49, 26.1; 3/16/49, 25.4; 4/12/49, 24.1; 5/24/49, 28.5; 6/29/49, 29.4; 7/28/49, 28.5; 8/26/49, 28.4; 11/21/49, 23.6; well destroyed.

15N 4E-11K1—Reference point—hole in top of pump base, elevation 83 feet, 0.29 mile west of Brophy Road, 0.90 mile north of Brophy School. 5/13/48, 18.1; 10/1/48, 20.1; 11/23/48, 19.4; 3/16/49, 18.4.

15N 4E-12P1—Reference point—hole in pump base, elevation 82.3 feet, 0.57 mile north of Brophy School, 0.29 mile east of Brophy Road. 11/24/47, 24.3; 3/1/48, 25.9; 3/31/48, 23.8; 11/23/48, 27.5; 11/21/49, 26.7; 12/5/49, 26.6; 3/24/50, 22.4; 11/2/50, 27.6; 4/4/52, 19.4.

15N 4E-13B1—Reference point—top of casing, elevation 84 feet. South side of Hammonton Road, 0.4 mile northeast from intersection with Brophy Road. 12/24/47, 22.9; 3/23/48, 22.6; 11/23/48, 25.7; 3/21/49, 22.1; 12/5/49, 26.2; 3/23/50, 22.7; 11/2/50, 27.7; 4/2/51, 18.7; 11/21/51, 26.4; 4/4/52, 20.4.

15N 4E-14B1—Reference point—top of casing, elevation 80.5 feet, 0.21 mile north of Hammonton Road, 0.20 mile southwest from intersection with Brophy Road. 11/26/47, 16.1; 3/1/48, 16.4; 3/31/48, 16.4; 11/24/48, 17.8; 3/17/49, 16.3; 11/22/49, 16.4; 3/30/51, 4.6; 11/20/51, 17.0; 4/4/52, 4.7.

15N 4E-14N1—Reference point—hole in pump base, elevation 79 feet, 0.11 mile south of Hammonton Road, 0.85 mile southwest from intersection with Brophy Road. 5/6/48, 24.0; 6/3/48, 26.7; 3/17/49, 25.7; 11/21/49, 30.3.

15N 4E-14N2—Reference point—top of casing, elevation 78.8 feet. North side of Hammonton Road, 0.87 mile southwest from intersection with Brophy Road. 11/26/47, 22.7; 5/6/48, 21.8; 10/1/48, 26.4; 10/8/48, 25.8; 11/24/48, 24.9; 1/17/49, 23.9; 3/16/49, 23.3; 5/24/49, 31.3; 6/29/49, 33.5; 7/28/49, 35.3; 8/26/49, 30.8; 11/22/49, 27.7; 3/23/50, 24.3; 11/10/50, 28.7; 3/30/51, 18.5; 11/20/51, 27.9; 4/1/52, 20.3.

15N 4E-14P1—Reference point—hole in pump base, elevation 82 feet, 0.52 mile west of Brophy Road, 0.23 mile south of Hammonton Road. 5/6/48, 25.2; 6/3/48, 28.7; 3/17/49, 26.9; 8/2/49, 40.6; 11/21/49, 30.7.

15N 4E-15A1—Reference point—pipe in concrete base, elevation 78.5 feet, 1.02 miles west of Brophy Road, 0.86 mile north of Hammonton Road. 11/26/47, 18.3; 3/2/48, 17.1; 3/31/48, 18.5; 10/8/48, 20.2; 11/24/48, 19.6; 1/7/49, 19.0; 3/16/49, 18.4; 11/21/49, 21.0; 3/23/50, 19.1; 11/10/50, 22.0; 4/2/51, 11.1; 11/21/51, 20.3; 4/4/52, 12.2.

15N 4E-15L1—Reference point—top of concrete pit, elevation 81.5 feet, 0.15 mile east of Griffith Avenue, 0.66 mile north of Hammonton Road. 11/26/47, 27.0; 3/2/48, 29.8.

15N 4E-16A1—Reference point—hole in side of pump base, elevation 79.5 feet. North side of Dantoni Road, 0.73 mile along road from Dantoni Packing Shed. 11/7/47, 22.5; 3/2/48, 23.2; 3/31/48, 22.7; 10/1/48, 23.7; 10/8/48, 23.7; 11/24/48, 23.7; 1/17/49, 23.2; 3/16/49, 23.0; 11/21/49, 25.1.

15N 4E-16K1—Reference point—base of pump, elevation 81.0 feet, 0.63 mile west of Dantoni Road, 1.43 miles along road from intersection with Hammonton Road. 11/22/47, 26.8; 3/2/48, 28.2; 3/31/48, 27.9; 10/1/48, 30.0; 10/8/48, 29.9; 11/24/48, 29.2; 3/16/49, 28.4; 11/22/49, 31.2; 11/10/50, 30.5; 4/2/51, 21.5; 11/21/51, 29.5; 4/5/52, 22.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N/4E-16N2—Reference point—hole in pump base, elevation 74.5 feet, 0.28 mile northwest of Dantoni Road, 0.76 mile along road from intersection with Hammonton Road. 11/19/47, 23.9; 3/2/48, 23.3; 3/31/48, 23.1; 5/6/48, 22.3; 6/1/48, 21.8; 10/4/48, 24.5; 11/24/48, 24.2; 3/16/49, 23.6.

15N/4E-16P1—Reference point—base of pump, elevation 76.9 feet, 0.23 mile west of Dantoni Road, 1.31 miles along road from intersection with Hammonton Road. 11/5/47, 24.7; 3/2/48, 24.1; 5/13/48, 24.2; 6/1/48, 22.3; 10/4/48, 25.8; 10/8/48, 25.7; 11/24/48, 24.7; 3/16/49, 24.4; 11/21/49, 28.2.

15N/4E-17M1—Reference point—top of casing, elevation 74.2 feet, 0.76 mile measured perpendicular north of Simpson Lane at a point 0.82 mile from 7th St. Bridge. 11/11/47, 26.4; 3/19/48, 25.8; 3/30/48, 25.5; 11/5/48, 27.0; 11/22/48, 32.8; 3/24/49, 25.2; 11/17/49, 27.3; 3/28/50, 24.7; 11/2/50, 28.2; 3/28/51, 17.9; 11/16/51, 25.8; 4/2/52, 15.9.

15N/4E-17N1—Reference point—top of casing, elevation 74.5 feet, 0.35 mile measured perpendicular north of Simpson Lane at a point 1.27 miles from intersection with Yuba Street. 11/11/47, 26.0; 3/19/48, 25.4; 3/30/48, 25.3; 11/22/48, 26.6; 3/24/49, 25.2; 11/17/49, 27.6.

15N/4E-18G1—Reference point—top of casing, elevation 71 feet, 0.13 mile east of State Highway 20 at a point 0.90 mile from intersection with Yuba Street. 11/19/47, 27.7; 3/19/48, 26.2; 11/21/48, 28.5; 3/28/49, 24.5; 11/17/49, 28.1; 11/2/50, 26.2; 3/28/51, 22.3; 11/16/51, 28.1; 4/2/52, 21.6.

15N/4E-18Q1—Reference point—base of pump at edge, elevation 68.7 feet, 0.36 mile measured perpendicular north of Simpson Lane at a point 0.75 mile from intersection with Yuba Street. 11/12/47, 23.7; 3/18/48, 22.5; 11/22/48, 24.3; 3/24/49, 22.0; 11/17/49, 25.5; 11/16/51, 27.7.

15N/4E-19H1—Reference point—surface of concrete block, elevation 67.0 feet, 0.13 mile measured perpendicular south of Simpson Lane at a point 1.04 miles from intersection with Yuba Street. 11/11/47, 23.5; 3/19/48, 22.6; 10/5/48, 20.0; 11/22/48, 26.5; 3/24/49, 20.7; 11/17/49, 25.0; 11/2/50, 25.3; 3/28/51, 13.7.

15N/4E-19J1—Reference point—hole in pump base, elevation 71.8 feet, 0.43 mile south of Simpson Lane at a point 1.12 miles from intersection with Yuba Street. 11/11/47, 27.4; 3/19/48, 27.3; 3/24/49, 26.8; 11/18/49, 30.0; 3/28/50, 27.5; 11/3/50, 30.3; 3/28/51, 18.5; 11/16/51, 26.5; 4/2/52, 17.6.

15N/4E-19N1—Reference point—top of casing, elevation 59.9 feet. South bank of Levee Road, 0.35 mile east of U. S. Highway 99E bridge over Yuba River. 11/10/47, 20.0; 3/17/48, 19.0; 3/24/49, 17.0; 11/18/49, 21.4.

15N/4E-19P1—Reference point—top of casing, elevation 64.0 feet, 0.04 mile south of levee between Avondale and Southern Pacific Railroad. 11/11/47, 22.7; 3/17/48, 22.6; 3/30/48, 21.1; 11/22/48, 33.7; 3/24/49, 21.0; 12/13/49, 25.2.

15N/4E-20F1—Reference point—hole in pump base, elevation 72.5 feet, 0.20 mile due west from intersection of Hammonton and Dantoni Roads. 11/11/47, 25.7; 3/17/48, 26.0; 5/3/48, 24.7; 6/2/48, 25.4; 11/22/48, 26.2; 3/24/49, 26.5; 11/17/49, 29.6; 3/28/50, 27.3; 11/16/51, 25.1; 4/2/52, 23.6.

15N/4E-20L1—Reference point—top of casing, elevation 66 feet, 0.41 mile north of Hammonton Road at a point 0.55 mile along Hammonton Road from intersection with U. S. Highway 99E. 11/11/47, 14.3; 3/17/48, 15.0; 11/22/48, 13.3; 11/18/49, 22.4; 11/3/50, 22.7; 3/28/51, 12.6.

15N/4E-20N1—Reference point—top of casing, elevation 57.8 feet, 0.40 mile north of Hammonton Road at a point 0.41 mile along Hammonton Road from intersection with U. S. Highway 99E. 11/11/47, 13.6; 3/17/48, 13.9; 10/4/48, 24.4; 11/22/48, 19.3; 3/24/49, 13.5; 11/18/49, 16.1; 3/28/50, 14.3.

15N/4E-20N2—Reference point—top of casing, 8.5 feet below top of concrete pit, elevation 53.4 feet, 0.22 mile north of Hammonton Road at a point 0.45 mile along Hammonton Road from intersection with U. S. Highway 99E. 11/11/47, 12.6; 3/17/48, 12.9; 3/24/49, 6.0; 11/18/49, 8.6.

15N/4E-20N3—Reference point—top of casing, elevation 58.9 feet, 0.31 mile north of Hammonton Road at a point 0.50 mile along Hammonton Road from intersection with U. S. Highway 99E. 4/8/47, 14.7; 3/17/48, 15.3; 3/30/48, 14.5; 11/12/48, 22.2; 3/24/49, 15.9; 11/18/49, 17.3.

15N/4E-20P1—Reference point—top of concrete pit, east wall, elevation 67.5 feet, 0.14 mile due west of intersection of Hammonton and Linda Roads. 12/10/47, 22.5; 3/1/48, 22.5; 11/22/48, 23.3; 3/17/49, 22.9; 11/22/49, 24.6; 3/24/50, 23.2; 11/2/50, 25.7; 11/15/51, 20.7.

15N/4E-20R1—Reference point—top of casing, elevation 67.4 feet. North side of Linda Road, 0.41 mile east of Hammonton Road. 12/12/47, 22.2; 3/1/48, 21.3; 11/22/48, 23.6; 11/22/49, 25.2.

15N/4E-21F1—Reference point—base of wooden block supporting pump, south side, elevation 70.4, 0.10 mile north of Hammonton Road, 0.68 mile west of Griffith Avenue. 11/26/47, 23.6; 3/1/48, 23.6; 10/8/48, 25.7; 11/24/48, 24.8; 3/16/49, 23.5; 6/29/49, 29.2; 8/26/49, 31.0; 11/21/49, 28.8; 3/23/50, 25.3; 11/2/50, 30.0; 3/30/51, 19.1; 11/20/51, 30.8; 4/5/52, 21.9.

15N/4E-21R2—Reference point—hole in pump base, elevation 75.1 feet. West side of Griffith Avenue, 0.05 mile north of North Beale Road. 11/26/47, 27.1; 10/8/48, 29.4; 11/22/48, 29.2; 3/17/49, 27.8; 11/21/49, 32.3; 3/24/50, 29.9; 11/3/50, 34.3; 3/30/51, 26.3; 11/21/51, 33.7; 4/3/52, 26.9.

15N/4E-22B1—Reference point—top of casing, elevation 73.6 feet. North side of Hammonton Road, 0.75 mile along road from intersection with Griffith Avenue. 11/26/47, 20.6; 3/1/48, 20.1; 3/31/48, 20.0; 5/6/48, 19.6; 10/1/48, 23.3; 10/8/48, 23.1; 11/24/48, 22.4; 1/17/49, 21.9; 3/16/49, 21.3; 5/24/49, 24.9; 7/1/49, 31.1; 8/3/49, 28.9; 8/26/49, 28.1; 11/21/49, 25.3; 3/23/50, 22.7; 11/2/50, 27.2; 3/30/51, 15.2; 11/20/51, 24.9; 4/4/52, 27.1.

15N/4E-22K1—Reference point—top of casing, elevation 86.9 feet, 0.40 mile north of North Beale Road, 0.76 mile east of Griffith Road. 12/10/47, 27.7; 3/1/48, 34.7; 10/8/48, 36.6; 11/22/48, 36.9; 3/17/49, 36.5; 11/22/49, 40.0.

15N/4E-22L1—Reference point—top of casing, elevation 74 feet, 0.39 mile east of Griffith Road, 0.26 mile north of North Beale Road. 11/22/29, 25.7; 9/16/30, 25.3; 12/14/31, 27.3; 12/9/32, 27.6.

15N/4E-22P1—Reference point—top of concrete foundation, elevation 72 feet, 0.32 mile east of Griffith Road, 0.15 mile north of North Beale Road. 11/5/47, 23.6; 12/10/48, 26.3; 12/9/49, 29.5; 11/10/50, 31.5; 12/5/51, 30.7.

15N/4E-22P2—Reference point—top of brick lining of well, elevation 73 feet, 0.31 mile east of Griffith Road, 0.15 mile north of North Beale Road. 12/14/33, 29.6; 11/20/34, 30.4; 11/28/36, 27.9; 11/22/37, 27.6; 1/27/39, 25.1; 1/9/41, 22.0.

15N/4E-23A1—Reference point—crack between wood blocks, southeast corner, elevation 84.2 feet. West side of Brophy Road, 0.96 mile north of North Beale Road. 11/26/47, 24.5; 3/1/48, 24.1; 3/31/48, 24.0; 5/6/48, 23.4; 6/3/48, 38.0; 10/1/48, 28.1; 10/8/48, 27.5; 11/23/48, 26.5; 1/17/49, 25.7; 3/16/49, 25.3; 6/1/49, 34.6; 7/3/49, 39.5 (operating); 8/2/49, 39.5 (operating); 11/22/49, 31.0; 3/23/50, 26.7; 11/2/50, 31.2; 3/30/51, 23.8; 11/21/51, 30.8; 4/4/52, 25.1.

15N/4E-23P1—Reference point—top of casing, elevation 77.2 feet, 0.04 mile north of North Beale Road, 0.65 mile east of Brophy Road. 12/10/47, 27.1; 3/1/48, 27.6; 3/31/48, 24.9; 10/8/48, 27.3; 11/22/48, 27.4; 3/17/49, 27.0; 11/22/49, 30.3; 11/2/50, 32.5.

15N/4E-23R1—Reference point—top of wooden platform under pitcher pump, elevation 79.1 feet, 0.05 mile northwest of intersection of North Beale and Brophy Roads. 12/10/47, 24.2; 3/1/48, 24.2.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N 4E-24C1—Reference point—top of casing, elevation 83 feet, 0.49 mile east of Brophy Road, 0.99 mile north of North Beale Road. 5/5/48, 25.1; 6/3/48, 28.6; 11/23/48, 28.1; 1/17/49, 27.4; 3/16/49, 27.0; 7/3/49, 46.0 (operating); 8/2/49, 52.0 (operating); 12/5/49, 30.8; 3/24/50, 29.1; 11/2/50, 33.3; 4/2/51, 28.3; 11/21/51, 38.1; 4/4/52, 35.9.

15N 4E-25L1—Reference point—hole in pump base, elevation 78 feet, 0.49 mile east of Brophy Road, 0.51 mile south of North Beale Road. 10/6/49, 30.0; 11/23/48, 29.5; 3/21/49, 28.6; 12/5/49, 33.7; 3/27/50, 32.1; 11/2/50, 37.2; 4/4/51, 34.5; 11/21/51, 40.0; 4/5/52, 36.7.

15N 4E-26J1—Reference point—hole in base of pump, elevation 76 feet, 0.70 mile south of North Beale Road due south of Brophy Road. 11/23/48, 28.8; 3/17/49, 28.5; 11/23/49, 31.9; 12/5/49, 32.6.

15N 4E-27E2—Reference point—top of concrete north wall, elevation 71.0 feet, 0.23 mile east of Griffith Road, 0.40 mile south of North Beale Road. 12/10/47, 23.1; 3/1/48, 22.3; 3/31/48, 22.4; 10/8/48, 25.5; 11/22/48, 25.4; 3/17/49, 24.5; 11/22/49, 28.5; 4/4/52, 25.3.

15N 4E-28D1—Reference point—hole in pump base, elevation 77.7 feet, 0.04 mile south of North Beale Road, 0.17 mile east of intersection of North Beale and Linda Roads. 11/26/47, 32.3; 3/1/48, 31.5; 11/22/48, 34.1; 3/26/49, 32.5; 11/21/49, 36.9; 3/24/50, 34.3; 11/2/50, 38.9; 3/30/51, 37.5 (operating); 11/21/51, 39.1; 4/3/52, 31.5.

15N 4E-29E1—Reference point—top of casing, elevation 61 feet, 0.23 mile northeast of U. S. Highway 99E, 0.20 mile southeast of Hammonton Road. 12/10/47, 20.9; 3/1/48, 20.6.

15N 4E-29F2—Reference point—top of 4" x 4" bridge over pit, elevation 64 feet, 0.26 mile south of North Beale Road, 0.62 mile west of intersection of North Beale and Linda Roads. 12/10/47, 22.4; 3/1/48, 20.9.

15N 4E-29P1—Reference point—top of 4" x 6" mud sill of shed, elevation 63.6 feet, 0.03 mile north of Earle Road, 0.04 mile east of Southern Pacific Railroad. 12/10/47, 21.5; 3/1/48, 22.7; 10/8/48, 25.0; 11/22/48, 24.2.

15N 4E-30B2—Reference point—hole in base of pump, elevation 62.7 feet, Northeast side of Avondale Avenue, 0.05 mile northwest of North Beale Road. 11/10/47, 21.3; 3/17/48, 20.3; 10/4/48, 23.7; 11/22/48, 22.2; 3/24/49, 19.0; 12/13/49, 23.4; 3/28/50, 20.5; 11/2/50, 24.6.

15N 4E-30D1—Reference point—base of pump, north side, elevation 59.1 feet, 0.03 mile south of U. S. Highway 99E at first turn south of Rancho Motel. 11/10/47, 20.4; 3/17/48, 20.5; 3/30/48, 18.8; 5/5/48, 16.0; 6/2/48, 16.6; 7/1/48, 39.2 (operating); 11/22/48, 21.6; 3/24/49, 18.0; 5/24/49, 20.8; 6/29/49, 24.3; 8/26/49, 25.1; 11/22/49, 24.8; 3/28/50, 17.0; 11/2/50, 22.3; 3/28/51, 10.2; 10/20/51, 21.8.

15N 4E-30E2—Reference point—base of pump, elevation 56.8 feet, Southwest side of Garden Avenue, 0.38 mile southeast of Walnut Avenue. 11/12/47, 18.9; 3/19/48, 17.8; 10/4/48, 22.1; 11/22/48, 21.0; 3/21/49, 16.8; 11/18/49, 21.2.

15N E-30L1—Reference point—top of pump base, elevation 56.0 feet, 0.04 mile southwest of Garden Avenue, 0.25 mile northwest of Feather River Boulevard. 11/11/47, 18.2; 3/19/48, 16.8; 11/22/48, 18.8; 3/21/49, 16.0; 11/18/49, 21.2.

15N 4E-30L2—Reference point—hole in pump base, elevation 56.5 feet, 0.03 mile northwest of Feather River Boulevard, 0.08 mile southwest of Garden Avenue. 11/12/47, 18.2; 3/19/48, 17.3; 3/30/48, 17.0; 3/24/49, 16.7; 12/13/49, 20.7; 3/28/50, 7.0; 11/2/50, 21.7; 3/28/51, 10.2; 11/20/51, 18.2; 4/1/52, 9.8.

15N 4E-31K1—Reference point—hole in pump base, elevation 60.1 feet, 0.56 mile south of Earle Road, 0.33 mile west of Arboga Road. 12/10/47, 21.8; 3/2/48, 21.1; 3/30/48, 20.9; 11/22/48, 23.1; 3/17/49, 21.6; 11/23/49, 22.7.

15N 4E-31Q1—Reference point—hole in side of pump, elevation 57 feet, 0.34 mile west of Arboga Road, 2.20 miles north of Ella Road. 11/12/47, 23.0; 3/5/48, 21.4.

15N 4E-32D1—Reference point—hole in pump base, elevation 64.6 feet, 0.10 mile west of intersection of U. S. Highway 99E and Earle Road, 0.03 mile south of Earle Road. 12/10/47, 31.2; 3/2/48, 22.7; 3/30/48, 22.3; 11/22/48, 24.5; 3/18/49, 23.1; 11/23/49, 26.1; 11/2/50, 28.5.

15N 4E-32D2—Reference point—top of casing, elevation 62 feet, South side Pasado Avenue 0.13 mile west of U. S. Highway 99E. 3/19/48, 22.4; 11/22/48, 27.6; 3/28/50, 27.1.

15N 4E-32F1—Reference point—top of wood frame in concrete floor under pump, elevation 62.2 feet, 0.18 mile west of U. S. Highway 99E at a point 0.53 mile south of intersection with Earle Road. 12/10/47, 21.8; 3/2/48, 22.2; 3/30/48, 20.8; 5/14/48, 20.9; 11/22/48, 23.7; 11/23/49, 25.1.

15N 4E-32L1—Reference point—top of concrete under pump, elevation 61 feet, 0.06 mile east of Olivehurst Avenue at a point 0.03 mile from intersection with U. S. Highway 99E. 12/1/47, 30.7; 3/17/48, 22.8.

15N 4E-32M1—Reference point—top of casing, elevation 60 feet, 0.40 mile due west of intersection of Olivehurst Avenue and U. S. Highway 99E. 12/1/47, 22.1; 3/17/48, 22.3; 11/19/48, 24.4; 3/21/49, 23.5.

15N 4E-33D1—Reference point—top of casing, elevation 70.5 feet, 0.10 mile south of Earle Road, 0.80 mile east of intersection with U. S. Highway 99E. 12/10/47, 28.2; 3/1/48, 26.7; 11/22/49, 33.1.

15N 4E-33D2—Reference point—top of concrete pit, north wall, elevation 70.2 feet, 0.10 mile south of Earle Road, 0.85 mile west of Griffith Avenue. 12/10/47, 28.1; 3/2/48, 26.6; 3/31/48, 26.6; 10/8/48, 31.6; 11/22/48, 30.5; 3/17/49, 28.2; 11/22/49, 33.8; 3/24/50, 30.8; 4/4/52, 31.8.

15N 4E-33H1—Reference point—top of casing, elevation 64.0 feet, 0.05 mile west of Grifith Avenue, 0.16 mile south of Earle Road. 12/4/47, 26.8; 3/18/48, 25.5; 11/19/48, 29.3; 3/23/49, 27.5; 11/23/49, 32.6; 3/27/50, 30.3; 11/2/50, 34.9; 7/5/51, 23.5; 11/30/51, 34.9; 4/4/52, 30.3.

15N 4E-33R1—Reference point—top of casing, elevation 65 feet, 1.51 miles north of McGowan Road, 1 mile due east of U. S. Highway 99E. 12/1/47, 26.8; 3/8/48, 29.6; 11/19/48, 33.9; 3/23/49, 31.6; 11/23/49, 38.0.

15N 4E-34D1—Reference point—top of wooden floor of pump house, elevation 69.4 feet, South side of Earle Road, 0.10 mile east of Grifith Avenue. 12/10/47, 22.7; 10/8/48, 26.5; 11/22/48, 25.6; 3/17/49, 24.8; 11/22/49, 29.0; 3/30/51, 26.8; 11/21/51, 31.2; 4/4/52, 26.1.

15N 4E-35E1—Reference point—top of 6" x 6" sill, south wall, elevation 68.7 feet, 0.15 mile east of curve in Earle Road, 1.32 miles south of North Beale Road. 12/10/47, 23.4; 3/1/48, 13.8; 3/31/48, 13.6; 10/8/48, 26.1; 11/22/48, 26.5; 3/17/49, 26.1; 11/22/49, 30.2; 3/24/50, 29.8; 11/2/50, 32.4; 3/30/51, 30.4; 11/21/51, 35.2; 4/4/52, 32.6.

15N 4E-35Q1—Reference point—top of casing, elevation 72.2 feet, North side of Spenceville Road, 0.26 mile east of intersection with Earle Road. 12/4/47, 21.8; 3/18/48, 21.6; 11/18/48, 25.3; 3/23/49, 23.9.

15N 5E-19C1—Reference point—top of brick curb, elevation 86 feet, 1.20 miles south of Hammonton Road at a point 1.50 miles from intersection of Brophy Road. 11/22/29, 24.3; 9/6/30, 24.1; 12/14/31, 26.2; 12/9/32, 25.7; 12/14/33, 25.9; 11/20/34, 26.6; 11/28/36, 25.4; 1/9/41, 3.0; 11/6/47, 24.6; 12/10/48, 24.6; 12/7/49, 27.3; 11/10/50, 26.9.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

15N/5E-19L1—Reference point—top of concrete crib, elevation 86 feet. 1.77 miles south of Hammonton Road at a point 1.40 miles from intersection of Brophy Road. 11/22/29, 25.8; 9/26/30, 25.5; 12/14/31, 26.5; 12/9/32, 26.7; 12/14/33, 27.4; 11/20/34, 27.6; 11/28/36, 26.2; 11/23/37, 27.1; 1/9/41, 3.0; 11/6/47, 30.9; 12/10/48, 33.4; 12/7/49, 37.0; 11/10/50, 39.6; 12/5/51, 69.7.

15N/5E-31R1—Reference point—top of casing, elevation 79.2 feet. North side of Spenceville Road, 2.43 miles east of intersection with Virginia Road. 12/24/47, 22.1; 3/24/48, 22.0; 11/18/48, 26.7; 1/18/48, 24.9; 3/21/49, 24.2; 12/5/49, 32.2; 3/27/50, 30.3; 11/2/50, 38.4; 4/2/51, 33.2; 4/4/52, 36.5.

15N/5E-32J1—Reference point—top of casing, elevation 91 feet. 0.26 mile north of Spenceville Road, 3.43 miles east of intersection with Virginia Road. 12/24/47, 33.9; 3/24/48, 33.7; 11/18/48, 36.0; 3/21/49, 36.1; 12/5/49, 43.5; 3/27/50, 42.1; 11/2/50, 50.6; 4/2/51, 45.6; 11/21/51, 48.6.

16N/2E-1B1—Reference point—top of casing, elevation 76.2 feet. 350 feet south of Pennington Road, 0.3 mile west of Township Road. 12/22/47, 10.1; 3/1/48, 10.4; 12/8/48, 9.6; 3/29/49, 8.0; 11/8/49, 9.4; 3/21/50, 8.8; 11/2/50, 9.7 3/27/51, 8.6; 11/13/51, 9.2; 4/2/52, 8.1.

16N/2E-1J1—Reference point—hole in pump flange, elevation 72.1 feet. 0.2 mile west of Township Road, 0.5 mile south of Pennington Road. 12/23/47, 7.2; 3/1/48, 7.4; 12/18/48, 6.9; 1/20/49, 6.5; 3/21/49, 4.0; 11/9/49, 6.6.

16N/2E-2A1—Reference point—top of concrete floor, elevation 74.2 feet. 300 feet south of Pennington Road, 0.15 mile west of Schroeder Road. 12/22/47, 8.1; 3/1/48, 8.6; 12/8/48, 7.7; 3/20/49, 6.1; 11/8/49, 6.1; 3/21/50, 7.3; 11/2/50, 6.9; 3/23/51, 7.2; 11/13/51, 7.3; 4/2/52, 6.6.

16N/2E-2J1—Reference point—top of casing, elevation 73.6 feet. 300 feet west of Schroeder Road, 0.75 mile south of Pennington Road. 12/23/47, 8.8; 3/1/48, 9.2; 12/8/48, 8.7; 3/21/49, 5.7; 11/9/49, 6.1.

16N/2E-3K1—Reference point—top of casing, elevation 71.0 feet. 0.50 mile south of Pennington Road, 0.50 mile west of Krehe Road. 11/26/29, 8.4; 10/21/30, 8.7; 12/16/31, 8.1; 12/9/32, 8.4; 12/13/33, 7.0; 11/21/34, 7.8; 11/27/36, 7.5; 12/1/37, 7.1; 1/25/39, 6.8; 1/10/41, 3.5; 11/4/47, 2.7; 12/14/48, 6.2; 11/8/49, 5.6; 11/10/50, 6.7; 11/26/51, 6.1.

16N/2E-4B1—Reference point—top of casing, elevation 73.7 feet. 0.30 mile south of Pennington Road, 1.27 miles west of Krehe Road. 12/22/47, 9.9; 3/2/48, 10.1; 12/3/48, 10.0; 3/30/49, 8.2; 11/15/49, 8.6.

16N/2E-5B1—Reference point—bottom of flange above discharge pipe, elevation 74.8 feet. 0.15 mile south of Pennington Road, 2.3 miles west of Krehe Road. 12/22/41, 6.8; 3/2/48, 6.7; 12/3/48, 9.2; 3/30/49, 10.0; 11/16/49, 8.0.

15N/2E-5L1—Reference point—top of casing, elevation 87.8 feet. 0.55 mile south-southeast of 90 degree turn in Pennington Road, 2.5 miles west of Krehe Road. 12/22/47, 12.8; 3/2/48, 12.8; 12/3/48, 13.6; 3/30/49, 12.0; 11/15/49, 14.0; 3/24/50, 12.8; 11/2/50, 16.1; 3/27/51, 12.9.

16N/2E-12J1—Reference point—top of casing, elevation 71.8 feet. 0.25 mile west of Township Road, 0.15 mile north of Paseo Avenue. 12/23/47, 8.5; 3/1/48, 8.6; 12/8/48, 8.4; 3/21/49, 4.0; 11/9/49, 8.0; 3/22/50, 7.3; 11/3/50, 8.0; 4/3/51, 7.1; 11/14/51, 7.8; 4/2/52, 7.0.

16N/2E-13G2—Reference point—top of casing, elevation 64.6 feet. 0.3 mile west of Township Road, 0.7 mile north of Clark Road. 12/23/47, 7.0; 3/1/48, 3.6; 12/8/48, 3.2; 3/21/49, —1.5; 11/10/49, 5.8; 3/22/50, 7.4.

16N/2E-24D1—Reference point—top of casing, elevation 66.4 feet. 100 feet south of Clark Road, 0.8 mile west of Township Road. 12/23/47, 8.9; 3/1/48, 8.0; 12/8/48, 7.7; 1/20/49, 8.5; 3/21/49, 6.1; 11/10/49, 4.5; 3/22/50, 8.2; 11/3/50, 8.1; 4/3/51, 36.2 (operating); 11/14/51, 8.2; 4/2/52, 6.6.

16N/2E-25P1—Reference point—top of casing, elevation 62.1 feet, 100 feet north of Sanders Road, 1.0 mile west of Broadway. 12/19/47, 9.7; 3/3/48, 10.5; 12/2/48, 9.2; 1/20/49, 10.0; 3/16/49, 8.8; 11/10/49, 7.7; 3/22/50, 9.2; 11/6/50, 8.2; 4/4/51, 8.6; 11/14/51, 8.3; 4/3/52, 6.9.

16N/2E-26K1—Reference point—top of casing, elevation 66.4 feet. 500 feet east of East Butte Road, 0.25 mile north of Sanders Road. 12/19/47, 14.7; 3/3/48, 14.5; 12/2/48, 13.5; 3/16/49, 13.3; 11/10/49, 10.8; 3/22/50, 11.9; 11/2/50, 12.8; 4/4/51, 11.9; 11/14/51, 12.4; 4/3/52, 9.2.

16N/2E-35B1—Reference point—top of casing, elevation 64 feet. 800 feet east of East Butte Road, 0.25 mile south of Sanders Road. 11/26/29, 12.0; 10/21/30, 11.5; 12/16/31, 13.0; 12/8/32, 12.1; 11/21/34, 12.2; 11/24/36, 12.7; 12/1/37, 11.0; 1/25/39, 12.0; 1/11/41, 6.7; 11/4/47, 1.0; 12/14/48, 12.1; 11/11/49, 10.3; 11/10/50, 11.1; 11/26/51, 11.6.

16N/2E-35C2—Reference point—top of casing (10 feet above ground), elevation 65 feet. 300 feet west of East Butte Road, 0.1 mile south of Sanders Road. 12/13/33, 16.3; 11/21/34, 16.9; 12/1/37, 14.5; 1/25/39, 16.2; 1/11/41, 9.8.

16N/3E-1E1—Reference point—top of casing at bottom of pit, ground elevation 80 feet. 0.1 mile east of State Highway 24, 0.6 mile north of Ramirez Road. 11/3/47, 12.5; 3/23/48, 9.4; 12/6/48, 11.2; 3/21/49, 9.4; 11/15/49, 13.4.

16N/3E-1E2—Reference point—base of pump, elevation 80 feet. 0.20 mile east of State Highway 24, 0.6 mile north of Ramirez Road. 11/3/47, 22.3; 3/23/48, 19.2; 12/6/48, 20.6; 3/21/49, 19.0; 11/15/49, 23.1; 3/21/50, 17.0; 11/7/50, 24.5; 3/29/51, 15.2; 11/15/51, 21.7; 4/6/52, 10.7.

16N/3E-1M1—Reference point—top of casing, elevation 78 feet. 500 feet east of State Highway 24, 0.3 mile north of Ramirez Road. 11/4/47, 21.2; 3/23/48, 18.5.

16N/3E-1P2—Reference point—base of pump, elevation 78 feet. 300 feet north of Ramirez Road, 0.60 mile east of State Highway 24. 11/4/47, 18.4; 3/23/48, 15.1; 12/2/48, 15.8; 3/21/49, 15.0; 11/15/49, 18.2; 3/2/50, 19.7; 3/29/51, 11.6; 11/15/51, 17.7; 4/6/52, 5.6.

16N/3E-2C1—Reference point—top of casing, elevation 80 feet. 0.60 mile west of State Highway 24, 0.70 mile north of Ramirez Road. 11/3/47, 21.6; 3/23/48, 18.0; 12/6/48, 20.5; 3/21/49, 18.5; 11/15/49, 22.6; 3/21/50, 16.2; 11/7/50, 22.4; 3/29/51, 14.0; 11/15/51, 21.0; 4/6/52, 10.3.

16N/3E-2[illegible]1—Reference point—top of casing, elevation 79 feet. 0.17 mile west of State Highway 24, 0.32 mile north of Ramirez Road. 6/1/48, 16.5; 6/30/48, 20.0; 7/21/48, 34.9; 9/1/48, 21.2; 9/30/48, 20.6; 12/3/48, 17.9; 3/21/49, 16.1.

16N/3E-4L1—Reference point—top of casing, elevation 75 feet. 30 feet west of Shelden Road, 0.25 mile south of Archer Road. 11/10/47, 10.4; 3/20/48, 13.4; 12/3/48, 10.9; 3/8/49, 13.0; 11/9/49, 9.2.

15N/3E-4M1—Reference point—top of casing, elevation 79.2 feet. 50 feet east of Sinnard Road, 0.15 mile south of Archer Road. 12/23/47, 11.3; 3/1/48, 11.9; 12/3/48, 10.7; 3/21/49, 9.4; 11/9/49, 9.9.

16N/3E-4N1—Reference point—top of casing, elevation 76.9 feet. 100 feet south of Coleman Avenue, 0.05 mile west of Sinnard Road. 12/23/47, 9.9; 3/1/48, 10.8; 12/3/48, 9.2.

16N/3E-5A1—Reference point—top of casing, elevation 78.6 feet. 400 feet south of Pennington Road, 0.4 mile east of Larkin Road. 12/23/47, 10.7; 3/1/48, 11.0; 12/8/48, 10.5; 3/30/49, 9.0; 11/8/49, 10.1; 3/22/50, 8.1; 11/2/50, 11.1; 3/27/51, 8.3; 11/14/51, 10.6; 4/2/52, 7.5.

16N/3E-5P1—Reference point—hole in pump base, elevation 74.9 feet. 0.15 mile west of Larkin Road, 1.0 mile north of Paseo Road. 5/4/48, 8.9; 6/2/48, 8.7; 6-30-48, 49.9 (operating); 12/4/48, 11.5; 3/21/49, 5.4; 4/3/51, 7.7.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

16N 3E-6A1—Reference point—top of casing, elevation 77.9 feet. South side of Pennington Road, 0.8 mile east of Township Road. 12/22/47, 12.1; 3/1/48, 11.4; 5/13/48, 10.0; 12/8/48, 12.3; 1/21/49, 11.4; 3/30/49, 8.0; 11/8/49, 12.6; 3/22/50, 8.6; 11/2/50, 13.6; 3/27/51, 7.5; 11/13/51, 12.8; 4/2/52, 5.2.

16N 3E-7D2—Reference point—top of casing, elevation 73.5 feet. 0.1 mile east of Township Road, 0.65 mile north of Paseo Avenue. 12/23/47, 10.4; 3/1/48, 9.8; 12/8/48, 9.5; 3/21/49, 3.6; 11/9/49, 9.2; 3/22/50, 8.0; 11/3/50, 10.0; 4/3/51, 7.4; 11/11/51, 8.7; 4/2/52, 7.0.

16N 3E-8C1—Reference point—top of curb, elevation 71.1 feet. 0.2 mile west of Larkin Road, 0.75 mile north of Paseo Avenue. 12/23/47, 8.9; 3/1/48, 9.1; 12/4/48, 9.1; 3/21/49, 5.4; 11/9/49, 6.9; 3/22/50, 5.5; 11/3/50, 9.9; 4/3/51, 6.3; 11/11/51, 8.9; 4/2/52, 2.9.

16N 3E-8P1—Reference point—top of casing, elevation 72.0 feet. 200 feet north of Paseo Avenue, 0.15 mile west of Larkin Road. 12/23/47, 8.8; 3/1/48, 9.0; 12/4/48, 8.7; 3/21/49, 5.5; 11/9/49, 7.3.

16N 3E-8R1—Reference point—top of casing, elevation 71 feet. 100 feet north of Paseo Avenue, 400 feet east of U. S. Highway 99E. 1/10/41, 3.4; 11/5/47, 7.6; 12/5/47, 9.2; 12/13/48, 9.3; 11/9/49, 7.1; 3/22/50, 8.7; 11/10/50, 9.4; 4/2/51, 7.2; 11/26/51, 7.8.

16N 3E-8R2—Reference point—top of casing, elevation 71 feet. 100 feet north of Paseo Avenue, 300 feet east of U. S. Highway 99E. 1/23/29, 8.8; 9/27/30, 8.3; 12/16/31, 9.3; 12/9/32, 9.3; 12/13/33, 8.9; 11/21/34, 7.3; 1/24/36, 8.4; 12/1/37, 7.3; 1/26/39, 10.3.

16N 3E-9A1—Reference point—top of casing, elevation 72 feet. 1,500 feet north of Bishop Road, 100 feet east of Levee. 11/10/47, 14.9; 3/20/48, 17.1; 12/3/48, 16.0; 3/8/49, 17.4; 11/9/49, 13.7; 3/22/50, 10.0; 11/3/50, 13.8; 4/2/51, 11.0; 11/11/51, 14.5; 4/3/52, 11.7.

16N 3E-9M1—Reference point—top of casing, elevation 71 feet. 400 feet east of Sinnard Road, 0.3 mile north of Paseo Avenue. 3/20/48, 11.5; 12/3/48, 10.8; 3/8/49, 11.3; 11/9/49, 8.7; 3/22/50, 9.1; 11/3/50, 9.0; 4/2/51, 7.3; 11/14/51, 8.8; 4/3/52, 5.9.

16N 3E-9Q1—Reference point—top of casing, elevation 75 feet. 60 feet west of Kent Avenue, 150 feet north of Paseo Avenue. 11/10/47, 16.4; 3/20/48, 19.1; 5/13/48, 13.4; 12/3/48, 18.6; 3/8/49, 18.2; 11/8/49, 17.2.

16N 3E-11C1—Reference point—base of pump, elevation 79 feet. 0.50 mile west of State Highway 24 on Ramirez Road extension. 11/4/47, 21.2; 3/23/48, 18.9; 5/7/48, 16.6; 12/3/48, 19.9; 1/26/49, 19.4; 3/21/49, 19.0; 11/15/49, 22.4; 3/21/50, 18.1; 11/7/50, 22.6; 3/29/51, 14.4; 11/15/51, 20.8; 4/6/52, 10.6.

16N 3E-11E1—Reference point—top of casing, elevation 78 feet. 0.75 mile west of State Highway 24, 0.45 mile south of Ramirez Road. 11/5/47, 21.2; 3/23/48, 18.3; 12/3/48, 20.7; 3/21/49, 17.6; 11/15/49, 21.6.

16N 3E-11F1—Reference point—top of casing, elevation 77 feet. 0.50 mile west of State Highway 24, 0.35 mile south of Ramirez Road. 11/5/47, 20.6; 3/23/48, 18.6; 12/3/48, 19.1; 3/21/49, 17.0; 11/15/49, 21.1.

16N 3E-11F2—Reference point—base of pump, elevation 76 feet. 0.50 mile west of State Highway 24, 0.30 mile south of Ramirez Road. 11/5/47, 19.8; 3/23/48, 17.5; 12/3/48, 19.2; 3/21/49, 15.2; 11/15/49, 20.3.

16N 3E-11K1—Reference point—base of pump, elevation 76 feet. 0.20 mile west of State Highway 24, 0.70 mile south of Ramirez Road. 11/5/47, 19.8; 3/23/48, 20.6; 12/3/48, 18.0; 3/18/49, 16.5; 11/15/49, 19.4.

16N 3E-11L1—Reference point—top of casing, elevation 76 feet. 0.40 mile west of State Highway 24, 0.7 mile south of Ramirez Road. 11/5/47, 18.0; 3/23/48, 16.2; 12/3/48, 16.1; 3/18/49, 14.6; 11/15/49, 17.8.

16N 3E-11Q1—Reference point—top of casing, elevation 75 feet. 750 feet west of State Highway 24, 0.9 mile south of Ramirez Road. 11/5/47, 10.1; 12/3/48, 9.5; 3/18/49, 7.0; 11/15/49, 10.0.

16N 3E-12B1—Reference point—top of casing, elevation 79 feet. 20 feet south of Ramirez Road, 0.70 mile east of State Highway 24. 11/4/47, 16.4; 3/23/48, 14.5; 5/7/48, 13.1; 12/2/48, 14.5; 1/25/49, 14.2; 3/21/49, 13.0; 11/15/49, 16.7.

16N 3E-12B2—Reference point—top of casing, elevation 79 feet. 750 feet south of Ramirez Road, 0.75 mile east of State Highway 24. 11/4/47, 9.4; 3/23/48, 7.4; 12/2/48, 7.2; 3/21/49, 5.6; 11/15/49, 8.6.

16N 3E-12E1—Reference point—top of casing at bottom of pit, elevation 76 feet, 0.3 mile east of State Highway 24, 0.6 mile south of Ramirez Road. 11/5/47, 10.2; 3/23/48, 7.6; 12/6/48, 9.5; 3/18/49, 7.5; 11/15/49, 10.3; 3/21/50, 15.3; 11/7/50, 20.6*; 3/29/51, 11.9; 11/15/51, 18.2*; 4/6/52, 6.4*.

16N 3E-12L2—Reference point—top of casing, elevation 76 feet. 0.6 mile east of State Highway 24, 0.6 mile south of Ramirez Road. 11/7/47, 11.3; 3/23/48, 9.2; 12/6/48, 5.4; 3/18/49, 8.0; 11/15/49, 10.1.

16N 3E-13G1—Reference point—top of casing, elevation 72 feet. 2,600 feet north of Magnon Way, 4,300 feet east of State Highway 24. 11/7/47, 14.6; 3/25/48, 13.8; 12/10/48, 13.7; 11/16/49, 14.7; 3/21/50, 13.6; 11/7/50, 18.1; 3/29/51, 9.1; 4/6/52, 5.5.

16N 3E-14B1—Reference point—top of casing, elevation 75 feet. 500 feet west of State Highway 24, 1.2 miles south of Ramirez Road. 11/5/47, 9.2; 3/23/48, 8.1; 5/7/48, 5.8; 12/3/48, 7.8; 3/18/49, 6.1; 11/15/49, 9.3; 3/21/50, 10.0; 11/7/50, 10.3; 3/29/51, 1.7; 11/15/51, 7.9; 4/6/52, 3.7.

16N 3E-14C1—Reference point—top of casing, elevation 74 feet. 1.2 miles south of Ramirez Road, 0.4 mile west of State Highway 24. 11/5/47, 9.75; 3/25/48, 9.1; 12/3/48, 6.8; 3/18/48, 6.8; 11/15/49, 9.9.

16N 3E-14D1—Reference point—top of casing, elevation 72 feet. 1.2 miles south of Ramirez Road, 0.5 mile west of State Highway 24. 11/5/47, 9.9; 3/23/48, 10.7; 5/7/48, 5.8; 12/3/48, 8.9; 1/26/49, 7.9; 3/18/49, 7.0; 11/15/49, 10.2; 3/21/50, 13.9; 11/7/50, 11.2; 3/29/51, 9.4; 11/15/51, 15.8.

16N 3E-14J1—Reference point—hole in front of base of pump, elevation 71 feet. 600 feet north of Magnolia Way, 950 feet east of State Highway 24. 11/8/47, 16.1; 3/25/48, 14.8; 12/3/48, 15.3; 3/18/49, 13.1; 11/16/49, 16.5.

16N 3E-14L1—Reference point—top of casing at bottom of 12-foot pit, elevation 59 feet. 0.5 mile west of State Highway 24, 1.5 miles south of Ramirez Road. 11/8/47, 6.7; 3/25/48, 5.1; 12/3/48, 5.3; 3/18/49, 5.1; 11/16/49, 7.3; 3/21/50, 3.2; 11/7/50, 7.8; 3/29/51, 12.0*; 11/15/51, 18.8*; 4/6/52, 6.0.

16N 3E-16M1—Reference point—top of concrete block, elevation 70 feet. 900 feet south of Cutting Avenue, 300 feet east of U. S. Highway 99E. 11/10/47, 7.65; 3/20/48, 11.7; 12/3/48, 8.9.

16N 3E-17C1—Reference point—top of flange under pump, elevation 72.4 feet. 400 feet east of Larkin Road, 0.8 mile north of Clark Road. 12/23/47, 8.7; 3/1/48, 8.8; 12/4/48, 7.7, 3/21/49, 6.5; 11/9/49, 7.8; 3/22/50, 7.6; 11/3/50, 8.9; 4/3/51, 7.5; 11/14/51, 8.2; 4/2/52, 6.9.

16N 3E-17Q1—Reference point—top of concrete pit, elevation 70.5 feet. 0.2 mile east of Larkin Road, 500 feet north of Clark Road. 12/23/47, 9.3; 3/2/48, 10.1; 5/4/48, 8.0; 6/1/48, 7.0; 12/1/48, 9.4; 1/20/49, 9.8; 3/21/49, 7.5; 5/26/49, 7.0; 6/30/49, 5.6; 7/31/49, 6.2; 8/31/49, 6.5; 11/10/49, 8.7; 3/22/50, 8.9; 11/3/50, 8.8; 4/3/51, 6.8; 11/14/51, 7.9; 4/3/52, 5.4.

* Top of pit.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

16N/3E-18C1—Reference point—top of casing, elevation 68.3 feet. 100 feet south of Paseo Avenue, 100 feet west of Broadway. 12/23/47, 6.4; 3/1/48, 6.3; 12/4/48, 8.3; 1/20/49, 6.2; 3/21/49, 4.1.

16N/3E-19C1—Reference point—top of casing, elevation 66.8 feet. 250 feet west of Broadway, 0.1 mile south of Clark Road. 12/23/47, 7.1; 3/2/48, 7.2; 12/4/48, 6.8; 3/21/49, 4.7; 11/10/49, 5.5; 3/22/50, 8.6; 11/3/50, 6.3; 4/3/51, 6.4; 11/14/51, 6.7; 4/2/52, 5.7.

16N/3E-20E1—Reference point—slot in concrete base, elevation 69.8 feet. 200 feet west of Marden Avenue, 0.2 mile south of Clark Road. 12/23/47, 10.4; 3/24/48, 11.3; 12/4/48, 10.2; 3/21/49, 8.1; 5/26/49, 7.5; 6/28/49, 7.8; 7/27/49, 9.3; 8/25/49, 8.7; 11/10/49, 9.7; 3/22/50, 10.0; 11/3/50, 9.3; 4/3/51, 9.6; 11/14/51, 10.3; 4/2/52, 9.2.

16N/3E-21D1—Reference point—hole in base of pump, elevation 70 feet. 200 feet south of Clark Road, 0.6 mile east of Larkin Road. 12/23/47, 10.7; 3/2/48, 11.4; 12/3/48, 10.3; 11/8/49, 10.3; 3/22/50, 9.6; 11/3/50, 10.3; 4/3/51, 6.4; 11/4/51, 9.2; 4/3/52, 4.0.

16N/3E-21J1—Reference point—top of casing, elevation 68.0 feet. 0.4 mile east of U. S. Highway 99E, 0.3 mile north of Encinal Road. 11/10/47, 17.9; 3/20/48, 16.4; 5/13/48, 13.3; 12/3/48, 17.5; 1/21/49, 17.0; 3/8/49, 16.8; 11/10/49, 18.6; 3/22/50, 17.2; 4/3/51, 10.5; 11/14/51, 16.5; 4/3/52, 5.2.

16N/3E-21P2—Reference point—top of casing, elevation 65.9 feet. West side of Southern Pacific Railroad Right of Way, 0.1 mile north of Encinal Road. 12/23/47, 14.5; 3/2/48, 15.3; 12/3/48, 14.1; 3/21/49, 13.0; 11/10/49, 15.3.

16N/3E-23C1—Reference point—top of casing, elevation 71 feet. 0.25 mile west of State Highway 24 at a point 0.4 mile south of Magnolia Way intersection. 11/8/47, 17.2; 3/25/48, 15.9; 5/19/48, 13.9; 12/2/48, 15.9; 1/26/49, 15.5; 3/8/49, 13.0.

16N/3E-23J1—Reference point—top of casing, elevation 70 feet. 0.1 mile east of State Highway 24, 0.3 mile north of Woodruff Lane. 11/8/47, 14.3; 3/25/48, 13.1; 5/19/48, 11.9; 12/2/48, 14.6; 3/18/49, 13.0; 11/16/49, 15.1.

16N/3E-23R3—Reference point—center of pump shaft, elevation 70 feet. 200 feet north of Woodruff Lane, 0.3 mile east of State Highway 24. 11/8/47, 14.0; 3/25/48, 13.0; 12/2/48, 13.0; 3/18/49, 11.5; 11/16/49, 13.9.

16N/3E-24A1—Reference point—top of casing, elevation 70 feet. 0.2 mile south of Magnolia Way extended 1.1 miles east of State Highway 24. 11/7/47, 13.8; 3/25/48, 13.5; 12/2/48, 13.7; 1/26/49, 14.4; 3/18/49, 11.1; 11/16/49, 14.5; 3/21/50, 12.1; 11/6/50, 15.8; 3/29/51, 9.4; 11/15/51, 15.1; 4/6/52, 6.0.

16N/3E-24C1—Reference point—top of casing, elevation 70 feet. 0.4 mile south of Magnolia Way, 0.75 mile east of State Highway 24. 11/7/47, 12.3; 3/25/48, 11.7; 12/10/48, 12.1; 3/18/49, 9.8; 11/16/49, 13.2.

16N/3E-24Q1—Reference point—top of casing in pit, elevation 66 feet. North of Woodruff Lane, 1.05 miles east of State Highway 24. 11/7/47, 4.2; 3/25/48, 4.2; 5/19/48, 2.9; 11/30/48, 4.6; 11/16/49, 11.8; 3/21/50, 8.8; 11/6/50, 12.8; 3/29/51, 6.9; 11/15/51, 17.3; 9/6/52, 5.0.

16N/3E-24R2—Reference point—hole in pump base, elevation 69 feet. 0.1 mile north of Woodruff Lane, 0.1 mile east of State Highway 24. 6/2/48, 11.8; 7/1/48, 15.2; 7/21/48, 15.5; 8/1/48, 18.1; 9/2/48, 17.3.

16N/3E-26F1—Reference point—hole in pump base, elevation 69 feet. 0.45 mile west of State Highway 24, at a point 0.3 mile south of Woodruff Lane intersection. 11/15/47, 18.0; 5/3/48, 12.3; 6/1/48, 13.2; 11/30/48, 18.2; 12/13/48, 18.1; 1/26/49, 15.5; 3/18/49, 14.1; 12/9/49, 18.7; 3/21/50, 14.0; 11/6/50, 17.8; 11/10/50, 18.6; 3/29/51, 10.1; 11/15/51, 17.4; 12/7/51, 14.7; 4/6/52, 5.9.

16N/3E-26F2—Reference point—top of concrete pit, elevation 68 feet. 0.5 mile west of State Highway 24, at a point 0.3 mile south of Woodruff Lane intersection. 11/26/29, 15.9; 9/25/30, 15.6; 12/16/31, 16.7; 12/6/32, 16.8; 12/14/33, 16.5; 11/23/34, 16.9; 11/24/36, 15.8; well destroyed.

16N/3E-26G1—Reference point—hole in pump base, elevation 68 feet. 0.25 mile west of State Highway 24 at a point 0.3 mile south of Woodruff Lane intersection. 5/7/48, 12.2; 6/30/48, 52.6 (operating); 11/30/48, 13.6.

16N/3E-26G2—Reference point—top of casing, elevation 68 feet. 0.15 mile west of State Highway 24, at a point 0.3 mile south of Woodruff Lane intersection. 12/1/37, 11.0; 1/27/39, 9.4; 1/10/41, 6.5.

16N/3E-27E1—Reference point—top of casing, elevation 66 feet. 0.1 mile north of Morse Road, 0.4 mile east of U. S. Highway 99E. 3/17/48, 21.9; 11/29/48, 23.7; 3/17/49, 20.0; 5/26/49, 20.5; 6/28/49, 24.5; 7/27/49, 25.1; 8/25/49, 26.2; 11/14/49, 25.2.

16N/3E-28C1—Reference point—top of concrete pit, elevation 65 feet. 0.05 mile south of Encinal Road, 0.1 mile west of U. S. Highway 99E. 3/17/48, 14.2; 11/29/48, 14.6; 3/17/49, 13.7; 11/14/49, 15.5.

16N/3E-28E1—Reference point—top of casing, elevation 65 feet. 0.25 mile south of Encinal Avenue, 0.35 mile west of U. S. Highway 99E. 11/4/47, 17.5.

16N/3E-28N1—Reference point—top of casing, elevation 64.6 feet. 200 feet north of Sanders Road, 0.6 mile east of Larkin Road. 12/19/47, 17.2; 11/29/48, 17.5; 3/17/49, 15.8; 11/10/49, 18.6; 3/22/50, 15.9; 11/3/50, 18.9; 4/3/51, 11.2; 11/14/51, 16.6; 4/3/52, 7.6.

16N/3E-29B1—Reference point—top of concrete pit, elevation 66.8 feet, South side of Encinal Road, 0.2 mile east of Larkin Road. 12/23/47, 12.8; 3/2/48, 13.6; 5/13/48, 11.5; 12/4/48, 13.0; 1/19/49, 13.0.

16N/3E-29N1—Reference point—top of concrete pit, elevation 65.8 feet. 0.25 mile west of Sacramento Northern Railroad tracks, 0.25 mile north of Sanders Road. 12/19/47, 15.3; 3/2/48, 15.2; 12/1/48, 14.3; 3/16/49, 14.0; 1/10/49, 14.7; 3/22/50, 13.2; 11/3/50, 14.5; 4/3/51, 9.6; 11/14/51, 12.4; 4/3/52, 7.3.

16N/3E-29R1—Reference point—hole in pump base, elevation 62 feet. 150 feet north of Sanders Road, 0.4 mile east of Larkin Road. 5/4/48, 17.3; 6/1/48, 16.1; 11/29/48, 19.6.

16N/3E-30A2—Reference point—top of casing, elevation 68.8 feet. 0.1 mile south of Encinal Road, 0.35 mile east of Broadway. 12/23/47, 12.1; 3/2/48, 12.8; 12/4/48, 11.9; 3/21/49, 11.4; 11/10/49, 11.0.

16N/3E-30F1—Reference point—top of pit wall, elevation 64.3 feet. 0.1 mile west of Broadway, 0.45 mile south of Encinal Road. 12/23/47, 11.1; 3/2/48, 11.6; 12/4/48, 10.8; 1/19/49, 10.7; 3/21/49, 9.0; 11/10/49, 10.5; 3/22/50, 10.1; 11/3/50, 10.7; 4/3/51, 9.2; 11/14/51, 10.8; 4/3/52, 6.7.

16N/3E-30L1—Reference point—top of casing next to pump, elevation 62.5 feet. 0.4 mile north of Sanders Road, 400 feet west of Broadway. 12/19/47, 8.9; 3/2/48, 9.5; 12/1/48, 8.7; 3/16/49, 8.8; 11/10/49, 7.8.

16N/3E-30R1—Reference point—top of casing next to pump, elevation 62.5 feet. 500 feet north of Sanders Road, 0.5 mile west of Sacramento Northern Railroad. 12/19/47, 12.9; 3/2/48, 12.6.

16N/3E-31D1—Reference point—top of casing under pump, elevation 60.4 feet. 500 feet south of Sanders Road, 0.2 mile west of Broadway Road. 12/19/47, 9.1; 3/3/48, 9.7; 3/16/49, 9.5.

16N/3E-31K2—Reference point—top of tin cover under pump, elevation 63.2 feet. 0.2 mile east of Broadway Road, 0.5 mile south of Sanders Road. 12/19/47, 13.7; 3/3/48, 14.1; 12/1/48, 17.3; 3/16/49, 16.4; 11/11/49, 18.3; 3/22/50, 15.2; 11/6/50, 19.3; 4/3/51, 12.1; 11/14/51, 16.6; 4/3/52, 17.0.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

16N 3E-32A2—Reference point—pump base hole, elevation 64.9 feet, 200 feet south of Sanders Road, 0.6 mile east of Sacramento Northern Railroad. 1/6/48, 19.5; 3/2/48, 19.7; 11/29/48, 21.0; 3/17/49, 17.0; 11/10/49, 19.8.

16N 3E-32B2—Reference point—top of 2" x 14" bridge over earth pit, elevation 64.4 feet, 200 feet south of Sanders Road, 0.3 mile east of Sacramento Northern Railroad. 12/19/47, 15.9; 3/2/48, 17.25; 12/1/48, 16.2; 3/17/49, 15.0; 11/10/49, 17.7.

16N 3E-32C2—Reference point—top of casing under pump, elevation 64.4 feet, 0.2 mile south of Sanders Road, 200 feet west of Sacramento Northern Railroad. 12/19/47, 18.1; 3/2/48, 18.7; 12/1/48, 16.9; 3/17/49, 16.1; 11/11/49, 18.5; 3/22/50, 15.9; 11/3/50, 18.2; 4/3/51, 11.3; 11/14/51, 16.1; 4/3/52, 6.4.

16N 3E-32G2—Reference point—hole in pump base, elevation 62.8 feet, 0.5 mile south of Sanders Road, 0.3 mile east of Sacramento Northern Railroad. 12/19/47, 18.9; 3/2/48, 20.2; 12/1/48, 16.9; 3/17/49, 16.8; 11/11/49, 19.8.

16N 3E-33D1—Reference point—top of concrete base, elevation 61.2 feet, 100 feet south of Sanders Road at a point 0.55 mile west of U. S. Highway 99E. 11/4/47, 17.2; 11/29/48, 19.2; 1/20/49, 17.2; 3/17/49, 16.8; 5/26/49, 17.1; 6/28/49, 19.3; 7/27/49, 26.15; 8/25/49, 25.9; 11/14/49, 20.0.

16N 3E-33E1—Reference point—top of concrete base under pump, elevation 64.1 feet, 0.3 mile south of Sanders Road at a point 0.8 mile west of U. S. Highway 99E. 11/4/47, 17.6; 3/17/48, 21.3; 5/13/48, 15.6; 11/29/48, 17.3; 11/14/49, 18.7; 3/22/50, 16.0; 11/6/50, 19.1; 4/3/51, 11.6; 4/3/52, 7.6.

16N 3E-33J2—Reference point—edge of pump base, elevation 66 feet, 150 feet west of U. S. Highway 99E at a point 0.45 mile north of Eager Road. 5/12/48, 20.3; 11/29/48, 27.0; 1/20/49, 23.0; 3/17/49, 22.0; 11/14/49, 27.3; 3/22/50, 22.0; 11/6/50, 25.4; 4/3/51, 17.2.

16N 3E-33P1—Reference point—hole beneath pump base, elevation 61.9 feet, 250 feet north of Eager Road at a point 0.6 mile west of U. S. Highway 99E. 1/9/48, 22.9; 11/22/48, 22.6; 3/17/49, 22.5; 11/14/49, 25.5.

16N 3E-35G1—Reference point—top of volute plug, elevation 67 feet, 100 feet north of Ellis Road at a point 0.5 mile west of State Highway 24. 11/6/47, 17.1; 1/26/49, 14.7; 3/18/49, 18.0; 11/16/49, 22.3.

16N 3E-35J1—Reference point—top of casing, elevation 70 feet, 100 feet south of Ellis Road at a point 0.2 mile west of State Highway 24. 11/6/47, 18.7; 3/29/48, 17.7; 11/30/48, 19.0; 3/17/49, 17.0; 11/16/49, 20.2.

16N 3E-35L1—Reference point—top of air gage hole, elevation 65 feet, 0.2 mile south of Ellis Road at a point 0.7 mile west of State Highway 24. 11/6/47, 20.2; 3/20/48, 20.1; 11/30/48, 20.3; 3/17/49, 29.1; 11/16/49, 22.9; 3/21/50, 17.4; 11/6/50, 22.9; 3/29/51, 19.5; 11/15/51, 23.5; 4/6/52, 10.1.

16N 3E-36G1—Reference point—top of concrete base under pump, elevation 64 feet, 300 feet north of Bills Road at a point 0.5 mile east of State Highway 24. 11/5/47, 11.7; 3/29/48, 11.4; 5/7/48, 10.0; 11/30/48, 12.2; 3/18/49, 9.6; 11/16/49, 12.4; 3/21/50, 11.1; 11/6/50, 12.7; 3/29/51, 6.7; 11/15/51, 11.8; 4/6/52, 4.6.

16N 4E-4L1—Reference point—top of concrete cribbing, elevation 96 feet, 0.15 mile west of La Porte Road, 0.30 mile north of Ramirez Road. 11/19/47, 22.4; 3/15/48, 22.8; 12/1/48, 23.1; 3/23/49, 21.0; 3/22/50, 21.9; 10/31/50, 26.7; 3/28/51, 23.5.

16N 4E-4N1—Reference point—top of casing, elevation 94 feet, 100 feet north of Ramirez Road, 0.05 mile east of Loma Rica Road. 3/15/48, 10.8.

16N 4E-5G1—Reference point—top of concrete cribbing, elevation 91 feet, 0.15 mile north of Ramirez Road, 0.5 mile west of Loma Rica Road. 11/19/47, 19.4; 3/15/48, 19.4; 12/1/48, 20.9; 3/23/49, 18.0; 12/9/49, 22.5; 3/22/50, 20.6; 10/31/50, 24.9; 3/28/51, 19.2; 11/14/51, 23.4; 4/6/52, 23.4.

16N 4E-6H1—Reference point—base of pump, elevation 85 feet, 0.50 mile north of Ramirez Road, 1.0 mile west of Loma Rica Road. 11/4/47, 17.8; 11/18/47, 17.2; 3/15/48, 17.6; 3/23/48, 17.4; 12/1/48, 18.4; 12/2/48, 19.0; 1/26/49, 17.1; 3/21/49, 16.2; 11/15/49, 20.7; 3/22/50, 17.6; 3/29/51, 16.7.

16N 4E-6J1—Reference point—top of casing, elevation 86 feet, 0.25 mile north of Ramirez Road, 1.0 mile west of Loma Rica Road. 11/4/47, 19.4; 11/19/47, 19.2; 3/15/48, 19.2; 3/23/48, 19.2; 12/1/48, 19.4; 12/2/48, 20.0; 3/21/49, 18.1; 11/15/49, 22.6; 3/21/50, 20.0; 3/22/50, 20.0; 11/7/50, 23.8; 11/15/51, 22.7; 4/6/52, 16.5.

16N 4E-6N1—Reference point—top of casing, elevation 80 feet, 30 feet north of Ramirez Road, 1.1 miles east of State Highway 24. 11/4/47, 16.9; 3/23/48, 15.5; well destroyed.

16N 4E-7B1—Reference point—top of casing, elevation 82 feet, 200 feet south of Ramirez Road, 1.5 miles west of Loma Rica Road. 11/4/47, 16.6; 3/23/48, 15.5; 12/2/48, 17.0; 3/21/49, 16.1; 11/15/49, 18.6.

16N 4E-8A1—Reference point—hole in pump base, elevation 91 feet, 150 feet south of Ramirez Road, 0.15 mile west of Loma Rica Road. 11/19/47, 18.8; 3/15/48, 20.0; 5/7/48, 17.5; 3/23/49, 17.8; 6/7/49, 40.5; 7/3/49, 37.3; 8/2/49, 37.6; 11/15/49, 22.0; 3/22/50, 19.8; 10/31/51, 18.9; 11/14/51, 23.0; 11/27/51, 22.6; 4/6/52, 18.0.

16N 4E-8A2—Reference point—top of casing, elevation 94 feet. South side of Ramirez Road, 0.15 mile west of Loma Rica Road. 11/26/29, 18.4; 9/25/30, 17.6; 12/14/31, 19.5; 12/6/32, 19.2; 12/14/33, 19.6; 11/23/34, 19.8; 11/24/36, 18.1; 11/23/37, 17.8; 11/27/39, 15.7; 1/9/41, 16.8; 11/5/47, 18.1; 12/13/48, 21.0; 12/9/49, 22.1; 11/10/50, 23.6.

16N 4E-9J1—Reference point—top of casing, elevation 95 feet, 200 feet west of Bangor Road, 0.6 mile south of Ramirez Road. 11/19/47, 23.2; 3/15/48, 23.4; 12/1/48, 24.0; 3/23/49, 21.8; 11/15/49, 26.6.

16N 4E-10E1—Reference point—top of casing at bottom of pit, elevation 80 feet, 400 feet east of Bangor Road, 0.35 mile south of Ramirez Road. 3/15/48, 2.4; 12/1/48, 3.4; 3/23/49, 2.6.

16N 4E-16A1—Reference point—hole in 4" x 4" board support, elevation 90 feet, 0.1 mile east of Bangor Road, 1.1 mile south of Ramirez Road. 11/19/47, 19.8; 3/15/48, 20.5; 5/7/48, 19.6; 12/1/48, 20.0; 3/23/49, 20.0; 11/17/49, 23.6; 3/23/50, 21.9; 10/31/50, 25.3; 3/28/51, 21.4; 11/14/51, 24.7; 4/6/52, 20.6.

16N 4E-16E1—Reference point—hole in pump base, elevation 81 feet, 100 feet east of Loma Rica Road, 1.25 miles south of Ramirez Road. 11/19/47, 13.0; 3/15/48, 9.3; 12/1/48, 13.6; 3/23/49, 11.8; 11/17/49, 16.5; 3/23/50, 14.5; 3/28/51, 13.1; 11/14/51, 14.6; 4/6/52, 10.8.

16N 4E-21M1—Reference point—top of casing, elevation 75 feet, 0.1 mile east of Loma Rica Road, 0.15 mile south of Bangor Road. 11/19/47, 5.6; 3/15/48, 6.5; 12/1/48, 6.2; 3/23/49, 4.0.

16N 4E-25M1—Reference point—top of concrete floor at bottom of pit, elevation 89 feet, 0.1 mile south of State Highway 20, 1.50 miles east of Loma Rica Road. 11/26/47, 2.8; 3/3/48, 5.0.

16N 4E-26F1—Reference point—top of casing, elevation 91 feet, 0.20 mile north of State Highway 20, 0.85 mile east of Loma Rica Road. 11/26/47, 16.5; 3/3/48, 17.4; 11/29/48, 16.9; 3/23/49, 17.2; 11/18/49, 17.8.

16N 4E-27F1—Reference point—bottom of 90° elbow on suction pipe, elevation 93.6 feet, 600 feet north of Woodruff Lane, 0.20 mile west of Loma Rica Road. 11/26/47, 7.3; 11/18/49, 8.4.

16N 4E-27M1—Reference point—top of casing, elevation 89 feet, 150 feet south of Woodruff Lane, 0.2 mile west of State Highway 20. 12/6/32, 6.4; 12/14/33, 6.9; 11/23/34, 6.9; 11/28/36, 5.6; 11/23/37, 11.6 (operating); 1/9/41, 2.7.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

16N/4E-27N1—Reference point—top of casing, elevation 89.0 feet, 500 feet north of State Highway 20, 0.30 mile south of Woodruff Lane. 11/27/29, 10.9; 9/25/30, 8.3; 12/14/31, 11.3; 1/9/41, 4.8; 11/5/47, 7.5; 11/26/47, 4.9; 3/3/48, 13.7; 11/29/48, 11.2; 12/13/48, 12.0; 3/23/49, 11.0; 11/18/49, 10.2; 12/9/49, 11.7; 3/23/50, 12.5; 10/31/50, 8.8; 3/30/51, 10.7; 11/14/51, 10.5; 11/27/51, 11.8; 4/6/52, 8.2.

16N/4E-28B1—Reference point—top of casing, elevation 89.4 feet, 0.25 mile north of Woodruff Lane, 0.60 mile east of Kimball Lane. 11/26/47, 13.3; 3/3/48, 16.1; 11/29/48, 13.7; 3/23/49, 12.2; 11/18/49, 12.8.

16N/4E-28E1—Reference point—top of 90° elbow, elevation 80.9 feet, 0.20 mile north of Woodruff Lane, 0.15 mile east of Kimball Lane. 11/26/47, 9.7; 3/3/48, 10.8; 11/29/48, 10.2; 3/23/49, 7.0; 11/18/49, 9.5; 3/23/50, 10.0; 10/31/50, 8.2; 3/30/51, 9.7; 11/14/51, 9.1; 4/6/52, 7.9.

16N/4E-29B1—Reference point—top of casing, elevation 78.1 feet, 500 feet west of Mathews Lane, 0.35 mile north of Woodruff Lane. 11/26/47, 8.7; 3/3/48, 9.6; 5/7/48, 8.1; 11/29/48, 9.3; 3/23/49, 7.2; 11/17/49, 9.5; 10/31/50, 9.0.

16N/4E-33B1—Reference point—top of casing, elevation 83 feet, 200 feet north of West Hallwood Road, 0.6 mile west of State Highway 20. 11/26/47, 7.7; 3/3/48, 10.6; 11/30/48, 8.5; 3/23/49, 13.0; 11/15/49, 7.9.

16N/4E-33J1—Reference point—top of casing, elevation 88.7 feet, 200 feet east of State Highway 20, 0.45 mile south of West Hallwood Road. 11/26/47, 11.8; 3/3/48, 14.9; 3/23/49, 13.0; 11/18/49, 11.8.

16N/4E-33K1—Reference point—top of casing, elevation 84.0 feet, 200 feet northwest of State Highway 20, 0.70 mile south of West Hallwood Road. 11/26/47, 9.2; 3/8/48, 12.1; 11/30/48, 10.5; 3/23/49, 9.7; 11/18/49, 9.7.

16N/4E-33N1—Reference point—top of casing cap, elevation 80.1 feet, 200 feet northwest of State Highway 20, 1.3 miles south of West Hallwood Road. 11/26/47, 8.3; 3/4/48, 11.5; 11/30/48, 10.6; 3/23/49, 9.2; 11/18/49, 10.0; 3/23/50, 10.2; 10/31/50, 9.3; 3/30/51, 9.1; 11/14/51, 10.0; 4/5/52, 7.4.

16N/4E-34B1—Reference point—top of casing, elevation 96.8 feet, 100 feet north of West Hallwood Road, 200 feet east of levee. 11/25/47, 14.4; 3/3/48, 20.5; 11/29/48, 19.5; 3/22/49, 15.8; 11/18/49, 14.6.

16N/4E-34D1—Reference point—top of casing, elevation 91.9 feet, 600 feet west of State Highway 20, 0.20 mile north of West Hallwood Road. 11/26/47, 12.7; 3/3/48, 16.1; 11/30/48, 13.8; 3/23/49, 13.5; 11/18/49, 13.0.

16N/4E-34L1—Reference point—top of casing 2.5 feet above ground, elevation 98.5 feet, 0.4 mile north of Walnut Road, 200 feet west of Hallwood Road. 10/25/47, 17.5; 3/3/48, 21.7; 11/29/48, 18.7; 3/22/49, 19.9; 11/18/49, 18.3.

16N/4E-34Q1—Reference point—top of casing under pump, elevation 95.3 feet, 400 feet north of Walnut Road, 400 feet east of Hallwood Road. 11/25/47, 16.7; 3/3/48, 21.1; 11/29/48, 17.7; 3/22/49, 19.3; 11/18/49, 16.7; 3/23/50, 19.7; 10/31/50, 16.6; 3/30/51, 17.6; 11/14/51, 17.1; 4/6/52, 15.1.

16N/4E-35M1—Reference point—top of casing under pump, elevation 101.1 feet, 0.6 mile east of Hallwood Road, 0.5 mile north of Walnut Road. 11/25/47, 15.3; 3/3/48, 17.9; 4/1/48, 18.1; 3/23/49, 16.8; 11/18/49, 16.6.

17N/1E-25J1—Reference point—hole in base of pump, elevation 77 feet, 100 feet south of North Butte Road, 0.4 mile west of 90° turn (NW.) in North Butte Road. 3/25/48, 18.9; 12/3/48, 19.7; 3/30/49, 16.7; 11/15/49, 22.0; 3/24/50, 16.6; 11/2/50, 21.6; 3/27/51, 21.2; 11/13/51, 23.8.

17N/2E-22R1—Reference point—top of casing, elevation 79.5 feet, 0.07 mile northwest of intersection of Krehe and Lucerne Roads. 12/22/47, 7.7; 3/2/48, 8.3; 11/15/49, 7.4.

17N/2E-24N1—Reference point—top of casing, elevation 81.1 feet, 100 feet north of Lucerne Road, 0.95 mile west of Township Road. 12/22/47, 7.4; 3/1/48, 8.2; 12/8/48, 8.0; 1/21/49, 7.5; 3/30/49, 4.5; 11/8/49, 6.5.

17N/2E-29M1—Reference point—hole in pump base, elevation 79.6 feet, 0.1 mile east of Crane Road, 0.3 mile north of Bigelow Road. 12/22/47, 14.6; 12/3/48, 16.1; 3/30/49, 12.6; 11/15/49, 16.1; 3/24/50, 13.5; 3/27/51, 12.6.

17N/2E-29Q1—Reference point—top of casing, elevation 77.9 feet, 0.1 mile, east-northeast of 90° turn in Bigelow Road, at a point 0.5 mile east of Crane Road. 12/23/47, 13.9; 3/2/48, 15.1; 12/3/48, 15.5; 3/30/49, 12.0; 11/15/49, 14.3.

17N/2E-30N1—Reference point—top of casing, elevation 83 feet, 0.15 mile south of Pennington Road at a point 0.1 mile west of Pennington School. 3/25/48, 22.9; 12/3/48, 24.1; 3/30/49, 21.3; 11/15/49, 25.2

17N/2E-31A1—Reference point—top of casing, elevation 85 feet, 100 feet north of Pennington Road at a point 0.1 mile west of Bigelow and Pennington Roads intersection. 3/25/48, 23.5; 12/3/48, 24.7; 3/30/49, 22.8; 11/15/49, 25.5; 3/24/50, 23.0; 11/2/50, 26.7; 3/27/51, 21.8; 11/13/51, 28.3; 4/2/52, 20.2.

17N/2E-33J1—Reference point—top of casing, elevation 71.3 feet, 0.35 mile north of Pennington Road, 1.05 miles west of Krehe Road. 12/23/47, 6.1; 3/2/48, 6.5; 12/13/48, 6.2; 3/30/49, 4.0; 11/15/49, 3.7.

17N/2E-34A1—Reference point—top of casing, elevation 74.6 feet, East side of Krehe Road, 0.9 mile north of Pennington Road. 12/22/47, 6.8; 3/1/48, 7.2; 12/8/48, 6.8; 1/21/49, 6.6; 3/30/49, 5.0; 11/8/49, 4.2; 3/21/50, 6.7; 11/2/50, 4.9; 3/27/51, 12.7 (operating); 11/13/51, 6.2; 4/2/52, 5.8.

17N/2E-34Q1—Reference point—top of outer casing, elevation 71.8 feet, North side of Pennington Road, 0.5 mile west of Krehe Road. 12/22/47, 6.4; 3/2/48, 7.1; 12/3/48, 7.0; 3/30/49, 5.0; 11/15/49, 5.7; 3/24/50, 5.5; 11/2/50, 5.5; 3/27/51, 6.6; 11/13/51, 6.1; 4/2/52, 5.4.

17N/2E-35A1—Reference point—top of casing, elevation 75.2 feet, 50 feet west of Schroeder Road, 0.95 mile north of Pennington Road. 12/22/47, 4.7; 3/1/48, 5.7; 12/8/48, 5.5; 3/30/49, 4.0; 5/26/49, 3.8; 6/28/49, 4.2; 7/27/49, 3.4; 8/25/49, 3.5; 11/8/49, 4.4; 3/21/50, 6.0; 11/2/50, 5.9; 3/27/51, 5.0; 11/13/51, 6.2; 4/2/52, 5.5.

17N/2E-36H1—Reference point—top of casing, elevation 76 feet, 300 feet west of Township Road, 0.6 mile north of Pennington Road. 3/26/48, 7.0; 12/8/48, 7.9.

17N/3E-22R1—Reference point—top of casing, elevation 86 feet, 0.25 mile north of Laurel Road at a point 0.48 mile west of intersection with Thame Road. 10/29/47, 23.3; 3/22/48, 26.0; 12/10/48, 21.9; 3/8/49, 21.2; 11/14/49, 23.3; 3/21/50, 22.2; 11/7/50, 23.4; 3/28/51, 16.8; 11/15/51, 22.1; 4/6/52, 13.6.

17N/3E-23P1—Reference point—hole in concrete base, elevation 87 feet, 0.37 mile north of Laurel Road, due north of intersection with Thame Road. 10/29/47, 22.7; 12/10/48, 20.5; 3/8/49, 20.0; 11/14/49, 22.9.

17N/3E-25G1—Reference point—hole in base of pump, elevation 85 feet, 2.57 miles north of Ramirez Road, 0.53 mile east of State Highway 24. 10/29/47, 22.9; 3/22/48, 19.1; 12/10/48, 19.4; 3/8/49, 18.8; 11/14/49, 21.6; 3/21/50, 18.1; 11/7/50, 21.7; 3/28/51, 46.0 (operating); 11/15/51, 23.4; 4/6/52, 9.3.

17N/3E-25M1—Reference point—hole in base of pump, elevation 80 feet, 2.27 miles north of Ramirez Road, 0.15 mile east of State Highway 24. 10/29/47, 22.6; 3/22/48, 19.8; 12/10/48, 20.8.

17N/3E-25N1—Reference point—hole in base of pump, elevation 84 feet, 1.97 miles north of Ramirez Road, 0.24 mile east of State Highway 24. 3/22/48, 20.7; 12/10/48, 19.3; 3/8/49, 18.0; 11/14/49, 21.8.

TABLE 1—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Division of Water Resources
(Depths to water in feet measured from reference point)

17N 3E-25Q1—Reference point—hole in base of pump, elevation 84 feet, 2.27 miles north of Ramirez Road, 0.75 mile east of State Highway 24. 10/31/47, 18.7; 3/22/48, 18.7; 12/10/48, 17.7; 3/8/49, 15.3; 11/14/49, 20.2.

17N 3E-26A2—Reference point—hole in base of pump, elevation 85 feet, 0.04 mile south of Laurel Road, 0.10 mile west of State Highway 24. 10/28/47, 22.8; 3/28/48, 21.9; 12/10/48, 21.1; 1/26/49, 20.5; 3/8/49, 20.1; 11/14/49, 23.7; 3/21/50, 21.1; 11/7/50, 22.8; 3/28/51, 14.6; 11/15/51, 27.6; 4/6/52, 11.1.

17N 3E-26B1—Reference point—flange of suction line, elevation 87 feet, 0.07 mile north of Laurel Road, 0.28 mile west of State Highway 24. 10/29/47, 15.5; 3/22/48, 11.9; 5/7/48, 9.7; 12/10/48, 13.5; 3/8/49, 12.5; 11/14/49, 15.5.

17N 3E-26H1—Reference point—hole in base of pump, elevation 85 feet, 0.25 mile south of Laurel Road, 0.22 mile west of State Highway 24. 10/29/47, 24.1; 12/10/48, 22.6; 11/14/49, 23.7.

17N 3E-26R1—Reference point—hole in base of pump, elevation 84 feet, 0.10 mile west of State Highway 24, 0.65 mile south of Laurel Road. 10/29/47, 20.0; 3/22/48, 20.8; 12/10/48, 18.8; 3/8/49, 18.0; 11/14/49, 21.0.

17N 3E-28P1—Reference point—top of flange on suction pipe, elevation 82 feet, 0.18 mile east of Cooley Road, 1.10 miles north of intersection of Meteer Road. 10/31/47, 5.8; 3/20/48, 7.4; 5/30/48, 4.7; 12/8/48, 4.9; 3/8/49, 7.0; 11/8/49, 5.5; 3/22/50, 5.1; 11/3/50, 7.0; 3/27/51, 3.1; 11/14/51, 6.5; 4/3/52, 2.2.

17N 3E-29C1—Reference point—top of casing, elevation 82.4 feet, 0.21 mile west of Larkin Road, 0.04 mile north of Riviera Road. 12/22/47, 8.9; 3/1/48, 9.4; 12/8/48, 9.7; 3/30/49, 5.9; 11/8/49, 8.2; 3/21/50, 6.3; 11/2/50, 8.8; 3/27/51, 5.8; 11/13/51, 8.8; 4/2/52, 4.5.

17N 3E-29H1—Reference point—top of casing, elevation 77.7 feet, South side Riviera Road, 0.52 mile east of Larkin Road. 12/23/47, 5.0; 3/1/48, 5.6; 5/12/48, 3.5; 11/8/49, 4.7.

17N 3E-30F1—Reference point—top of casing, elevation 80.6 feet, South side Riviera Road, 0.35 mile east of Township Road. 11/26/29, 4.7; 9/27/30, 3.3; 12/16/31, 6.2; 12/9/32, 5.4; 12/13/33, 5.6; 11/21/34, 5.4; 11/23/37, 3.7; 1/26/39, 6.4; 1/10/40, 3.1; 11/4/47, 7.8; 12/5/47, 8.0; 12/22/47, 8.2; 3/1/48, 8.5; 12/8/48, 8.6; 12/13/48, 9.3; 11/8/49, 7.6; 3/30/49, 5.4; 3/21/50, 3.5.

17N 3E-30G1—Reference point—top of casing, elevation 81 feet. South Side of Riviera Road, 0.23 mile west of U. S. Highway 99E. 11/10/50, 8.6; 11/26/51, 8.7.

17N 3E-30N1—Reference point—top of pumphouse floor, elevation 73.0 feet, 0.08 mile east of Township Road, 1.25 miles north of Pennington Road. 12/22/47, 4.1; 3/1/48, 4.4; 5/13/48, 3.1; 12/8/48, 4.0; 1/21/49, 4.0; 3/30/49, 1.5; 5/26/49, 7.0; 6/28/49, 7.0; 7/27/49, 7.5; 8/25/49, 8.5; 11/8/49, 3.7; 3/21/50, 6.5; 11/2/50, 8.9; 3/27/51, 6.6; 11/13/51, 8.4; 4/2/52, 1.0.

17N 3E-31A2—Reference point—hole in base of pump, elevation 82 feet, 1.01 miles west of Township Road, 0.85 mile north of Pennington Road. 12/8/48, 10.0; 3/30/49, 6.6.

17N 3E-31M1—Reference point—top of casing, elevation 75 feet, 0.24 mile east of Township Road, 0.32 mile north of Pennington Road, 3/26/48, 7.1; 12/8/48, 9.1.

17N 3E-32B1—Reference point—top of casing, elevation 81.5 feet, 0.09 mile east of Larkin Road, 1 mile south of Riviera Road. 12/23/47, 12.2; 3/1/48, 12.4; 12/8/48, 11.7; 3/30/49, 8.1; 11/8/49, 13.3; 3/22/50, 7.8; 3/27/51, 6.5; 11/13/51, 9.8; 4/2/52, 4.7.

17N 3E-33Q1—Reference point—top of casing, elevation 80 feet. North side of Pennington Road, 0.50 mile east of Meteer Road. 11/10/47, 12.2; 3/20/48, 16.7; 12/3/48, 13.1; 3/8/49, 16.6; 11/9/49, 10.7; 3/22/50, 14.0; 11/3/50, 11.4; 4/2/51, 11.3; 11/14/51, 12.4; 4/3/52, 8.8.

17N 3E-35H1—Reference point—top of casing, elevation 82 feet, 0.05 mile west of State Highway 24, 1.57 miles north of Ramirez Road. 10/29/47, 21.5; 3/22/48, 19.0; 10/10/48, 19.7; 3/8/49, 19.0; 11/15/49, 22.2.

17N 3E-35H2—Reference point—hole in base of pump, elevation 82 feet, 1.67 miles north of Ramirez Road, west side of State Highway 24. 10/29/47, 23.4; 3/22/48, 21.0; 5/7/48, 17.2; 12/10/48, 19.9; 3/8/49, 19.0; 11/15/49, 22.3; 3/21/50, 18.2; 11/7/50, 22.9; 3/28/51, 14.2; 11/15/51, 22.3; 4/6/52, 10.1.

17N 3E-36B1—Reference point—top of casing, elevation 84 feet. 0.70 mile east of State Highway 24, 1.87 miles north of Ramirez Road. 10/31/47, 17.9; 3/22/48, 17.6; 12/10/48, 17.0; 3/8/49, 15.5; 11/14/49, 19.6.

17N 3E-36B2—Reference point—hole in base of pump, elevation 84 feet, 0.55 mile east of State Highway 24, 1.9 miles north of Ramirez Road. 10/31/47, 23.7; 3/22/48, 17.3; 5/7/48, 17.0; 12/10/48, 17.6; 1/26/49, 17.1; 3/8/49, 16.3; 11/14/49, 19.9; 3/21/50, 16.6; 11/7/50, 20.2; 3/28/51, 12.3; 11/15/51, 18.6; 4/6/52, 7.4.

17N 3E-36E1—Reference point—slot in base, elevation 83 feet, 0.2 mile east of State Highway 24, 1.55 miles north of Ramirez Road. 10/31/47, 20.3; 3/22/48, 18.4; 3/8/49, 17.7; 11/15/49, 20.8.

17N 4E-22H1—Reference point—top of casing, elevation 116 feet, 0.2 mile east of La Porte Road bridge across Middle Honcut Creek. 2/25/48, 16.1; 3/15/48, 15.3; 11/17/49, 18.3; 3/28/51, 12.1; 11/14/51, 18.6; 4/6/52, 10.2.

17N 4E-27E1—Reference point—top of concrete pit cribbing, elevation 105 feet, 0.30 mile west of La Porte Road bridge across South Honcut Creek. 11/19/47, 29.9; 3/15/48, 33.2; 11/30/48, 30.0; 3/23/49, 24.2.

17N 4E-27F1—Reference point—top of casing, elevation 106 feet. West side La Porte Road, south bank of South Honcut Creek. 11/18/47, 24.8; 3/30/48, 24.2; 5/12/48, 24.2; 11/30/48, 24.9; 3/23/49, 23.1; 11/17/49, 28.0; 3/22/50, 24.9; 10/3/50, 30.2; 3/28/51, 24.1; 11/14/51, 30.3; 4/6/52, 23.8.

17N 4E-29L1—Reference point—hole in pump base, elevation 80 feet, 1.02 miles west of Southern Pacific Railroad tracks, 0.30 mile south of South Honcut Creek. 12/1/48, 21.2; 3/23/49, 19.5; 11/17/49, 26.1; 3/22/50, 22.3; 10/31/50, 30.0; 3/28/51, 21.6; 11/27/51, 14.6; 4/6/52, 5.0.

17N 4E-33D1—Reference point—top of casing, elevation 96 feet. West side Southern Pacific Railroad tracks, 1.08 miles north along tracks from intersection with Ramirez Road. 11/18/47, 24.1; 3/15/48, 24.8; 12/1/48, 25.2; 3/23/49, 27.6; 11/17/49, 27.6; 3/22/50, 27.0; 10/31/50, 28.0; 3/28/51, 25.1; 11/14/51, 28.1; 4/6/52, 24.3.

17N 4E-35C1—Reference point—hole in pump base, elevation 122 feet. South side Iowa City Road, 1.20 miles east of La Porte Road. 3/15/48, 26.7; 11/17/49, 28.5; 3/28/51, 28.5; 11/14/51, 33.1; 4/6/52, 30.1.

TABLE 2

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by S. T. Harding
(Depths to water in feet measured from reference point)

13N/2E-1 (Harding 43)—Reference point—top of pump house floor, elevation 35 feet. 1,800 feet north of east quarter corner of section. 9/20/31, 16.5; 12/2/32, 15.7.

13N/3E-2 (Harding 139)—Reference point—top of casing, elevation 43 feet. 30 feet north of east and west center line, 1,700 feet east of Garden Highway. 10/16/31, 22.7; 11/29/32, 18.0.

13N/3E-3 (Harding 76)—Reference point—top of casing, elevation 40 feet. 200 feet south and 1,400 feet east of center of section. 10/13/31, 21.3; 11/29/32, 19.2.

13N/3E-4 (Harding 141A)—Reference point—top of casing, elevation 39 feet. 800 feet south and 50 feet west of northeast corner of section. 10/9/31, 22.1; 12/2/32, 20.0.

13N/3E-4 (Harding 70)—Reference point—top of casing, elevation 40 feet. 20 feet west of Sawtelle Avenue at southeast corner of section. 10/8/31, 23.0; 12/2/32, 20.0.

13N/3E-5 (Harding 140)—Reference point—top of pit, elevation 36 feet. 550 feet south and 200 feet west of north quarter corner of section. 10/9/31, 23.0; 12/2/32, 20.7.

13N/3E-5 (Harding 141)—Reference point—top of casing, elevation 34 feet. 200 feet west and 300 feet north of east quarter corner of section. 10/9/31, 20.5; 12/2/32, 18.0.

13N/3E-7 (Harding 73)—Reference point—top of casing, elevation 33 feet. 1,300 feet east of west quarter corner of section. 10/8/31, 12.0; 12/2/32, 13.0.

13N/3E-9 (Harding 72)—Reference point—top of wall of pit, elevation 35 feet. 500 feet south of north quarter corner of section. 10/8/31, 18.5; 12/2/32, 13.1.

13N/3E-10 (Harding 69)—Reference point—top of wall of wooden pit, elevation 38 feet. 500 feet north and 500 feet south of northeast corner of section. 10/8/31, 17.0; 12/2/32, 17.1.

13N/3E-11 (Harding 75)—Reference point—top of wall of pit, elevation 40 feet. 2,000 feet south and 600 feet west of northeast corner of section. 10/8/31, 17.5; 12/7/32, 15.6.

13N/3E-13 (Harding 74)—Reference point—top of wall of pit, elevation 38 feet. 100 feet east and 1,000 feet north of southwest corner of section. 10/8/31, 16.8; 12/7/32, 17.1.

13N/3E-14 (Harding 64)—Reference point—top of wall of pit, elevation 35 feet. 500 feet north of intersection of Wilson Road and Garden Highway. 10/6/31, 15.5; 12/2/32, 15.2.

13N/3E-15 (Harding 63)—Reference point—top of casing, elevation 35 feet. West side of Southern Pacific Railroad, ¼ mile north of Wilson Road. 10/6/31, 15.0; 12/2/32, 13.8.

13N/3E-16 (Harding 62)—Reference point—top of casing, elevation 36 feet. 500 feet north of southeast corner of section. 10/6/31, 17.0; 12/2/32, 16.4.

13N/3E-16 (Harding 71)—Reference point—top of casing, elevation 31 feet. 1,300 feet east and 2,700 feet south of northwest corner of section. 10/8/31, 12.0; 12/2/32, 11.3.

13N/3E-23 (Harding 60)—Reference point—top of concrete pit wall, elevation 35 feet. 100 feet east of Garden Highway, 2,200 feet south of north quarter corner of section. 10/6/31, 15.5; 12/2/32, 12.5.

13N/3E-23 (Harding 61)—Reference point—top of casing, elevation 36 feet. 500 feet east and 200 feet south of northwest corner of section. 10/6/31, 16.4; 12/2/32, 15.2.

14N/2E-4 (Harding 51)—Reference point—top of casing, elevation 37 feet. 300 feet west and 200 feet south of northeast corner of section. 9/26/31, 8.3; 11/30/32, 6.6.

14N/2E-36 (Harding 47)—Reference point—top of casing, elevation 34 feet. 500 feet south of north quarter corner of section. 9/23/31, 12.0; 12/2/32, 11.6.

14N/2E-36 (Harding 42)—Reference point—top of casing, elevation 35 feet. At east quarter corner of section. 9/20/31, 14.0; 12/2/32, 13.2.

14N/3E-1 (Harding 99)—Reference point—top of casing, elevation 53 feet. 200 feet west of Feather River Boulevard and 1.5 miles south of Alicia Station. 10/16/31, 12.0; 12/5/32, 12.3.

14N/3E-2 (Harding 54)—Reference point—top of casing below ground, elevation 48 feet. 5,200 feet east of Southern Pacific Railroad and 1,500 feet north of latitude 39° 05'. 9/26/31, 21.3; 11/29/32, 18.5.

14N/3E-2 (Harding 79)—Reference point—top of casing, elevation 48 feet. 1,400 feet east and 700 feet south of northwest corner of section. 10/13/31, 19.5; 11/29/32, 16.0.

14N/3E-3 (Harding 66)—Reference point—top of casing, elevation 51 feet. 700 feet west of Southern Pacific Railroad, 1,700 feet south of north line of section. 10/7/31, 35.3; 12/1/32, 33.0.

14N/3E-4 (Harding 57)—Reference point—top of concrete pit, elevation 51 feet. 1,150 feet east and 800 feet south of north quarter corner of section. 9/28/31, 36.3; 11/30/32, 35.3.

14N/3E-4 (Harding 56)—Reference point—top of concrete pit, elevation 48 feet. 600 feet east and 360 feet south of west quarter corner of section. 9/27/31, 33.9; 11/30/32, 32.0.

14N/3E-8 (Harding 118)—Reference point—top of casing, elevation 44 feet. 1,500 feet north and 200 feet east of southwest corner of section. 9/28/31, 25.1; 11/30/32, 23.6.

14N/3E-9 (Harding 123)—Reference point—top of pit, elevation 46 feet. 300 feet east and 200 feet north of south quarter corner of section. 9/30/31, 32.5; 11/30/32, 31.0.

14N/3E-10 (Harding 116)—Reference point—top of pit, elevation 50 feet. 300 feet north of east and west center line, 550 feet west of Southern Pacific Railroad. 10/1/31, 36.0; 12/1/32, 32.6.

14N/3E-10 (Harding 115)—Reference point—top of casing, elevation 52 feet. 700 feet south and 200 feet west of northeast corner of section. 10/1/31, 33.8; 11/29/32, 29.0.

14N/3E-11 (Harding 55)—Reference point—top of casing, elevation 53 feet. 4,400 feet east of Southern Pacific Railroad, 100 feet south of latitude 39° 05'. 9/5/31, 30.1; 10/17/31, 29.0.

14N/3E-13 (Harding 100)—Reference point—top of wall of pit, elevation 50 feet. West of Feather River Boulevard, 500 feet north of Pearson Station. 10/16/31, 10.0; 12/5/32, 10.1.

14N/3E-15 (Harding 67)—Reference point—top of concrete pit, elevation 47 feet. 800 feet east and 150 feet south of northwest corner of section. 10/7/31, 32.7; 12/1/32, 29.2.

14N/3E-15 (Harding 124)—Reference point—top of concrete pit, elevation 48 feet. 1,600 feet south of north line and 200 feet east of Southern Pacific Railroad. 10/8/31, 30.8; 12/1/32, 25.2.

14N/3E-15 (Harding 122)—Reference point—top of concrete pit, elevation 45 feet. 2,150 feet north and 600 feet east of southwest corner of section. 10/17/31, 29.4; 12/1/32, 24.0.

14N/3E-16 (Harding 58)—Reference point—bottom of 6 x 6 strut across top of pit, elevation 45 feet. 750 feet north and 40 feet west of southwest corner of section. 9/29/31, 25.8; 11/30/32, 25.6.

14N/3E-16 (Harding 120)—Reference point—top of concrete pit, elevation 45 feet. 1,350 feet east and 200 feet north of south quarter corner of section. 10/17/31, 27.7; 12/1/32, 25.4.

14N/3E-17 (Harding 119)—Reference point—top of casing, elevation 42 feet. 1,500 feet north and 100 feet east of southwest corner of section. 10/3/31, 21.5; 11/30/32, 20.0.

14N/3E-18 (Harding 45)—Reference point—top of wall of concrete pit, elevation 39 feet. 1,100 feet east and 2,000 feet south of northwest corner of section. 9/21/31, 14.5; 11/30/32, 14.4.

14N/3E-19 (Harding 46)—Reference point—top of pit wall, elevation 38 feet. 1,800 feet east and 900 feet south of northwest corner of section. 9/21/31, 16.0; 11/30/32, 15.0.

14N/3E-20 (Harding 123A)—Reference point—top of casing, elevation 42 feet. 2,000 feet north and 130 feet west of southeast corner of section. 10/3/31, 29.7; 12/1/32, 26.4.

TABLE 2—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by S. T. Harding
(Depths to water in feet measured from reference point)

14N 3E-22 (Harding 68)—Reference point—top of concrete pit, elevation 45 feet. 1,100 feet south of north line of section and 250 feet west of Garden Highway. 10/8/31, 23.4; 11/29/32, 19.7.

14N 3E-23 (Harding 107)—Reference point—top of pit wall, elevation 50 feet. West end of Country Club Road on center line of section. 10/16/31, 20.5; 12/9/32, 19.7.

14N 3E-23 (Harding 129)—Reference point—top of casing, elevation 46 feet. 100 feet east of Garden Highway and 1,650 feet north of latitude 39° 32′ 30″. 10/13/31, 25.2.

14N 3E-27 (Harding 131)—Reference point—top of casing, elevation 42 feet. 700 feet east of Southern Pacific Railroad and 300 feet north of south line of section. 10/16/31, 25.0; 11/29/32, 21.7.

14N 3E-27 (Harding 130)—Reference point—top of casing, elevation 44 feet. 2,000 feet south of latitude 39° 32′ 30″ and 400 feet west of Garden Highway. 10/13/31, 25.2; 11/29/32, 21.2.

14N 3E-28 (Harding 128)—Reference point—top of concrete pit, elevation 40 feet, 500 feet east and 1,600 feet north of southwest corner of section. 10/12/31, 29.8; 12/1/32, 27.0.

14N 3E-28 (Harding 127)—Reference point—top of casing, elevation 42 feet. 150 feet west and 25 feet south of northwest corner of section. 10/12/31, 30.3; 12/1/32, 27.4.

14N 3E-29 (Harding 126)—Reference point—top of planks across top of pit, elevation 41 feet. 1,200 feet west and 1,600 feet south of northeast corner of section. 10/10/31, 29.0; 12/1/32, 26.7.

14N 3E-29 (Harding 125)—Reference point—top of concrete casing, elevation 42 feet. 750 feet north and 300 feet west of south quarter corner of section. 9/5/31, 29.2; 10/9/31, 28.3; 12/2/32, 25.5.

14N 3E-30 (Harding 77)—Reference point—top of casing, elevation 39 feet. 1,500 feet south and 250 feet west of northeast corner of section. 10/13/31, 23.1; 12/2/32, 20.7.

14N 3E-31 (Harding 44)—Reference point—top of concrete pit, elevation 37 feet. 1,000 feet west and 200 feet south of northeast corner of section. 9/20/31, 21.5; 12/2/32, 16.5.

14N 3E-32 (Harding 133)—Reference point—top of casing, elevation 36 feet, 2,000 feet north and 200 feet east of southwest corner of section. 10/14/31, 23.3; 12/2/32, 20.7.

14N 3E-32 (Harding 132)—Reference point—top of casing, elevation 37 feet. 250 feet south and 150 feet west of center of section. 10/14/31, 25.0; 11/29/32, 21.0.

14N 3E-33 (Harding 134)—Reference point—top of tile at hand pump, elevation 43 feet. 200 feet south and 1,410 feet east of northwest corner of section. 10/14/31, 27.6; 12/1/32, 24.8.

14N 3E-34 (Harding 135)—Reference point—top of pit, elevation 41 feet, 300 feet east and 40 feet south of northwest corner of section. 10/14/31, 27.8; 12/1/32, 24.9.

14N 3E-35 (Harding 138)—Reference point—top of wood pit, elevation 42 feet. 100 feet west of levee, 500 feet north of south line of section. 10/16/31, 18.3; 11/29/32, 17.5.

14N 3E-35 (Harding 137)—Reference point—top of casing, elevation 43 feet, 100 feet east of Garden Highway, 100 feet north of south line of section. 10/16/31, 25.4; 11/29/32, 22.1.

14N 3E-35 (Harding 136)—Reference point—top of wooden pit, elevation 42 feet, 200 feet east of Garden Highway, 1,400 feet north of south line of section. 10/16/31, 24.8; 11/29/32, 22.0.

14N 4E-8 (Harding 101)—Reference point—top of pit wall, elevation 56 feet, 700 feet west and 700 feet south of west quarter corner of section. 10/16/31, 12.0; 12/3/32, 12.8.

14N 4E-8 (Harding 103)—Reference point—top of casing, elevation 63 feet. 200 feet southeast of northwest corner of section. 10/16/31, 18.0; 12/3/32, 18.8.

14N 4E-19 (Harding 104)—Reference point—top of casing, elevation 49 feet. Immediately north of center of section. 10/16/31, 14.0; 12/3/32, 13.5.

14N 4E-31 (Harding 98)—Reference point—top of casing, elevation 59 feet. 50 feet east of bend in River Road, ½ mile above Alicia. 10/16/31, 18.0; 12/3/32, 17.0.

15N 2E-1 (Harding 18)—Reference point—top of casing, elevation 56 feet. 1,000 feet south and 180 feet west of northeast corner of section. 9/7/31, 11.8; 10/17/31, 11.3; 12/8/32, 10.2.

15N 2E-12 (Harding 17)—Reference point—top of casing in pit, elevation 51 feet. 1,600 feet south and 400 feet west of northeast corner of section. 9/7/31, 8.1; 10/17/31, 9.3; 12/8/32, 10.1.

15N 2E-12 (Harding 114)—Reference point—top of casing, elevation 54 feet, 200 feet south of Butte House Road on north side of east and west center line of section. 10/1/31, 8.5; 12/8/32, 11.9.

15N 2E-13 (Harding 35)—Reference point—top of highest horizontal flange on suction, elevation 51 feet. 1,800 feet west and 200 feet north of east quarter corner of section. 9/18/31, 14.5; 12/8/32, 14.6.

15N 2E-13 (Harding 113)—Reference point—top of casing, elevation 50 feet. 1,000 feet east and 500 feet north of west quarter corner of section. 10/1/31, 8.0; 12/8/32, 9.7.

15N 2E-26 (Harding 111)—Reference point—top of casing, elevation 44 feet. 2,000 feet west and 50 feet south of northeast corner of section. 10/1/31, 7.0; 11/30/32, 7.7.

15N 2E-28 (Harding 112)—Reference point—top of casing, elevation 43 feet. 500 feet west of east quarter corner of section. 10/1/31, 9.0; 11/30/32, 7.9.

15N 2E-35 (Harding 53)—Reference point—top of casing, elevation 38 feet. 0.25 mile west and 300 feet north of southeast corner of section. 9/26/31, 5.0; 11/30/32, 5.4.

15N 3E-1 (Harding 87)—Reference point—top of casing, elevation 64 feet. East side of State Highway 24. 0.5 mile north of Walnut Avenue. 10/15/31, 14.5; 12/5/32, 13.8.

15N 3E-1 (Harding 85)—Reference point—top of casing, elevation 66 feet. 200 feet north of Walnut Avenue, 0.25 mile west of State Highway 24. 10/15/31, 19.5; 12/5/32, 15.8.

15N 3E-1 (Harding 84)—Reference point—top of walls of pit, elevation 61 feet. 700 feet east of State Highway 24 and 1 mile north of railroad crossing. 10/15/31, 6.0.

15N 3E-1 (Harding 84A)—Reference point—top of casing, elevation 61 feet. 300 feet east of State Highway 24 and 1 mile north of railroad crossing. 12/5/32, 5.0.

15N 3E-2 (Harding 86)—Reference point—top of casing, elevation 68 feet. 500 feet north of west end of Walnut Avenue. 10/15/31, 25.5; 12/5/32, 24.1.

15N 3E-2 (Harding 109)—Reference point—top of casing, elevation 62 feet. West end of first road to left on State Highway 24 after crossing bridge ¼ mile north of cemetery. 10/20/31, 21.5; 12/5/32, 21.0.

15N 3E-2 (Harding 108)—Reference point—top of wall of pit, elevation 61 feet. 0.60 mile west of State Highway 24, on first left road after crossing bridge, ¼ mile north of cemetery. 10/20/31, 19.0; 12/5/32, 18.3.

15N 3E-3 (Harding 4)—Reference point—top of casing, elevation 61 feet. 250 feet south and 240 feet east of northwest corner of section. 8/31/31, 22.7; 10/17/31, 23.4.

15N 3E-4 (Harding 15)—Reference point—top of concrete pit, elevation 60 feet. 1,900 feet north and 900 feet west of southeast corner of section. 9/4/31, 25.5; 10/17/31, 25.5; 12/7/32, 23.7.

15N 3E-5 (Harding 14)—Reference point—2 inches above top of concrete pit, elevation 59 feet. On east line 1,800 feet north of southeast corner of section. 9/3/31, 24.5; 10/17/31, 24.5; 12/7/32, 22.8.

TABLE 2—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by S. T. Harding
(Depths to water in feet measured from reference point)

15N/3E-6 (Harding 16)—Reference point—top of casing, elevation 60 feet, 1,320 feet west and 1,200 feet north of southeast corner of section. 9/7/31, 18.2; 12/8/32, 17.1.

15N/3E-9 (Harding 22)—Reference point—top of concrete pit, elevation 58 feet, 1,000 feet south and 500 feet east of west quarter corner of section. 9/10/31, 28.1; 10/17/31, 27.9; 12/8/32, 25.7.

15N/3E-10 (Harding 19)—Reference point—top of concrete pit, elevation 63 feet. Near north quarter of section. 9/8/31, 30.7; 10/17/31, 30.5; 12/7/32, 28.0.

15N/3E-11 (Harding 82)—Reference point—top of casing, elevation 57 feet. Under Southern Pacific Railroad trestle 2 miles north of Yuba City. 10/20/31, 16.5; 12/6/32, 16.3.

15N/3E-13 (Harding 110)—Reference point—top of casing, elevation 62 feet. 50 feet east of road which runs north and south behind Marysville High School and 0.4 mile south of north end of road. 10/20/31, 12.0; 12/5/32, 12.6.

15N/3E-14 (Harding 83)—Reference point—top of wall of pit, elevation 56 feet. 400 feet east and 200 feet south of west quarter corner of section. 10/13/31, 21.5.

15N/3E-15 (Harding 21)—Reference point—top of concrete pit, elevation 60 feet. 500 feet west of highway and 100 feet south of north line of section. 9/8/31, 29.3; 10/17/31, 29.1; 12/7/32, 27.2.

15N/3E-16 (Harding 23)—Reference point—top of concrete pit, elevation 58 feet. 750 feet south and 850 feet west of northeast corner of section. 9/10/31, 30.2; 10/17/31, 29.7; 12/7/32, 27.7.

15N/3E-17 (Harding 29)—Reference point—top of concrete pit, elevation 56 feet. 1,100 feet east of Live Oak drain, south of Sacramento Northern Railroad. 9/19/31, 25.0; 12/8/32, 22.5.

15N/3E-19 (Harding 37)—Reference point—floor of pit, 8 feet deep, elevation 50 feet, 660 feet east and 500 feet south of northwest corner of section. 9/18/31, 16.0; 10/17/31, 17.5; 11/28/32, 16.9.

15N/3E-19 (Harding 36)—Reference point—top of concrete pit wall, elevation 50 feet. 1,320 feet north and 300 feet east of southwest corner of section. 9/18/31, 18.0; 12/1/32, 17.0.

15N/3E-20 (Harding 20)—Reference point—top of concrete pit, elevation 57 feet. 850 feet west and 40 feet south of northeast corner of section. 9/8/31, 31.4; 10/17/31, 31.0; 12/1/32, 28.6.

15N/3E-20 (Harding 28)—Reference point—floor of pump house or top of pit, elevation 56 feet. 220 feet east and 250 feet north of south quarter corner of section. 9/18/31, 32.1.

15N/3E-21 (Harding 24)—Reference point—top of casing, elevation 55 feet. 1,100 feet west and 400 feet south of northeast corner of section. 9/10/31, 28.1; 10/17/31, 28.5.

15N/3E-23 (Harding 27)—Reference point—top of casing, elevation 57 feet. In Yuba City, back of blacksmith shop, 150 feet south of Sutter Hotel. 9/17/31, 22.2; 11/29/32, 21.1.

15N/3E-26 (Harding 48)—Reference point—top of concrete pit, elevation 54 feet. 3,800 feet east and 700 feet south of northwest corner of section. 9/—/31, 26.5; 11/29/32, 26.0.

15N/3E-26 (Harding 80)—Reference point—top of casing, elevation 50 feet. 2,000 feet east of northwest corner of section. 10/13/31, 20.5.

15N/3E-26 (Harding 81)—Reference point—top of casing, elevation 55 feet. 100 feet west of toe of levee, 3,500 feet south of Yuba City south limit. 10/13/31, 23.5; 11/29/32, 25.5.

15N/3E-27 (Harding 25)—Reference point—top of casing, elevation 55 feet. 500 feet west and 300 feet south of north quarter corner of section. 8/17/31, 30.2; 12/1/32, 28.5.

15N/3E-27 (Harding 49)—Reference point—top of concrete pit, elevation 51 feet. 1,000 feet west and 1,300 feet north of south quarter corner of section. 9/1/31, 32.2; 11/30/32, 32.4.

15N/3E-28 (Harding 26)—Reference point—top of wood pit, elevation 53 feet. South side of highway, 1,100 feet west of northeast corner of section. 4/—/13, 17.0; 9/17/31, 31.4; 12/1/32, 28.4.

15N/3E-29 (Harding 31)—Reference point—top of concrete pit, elevation 50 feet. 150 feet north and 50 feet west of southeast corner of section. 9/22/31, 32.4; 11/30/32, 29.4.

15N/3E-29 (Harding 30)—Reference point—top of concrete pit, elevation 49 feet. 660 feet east and 660 feet north of southwest corner of section. 9/20/31, 25.2; 11/30/32, 22.6.

15N/3E-30 (Harding 39)—Reference point—top of frame of wooden pit, elevation 52 feet. 1,320 feet south of north quarter corner on east bank of Live Oak drain. 9/19/31, 22.5.

15N/3E-31 (Harding 40)—Reference point—top of wall of concrete pit, elevation 45 feet. 1,800 feet east and 200 feet north of southwest corner of section. 9/19/31, 17.5; 11/30/32, 17.3.

15N/3E-31 (Harding 38)—Reference point—top of wall of concrete pit, elevation 47 feet. 200 feet west and 200 feet south of northeast corner of section. 9/19/31, 22.0; 11/30/32, 21.8.

15N/3E-32 (Harding 32)—Reference point—top of concrete pit, elevation 50 feet. 600 feet east and 500 feet north of south quarter corner of section. 9/22/31, 32.7; 12/1/32, 29.1.

15N/3E-33 (Harding 33)—Reference point—top of concrete pit, elevation 50 feet. 1,150 feet east and 250 feet south of northwest corner of section. 9/23/31, 33.3; 11/30/32, 30.6.

15N/3E-34 (Harding 50)—Reference point—top of concrete pit, elevation 52 feet. 1,600 feet north and 400 feet east of south quarter corner of section. 9/—/31, 34.6; 12/1/32, 32.7.

15N/4E-32 (Harding 102)—Reference point—top of wall of pit, elevation 61 feet. 50 feet east of west line of section, 500 feet south of railroad crossing. 10/16/31, 17.0; 12/3/32, 18.0.

16N/3E-2 (Harding 95)—Reference point—top of casing, elevation 80 feet. 100 feet north of Ramirez Road, 0.50 mile east of State Highway 24. 10/15/31, 17.5.

16N/3E-11 (Harding 96)—Reference point—top of casing, elevation 76 feet. At west end of road running west from State Highway 24, 0.8 mile north of Magnolia Avenue. 10/15/31, 19.5; 12/6/32, 17.9.

16N/3E-14 (Harding 97)—Reference point—top of wall of pit, elevation 75 feet. 500 feet west of State Highway 24, 400 feet south of La Finca Lane. 10/15/31, 15.0; 12/6/32, 14.9.

16N/3E-19 (Harding 12)—Reference point—top of casing, elevation 67 feet. 1,260 feet east and 200 feet north of north quarter of section. 9/2/31, 10.1; 12/7/32, 10.1.

16N/3E-21 (Harding 10)—Reference point—top of wood pit, west side, elevation 68 feet. Near southeast corner of section, 0.5 mile east of Southern Pacific Railroad. 9/2/31, 23.8; 10/17/31, 22.9; 12/7/32, 20.8.

16N/3E-24 (Harding 90)—Reference point—top of casing, elevation 70 feet. North of Woodruff Road, 1 mile east of State Highway 24. 10/15/31, 10.0; 12/6/32, 11.5.

16N/3E-27 (Harding 78)—Reference point—top of casing, elevation 69 feet. 500 feet north of east and west center line of section at toe of levee. 10/13/31, 25.0; 12/7/32, 22.4.

16N/3E-28 (Harding 8)—Reference point—top of concrete pit, west side, elevation 64 feet. 1,300 feet west of U. S. Highway 99E, 250 feet north of south line of section. 9/2/31, 21.8; 10/17/31, 20.6; 12/7/32, 19.1.

16N/3E-28 (Harding 9)—Reference point—top of casing, elevation 66 feet. 1,000 feet south of north line of section and 300 feet east of Southern Pacific Railroad. 9/2/31, 19.0; 10/17/31, 19.2; 12/7/32, 17.7.

16N/3E-29 (Harding 2)—Reference point—top of concrete pit, elevation 66 feet. 100 feet west and 120 feet south of northeast quarter of northwest quarter of section. 8/13/31, 13.5; 10/17/31, 13.2; 12/7/32, 12.6.

TABLE 2—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by S. T. Harding
(Depths to water in feet measured from reference point)

16N 3E-29 (Harding 1)—Reference point—top of casing, elevation 65 feet, 1,890 feet north and 660 feet west of east quarter corner of section. 8/31/31, 15.5; 10/17/31, 14.8; 12/7/32, 13.7.

16N 3E-29 (Harding 6)—Reference point—top of casing, elevation 65 feet, 750 feet east and 1,100 feet north of south quarter corner of section. 8/31/31, 18.4; 10/17/31, 18.0; 12/7/32, 16.3.

16N 3E-29 (Harding 91)—Reference point—top of casing, elevation 71 feet. At cross roads at east end of Woodruff Road. 10/15/31, 6.5; 12/6/32, 6.0.

16N 3E-30 (Harding 11)—Reference point—top of casing, elevation 66 feet, 1,750 feet east and 500 feet north of southwest corner of section. 9/2/31, 10.1; 12/7/32, 12.0.

16N 3E-31 (Harding 34)—Reference point—top of timber frame, elevation 61 feet, 1,300 feet east and 300 feet north of south quarter corner of section. 9/17/31, 18.0; 10/17/31, 20.0; 12/7/32, 17.8.

16N 3E-32 (Harding 13)—Reference point—top of concrete pit, elevation 64 feet, 1,350 feet south and 300 feet east of north quarter corner of section. 9/2/31, 19.1; 10/17/31, 18.6; 12/7/32, 17.5.

16N 3E-32 (Harding 3)—Reference point—top of wood pit, west side, elevation 60 feet, 600 feet north and 300 feet east of south quarter corner of section. 8/31/31, 19.3; 10/17/31, 18.9; 12/7/32, 17.0.

16N 3E-33 (Harding 5)—Reference point—top of casing, elevation 64 feet, 3,300 feet west of U. S. Highway 99E, 200 feet south of north line of section. 8/31/31, 24.9; 10/17/31, 19.1; 12/7/32, 17.5.

16N 3E-33 (Harding 7)—Reference point—top of concrete base, elevation 60 feet, 1,100 feet east and 400 feet north of southwest corner of section. 9/1/31, 20.6; 12/7/32, 18.8.

16N 3E-35 (Harding 89)—Reference point—top of wall of pit, elevation 66 feet, 1,000 feet west of angle in Oroville Highway, 0.5 mile north of Ellis Road. 10/15/31, 18.0; 12/6/32, 16.4.

16N 3E-35 (Harding 88)—Reference point—top of wall of pit, elevation 65 feet, 0.75 mile north of Walnut Avenue, 0.50 mile west of Oroville Highway. 10/15/31, 20.0; 12/6/32, 19.1.

16N 3E-36 (Harding 92)—Reference point—top of wall of pit, elevation 65 feet, 600 feet south of Ellis Road, 500 feet west of Western Pacific Railroad. 10/15/31, 7.5; 12/5/32, 8.5.

TABLE 3

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Sutter County Farm Advisor
(Depths to water in feet and/or inches measured from reference point)

13N/3E-2C1—Reference point—air gage. 1/19/32, 18.2; 2/24/32, 17.5; 3/2/32, 17.9; 4/18/32, 19.0; 5/23/32, 17.1; 6/15/32, 20.4; 7/18/32, 23.0; 9/8/32, 19.8; 10/25/32, 19.0; 11/15/32, 19.3; 12/23/32, 19.0; 2/3/33, 18.5; 3/3/33, 18.6; 4/11/33, 21.4; 5/2/33, 19.8; 6/28/33, 24.2; 8/1/33, 35.0; 9/14/33, 32.0; 10/17/33, 31.0; 3/22/34, 27.0; 9/18/34, 31.5; 11/9/34, 30.0; 12/27/34, 29.3; 1/22/35, 27.8; 3/22/35, 26.3; 4/19/35, 23.7; 5/27/35, 22.7; 7/2/35, 57.8 (operating); 10/31/35, 28.4; 12/26/35, 27.6; 1/3/36, 26.0; 2/25/36, 22.0; 4/11/36, 23.0; 6/15/36, 29.0; 7/24/36, 33.0; 8/20/36, 28.0; 9/24/36, 27.8; 10/27/36, 27.8; 12/28/36, 27.0; 2/9/37, 26.0; 4/5/37, 20.0; 5/13/37, 20.0.

13N/3E-5E2—Reference point—top of pit. 5/16/31, 20' 8"; 7/11/31, 24' ¾"; 8/31/31, 21' 7½"; 9/23/31, 21' 7"; 10/16/31, 21' ½"; 11/17/31, 20' 7"; 12/17/31, 19' 11"; 1/19/32, 18' 11"; 2/24/32, 18' 3¾"; 3/22/32, 17' 11½"; 4/19/32, 18' 5½"; 5/23/32, 19' 6"; 6/23/32, 19' 2"; 9/13/32, 19' 11½"; 10/18/32, 19' 10"; 11/30/32, 19' 7"; 12/27/32, 19' 6"; 2/6/33, 19' 2"; 3/5/33, 18' 10½"; 4/10/33, 19' ¾"; 5/17/33, 20' 5½"; 8/1/33, 22' 4¾"; 9/14/33, 21' 5½"; 3/16/34, 19' 5½"; 11/9/34, 20' 7"; 12/11/34, 20' 0"; 2/15/35, 17' 7"; 3/22/35, 18.0; 4/19/35, 17.5; 5/24/35, 17.6; 7/2/35, 24.8 (operating); 8/21/35, 18.7; 9/25/35, 18.5; 10/31/35, 18.5; 12/26/35, 18.1; 1/24/36, 17.7; 2/25/36, 16.6; 4/14/36, 15.2; 4/22/36, 16.7; 8/18/36, 16.9; 9/28/36, 16.9; 10/21/36, 16.4; 12/28/36, 15.8; 2/9/37, 15.3.

13N/3E-24G1—Reference point—air gage. 5/6/31, 19.9; 7/15/31, 22.2; 8/28/31, 19.9; 9/22/31, 21.1; 10/14/31, 19.9; 11/17/31, 19.9; 12/17/31, 19.7; 1/2/32, 17.2; 1/19/32, 16.5; 2/25/32, 15.8; 3/2/32, 17.6; 4/26/32, 15.1; 6/22/32, 16.9; 7/18/32, 19.9; 9/8/32, 18.8; 10/18/32, 18.1; 11/15/32, 18.8; 12/22/32, 18.1; 2/3/33, 17.6; 3/3/33, 17.4; 4/11/33, 21.1; 5/2/33, 17.6; 6/28/33, 34.9 (operating); 8/1/33, 22.2; 9/14/33, 19.5; 10/17/33, 18.3; 3/22/34, 28.0; 6/29/34, 21.6; 9/18/34, 19.9; 11/9/34, 19.7; 12/27/34, 18.8; 1/22/35, 16.5; 3/22/35, 16.5; 4/19/35, 13.0; 5/27/35, 12.4; 7/2/35, 36.1 (operating); 8/19/35, 16.5; 9/25/35, 19.5; 10/31/35, 17.6; 12/26/35, 17.6; 1/30/36, 15.3; 2/25/36, 10.9; 4/6/36, 11.9; 8/10/36; 19.5; 9/3/36, 19.9; 9/24/36, 14.9; 10/27/36, 18.8; 12/28/36, 18.8; 2/9/37, 12.4; 4/5/37, 7.1; 5/19/37, 7.8; 9/13/37, 14.1; 12/30/37, 9.7; 2/24/36, 4.7; 3/23/38, 3.8; 4/25/38, 3.7; 6/3/38, 4.8; 6/21/38, 8.9; 7/22/38, 12.2; 9/8/38, 12.3; 2/25/39, 12.5; 4/10/39, 13.8; 8/2/39, 17.6; 10/11/39, 15.8; 11/29/39, 15.4; 2/8/40, 11.5; 3/22/40, 7.8; 5/20/40, 7.9; 8/24/40, 15.0.

13N/4E-13F3—Reference point—hole in pump base. 12/1/32, 18' 6¾"; 1/12/33, 17' 9½"; 2/3/33, 17' 4½"; 3/10/33, 16' 9½"; 4/3/33, 18' 2"; 5/23/33, 20' 8½"; 10/23/33, 22' 1¼"; 3/20/34, 23' 3½"; 6/27/34, 30' 6"; 9/26/34, 24' 6"; 12/10/34, 20' 11"; 2/14/35, 18' 5"; 3/25/35, 17' 4½"; 4/30/35, 15' 6¼"; 5/28/35, 19' 2"; 8/18/35, 26' 3½"; 9/26/35, 20' 7½"; 1/15/36, 16.7; 3/28/36, 14.2; 3/27/36, 20.6; 8/10/36, 25.3; 8/20/36, 22.6; 9/23/36, 21.0; 10/27,36, 19.4; 1/2/37, 16.7; 2/10/37, 15.6; 4/8/37, 11.6; 11/27/37, 17.0; 3/16/38, 11.0; 4/27/38, 10.7; 5/31/38, 14.0; 7/21/38, 32.2*; 9/8/38, 18.1; 12/29/38, 15.6; 2/16/39, 15.3; 6/15/39, 34.9; 10/12/39, 22.7; 12/6/39, 20.9; 2/19/40, 17.1; 3/27/40, 15.1; 5/15/40, 15.3; 8/6/40, 28.7.

13N/4E-13R2—Reference point—top of casing. 1/12/33; 16' 3"; 2/3/33, 14' 8¼"; 3/10/33, 15' 0"; 4/3/33, 16' 4½"; 5/23/33, 18' 1"; 6/28/33, 26' 3"*; 8/9/33, 25' 1¾"; 9/15/33, 22' 8". Following measurements from new well, reference point—hole in side of pump, 3/20/34, 22' 3½"; 12/10/34, 18' 8"; 2/14/35, 16' 3½"; 3/25/35, 14' 11½"; 4/30/35, 13' 5¼"; 5/28/35, 14' 10"; 7/3/35, 22' 4½"; 1/25/36, 11.2; 2/28/36, 16.2; 8/10/36, 20.7; 8/20/36, 19.0; 9/23/36, 19.6; 10/27/36, 15.4; 1/2/37, 13.4; 2/10/37, 11.9; 4/8/37, 7.6; 5/26/37, 9.7; 11/27/37, 13.6; 3/16/38, 6.9; 4/27/38, 6.6; 5/31/38, 7.8; 12/29/38, 11.6; 2/16/39, 9.2; 12/6/39, 16.5; 2/19/40, 13.3; 3/27/40, 11.3; 5/15/40, 9.7; 8/6/40, 21.5; 5/19/41, 6.4.

* Nearby well pumping.

13N/4E-14D1—Reference point—air gage. 2/14/33, 12.01; 3/8/33, 12.01; 4/5/33, 39.63 (operating); 6/27/33, 15.00.

13N/4E-15R1—Reference point—air gage. 2/14/33, 18.94; 3/8/33, 18.25; 4/5/33, 43.2 (operating); 5/23/33, 23.56; 6/26/33, 32.8; 9/26/33, 24.0; 10/23/33, 28.18; 3/20/34, 23.56; 6/27/34, 31.65; 9/26/34, 30.49; 12/10/34, 35.11; 2/14/35, 22.15; 3/25/35, 20.79; 4/30/35, 18.94; 5/28/35, 18.94; 6/24/35, 27.03; 8/6/35, 31.65; 9/26/35, 25.18; 1/15/36, 21.25; 2/28/36, 18.25; 3/29/36, 28.18; 7/23/36, 30.5; 8/20/36, 30.5; 9/23/36, 31.65; 10/27/36, 28.41; 1/2/37, 23.56; 2/10/37, 21.25; 5/26/37, 16.63; 7/21/37, 26.4.

13N/5E-7L1—Reference point—top of casing. 12/1/32, 22' 2"; 2/3/33, 20' 10½".

13N/5E-16D1—Reference point—top of casing. 12/1/32, 1' 3¾"; 1/12/33, 1' ½"; 2/3/33, 0' 10½"; 3/10/33, 0' 6½"; 4/5/33, 0' 6"; 5/23/33, 1' 4"; 6/27/33, 2' 8½"; 8/9/33, 7' 1"; 9/15/33, 5' 0"; 10/23/33, 4' 8½"; 3/20/34, 1' 4"; 6/27/34, 4' 6½"; 9/26/34, 6' ½"; 12/10/34, 4' 4"; 2/14/34, 1' 10¾"; 3/25/35, 0' 2½"; 4/30/35, 0' 9½"; 5/28/35, —0' 1¾"; 7/3/35, 1' 9"; 8/6/35, 3' 0"; 9/26/35, 2' 7"; 1/15/36, 13.0; 2/28/36, 9.1; 3/27/36, 9.3; 7/30/36, 14.3; 8/20/36, 13.7; 9/23/36, 13.3; 10/27/36, 13.1; 1/2/37, 12.7; 2/10/37, 11.3; 4/8/37, 6.5; 5/26/37, 9.1; 7/21/37, 14.7; 3/16/38, 5.1; 4/27/38, 6.4; 7/21/38, 12.5; 9/8/38, 13.5; 12/29/38, 11.5; 2/16/39, 11.4; 4/27/39, 14.4; 6/15/39, 15.9; 10/12/39, 17.5; 12/6/39, 15.6; 2/9/40, 12.9; 3/27/40, 9.8; 5/15/40, 8.7; 8/6/40, 16.8; 5/19/41, 6.7; 7/28/41, 14.2.

13N/5E-18C1—Reference point—hole in top of pump base. 12/1/32, 17' 4½"; 1/12/33, 16' 7"; 2/3/33, 16' 2"; 3/10/33, 15' 7"; 4/3/33, 18' 4½"; 5/23/33, 19' 9"; 6/28/33, 25' 1"; 9/15/33, 22' 6"; 10/23/33, 21' 4"; 6/27/34, 30' 3"; 9/26/34, 23' 7½"; 12/10/34, 20' ½"; 2/14/35, 17' 11½"; 3/25/35, 15' 7½"; 4/30/35, 14' 1½"; 5/28/35, 16' 2"; 6/24/35, 21' 4"; 8/6/35, 26' 5½"; 9/26/35, 18' 8½"; 8/10/36, 22.05; 8/20/36, 22.2; 9/23/36, 20.9; 10/27/36, 15.0; 1/2/37, 14.3; 2/16/37, 13.04; 4/8/37, 8.2; 5/26/37, 12.9; 11/27/37, 14.6; 3/16/38, 8.0; 4/27/38, 8.2; 5/31/38, 10.2; 7/21/38, 20.3; 9/8/38, 16.4; 12/29/38, 13.2; 5/19/41, 8.2; 7/28/41, 19.7.

15N/3E-7M2—Reference point—top of casing. 7/15/31, 17' 6½"; 8/27/31, 17' 11"; 9/17/31, 17' 6"; 10/26/31, 16' 11"; 11/19/31, 16' 6½"; 12/16/31, 16' ¾"; 4/18/32, 14' 8½"; 2/23/32, 14' 2"; 3/23/32, 14' 2½"; 4/15/32, 14' 6½"; 5/18/32, 14' 7½"; 6/2/32, 15' 3½"; 7/13/32, 15' 9½"; 9/12/32, 16' 2½"; 10/17/32, 17' 11"; 11/30/32, 16' 4"; 12/29/32, 16' 3¾"; 1/26/33, 16' 5½"; 3/3/33, 16' 2¾"; 4/7/33, 16' 5"; 5/12/33, 16' 9½"; 6/20/33, 18' 3"; 7/31/33, 18' 6½"; 9/13/33, 17' 2"; 10/17/33, 16' 9½"; 11/8/33, 16' 11½"; 3/12/34, 16' 3"; 6/26/34, 17' 8"; 11/2/34, 18' 5½"; 1/28/35, 17' 5"; 3/14/35, 16' 3"; 4/18/35, 15' 5½"; 5/23/35, 15' 1¾"; 6/25/35, 16' 0"; 7/27/35, 17' 0"; 10/25/35, 15.2; 12/19/35, 15.2; 1/23/36, 14.8; 2/27/36, 13.2; 3/31/36, 11.7; 7/9/36, 12.0; 8/18/36, 12.8; 9/17/36, 12.5; 10/20/36, 13.3; 12/28/36, 13.2; 2/16/37, 12.2; 3/29/37, 9.4; 5/3/37, 8.8; 7/16/37, 10.7; 9/28/37, 12.2; 12/4/37, 14.2; 4/15/38, 4.6; 5/26/38, 6.6; 7/14/38, 8.5; 9/20/38, 10.3; 10/28/38, 9.5; 12/24/38, 10.5; 1/31/39, 10.6; 3/3/39, 10.9; 4/13/39, 11.6; 8/1/39, 14.7; 9/27/39, 14.6; 11/8/39, 14.2; 1/18/40, 13.2; 3/20/40, 9.6; 5/16/40, 7.9; 8/2/40, 11.2; 10/17/40, 12.7; 9/20/41, 10.3.

15N/3E-31A1—Reference point—top of pit plus 4-inch timber. 5/12/31, 21' 10¾"; 6/26/31, 22' 10¾"; 7/28/31, 24' 0"; 8/31/31, 24' 11"; 9/23/31, 24' ¾"; 10/20/31, 23' 8½"; 11/8/31, 23' 1"; 12/17/31, 22' 9½"; 1/19/32, 22' 2"; 2/23/32, 21' 4"; 3/22/32, 20' 11½"; 4/18/32, 21' 4½"; 5/23/32, 21' 2"; 6/21/32, 21' 5½"; 7/19/32, 22' 4"; 9/13/32, 22' 11"; 10/18/32, 22' 6¾"; 11/22/32, 22' 2½"; 12/27/32, 21' 10"; 1/30/33, 21' 3"; 4/10/33, 21' 5"; 5/17/33, 22' 2½"; 6/29/33, 23' ¾"; 7/25/33, 24' 5"; 10/18/33, 23' 7½"; 12/8/33, 23' 7½"; 3/13/34, 22' 3½"; 6/26/34, 23' 11"; 10/2/34, 24' 7"; 11/5/34, 24' ¾"; 12/11/34, 23' 7½"; 2/15/35, 22' 5"; 3/19/35, 21' 11"; 4/19/35, 21' 2"; 5/23/35, 20' 5½";

TABLE 3—Continued

DEPTHS TO GROUND WATER AT MEASUREMENT WELLS IN SUTTER-YUBA AREA

Measurements Made by Sutter County Farm Advisor
(Depths to water in feet and/or inches measured from reference point)

6/27/35, 21′ 2″; 7/30/35, 22′ 6″; 9/21/35, 23′ 1¾″; 10/25/35, 21.9; 12/20/35, 21.1; 1/23/36, 17.2; 2/25/36, 20.1; 4/14/36, 19.1; 7/22/36, 20.1; 8/18/36, 20.7; 9/17/36, 20.2; 10/21/36, 20.2; 12/28/36, 19.7.

16N 3E-30A1—Reference point—top of casing, 6 inches above ground level. 6/27/31, 11′ 10″; 7/28/31, 12′ 2″; 8/27/31, 12′ 3¼″; 9/17/31, 12′ 6″; 10/26/31, 12′ 9″; 11/17/31, 13′ ½″; 12/16/31, 13′ 1½″; 1/18/32, 10′ ¾″; 2/18/32, 9′ 11″; 3/18/32, 10′ 1½″; 5/15/32, 10′ 10½″; 6/30/32, 10′ 6½″; 7/13/32, 10′ 9½″; 9/8/32, 11′ 10″; 10/17/32, 12′ 4¾″; 11/22/32, 12′ 8¾″; 12/21/32, 13′ 2″; 1/26/33, 13′ 2½″; 3/3/33, 13′ 7¼″; 4/7/33, 12′ 11″; 5/11/33, 12′ 8¼″; 6/20/33, 12′ 11″; 7/31/33, 12′ 11″; 9/13/33, 13′ 6½″; 10/17/33, 13′ 10″; 12/8/33, 14′ 4″; 3/12/34, 12′ 7¼″; 6/26/34, 11′ 9″; 7/31/34, 12′ 1¼″; 9/27/34, 12′ 6½″; 11/2/34, 13′ 1″; 12/11/34, 13′ 7¾″; 1/28/35, 11′ 4¼″; 3/14/35, 9′ 2″; 4/18/35, 9′ 6¾″; 5/22/35, 10′ 5″; 6/25/35, 10′ 8″; 7/29/35, 10′ 11½″; 9/19/35, 12′ 2″; 10/23/35, 11.9; 12/19/35, 12.6; 1/22/36, 11.2; 2/27/36, 7.5; 3/31/36, 9.1; 5/15/36, 9.7; 6/12/36, 10.2; 7/9/36, 10.7; 8/18/36, 11.7; 9/17/36, 12.1; 10/20/36, 12.2; 12/22/36, 12.7; 2/16/37, 9.1; 3/29/37, 6.6; 5/3/37, 8.6; 7/16/37, 10.1; 12/4/37, 10.2; 5/17/38, 7.9; 7/14/38, 9.5; 9/15/38, 11.2; 10/26/38, 11.8; 12/24/38, 12.4; 1/31/39, 12.6; 3/3/39, 12.7; 4/13/39, 13.1; 6/3/39, 12.1; 8/1/39, 12.5; 9/22/39, 11.6.

16N 3E-30C1—Reference point—top of casing, 4 inches above ground. 5/22/31, 11′ 8½″; 6/25/31, 11′ 7″; 7/29/31, 12′ 0″; 8/27/31, 11′ 9″; 9/17/31, 11′ 7½″; 10/21/31, 11′ ½″; 11/19/31, 10′ 7½″; 12/23/31, 10′ 2″; 1/18/32, 8′ 7″; 2/23/32, 8′ 4½″; 3/19/32, 8′ 4½″; 4/15/32, 8′ 11¾″; 5/17/32, 9′ 1″; 6/21/32, 8′ 9½″; 7/13/32, 9′ 1″; 9/12/32, 9′ 2½″; 10/17/32, 9′ 4½″; 11/30/32, 10′ 2¼″; 12/29/32, 10′ 6¼″; 1/26/33, 10′ 9¼″; 3/3/33, 10′ 6½″; 4/7/33, 10′ 10″; 5/12/33, 10′ 9¼″; 6/20/33, 9′ 10″; 7/31/33, 9′ 7½″; 9/13/33, 9′ 3″; 10/17/33, 9′ 6″; 12/8/33, 10′ 4½″; 3/12/34, 10′ 0″; 6/26/34, 11′ 8½″; 9/27/34, 11′ 9″; 11/2/34, 12′ 9″; 12/11/34, 11′ 11½″; 1/28/35, 10′ 10¾″; 3/4/35, 9′ 8½″; 4/18/35, 9′ 4″; 5/23/35, 9′ 8″; 6/25/35, 10′ 5″; 7/29/35, 11′ 5½″; 9/21/35, 11′ 2½″; 10/25/35, 10′ 10¾″; 12/19/35, 11.1; 1/23/36, 10.7; 2/27/36, 9.5; 3/31/36, 8.3; 7/9/36, 9.4; 8/18/36, 9.8; 9/17/36, 9.6; 10/20/36, 9.7; 12/28/36, 10.3; 2/16/37, 6.5; 3/29/37, 6.9; 5/3/37, 8.5; 7/16/37, 8.6; 9/28/37, 8.2; 12/4/37, 8.6; 1/25/38, 6.5; 4/14/38, 3.2; 5/26/38, 6.3; 7/14/38, 6.9; 9/20/38, 8.5; 10/26/38, 8.0; 12/24/38, 8.7; 1/31/39, 8.9; 3/3/39, 9.2; 4/13/39, 10.3; 8/1/39, 11.2; 9/22/39, 12.1; 11/8/39, 10.6; 1/18/40, 10.2; 3/20/40, 6.5; 5/16/40, 6.7; 8/2/40, 9.7; 10/17/40, 10.3.

16N 3E-32G5—Reference point—top of casing, 1 foot 6 inches above ground surface. 6/25/31, 22′ 5″; 7/28/31, 26′ 2½″; 8/27/31, 24′ 6½″; 9/17/31, 20′ 5¼″; 10/19/31, 18′ 11″; 11/19/31, 18′ 6″; 12/16/31, 18′ 2¾″; 1/2/32, 17′ 8½″; 1/18/32, 17′ 0″; 2/18/32, 15′ 9″; 3/18/32, 12′ 8½″; 4/15/32, 19′ 6″; 5/17/32, 15′ 1¼″; 6/23/32, 23′ 10¼″*; 7/13/32, 18′ 1″; 9/8/32, 18′ 2½″; 10/17/32, 17′ 10¼″; 11/22/32, 17′ 8″; 12/29/32, 17′ 5″; 1/26/33, 17′ 3½″; 3/3/33, 18′ 1½″; 4/7/33, 25′ 4″ (operating); 5/11/33, 17′ 9½″; 6/20/33, 22′ 5½″; 7/31/33, 28′ 10″ (operating); 9/13/33, 21′ 10¼″; 10/17/33, 21′ 0″; 11/18/33, 19′ 2½″; 3/12/34, 18′ 2″. Reference point—top of casing, ground level. 6/26/34, 24′ 5″; 7/31/34, 25′ 7″; 9/27/34, 23′ 9¾″; 11/2/34, 19′ 5″; 12/11/34, 18′ 5½″; 1/28/35, 16′ 10″; 3/14/35, 14′ 4½″; 4/18/35, 14′ ½″; 5/22/35, 12′ 2½″; 7/3/35, 16′ 5½″; 7/29/35, 20′ 0″; 8/27/35, 17′ 1″; 9/19/35, 19′ 17″; 1/22/36, 15.4; 2/27/36, 12.9; 3/31/36, 13.4; 7/9/36, 18.5; 8/18/36, 18.8; 9/17/36, 19.5; 10/23/36, 16.4; 12/22/36, 15.3; 2/16/37, 13.8; 3/29/37, 11.2; 5/3/37, 10.7; 7/16/37, 15.3; 12/4/37, 15.0; 1/25/38, 12.2; 2/25/38, 5.1; 4/14/38, 3.5; 5/26/38, 5.7; 7/14/38, 12.8; 9/15/38, 13.2; 10/26/38, 12.8.

* Nearby well operating.

APPENDIX F

RECORDS OF APPLICATION OF GROUND WATER TO REPRESENTATIVE CROPS IN SUTTER-YUBA AREA

APPLICATION OF GROUND WATER TO REPRESENTATIVE CROPS IN SUTTER-YUBA AREA IN 1948 AND 1949

Crop	Season	Map number	Well number	Method of irrigation	Soil type	Acres	Depth per irrigation, in inches							Total depth, in inches
							1st	2d	3d	4th	5th	6th	7th	
Alfalfa	1948	1	15N/1E-13E1	Border check	Clay adobe	8	5.8	8.1	7.3	7.3				28.5
	1948	2	11N/3E-15P1	Border check	Fine sandy loam	32	16.1	4.4	30.8	7.5	12.7	2.3		73.8
	1949	3	14N/5E-32R1 14N/5E-32R2	Border check	Loam	20	4.15	4.01	8.81	4.70	4.99	12.96	5.98	53.6
	1949	3	14N/5E-32R1 14N/5E-32R2	Border check	Loam	18	7.83	8.47	9.89	9.29	10.54	11.90	11.10	69.0
	1949	4	15N/5E-18B1	Border check	Loam	27								91.8
							Weighted mean depths: 1948 64.8 inches (5.4 feet) 1949 73.8 inches (6.1 feet) 1948-49 70.0 inches (5.8 feet)							
Almonds	1948	5	16N/3E-29R1	Contour check	Loam	13	5.1	5.0	6.2					16.3
	1948	6	16N/3E-26Q1	Contour check	Loam	50	7.5	7.3						14.8
	1948	7	15N/2E-8J1	Contour check	Loam	70	1.8	8.9						10.7
	1949	6	16N/3E-26Q1	Contour check	Loam	50	7.8	7.33	5.0					20.1
	1949	8	14N/3E-4F1	Contour check	Loam	20	6.4	7.65	3.75	3.75				21.5
							Weighted mean depths: 1948 12.8 inches (1.1 feet) 1949 20.5 inches (1.7 feet) 1948-49 15.4 inches (1.3 feet)							
Young Almonds Inter-planting Beans	1948	9	16N/3E-23R2	Contour check	Loam	20	6.1	4.2	3.8					14.1
Beans	1948	10	13N/4E-7E1	Furrow	Silt loam	36								8.4
	1948	11	15N/4E-17J1 15N/4E-8R1	Furrow	Fine sandy loam	103	4.2	0.8	5.0	6.5				16.5
	1948	12	13N/5E-6D2	Furrow	Fine sandy loam	60	6.0	5.2						11.2
	1949	13	13N/4E-12C1	Furrow	Fine sandy loam	50	4.5	2.0	1.5	1.7	1.7			11.4
							Weighted mean depths: 1948 13.4 inches (1.1 feet) 1949 11.4 inches (1.0 foot) 1948-49 13.0 inches (1.1 feet)							
Cherries	1948	14	15N/3E-15G1	Contour check	Loam	18	6.8	6.8	2.5	4.4	1.9			22.4
	1948	15	15N/3E-3D1	Contour check	Loam	60	7.4	7.7	5.9	7.3	0.7			29.0
							Weighted mean depth: 1948 27.5 inches (2.3 feet)							
Egyptian Corn	1948	11	15N/4E-17J1 15N/4E-8R1	Furrow	Fine sandy loam	13	6.2	5.7	9.2	8.9	1.3			31.3
	1949	12	13N/5E-6D2	Furrow	Fine sandy loam	60	5.6	8.1	7.5					21.2
							Weighted mean depth: 1948-49 23.0 inches (1.9 feet)							
Flax	1948	16	12N/4E-2Q1	Contour check	Clay loam	55								10.4
Hops	1948	17	13N/5E-4J1	Furrow	Fine sandy loam	19	3.7	3.1	3.4	0.8				11.0
	1949	17	13N/5E-4J1	Furrow	Fine sandy loam	27.5	3.8	3.0	3.6					10.4
							Weighted mean depth: 1948-49 10.6 inches (0.9 foot)							
Pasture	1948	18	12N/4E-10A1	Border check	Loam	60								51.5
	1948	19	14N/4E-34C1	Contour check	Loam	120								26.2
	1949	18	12N/4E-10A1	Border check	Loam	75								71.0
	1949	4	15N/3E-18B1	Border check	Loam	30								84.6
	1949	20	14N/5E-21B1	Border check	Loam	172								79.8
							Weighted mean depths: 1948 34.6 inches (3.9 feet) 1949 78.0 inches (6.5 feet) 1948-49 60.7 inches (5.1 feet)							

APPLICATION OF GROUND WATER TO REPRESENTATIVE CROPS IN SUTTER-YUBA AREA IN 1948 AND 1949—Continued

Crop	Season	Map number	Well number	Method of irrigation	Soil type	Acres	Depth per irrigation, in inches							Total depth, in inches
							1st	2d	3d	4th	5th	6th	7th	
Peaches	1948	21	13N/4E-15K1	Contour check	Fine sandy loam	37	17.4	14.1	12.7					44.2
	1948	22	15N/3E-4C2	Contour check	Clay loam	38.5	1.8	7.3	11.5					20.6
	1948	23	13N/5E-7C2	Contour check	Fine sandy loam	55	6.8	5.7	7.7	6.5				26.7
	1948	24	13N/4E-16N1	Contour check	Fine sandy loam	22	4.1	8.0	7.8	7.1				27.0
	1948	25	15N/3E-33D1	Contour check	Loam	47	1.5	17.0	5.2	8.6				32.3
	1948	26	13N/3E-2L1	Contour check	Loam	15	4.0	7.4	5.6	5.2	6.5			28.7
	1948	27	15N/3E-9A1	Contour check	Loam	40	6.8	2.1	4.3	3.5				16.7
	1948	28	14N/3E-26M2	Contour check	Loam	56								31.6
	1948	29	15N/3E-34L1	Contour check	Loam	30								29.5
	1949	26	13N/3E-2L1	Contour check	Loam	15	6.0	5.0	4.7	6.9	11.9			34.5
	1949	23	13N/5E-7C2	Contour check	Fine sandy loam	55								27.0
	1949	30	13N/4E-13F1	Contour check	Fine sandy loam	34								36.1
	1949	24	13N/4E-16N1	Contour check	Fine sandy loam	22								30.6
	1949	29	15N/3E-34L1	Contour check	Loam	30								37.1
							Weighted mean depths: 1948 28.7 inches (2.4 feet) 1949 32.2 inches (2.7 feet) 1948-49 29.7 inches (2.5 feet)							
Prunes	1948	25	15N/3E-33F1	Contour check	Loam	108	7.1	4.7						12.0
	1948	31	16N/3E-36L1	Contour check	Loam	100	3.7	6.4						10.1
	1948	27	15N/3E-9A1	Contour check	Loam	20	2.5	1.8	3.7					8.0
	1948	32	16N/3E-17Q1	Contour check	Loam	20	13.1	9.8	8.1					31.0
	1949	32	16N/3E-17Q1	Contour check	Loam	20	11.75	9.9	10.2	9.35				41.1
							Weighted mean depths: 1948 12.5 inches (1.0 foot) 1949 41.1 inches (3.4 feet) 1948-49 14.6 inches (1.2 feet)							
Rice	1948	33	12N/4E-24F1	Contour check	Loam	80								63.5
	1948	34	11N/4E-9L1 11N/4E-9C1	Contour check	Clay adobe	150								88.5
	1948	35	15N/4E-23A1 14N1,14P1,24C1	Contour check	Loam	325								48.7
	1949	36	16N/4E-6N2	Contour check	Clay loam	120								66.0
	1949	37	12N/4E-20J1 R1, Q1	Contour check	Clay loam	185								171.5 56.2
	1949	35	15N/4E-23A1 14N1, 14P1, 24C1	Contour check	Loam	315	Weighted mean depths: 1948 60.6 inches (5.1 feet) 1949 92.5 inches (7.7 feet) 1948-49 77.5 inches (6.5 feet)							
Sugar Beets	1948	10	13N/4E-7E1 7M1, 18F1	.....	Silt loam	224								17.5
Walnuts	1948	6	16N/3E-26Q1	Furrow	Loam	65	8.6	5.9	3.2					17.7
	1948	14	15N/3E-15G1	Contour check	Loam	12	6.7	6.7	2.6	4.4	1.9			22.3
	1948	11	15N/4E-17J1	Contour check	Fine sandy loam	35	16.6	13.7						30.3
	1948	38	15N/4E-20F1	Contour check	Fine sandy loam	40	6.3	8.1	6.0	6.2	4.3			30.9
	1949	6	16N/3E-26Q1	Furrow	Loam	65	6.2	5.1	4.0	4.6	2.8			22.7
							Weighted mean depths: 1948 24.1 inches (2.0 feet) 1949 22.7 inches (1.9 feet) 1948-49 23.9 inches (2.0 feet)							

APPENDIX G

RESERVOIR YIELD STUDIES

6—63095

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RESERVOIR YIELD STUDIES

YIELD STUDY
HONCUT CREEK RESERVOIR PLUS DIVERSION FROM FRENCH DRY CREEK (NOVEMBER-APRIL)

Capacity: 38,000 acre-feet **Yield: 24,000 acre-feet**

(In acre-feet)

Season	November-May				June-October							Spill, end of May	Deficiency, in percent
	Runoff	Diversion	Demand, 30% of annual demand	Storage, end of May	Demand, 70% of annual demand	Apparent storage, end of October	Apparent deficiency, end of October	Average summer storage	Evaporation	Storage, end of October	Deficiency, end of October		
1920-21	43,170	44,950	7,200	38,000	16,800	21,200		29,600	2,500	18,700		42,920	
1921-22	35,470	28,390	7,200	38,000	16,800	21,200		29,600	2,500	18,700		37,360	
1922-23	18,060	18,350	7,200	38,000	16,800	21,200		29,600	2,500	18,700		9,910	
1923-24	4,700	4,720	7,200	20,920	16,800	4,120		12,520	1,400	2,720			
1924-25	18,490	19,010	7,200	33,020	16,800	16,220		24,620	2,300	13,920			
1925-26	11,350	11,890	7,200	29,960	16,800	13,160		21,560	2,100	11,060			
1926-27	31,120	29,700	7,200	38,000	16,800	21,200		29,600	2,500	18,700		26,680	
1927-28	22,180	22,990	7,200	38,000	16,800	21,200		29,600	2,500	18,700		18,670	
1928-29	6,860	6,260	7,200	24,620	16,800	7,820		16,220	1,700	6,120			
1929-30	16,430	17,110	7,200	32,460	16,800	15,660		24,060	2,200	13,460			
1930-31	4,520	4,680	7,200	15,460	16,800		1,340	7,060	1,000		2,340		9.8
1931-32	21,130	19,720	7,200	33,650	16,800	16,850		25,250	2,300	14,550			
1932-33	8,100	6,120	7,200	21,570	16,800	4,770		13,170	1,500	3,270			
1933-34	6,200	6,320	7,200	8,590	16,800		8,210	190	50		8,260		34.4
1934-35	21,200	20,600	7,200	34,600	16,800	17,800		26,200	2,400	15,400			
AVERAGE	17,900	17,400	7,200		16,800						710	9,040	

YIELD STUDY
CAMP FAR WEST RESERVOIR

Capacity: 104,000 acre-feet **Yield: 90,000 acre-feet**

(In acre-feet)

Season	November-May				June-October							Spill, end of May	Deficiency, in percent
	Runoff	Diversion	Demand, 30% of annual demand	Storage, end of May	Demand, 70% of annual demand	Apparent storage, end of October	Apparent deficiency, end of October	Average summer storage	Evaporation	Storage, end of October	Deficiency, end of October		
1920-21	467,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		336,000	
1921-22	409,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		312,800	
1922-23	364,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		267,800	
1923-24	23,000		27,000	30,800	63,000		32,200				32,200		35.8
1924-25	239,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		108,000	
1925-26	223,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		116,800	
1926-27	450,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		353,800	
1927-28	296,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		199,800	
1928-29	112,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		15,800	
1929-30	355,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		258,800	
1930-31	145,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		48,800	
1931-32	234,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		137,800	
1932-33	51,000		27,000	58,800	63,000		4,200	27,300	3,100		7,300		8.1
1933-34	126,000		27,000	99,000	63,000	36,000		67,500	5,800	30,200			
1934-35	354,000		27,000	104,000	63,000	41,000		72,500	6,200	34,800		253,200	
AVERAGE	256,000		27,000		63,000						2,600	160,600	

YIELD STUDY

COON CREEK RESERVOIR PLUS COMBIE-OPHIR DIVERSION OF 100 SECOND-FEET (NOVEMBER-APRIL)

Capacity: 59,000 acre-feet | Yield: 56,000 acre-feet

(In acre-feet)

Season	November-May				June-October							Spill, end of May	Deficiency, in percent
	Runoff	Diversion	Demand, 30% of annual demand	Storage, end of May	Demand, 70% of annual demand	Apparent storage, end of October	Apparent deficiency, end of October	Average summer storage	Evaporation	Storage, end of October	Deficiency, end of October		
1920-21	44,600	35,700	16,800	59,000	39,200	19,800	--------	39,400	2,500	17,300	--------	4,500	--------
1921-22	40,000	35,700	16,800	59,000	39,200	19,800	--------	39,400	2,500	17,300	--------	17,200	--------
1922-23	33,500	35,700	16,800	59,000	39,200	19,800	--------	39,400	2,500	17,300	--------	10,700	--------
1923-24	5,900	35,700	16,800	42,100	39,200	2,900	--------	22,500	1,800	1,100	--------	--------	--------
1924-25	24,600	35,700	16,800	44,600	39,200	5,400	--------	25,000	2,000	3,400	--------	--------	--------
1925-26	22,300	35,700	16,800	44,600	39,200	5,400	--------	25,000	2,000	3,400		--------	--------
1926-27	48,200	35,700	16,800	59,000	39,200	19,800	--------	39,400	2,500	17,300	--------	11,500	--------
1927-28	30,200	35,700	16,800	59,000	39,200	19,800	--------	39,400	2,500	17,300	--------	7,400	--------
1928-29	11,500	35,700	16,800	47,700	39,200	8,500	--------	28,100	2,100	6,400	--------	--------	--------
1929-30	19,000	35,700	16,800	44,300	39,200	5,100	--------	24,700	2,000	3,100	--------	--------	--------
1930-31	5,900	35,700	16,800	27,900	39,200	--------	11,300	8,300	900	--------	12,200	--------	21.8
1931-32	23,300	35,700	16,800	42,200	39,200	3,000	--------	22,600	1,800	1,200	--------	--------	--------
1932-33	11,500	35,700	16,800	31,600	39,200	--------	7,600	12,000	1,200	--------	8,800	--------	15.7
1933-34	11,200	35,700	16,800	30,100	39,200	--------	9,100	10,500	1,100	--------	10,200	--------	18.2
1934-35	31,800	35,700	16,800	50,700	39,200	11,500	--------	31,100	2,200	9,300	--------	--------	--------
AVERAGE	24,200	35,700	16,800	--------	39,200	--------	--------	--------	--------	--------	2,100	3,400	--------

APPENDIX H

ESTIMATES OF COST

TABLE OF CONTENTS

ESTIMATES OF COST

ESTIMATED COST OF PEACH BOWL PROJECT

(Based on prices prevailing in April, 1952)

Pumping plant capacity: 135 second-feet
Gross seasonal diversion: 24,000 acre-feet
Maximum monthly demand: (July) 6,450 acre-feet, 105 second-feet

Acreage served: Presently irrigated lands, 4,500 acres; irrigated lands to be developed, 2,500 acres

Item	Quantity	Unit price	Cost	
Capital Costs				
Pumping Plant				
Pumps, motors, and electrical equipment	3 each	$14,330	$43,000	
Discharge pipe and footings	3 each	5,700	17,100	
Sump and trash racks		lump sum	7,100	
Structure		lump sum	14,400	
Discharge structure and sand trap		lump sum	3,400	$85,000
Subtotal				$85,000
Administration and engineering, 10%				$8,500
Contingencies, 15%				12,800
Interest during construction				1,600
TOTAL				$107,900
Conveyance System				
Excavation	137,800 cu. yd.	$0.30	$41,400	
Trimming	195,900 sq. yd.	0.25	49,000	
Lining, concrete	10,900 cu. yd.	35.00	381,500	
Turnouts, 100 second-feet	14 each	1,100	15,400	
50 second-feet	20 each	830	16,600	
Crossings, 100 second-feet				
Railroad	1 each	5,800	5,800	
County road	1 each	3,200	3,200	
Crossings, 50 second-feet				
County road	4 each	2,300	9,200	
Farm road	6 each	1,400	8,400	
Right of way				
Orchard lands	52 acres	1,500	78,000	
Open lands	44 acres	750	33,000	$641,500
Subtotal				$641,500
Administration and engineering, 10%				$64,200
Contingencies, 15%				96,200
Interest during construction				12,000
TOTAL				$813,900

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Distribution System				
Presently irrigated lands	4,500 acres	$70.00	$315,000	
Irrigable lands to be developed	2,500 acres	20.00	50,000	$365,000
Subtotal				$365,000
Administration and engineering, 10%				$36,500
Contingencies, 15%				54,800
Interest during construction				6,800
TOTAL				$463,100
Annual Costs				
Pumping Plant				
Interest, 3%				$3,200
Amortization, 0.887%				1,000
Replacement, 0.513%				600
Operation and maintenance, 5%				5,400
Electric energy				5,800
TOTAL				$16,000
Conveyance System				
Interest, 3%				$24,400
Amortization, 0.887%				7,200
Replacement, 0.50%				4,100
Operation and maintenance, 1.0%				8,100
TOTAL				$43,800
Distribution System				
Interest, 3%				$13,900
Amortization, 0.887%				4,100
Operation and maintenance				
Ditch tender service, $0.70 per acre-foot				16,800
Maintenance charge, $0.40 per acre				2,800
District overhead, $0.50 per acre				3,500
TOTAL				$41,100

ESTIMATED COST OF SOUTH HONCUT CREEK DAM AND RESERVOIR

(Based on prices prevailing in April, 1952)

Elevation of crest of dam: 910 feet, U.S.G.S. datum
Elevation of crest of spillway: 898 feet
Height of dam to spillway crest, above stream bed: 168 feet

Capacity of reservoir to crest of spillway: 38,000 acre-feet
Capacity of spillway with 4-foot freeboard: 10,000 second-feet

Item	Quantity	Unit price	Cost	
Capital Costs				
Dam				
Unwatering and care of stream		lump sum	$10,000	
Stripping and preparation of foundation				
Common	37,570 cu. yd.	$1.00	37,600	
Rock	7,760 cu. yd.	3.00	23,300	
Excavation for embankment				
From borrow pits	338,200 cu. yd.	0.45	152,200	
Tailings	451,900 cu. yd.	0.45	203,400	
Sand and gravel filter	101,200 cu. yd.	1.50	151,800	
Embankment				
Impervious from borrow	294,000 cu. yd.	0.25	73,500	
Sand and gravel filter	101,200 cu. yd.	0.50	50,600	
Tailings	451,900 cu. yd.	0.20	90,400	
Rock from salvage	71,600 cu. yd.	0.30	21,500	
Drilling grout holes	4,020 lin. yd.	3.00	12,100	
Pressure grouting	2,680 cu. ft.	4.00	10,700	$837,100
Spillway				
Excavation	86,620 cu. yd.	2.50	216,600	
Concrete	2,770 cu. yd.	35.00	97,000	
Reinforcing steel	207,000 lbs.	0.15	31,100	344,700
Outlet Works				
Excavation				
Common	200 cu. yd.	2.00	400	
Rock	1,980 cu. yd.	6.00	11,900	
Concrete				
Inlet structure	44 cu. yd.	100.00	4,400	
Trench backfill and cut-offs	1,590 cu. yd.	30.00	47,700	
Steel pipe, 42-inch diameter	112,000 lbs.	0.25	28,000	
Reinforcing steel	163,800 lbs.	0.15	24,600	

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Outlet Works—Continued				
High pressure slide gates and controls, 30-inch diameter				
Trash rack steel	2 each	lump sum	$15,000	
Control house		lump sum	1,000	
Howell-Bunger outlet valve, 36-inch diameter		lump sum	1,000	
		lump sum	3,600	$137,600
Reservoir				
Land				
Improvements	906 acres	$125.00	$113,300	
Road to dam site		lump sum	60,000	
Clearing	2 miles	50,000	100,000	
	906 acres	150.00	135,900	409,200
Subtotal				
				$1,728,600
Administration and engineering, 10%				
Contingencies, 15%				$172,900
Interest during construction				259,300
				64,800
TOTAL				
				$2,225,600
Annual Costs				
Interest, 3%				$66,800
Amortization, 0.887%				19,700
Replacement, 0.07%				1,600
Operation and maintenance				6,300
TOTAL				$94,400

ESTIMATED COST OF FRENCH DRY CREEK DIVERSION AND CONDUIT

(Based on prices prevailing in April, 1952)

Elevation of crest of weir: 2,132 feet, U.S.G.S. datum
Height of crest of weir, above stream bed: 7 feet

Capacity of weir with 11-foot head: 10,000 second-feet
Capacity of diversion canal: 200 second-feet
Length of canal: 2 miles

Item	Quantity	Unit price	Cost	
Capital Costs				
Diversion Works				
Excavation	436 cu.yd.	$5.00	$2,200	
Concrete, weirs and head-wall	363 cu.yd.	40.00	14,500	
Reinforcing steel	27,800 lbs.	0.15	4,200	
Trash rack steel	360 lbs.	0.30	100	
Headgates and sluice gate	3 each	1,000	3,000	$24,000
Conduit				
Excavation	12,680 cu.yd.	0.50	6,300	
Compacted fill	6,340 cu.yd.	0.50	3,200	
Shotcrete lining	21,100 sq.yd.	3.50	73,900	
Rights of way	15 acres	200.00	3,000	
Fencing	4 miles	1,500	6,000	
Clearing	15 acres	200.00	3,000	
Road crossings	3 each	500.00	1,500	96,900
Subtotal				$120,900

Item	Quantity	Unit price	Cost
Capital Costs—Continued			
Administration and engineering, 10%			$12,100
Contingencies, 15%			18,100
Interest during construction, none			
TOTAL			$151,100
Annual Costs			
Interest, 3%			$4,500
Amortization, 0.887%			1,300
Replacement, 0.50%			800
Operation and maintenance, 1.0%			1,500
TOTAL			$8,100

ESTIMATED COST OF SOUTH HONCUT CREEK DIVERSION AND CONDUIT

(Based on prices prevailing in April, 1952)

Elevation of crest of weir: 609 feet, U.S.G.S. datum
Height of weir crest, above stream bed: 9 feet
Capacity of weir with 10-foot head: 10,000 second-feet

Capacity of conduit: 150 second-feet
Length of conduit: 4.7 miles

Item	Quantity	Unit price	Cost	
Capital Costs				
Diversion Works				
Excavation, rock	425 cu.yd.	$5.00	$2,100	
Concrete, weirs and headwall	518 cu.yd.	40.00	20,700	
Reinforcing steel	14,900 lbs.	0.15	2,200	
Trash rack steel	360 lbs.	0.30	100	
Headgates and sluice gate	3 each	1,000	3,000	$28,100
Conduit				
Excavation	35,200 cu.yd.	0.50	17,600	
Compacted fill	21,000 cu.yd.	0.50	10,500	
Shotcrete lining	40,800 sq.yd.	3.50	142,800	
Siphon	1,500 lin.ft.	36.70	55,000	
Flume, metal	1,100 lin.ft.	23.40	25,800	
Rights of way	23.4 acres	200.00	4,700	
Fencing	9.4 miles	1,500	14,100	
Clearing	23.4 acres	200.00	4,700	275,200
Subtotal				$303,300

Item	Quantity	Unit price	Cost
Capital Costs—Continued			
Administration and engineering, 10%			$30,300
Contingencies, 15%			45,500
Interest during construction, none			
TOTAL			$379,100
Annual Costs			
Interest, 3%			$11,400
Amortization, 0.887%			3,400
Replacement, 0.50%			1,900
Operation and maintenance, 1.0%			3,800
TOTAL			$20,500

ESTIMATED COST OF NORTHEAST ZONE DIVERSION, CONDUIT, AND DISTRIBUTION SYSTEM

(Based on prices prevailing in April, 1952)

Capacity of conduit: 75 second-feet at diversion, decreasing uniformly to 25 second-feet at terminus
Diversion: Temporary earthfill dam on Prairie Creek

Length of conduit: 6.3 miles
Distribution system: Unlined canals and ditches
Acreage served: 2,300 acres

Item	Quantity	Unit price	Cost	
Capital Costs				
Diversion Dam				
Stripping	60 cu.yd.	$1.00	$100	
Compacted fill	160 cu.yd.	1.00	200	$300
Subtotal				$300
Administration and engineering, 10%				$100
Contingencies, 15%				100
Interest during construction, none				
TOTAL				$500
Conduit				
Excavation	39,400 cu.yd.	$0.50	$19,700	
Compacted fill	30,800 cu.yd.	0.50	15,400	
Trimming	82,500 sq.yd.	0.30	24,800	
Concrete				
Shotcrete, at road crossings	400 sq.yd.	3.50	1,400	
Reinforced, road crossings	80 cu.yd.	50.00	4,000	
Canal headwall and cutoff	15 cu.yd.	50.00	800	
Reinforcing steel	7,100 lbs.	0.15	1,100	
Headgate, 4′ x 5′ slide gate		lump sum	500	
Rights of way	46 acres	200.00	9,200	
Clearing	46 acres	200.00	9,200	
Fencing	12.6 miles	1,500	18,900	$105,000
Subtotal				$105,000
Administration and engineering, 10%				$10,500
Contingencies, 15%				15,800
Interest during construction, none				
TOTAL				$131,300

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Distribution System	2,300 acres	$20.00	$46,000	$46,000
Subtotal				$46,000
Administration and engineering, 10%				$4,600
Contingencies, 15%				6,900
Interest during construction, none				
TOTAL				$57,500
Annual Costs				
Diversion Dam				
Construction cost				$500
Subtotal				$500
Conduit				
Interest, 3%				$3,900
Amortization, 0.887%				1,200
Replacement, 0.50%				700
Operation and maintenance, 1.0%				1,300
TOTAL				$7,100
Distribution System				
Interest, 3%				$1,700
Amortization, 0.887%				500
Operation and maintenance				
Ditch tender service, $0.50 per acre-foot				5,400
Maintenance charge, $0.40 per acre				900
District overhead, $0.50 per acre				1,200
TOTAL				$9,700

ESTIMATED COST OF BROWNS VALLEY DISTRIBUTION SYSTEM

(Based on prices prevailing in April, 1952)

Distribution system: Unlined canals and ditches

Acreage served: 2,600 acres

Item	Quantity	Unit price	Cost	
Capital Costs				
Distribution System	2,600 acres	$20.00	$52,000	$52,000
Subtotal				$52,000
Administration and engineering, 10%				$5,200
Contingencies, 15%				7,800
Interest during construction, none				
TOTAL				$65,000

Item	Quantity	Unit price	Cost
Annual Costs			
Interest, 3%			$2,000
Amortization, 0.887%			600
Operation and maintenance			
Ditch tender service, $0.80 per acre-foot			8,100
Maintenance charge, $0.60 per acre			1,600
District overhead, $0.80 per acre			2,100
TOTAL			$14,400

ESTIMATED COST OF CAMP FAR WEST DAM AND RESERVOIR

(Based on prices prevailing in April, 1952)

Elevation of crest of dam: 311 feet, U.S.G.S. datum
Elevation of crest of spillway: 300 feet
Height of dam to spillway crest, above stream bed: 155 feet

Capacity of reservoir to crest of spillway: 104,000 acre-feet
Capacity of spillway with 4-foot freeboard: 60,000 second-feet

Item	Quantity	Unit price	Cost	
Capital Costs				
Dam				
Diversion and care of stream		lump sum	$50,000	
Stripping and preparation of foundation	149,000 cu.yd.	$1.00	149,000	
Excavation for embankment				
From borrow pits	743,600 cu.yd.	0.65	483,300	
Stream bed gravel	1,243,100 cu.yd.	0.40	497,200	
Rock riprap	63,100 cu.yd.	2.00	126,200	
Embankment				
Common compacted	649,300 cu.yd.	0.25	162,300	
Pervious				
From excavation	1,055,600 cu.yd.	0.20	211,100	
From salvage	112,000 cu.yd.	0.30	33,600	
Sand and gravel filter	187,500 cu.yd.	0.50	93,800	
Rock riprap	63,100 cu.yd.	0.50	31,600	
Drilling grout holes	4,140 lin.ft.	3.00	12,400	
Pressure grouting	2,760 cu.ft.	4.00	11,000	$1,861,500
Spillway				
Excavation	200,000 cu.yd.	1.00	200,000	
Concrete	7,570 cu.yd.	35.00	265,000	
Reinforcing steel	559,400 lbs.	0.15	83,900	548,900
Outlet Works				
Tunnel, 8-foot diameter	950 lin.ft.	200.00	190,000	
Portal, excavation	8,500 cu.yd.	2.00	17,000	
Concrete (intake, gate chamber, saddles, plug, and walkway)	280 cu.yd.	60.00	16,800	

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Outlet Works—Continued				
Reinforcing steel	28,000 lbs.	$0.15	$4,200	
Steel pipe, 66-inch diameter	210,000 lbs.	0.25	52,500	
High pressure 5' x 5' slide gate		lump sum	25,000	
Stilling basin		lump sum	8,800	
Needle valve				
60-inch diameter		lump sum	27,500	
36-inch diameter		lump sum	10,000	
Venturi meter		lump sum	5,000	$356,800
Reservoir				
Land and improvements	2,160 acres	$50.00	$108,000	
Clearing reservoir land	2,160 acres	100.00	216,000	$324,000
Subtotal				$3,091,200
Administration and engineering, 10%				$309,100
Contingencies, 15%				463,700
Interest during construction				115,900
TOTAL				$3,979,900
Annual Costs				
Interest, 3%				$119,400
Amortization, 0.887%				35,300
Replacement, 0.07%				2,800
Operation and maintenance				12,500
TOTAL				$170,000

ESTIMATED COST OF BEAR RIVER CANAL

(Based on prices prevailing in April, 1952)

Elevation of stilling basin: 187 feet, U.S.G.S. datum
Elevation of division box: 183 feet

Capacity of canal: 400 second-feet

Item	Quantity	Unit price	Cost	
Capital Costs				
Canal				
Excavation	43,600 cu. yd.	$1.50	$65,400	
Compacted fill	40,000 cu. yd.	0.50	20,000	
Lining, shotcrete	24,000 sq. yd.	3.50	84,000	
Drainage structures	3 each	lump sum	1,500	$170,900
Division Box				
Excavation	230 cu. yd.	3.00	700	
Concrete	87 cu. yd.	60.00	5,200	
Gates and trash racks	4 each	600.00	2,400	8,300
Rights of Way				
Land	18 acres	50.00	900	
Clearing	18 acres	100.00	1,800	
Fencing	3 miles	1,500	4,500	7,200
Subtotal				$186,400

Item	Quantity	Unit price	Cost
Capital Costs—Continued			
Administration and engineering, 10%			$18,600
Contingencies, 15%			28,000
Interest during construction, none			
TOTAL			$233,000
Annual Costs			
Interest, 3%			$7,000
Amortization, 0.887%			2,100
Replacement, 0.50%			1,200
Operation and maintenance, 1.0%			2,300
TOTAL			$12,600

ESTIMATED COST OF EAST CENTRAL ZONE SIPHON, CONDUIT, AND DISTRIBUTION SYSTEM

(Based on prices prevailing in April, 1952)

Capacity of siphon: 200 second-feet
Length of siphon: 800 feet
Capacity of conduit, initial 2.9 miles: 200 second-feet
Capacity of conduit, remaining 0.8 mile: 100 second-feet

Distribution system: Unlined canals and ditches
Acreage served: 8,500 acres

Item	Quantity	Unit price	Cost	
Capital Costs				
Siphon				
Excavation, trench	3,000 cu. yd.	$3.00	$9,000	
Backfill				
Concrete	540 cu. yd.	35.00	18,900	
Earth	1,800 cu. yd.	1.00	1,800	
Steel pipe, 66-inch diameter	140,500 lbs.	0.20	28,100	$57,800
Conduit				
Excavation	113,800 cu. yd.	0.50	56,900	
Trimming of canal	61,420 sq. yd.	0.30	18,400	
Compacted fill	16,780 cu. yd.	0.50	8,400	
Concrete				
Shotcrete	9,060 sq. yd.	3.50	31,700	
Flume intake and outlet	40 cu. yd.	50.00	2,000	
Road crossings	63 cu. yd.	50.00	3,200	
Flume footings	20 cu. yd.	80.00	1,600	
Parshall flume	15 cu. yd.	70.00	1,100	
Reinforcing steel	11,800 lbs.	0.15	1,800	
Timber				
Road crossings	6.37 MBM	350.00	2,200	
Flume substructure	14.1 MBM	400.00	5,600	
Flume, metal	300 lin. ft.	30.00	9,000	
Flume, hardware	1,690 lbs.	1.00	1,700	
Rights of way	42 acres	200.00	8,400	
Clearing	42 acres	200.00	8,400	
Fencing	7.4 miles	1,500	11,100	$171,500
Subtotal				$229,300
Administration and engineering, 10%				22,900
Contingencies, 15%				34,400
Interest during construction, none				
TOTAL				$286,600

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Distribution System	8,500 acres	$20.00	$170,000	$170,000
Subtotal				$170,000
Administration and engineering, 10%				17,000
Contingencies, 15%				25,500
Interest during construction, none				
TOTAL				$212,500
Annual Costs				
Siphon and Conduit				
Interest, 3%				$8,600
Amortization, 0.887%				2,500
Replacement, 0.50%				1,400
Operation and maintenance, 1.0%				2,900
TOTAL				$15,400
Distribution System				
Interest, 3%				$6,400
Amortization, 0.887%				1,900
Operation and maintenance				
Ditch tender service, $0.55 per acre-foot				16,500
Maintenance charge, $0.40 per acre				3,800
District overhead, $0.50 per acre				4,200
TOTAL				$32,800

ESTIMATED COST OF SOUTH SIDE ZONE CONDUIT AND DISTRIBUTION SYSTEM

(Based on prices prevailing in April, 1952)

Capacity of conduit, initial 11.0 miles: 200 second-feet
Capacity of conduit, remaining 7.8 miles: 100 second-feet

Distribution system: Unlined canals and ditches
Acreage served: 8,500 acres

Item	Quantity	Unit price	Cost	
Capital Costs				
Conduit				
Excavation	311,360 cu. yd.	$0.50	$155,700	
Compacted fill	81,840 cu. yd.	0.50	40,900	
Trimming	330,240 sq. yd.	0.30	99,100	
Concrete				
Shotcrete	13,650 sq. yd.	3.50	47,800	
Flume transition structures	33 cu. yd.	50.00	1,700	
Road crossing	100 cu. yd.	50.00	5,000	
Substructure footings	20 cu. yd.	80.00	1,600	
Parshall flume	15 cu. yd.	70.00	1,100	
Siphon transition structure	30 cu. yd.	50.00	1,500	
Reinforcing steel	20,000 lbs.	0.15	3,000	
Timber				
Road crossings	12.5 MBM	350.00	4,400	
Flume substructure	11 MBM	400.00	4,400	
Flume, metal	420 lin. ft.	15.00	6,300	
Flume, hardware	1,320 lbs.	1.00	1,300	
Pipe, 48" corrugated metal	150 lin. ft.	20.00	3,000	
Jacking costs	100 lin. ft.	50.00	5,000	
Diversion dam at Markham Ravine		lump sum	1,500	
Rights of way	190 acres	300.00	57,000	
Fencing	37.6 miles	1,500	56,400	
Clearing	190 acres	200.00	38,000	$534,700
Subtotal				$534,700
Administration and engineering, 10%				53,500
Contingencies, 15%				80,200
Interest during construction, none				
TOTAL				$668,400

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Distribution System	8,500 acres	$20.00	$170,000	$170,000
Subtotal				$170,000
Administration and engineering, 10%				17,000
Contingencies, 15%				25,500
Interest during construction, none				
TOTAL				$212,500
Annual Costs				
Conduit				
Interest, 3%				$20,100
Amortization, 0.887%				5,900
Replacement, 0.50%				3,300
Operation and maintenance, 1.0%				6,700
TOTAL				$36,000
Distribution System				
Interest, 3%				$6,400
Amortization, 0.887%				1,900
Operation and maintenance				
Ditch tender service, $0.55 per acre-foot				16,500
Maintenance charge, $0.40 per acre				3,800
District overhead, $0.50 per acre				4,200
TOTAL				$32,800

ESTIMATED COST OF COON CREEK DAM AND RESERVOIR

(Based on prices prevailing in April, 1952)

Elevation of crest of dam: 560 feet, U.S.G.S. datum
Elevation of crest of spillway: 552 feet
Height of dam to spillway crest, above stream bed: 207 feet

Capacity of reservoir to crest of spillway: 59,000 acre-feet
Capacity of spillway with 4-foot freeboard: 14,000 second-feet

Item	Quantity	Unit price	Cost	
Capital Costs				
Dam				
Diversion and care of stream		lump sum	$5,000	
Stripping and preparation of foundation	304,200 cu.yd.	$1.50	456,300	
Excavation for embankment				
From borrow pits	903,900 cu.yd.	0.75	677,900	
From Bear River, gravel	1,245,230 cu.yd.	0.75	933,900	
Embankment				
Impervious zone, compacted	786,040 cu.yd.	0.25	196,500	
Pervious zone				
From excavation	1,130,730 cu.yd.	0.20	226,100	
From salvage	128,300 cu.yd.	0.30	38,500	
Sand and gravel filter	115,500 cu.yd.	0.50	57,700	
Rock riprap (from salvage)	40,500 cu.yd.	0.50	20,300	
Drilling grout holes	8,400 lin.ft.	3.00	25,200	
Pressure grouting	5,600 cu.ft.	4.00	22,400	$2,659,800
Auxiliary Dams				
Stripping and preparation of foundation	55,260 cu.yd.	1.50	82,900	
Excavation for embankment				
From borrow pits	180,160 cu.yd.	0.75	135,100	
From quarry	251,410 cu.yd.	0.75	188,600	
Embankment				
Impervious zone	156,660 cu.yd.	0.25	39,200	
Pervious zone				
From excavation	176,510 cu.yd.	0.20	35,300	
From salvage	22,800 cu.yd.	0.30	6,800	
Sand and gravel filter	74,900 cu.yd.	0.50	37,400	
Rock riprap (from salvage)	17,900 cu.yd.	0.50	9,000	
Drilling grout holes	3,400 lin.ft.	3.00	10,200	
Pressure grouting	2,260 cu.ft.	4.00	9,000	553,500

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Spillway				
Excavation	2,600 cu.yd.	$2.00	$5,200	
Concrete	3,962 cu.yd.	30.00	119,000	
Reinforcing steel	98,600 lbs.	0.15	14,800	$139,000
Outlet Works				
Excavation	2,000 cu.yd.	5.00	10,000	
Concrete				
Trench backfill	1,000 cu.yd.	30.00	30,000	
Intake structure	50 cu.yd.	100.00	5,000	
Outlet structure	20 cu.yd.	100.00	2,000	
Reinforcing steel	110,000 lbs.	0.15	16,500	
Steel pipe, 48-inch diameter 1/4" plate	127,500 lbs.	0.25	31,900	
High pressure slide gates and controls, 30-inch diameter	2 each	lump sum	17,000	
Howell-Bunger valve, 42-inch diameter	1 each	lump sum	7,600	120,000
Reservoir				
Land and improvements	820 acres	75.00	61,500	
Clearing	820 acres	200.00	164,000	
Road across dam		lump sum	10,000	235,500
Subtotal				$3,707,800
Administration and engineering, 10%				370,800
Contingencies, 15%				556,100
Interest during construction				139,000
TOTAL				$4,773,700
Annual Costs				
Interest, 3%				$143,200
Amortization, 0.887%				41,200
Replacement, 0.07%				3,300
Operation and maintenance				8,500
TOTAL				$196,200

ESTIMATED COST OF COON CREEK DIVERSION, CONDUIT, AND DISTRIBUTION SYSTEM

(Based on prices prevailing in April, 1952)

Capacity of conduit: 100 second-feet
Length of conduit: 7.8 miles
Canal lined for first 0.5 mile

Distribution system: Unlined canals and ditches
Acreage served: 12,000 acres

Item	Quantity	Unit price	Cost	
Capital Costs				
Diversion Structure				
Stripping	320 cu.yd.	$0.50	$200	
Embankment	900 cu.yd.	0.50	400	
Timber, flashboards	1.2 MBM	250.00	300	
Crane for removing flashboards		lump sum	1,000	$1,900
Levee				
Stripping	1,500 cu.yd.	0.50	800	
Embankment	2,000 cu.yd.	0.50	1,000	
Concrete headwall and wing walls	22 cu.yd.	60.00	1,300	
Reinforcing steel	2,200 lbs.	0.15	300	
Headgate, 4' x 5'		lump sum	500	3,900
Conduit				
Excavation	72,810 cu.yd.	0.50	36,400	
Compacted fill	32,740 cu.yd.	0.50	16,400	
Trimming	101,830 sq.yd.	0.30	30,500	
Concrete				
Shotcrete	5,330 sq.yd.	3.50	18,700	
Flume transition structures	16 cu.yd.	50.00	800	
Road crossings	60 cu.yd.	50.00	3,000	
Substructure footings	4 cu.yd.	80.00	300	
Siphon transition structure	30 cu.yd.	50.00	1,500	
Reinforcing steel	14,000 lbs.	0.15	2,100	
Timber				
Road crossings	7.5 MBM	350.00	2,600	
Flume substructure	2.6 MBM	400.00	1,000	
Flume, metal	100 lin.ft.	15.00	1,500	
Flume hardware	310 lbs.	1.00	300	
Pipe, 48-inch corrugated metal	150 lin.ft.	20.00	3,000	
Jacking costs	100 lin.ft.	50.00	5,000	
Diversion dam at Markham Ravine		lump sum	1,500	
Rights of way	60 acres	300.00	18,000	
Fencing	15.6 miles	1,500	23,400	
Clearing	60 acres	200.00	12,000	178,000
Subtotal				$183,800

Item	Quantity	Unit price	Cost	
Capital Costs—Continued				
Administration and engineering, 10%				$18,400
Contingencies, 15%				27,600
Interest during construction, none				
TOTAL				$229,800
Distribution System	12,000 acres	$20.00	$240,000	$240,000
Subtotal				$240,000
Administration and engineering, 10%				24,000
Contingencies, 15%				36,000
Interest during construction, none				
TOTAL				$300,000
Annual Costs				
Diversion and Conduit				
Interest, 3%				$6,900
Amortization, 0.887%				2,000
Replacement, 0.50%				1,100
Operation and maintenance, 1.0%				2,300
TOTAL				$12,300
Distribution System				
Interest, 3%				$9,000
Amortization, 0.887%				2,700
Operation and maintenance				
Ditch tender service, $0.55 per acre-foot				23,100
Maintenance charge, $0.40 per acre				4,800
District overhead, $0.50 per acre				6,000
TOTAL				$45,600

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PLATE I


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
LOCATION OF
SUTTER-YUBA AREA
SCALE OF MILES
1952
OREGON
NEVADA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
SHASTA
LASSEN
TRINITY
HUMBOLDT
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
LAKE
SONOMA
ALPINE
MONO
TUOLUMNE
INYO
ALAMEDA
SANTA CLARA
MONTEREY
KINGS
TULARE
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
SAN FRANCISCO
Lake Tahoe
Clear Lake
Eagle Lake
Honey Lake
Lake Almanor
Mono Lake
Lake Mead
Sacramento
Russian
SAN DIEGO

PLATE 2

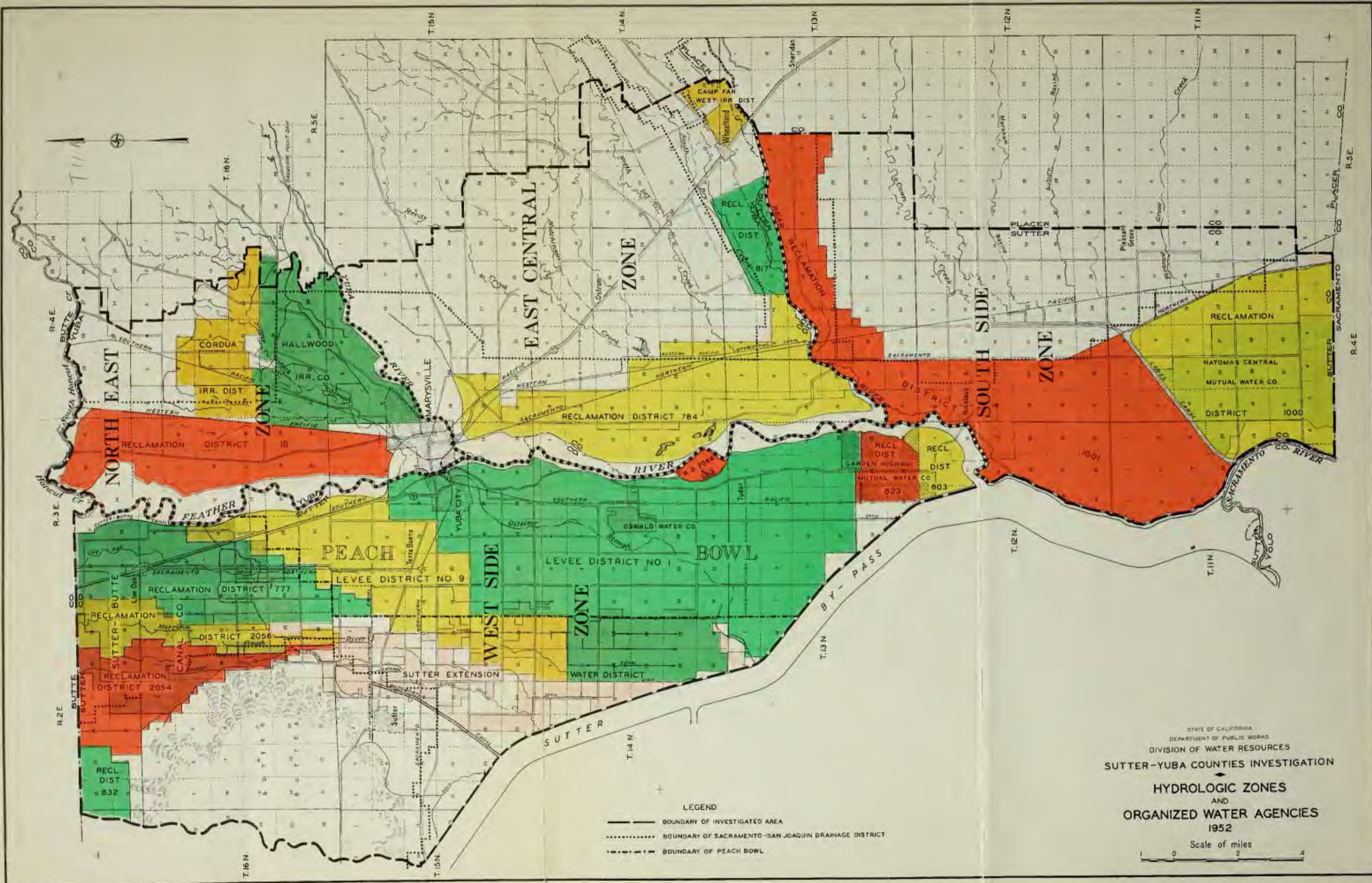
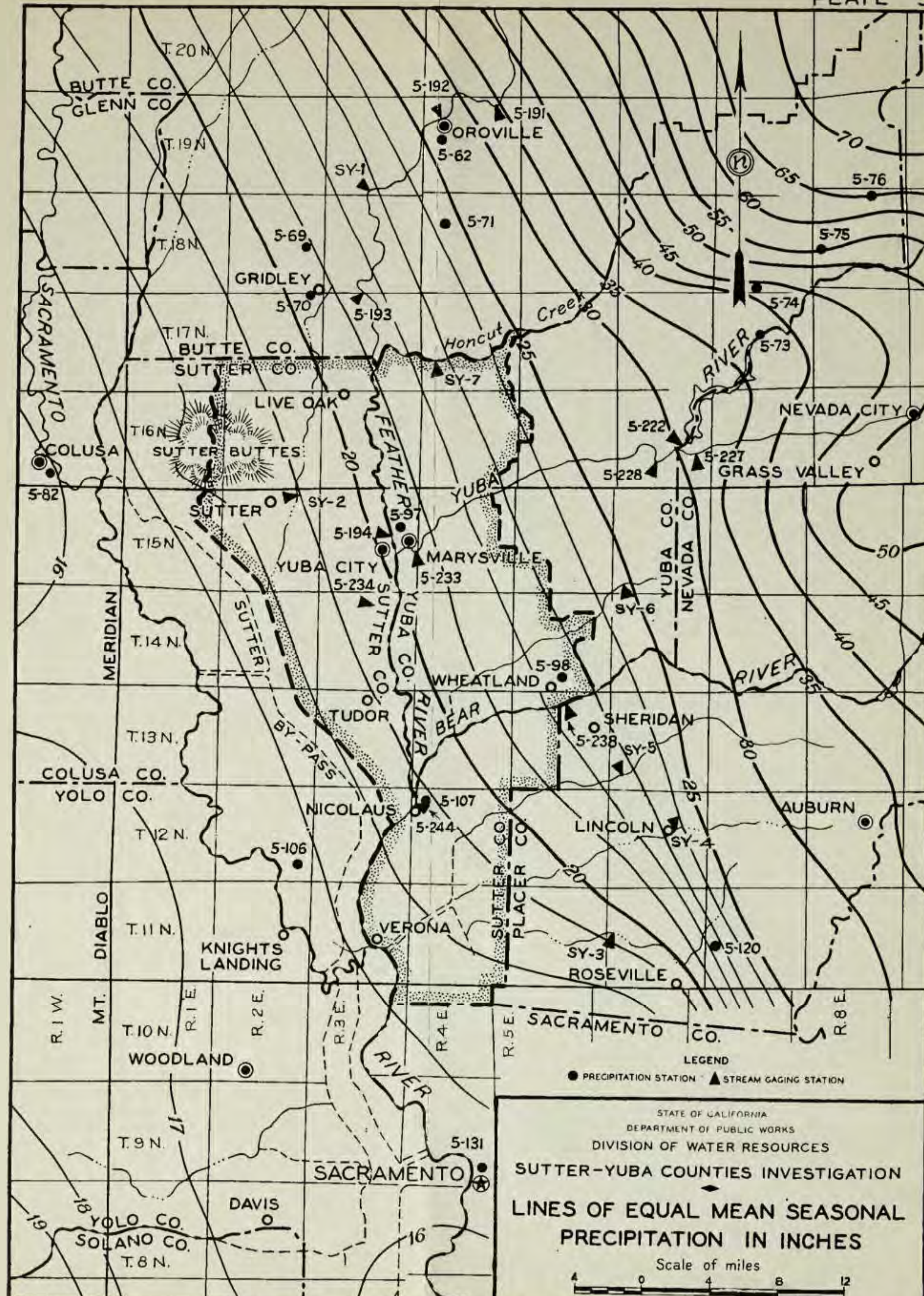

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
HYDROLOGIC ZONES
AND
ORGANIZED WATER AGENCIES
1952
Scale of miles
1 0 2 4
LEGEND
BOUNDARY OF INVESTIGATED AREA
BOUNDARY OF SACRAMENTO-SAN JOAQUIN DRAINAGE DISTRICT
BOUNDARY OF PEACH BOWL
NORTH EAST ZONE
EAST CENTRAL ZONE
SOUTH SIDE ZONE
WEST SIDE ZONE
PEACH BOWL
RECLAMATION DISTRICT 10
CORDUA IRR. DIST
HALLWOOD IRR. CO
RECLAMATION DISTRICT 784
RECL DIST 817
CAMP FAR WEST IRR DIST
Wheatland
BEAR RIVER RECLAMATION DISTRICT
RECLAMATION DISTRICT 1001
NATOMAS CENTRAL MUTUAL WATER CO
RECLAMATION DISTRICT 1000
RECL DIST 803
RECL DIST 823
GARDEN HIGHWAY MUTUAL WATER CO
R.D. 2068
OSWALD WATER CO
LEVEE DISTRICT NO. 1
LEVEE DISTRICT NO 9
SUTTER EXTENSION WATER DISTRICT
RECLAMATION DISTRICT 777
SUTTER-BUTTE CANAL CO
RECLAMATION DISTRICT 2056
RECLAMATION DISTRICT 2054
RECL DIST 832
MARYSVILLE
YUBA CITY
Sutter
Sheridan
Terra Buena
FEATHER RIVER
SACRAMENTO RIVER
SUTTER BY-PASS
T.11N
T.12N
T.13N
T.14N
T.15N
T.16N
R.2E.
R.3E.
R.4E.
R.5E.

PLATE 3

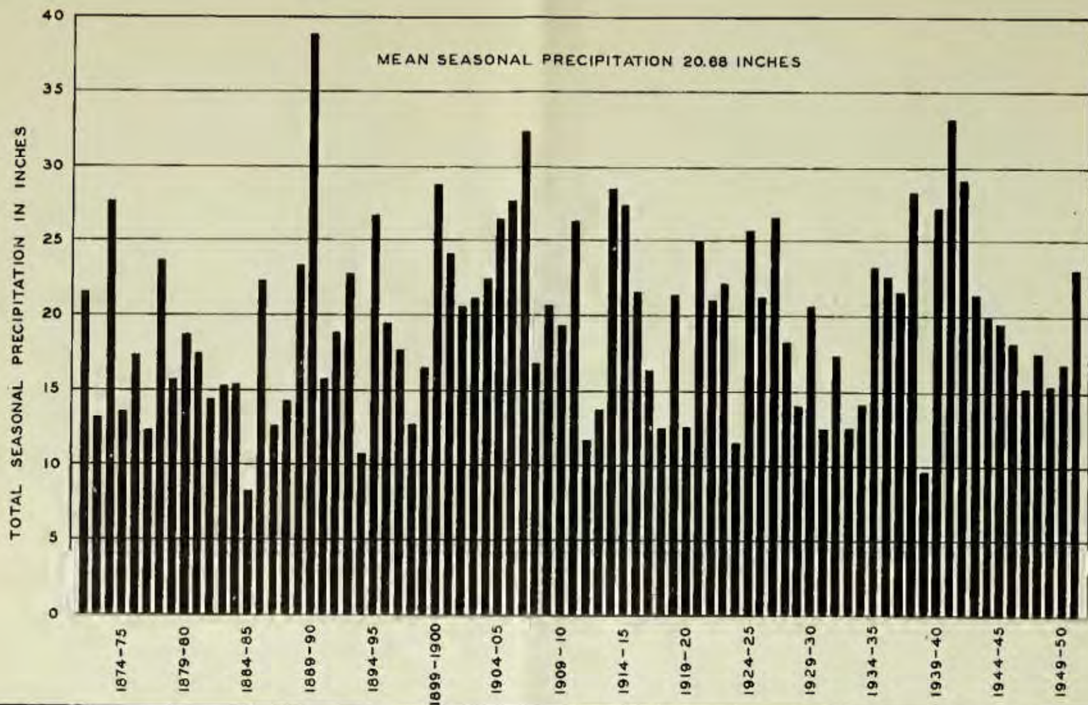


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION

LINES OF EQUAL MEAN SEASONAL PRECIPITATION IN INCHES

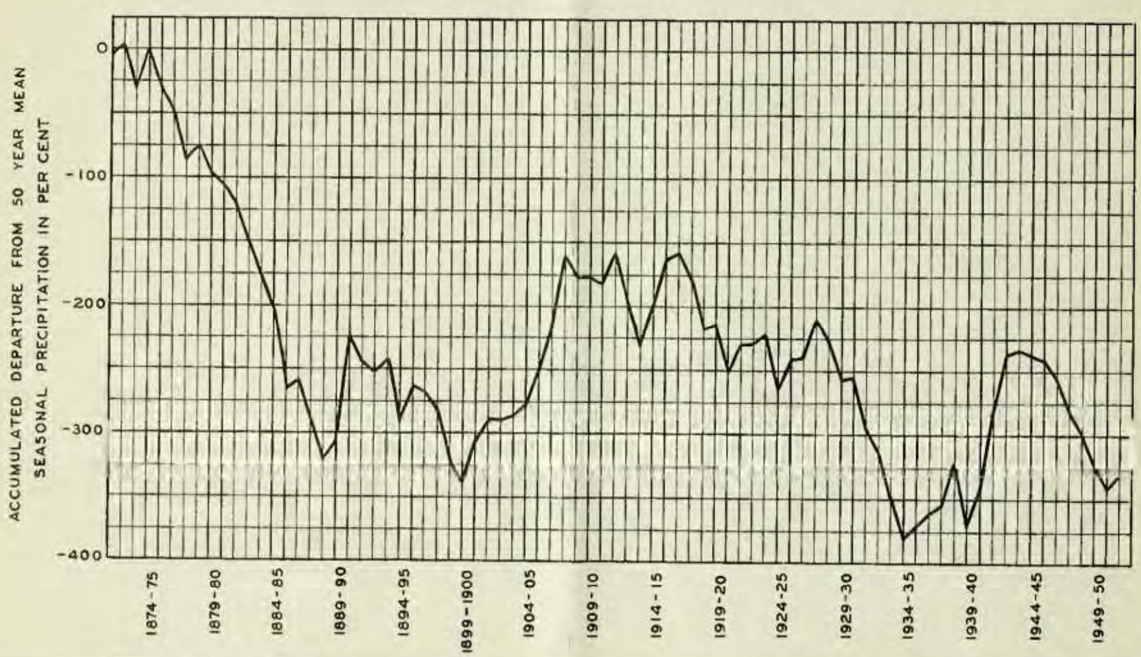
Scale of miles

PLATE 4

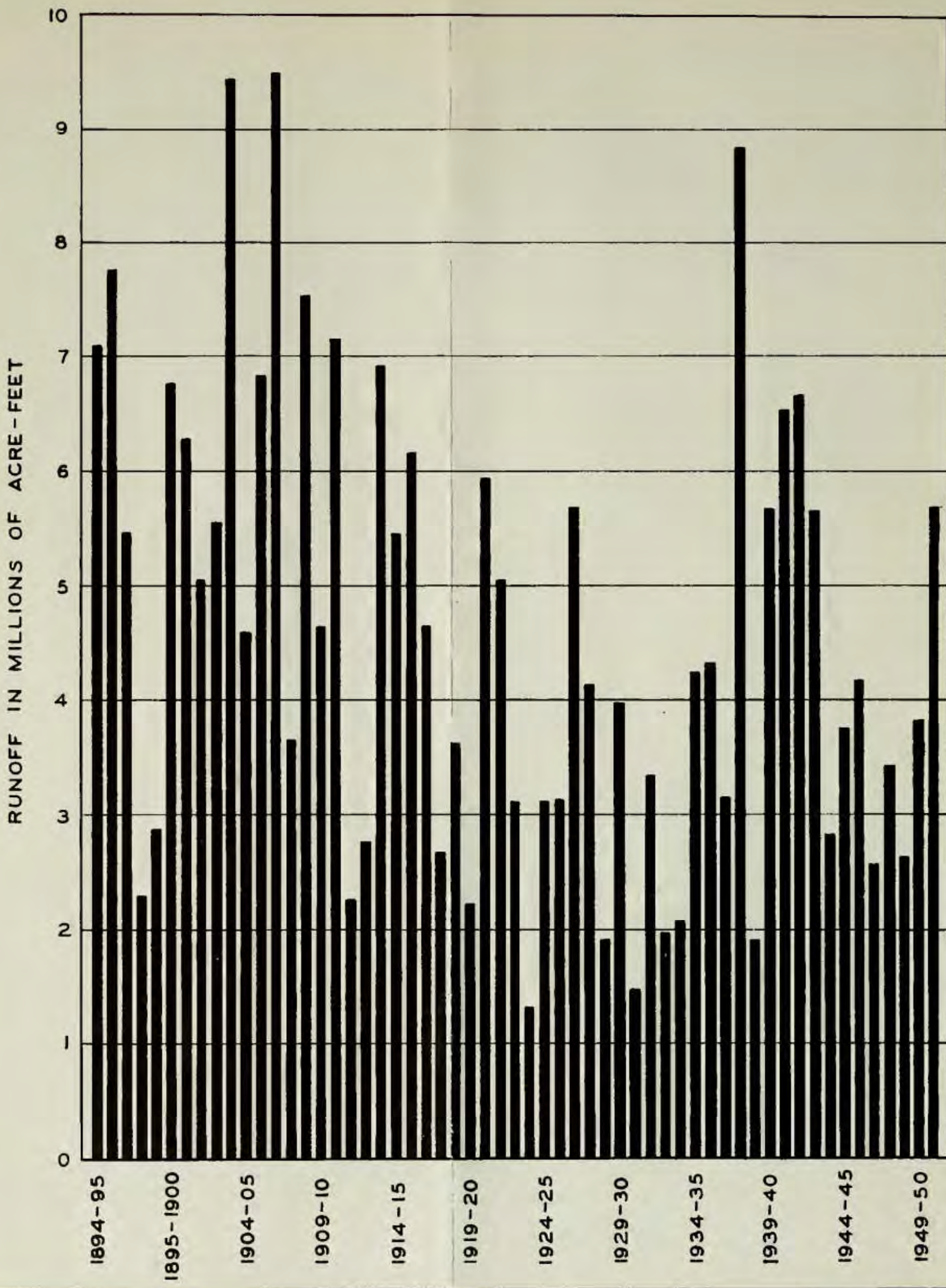


RECORDED SEASONAL PRECIPITATION AT MARYSVILLE

PLATE 5



ACCUMULATED DEPARTURE FROM MEAN SEASONAL PRECIPITATION AT MARYSVILLE

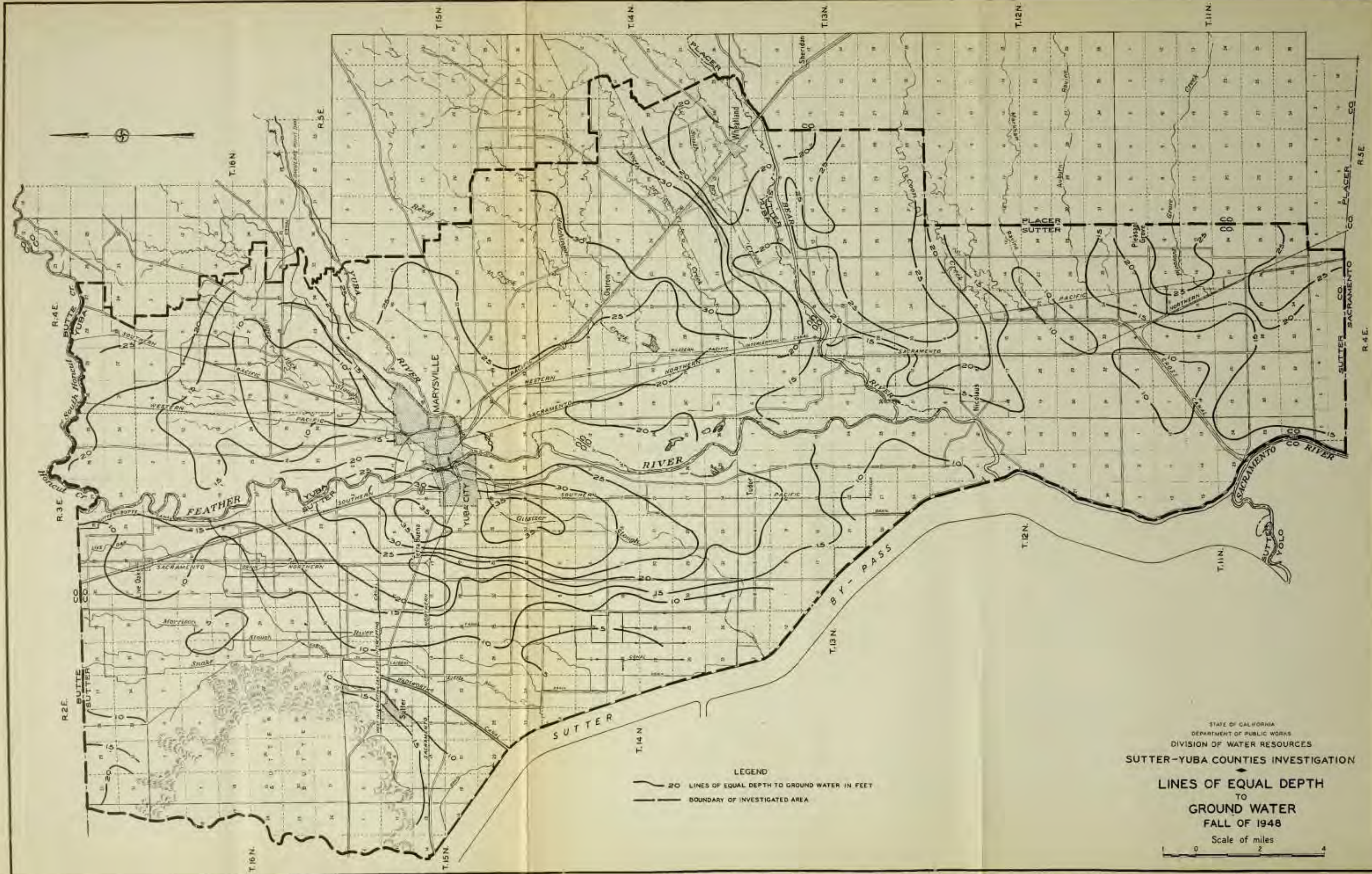


ESTIMATED SEASONAL NATURAL RUNOFF OF FEATHER RIVER AT OROVILLE

PLATE 7


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
LINES OF EQUAL DEPTH
TO
GROUND WATER
FALL OF 1947
Scale of miles
0 2 4
LEGEND
20 LINES OF EQUAL DEPTH TO GROUND WATER IN FEET
BOUNDARY OF INVESTIGATED AREA
MARYSVILLE
YUBA CITY
FEATHER RIVER
YUBA RIVER
BEAR RIVER
SACRAMENTO RIVER
SUTTER BY-PASS
Wheatland
Sheridan
Nicolaus
Tudor
Sutter
Live Oak
T.11N.
T.12N.
T.13N.
T.14N.
T.15N.
T.16N.
R.2E.
R.3E.
R.4E.
R.5E.

PLATE 8


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
LINES OF EQUAL DEPTH
TO
GROUND WATER
FALL OF 1948
Scale of miles
0
2
4
LEGEND
20 LINES OF EQUAL DEPTH TO GROUND WATER IN FEET
BOUNDARY OF INVESTIGATED AREA
MARYSVILLE
YUBA CITY
Wheatland
Sheridan
Nicolaus
Tudor
Sutter
Live Oak
Pleasant Grove
FEATHER
RIVER
YUBA
BEAR
SACRAMENTO
SUTTER BY-PASS
PLACER
SUTTER
BUTTE
YOLO
T.11N.
T.12N.
T.13N.
T.14N.
T.15N.
T.16N.
R.2E.
R.3E.
R.4E.
R.5E.


MARYSVILLE
YUBA CITY
Wheatland
Sheridan
Nicolaus
Tudor
Live Oak
Sutter
FEATHER
RIVER
YUBA
BEAR
SACRAMENTO
SUTTER BY-PASS
PLACER
SUTTER
BUTTE
YOLO
R.2E.
R.3E.
R.4E.
R.5E.
T.11N.
T.12N.
T.13N.
T.14N.
T.15N.
T.16N.
LEGEND
20 LINES OF EQUAL DEPTH TO GROUND WATER IN FEET
BOUNDARY OF INVESTIGATED AREA
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
LINES OF EQUAL DEPTH
TO
GROUND WATER
FALL OF 1949
Scale of miles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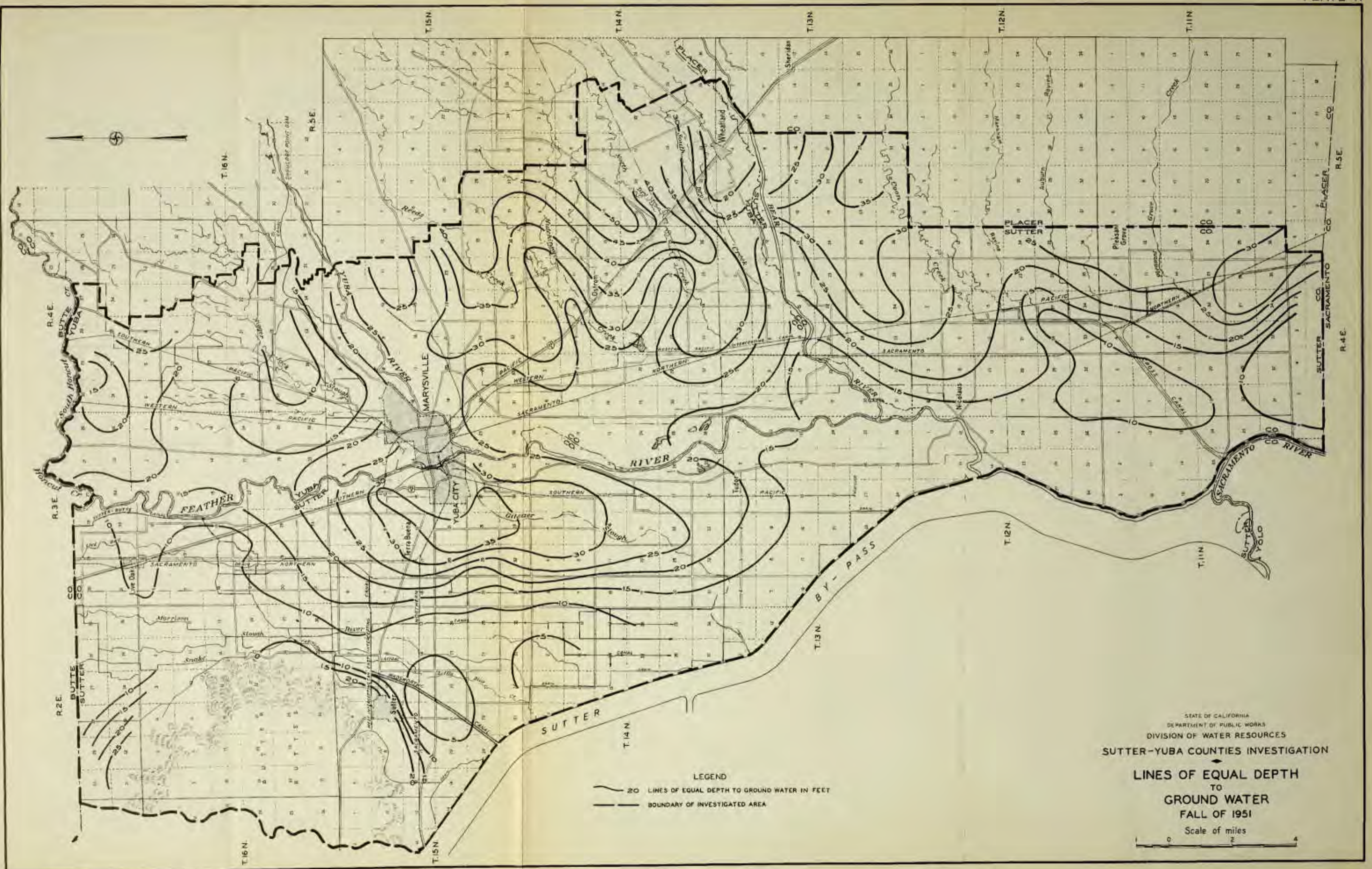
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
LINES OF EQUAL DEPTH
TO
GROUND WATER
FALL OF 1950
Scale of miles
0
2
4
LEGEND
20 LINES OF EQUAL DEPTH TO GROUND WATER IN FEET
BOUNDARY OF INVESTIGATED AREA
MARYSVILLE
YUBA CITY
Wheatland
Sheridan
Nicolaus
Tudor
Live Oak
Sutter
Terra Buena
FEATHER
RIVER
YUBA
BEAR
SACRAMENTO
SUTTER BY-PASS
PLACER
SUTTER
YOLO
BUTTE
T.16N.
T.15N.
T.14N.
T.13N.
T.12N.
T.11N.
R.2E.
R.3E.
R.4E.
R.5E.



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SUTTER-YUBA COUNTIES INVESTIGATION

LINES OF EQUAL DEPTH
TO
GROUND WATER
FALL OF 1951

Scale of miles
0 2 4

LEGEND
20 LINES OF EQUAL DEPTH TO GROUND WATER IN FEET
BOUNDARY OF INVESTIGATED AREA

PLATE 12

STATE OF CALIFORNIA
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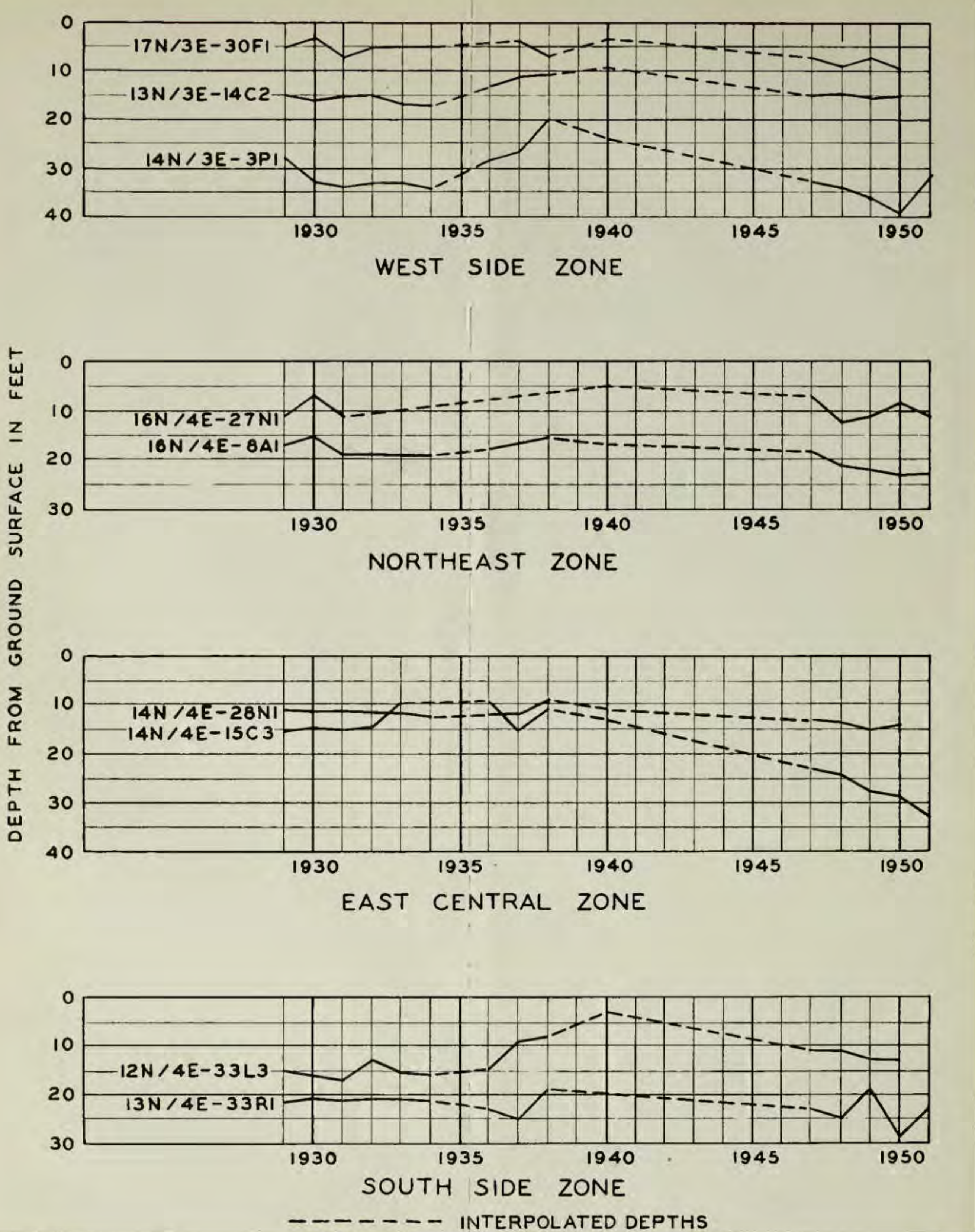
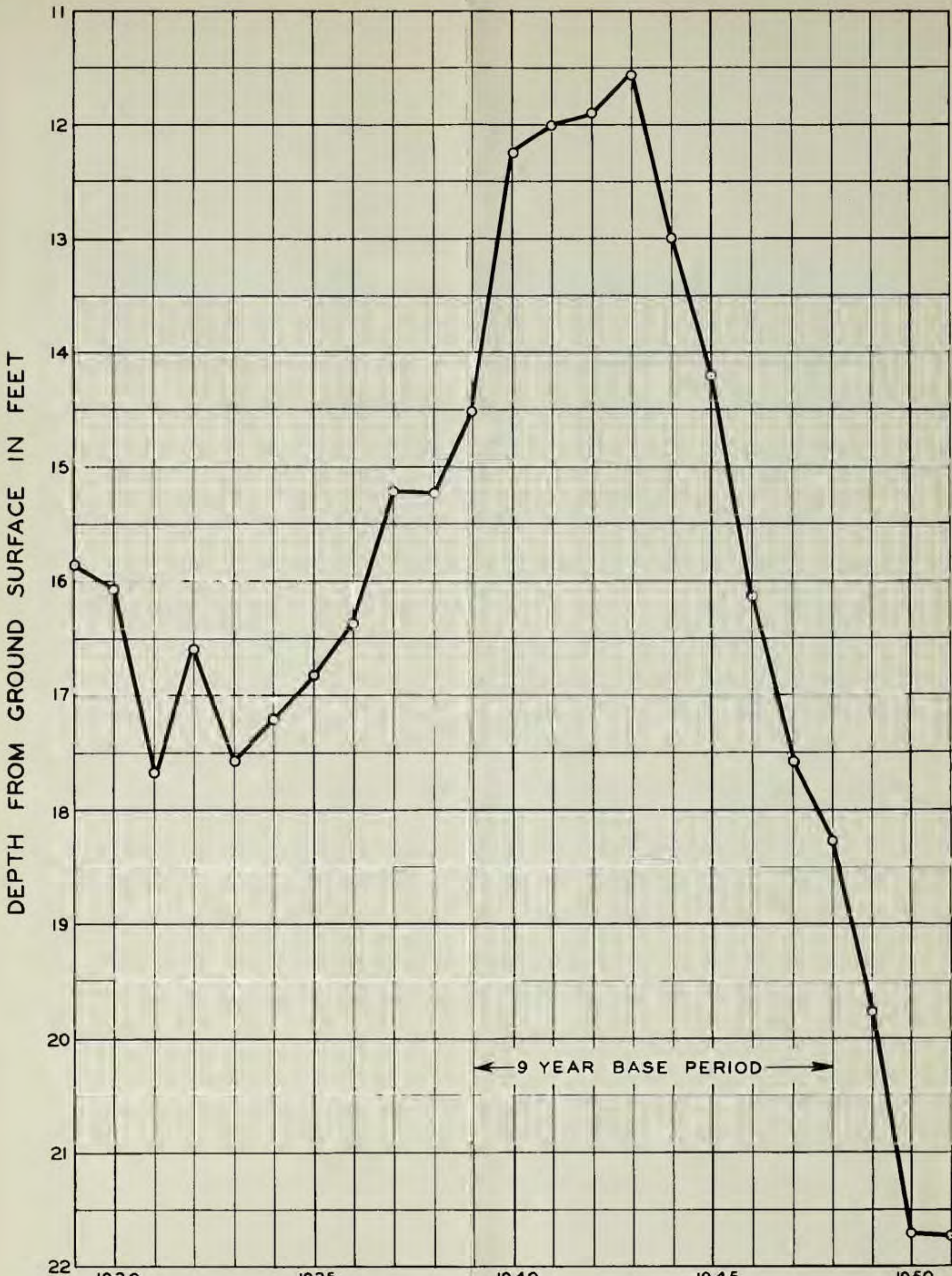
SUTTER-YUBA COUNTIES INVESTIGATION

LINES OF EQUAL ELEVATION OF GROUND WATER
FALL OF 1949

Scale of miles



MEASURED FALL DEPTHS TO GROUND WATER AT REPRESENTATIVE WELLS



AVERAGE FALL DEPTH TO GROUND WATER

PLATE 15


STATE OF CALIFORNIA
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SUTTER-YUBA COUNTIES INVESTIGATION
LINES OF EQUAL CHANGE
IN
GROUND WATER ELEVATIONS
FALL OF 1947 TO FALL OF 1951
Scale of miles
0
2
4
LEGEND
-2 LINES OF EQUAL CHANGE IN GROUND WATER IN FEET
- INDICATES LOWERING + INDICATES RISE
BOUNDARY OF INVESTIGATED AREA
MARYSVILLE
YUBA CITY
FEATHER
RIVER
YUBA
BEAR
SUTTER
BY-PASS
SACRAMENTO
PLACER
T.11N.
T.12N.
T.13N.
T.14N.
T.15N.
T.16N.
R.2E.
R.3E.
R.4E.
R.5E.

STATE OF CALIFORNIA
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SUTTER-YUBA COUNTIES INVESTIGATION

LINES OF EQUAL CONCENTRATION
OF
CHLORIDES IN GROUND WATER
JULY 1949

Scale of miles
1 0 2 4

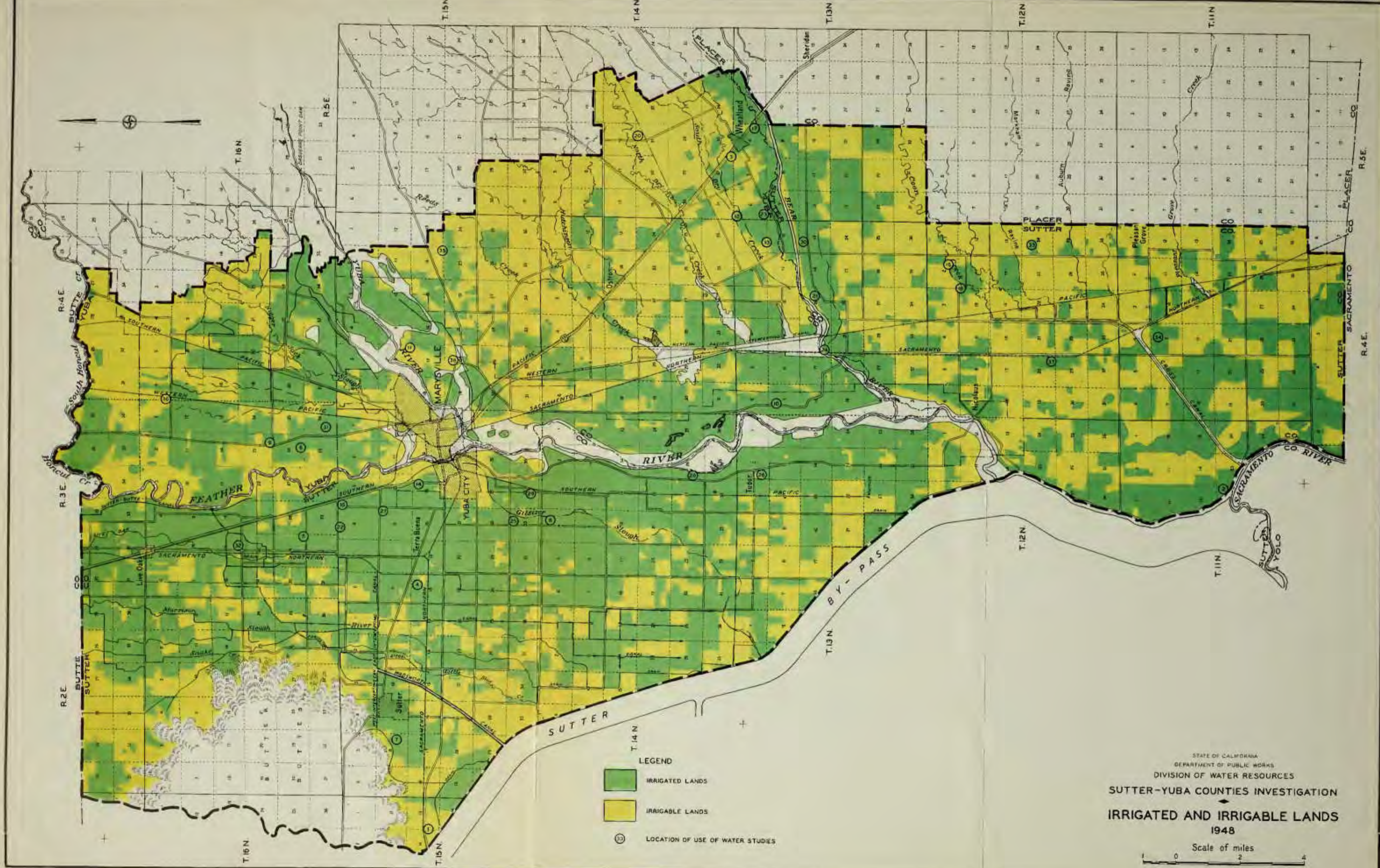
LEGEND

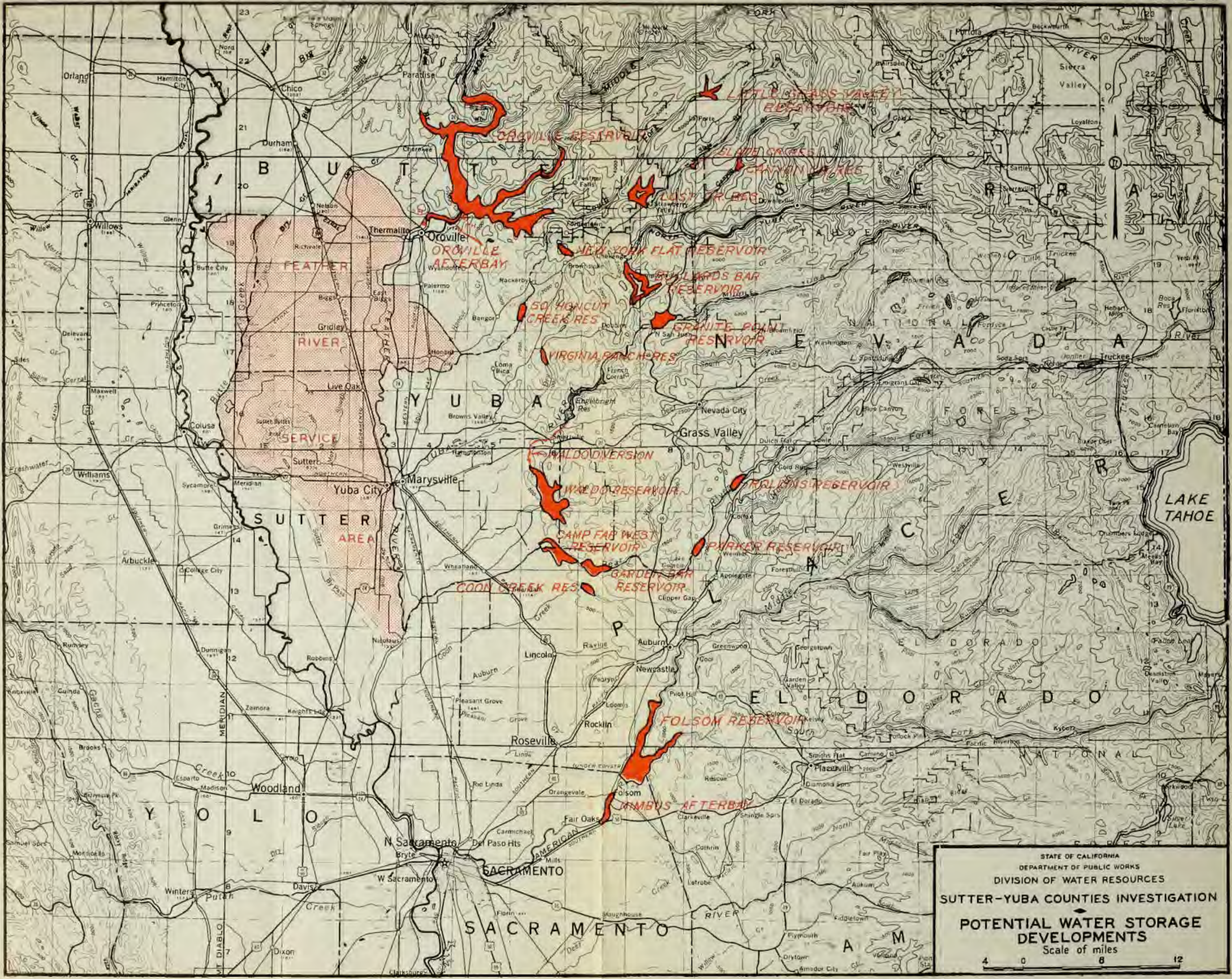
2 — CONCENTRATION OF CHLORIDES IN EQUIVALENTS PER MILLION (PART PER MILLION = E.P.M. x 35.5)

INTERPOLATED

BOUNDARY OF INVESTIGATED AREA

PLATE 17


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
IRRIGATED AND IRRIGABLE LANDS
1948
Scale of miles
0
2
4
LEGEND
IRRIGATED LANDS
IRRIGABLE LANDS
LOCATION OF USE OF WATER STUDIES
MARYSVILLE
YUBA CITY
FEATHER
RIVER
SUTTER
BY-PASS
PLACER
SUTTER
Wheatland
Sheridan
Live Oak
Terra Buena
Tudor
Nicolaus
Sutter
SACRAMENTO
YOLO
T.11N.
T.12N.
T.13N.
T.14N.
T.15N.
T.16N.
R.2E.
R.3E.
R.4E.
R.5E.


LITTLE GRASS VALLEY RESERVOIR
OROVILLE RESERVOIR
SLATE CREEK
CANYON CREEK
LOST CR. RES
OROVILLE AFTERBAY
NEW YORK FLAT RESERVOIR
BULLARDS BAR RESERVOIR
SO. HONCUT CREEK RES
GRANITE POINT RESERVOIR
VIRGINIA RANCHES RES
WALDO DIVERSION
WALDO RESERVOIR
ROLLINS RESERVOIR
CAMP FAR WEST RESERVOIR
PARKER RESERVOIR
GARDEN BAR RESERVOIR
COON CREEK RES
FOLSOM RESERVOIR
NIMBUS AFTERBAY
FEATHER RIVER SERVICE AREA
BUTTE
SUTTER
YUBA
YOLO
PLACER
NEVADA
SIERRA
EL DORADO
SACRAMENTO
LAKE TAHOE
Oroville
Marysville
Yuba City
Sacramento
Grass Valley
Nevada City
Auburn
Chico
Woodland
Truckee
STATE OF CALIFORNIA
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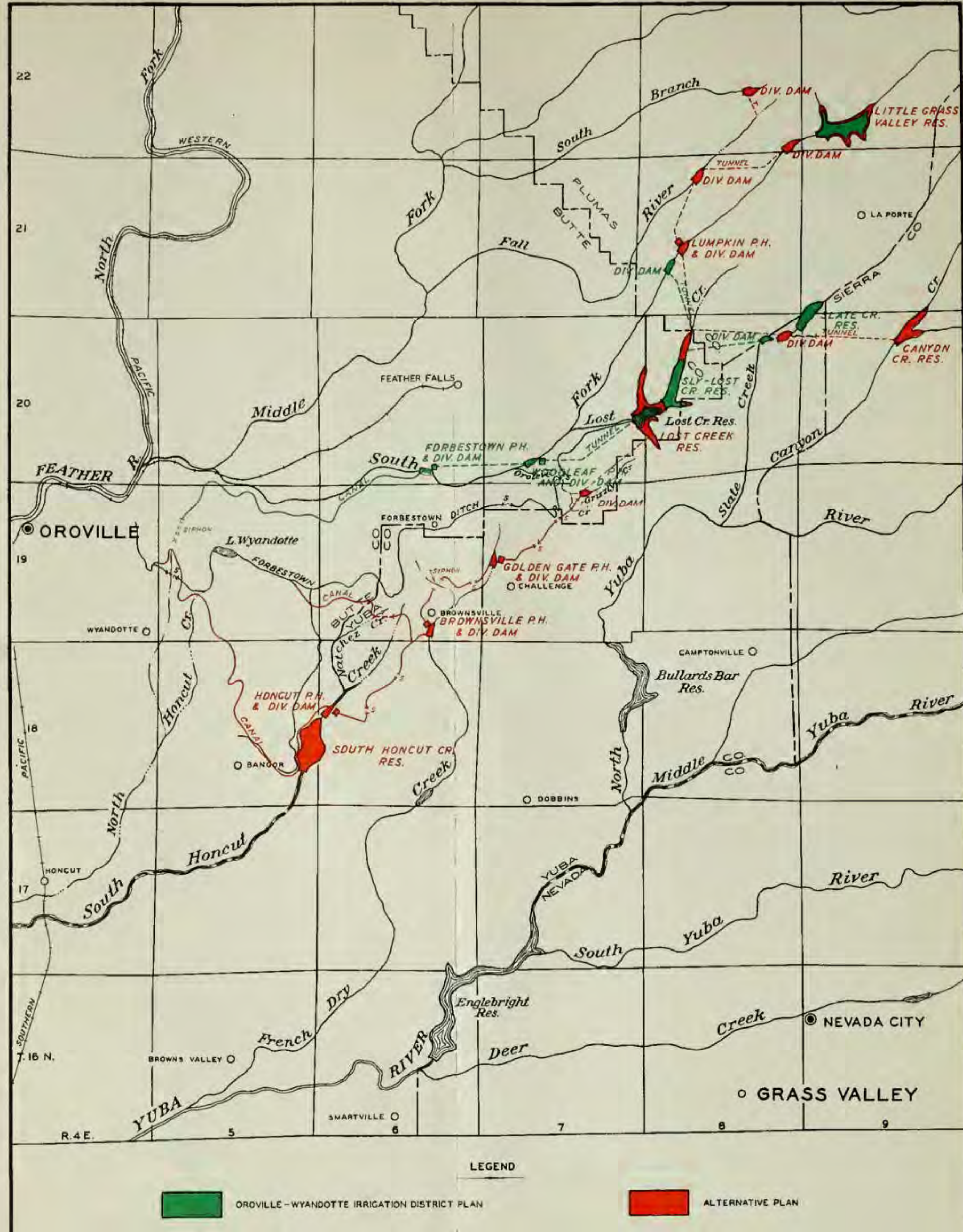
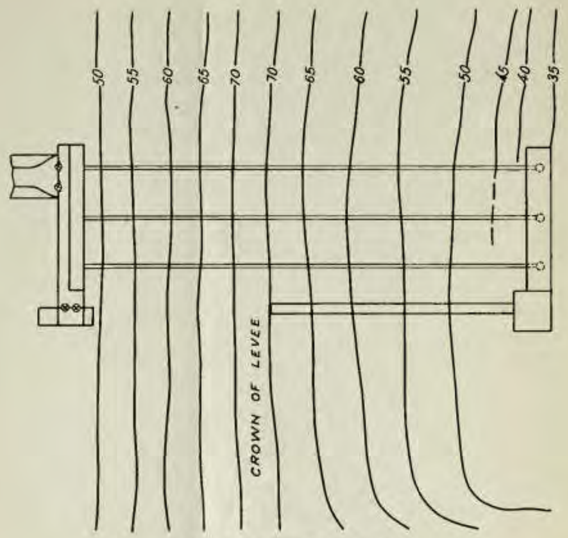
DIVISION OF WATER RESOURCES
SUTTER-YUBA COUNTIES INVESTIGATION
POTENTIAL WATER STORAGE DEVELOPMENTS
Scale of miles
4 0 8 12



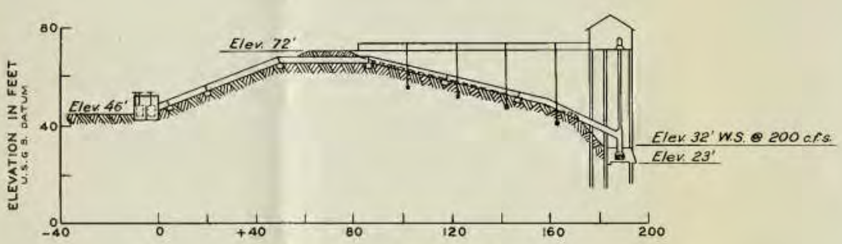
PLANS FOR DEVELOPMENT
OF
SOUTH FORK OF FEATHER RIVER

SCALE 1 0 2 4 MILES

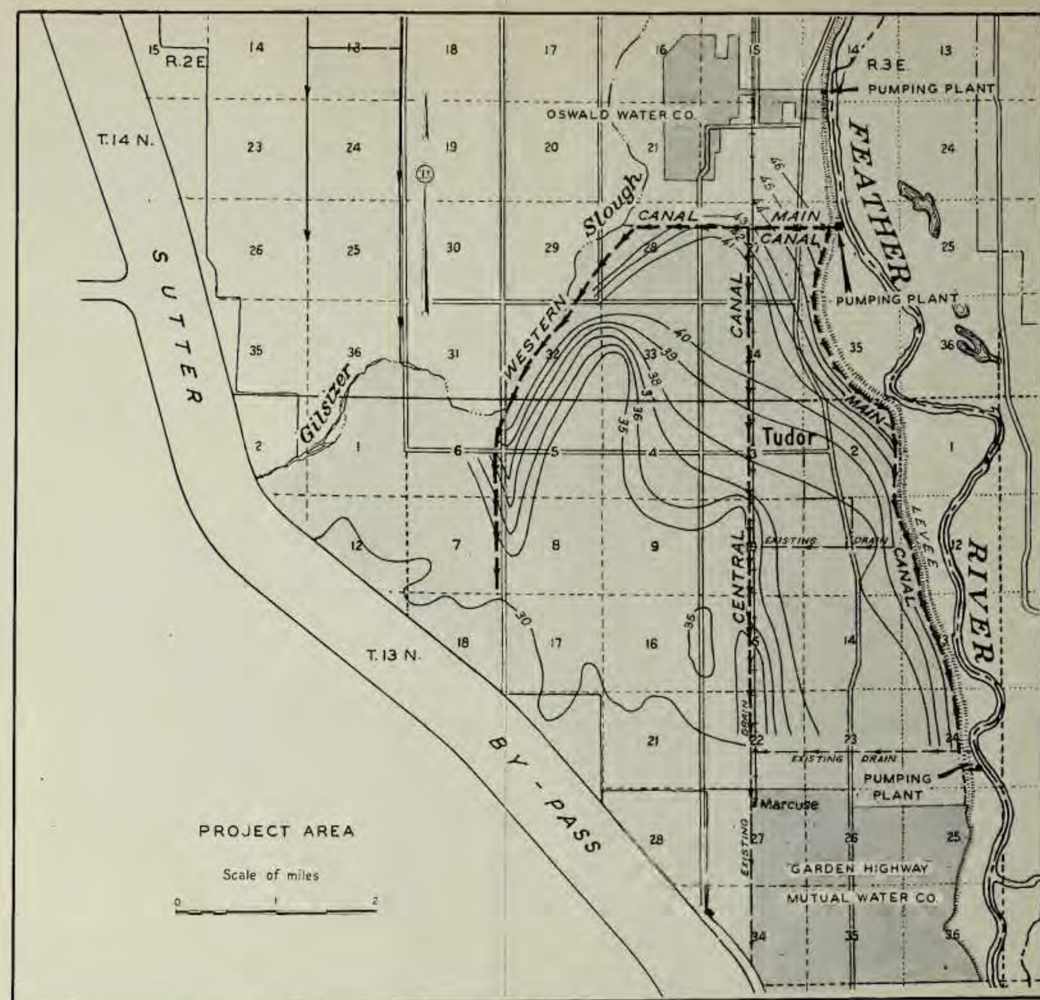


PLAN OF PUMPING PLANT

Scale of feet



PROFILE OF PUMPING PLANT



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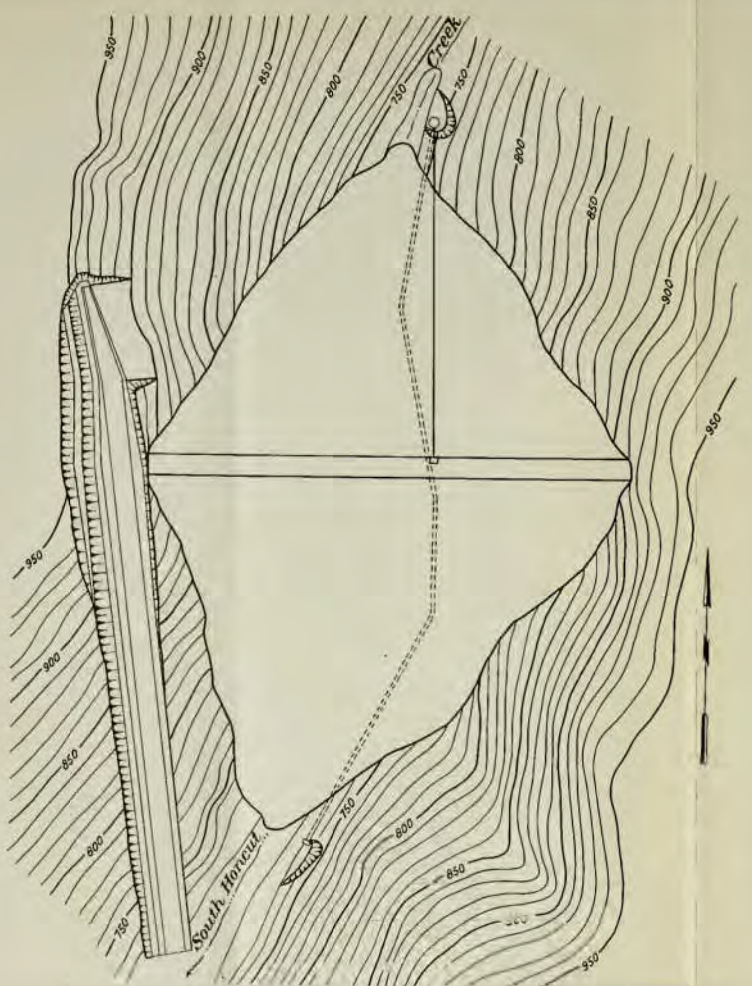
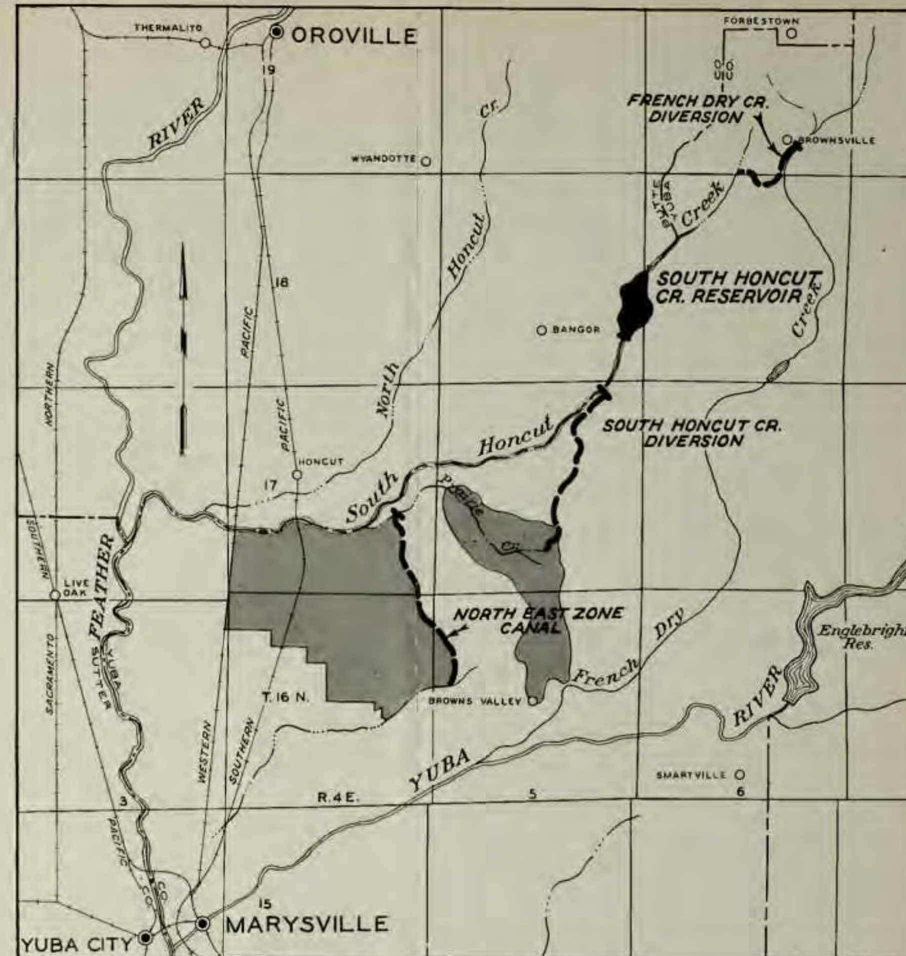
SUTTER-YUBA COUNTIES INVESTIGATION

PEACH BOWL PROJECT

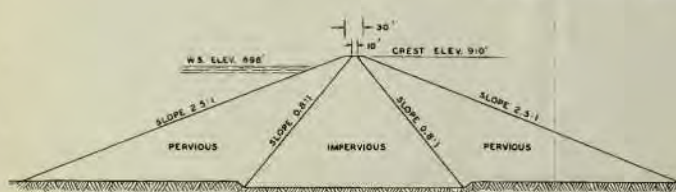


GENERAL PLAN OF DAM
SCALE OF FEET 0 100 200

LENGTH IN FEET
PROFILE OF DAM
LOOKING UPSTREAM



PROJECT AREA
Scale of miles
2 0 2 4



SECTION OF DAM
SCALE OF FEET 0 100 200

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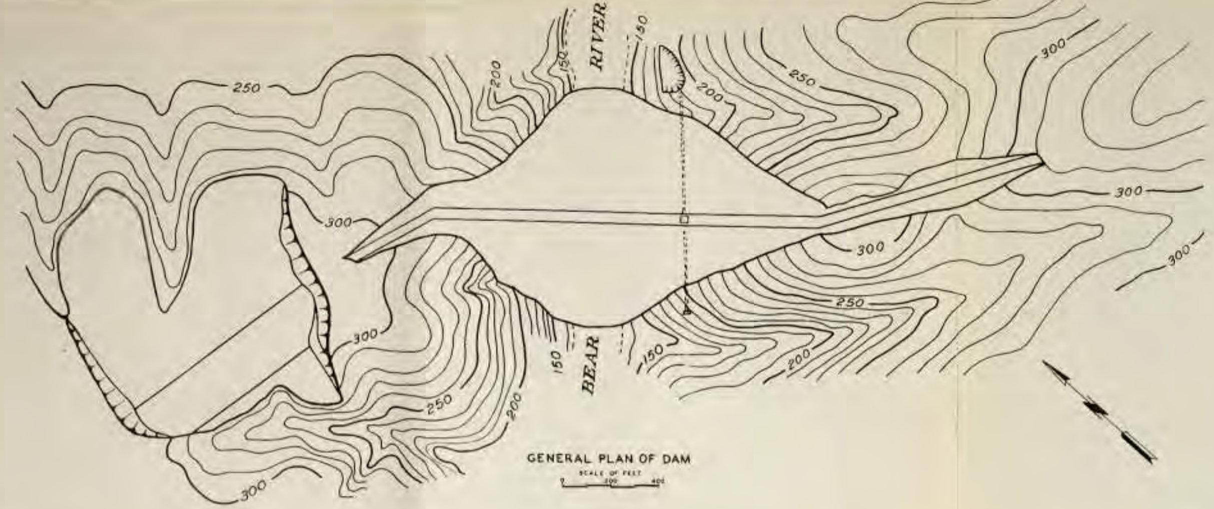
SUTTER-YUBA COUNTIES INVESTIGATION

SOUTH HONCUT CREEK PROJECT



GENERAL PLAN OF DAM

SCALE OF FEET

PROFILE OF DAM

LOOKING UPSTREAM

SECTION OF DAM

PROJECT AREA

Scale of miles

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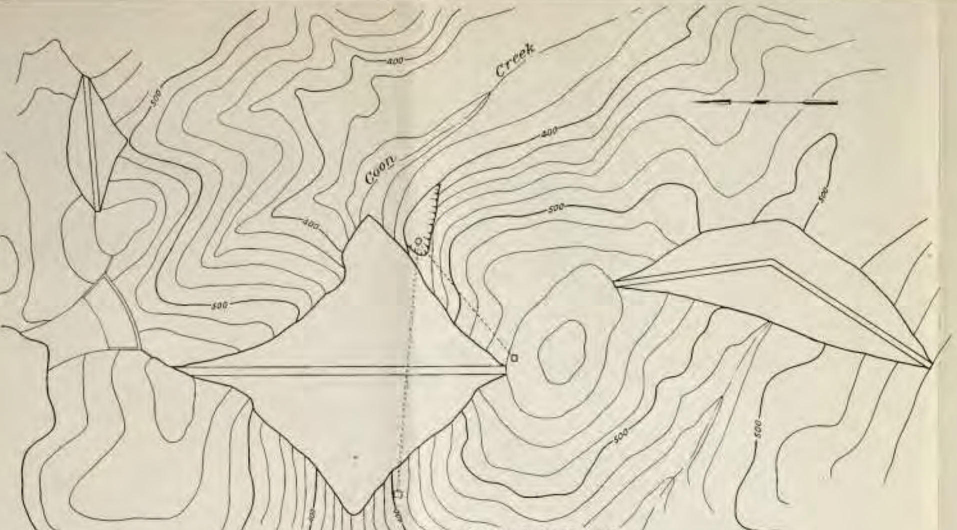
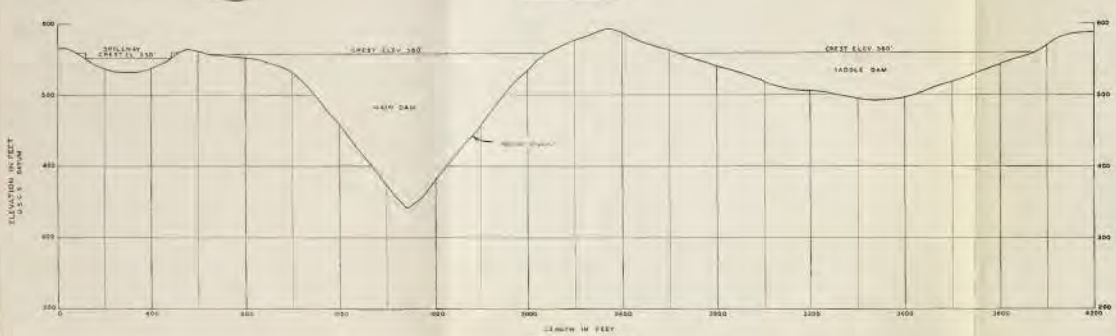
SUTTER-YUBA COUNTIES INVESTIGATION

CAMP FAR WEST PROJECT



GENERAL PLAN OF DAMS
SCALE OF FEET
0 200 400



PROFILE OF DAMS
LOOKING UPSTREAM

PROJECT AREA
Scale of miles

SECTION OF DAMS
SCALE OF FEET
0 100 200

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
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SUTTER-YUBA COUNTIES INVESTIGATION

COON CREEK PROJECT

Hydrogeology of the Sutter Basin, Sacramento Valley, California

HYDROGEOLOGY OF THE SUTTER BASIN, SACRAMENTO VALLEY, CALIFORNIA

by

George Curtin

A Thesis Submitted to the Faculty of the

DEPARTMENT OF GEOSCIENCES

In Partial Fulfillment of the Requirements
For the Degree of

MASTER OF SCIENCE
WITH A MAJOR IN GEOLOGY

In the Graduate College

THE UNIVERSITY OF ARIZONA

1 9 7 1

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APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

Jerome J. Wright
JEROME J. WRIGHT
Associate Professor of Geology

March 23, 1971
Date

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