American Viticultural Area

Capay Valley, California

Capay Valley VINEYARDS

P.O.Box 17, Brooks, CA 95606 tel. (530) 796-4110 fax (530) 796-3788

6/27/01
Jod

June 25, 2001

Mr. Thomas R. Crone, Chief
ATF Regulations Division
Washington, DC 20226

Re: American Viticultural Area for Capay Valley, California

Dear Mr. Crone:

Enclosed is material supporting the application for an AVA for the Capay Valley in California.

This unique growing region is evident by examining the relief map and the valley's location with respect to other wine grape growing regions in northern California.

Capay Valley is located in northwest Yolo County bordering Napa, Lake and Colusa Counties. The valley is formed by the Blue Ridge Mountains in the west and the Capay Hills to the east. Cache Creek runs the entire length of the valley.

From an historical perspective, Capay Valley was the location of the finest vineyard in California in the year 1861 ("Capay Valley-The land and the People" -Ada Merhoff - p.14) We plan to make it so again.

If we can be of further assistance, please contact us.

Sincerely,

Tom Frederick
Pamela S. Welch

Capay Valley Vineyards

AVA Application - Capay Valley, California

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TTB Note: Due to its size, the soil map in section 7 has not been scanned. Contact TTB for more information.

Capay Valley AVA Boundary Lines
(as referenced on Healdsburg, CA topographic map 30x60 minute series)

The narrative description of the boundaries are as follows:

From the beginning point at the conjunction of the Yolo, Napa, Lake county lines
- north along Yolo/Lake county line , east along Colusa/Yolo county line to Capay Hills ridge line

- south along ridge line to junction with Section T11N

- east along T11N line to County Road 85

- south along County Road 85 to Highway 16

- east on Highway 16 to county road 85B

- south on 85B to County Rd 23

- west on County Road 23

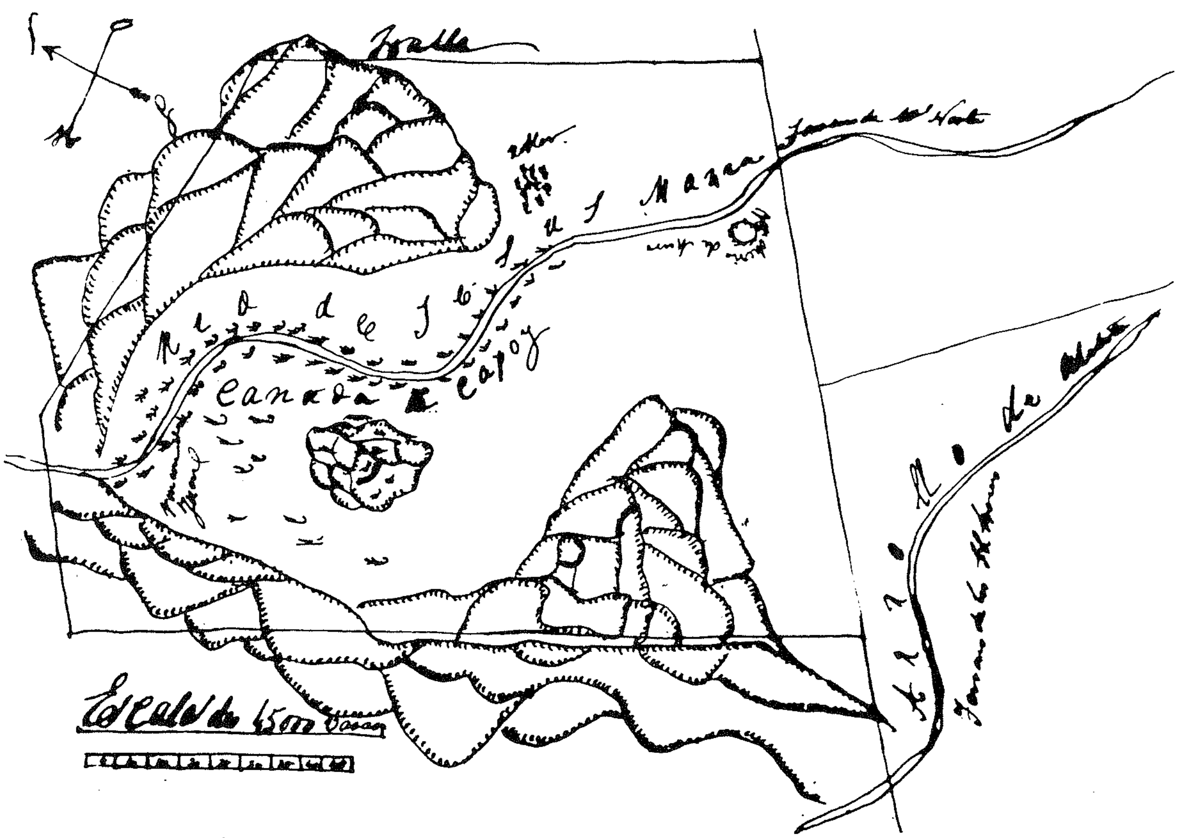
- south on County Road 85 to T10N line

- west on T10N line to the Napa County line

- north along Yolo county/Napa county line to the starting point

(This description follows the boundaries of the Capay Valley General Plan)

Capay Valley
The Land & The People
1846-1900



The map on the preceding page is the diseño which accompanied the document or 'Espediente' giving title to three Berryessa brothers of the Cañada de Capay, a land grant of nine square leagues in the jurisdiction of Sonoma. Capay Valley lies within the boundaries of this grant awarded Santiago, Nemesio and Francisco Berryessa. Their petition for the land was approved May 3, 1846, reviewed by the Committee on Vacant Lands, and title to the grant was signed by Governor Pio Pico of the Mexican nation at the meeting of the Departmental Assembly in Los Angeles, June 3, 1846.

(California State Archives Espediente 511)

Printed by Roger C. Franke • Woodland, California

Capay Valley
The Land & The People
1846-1900

Ada Merhoff

Title History

1846-1858

In 1849 water in two large creeks, in hillside arroyos and in spring-fed sloughs, coursed through the low mountains along the western boundary of Yolo County and spilled eastward over sloping low lands to reach the Sacramento River which seasonally overflowed its banks to nourish large areas of permanent swampland. Tules were 'as high as a man standing tall in his stirrups'; and when the first State Legislature met that year to establish the physical limits of several northern counties, it named the area 'Yoloy', the Indian word for "a place abounding with rushes" (*Rensch & Hoover*).

'Yoloy' quickly became Yolo, and the creek that the Indians called 'Yoso Capi' and the Spanish called 'Rio Jesus Maria' became Cache Creek, as Californians adopted the local name used by pioneer trappers who stored beaver furs along its banks. With its source in Clear Lake, the creek flowed south-eastward through mountain canyons some 20 miles, then the length of a narrow flat valley another 15 miles, to turn east for five miles as it passed through low bordering hills and reached flat land at the western edge of the Sacramento Valley.

As early as the 1840s, this valley identified with Cache Creek was called Capay, using the Indian word 'capi' or 'Kaipai' meaning stream (*Kroeber*). The first county records referred to it variously as Capay Valley, Cache Creek Valley, Cache Creek Canyon or simply Cañon, Spanish word for valley. Southward the level floor of Capay Valley widened from one to perhaps four miles, and the creek lying along the base of the bluffs on the east side changed too in width as gravel bars or erosion at the foot of arroyos altered its course or the swiftness of its current. It proceeded from an elevation of 400′ to 150′ at the southern end where the bluffs were replaced by low rounded hills.

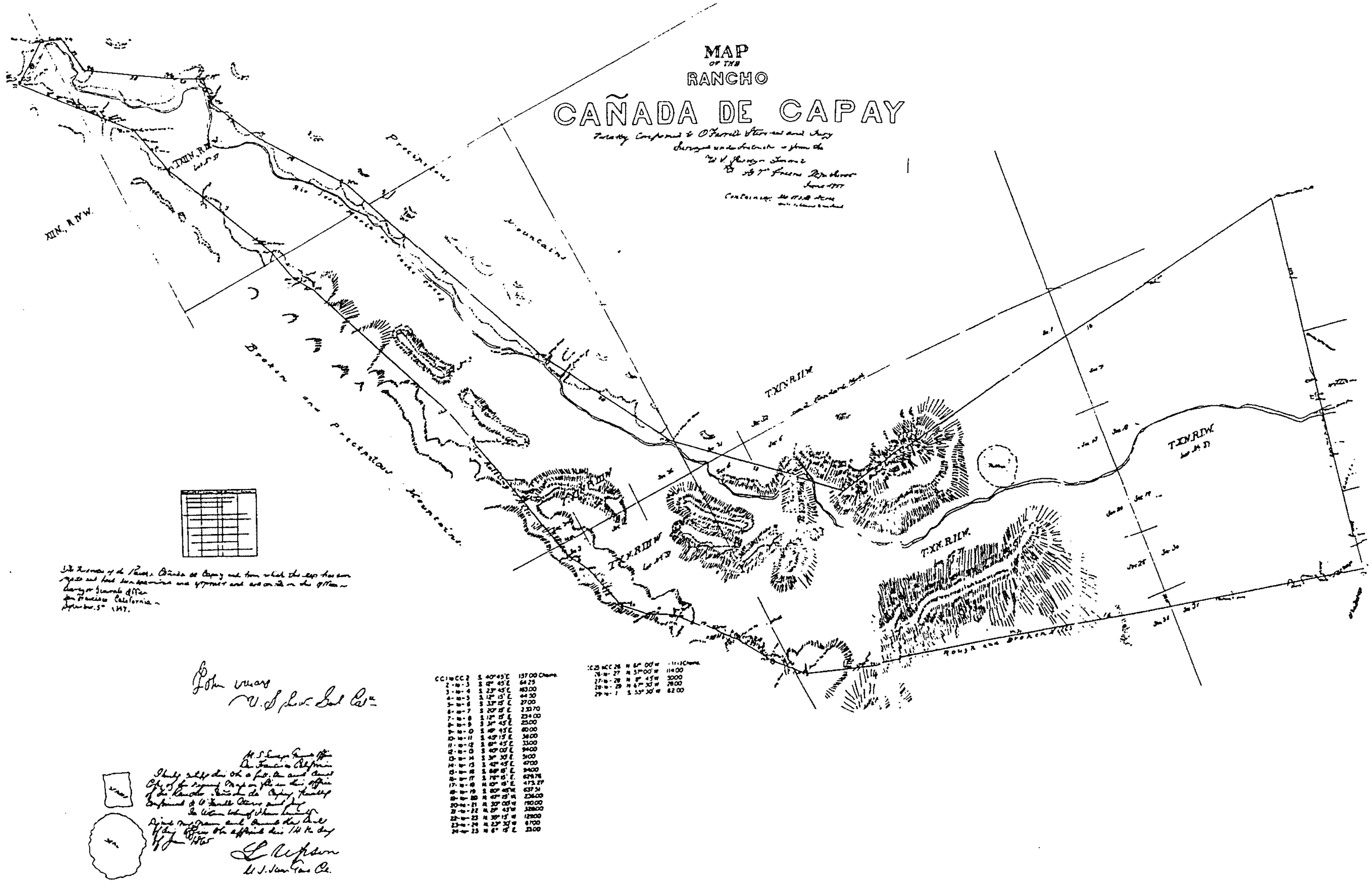
Covered with oak, pine, cottonwood and chaparral, the valley, the stream and the hillsides supported an abundance of fish, waterfowl, aquatic animals and large game. Ewing Young, mountain man and trapper, camped there with a party in the winter of 1832 "were the first of their race in that valley" (*Gilbert, p. 28*), and Indians of the Southern Wintun Nation who had established at least eight villages along Cache Creek blamed them for a plague suffered the following summer.

Several names are associated with the valley during the pre-statehood decade—Neal, Thompson, O'Farrell, Paddy Clark, Roulette, Todd, Scott—and indirectly, William Gordon, the earliest white resident in the western part of Yolo County. In 1842 Gordon settled his family on his two-league (six square miles) Guesissosi Grant from the Mexican government which since 1824 had governed the large territory known as Alta California. Gordon's place, about five miles east of Capay Valley, was a stop-over for travelers and hunting parties following the 'trail around the tules' from Benicia north to the Sacramento River at Knights Landing. Using Gordon's ranch as a base, white trappers and hunters went up Capay Valley taking advantage of its wind sheltered higher ground.

In 1846 Captain Ezekial Merritt led a party of some 33 men from the Sacramento Valley to capture General Vallejo and the town of Sonoma (northern headquarters of the Mexican government) to proclaim California a republic independent of Mexican rule and to raise the symbolic Bear Flag. Historian Sprague (*p. 12*) identifies four of the Merritt party as men living in a log cabin in the Capay Valley at the time. Stopping at the Gordon Ranch from a raid "to capture Indians to harvest wheat for Don Armijo of Suisun," they heard of Merritt's plans and joined him in the dramatic ride to Sonoma. The men were W.L. Todd, brothers George and William Scott and William W. Roulette. Like Merritt, the Scott brothers and Roulette had come to California the previous year with the Grigsby-Ide wagon train, Todd arriving later.

Historian Gilbert (*p. 33*) describes another early resident in 1847: ". . . during this year that the first house was built in Capay Valley by a party who intended to make the section his future home. The structure was of logs, and erected about one mile up the valley from the present (1879) site of Langville and was the property of Francis, popularly known as 'Paddy' Clark." Clark had come to California in 1843, worked in Napa County, "putting the proceeds of his labor into stock that under Gordon's general supervision, was allowed to roam at will in the valley he had decided to occupy." He left Yolo County in 1852, but the 1850 Tax Assessor records show Francis Clark's property valued at $6,000, assessed at $52.50 and marked 'paid'.

Succession of title to property in the Capay Valley was similar to that throughout the area known as Alta California. When Mexico achieved its independence from Spain in 1824, it assumed title to all the land acquired by Spanish conquest and appointed territorial governors to administer natural geographic subdivisions. In 1824, a Mexican Congress colonization law defined the regulations for obtaining title to land—"gave authority to territorial governors to grant vacant lands to contractors (empresarios), families or private persons." Each applicant was required to present a petition with a diseño which "served as the first graphic definition of the land in question" (*Becker*).


MAP
OF THE
RANCHO
CAÑADA DE CAPAY
Rio Jesus Maria
T.X.N. R.I.W.
T.X.N. R.II.W.
Broken and Precipitous Mountains

5/3/1846—Land Grant

Pio Pico, governor of the territory of Alta California, granted nine square leagues of land comprising 40,078 and 58/100-square acres called the Rancho Cañada de Capay to three **Berryessa brothers, Menesio, Francisco,** and **Santiago.** It included the whole of what would be called the Canyon of the Rio de Jesus Maria—later Cache Creek Canyon—later Capay Valley.

"**Jose de los Santos Berryessa** presented the petition for his brothers, together with the diseño which he himself had drawn during the course of a visit to the valley" 'Santos' Berryessa, familiar with Mexican law, made highly detailed diseños and at land commission hearings represented his family in securing title to their several large land holdings. He testified that "accompanied by one of his brothers, his cousin Sixto, owner of Rancho Putas in the adjoining Berryessa Valley, and an Indian, he crossed the intervening range of hills, when I saw myself in the Cañada de Capay. . . . After leaving the land, I went to the highest mountain which is in the mouth of the Cañada Capay, situated in a westerly direction from the mouth of the Cañada, and from that point I took the most remarkable points according to the best of my view from that place and after finishing that part, I went back to the Berryessa Valley, and proceeded to the highest mountain which is shown on the range delineated on the western side of the diseño, the same mountains which divided the Canada Capay from the Berryessa Valley, and from this place I saw the rest of the land, and then I put it on the paper" (*Becker*).

Upon being presented a petition and a diseño, the governor ordered an official title paper requiring: "1—that within one year the land be occupied and a permanent dwelling be erected and inhabited. 2—that the land might be fenced. 3—that the rights of previous inhabitants (Indians) be reserved and protected. 4—that the grantee obtain from the local magistrate the act of juridicial possession which would define and measure the boundaries" (*Becker*).

"**The Act of Juridicial Possession** was the only means by which the Californians established the boundaries to their lands. This process entailed the summoning of the new owner and all of his neighbors by the local magistrate. That official then appointed two cordeleros, two mounted men each carrying a pole, connected to one another by a cord usually of 50 varas in length. A vara is approximately 33 inches; the cord was thus 137 feet 6 inches in length. After establishing a corner of the rancho and generally marking it with a pile of stones or other landmark (mojonero), in company with the neighbors and with their agreement, the magistrate designated the direction the boundary line was to take from that point. The first cordelero rode forward the length of the cord where he placed the tip of his pole on the ground. The second cordelero then rode past him another length of the cord, while the magistrate or another official kept count of the number of cordeles. The cordeleros, directed by the magistrate who was expected to adjudicate between the new owner and his neighbors on the spot, continued until they had gone around the property and had returned to the place of the beginning.

At the conclusion the magistrate formally indicated to the grantee his possession of the land, and the latter symbolized the fact by pulling up clumps of grass, breaking the branches of trees or bushes and throwing rocks in the four cardinal directions, demonstrating that as its owner he could do things to the land that would not be permitted to another" (*Becker*).

Thus was the Cañada de Capay Grant established. In later documents it would be described:

"that certain tract of land in Yolo County, California, consisting of land of the Rancho de Capay, situated on the Rio de Jesus Maria, being bounded on the south by the land occupied by Senor Vaca or Guisquel; on the east by the property of Senor N______; and on the north by the valley of the river of Jesus Maria" (*Patent A-38*).

7/24/1847—Deeds A-16:

Jose S. Berryessa, agent and attorney for Nemecio, Francisco and Santiago Berryessa sold to **Jasper O'Farrell** "civil engineer of Upper California" for $3,000 "well and truly paid . . . all that certain tract of land situated and being in the valley of Capay Upper California on the River Jesus Maria and commonly known as the Rancho 'Capay' containing **seven leagues and one half of a league of land** being the same land as granted in an original title by Pio Pico bearing date May third AD 1846 and recorded in the Archives of Public Record for California in the Pueblo de Los Angeles."

Jose Berryessa and Jasper O'Farrell appeared before George Hyde, 1st Alcalde of San Francisco and "acknowledged the foregoing instrument to be their true act and deed" on July 21, 1847. June 26, 1850 this deed was recorded by George W. Crane, Yolo County Recorder.

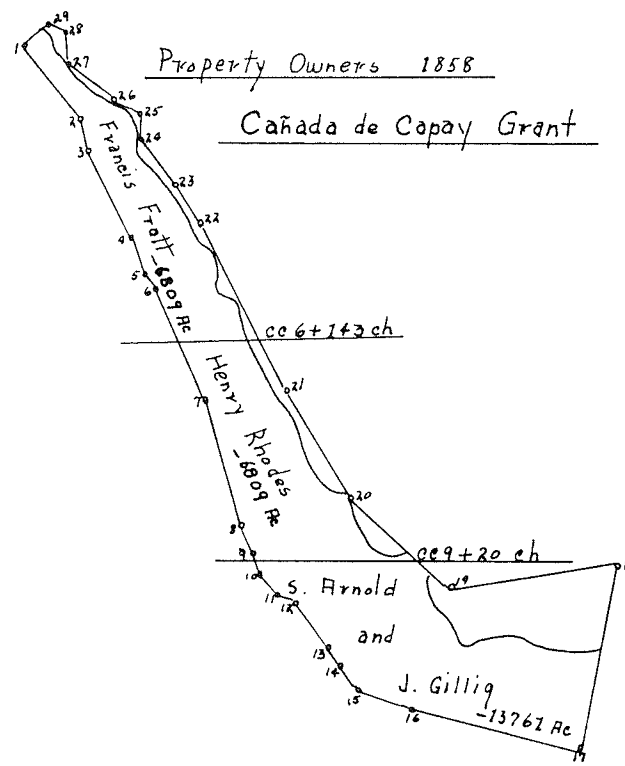
The first Yolo County Tax Assessor Book dated 1850 shows Jasper O'Farrell to be the largest taxpayer in the county. His assessed holdings: seven and one-half leagues valued at $41,662 assessed for $312.46½. (This figure included a poll tax.)

10/31/1849—Deeds A-338:

The remaining **one and one-half leagues** of the original nine-league Grant were given to **Jacob Hoppe** by a separate agreement with the Berryessa

Cañada de Capay Grant title holders

1846 — Berryessa brothers
1847 — Jasper O'Farrell
1851 — Jasper O'Farrell - ½; C.G. Holdforth - ½
1856 — John M. Rhodes - ½; C.G. Holdforth - ½
1858 — F.W. Fratt - ½; C.G. Holdforth - ½
1858 — Fratt - ¼; Henry Rhodes - ¼; C.G. Holdforth - ½
1858 — Fratt - ¼; Henry Rhodes - ¼; John Adamson - ½
1858 — Fratt - ¼; Henry Rhodes - ¼; Arnold & Gillig - ½



5/27/1858—Deeds C-330:

Using the Greene map for the first time, by a Deed of Partition and $1,000 paid to Holdforth, **Fratt and Henry Rhodes** as tenants in common located their one-half at the north end of the valley—"Beginning at an oak stump marked CC-1 . . ." and being all the Grant property south to a line going due east from a point at CC-9 plus 20 chains SE. This was about 12 miles south of CC-1, was the line later known as the Clear Lake-Sacramento Road which went west from south of present-day Brooks, up the hills to the County line at the crest to become a toll road into Berryessa Valley. (After Fratt, Rhodes and Holdforth had defined their acreages within the valley, there remained approximately 5,000 acres undivided Grant property outside the limits of Capay Valley which was later surveyed, divided and sold.)

5/29/1858—Deeds C-332:

In a second Deed of Partition, **Henry Rhodes** assumed title to the area north from the major dividing line (CC-9 plus 20 chains SE) to an east-west line starting at CC-6 plus 143 chains SE (present-day Road 63) north of which line would belong to **Fratt**—6,809 acres each. (*Map*)

Even before these deeds of partition were finalized, John Milton Rhodes, son of Henry Rhodes, became the first owner-resident in Capay Valley—also the first Capay Valley landowner to be associated with Yolo County growth, as he became a prominent civic leader and businessman with investments in several flour mills. He had come to Sacramento from Mansfield, Ohio and a successful banking business. With two partners, he started a bank on Second Street in 1850. He returned to Ohio the following spring to accompany his wife and two small children to San Francisco via the Panama Isthmus (*Rhodes Journal*). His brothers James and George, as well as his uncle Jesse, also came to California and were in inter-related family enterprises of banking, staging, gold transport, etc. Without the security of insurance against loss by fire, ship sinkings, and highway robbery, success was as dependent on good fortune as on skillful management, and he experienced the very good years and the serious reverses associated with much early California commerce.

Describing the Capay Valley property, "In the spring of 1857 I moved my family onto the land." This was his wife Mary (Christmas) and five children. The homesite and corral were south of the deep arroyo which crossed the Henry Rhodes property north of later day Tancred. That first winter, the youngest child Edward was buried "in a grave in the shade of a green oak" (*Rhodes Journal*). The following year when Henry Rhodes' title to the 6,809 acreage was final, he and his wife Esther, accompanied by the families of son William and daughter Mary Smith, left Ohio to live upon the new property. There were now four Rhodes homes, one of which would appear on the Greene survey map as 'Rhodes house' and be identified as that of William, who may have come ahead in 1857.

Henry Rhodes built his home close to the hills on the west side of the valley midway between the 'big arroyo' and the north limit of the property. His tax in 1858 reflected this residence as real estate 'improvements' valued at $400 and remained about the same for at least four years whereas the value placed on the land doubled in that time. The tax record in 1858 showed 70 cattle worth $2,700, four horses worth $300, and no hogs or sheep. Animal counts on early tax records cannot be accepted as accurate, but they do indicate the use to which people put their land.

is given on the deed, but at a Yolo County Board of Equalization meeting the following August, it was "ordered that Arnold and Gillig be assessed for 13761 acres of land at $2.50 per acre" (*Supervisors Book A, p. 339*). Arnold and Gillig commissioned Charles F. Reed, a local surveyor, to make a tract map of their property. Dated May 27, 1859, it subdivided the area from their north boundary line (east-west at CC-9 plus 20 chains SE) to a line extended from present Road 85-B at the southeast edge of the hills into eighteen parcels identified alphabetically. This was the Arnold and Gillig Subdivision, providing a legal description for the first land sales in the Capay Valley which, for the most part, would be of less than 1,000 acres. Deeds for most of the parcels were filed within fifteen years.

In May 1859 one of the first sales was lot 'A' to John Arnold of Yolo County whose relationship to Sylvanus Arnold is uncertain, likely he was a brother—this being the first sale in the Capay Valley of less than 6,800 acres. A provision of the deed described:

> "916 acres excepting the stream of water through said land known as Jesus Maria or Cache Creek and all the land necessary not exceeding 25 acres upon which to locate a mill, mill yard and other buildings therewith connected, with the privilege of a head and tail race—said 25 acres . . . are to be located at such point and in such shape . . . as said first party (Sylvanus Arnold) may designate."

The provision was included in the deed by which Sylvanus' wife Lucretia later relinquished her interest in Lot 'A' for $2,500 in 1865. Apparently this mill was never built, but its planning demonstrates the use to which Arnold intended to put his land.

John Gillig, co-owner of the Arnold & Gillig Subdivision, was a Sacramento businessman and held mortgages on considerable Yolo County property. He chose Lot 'B' and 133 acres off the west side of Lot 'C' as his own, sold 100 acres off the south end in Lamb Valley. It is not certain whether the large adobe home near Cache Creek had been built by 1860, but the young John Gillig family from Ohio was indeed residing on their ranch at the time of the 1860 United States census: John, 30; Rebecca, 21; and a 2-year old son, Harry, born in California. Their property in Capay Valley was the 'Adobe Ranch', a vineyard and winery mentioned by historians Sprague and Gilbert in 1869 and '79 respectively:

> "Capay Valley Winery at Gillig's Ranch—At this place the annual crop from the home vineyard is manufactured into wine, besides the crops of several small vineyards in the surrounding neighborhood . . . about 30,000 gallons of wine are manufactured yearly at this place, the white and red varieties."
> (*Sprague, p. 148*)

> "The vineyard at the Adobe Ranch in Capay Valley was commenced in 1858 by John Gillig, the owner being awarded the premium in 1861 for having the finest vineyard in the state. In 1862 he had 35,000 vines. In 1865 Henry Strohback took charge of the vineyard and wine making, continuing until 1870 when the place was rented to an Italian named Cadenasso . . . a considerable amount of both wine and brandy has been produced there."(*Gilbert, p. 45*)

Gillig's vineyard apparently was restricted to the area between the present highway and Cache Creek. After Sylvanus Arnold's sudden tragic death in 1867, Gillig was identified on subdivision deeds as "surviving partner of the late firm of Arnold & Gillig." In 1870 the Gilligs returned to Virginia City, Nevada. His death there in 1901 left to his widow Rebecca and son Harry the original homesite on the creek in Capay Valley.

Joel Wood who had been in the valley about six years, in 1859 was the first person to purchase the site on which he lived—212½ acres in the west half of Lot 'J'. As previously described, his blacksmith shop-general store and home where travelers could have a meal and 'stay over' was the nucleus of a community locally called 'Dogtown', formally called 'Capay City' by historian Sprague and the Yolo County newspaper.

That same year George Washington Lambert and Devereaux Goodale purchased land through which Salt Creek flowed from the base of the hills to the old bridge—Lot 'I'. A few years later Edmund Clark, Sr., Joel's father-in-law, bought the property between—E half Lot 'J'. Wash Lambert established the homesite-headquarters of a large cattle ranch on the west side of Salt Creek prior to 1856 when he was assessed for $500 real estate improvements and three times that much for personal property—presumably the beginning of his cattle business. On later registrations he would be identified as a stock dealer. Originally from Virginia, he and Alaminta came to California in 1854 from Iowa where their first child was born.

Wash Lambert, his brother Grenville and other relatives homesteaded an extensive area in the hill country east of Salt Creek canyon which was consolidated in the 1860s to be known as the Lambert range (later the site of the Linderman corrals). As did other large landowners, he used Indian labor as described by Charles Alexander noting the death of 'Indian Pete Lambert' at the age of ninety—

> "Pete was not a native of Yolo County but was brought from the Eel river with a number of other Indian children by a man of the name of Jerry Lambert, along in the early sixties and sold or given to the ranchers around Capay Valley. My uncle (Vincent Barnes) got one about 9 or 10 years of age. Mr. Aldrich got one, and a Wash Lambert got two,

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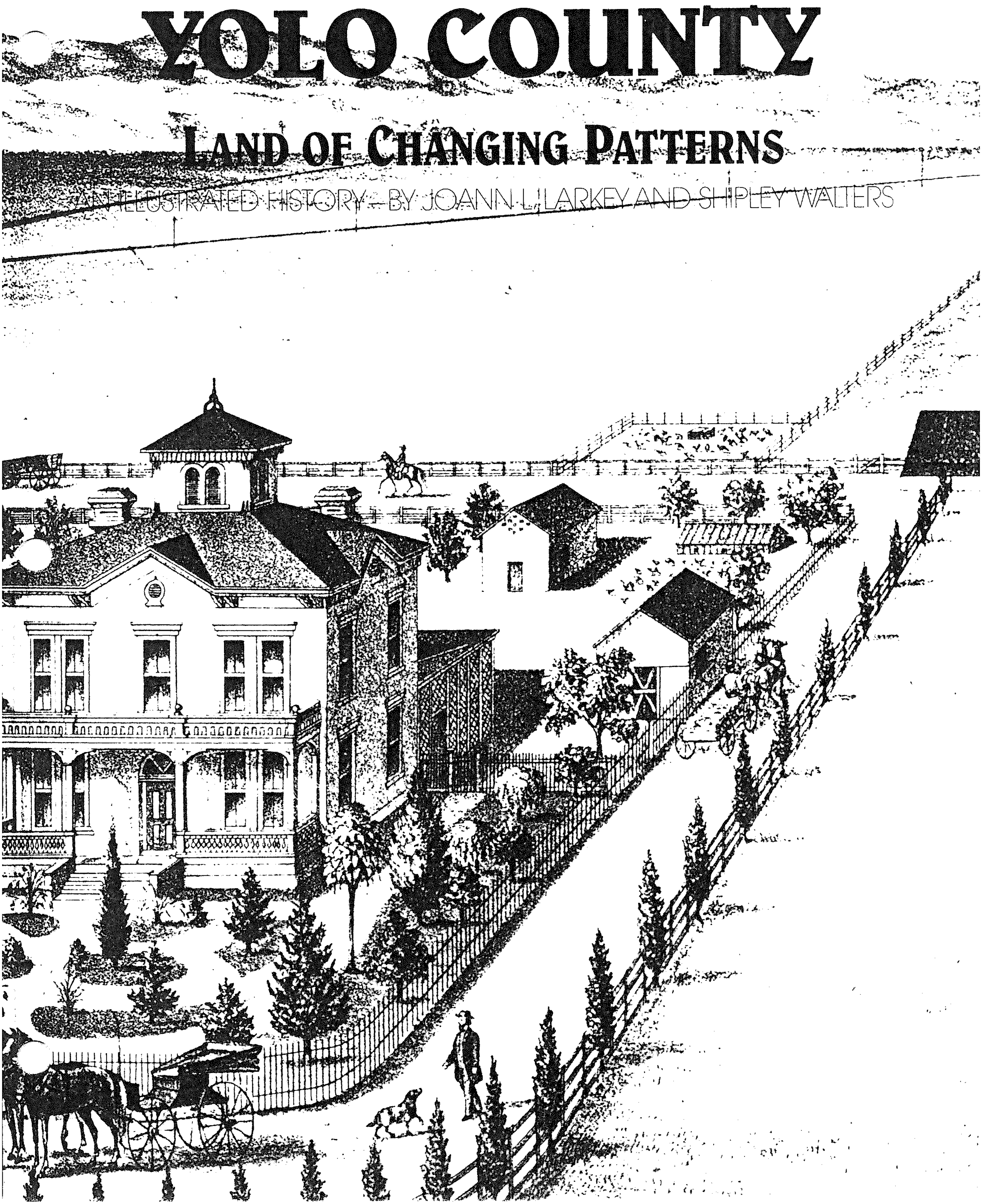
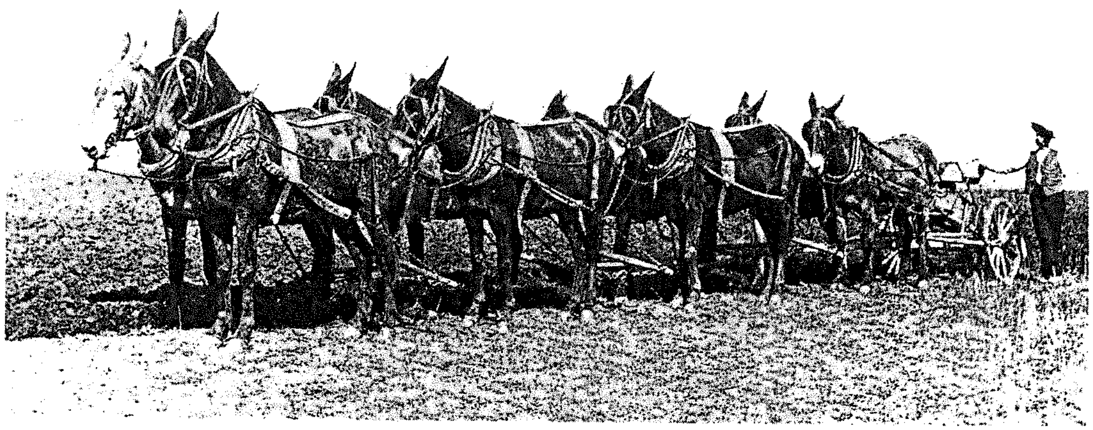
YOLO COUNTY

LAND OF CHANGING PATTERNS

AN ILLUSTRATED HISTORY — BY JOANN L. LARKEY AND SHIPLEY WALTERS



To the record keepers, historians, researchers, chroniclers, and observers of human events—all those men and women who have contributed to the historical resources upon which this volume is based—
we dedicate this history of Yolo County.



Right: The gang plow was used in Yolo County as early as 1854. One man and eight mules could cover the same area as fifty men with an ordinary plow. In the photograph, taken in the 1860s, George Hutton Swingle poses with a plow and team on his ranch east of present day Davis.

Previous page: The success of Davis Newcomer Hershey is reflected in this 1879 view of his family residence and ranch headquarters near Blacks (Zamora). This lithograph was drawn shortly after the railroad was extended through northern Yolo County. Hershey—a rancher, businessman, lawmaker, and civic leader—was renowned for his role in building the Woodland Opera House of 1896. From Frank T. Gilbert's The Illustrated Atlas and History of Yolo County, *1879. Courtesy, DePue and Company*

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Cottonwood, named for Cottonwood Creek. In 1852 Charles Heinrich built a store and stagecoach stop three miles south of Cache Creek, near Gordon's rancho. The first post office in the central part of Yolo County was established there in March 1852. By 1870 Cottonwood was the service center for 1,319 people living on scattered farms between Cottonwood and Esparto.

A few miles north of Cottonwood a road branched off to the northwest, following Cache Creek into Capay Valley (named for the Indian word *capi*, meaning creek). In 1852 two brothers from Missouri, George D. and John D. Stephens, established the Oakdale Ranch along this road, south of Cache Creek and east of the valley's entrance, where they raised cattle and dry farmed grain. The brothers built an adobe granary which they converted in 1854 into a home that is still occupied by their descendants today.

In Capay Valley there were scattered houses along the road. Munchville, later called Capay City, was a collection of a few buildings, including Munch's store and blacksmith shop. Sylvannus Arnold and John Gillig purchased 16,700 acres of the Berryessa land grant in 1858, including the town of Munchville, and subdivided it into parcels. Gillig planted grapevines and fruit trees and sowed grain on his Adobe Ranch two miles northwest of the present town of Capay, and in 1860 he established there the county's earliest winery. The area developed slowly, despite increased traffic on the road generated in the 1860s when Charles F. Reed's quicksilver mine began operating in the hills to the west.

The main Benicia-Colusa road from Cottonwood followed Cache Creek until it crossed the creek at a natural ford about six miles northeast of Gordon's grant. A community known as Cochran's Crossing began to develop there in 1849 when Thomas Cochran established a crude hotel for travelers going to and from the northern mining districts. Cochran left the area in 1851, and James A. Hutton, who later became a prosperous farmer and county judge, acquired some of his property. The Yolo Post Office was established there in February 1853, and soon a blacksmith shop and other businesses were catering to a growing number of farm families who settled in the vicinity.

In 1857 the town, now officially known as Cacheville, was formally laid out and became the Yolo County seat. The establishment of the *Yolo Democrat* newspaper that year was a sign of the town's growing maturity, as was the construction of a Union Church and a cemetery (later Mary's Chapel and Cemetery).

In 1860 Cache Creek Township, with Cacheville as its principal community, had a population of 1,995, the largest in the county. However, in September 1860 the county seat was moved back to Washington and efforts to locate the new Pacific Methodist College in the town failed. Cacheville stopped growing and settled comfortably into its role as the commercial and social center of the surrounding farming area.

The Benicia road continued north past Cache Creek, Oat Valley, the Dunnigan Hills, and Hungry Hollow, and on to Colusa. Many German families settled in the hilly districts in the 1850s and 1860s, raising grain and livestock. In 1856 those in the northernmost part of the county could get their mail at the Antelope post office three miles south of the Colusa County line. In 1855 A.W. Dunnigan and his partner Henry Yarrick had opened a hotel and blacksmith shop in the area, and with the addition of the post office the settlement developed into a commercial center.

Besides the Benicia-Colusa road, there were other roads for travelers during the county's early years, but they were passable only in dry weather. One road from Benicia crossed Putah Creek near Davis and proceeded eastward through the tules to Sacramento. A commercial center began to develop along this road when Joshua Bradstreet Tufts and his wife Mary, Forty-Niners who had operated a hotel in Washington, moved to the south bank of Putah Creek in 1855. They opened a combination hotel, store, stage stop, and blacksmith shop

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Woodland News, 1862-1864
Woodland Record, 1938-1967
Yolo Democrat, 1864-1877

GEOLOGIC STRUCTURE IN THE CAPAY HILLS

Yolo County, California

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INTRODUCTION

The Capay Hills, long referred to as the Rumsey Hills in geologic literature (Kirby, 1943a), are located along the west side of the Sacramento Valley northeast of Lake Berryessa (Figure 1 and Photo 1). The hills are separated from the rugged mountains of Blue Ridge to the west by the Capay Valley and Cache Creek, a stream of regional importance that flows from Clear Lake, southward through Capay Valley to the Sacramento Valley.

Natural gas occurs in many springs along the west side of the Capay Hills and exploration wells were drilled in this area as early as 1900 (Kirby, 1943a). One of the earliest gas-prospect wells to be located by geologic mapping was drilled in 1921 along "...the anticline having surface expression in the Rumsey Hills..." (Carlson, 1962).

The Capay Hills were originally mapped in 1932-33 using plane-table mapping techniques (Kirby, 1943a; 1943b). In spring of 1980 the authors conducted field work to adjust the plane-table map to modern topographic maps during preparation of the Santa Rosa 1° x 2° quadrangle (Wagner and Bortugno, 1982) of the California Division of Mines and Geology Regional Geologic Map Series. During this reconnaissance work, a number of observations were made along the Sweitzer fault resulting in structural interpretations that differ from the earlier interpretations.

GEOLOGIC SETTING

Stratigraphy

Great Valley sequence. The oldest rocks exposed in the Capay Hills are those of the Mesozoic Great Valley sequence (Figure 1). This unit is one of the thickest and probably the most thoroughly studied Mesozoic sedimentary sections in the world.

Photo 1. Capay Valley from the Capay Hills, view to the northwest. Blue Ridge in the background is underlain by Upper Cretaceous strata of the Great Valley sequence. *Photo by D.L. Wagner.*

The Venado Formation, the oldest Upper Cretaceous formation in the sequence, is composed of a massive, cliff-forming sandstone that is exposed only in the southwest corner of the map area (Kirby, 1943c). Overlying the Venado Formation is the Yolo Formation, a poorly exposed shale unit 160 to 360 meters thick. About 850 meters of thick, well-bedded sandstone with shale interbeds of the Sites Formation overlie the Yolo Formation. The Funks Formation, a siltstone and shale unit about 300 to 830 meters thick, overlies the Sites Formation. These four formations (Venado, Yolo, Sites, and Funks) form a steep, east-dipping monoclinal sequence in the southwest part of the map area between Blue Ridge and Capay Valley (Figure 1).

The next formation of the Great Valley sequence is the Guinda Formation. About 330 meters of concretionary sandstone and interbedded shale of the Guinda Formation are exposed along the escarpment of the Sweitzer fault and on the crest of the Capay Hills (Kirby 1943a), (Photo 2). The Forbes Formation conformably overlies the Guinda Formation. At its type locality along Salt Canyon on the east flank of the Capay Hills, it consists of 410 meters of siltstone and shale (Kirby, 1943a).

Capay Formation. The name Capay Formation was given to east-dipping strata of Eocene age exposed along the west side of the Capay Valley (Crook and Kirby, 1935). At its type locality in Capay Valley, the Capay Formation consists of conglomerate, sandstone, and shale that is up to 930 meters thick. The type Capay Formation was deposited as fill in a submarine canyon cut into Upper Cretaceous rocks (Redwine, 1972; Baker, 1975). There is some confusion between

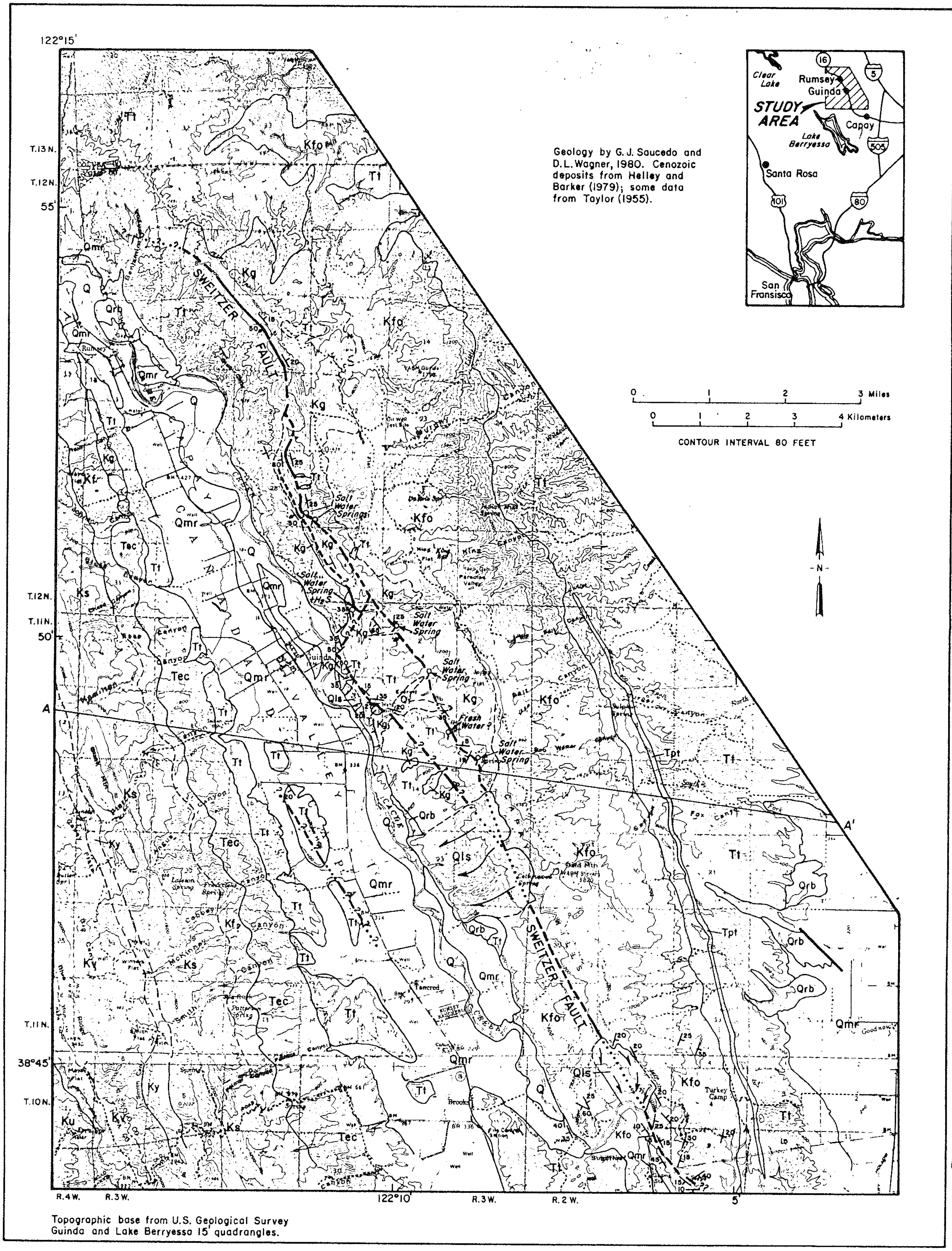

Figure 1. Geology of the Capay Hills, Yolo County, California.

EXPLANATION OF MAP UNITS

CENOZOIC

Quaternary

Q	Alluvium – modern stream channel deposits
Qls	Landslide deposits (arrows show direction of movement)
Qmr	Undifferentiated Modesto – Riverbank Formations – Alluvial deposits
Qrb	Red Bluff Formation – pediment gravel

Tertiary

Tt, Tpt	Tehama Formation – continental gravel, sand, and silt Tpt – Putah Tuff member
Tec	Capay Formation – massive feldspathic sandstone; numerous conglomerate lenses and shale interbeds

MESOZOIC

Upper Cretaceous

Ku	Undifferentiated Upper Cretaceous Great Valley sequence

Formations of Kirby (1943c)

Kfo	Forbes Formation – siltstone and shale
Kg	Guinda Formation – concretionary sandstone and shale interbeds
Kf	Funks Formation – siltstone and shale
Ks	Sites Formation – massive, well-bedded sandstone with shale interbeds
Ky	Yolo Formation – shale
Kv	Venado Formation – massive sandstone

SYMBOLS

Contact; dashed where approximately located; dotted where concealed.

50 — Fault; dashed where approximately located; dotted where concealed; D = downthrown block; U = upthrown block; arrow shows dip of fault where shear surfaces and slickensides where observed.

25 — Dip and strike of beds (angle shown in degrees where measured).

Landslides; arrows show direction of movement.

Geologic Cross Section, A-A′.

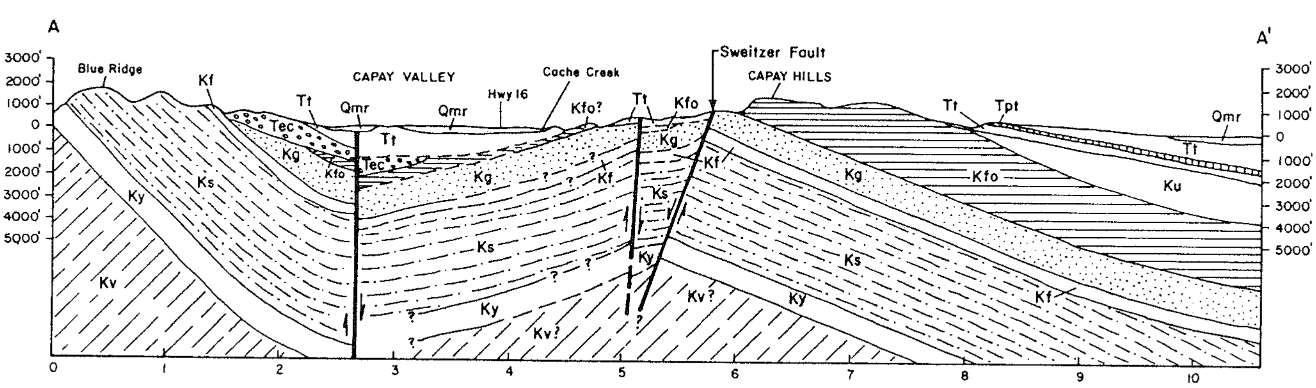

Photo 2. Large sandstone concretion from the Guinda Formation. The concretion is approximately 2 meters in diameter. *Photo by D.L. Wagner.*

the Capay Formation and a subsurface unit which is called "Capay shale" by petroleum geologists. The "Capay shale", however, is a submarine shelf deposit of roughly the same age (Redwine, 1972) but the relationship between the two units is ambiguous.

Tehama Formation. Pliocene gravel, sand, silt, and tuff of the Tehama Formation unconformably overlie the Great Valley sequence and the Capay Formation. The Putah Tuff Member of the Tehama Formation is exposed along the east side of the Capay Hills. Samples of Putah Tuff collected along Putah Creek to the south have yielded an age of 3.3 ± 0.1 million years (Miller, 1966).

Quaternary Alluvial Deposits. Quaternary alluvial deposits include: small patches of Pleistocene pediment gravel (Helley and Barker, 1979) along the flanks of the Capay Hills; the Pleistocene alluvial fill of Capay Valley, mapped as the Modesto and Riverbank Formations by Helley and Barker (1979), but shown undifferentiated on the geologic map (Figure 1); and gravel, sand, and silt in the bed of Cache Creek. An alluvial deposit, possibly ponded alluvium, underlies Everitt Flat southeast of the town of Guinda.

Landslides

Two large landslides occur on the east side of the valley along the escarpment of the Sweitzer fault. The larger of the two landslides is a rotational bedrock slide north of Tancred which extends over an area greater than 16 square kilometers. Kirby (1943a) mapped cross faults with westerly offsets in this area. It is more likely that landslide movement is responsible for the offsets shown by Kirby. The second slide area is along Cache Creek at the south end of Capay Valley and is named "The Slide" on the U.S. Geological Survey topographic map.

Faulting and folding

Kirby (1943a) described the Capay (Rumsey) Hills as being a faulted, assymetrical anticline that could be traced for 35 km. According to Kirby, the west limb of the fold is very steep and the east limb usually dips less than 40°. He called the fault which cuts the anticline the Sweitzer fault, apparently named for the Sweitzer Hills, the steep-sided hills in the Capay Valley between the communities of Guinda and Tancred. The crest of the "Rumsey anticline", according to Kirby (1943a, p.604), occurs just to the west of the Sweitzer fault in a zone of "crumpling" and faulting that is at right angles to the Sweitzer fault.

A prominent escarpment along the west side of the Capay Hills marks the trace of the Sweitzer fault for a distance of about 22 km (Photo 3). Kirby (1943a) described the Sweitzer fault as a reverse fault dipping 45° to the east with maximum displacement of roughly 150 meters. Along most of the extent of the Sweitzer fault, beds of the Tehama Formation on the west are juxtaposed against the Guinda Formation on the east. Kirby was able to trace the fault northward to a point east of Rumsey where it curves westward and loses surface expression.

The bedding attitudes we measured during the 1982 field mapping do not indicate the existence of a major anticline in the Capay Hills. Our mapping confirmed deformation just west of the Sweitzer fault which consists of high angle faults as well as folds that are too small to show on a 15-minute quadrangle. In our opinion, offsets at right angles to the Sweitzer fault described by Kirby are better explained by landsliding along the steep fault escarpment (Photo 3, Figure 1).

The Sweitzer fault was mapped from just north of Cache Creek near Capay northward for about 22 km where it becomes obscured in gravels of the Tehama Formation northeast of Rumsey. It is marked by the escarpment described by Kirby and numerous salt water springs

Photo 3. View to the north along the escarpment of the Sweitzer fault in the Capay Hills. First mapped by Kirby (unpublished mapping 1932-33; 1943a) as an east-dipping reverse fault. Mapping during this study indicates that it is a west-dipping normal fault. The poorly drained areas are caused by landsliding along the escarpment. Strata of the Guinda and Forbes formations crop out along the scarp. *Photo by G.J. Saucedo.*

Photo 4. One of the many saltwater springs that occur along the Sweitzer fault. *Photo by D.L. Wagner.*

which also issue natural gas and hydrogen sulfide. These springs are sites of rock alteration and support growths of saline-tolerant pickle weed (Photo 4). Strata of both the Guinda and Forbes formations exposed along the fault escarpment dip 20° to 25° eastward. West of the fault they dip 50° to 80° to the west. The same relationship holds true for rocks of the Tehama Formation. West-dipping shear planes were observed at three places along the fault. At two of these localities, slickensides plunge 50° SW along shear planes that trend N 40° W, indicating that at the surface the Sweitzer fault dips to the west and not the east. In as much as the west side of the fault is dropped down, the Sweitzer appears to be a normal fault.

A low-angle fault called the Eisner thrust lying to the west of the Sweitzer fault was also described by Kirby (1943a). During the 1982 reconnaissance no evidence for the existence of the Eisner thrust was found.

Displacement varies along the Sweitzer fault with a maximum offset of about 150 meters (Kirby, 1943a). The current mapping shows that the base of the Tehama Formation has been offset between 120 and 230 meters.

The amount of displacement shown by the offset of the Tehama Formation along the Sweitzer fault could not form a depression the size of Capay Valley. This implies that faults larger than the Sweitzer fault exist in the area. Topography suggestive of faulting in the Sweitzer Hills supports the existence of a fault shown by Kirby (Standard Oil Company; unpublished map, 1932-33). This fault could be an extension of the Salt Canyon fault of Boyd (1956) but it is more likely to be a fault called the west side fault (Harwood and Helley, U.S.G.S., written communication, 1983). Another subsurface fault mapped by Harwood and Helley (written communication, 1983), which they call the Capay fault, is a down-to-the-east normal fault beneath the east margin of the Capay Hills. Displacements on these normal faults are estimated by Harwood and Helley to be on the order of 600 to 700 meters; certainly enough to form Capay Valley. Therefore, it seems that the Sweitzer fault is one of several faults in the area.

Redwine (1972, p. 199) considered the Sweitzer fault to be a continuation of the Midland fault to the south and suggested that these faults are part of a major right-lateral strike-slip fault system. As evidence for this interpretation, Redwine (1972, p. 200 and Plate VII) described a steep east-dipping subsurface normal fault, penetrated by the Amerada "Capay Community 5" No. 1 well southwest of Capay. This fault, he reasoned, is the connection between the Midland and Sweitzer faults. Differences in sense of movements and magnitude of displacements among the three faults were described by Redwine as apparent offsets caused by lateral movement of uneven surfaces. We feel this interpretation is untenable for a number of reasons: (1) the Sweitzer fault is a west-dipping normal fault that was active until at least late Pliocene time; (2) the subsurface fault of Redwine (1972, Plate VII) is an east-dipping normal fault overlain by unfaulted Pliocene rocks; (3) the Midland fault, though a down-to-the-west normal fault, is an early Oligocene fault (Almgren, 1978, p. 288), and (4) the Midland fault dies out in a zone of folding in the Pleasant Creek gas field near Winters (Dennis Sparks, Geo-Logic Inc., personal communication, 1980) (Figure 2).

The subsurface fault penetrated by the Amerada "Capay Community 5" No. 1 well (Redwine, 1972) is probably the Capay fault (Harwood, personal communication, 1983), which is also a down-to-the-east normal fault. Thus it appears that the Midland fault, the Capay fault, and numerous normal faults of Capay Valley (including the Sweitzer fault) represent episodic extensional faulting which propagated northward through the southern Sacramento Valley during much of late Cenozoic time.

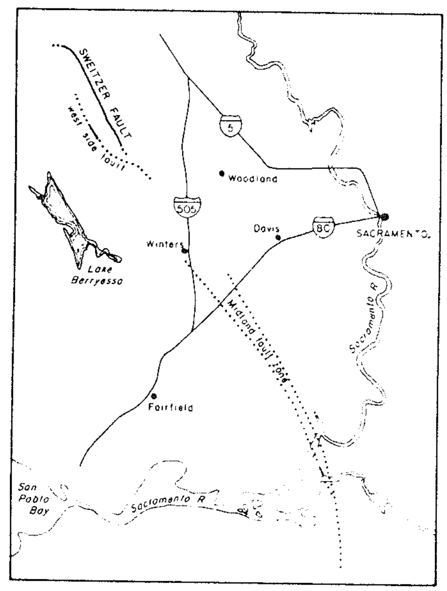

Figure 2. Locations of the Sweitzer fault, the west side fault of Harwood and Helley (1982), and the buried Midland fault. Concealed faults are dotted.

CONCLUSIONS

1) The Sweitzer fault is a normal fault that dips about 40° to 50° to the west instead of an east-dipping thrust as described by Kirby (1943a).
2) The Sweitzer fault is one of several high angle faults in the Capay Hills.
3) The Sweitzer fault is not connected to the Midland fault as interpreted by Redwine (1972).
4) The Sweitzer fault formed during late Pliocene time by extensional faulting. This was the latest of a series of extensional faulting episodes that migrated northward through the Sacramento Valley during late Cenozoic time.

ACKNOWLEDGMENTS

We would like to thank David Harwood and Edward Helley of the U.S. Geological Survey for providing unpublished data and discussing the subsurface geology of the Capay area. Ralph Kraetch of Chevron kindly provided access to unpublished material of J.M. Kirby. We also would like to acknowledge the secreterial assistance by Renita Stone of the California Division of Mines and Geology. Early versions of this paper were reviewed by Charles Bishop and Charles Jennings of CDMG and David Harwood of the U.S. Geological Survey.

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Landslide and Flood Potential Along Cache Creek

Lake, Colusa, and Yolo Counties, California

By

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This article was adapted from *Landslide Hazards along Cache Creek between Clear Lake and Capay Valley, Lake, Colusa, and Yolo counties, California*, Division of Mines and Geology Open-File Report 89-30 (Landslide Hazard Map No. 19, scale 1:24,000). The landslide investigation was performed under the Landslide Hazards Identification Program (LHIP) established in 1983 by the California legislature to provide information to reduce landslide hazards and property losses in developing areas, to improve public safety by identifying areas subject to debris flows, and to develop maps showing landslide hazards for use by local government planners. The Cache Creek area is one of more than 20 areas within California mapped under this program (see California Department of Conservation, 1988; Manson, 1989a).

The study covers geologic conditions related to slope stability along Cache Creek between Clear Lake and Capay Valley to identify localities where landslide movement could result in blockage of Cache Creek in an event similar to the 1906 landslide blockage of the creek.

The study results can be used by local agencies to make land-use decisions and to prepare for mitigation of landslide hazards that pose a threat to public safety. The complete report (OFR 89-30), including recommendations for emergency preparedness and planning for mitigation of landslide hazards, will be available soon from Division of Mines and Geology, Public Information, 660 Bercut Drive, Sacramento, CA 95814-0131.
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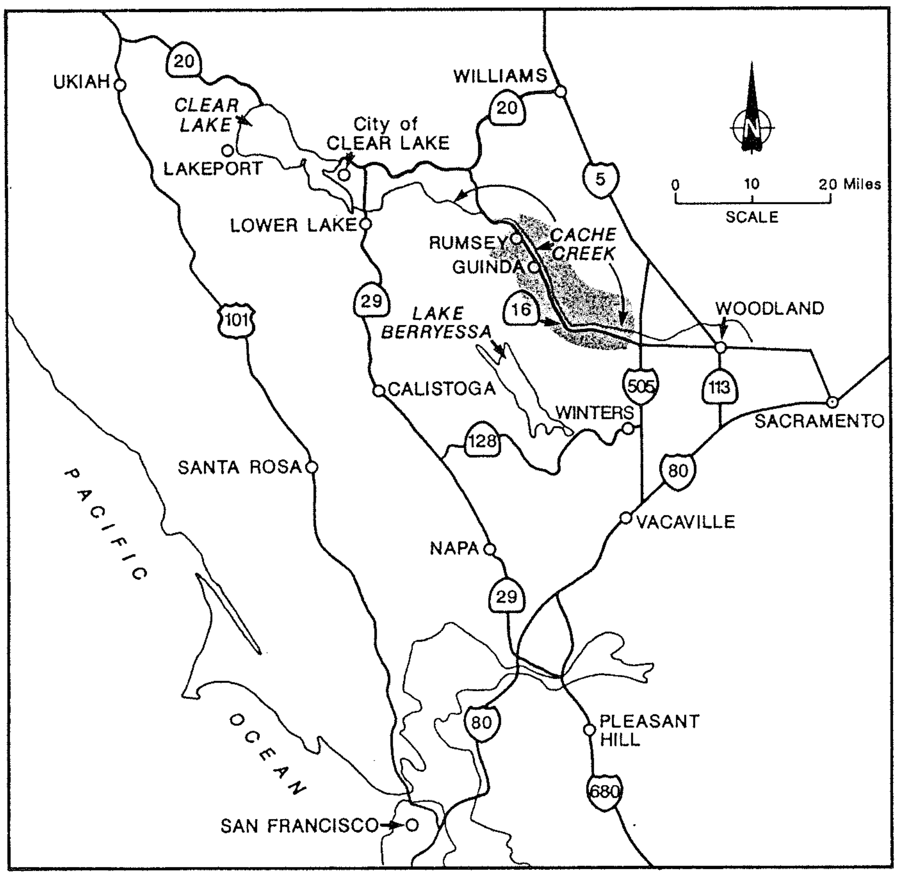

Figure 1. Location of Cache Creek and Capay Valley (in color) in central California Coast Ranges.

INTRODUCTION

At about 9 o'clock on the evening of Tuesday, May 1, 1906, a slight shock was felt in Capay Valley, California (Figure 1). The great San Francisco earthquake had occurred only 13 days before, and not too much notice was given to this latest shock. When the local citizens arose the next morning, however, they were surprised to find that the water level in Cache Creek had fallen considerably. At Guinda, in the Capay Valley, the creek level had dropped 5 feet overnight (*Winters Express*, 1906a; *Woodland Daily Democrat*, 1906).

Due to the rugged and remote nature of the Cache Creek drainage upstream from Capay Valley, the cause of the drop in water was not known until Thursday, May 3, 1906, when word was received in Capay that a landslide had blocked Cache Creek below Wilson Valley (Figures 2 and 3).

The landslide that dammed Cache Creek was about 100 feet high and nearly 500 feet wide on top (*Winters Express*, 1906b). It was composed of debris from the Crack Canyon Formation (Lower Cretaceous; Lawton, 1956) and impounded approximately 12,000 acre-feet of water (Scott, 1970) in a lake that extended about 4 miles upstream. No attempts were made by local authorities to remove the obstruction due to difficult access to this remote location. In anticipation of a flood, most of the residents in the upper Capay Valley evacuated their homes and camped out on nearby hillsides (Photo 1).

When the dam failed five days after the landslide created it, the resulting flood entered the Capay Valley and devastated the small town of Rumsey (Figure 1), destroyed several buildings, and damaged the county bridge across Cache Creek and the Southern Pacific rail facilities. The flood-water level reached a height of four feet above the normal high water mark. Fortunately, no one was injured or killed. Although the landslide and flood were mentioned in the summary report on the 1906 San Francisco earthquake (Lawson and others, 1908), it soon faded into obscurity along with many other effects of that great event.

The following article by Ed E. Leake, editor and publisher of the *Winters Express*, appeared in the May 11, 1906 issue.

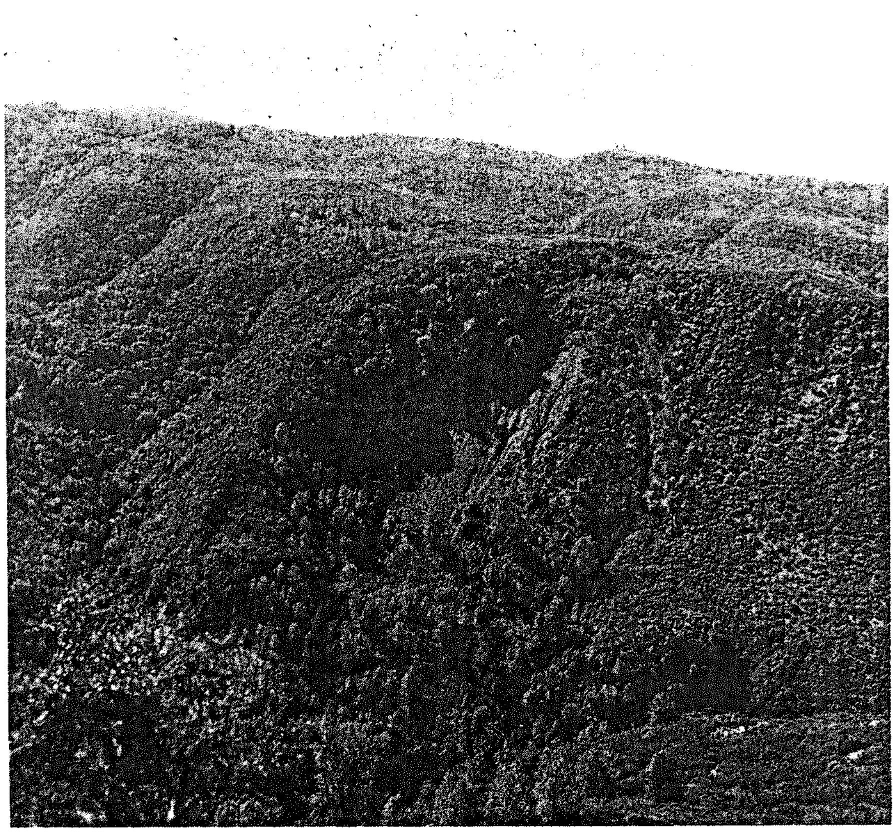

Photo 1. Scarp of the 1906 landslide (center of photo). Cache Creek is just out of view at the base of the cliff. Although this slide occurred 84 years ago, the scarp and slide mass of the landslide on Cache Creek are still distinct. The landslide covers about 28 acres and originally contained 3.2 million cubic yards of material (Scott, 1970). Although the subsequent flood and the damage it caused to downstream communities were serious topics, the local citizens found some humor in the situation. One Woodland store ran an advertisement in the *Daily Democrat* during the week of May 8-14, 1906 that read in part, "DANGER OF FLOOD IS OVER! Not bathing costume but good knit underwear is the garment now needed." *Photos by M.W. Manson.*

WHAT HAPPENED TO CACHE CREEK

The Great Dam Goes Out Easy and Nobody Is Hurt . . . Small Property Loss at Rumsey and Lots of Excitement All Along the Creek.

The great slide in Cache Creek has gone out, and the people of Capay valley have settled down to normal conditions. For five days the inhabitants of that beautiful valley were under intense suspense, expecting hourly that the dam would give way and thousands of tons of water be precipitated down the creek, sweeping all before it. The expected and feared happened in only a small degree. Sunday night about two o'clock the dam went, cutting away in the center and letting out the water slowly. Of course a vast amount of debris went down with it, and the crest of the flood was so covered with driftwood and trees that even at Capay it looked like one could almost walk across it.

The principal damage was done at Rumsey, the head of the valley. Travis' house was washed away, the Earl Fruit Co's loading shed wrecked, the Southern Pacific pump house carried up to the depot, all the yard tracks destroyed, Lloyd's barn carried off, both approaches to the county bridge across the creek destroyed and the sills damaged, and considerable injury was done to some orchards. The water went into the depot, but did no harm. It also carried off J.M. Morrin's store and post office and wagon shed, but everything had been moved out, so no damage was done to the stock or the mail.

To see just what the conditions were before the break the editor of the Express made the trip to the scene of the slide, leaving Winters Friday morning at a moment's notice. At Madison, J.R. Jones boarded the train, and soon made it known that he was on the way to the slide. Mr. Jones has much stock on his farm that would be affected by a big rush of water, and he wanted to see what the danger was. So he and the newspaper man made a compact to go together.

Arriving at Rumsey, it was learned that the slide was probably twenty miles away, and the country between inaccessible mountains, if one did not know the way. Those who had the trip to make under normal conditions followed up the creek banks, but as the flood was expected at any time, nobody wanted to go by that route.

[A party of five officials from Yolo County] . . . had arrived that morning from Woodland, and taking all the available horses and two or three guides set out for the dam before the train arrived.

Mr. Jones expected to make the trip on foot, but the distance was too great, and being unaccustomed to horseback riding he decided to go home. That left the newspaper man alone, and he was not a little depressed at the seeming necessity of making the trip alone, no one appearing to want to attempt it.

Through the kindness of Mr. Cass Irwin a good horse was obtained, and about five o'clock a young Mr. Morrin said he would go. Securing a mule "whose name was Maude," but was afterward christened "Dynamite" for reasons that will appear, he and the scribe fared forth.

Cache Creek canyon is a marvel of nature's handiwork. The stream flows at the bottom of a tremendous gorge, whose mountain sides are from one to two thousand feet high — steep mountain ridges of stratified slate, lying at an angle of forty five degrees, and where the surface has sufficiently decomposed, covered with a heavy growth of chaparral, manzanita, scrub oak, some pines, and an infinite variety of thorny bushes . . .

Two hours travel brought us face to face with the Woodland tourists. They had gone up in two parties, one on either side of the creek. [Yolo County] Surveyor Ashley's party only had reached the slide. Mr. Ashley reported that . . . [the landslide] had formed a complete dam in the creek about 1000 feet from bank to bank, 200 feet wide on top and with a base of over 1000 feet it was about 100 feet high and its immense bulk and weight kept it from being pushed down stream by the great weight of water impounded. The water was within ten feet of the top, rising at the rate of six inches an hour, and could be expected to run over in twenty hours, whild the possibility was that the barrier would give way in much less time.

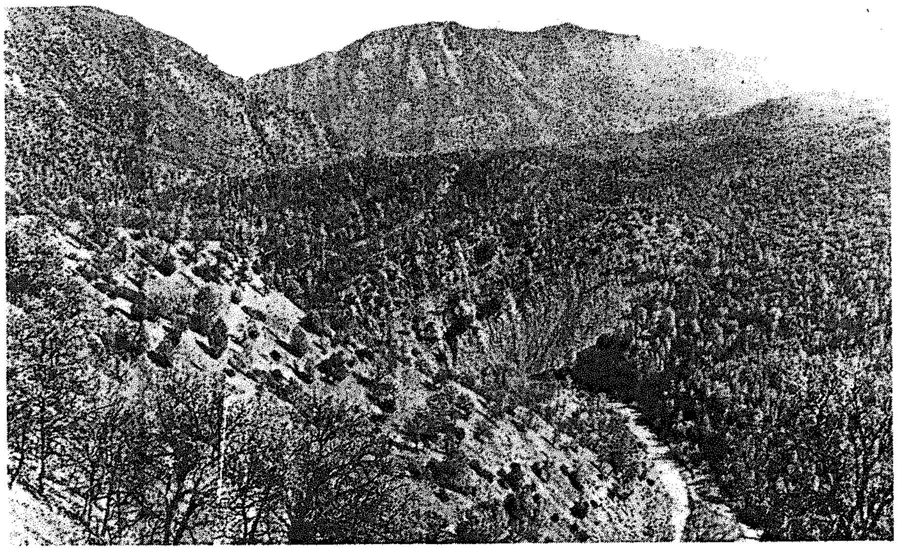

Photo 2. General topography of the Cache Creek region. View toward the east. Cache Creek (bottom center of photo) meanders eastward through the northern Coast Ranges from Clear Lake to Capay Valley. Glasscock Mountain and Blue Ridge (on the left and right horizons, respectively) mark the transition from the rugged terrain of the Coast Ranges to the low rolling hills and level expanses of the Central Valley just beyond the hills in the photo. The abrupt vertical scarp of a distinct landslide can be seen on Glasscock Mountain. Reactivation of this large slide would impound Cache Creek and threaten State Highway 16.

Now traveling at night up a canyon from which escape would be more or less difficult in daylight is no fun, and the newspaper man was not at all surprised that his companion and guide, after the returning party had disappeared in the darkness, should announce that he also had business in Rumsey. Back he went for home, and then it was up to the other fellow to go on alone or return to Rumsey for another maker of rash promises. Catching up with the [Woodland] party there was found among them a young man, who had started for the slide but failed to reach it, before those who did, wanted to go home. This was Albert A. Allen of Woodland. He traded his jaded mule for "Dynamite" ridden by the homeward bound Rumsey man, and again we were outward bound. This was the third companion the Express editor had been blessed with in one day and he uttered a silent supplication that he might be a stayer. He was. A. Allan stuck to the mule until that pugnacious quadruped could no longer carry him, and safely made the round trip.

Traveling on to Bear Creek, a stream as large now as is Putah Creek in summer, we crossed to the divide, took up a can of water, built a rousing fire by the light of which we dried wet stockings and ate sardines and crackers, and taking a turn in our neckties we climbed on downy beds of ease with the vaulted, star bedecked sky for a coverlid and slept until 4 o'clock, occasionally getting up to replenish the fire and chase the festive woodtick.

Again descending to the creek bed, winding back and forth across it until Knob's ranch was reached five miles from the slide, the hour had come when it seemed foolhardy to court danger longer, and we climbed to the north side mountain.

Chaparral everywhere; mountain side almost too steep for progress; sun fiercely hot; no water; deep ravines that could not be crossed, compelling long detours. Once more we slid down to the stream and followed it until we thought the slide but two miles away and then, climbing up the mountain on the south side, again took up the struggle with chaparral.

That last two miles consumed just two hours and at eleven o'clock we stood at the edge of the barren mountain side from which some nine or ten acres of dirt had slid into Cache Creek, stopping its flow as completely as though the earth had opened and swallowed up the water. The dam was complete. Not a drop of liquid oozed through it.

Here was a great barren space on the mountain side from which the soil had all slipped away. The exposed surface was yellow clay and rock. It was almost as smooth as the back of one's hand, and in many places springs of water were pouring from it.

The real cause of the slide was not hard to find. Here was a mountain side so steep that climbing was difficult. From a higher range the reservoirs of Winter rains were feeding springs that had completely saturated the few feet of earth that covered the clay and rock, and then wetting the harder surface, the hill side acted just like the ways of a shipyard slipping its burden into the sea below. No earthquake was needed. Gravity and the lack of adhesion did the work.

Clear across the creek went the slide, carrying with it brush and trees and even a boulder of twenty feet or more in diameter that was pushed up on the north bank of Cache Creek until it was thirty or forty feet higher than the center of the dam, which was itself about 100 feet high.

Securely impinged against a perpendicular bluff at its north end, while the south was reinforced by an immense weight of earth and debris, a dam lay across the creek that if the water could be kept from flowing over it, might stand for ages.

Calm and serene as a sleeping child a lake of water lay above it, with just enough motion to suggest life, but giving no hint of the cruel power it could display should it be loosed from the leash. Over 1000 feet average width, 100 feet deep and some eight miles in length, here was a body of water that set in motion suddenly would wipe off the map the orchards and farms of a prosperous valley below it.

[County] Surveyor Ashley and others of good judgement expected the worst to happen. There was a chance that as the middle of the dam was lower than the ends, the water would by cutting through there first, flow slowly and that the vast body of earth requiring so much time to be washed out would hold back the flood until it was too small to do extensive damage. This is actually what happened, and to that is due the fact that the beautiful Capay valley is still inhabitable.

Everybody had been fully warned. All on the lowlands had taken to the hills. It were better that many moved who need not than that any should suffer. Not a life was lost and the destruction of property was inconsiderable compared with what might have been.

Leaving the slide at one o'clock and feeling confident it would not go out before another day, we easily made the trip to Rumsey by night fall, where T.D. Morrin gave us our first warm meal in forty hours, and provided comfortable beds on the high ground where we slept in peace.

The 1906 landslide/flood event occurred at a time when the region was much less densely populated than it is now. A similar landslide/flood event today in the area would be a threat to life and property.

CACHE CREEK STUDY AREA

The Cache Creek study area is in the northern Coast Ranges geomorphic province of California, approximately 75 miles north of San Francisco and 46 miles west-northwest of Sacramento (Figure 1; Photo 2). The study area extends approximately 30 miles downstream along Cache Creek from the Clear Lake Impounding Dam (in the City of Clear Lake) to Rumsey (at the head of Capay Valley; Figure 2). Access is by way of

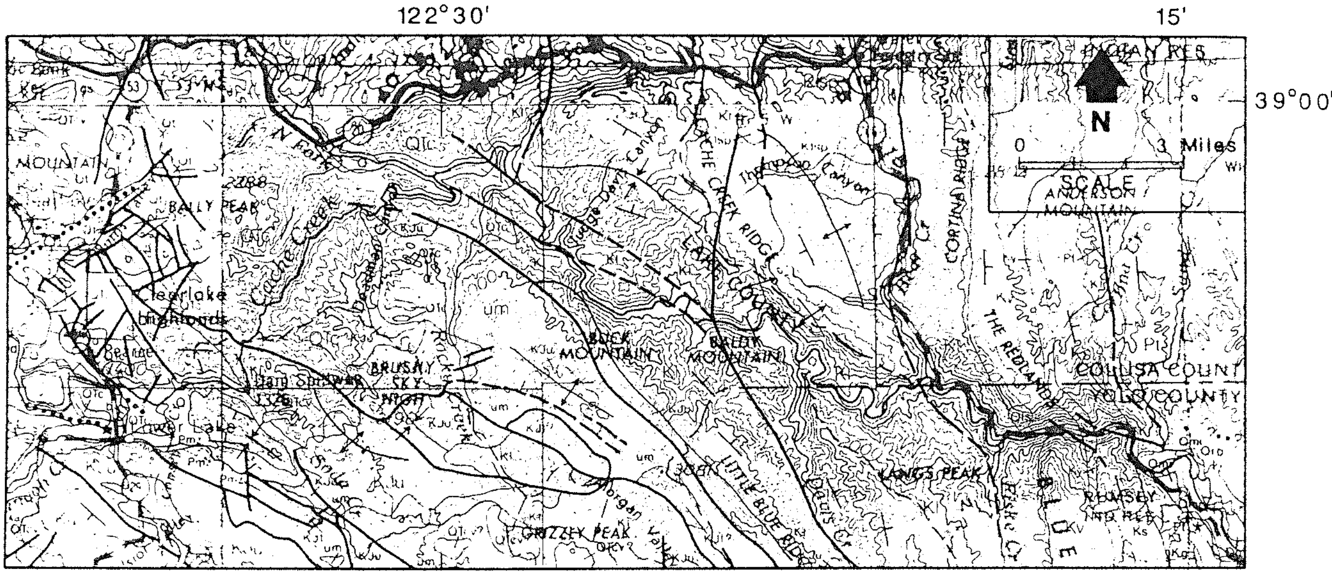

Figure 2 Regional geologic map of Cache Creek study area. Geology from Jennings and Strand (1960), Lawton (1956), and Wagner and Bortugno (1982); locally modified by Manson (1989a).

SYMBOLS

Fault — solid where accurately located; dashed where approximately located; dotted where concealed.
Contact
Anticline
Syncline

UNIT DESCRIPTION

Q	Alluvium (Holocene)
Qls	Landslide deposits (Holocene)
Qmr	Modesto-Riverbank formations (arkosic alluvium) (Pleistocene)
Qt	Terrace deposits (Pleistocene)
Qrb	Red Bluff Formation (gravel in reddish silty or sandy matrix) (Pleistocene)
QTc	Cache Formation (Pebbly sandstone, conglomerate, siltstone and tuff) (Plio-Pleistocene)
Qtcv	Clear Lake volcanics (d-dacite; a-andesite to basaltic rock; b-basalt; r-rhyolite; t-tuff and other pyroclastic rocks) (Plio-Pleistocene) *Quaternary cinder cone or volcano
Pt	Tehama Formation (Sand, silt, and volcaniclastic rocks) (Pliocene)
Ec	Capay Formation (Marine sandstone) (Eocene)
Pmz	Martinez Formation (Marine quartzose sandstone) (Paleocene)
	Upper Cretaceous Great Valley Sequence
Ku	Upper Cretaceous (Undifferentiated marine rocks)
Kfo	Forbes Formation (Marine shale and siltstone)
Kg	Guinda Formation (Marine sandstone and mudstone)
Kf	Funks Formation (Marine shale and sandstone)
Ks	Sites Formation (Marine sandstone)
Ky	Yolo Formation (Marine shale and sandstone)
Kv	Venado Formation (Marine sandstone and conglomerate)
Kl, Klsp	Lower Cretaceous Great Valley Sequence (Marine mudstone, sandstone and conglomerate) (Kisp — detrital serpentine)
KJu, Kjsp	Lower Cretaceous-Upper Jurassic Great Valley Sequence (Marine mudstone, siltstone, sandstone and conglomerate) (KJsp — detrital serpentine)
Kjf	Franciscan Complex (ss-sandstone, shale, conglomerate, ch-chert, gs-greenstone; mg-metagraywacke)
um	Serpentinized ultramafic rocks
Jgd	Gabbro and diabase

State Highways 16 and 20, although large portions of the west half of the Cache Creek area do not have improved roads and few roads lead directly to the creek itself. The width of the study area ranges from one to three miles, and relief in the area approaches 2,200 feet.

The climate in the study area is characterized by hot dry summers and moderate winters. Snow occasionally covers much of the area during intense winter storms, whereas the summertime temperatures reflect the proximity of the area to the hot Central Valley. Temperature extremes in the study area are greater than at Clear Lake because it lacks the moderating effects of the lake. Much of the area is covered by thick brush consisting of chamise, manzanita, and buckthorn. The remainder is grassland with scattered oak trees.

The isohyetal (lines of equal rainfall) map shows the Cache Creek study area received an average of 25 to 30 inches of rainfall per year between 1906 and 1956 (Rantz, 1971). Lakeport, on the west margin of Clear Lake, received an average of 30 inches per year. From July 1, 1905 to June 30, 1906, 37.33 inches of rain fell on Lakeport; an estimated 96.2 percent of this amount fell from July 1 to April 30 (California Department of Water Resources, 1961, Tables 2 and 3).

There are several small ranches upstream from the Clear Lake Impounding Dam, and numerous farms and ranches are downstream in Capay Valley. Few, if any, people live along Cache Creek between the dam and the valley. Most of the land in the study area is State or Federal property (U.S. Bureau of Land Management, 1972). The grasslands are used for cattle grazing. Access to much of the private land in the area is controlled by hunting clubs (Lawton, 1956). A large Tule elk herd ranges through the study area, and deer are plentiful.

STUDY METHOD

Because the terrain in the study area is extremely rugged, aerial photos were used to conduct a landslide inventory. Landslides and debris flows typically create distinctive landforms, such as scarps in the source areas and benches and elongated bulges at the toe or downhill end (Photo 2). Selected aerial photos were examined for evidence of landslides using a stereoscope and identified landslides were plotted on a base map (scale 1:24,000). Existing geologic mapping was also compiled on the base map. Field observation of landslides was limited to accessible areas along State Highways 16 and 20, along Cache Creek between Peachtree Crossing and the North Fork of Cache Creek, and from several vista points along Cache Creek canyon. Field studies were made in late 1988 and early 1989.

GEOLOGIC SETTING

Rock Units

Geologic units within the Lower Lake (7.5 minute) quadrangle (at the west end of the study area) include the Cache Formation (Plio-Pleistocene: Rymer, 1978; 1981), some ultramafic* and silica carbonate rocks that are part of the Coast Range ophiolite* (Brice, 1953), and Cretaceous sedimentary units near Lower Lake and Middletown (Swe and Dickinson, 1970). Adjacent parts of the Wilson Valley and Glasscock Mountain (7.5 minute) quadrangles to the east include the Great Valley Sequence of Upper Jurassic(?) and Cretaceous age, and other units such as the Cache Formation (Lawton, 1956). Detailed mapping along Cache Creek in the vicinity of Wilson Valley was conducted during an investigation of proposed damsites (Scott, 1970).

The Great Valley Sequence comprises several distinct geologic formations in the eastern and central portions of the study area (Figure 2). These formations consist of interbedded shale, mudstone, sandstone and conglomerate strata that dip steeply eastward, and are highly fractured and jointed. Areas around Clear Lake that are underlain by units correlated with some of the formations (the Venado and Brophy Canyon Formations, the Blue Ridge Member of the Crack Canyon Formation, and the "Unnamed Mudstone" Formation; Units IIc, IIa, Ib and Ia, respectively, of Swe and Dickinson, 1970) were classified as "Most Susceptible" to landslides and debris flows (Manson, 1989a). The Cache Formation, which underlies the western portion of the Cache Creek study area, is an uncemented and

* See glossary, p. 106.

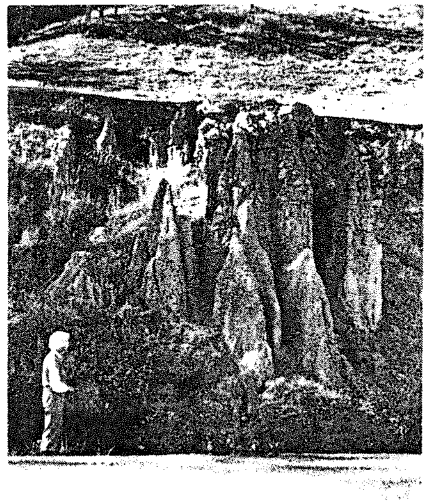

Photo 3. Poorly sorted sand and gravel of the Plio-Pleistocene Cache Creek Formation at its type locality along New Long Valley Road, Lake County. View is to the west. Person is about 5 feet, 3 inches tall. The type locality of a rock formation is the area where the formation was first recognized and described. Note how the uncemented and unconsolidated sediments have readily eroded from the runoff of winter rains.

relatively unconsolidated assemblage of poorly sorted cobble gravels, sand and silt (Photo 3). Areas around Clear Lake that are underlain by this unit are also designated as "Most Susceptible" to landslides and debris flows (Manson, 1989a).

Landslides

A landslide is defined as a mass of rock, soil, and debris that has been displaced downslope by sliding, flowing, or falling. Landslides include cohesive block glides and disrupted slumps that have formed by translation* or rotation* of the slope materials along one or more planar or curviplanar slip surfaces. The Cache Creek landslide hazard map shows medium and large landslides that are visible on the black and white aerial photos used for this study. In addition to these landslides, there are innumerable unmapped small landslides, debris avalanche scars, and rock falls along Cache Creek and its tributaries. Due to slope instability factors, both the large and small slope failures will continue to occur (Photo 4).

Cache Creek is an antecedent* stream; it maintains its original easterly course through mountains that are being uplifted because the various geologic units traversed by Cache Creek erode relatively easily (Photos 2-4). Many of the slope failures are triggered by undercutting and erosion of the hillside slopes by Cache Creek and its tributaries.

When shale and sandstone units are steeply dipping, the less resistant shale beds are eroded down the dip and along the upper surface of the more-resistant sandstone beds. The sandstone beds act as pavements on the dip slopes (those slopes that are parallel to the direction of bedding tilt). The mudstone, shale, and sandstone layers that are stratigraphically above the "pavement" beds are eroded by undercutting on the antidip* slopes (Figure 4), and, therefore, are highly susceptible to landsliding and debris flows (Radbruch and Weiler, 1963). Well-developed jointing or fracturing weakens the strata and intensifies susceptibility to landsliding. Joints in the rocks provide a path for groundwater infiltration and migration, which reduces cohesion of the sediments. Researchers have found that as many as 90 percent of active slope failures develop on antidip slopes in tilted, regularly jointed sedimentary rocks (Rogers, 1986, p. 25).

Other slope failures are triggered by increased pore-water pressure (pressure exerted by groundwater within the voids between mineral grains in soil, alluvium, and bedrock) due to the infiltration of rainwater. The resulting decrease of shear strength (internal resistance to deformation by shearing) can cause slope failure. The level of the water table (depth to groundwater beneath the land surface) varies with the amount of rainfall for the area. During the winter, the water table and pore-water pressure rise because of increased rainfall, and during the summer and fall months the water table and pore-water pressure drop because rainfall is negligible. If rainfall is higher than average during the winter season, the water table will be higher than average on a hillslope and groundwater pressures may become dangerously high. Under these conditions, hillside movement could be activated by an earthquake, or oversaturation of soil by additional rainfall, or vibrations from explosions for road construction.

Numerous studies have shown a correlation between large earthquakes and incidents of landslides. Landslides that were triggered by 40 historical earthquakes have been documented (Keefer, 1984). The magnitude 7.1 Loma Prieta earthquake of October 17, 1989 activated many landslides in Santa Cruz County (Manson and others, 1989; Spittler and others, 1989). A landslide near La Honda, in San Mateo County, California, which occurred 33 miles away from the epicenter, was probably triggered by the Morgan Hill (M 6.1) earthquake of 1984

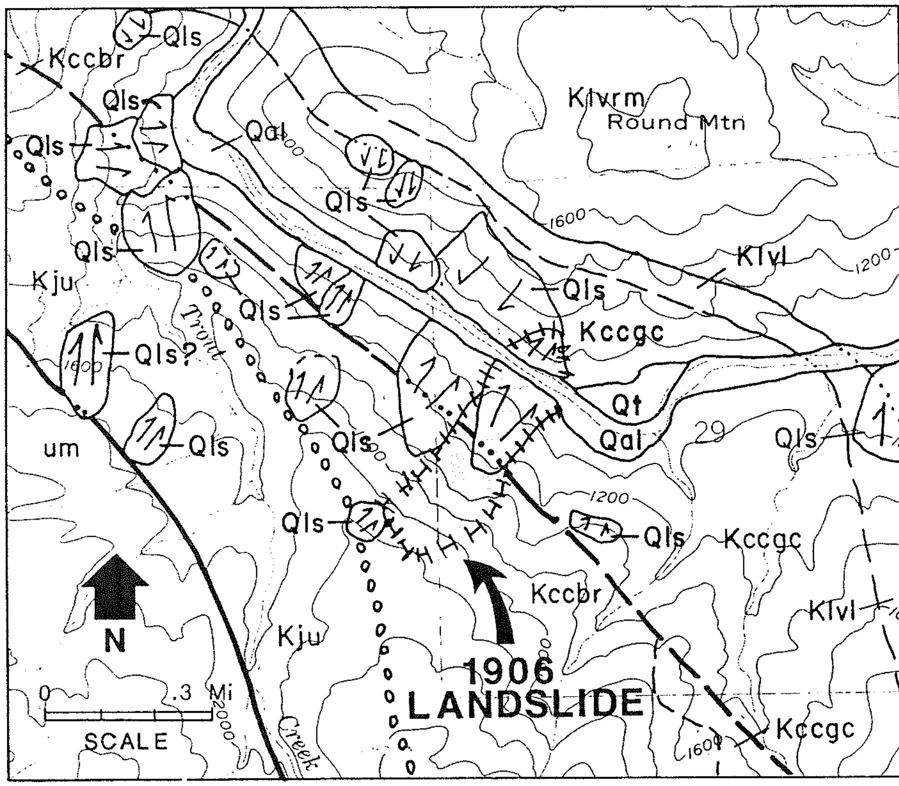

Figure 3. Geologic map of the 1906 Cache Creek landslide locality (from Manson, 1989b; modified from Lawton, 1956).

Conglomerate beds o o o o o o o o o o o o o o

Fault ——————— — — — — —

Unit contact ———————————

Landslide: Arrows show direction of downslope movement.

SYMBOL	UNIT DESCRIPTION
Qal	ALLUVIUM (Holocene): Deposits of gravel, sand, silt and clay along the active stream channels; includes small patches of older bedrock locally.
Qls	LANDSLIDE DEPOSITS (Holocene and Late Pleistocene): Includes landslides mapped by previous workers; many other small landslides exist but are not shown; arrows indicate general direction of movement. Landslides that currently appear to be stable can readily become remobilized by increased precipitation.
Qt	TERRACE DEPOSITS (Holocene and Pleistocene): Unconsolidated to semi-consolidated alluvium deposited mainly by streams, with minor lakebed deposits of siltstone and mudstone; elevated above present stream channels and lake basins.
Klvrm	LITTLE VALLEY FORMATION, ROUND MOUNTAIN MEMBER (Lower Cretaceous): Predominantly light-gray to brown shale and silty shale, with minor mudstone, interbedded sandstone and some limestone; contains detrital serpentinite locally. Conformably overlain by the Baldy Mountain member of the Davis Canyon Formation, and conformably overlies the Leesville member of the Little Valley Formation. Unit thickness in the study area is greater than 4,200 feet.
Klvl	LITTLE VALLEY FORMATION, LEESVILLE MEMBER (Lower Cretaceous): Predominantly buff, light-gray or yellow-brown sandstone, with interbedded shale and silty shale and occasional conglomerate. Unit is 600 to 1,800 feet thick, and rests conformably upon the "Grizzly Creek member" of the "Crack Canyon Formation."
Kccgc	CRACK CANYON FORMATION, GRIZZLY CREEK MEMBER (Lower Cretaceous): Predominantly shale, silty shale, and mudstone, with occasional sandstone and several conglomerate lenses; contains thick lenses of detrital serpentinite locally. Unit thickness is 3,200 to 4,600 feet.
Kccbr	CRACK CANYON FORMATION, BLUE RIDGE MEMBER (Lower Cretaceous): Conglomerate and sandstone with some interbedded mudstone. Conformably overlies Sulphur Creek Formation (Lawton, 1956; Swe and Dickinson, 1970). Unit thickness in the study area is approximately 2,100 feet.
KJu	UNNAMED MUDSTONE FORMATION (Upper Jurassic-Lower Cretaceous): Dominantly mudstone with minor sandstone and conglomerate; thin-bedded chert and pillow lavas present near base of unit. Shale is medium to dark brown or gray; sandstone is greenish gray or brown. Includes Knoxville Formation (Brice, 1953), Sulphur Creek Formation (Lawton, 1956; Swe and Dickinson, 1970).

(Wieczorek and Keefer, 1987). The 1906 Cache Creek landslide may have been initiated by the magnitude 8.25 San Francisco earthquake of April 18, 1906, although the epicenter was about 83 miles south of the Cache Creek area (Real and others, 1978). The 1906 San Francisco earthquake occurred at the end of a winter that had higher than normal rainfall. The shaking intensity for the region surrounding the Cache Creek landslide is estimated to have been V-VI on the Modified Mercalli (MM) scale during the 1906 earthquake (Scott, 1970). Shallow, highly disrupted landslides from steep slopes, such as occurred at Cache Creek in 1906, are common at MM VI (Keefer, 1984, p. 420). Although the 1906 Cache Creek landslide was not instantaneously triggered by the earthquake, the associated ground motion may have opened incipient failure planes in the slide mass along which groundwater percolation caused hydrostatic pore pressure to increase, resulting in slope failure 12 days later (Scott, 1970, p. 15).

The 1906 Cache Creek landslide moved with such velocity that a boulder 20 feet in diameter was carried across the canyon and lifted more than 30 feet above the main mass of the dam. The tremor felt in Capay Valley on the night of May 1 could have been caused by the impact of the landslide (Scott, 1970). Although this is very possible, an alternative hypothesis is that a small earthquake did occur locally and triggered the landslide. No local earthquake of magnitude 4 or larger is listed for that date (Toppozada and others, 1978). One earthquake was reported at 9:30 p.m. on that date near Guerneville, Sonoma County, approximately 38 miles west of Capay Valley. It is listed as MM intensity VI (felt by all persons).

Between 1969 and 1984 more than 36 small earthquakes (magnitude 1.0 to 2.9) occurred in the region between the 1906 Cache Creek landslide locality and Lake Berryessa, approximately 19 miles to the south. One earthquake epicenter was only 2 miles west of the landslide (U.S. Geological Survey, 1985). The same amount of microseismicity may have occurred in the region in 1906, but because there were no instruments capable of recording any small earthquakes near Cache Creek at that time, a hypothetical "triggering" earthquake would not have been recorded.

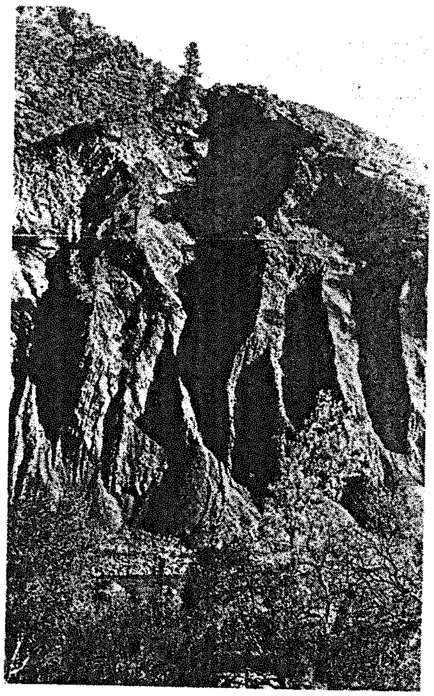

Photo 4. Exposure of nearly vertically dipping strata of the Fiske Creek Formation rocks, Great Valley Sequence, along State Highway 16 south of Glasscock Mountain. View is to the south. The debris that falls off the outcrops, such as from heavy rains, moves downslope where it eventually reaches the Cache Creek channel. The amount of debris transported by the stream depends on the amount and velocity of the waterflow. With increased stream flow clay and silt are transported first, followed by sand, pebbles, cobbles then boulders. Finer sediments are carried in suspension and act as an abrasive slurry along the length of the channel. Larger clasts are bounced and rolled along the channel bed by water action. When the stream has removed all of the sediment from the bed load, erosive forces then begin to scour the channel, downcutting into the bedrock. Tectonic uplift of the Coast Ranges produced dramatic folding and faulting and caused the entrenchment of Cache Creek.

SUMMARY

DMG landslide program staff made the following conclusions from data gathered during the Cache Creek landslide investigation:

1. Numerous landslides, both active and dormant, are present along Cache Creek. Notable landslides are located at Glasscock Mountain, Round Mountain, and along the South Fork (main branch) of Cache Creek upstream from its confluence with the North Fork. The 1906 Cache Creek landslide, located along Cache Creek across from Round Mountain, is easily identified on air photos and in the field due to the large hillside scar and its relatively fresh appearance.

2. Landslide activity in the area will occur in the future. Some of the larger existing landslides could block the creek if they were reactivated. A landslide complex located on the south face of Glasscock Mountain at the eastern end of the study area could block both State Highway 16 and Cache Creek if it is reactivated.

3. A few existing landslides along the South Fork of Cache Creek within one mile of the Clear Lake Impounding Dam are located in areas where the creek could be blocked if one or more of them become reactivated and dammed the creek. The impounded water would flood Clear Lake basin.

4. The study area is a tectonically active regime where uplift is occurring. This process leads to the oversteepening of slopes along Cache Creek, thus increasing their instability. The Eocene, Paleocene, and Cretaceous rock units in the area consist of shale, mudstone, sandstone, and conglomerate strata that are steeply dipping and highly fractured. The Plio-Pleistocene Cache Formation is unconsolidated and uncemented. Although samples of these rock units were not tested in a laboratory, they can be expected to have relatively low shear strength. In addition these rock units are relatively easily eroded.

5. The geomorphology of the area also contributes to landslide activity. The eastward trend and meandering pattern of Cache Creek formed prior to the uplift of the present-day mountains. Due to the relative ease of erosion of the surrounding rocks, Cache Creek maintained its course. Over time the creek cut deep into the rising terrain. Today Cache Creek is confined by steep banks. Undermining of the steep riverbanks by lateral erosion in the creek channel has made them unstable and susceptible to failure.

A LESSON LEARNED

The following article is taken from the *Sacramento Union* of May 10, 1906.

CACHE CREEK FLOOD HAS A LESSON

People of Capay Valley Find Out That Prompt Action Is Needed Under Such Circumstances.

GUINDA, May 9 [1906]. — The lesson learned by the people of Capay Valley from recent experience with the landslide in the Cache Creek canyon which threatened great damage to property in the valley is that such obstructions should be cleared away immediately. It is believed that the timely use of a sufficent quantity of dynamite would have obviated all the danger from the threatened overflow and would have prevented any scare to the people living in Capay Valley. Now that it is all over it seems easy enough to explain that the danger was not serious, but while the waters were gathering in the canyon behind the big embankment caused by the landslide the residents of the valley below were not in a position to take a philosophical view of the matter. That was why some of them got scared and took to the hills with their household goods and more valuable belongings.

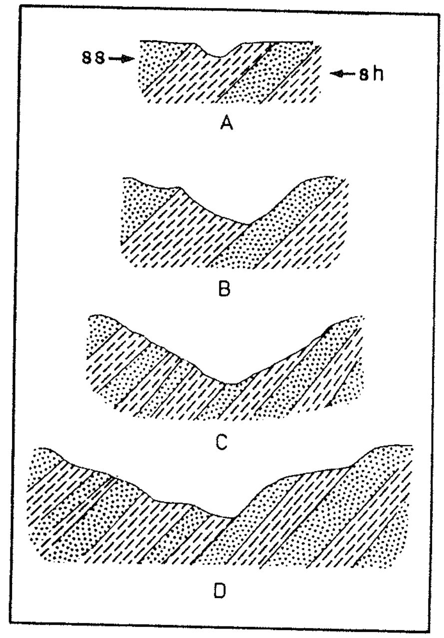

Figure 4. Four stages showing the development of valleys with alternating shale (sh) and sandstone (ss) strata (after Radbruch and Weiler, 1963, Figure 7).

A. Gully formed in jointed inclined shales (top).
B. Ravine formed by enlargement of the gully, due to erosion down the dip of the more resistant sandstone strata by undercutting the shales.
C. Continued erosion down dip results in formation of a valley with sandstone and shale beds exposed on both sides.
D. A larger valley with sandstone and shale exposed on both sides. The sandstone strata that dip in the opposite direction to the valley side fail when the shale interbeds wash away. The sandstone beds the dip in the same direction as the valley side erode more slowly than the shale, forming ridges that act as buttresses for the shale beds.

ACKNOWLEDGMENTS

I wish to thank Ralph Scott, of the California Department of Water Resources, Red Bluff office, for providing data concerning the 1906 Cache Creek landslide and flood. The *Sacramento Union* and *Winters Express* generously granted permission to CALIFORNIA GEOLOGY to reprint their articles.

Glossary

antecedent stream: a stream that maintains its original course during local uplift or deformation.

antidip slope: a hill shape dipping in the opposite direction to the dip of local strata or tilt of the land surface.

ophiolite: a group of mafic and ultramafic igneous rocks that formed during the early phase of a developing ocean basin.

ultramafic rock: igneous rock that is comprised mainly of mafic (dark colored) minerals.

translational slide: downslope displacement of slope material along a planar slip surface.

rotational slide: downslope displacement of slope material along a curviplanar slip surface.

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B. Current Conditions: Cache Creek Watershed, Capay Valley

Capay Valley is a unique landform of low, flat alluvial soils extending into the foothills like an appendage of the Great Central Valley. Named after "capi", a Hill Patwin word for creek, Capay Valley was explored by French trappers from Hudson's Bay Company in the 1829-30, then granted to three Berreyesa brothers as a Spanish Land Grant in 1846. Native Patwin living along its banks were decimated by malaria and smallpox epidemics which swept the Central Valley in 1832-34, but surviving Patwin lived in relative peace with their white neighbors, working on fruit farms and ranches.
Citation: The Putah-Cache Bioregion Project, UC Davis, Public Service Research Program and Chancellor's Commission on the Environment

USDA Forest Service and Natural Resources Conservation Service Ecological Unit Description:

Section M261C
Northern California Interior Coast Ranges

This section is the southeastern edge of the northern California Coast Ranges Mountains, and hills and terraces along the west side and north end of the Sacramento Valley. It is in MLRAs 15 and 17.

Geomorphology. Parallel ranges, folded, faulted and metamorphosed strata; rounded crests of subequal height. Coast Ranges Geomorphic province.

Lithology. Late Mesozoic shelf and slope sedimentary deposits.

Soil Taxa. Alfisols, Inceptisols, Mollisols and Vertisols in combination with thermic soil temperature regime and xeric soil moisture regime.

Vegetation. Predominant potential natural communities include the Blue Oak series, Chamise series, Purple needlegrass series and Foothill pine series.

The following series are found throughout the section and are not restricted to or extensive in any subsection. Series dominated by exotic plants are not listed under subsections unless they are extensive and stable.

Series dominated by exotic plants: Cheatgrass series, Eucalyptus series, Tamarisk series.
Series that can occur in all subsections, but are not extensive: Bulrush series, Bulrush - cattail series, Cattail series, Creeping ryegrass series, Duckweed series, Mosquito fern series, Nodding needlegrass series, One-sided bluegrass series, Pondweeds with floating leaves series, Pondweeds with submerged leaves series, Purple needlegrass series. Saltgrass series, Sedge series, Spikerush series.
Series restricted to riparian settings: Arroyo willow series, Black willow series, Buttonbush series, Fremont cottonwood series, Mixed willow series, Mulefat series, Narrowleaf willow series, Pacific willow series, Red willow series, White alder series.

Fauna. Mammals include mule deer, black-tailed deer, coyotes, ground squirrels, cottontails, jack rabbits and kangaroo rats. Birds include turkey vultures, eagles, hawks, owls, quail, mourning dove, mockingbird, scrub jay, western meadow
lark, finches and sparrows.

Elevation. 200 to 3000 feet.

Precipitation. 15 to 40 inches.

Temperature. 55° to 62° F.

Growing Season. 150 to 250 days.

Surface Water Characteristics. Many rapid perennial or intermittent streams in deeply incised canyons with weak bedrock channels flowing easterly to the Sacramento River. Reservoirs for irrigation water and flood control are common.

Disturbance Regimes.

Fire: Fires are low, moderate and high intensity surface or stand replacing fires.

Land Use. Composition and successional sequence of some communities has changed because of plant and animal species introduced between the mid 1800's and early 1900's related to grazing and agriculture.

Cultural Ecology. Humans have been utilizing the interior Coast Range foothills for 8,000 to 9,000 years, and have been an integral part of the ecology for 3,000 to 5,000 years. Historically, ranching and agriculture provided the primary Euroamerican livelihood. Contemporary attitudes and beliefs are dichotomized between emphasis on amenity/newcomer and commodity/long-time resident values, with all overlain by a rural lifestyle. Contemporary economic pursuits include government employment, agriculture, and recreation.

SOIL RESOURCES

SOIL EROSION:

Impacts of Grazing

Grazing activity, particularly improper grazing, is a potential source of excessive sediment, nutrients, and pathogens. Soil erosion and sedimentation are the primary contributors to lowered water quality from rangeland. Pasture and rangeland generally become a source of nonpoint source pollution when grazing removes a high percentage of the vegetative cover, exposing the soil surface to the erosive action of water and wind. Eroded soil subsequently becomes sediment, creating the potential for water degradation which may lead to impaired uses (drinking, swimming, industrial, etc.).
Citation: California Rangeland Water Quality Management Plan

Erosion Potential

Sheet and rill erosion is a problem on one-third of private rangeland in California with erosion averages of 3.3 tons/acre/year on 19 million acres. Sheet and rill erosion can approach 40 tons per acre per year before any rangeland improvement practices are installed within the Cache Creek watershed within the Cache Creek watershed. If proper grazing use and other practices were used, this rate could drop to about two tons per acre per year. Because of steep slopes, highly erodible soils, and intense storm characteristics found within the Cache Creek watershed, the sediment delivery ratio (a measure of the amount of eroded soil delivered to a waterbody) from rangeland can be relatively high.
Citation: 1984 USDA NRCS County Resource Inventory

Erosion and Sedimentation

The rangeland portion of the Cache Creek watershed contributes sediment to the Creek through both geologic erosion and accelerated erosion through human activities.

County Resource Inventory data provided by the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service) suggests that there remains a great deal of opportunity to improve grazed lands. There are many acres with the potential for vegetative manipulation. This manipulation can be:

- Type Conversions (long term change in type of plants grown, such as burning brush and planting grass)
- Fire Hazard Reduction (reducing fuel loads).

Citation: 1984 USDA NRCS County Resource Inventory
Citation: Cache Creek Range/Watershed/Important Farmlands Issues, Phil Hogan, NRCS, 1995

Streambank Erosion

Streambank erosion is another source of sediment from rangelands. In Yolo County, the most obvious example of natural streambank erosion is in the upper reaches of Cache Creek. How much of this can be economically treated is still in question. Mismanaged grazing in our riparian areas is a big concern, as it exacerbates the natural geologic rate of erosion. These areas will need extra care and management to solve the problem. The road network in our rangelands is also a contributor to the sediment load of Cache Creek.

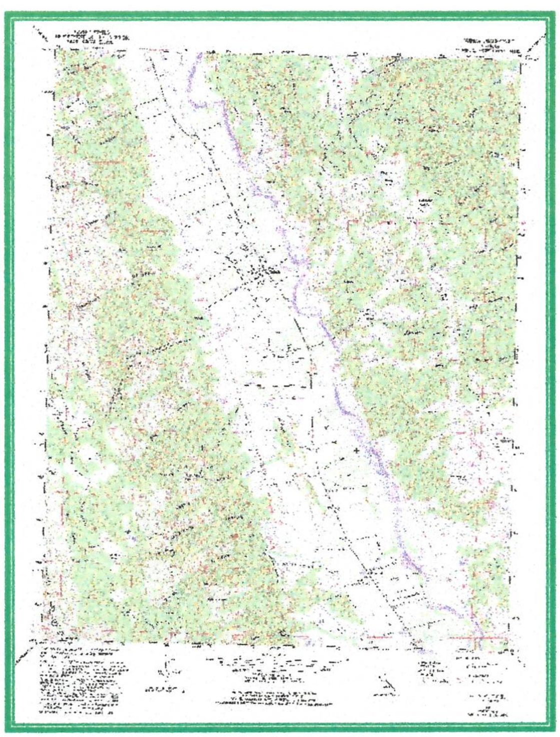
Degraded Channels and Riparian Vegetation

- Wide fluctuations in water flow capacity leading to increased bank cutting, erosion, and downstream sedimentation.
- Reduced reservoir storage capacity and water quality.
- Fisheries degradation.
- General decline in watershed utilization by domestic stock and wildlife because the riparian community serves as a corridor through other habitat types.
- Increased rates of soil erosion and downstream sedimentation.
- Degradation in habitat quality due to invasion of exotics such as Tamarisk (Salt Cedar)

Citation: Cache Creek Range/Watershed/Important Farmlands Issues, Phil Hogan, NRCS, 1995

Cache Creek is a gravel-rich, western tributary to the Sacramento River. The floodplain of Cache Creek in Capay Valley is productive farmland supporting a variety of agricultural crops. Extensive gravel mining east of the town of Capay has significantly altered the character and dynamics of this stream system. Cache Creek has experienced episodic channel incision, which has caused the historic floodplain to be detached from the active stream channel. In response to the incision, the channel has widened to create a new floodplain, resulting in extensive bank erosion.
Citation: Janine Castro, Geomorphologist, USDA NRCS, 1998

The heavy rains during the winters of 1995 and 1998 resulted in the loss of thousands of feet of riparian property, destroying orchards and threatening homes. The USDA NRCS has spent about 2.5 million dollars through the Emergency Watershed Protection (EWP) installing rock riprap to prevent further threats to life and property. An integrated systems approach for reducing streambank erosion along Cache Creek appears to be the best hope for reducing this problem.
Citation: Phil Hogan, USDA NRCS, EWP program statistics for 1995 and 1998 storm events.
Citation: Dr. Robert C. MacArthur, P.E., Northwest Hydraulics, INC., 1998 ("Integrated Systems Approach for Planning, Resource Management and Design in the Cache Creek Watershed").



Meandering Pattern of Cache Creek in Capay Valley

WATER RESOURCES

WATER QUALITY:

Elevated mercury concentrations in Cache Creek sediments have been a problem for many years. The Cache Creek watershed in the Coast Ranges, which is a tributary to the lower Sacramento River, has numerous mercury-depositing hot springs and abandoned mercury mines. Until recently, however, the primary sources and transport mechanisms had not been well identified. Studies by the USGS, in cooperation with the Central Valley Regional Water Resources Control Board and the Los Alamos National Laboratories, have identified hot springs in the Sulphur Creek drainage basin as a major mercury source. Abandoned mines are a secondary source in the basin. During most of the year, mercury is deposited primarily in fine-textured creek sediments within 0.5 mile of the sources, mercury concentrations can be as high as 195 parts per million (compared with the average 0.08 to 0.4 part per million for most rock types). During the first seasonal high streamflow, these sediments are transported down the drainage basin. This episodic nature of mercury transport is significant for Cache Creek watershed management and the evaluation of the fate of mercury originating in the area. A proposed regulatory approach may involve development of Total Maximum Daily Loads (TMDLs) and pollutant trading whereby dischargers to the Bay-Delta could participate in load reductions upstream in exchange for relief on their discharge permits.
Citation: USGS, "Mercury Loads to the Sacramento-San Joaquin Delta from the Cache Creek Watershed and the Yolo Bypass."
Citation: California Unified Watershed Assessment List of Priority Category I Watersheds

Cataloging Unit #	Watershed Name
18020110	Lower Cache

AIR RESOURCES

AIR QUALITY:

The biggest threat to air quality in the Capay Valley potion of the Lower Cache Creek Watershed is the potential for massive wildfires in the decades-old chaparral brushlands. A strategic plan for brush management and prescribed fire is necessary if this perennial threat is to be reduced. Capay Valley residents have been concerned and have been monitoring the emissions from activities of the Homestake Gold Mine since the early 1980's, but there is little impact that watershed activities within Capay Valley could have on that. The mine is scheduled to close down within a few years.

Other problems that can result from this brushland building up without any management include:

Excessive Fuel Load:

- High fire suppression costs.
- Air quality hazard if burned.
- Potential for high intensity fires leading to high soils nutrient losses, runoff, and soil erosion.
- Decreased reservoir storage capacity due to increased sedimentation in the case of catastrophic wildfires.
- Potential damage to riparian community from wildfire.
- Decreased water yields over existing potential.
- Limited access for domestic stock and fire control.
- Little or no forage value for domestic stock or wildlife reduced production.
- Poor wildlife cover contributing to reduced reproduction.

Citation: Cache Creek Range/Watershed/Important Farmlands Issues, Phil Hogan, NRCS, 1995

PLANT RESOURCES

INVASIVE WEEDS:

Tamarisk (Salt Cedar) has presented a serious problem in the Cache Creek Channel, and has also invaded upstream tributaries to Cache Creek as well. As an exotic phreatophyte, it has displaced native riparian vegetation, altered soil chemistry so that natives do not have as much of a chance to get estahlished, has decreased the diversity of wildlife, and has changed the hydrology of the stream in some locations. The USDA Agricultural Research Service presented a proposal to the Cache Creek Stakeholders Association and to the Capay Valley Water Users Association to release a beneficial insect that would control the tamarisk, but many of the local people in the Valley were concerned that the insect would escape and become a pest to their orchard crops. The trial will now take place down in the eastern stretch of Cache Creek past the town of Esparto.

Arundo donax also presents a serious weed problem along Cache Creek.

And, of course, Star Thistle and Medusa Head continue to spread in the rangelands, reducing the quantity and quality of forage for livestock.

WILDLIFE RESOURCES

Cache Creek has been identified by CALFED as requiring additional data for monitoring and research of wetland and floodplain habitats under their Ecosystem Restoration Program. Additional data needed will be:

- Inflows into the Yolo Bypass
- Baseline information on habitats
- Ecosystem health monitoring

Citation: CALFED Fluvial Geomorphology and Riparian Issues Group, 11/98

Capay Valley VINEYARDS

P.O.Box 17, Brooks, CA 95606 tel. (530) 796-4110 fax (530) 796-3788

June 25, 2001

Mr. Thomas R. Crone
Chief, Regulations Division
Bureau of Alcohol, Tobacco and Firearms

Re: Capay Valley AVA

Dear Mr. Crone:

Capay Valley Vineyards was established by Tom Frederick and Pam Welch, twenty year residents of Capay Valley. Our vineyards are located on well drained, volcanic soils with moderate, west facing slopes. Production is small, to enable us to focus on high quality, hand made wines.

We are currently growing Viognier, Syrah, Tempranillo, and Cabernet Sauvignon varietals. Our current releases are the 2000 Viognier and 1999 Syrah -both of which received medals this year at the Orange County Commercial Wine Competition.

We look forward to an AVA for the valley.

Sincerely,

Tom Frederick
Pamela S. Welch

TNT Vineyard
15891 County Road 45
Guinda, CA 95637
(530)796-3808

Mr. Thomas R. Crone
Chief Regulations Division
Bureau of Alcohol, Tobacco and Firearms

RE:Capay Valley AVA

Dear Mr. Crone:

My name is Terrel Porter-Smith and I have an 8 acre vineyard in the Capay Valley of Northern California. The Capay Valley is approximately 30 miles east of The Napa Valley and is about 10 miles west of the Dunnigan Hills Appellation. We have hot, long growing summers and cool to cold winters with average rainfall. Most of my soil ranges from Class 1 to Class 4 and is a loam/clay type.

I am currently growing Merlot, Cabernet Franc, Cabernet Sauvignon, Barbera, and Melbac. Tempranillo will be planted in 2 weeks. These varieties are on 1109 rootstock and bi-lateral VSP cordon trellis.

Over the next 2-3 years, I will be planting many more varieties. Because of our weather, I'm sure Nebiolo, Sangiovese, Charbono, Zinfandel and other reds, will thrive.

I am dedicated to growing quality grapes in this lovely Valley with all of it's unique characteristics.

Yours truly,

T. Porter-Smith

Terrel Porter-Smith
Owner TNT Vineyard

CAPAY VALLEY AVA

Capay Valley is located in northwest Yolo County bordering Napa, Lake and Colusa Counties. The valley is approximately twenty-one miles long and seven miles wide. The natural boundaries of the valley are formed by the Blue Ridge Mountains to the west and the Capay Hills to the east. Cache Creek runs the entire length of the valley. The boundaries as outlined in the petition follow these natural physical boundaries. These also coincide with the boundaries of the Capay Valley General Plan.

The name Capay was used as early as the 1840's to identify the petition area. This word came from the Indian word "capi" which means stream. In the late 1840's Pio Pico, Governor of the territory of Alta California, granted nine square leagues of land called the Rancho Canada de Capay to three Berryessa brothers. A map titled "Property owners 1858 Canada de Capay Grant" shows further subdivision as lands were sold

The first recorded winery in Capay Valley was mentioned by historians Sprague in 1869 and Gilbert in 1879. They referenced the Capay Valley Winery whose annual crop from the home vineyard plus several small surrounding vineyards in the neighborhood yielded 30,000 gallons of wine - both red and white varieties. In 1861 this vineyard received the premium for having the finest vineyard in the state. (ref -Ada Merhoff)

The valley's climate is characterized by hot, dry summers with a long growing season. Portions of the valley receive moderating breezes from the Sacramento Delta and San Francisco Bay. Fog creeps over the tops of the Blue Ridge during heavy fog periods in the bay. Winters are moderate. The valley is shielded from the ground fog that is pervasive in the Sacramento Valley. Late spring frosts are occasional enough to negate the need for active frost protection.

Soil types range from Yolo-Brentwood - well drained, nearly level, silty clay loams on alluvial fans to Dibble-Millsholm - well-drained, steep, silty clay loams over sandstone.

Some areas have clay soil with creek rock and debris intermixed. Volcanic ash is also found in some areas - primarily in the rolling hills in the center of the valley. These clay soils intermixed with creek rock and volcanic ash add an interesting viticultural aspect to these areas.

There are several wine grape growers in Capay Valley including one who received recent awards for their wines. Approximately twenty-five acres are currently planted to wine grapes. The valley already has an outstanding reputation in the San Francisco area for it's market gardens.

The Yolo County Board of Supervisors has written a letter of support for the establishment of an AVA for Capay Valley.

September 19, 2001

803000:KMC
5120

Mr. Tom Frederick or Ms. Pamela Welch
Capay Valley Vineyards
#1 Ranch Road
P.O. Box 17
Brooks, CA 95606

Dear Mr. Frederick or Ms. Welch:

I have been assigned to work with you during the rulemaking process of your petition for designation of the "Capay Valley" viticultural area. In our review of your petition, we had several questions and need clarification on certain items:

1) Based on the United States Geological Survey map you provided, it appears the upper northwest section of the proposed area feeds into a different river system than the Valley which feeds into the Cache Creek system. What is the purpose for including the upper northwest section of the proposed viticultural area? Is it necessary to include this section in the proposed area? Are there vineyards and wineries there? If so, what are their names and approximate locations?

2) We need additional evidence that there is a difference between the growing conditions within and outside your proposed boundaries, or further evidence that growing conditions of different areas within the proposed boundaries are alike. For example, what are some characteristics (climate, soil, elevation, etc.) within the proposed area, that are different, or do not exist outside of the proposed area? What are some commonalties within the proposed area in its entirety, not just portions?

4) What are the elevation boundaries/description of the proposed "Capay Valley" viticultural area?

5) Approximately how many square miles are included in the entire proposed area?

6) You stated approximately 25 acres are currently planted to wine grapes in "Capay Valley". Is that the valley alone, or the proposed area as a whole?

If it is just the valley, how many planted acres are in the entire proposed area?

7) You also stated there are several wine grape growers in Capay Valley. Approximately how many vineyards and winery businesses are in the proposed area? What are their names and approximate locations?

Thank you for your assistance in this matter. If you have questions, please contact me at (202) 927-8206.

Sincerely,

/Kmc/

Kristy Colón
Specialist, Regulations Division

Capay Valley VINEYARDS

P.O.Box 17, Brooks, CA 95606 tel. (530) 796-3788 fax (530) 796-3788

October 19, 2001

Ms. Kristy Colon, Specialist
ATF Regulations Division
650 Massachusetts Avenue NW
5th Floor Rm 5150
Washington, DC 20226

fax (202) 927-8525

Dear Ms. Colon:

Attached is the response to your letter dated September 19, 2001. We are also mailing a copy - but wanted to get this to you as soon as possible.

Please let us know if we can supply any other information.

Sincerely,

Pamela Welch

Tom Frederick
Pamela Welch

Capay Valley AVA - additional information - October 19, 2001

1. The upper northwest section was included because it is part of the Capay Valley General Plan (see enclosed map)

   While it is not absolutely necessary to include this area, there is private land within the area that would have historically been known as the Capay Valley region. There are no vineyards or wineries in this location at this time.

2. One of the major soil differences between Capay Valley and the adjacent Central Valley area is the abundance of calcareous soils. This supply of calcium makes clay soils less binding and allows roots to penetrate through the soils more easily.Water usage is less than would be expected given the warm climatic conditions.The calcium - magnesium ratio in the soils is easier to manage because it's easier to add magnesium than calcium.

   Also common to the whole valley is a climate warmer than the Napa Valley to the west. This allows the valley to avoid the frost problems that are common in Napa and also offers an earlier growing season - typically 3-4 weeks. This warmer climate also reduces the need for as many sulphur sprays throughout the growing season.

   Capay Valley differs again from it's Central Valley neighbors to the east in that while they share a warmer climate, Capay Valley's budbreak is typically 1-2 weeks later.

4. The elevations of the viticultural area range from 750 meters at the top of the Blue Ridge, 550 meters at the top of the Capay Hills, to 100 meters on the valley floor.

5. The proposed viticultural area is 5 miles wide and 18 miles long

6. both

7. TNT Vineyard, 15891 County Road 45, Guinda, CA 95637
   8 acres planted to Merlot, Cabernet Franc, Cabernet Sauvignon, Barbera, Melbac, and Tempranillo

   Capay Valley Vineyards, #1 Ranch Road, Brooks, CA 95606
   15 acres planted to Syrah, Viognier, Tempranillo, Cabernet Sauvignon
   Their wines have received gold and silver medals from the California State Fair, silver and bronze from the Orange County Fair.

   Hans Herren, Capay, CA 95607
   2 acres planted to Syrah

   There are a number of farmers interested in growing wine grapes. They are awaiting the Capay Valley AVA.

County of Yolo

625 Court Street, Room 204 Woodland, California 95695 (530) 666-8195 FAX (530) 666-8193

BOARD OF SUPERVISORS

First District - Mike McGowan
Second District - Lois Wolk
Third District - Tom Stallard
Fourth District - Dave Rosenberg
Fifth District - Lynnel Pollock
County Administrator - Victor Singh
Clerk of the Board - Patty Crittenden

July 10, 2001

Mr. Thomas R. Crone, Chief
ATF Regulations Division
Washington, DC 20226

RE: American Viticultural Area for Capay Valley, California

The Yolo County Board of Supervisors has voted to support an American Viticultural Area (AVA) for Capay Valley.

The Capay Valley is a unique and distinct geographic region of our County delineated by the Cache Creek watershed. The expansion of wine grapes in this area is highly desirable and has the potential too greatly increase the economic viability of farming plus contribute to our agri-tourism efforts.

Yolo County is proud if its agricultural heritage and is dedicated to preserving and enhancing our agricultural production. We encourage you to favorably consider an American Viticultural Area for Capay Valley.

Sincerely,

Tom Stallard
Chairman, Yolo County Board of Supervisors