Sacramento River Bridge
Spanning Sacramento River south of Locke
Isleton
Sacramento County
California

HAER No. CA-55

HAER
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34-ISLE,
1-

PHOTOGRAPH

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, DC 20013-7127

ADDENDUM TO
SACRAMENTO RIVER BRIDGE
Spanning the Sacramento River South of Locke
Isleton
Sacramento County
California

HAER No. CA-55

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HISTORIC AMERICAN ENGINEERINC RECORD
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Washington, D.C. 20013

ISLETON BRIDGE
(Bridge No. 24-51)
Spanning Sacramento River at Post Mile 5.95 of California
State Highway 160
Isleton
Sacramento County
California

HAER CA-55
HAER CAL,34-ISLE,1-

ADDENDUM TO:
SACRAMENTO BRIDGE
Spanning the Sacramento River south of Locke
Isleton
Sacramento County
California

PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA
FIELD NOTES

HISTORIC AMERICAN ENGINEERING RECORD
Pacific West Region
National Park Service
U.S. Department of the Interior
San Francisco, California 94102

HISTORIC AMERICAN ENGINEERING RECORD

ISLETON BRIDGE
(Bridge No. 24-51)

ADDENDUM TO:
SACRAMENTO RIVER BRIDGE
HAER No. CA-55

Location:	Spanning Sacramento River at Post Mile 5.95 of California State Highway 160, Isleton Vicinity, Sacramento County, California UTM: 10-623189mE/4225819mN. UTM References were calculated using the North American Datum (NAD) 1983 series of the United States Geological Survey (U.S.G.S.), which is the California State Standard.
Present Owner:	California Department of Transportation 1120 N Street Sacramento, CA 95814
Present Use:	Highway Bridge
Significance:	The Isleton Bridge is one of the very few unmodified examples in California of the Strauss Heel Trunnion Bascule Bridge. It was also a link in the Victory Highway, a transcontinental highway, and played an integral part in transportation and agricultural history in the California Delta Region.
Report Prepared By:	Margo Nayyar, Research Associate; Tory Swim, Research Associate; and Gloria Scott, Built Environment Preservation Services Branch Chief, Cultural Studies Office, Division of Environmental Analysis, California Department of Transportation
Project Information:	The control house on Isleton Bridge was removed and replaced in 2007 as part of a project to correct various safety deficiencies, install state-of-the-art electrical control equipment to operate the movable spans, and to bring the bridge up to current health and safety codes for decent, safe and sanitary structures. The bridge was determined eligible for inclusion in the National Register of Historic Places by the Keeper of the National Register of Historic Places on December 27, 1985.This documentation is intended to comply with the conditions to avoid Adverse Effect to the historic bridge, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended.
Date:	October 14, 2011

Part I. Historical Information

A. Physical History:

1. **Date of Construction:** 1923
2. **Engineer:** Charles W. Deterding, Jr., Sacramento County Engineer and the Strauss Bascule Bridge Company
   Builder: American Bridge Company
   Contractor: Jenkins & Elton

Charles W. Deterding

Charles W. Deterding was Sacramento County's Engineer who participated in building the Isleton Bridge. Deterding first joined the county in 1908 as a surveyor. In 1921 Deterding became the County Engineer, just two years prior to the construction of the Paintersville, Isleton and Steamboat Slough bridges. In July 1933 the Board of Supervisors named Deterding County Executive for a two-year term. Deterding continued to fill the position of county engineer as well. As County Executive he was in charge of administrative functions that the board had previously handled and, therefore, the board became a legislative body. Deterding had worked for the county since 1908 having been assistant engineer and surveyor except for two years spent in the United States Army during the first World War.[1] The Sacramento Union credited Deterding with assisting in the design and construction in nearly all of the county bridges that cross the Sacramento River. He retired from county service in 1955. His obituary mentioned his direction over the construction of the Isleton, Paintersville, and Steamboat Slough bridges.[2]

Joseph Strauss, Strauss Engineering Company of Chicago

Joseph Strauss, the Chicago based architect who headed the company, became best known for designing the Golden Gate Bridge.[3] Joseph Strauss was born on January 9, 1870 in Cincinnati, Ohio. In 1892, Strauss graduated from the University of Cincinnati. After a long unemployment he obtained a job in New Jersey as a draftsman for the New Jersey Steel and Iron Company. Due to the national recession Strauss was laid off and began teaching mathematics at the University of Cincinnati. After marrying May Van, Strauss was employed by Brackett Bridge Company in Glendale, Ohio. Strauss built a bridge near Cincinnati for the company. After leaving the Brackett Bridge Company

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[1] Deterding's obituary in the January 20, 1975 edition of *The Sacramento Bee* and a June 12, 1933 article in *The Sacramento Bee* cite 1908 as the beginning year of Deterding's service with the county. *The Sacramento Union*, June 8, 1941 article, "Deterding Ends Eighth Year with County," however cites 1909.

[2] *The Sacramento Bee*, "Deterding is Selected by Supervisors as Manager," June 12, 1933; *The Sacramento Bee*, "County Incurs No Indebtedness Over 20 Years," April 24, 1937; *The Sacramento Union*, "Deterding Ends Eighth Year With County," June 8, 1941; *The Sacramento Bee*, "Deterding, First County Executive, Is Dead At 89," January 20, 1975.

[3] State of California, Department of Transportation (Caltrans), *Historic Highway Bridges of California*, 112.

Strauss held odd jobs for various bridge companies in Chicago and New York, and in 1899 he began working for the Modjeski Company.[4]

When Strauss joined the Modjeski Company, the bascule style of movable bridges was growing in popularity throughout the United States. Bridge engineers worked on designing an efficient counterweight that cost less than the expensive iron counterweights. Although not assigned to solve this problem, Strauss came up with his own original design that employed concrete rather than iron in the design of the counterweights. To obtain a heavy enough weight with concrete, Strauss designed the counterweights larger than those made of iron and redesigned the mechanism that moved the counterweights. The Modjeski Company was skeptical of his proposals and did not support his new designs. As a result, Strauss left the Modjeski Company in 1904 and opened his own bridge-building business: Joseph B. Strauss and Company. Strauss' bascule design was put to the test when a railroad company hired Strauss and withheld payment until the bascule bridge was constructed and proved a success. The bridge was a success and Strauss started a prominent career, including 400 bridges, having "revolutionized the entire art of building movable bridges."

The Strauss Bascule Bridge Company of Chicago built virtually all bascule bridges in California prior to World War II. The proliferation of Strauss bascules can be attributed to two reasons: one, Strauss' bascule bridge design used multiple trunnions instead of a single hinge design, and two, the San Francisco office provided an opportunity for product marketing.[5]

American Bridge Company

Founded in April 1900, the American Bridge Company (ABC) was formed from the consolidation of twenty-eight of the nation's largest steel fabricators and constructors. The company's roots, however, extend as far back as the late 1860s. From 1901 to 1987, the ABC was a subsidiary of the United States Steel Corporation. Since 1987, the ABC has been privately owned. Prior to the 1920s, the company relied on affiliated firms to erect the company's bridges, but in the 1920s the company began involvement in construction. The ABC is responsible for building a number of the tallest buildings, longest arches, and the longest self-supporting continuous truss bridge in the world.

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[4] Michael Chester, *Joseph Strauss; Builder of the Golden Gate Bridge* (New York: G.P. Putnam's Sons, 1965), 15, 29, 32; PBS, "Golden Gate Bridge; People & Events: Joseph Strauss (1870-1938)," *American Experience*, created 16 April, 2004, <http://www.pbs.org/wgbh/amex/goldengate/peopleevents/p_strauss.html> (accessed 13 October 2004).

[5] Michael Chester, *Joseph Strauss; Builder of the Golden Gate Bridge*, 32,33,34,36, 40, 42; PBS, "Golden Gate Bridge," <http://www.pbs.org/wgbh/amex/goldengate/peopleevents/p_strauss.html> (accessed 13 October 2004); Port *of Los Angeles Virtual History Tour*, "Badger Avenue Bridge, People," Copyright 2001, <http://laporthistory.org/level4/Badger/badger_people.html> (accessed 13 October 2004).

Furthermore, the ABC designed the "first ever stiffening truss replacement on a loaded, fully operational suspension bridge."[6] As one source notes:

Although never in complete control of the bridge market, the American Bridge Company supplied a substantial portion of the steel bridges purchased by state and local highway officials in the early twentieth century, and there can be no doubt that the company was the single most important fabricator of the period.[7]

Jenkins & Elton

Morris A. Jenkins was a native Californian, born in Elk Grove, California on July 22, 1874. His mother Addie Harrington was from Wales; his father Thomas came to California in 1860 and settled as a rancher in Sacramento County. Morris Jenkins graduated from Elk Grove Union High School's first graduating class in 1896. Jenkins attended Heald's Engineering School in San Francisco and in 1902 he finished his Civil Engineering degree at Ohio Northern University. From ca. 1904-21 he was a member of the firm of Jenkins & Wells.[8] Wells retired and M. N. Elton joined the firm. Jenkins & Elton were engineers and general contractors that specialized in bridge and heavy construction work. The firm was awarded large contracts including the bascule bridge in Walnut Grove. The firm also was cited as doing pile-driving and foundation work and the firm was noted to "have contributed materially to the upbuilding and improvement of this section of the state and their work represents the highest degree of efficiency in their line."[9]

In 1926 M. N. Elton was no longer part of the firm. Jenkins is listed as a general contractor, with no permanent partners in the Sacramento City Directories from 1926-52.[10] However, he was documented to have worked with J.W. Hoopes in "dismantling a pony truss bridge in July-October 1933.[11] The business was located at the address 3560 Y Street Sacramento from 1915-40 (Y Street became Broadway). It moved to 4521 15th Avenue in 1945. Jenkins and his wife, Amanda L. Rickey are listed in the city directories until 1966.

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[6] "Connecticut's Historic Highway Bridges," available at http://www.past-inc.org/historic-bridges/Design-right.html (accessed 16 June 2005); American Bridge Company, "History," available at http://www.americanbridge.net/company/history.php (accessed 16 June 2005).

[7] "Connecticut's Historic Highway Bridges," available at http://www.past-inc.org/historic-bridges/Design-right.html (accessed 16 June 2005); American Bridge Company, "History," available at http://www.americanbridge.net/company/history.php (accessed 16 June 2005).

[8] There is a discrepancy on his dates of employment. According to the Sacramento City Directories he is not part of the firm until 1909 and until 1921, but according to the Walter G. Reed, *History of Sacramento County, California With Biographical Sketches*, he works from 1904-1921.

[9] Walter G. Reed, *History of Sacramento County, California With Biographical Sketches* (Historic Record Company: Los Angeles, CA, 1923), 379.

[10] Sacramento City Directory, 1909-1966.

[11] John W. Snyder, "Photographs: Written Historical and Descriptive Data, Middle Fork Stanislaus River Bridge," HAER NO. CA-72, California Department of Transportation, October 21, 1992.

3. Original Plans and Construction:

The original plans are on file in the California Department of Transportation (Caltrans) Bridge Inspection Records Information System (BIRIS), located in Sacramento, California.

4. Alterations and Additions:

As stated in the FHWA "Finding of No Adverse Effect"[12]:

> The bridge has a high degree of integrity, the only notable modifications being the removal of original concrete light posts and replacement of the original deck with an open grate steel deck.[13]

In a letter dated April 16, 1918, a Sacramento County Highway Commission engineer answered a request from the State Engineer, William F. McClure, "specifying the more important features of the specifications intended for the proposed bridge at Isleton, Sacramento County. . ." The Isleton Bridge was finished in 1923 and has since undergone minor changes and repairs.

In April 1934 Isleton Bridge's fenders were reconstructed. Fire fighting facilities were installed in January 1936 and in September 1936, "two pier fenders were constructed." On July 28, 1944, the operator's house received a substitute for the 1/8" brown linoleum and a walkway around the stairs on both fenders was constructed. Traffic signals were installed in March 1937. In 1971 an electric toilet was installed in the bridge operator's house. In 1991 they relocated "the water pump base and box, [and] install[ed] water pump and piping (moved to the south east façade of operator's cabin in front of door that is bolted shut)." Six new navigation lights also were installed at each dolphin in 1991. In June 1993 some dolphins and lights were replaced, and in 1995, the working platform was raised.[14]

The control house on Isleton Bridge was replaced in 2007 as part of a project to correct various safety deficiencies, install state-of-the-art electrical control equipment to operate the movable spans, and to bring the bridge up to current health and safety codes for decent, safe and sanitary structures. The control house was removed and a new one lifted into place. Other design features to avoid an adverse effect to the bridge ensured that the new control house is compatible in color, scale, siding, roofline, and location to the original control house, and the work was completed in a manner consistent with the

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[12] Federal Highway Administration (FHWA), "Finding of No Adverse Effect for the Rehabilitation of Isleton Bridge (#24-51), Steamboat Slough Bridge (#24-52) and Paintersville Bridge (#24-53) Sacramento County California, 03-Sac-160 KP9.5, 31.9, 33.6 (PM 5.9, 19.8, 20.9) EA.03-437200 February 2000," (FNAE).

[13] FHWA, "FNAE", page 5.

[14] All information obtained from bridge reports and supplementary bridge reports located in the Caltrans Bridge Inspection Records Information System (BIRIS) database. Specific dates of quoted reports are April 1934, September 1936, July 28, 1944, October 1971, February 1991, June 1993, and May 1995.

Secretary of the Interior's Standards for the Treatment of Historic Properties, Rehabilitation Treatment Option. The control house is a contributing feature of the bridge.

B. Historical Context:

The Sacramento-San Joaquin River Delta region, an area situated roughly between the Cities of Sacramento, San Francisco and Stockton in a triangular shape, incorporates the Stanislaus, Pittsburg, San Joaquin, Mokelumne and Sacramento Rivers. Streams, islands, sloughs, rivers and levees diversify the region. High winds, heavy wave action and shifting deposits of earth and detritus contributed to the formation of meandering channels of unequal heights and "accumulated" islands between the channels.[15]

Native Americans

The abundance of the Delta, with its rich soils, winding waterways and floodplain, historically has been a desirable area for inhabitants. The Maidu, Miwok, Yokuts, and Costanoan Native American tribes inhabited the Delta region. The area concerning the Paintersville, Isleton and Steamboat Slough bridges is within the ethnographic homeland of the Plains Miwok, and the village of the Ochegamne, the largest tribelet on the Sacramento River.[16] Native Americans fished and hunted the Delta area, and during flood season tribes retreated to higher ground. According to California historian Richard Dillon, three to fifteen thousand Indians resided in the Delta. [17] Despite the large Native American population early explorers believed the Delta was desolate because of the rarity of *Rancherias*.[18]

European Contact

Delta Indians first encountered Spanish explorers in March 1772, three years after the San Francisco Bay discovery in 1769. The two Spaniards, Fray Juan Crespi and Captain Pedro Fages, sought a new route to Point Reyes using the San Francisco Bay. In their search they discovered the Sacramento- San Joaquin Delta.[19]

The Delta was mapped in September 1775 by Captain Juan Manuel de Ayala, and in 1776, California's founder, Captain Juan Bautista de Anza, and Lieutenant José Joaquín Moraga

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[15] John A Nejedly, "The Sacramento-San Joaquin Delta 'Islands,' " *California Water Crisis Website*, Copyrighted 2002, <http://californiawatercrisis.org/the_history_of_the_delta.htm> (11 August 2004).

[16] State of California, Department of Transportation, "Negative Archaeological Survey Report" in the "Historic Property Survey Report for the Control House Replacement on Three Bridges In Sacramento County, 03-Sac-160 KP 9.5, 31.9, 33.6 03-437200" September 1999, 1.

[17] Richard Dillon. *Delta Country* (Novato, CA: Presidio Press, 1982), 25.

[18] Dillon, *Delta Country*, 25.

[19] Dillon, *Delta Country*, 28; Charles A. Bohakel, *The Historic Delta Country; A Guidebook to State highway 160, the Bayou of the West* (Antioch, Calif.: by the author, 1979), 4.

and Padre Pedro Font investigated twenty miles further than Fages' expedition. In their investigation they found three *Rancherias*.[20]

Spanish exploration resulted in the establishment of Spanish missions throughout California. Spanish missionaries converted Indians to Catholicism and often exploited Indian labor to ensure the mission's prosperity. The California mission system is known for repressing the freedoms of Native Americans, and Bay Indians escaping Spanish cruelty fled to the Delta. By the late eighteenth century approximately five percent of the Native American population in the Delta was ex-converts. Neophytes, baptized mission Indians, also were used by the Spaniards to recruit new Indians. At one time "the governor tried sending parties of Christian Indians to tame the Delta's savages by propagandizing, proselytizing, and converting. But these sorties were not very successful."[21] By 1805, labor was difficult to find and the Spanish militia was sent into the Delta for "punitive expeditions" to capture runaways.[22] Strong Indian retaliation progressed against the Spanish until Indian populations were annihilated by disease. The Spanish and Hudson Bay Company trappers introduced a variety of diseases, small pox being the most destructive. In 1833 and 1839, smallpox epidemics obliterated the Delta Indian population. Dillon notes that census enumerators in 1850 estimated that there were only 379 Indians remaining in San Joaquin County and by 1870 only five remained.[23]

Fur Trapping & Farming

The Delta region grew when trappers and farmers began to populate the area. One such trapper, Jedediah Smith, trapped otter and beaver in the Delta in 1828 and sold the furs to the Hudson Bay Company, igniting competition between the Hudson Bay Company and John Augusta Sutter's Company, located in Sacramento.[24] In 1840, Frenchman Eugène Duflot de Mofras explored the Delta and traveled the Sacramento River to Sutter's Fort. Captain John Sutter obtained a fur monopoly in 1844 and sent forty trappers to the Delta. By that time, however, the area's fur resources were depleted. "The real coup de grace for Delta's fur trade," wrote Dillon "came in 1848-49 with the Gold Rush, hard on the heels of the disruptive Mexican War. It turned the California economy upside-down and flooded Alta California with a tidal wave of Argonauts."[25]

Men working for John Marshall discovered gold in 1848 along the American River in the California Sierra Nevada foothills. This sole event in California history propelled the migration of hundreds of thousands of prospectors in search for prosperity. The influx of people to the West Coast raised the population of the Delta region and hugely impacted the use of the Sacramento River. It became the main route from the San Francisco port to the mining camps in the "Mother Lode." A steamboat industry developed to answer miners'

[20] Dillon, *Delta County*, 29.
[21] Dillon, *Delta Country*, 30.
[22] Bohakel, *The Historic Delta Country*, 4.
[23] Dillon, *Delta Country*, 35-36.
[24] Bohakel, *The Historic Delta Country*, 4, 5.
[25] Dillon, *The Delta Country*, 41, 42.

demands for quick river transportation.[26] Twenty-eight steamboats operated between Sacramento and San Francisco by 1850.[27] Regular steamer service (paddle wheelers) began between San Francisco, Stockton, and Sacramento, The era of paddle wheelers on the Delta endured for almost a hundred years.[28]

While huge numbers of gold miners migrated to the foothills of the Sierra Nevada, some migrants recognized the floodplain's rich "alluvial and peat" soil, and settled the Delta to farm. Unsuccessful miners also settled the Delta and prospered by farming and ranching.[29] Logging also was a noteworthy industry, in addition to vegetable gardening, salmon fishing and brandy distilling.[30]

Land Reclamation in the Delta

Farmers settled the Delta region in the 1840s, but successful agriculture was dependant on land reclamation. Prior to reclamation, farming proved challenging because of annual flooding.

In 1850, the federal government granted to the State of California 2.1 million acres of swampland, including approximately 500,000 acres in the Delta. The condition for this gift was that land recipients were responsible for funding levee construction.[31] The passage of several laws by the federal and state government made reclamation legally possible and financially profitable.

Having recognized the importance of the Delta region in California's agricultural economy, Congress passed the Swamp and Overflowed Land Act. The Act conveyed ownership of all swamp and overflow land, including the Delta, to the State of California who, in turn, sold the land to individuals to raise funds for reclamation of the region for farming.[32] The Act stipulated the division of land parcels and prohibited the reselling of land. Reclamation proved too difficult to achieve for small farms.[33] As more settlers purchased land parcels in the Delta region, it was necessary, for profitable farming to create a communal system of levees and an efficient road system, rather than levees that served individual needs.

Reuben Kercheval undertook building the first reclamation levee on the tip of Grand Island in 1850. The levee was poorly constructed and although Kercheval raised the levee higher

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[26] Bohakel, *The Historic Delta Country*, 5.
[27] Bohakel, *The Historic Delta Country*, 19.
[28] Bohakel, *The Historic Delta Country*, 5.
[29] Bohakel, *The Historic Delta Country*, 5.
[30] Dillon, *The Delta Country*, 64.
[31] Martin D. Mitchell, "Land and Water Policies in the Sacramento-San Joaquin Delta," *Geographical Review* 84, no.4 (Oct 1994): 411-412.
[32] California Department of Water Resources, Division of Planning and Local Assistance, "Introduction," *Sacramento-San Joaquin Delta Atlas*, 8 August 1995, <http://rubicon.water.ca.gov/delta_atlas.fdr/intro.html> (11 August 2004).
[33] Jane Wolff. *Delta Primer; A Field Guide to the California Delta,* with a preface by Kevin Starr (San Francisco: William Stout Publishers, 2003), 37.

the following year, it did not survive. He persevered, however, and "got a larger gang of Indians, kanakas, and especially, Chinese in 1853 to build a great wall of earth, three feet high, three feet across the crown, and thirteen feet at the base, for a dozen miles. . . .by 1857, the apex of the island was protected by eighteen miles of dikes of various sizes."[34] At first, the reclamation of this island cost one dollar per acre, but reclamation costs rose as the height of the levees increased. By 1892, some levees measured eight feet.[35]

Nine years after the passage of the original Swamp and Overflowed Lands Act, a second Swamp and Overflowed Lands Act (1859) was passed that encouraged reclamation by returning the payment for land upon completion of reclamation if completed within three years. The charge of one dollar an acre and a twenty-cent application fee still applied, but settlers received a return of all payment, excepting administration charges, upon the completion of reclamation.[36] By 1861, the California Legislature authorized the Reclamation and District Act allowing drainage and construction of levees in the Delta region. The State implemented a Board of Swamp and Overflowed Land Commissioners that same year to manage reclamation projects, but by 1866 they transferred that power to the County Boards of Supervisors. However, after 1865, "the swampland board was in jeopardy, because it had failed to implement large-scale reclamation and flood-control plans for lack of baseline information and financing."[37]

Levee construction increased after acreage ownership limitations were removed in 1868.[38] Reclamation cost five dollars per acre in the year 1868. Also in that year, a:

> new law authorized reclamation districts and permitted tax assessments, with the stipulation that the process be supervised at the county level. County boards of Supervisors were empowered to form reclamation districts that were controlled by trustees elected by landowners. Removal of acreage limits permitted large investment in swampland reclamation.[39]

Laws, however, only partially contributed to the success of reclamation. The advancement of technology that developed during the 1870s overtook hand labor at half the price. By 1871, nearly all of the swampland was "in large holdings," and reclamation quickly commenced with steam-powered dredges. In addition, in 1871 the Secretary of the Interior accepted the state survey lines.[40]

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[34] Dillon, *Delta Country*, 89-90. *Kanakas* were Native Hawaiian workers.
[35] Dillon, *Delta Country*, 90.
[36] Nejedly, "The Sacramento-San Joaquin Delta 'Islands.'" <http://californiawatercrisis.rog/the_history_of_the_delta.htm>
[37] Martin D. Mitchell, "Land and Water Policies in the Sacramento-San Joaquin Delta," 413.
[38] California Department of Water Resources, "Introduction," <http://rubicon.water.ca.gov/delta_atlas.fdr/intro.html>
[39] Dillon, *Delta Country*, 90.
[40] Mitchell, "Land and Water Policies in the Sacramento-San Joaquin Delta," *The California Geographer* Volume 35 (1995): 414, 412.

Levee Construction

Levee construction in the Delta increased in the second half of the nineteenth century. Originally, farmers and settlers constructed the first levees to protect their crops from annual flooding; later, levees served as the foundation for a major transportation route between the San Francisco Bay Area and the Sierra Nevada foothills.

Reclamation in the Delta began in 1850, but consisted of inadequately constructed levees built solely to block seasonal flooding. Early levee construction relied on "island tule sod which was highly organic and shrank when dried and set into blocks for fill."[41] Prior to the 1870s, levee construction did not guarantee long-term results; cracks and surface irregularities commonly developed, and waves eroded the thin, organic construction. The size of a typical levee during the earlier period of construction was thirteen feet at the base, five feet at the crown and three feet tall.[42] As described by Daniel Arreola, "…early levees were little more than fragile retaining walls which often gave way during the season's first flood."[43]

Settlers first constructed levees using horses dragging large scrapers to accumulate soil. This method of levee construction lowered the level of the ground, and farmers were forced to make taller levees to compensate for sinking farmlands.[44] Later, settlers and farmers dredged river soils instead of farmland, thereby lowering the level of the water bed and protecting their fields at higher elevations. This method was achieved using steam dredges. Introduced in the 1870s, steam dredges were more cost efficient because they moved alluvial soils from the bottom of river channels rather than using valuable farmland.

First used in 1879, the clamshell dredger coated levees with natural clay and sand from the river bottom giving "a more protective surface which did not crack or leak like clay or peat, and it retarded rodent penetration." [45] Dredges allowed levees to increase in size and quickened reclamation. Levees reached 200 feet at the base and thirty feet high.[46]

Regardless of the method of levee construction, levees contributed to many topographic changes of the Delta region during the period between the Gold Rush and the end of the nineteenth century. Chinese labor contributed heavily to levee construction, and therefore, the development of the Delta region. Many Chinese left mining during the Gold Rush and worked constructing levees. In the 1870s, after the completion of the Central Pacific Railroad, thousands of Chinese railroad workers moved to the Sacramento-San Joaquin Delta

[41] Arreola, "The Chinese Role in the Making of the Early Cultural Landscape of the Sacramento-San Joaquin Delta," 5. Tules are bulrush plants that grow in low marsh or swamp land.
[42] Arreola, "The Chinese Role," 5.
[43] Arreola, "The Chinese Role," 5.
[44] Wolff, *Delta Primer*, 38.
[45] Department of Water Resources, "Introduction," 8 August 1995 Hhttp://rubicon.water.ca.gov/delta_atlas.fdr/intro.htmlH (accessed 11 August 2004); Wolff, *The Delta Primer*, 91; SacDelta.com, "The History of the Delta," copyrighted 1997-2002, <http://www.sacelta.com/hist.html> (accessed 23 August 2004); Arreola, "The Chinese Role," 6.
[46] Mitchell, "Land and Water Policies in the Sacramento-San Joaquin Delta," 414.

in pursuit of new employment. Paid very small wages, "Chinese workers were employed…in reclaiming the delta country for agriculture. They built the first systems of levees along the various islands, working laboriously with wheelbarrows."[47] Chinese workers built levees and created channels implementing techniques they learned in China on the Yangtze River.[48] Chinese laborers completed the first coordinated levee system in 1869 at Sherman Island and Twitchel Island. The construction of these levees and the reclamation of the two islands resulted in plentiful crops. [49]

According to an 1876 account: "Chinamen reclaim these lands; they build levees; they patiently work in the mud and water where Whitemen will not; and as a rule it may be said they 'create' wealth for they do that work which but for them would not be done at all."[50]

Resulting from successful reclamation, made possible through laws passed during the 1850s and 1860s, technologically advanced dredging machines, and the hard work of minority laborers, a solid levee system was created. The levee system and rich soil in the Delta region provided the perfect atmosphere for an agricultural boom.

Agriculture

In addition to reclamation, farmers prepared the land for agriculture by felling, plowing and removing trees. Between 1860 and 1920, ninety percent of the Delta had been reclaimed. "Once the land had been reclaimed," writes Daniel Arreola, "the costly and troublesome clearing of tules…and breaking of virgin organic or mineral-organic soil was necessary."[51] Fire was used to clear tules. Once reclaimed and settled, the Delta region proved to be one of California's major agricultural areas. Prior to 1900 Delta agriculture was "primarily small-scale farming and vegetable gardening, and not until the twentieth century did it become large-scale, specialized field agriculture."[52]

According to Kathleen Graham, "no fertilizers or other ground preparations or enhancers were needed to farm the land [until] well into the twentieth century."[53] Because of the thick peat soil and California's Mediterranean climate, farming boomed in the Delta region. Successful crops included: peaches, plums, pears, cherries, tomatoes, pink beans, onions, peas, asparagus, celery, barley, feed corn, spinach, potatoes, melons, alfalfa, hemp, wheat, sugar beets, safflower, grapes, kiwi, and pears. Unsuccessful crops included: peanuts, rice, jute, ramie, hemp, cranberries, mulberries, peppermint, and spearmint.[54] Interestingly, Delta

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[47] Mildred Brook Hoover; Rensch, Hero Eugene; Rensch, Ethel Grace; William N. Abeloe. *Historic Spots in California* (fourth edition revised by Douglas E. Kyle). Stanford, CA: Stanford University Press, 1990.
[48] Bruce Crawford *Images of America: Isleton* (Charleston, SC: Arcadia Publishing, 2003), 7.
[49] California Department of Water Resources, "Introduction," 8 August 1995. Hhttp://rubicon.water.ca.gov/delta_atlas.fdr/timeline.htmlH (accessed 11 August 2004).
[50] Daniel D. Arreola, "The Chinese Role" *The California Geographer* Volume 35 (1995): 4-5.
[51] Arreola, "The Chinese Role," 6.
[52] Arreola, "The Chinese Role," 7.
[53] Kathleen Graham, *Discovering the Sacramento River Delta*, rev. ed. (1982; Walnut Grove, Calif.: Sacramento River Delta Historical Society, 1985), 12.
[54] Dillon, *Delta Country*, 93.

agriculture was differentiated by ethnic groups who were identified with different types of crops or livestock. The Chinese, Italian and Portuguese were vegetable gardeners, while American-born farmers took to grain and livestock.[55]

Agriculture became a "principal occupation" by the mid-1860s. "At first," writes Peter C.Y. Leung, "grain was the main crop. By the 1870s, however, it had become apparent that fruit orchards and truck farms were more profitable. In the 1920s and 1930s, the most important crops were pears, asparagus, onions and potatoes."[56] First grown in 1852, asparagus became one of the region's main crops and by the early twentieth century the Delta produced ninety percent of the world's asparagus. "Between 1900 and 1941," writes Kathleen Graham, "there were approximately 82,000 acres of asparagus planted."[57] Asparagus did decline, however, and by 1950 there were no longer any canneries in Walnut Grove, Rio Vista or Isleton.

During the 1920s, the Delta supplied ninety-five percent of the United States tomato market. Kathleen Graham explains:

> Tomatoes were later processed in the 1920's by Libbey, McNeil & Libbey [*Sic*] at Locke and Del Monte did the same at Rio Vista. Del Monte had large asparagus plants at Rio Vista and Vorden, Pratt-Low at Ryde, Libbey at Locke, Sun Garden at Isleton, to name a few.[58]

Different crops declined at different times. For the potato culture, the rising costs of labor, fertilizer and farm machinery after World War I led to its decline. Although the California Delta Potato Growers Association stated that ten million pounds of potatoes were being dug monthly, by 1924 only seven percent of the Delta's crops were potatoes and by 1952 the percentage dropped to 1.8.[59]

Pears were introduced to the Delta in the late 1870s when fruit quality was damaged by mining debris seepage into the Sacramento River. Bartlett Pears boomed around World War I, 48.5 percent of all American pears were produced in California. "Pears," writes Bruce Crawford, "are natural for the Delta. Many of the trees are below river level, but their root system does well in the soggy soil. They are high producers, fairly easy to harvest, and maintenance is limited to spraying and pruning."[60] Planting pear orchards in close proximity to the levees provided shade, protection from wind, hail and insects. Although pears remain the primary crop today, at one time they declined in importance due to the asparagus crop. In

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[55] Arreola, "The Chinese Role," 9.
[56] Peter C.Y. Leung *One Day, One Dollar: Locke, California and the Chinese Farming Experience in the Sacramento Delta* (El Cerrito, Calif.: Chinese/Chinese American History Project, 1984), 37.
[57] Graham, *Discovering the Sacramento River Delta*, 13.
[58] Graham, *Discovering the Sacramento River Delta*, 15.
[59] Dillon, *Delta Country*, 97-99.
[60] Crawford, *Images of America: Isleton*, 85.

1929 there were 16,500 acres of pears, and in 1945 there were only 4,900 acres. Today, pear orchards consume approximately 6,000 acres in the Delta area.[61]

Sheep also were raised in the Delta, and creameries and dairies were established. And until 1981, Heinz had a "pickle works at Isleton."[62] Canneries were an important aspect of the Delta's agricultural industry, providing the bulk of the available jobs. In 1929, ten canneries functioned between Walnut Grove and Rio Vista with Isleton as the hub of the canning industry. "Packing sheds (houses,)" argues Graham, "were numerous which heightened the competition in fresh fruit and vegetable marketing. Over the years there have been over 200 pear labels alone, and many, many asparagus labels."[63] The Delta was an ideal area for canneries due to the close proximity of navigable water.[64] Historian Richard Dillon attributes the decline of canneries on the Great Depression and "because the railroads and good highways made centralized packing in the cities more cost efficient as the Delta labor force dwindled."[65]

Transportation

Since the time of the California Gold Rush, the Delta has provided water transportation for freights and passengers to and from major cities in the San Francisco Bay Area, and farms in the San Joaquin and Sacramento Valleys. With an increase in farming in the area toward the end of the nineteenth century, the need for overland transportation proved even more necessary. Early travelers passed through the area over the most obvious routes– the high levee roads. However, good-quality roads in the Delta took forty years to transpire. The earliest roads followed old trails that followed natural levees, rivers and creeks. However, the Delta's numerous islands and tributaries limited the possibility for a direct overland route from San Francisco to Sacramento.[66]

The east bank of the Sacramento River developed as a transportation route because the west bank had recurring flooding problems. On the east bank of the Sacramento River, the Georgiana Road went from Freeport to Walnut Grove. In 1857, the Georgiana Road was designated a public road, and by 1870 it was extended southward to Sherman Island. In the early 1900s, to accommodate the new stream of automobile traffic, the County of Sacramento built three bridges between Walnut Grove and Sherman Island.[67]

Before Sacramento and Yolo counties built bridges to connect the islands and tributaries, ferries provided river crossing transportation. Since the 1850s, there have been over twenty privately-owned ferries providing service within the Delta. The ferries required a fee and

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[61] Dillon, *Delta Country*, 96. One source noted that the Delta produced 90,000 tons of pears annually.
[62] Graham, *Discovering the Sacramento River Delta*, 15.
[63] Graham, *Discovering the Sacramento River Delta*, 15.
[64] Bohakel, *The Historic Delta Country*, 5, 12; Wolff, *Delta Primer*, 60, 62, 69.
[65] Dillon, *The Delta Country*, 111.
[66] John Thompson, "From Waterways to Roadways in the Sacramento Delta," *California History* 59, no.2 (1980): 146-7.
[67] Thompson, "From Waterways to Roadways," 147.

posting of a bond. After 1900, ferries generally became toll free with county aid.[68] Steamboating, however, diminished in the 1930s. "River freighting," writes Dillon, "gave way to trucking, and passenger traffic yielded to privately owned Model A's. As transportation changed, bridges provided improved mobility."[69]

Roadway System and Highway System

Although the early farmers and settlers of the Delta had constructed roads on top of the levee system along the banks of the Sacramento River, these roads were not designed to sustain a large amount of vehicles or heavy trucks carrying loads of produce. As a result, the concern and need for better roadways increased during the first part of the twentieth century as the automobile population expanded. The numbers of automobiles in California increased after 1908 when Henry Ford's assembly line approach to manufacturing made the Model T more affordable for the average person. As with the popularity of the automobile, trucking also became a preferred and more standard way of transporting goods.[70]

In 1909, the First State Highway Bond Act established a State Highway System. The bond appropriated $18 million, but it was discovered that $18 million would not be enough money to construct a state highway system. The State and counties negotiated a deal concerning the highway system's construction. The counties donated the right of way to build bridges; the State developed the highway system in between. Sacramento County was slow to initiate an active role in the Delta area because the County spent its limited resources carefully and was weary of the monetary responsibility of building and repairing levees, and building and repairing roads. Farmers also added to the delay of road improvement and maintenance because they took pride in the land reclamation and the roads they had built on top of their levees. To farmers, the roads were exemplary of the achievements of land reclamation.[71] In 1909, the Freeport Road became the first road in the Delta to be macadamized or surfaced.[72] In 1912 the Southern Pacific Railroad opened the Walnut Grove Short Line. This line extended from Sacramento, to Isleton, to Walnut Grove, and held both passengers and freight. Produce, then, was shipped back East directly from the Delta by railroad.[73]

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[68] Thompson, "From Waterways to Roadways," 151, 145.
[69] Dillion, *The Delta Country*, 111.
[70] Richard F. Weingroff, "Federal Aid Road Act of 1916: Building the Foundation," *U.S. Department of Transportation, Federal Highway, Infrastructure Website*, 6 February 2004, <http://www.fhwa.dot.gov/infrastructure/rw96a.htm> (accessed 20 August 2004).
[71] State of California, "Fact Sheet; Important Events in Caltrans History," *Department of Transportation*, copyrighted 2003, <http://www.dot.ca.gov/hq/paffairs/about/chist.htm> (accessed 23 August 2004); Norman Root, *A History of Bridge Building in California on the Lincoln Highway*, produced by California Department of Transportation, Division of Engineering Services, Education Committee, 75 min., 2000, CD-Rom. Located in the Transportation Library at Caltrans Headquarters in Sacramento. Norman Root presented the recorded lecture in Sacramento, CA; Thompson, "From Waterways to Roadways," 157.
[72] Parsons Harland Bartholomew & Associates, Inc, "Historic Resources Evaluation Report Freeport Shores Pedestrian/Bicycle Trail Project Sacramento County, State 160/Freeport Boulevard," March 2004, 9.
[73] Graham, *Discovering the Sacramento River Delta*, 30.

History of Road and Bridge Progress

Prior to 1880, counties constructed few bridges in California. Those who traveled by automobile "negotiated" numerous ferry crossings on Highway 160 until "the first Antioch Bridge was completed to open the Victory Highway on New Year's Day of 1926."[74] Prior to the 1880s,

> highway bridge building in California was predominantly a private endeavor. While a few counties built public bridges as early as 1855, it was not until after 1874 that the state legislature adopted a comprehensive program through which counties could establish road districts, road commissioners, and property taxes reserved for road construction.[75]

In 1893, a new law mandated that counties "seek the advice of its county surveyor on bridge design. This law helped professionalize the office of county surveyor and attracted trained bridge engineers."[76] By 1903 agriculture and crop processing expanded, thereby increasing traffic; and in 1906, to accommodate traffic, Sacramento County instituted the first phase of bridge construction. The County constructed three bridges in 1906, which provided a continuous road from the Brannan, Andrus and Grand Islands to Sacramento, and an easterly road from Walnut Grove to Thornton.

The second stage of bridge construction began in the Delta in 1911 with the goal to improve roads. During this period, routes to and from Sacramento were flooded most of the year. Poor road quality made trucking goods to regions west of Sacramento difficult. Companies and farmers wishing to ship products to San Francisco from Sacramento and the Delta region remained heavily dependent on steamboats and water carriers. In response to the monopoly on freight service, steamboat captains, having realized the control they held on transportation, held annual strikes to force a rise in prices. In May 1916, however, on the same day as an annual steamboat strike, the Yolo bypass opened between Sacramento and Yolo Counties providing an alternate transportation route from Sacramento to the San Francisco ports by road. With the opening of the Yolo bypass, trucking became the preferred alternative to transport goods.[77]

In 1916, the Goodyear Tire and Rubber Company introduced the pneumatic cord truck tire. The pneumatic tire was designed as a tire within a tire; therefore, the pneumatic tire was more resistant to puncturing and could carry substantially more weight.[78] With trucks

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[74] Hal Schell, *Cruising California's Delta* (Stockton, Calif: Schell Books, 1995), 13.

[75] Christopher McMorris, "Caltrans Historic Bridge Inventory Update: Metal Truss, Movable and Steel Arch Bridges, Volume 1: Report and Figures," JRP Historical Consulting, prepared for California Department of Transportation, Environmental Program, Sacramento, as part of 2004 Bridge Survey Report. March 2004, 15.

[76] McMorris, "Caltrans Historic Bridge Inventory Update," JRP Historical Consulting, prepared for California Department of Transportation, Environmental Program, Sacramento, as part of 2004 Bridge Survey Report. March 2004, 15.

[77] Norman Root, *A History of Bridge Building in California on the Lincoln Highway*, CD-rom; Thompson, "From Waterways to Roadways," 151.

[78] Jack Thiessen, contributing editor, "1908-1917; Trucking Enters its Teens," in *Heavy Duty Trucking: 100*

equipped to transport heavy loads, the strongest inhibitor to the progression of roadway traffic and trucking was the poor road conditions. The Delta region also needed better bridges. The first part of the twentieth century would become an era of mass bridge construction within the Delta region.

The Campaign for Good Roads

The general concern for road conditions extended beyond local concern and became of national interest. Locally, "until about 1914," describes author Kathleen Graham, "the vehicular roads in the region were rudimentary. In the early days the levees were low, between 4 and 8 feet and narrow ('shoestring levees') and a footpath either followed the top or was on the riverside of the levee. Any road for vehicles was usually next to the levee on the land side. As the levees grew in size and the tops gradually broadened, they were increasingly used for vehicular traffic. After 1914, the levees were raised about 5 feet to approximately their height in the mid 1980s. The roadbeds were unpaved and sandy."[79]

At a national level, the desire for good roads was strong. Carl Fisher, founder of Indianapolis Motor Speedway, began to promote the idea of a transcontinental highway in 1912. Wanting to implement a paved roadway from Times Square in New York City to Lincoln Park in San Francisco, Fisher planned to incorporate and involve towns along his highway by having them provide the necessary equipment while he, in return, would provide "free materials and a place along America's first transcontinental highway." Fisher also asked for cash donations. The Lincoln Highway began in 1912 and lasted until it began to be "chopped up" in 1925 as the federal government began a "system of *numbered* highways.[80]

As Fisher and other visionaries began to think of a paved road that extended across the country and put the plan into action, residents and enthusiasts of the Delta worked toward improving the roadways in the Delta area. Although a plan had been proposed by Delta supporters for the construction of six bridges and the upgrading of sixty percent of all road mileage as early as 1911, the California Highway Commission did not adapt this plan until 1916. By 1912, the California Highway Commission began to change bridge and road construction and maintenance within California:

> Beginning in 1912 the California Highway Commission began to require that all structures built as part of the state highway project be designed by competent engineers and the plans, specifications, and workmanship be subject to the inspection and approval of the Highway Engineer. The commission also established the minimum width and live load guidelines for their designs and went

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Years of Trucking 1898-1998, special issue of monthly publication *Heavy Duty Trucking* (Santa Ana, Calif.: Newport Publications Division, HIC CORP, March 1998), 40; Paul Dickson and William D. Hickman *Firestone: A Legend, A Century, A Celebration*. Edited by Nelson Eddy (New York: Bridgestone/Firestone Inc., 200): 75.

[79] Graham, *Discovering the Sacramento River Delta*, 31.

[80] James Lin, "A Brief History: Parts 1-4," *Lincoln Highway Homepage*, 7 October 1998, <http://www.ugcs.caltech.edu/~jlin/lincoln/history/part1.html> (18 August 2004). Parts 2-4 may be accessed from this link.

> on record in favor of the use of reinforced concrete designs when possible. . . . Reliance on the counties to furnish bridges had led to the bridge work lagging behind road construction on state highways. In response, the highway commission began requiring that all bridge design and construction on the state highway system be done under the direction of the Bridge Department beginning in 1923.[81]

These requirements increased the workload for the commission and created a need for the formation of a Bridge Department, which began supervising bridge construction in 1923.[82]

The federal government also began to assist in improving roads. Proposed by the American Association of State Highway Officials (AASHO), federal government passage of the 1916 Federal Aid Road Act aided the state and counties with road improvements. Also in 1916, the state issued a second highway bond for $15 million. The California Highway Commission implemented the adapted 1911 road improvement plan in the Delta region, covering thirty-nine miles of asphalt from Freeport to beyond Isleton and constructing several bridges: Walnut Grove (1916), Rio Vista (1919), Paintersville (1923), Isleton (1923) and Steamboat Slough (1924).[83] The American Toll Bridge Company had finished a bridge spanning the San Joaquin River in the Antioch vicinity in 1926, and in 1928 the Freeport Bridge became part of the Sacramento and Yolo Counties road system.[84] "By 1929," argues Kathleen Graham, "all the major bridges were built and by 1930, there was an extensive network of primary and secondary paved roads."[85]

State Highway 160—the Victory Highway

Paintersville, Isleton and Steamboat Slough bridges are all located on the present-day State Highway 160, which at one time was known as the Victory Highway, a transcontinental route.[86] State Highway 160, also known as State Route 160, is one of the three main highways that run through the Delta.

The Victory Highway Association, organized in 1921, aimed to promote road improvements and follow U.S. Route 40. The Victory Highway was established after World War I as a memorial to those who served in the war. In 1923, the Secretary of Agriculture Henry C. Wallace chose the routing of the Victory Highway via Wendover, Utah, the same route that

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[81] Thompson, "From Waterways to Roadways," 152-53; McMorris, "Caltrans Historic Bridge Inventory Update," 16-17.
[82] McMorris, "Caltrans Historic Bridge Inventory Update," 17.
[83] Weingroff, "Federal Aid Road Act of 1916," *Infrastructure Website*; State of California, "Fact Sheet," *Department of Transportation*; Thompson, "From Waterways to Roadways," 153-54. Thompson's report dates the construction of the Paintersville bridge as 1920, however, all other documents, such as BIRIS reports, state the bridge's construction being in the year 1923.
[84] Thompson, "From Waterways to Roadways," 154.
[85] Kathleen Graham, *Discovering the Sacramento River Delta*, 32.
[86] Root, *A History of Bridge Building* lecture, CD-Rom. Some rumors suggest that after the construction of the Antioch Bridge in 1926, Highway 160 became part of the Lincoln Highway.

the Utah state government wished for the Lincoln Highway.[87] The Victory Highway gained additional funding in 1921 after the Utah government chose the Victory Highway as a federal road and, therefore, received money from the new federal highway act.[88]

The Victory Highway detours from Route 40 between Sacramento and San Francisco.[89] The Delta region, for economic reasons, wanted The Victory Highway, "In an effort to obtain additional funds for transportation improvements the Victory Highway Association made several 'reroutings' of the Highway through Sacramento."[90] Businessmen and different business sectors in Oakland and San Francisco and of the California State Automobile Association desired a steadier flow of traffic from Salt Lake City and Ely, Nevada, and the newly formed Victory Highway Association worked to find a solution to steering more traffic towards San Francisco.[91] By 1924, the Victory Highway was well established as noticed from this 1924 commentary by Edward Tree, the editor of *Good Roads* magazine:

> Approaching the Pacific end of the Victory Highway line the tourist is supplied with an entry way into San Francisco from Sacramento that follows a concrete highway down the Sacramento River levee, crosses the San Joaquin River at Antioch and follows the wonderful concrete county highway system of Contra Costa County. . .[92]

When the Antioch Bridge was completed in 1926, in celebration of the diversion of the Victory Highway through the Delta region, the bridge was named "The Victory Bridge." [93]

Bridges, inevitably, made the River Road eligible for incorporation into a major highway. According to historian Frank Lortie, "Without modern, movable bridges the River Road would have never been the up-to-date motor transportation route that the Delta needed. Between Antioch and Freeport there were ultimately eight movable bridges along State Route 160. . .The bascule design seems to have been the best type of bridge for most of the

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[87] Thompson, "From Waterways to Roadways," 154; Parsons Harland Bartholomew & Associates, Inc., "Revised Historical Resources Compliance Report for the Relinquishment of State 160 to the City of Sacramento, California by the California Department of Transportation, Sacramento County, Sac-160 PM 35.04/44.46; EA 03-2A4700," April 2001, 11; Frank X. Brusca, "Victory Highway," *U.S. Route 40; America's Golden Highway*, copyrighted 2002, <http:www.route40.net/history/victory.shtml> (accessed 18 August 2004).

[88] James Lin, "A Brief History: Parts 1-4," *Lincoln Highway Homepage*. The act provided $75 million worth of matching funds to state highway construction in addition to requiring, unlike in 1916, that states identify "7 percent of its total mileage as 'primary'; only these roads would be eligible for federal funds."

[89] Brusca, "Victory Highway," *U.S. Route 40; America's Golden Highway Website.*<http:www.route40net/history/victory.shtml>

[90] Parsons Harland Bartholomew & Associates, Inc, "Revised Historical Resources Compliance Report," April 2001, 11.

[91] Thompson, "From Waterways to Roadways," 154.

[92] Parsons Harland Bartholomew & Associates, Inc, "Revised Historical Resources Compliance Report," 9.

[93] Thompson, "From Waterways to Roadways," 154.

Delta crossings."[94] The county constructed the three movable bridges studied in this report during the early 1920s.

Movable Bridges

At the turn of the twentieth century, movable bridges dotted the Delta region. In such a diverse geographic area as the Delta, the need for bridges equated to that for paved roads. To accommodate the need for an improved road system, but not affect the water carriers, the county selectively built movable bridges because of the high cost of construction and operation.[95] Movable bridges improved the efficiency of the road, as well as, accommodated the water vessels that had the right of way. The vast majority of movable bridges in California existed within the Sacramento-San Joaquin Delta where highway traffic and navigation often met.[96] Within California, nineteen of the thirty-eight movable bridges are located in Sacramento and San Joaquin counties. Twenty-five are located within the Delta region, and the rest, except two, are located in the counties between San Francisco and the inland ports.[97]

The first movable bridge in the Delta region spanned the lower American River in 1851 at the approximate site of Sixteenth Street and the American River in the City of Sacramento. Lisle's Bridge, constructed out of timber, "was a vertical lift (sort of)," according to author Hal Schell. In 1858, the Sacramento-Yolo Bridge, a swing bridge, opened in Sacramento.[98] In 1901, a steel drawbridge was constructed across Georgiana Slough shortly before the county began their first phase of bridge construction. By the 1920s, most of the ferries that had once served the Delta roads were replaced by bridges or "earthen fills," and by 1950 only five ferries remained. Today only two ferries provide such a service.[99] These are the Cache Slough Ferry (also called the Real McCoy and the Ryer Island Ferry) on State Highway 94,

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[94] Frank Lortie, "Historic Architectural Survey Report for The Steamboat Slough and Threemile Slough Bridges, Bridge Numbers 24-52 and 24-121, Seismic Retrofit Projects; 3-Sac-160, PM 19.3 and 6.98, EA 3-428000," California Department of Transportation, Sacramento, January 1996, 4.

[95] Caltrans, *Historic Highway Bridges of California*, 111.

[96] Caltrans, *Historic Highway Bridges of California*, 111.

[97] Query of Movable Bridges from the Caltrans Bridges Database, Microsoft Access, 2002; Caltrans, *Historic Highway Bridges,* 111. There are some discrepancies between the Caltrans 1990 publication and its 2002 bridge database. According to the 1990 publication, there are 39 movable bridges found in California. Of those bridges, 27 are located in and between Sacramento, San Joaquin and Yolo Counties. The publication also notes that two movable bridges found outside of these counties, and counties associated with the San Francisco Bay Area, are a bridge in Los Angeles and Glenn County. The 2002 database lists movable bridges that still exist and have not been locked into place. It notes that there are only 38 movable bridges, 25 located in Sacramento, San Joaquin, Yolo and Solano counties. The two bridges outside of the Delta or Bay Area are noted to be located in San Diego and Los Angeles County. There are no movable bridges listed for Glenn County.

[98] Hal Schell, "Historic Drawbridges of the Delta," *California Delta Chambers & Visitors Bureau Website*, 16 January 2003, <http://www.californiadelta.org/bridges.htm> (accessed 27 July 2004).

[99] Thompson, "From Waterways to Roadways," 149, 151-52; Wolff, *Delta Primer*, 146-7; Hal Schell, "Ferries of the Delta," *California Delta Chambers and Visitors Bureau Website*, 19 August 2004, <http://www.californiadelta.org/ferries.htm> (23 August 2004). While the *Delta Primer* states that there are two remaining ferries, it should be specified that Hal Schell's work claims there are five ferries that remain, but three lead to private properties.

and the Steamboat Slough Ferry (or J-Mack Ferry) on State Highway 220. Both are near the Sacramento River and are maintained by Caltrans.

Bridges changed the economic picture of the Delta region; "by the late 1920s recreational boating and tourist traffic had increased substantially and put new demands upon the Delta merchants and resort owners."[100] The Paintersville, Isleton and Steamboat Slough bridges are each a bascule bridge, one type of movable bridge. There are three basic types of movable bridges. Two types swing and lift. Swing bridges, the earliest movable bridges, pivot on a central pier. Bascule bridges have a "movable span that pivots about a hinge, or trunnion, with the span being pulled upward and inward toward a source of power beyond the trunnion."[101] More time efficient, the bascule design replaced swing bridges because the bascule spans only had to adjust the deck height to accommodate approaching vessels, whereas swing bridges had to turn entirely regardless of the size of vessel.[102]

Bascule Bridge Design

Early bascule bridges did not have counterweights. The earliest type of bascule bridges consisted of "a simple span, trunnioned or hinged at one end, moving in a vertical plane about such trunnion, by virtue of an out-haul line attached to the free end and running upward and inward to the source of power."[103] The genealogy of this design is traced to the medieval drawbridge. Although some bascule bridges existed in Europe during the first half of the nineteenth century, the twentieth-century "modern" bascule bridge was not developed until the 1920s. One of the forerunners to the bascule span of the 1920s was the Van Buren Street Bridge in Chicago, completed in 1893.[104] The Delta's first drawbridge, Lisle's Bridge, was a vertical lift bridge spanning part of the lower American River built in 1851.[105]

The development of the bascule design occurred rapidly due to the design's many advantages, such as, quick operation, diminished interference with the channel during operation, the duration of the opening, and pier considerations. In many of these regards, the bascule bridge was advantageous when compared to the swing bridge.[106]

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[100] Lortie, "Historic Architectural Survey Report for the Steamboat Slough and Threemile Slough bridges," 5.
[101] Caltrans, *Historic Highway Bridges of California*, 111.
[102] George A. Hool, et al, *Movable and Long-Span Steel Bridges*, 2d ed, Structural Engineers' Handbook Library (New York: McGraw-Hill Book Company, Inc, 1943), 1-2.
[103] Hool, *Movable and Long-Span Steel Bridges*, 1-2.
[104] In Frank Lortie's report, "Historic Architectural Survey Report for The Steamboat Slough and Threemile Slough Bridges," he specifies that "The modern bascule bridge designs were developed in Chicago in the 1890s along the Chicago River, and were the prototypes for several subsequent bascule designs that became popular nationally and internationally," 4.
[105] Dana Supernowicz, "Bridge Evaluation Report for Rehabilitation of the Mokelumne River Swing Truss Bridge (29-0043) State Route 12 San Joaquin County, California 10-SJ-12 (P.M.0.01) EA 3A2300," February 2001, in Historical Resources Compliance Report for the Rehabilitation of the Control houses on THE OLD RIVER BRIDGE (Br. No. 29-0045) Located at 10-SJ-4-0.0 THE MOKELUMNE RIVER BRIDGE (Br. No. 29-0043) Located at 10-SJ-12-0.0 San Joaquin County, California, EA 10-0C1500," by Andrea Galvin, November 2002, 3; George A. Hool, et al, *Movable and Long-Span Bridges*, 1.
[106] George A Hool, et al, *Movable and Long-Span Bridges*, 1-8.

The bascule bridges also incorporated truss styles, the three major types of steel truss bridges in California being the "Through Truss," "Pony Truss," and "Deck Truss." "For those standard configurations, engineers designed four common types, which included the 'Pratt Truss,' 'Baltimore Truss,' 'Parker Truss,' and 'Pennsylvania Truss.'"[107] By the twentieth century the truss design had lost favor to the concrete arch for various reasons: the organization of the American Bridge Company, the growth of state and county involvement in bridge construction and the disfavor of "City Beautiful" advocates. These events contributed to the downfall of the truss design being used for "ordinary" spans. The design was used, however, for extraordinary circumstances, such as, spanning navigable water.[108]

History of Isleton

The Isleton Bridge is located in the Delta, an area that, since the late nineteenth century, has been concerned with improving transportation routes. The Isleton Bridge was constructed in 1923 and served as an important component to the Delta's intricate water land transportation systems.

In 1874 Dr. Josiah Poole founded Isleton and had "the townsite platted and recorded."[109] Dr. Poole constructed the first wharf in 1875 where steamers stopped daily. Persuaded by Dr. Poole, the Sugar Manufacturing Company of California built and established a plant in Isleton in 1876. Unfortunately, it lasted only one season due to the flooding of the sugar beet crop. The building was later turned into a cannery.[110]

Built by the American Bridge Company and designed by the Strauss Engineering Company, the Isleton Bridge was constructed the same year that Isleton was officially incorporated into Sacramento County. During construction, a wood frame was the only way to cross the Sacramento River and ships used other channels.[111] The Isleton Bridge was dedicated on Saturday, October 27, 1923. The dedication celebration began at 10:00 am and at 10:30 am a parade crossed the bridge from Grand Island to Isleton. The event was concluded by a grand ball from 8:00 in the evening until 1:00 the following morning.[112] According to the Annual Statistical Report for Sacramento, California—Fiscal Year 1924-25, the Isleton Bridge can

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[107] Supernowicz, "Bridge Evaluation Report for Rehabilitation of the Mokelumne River Swing Truss Bridge (29-0043) State Route 12 San Joaquin County, California 10-SJ-12 (P.M.0.01) EA 3A2300," 4 of Supernowicz's report.

[108] California Department of Transportation, Environmental Program, "Historic Bridge Inventory," 1986, 16-17; McMorris "Caltrans Historic Bridge Inventory Update," 15-16.

[109] The Isleton May Festival Committee. *The Isleton May Festival: May 3rd & 4th, 1975* (Isleton, Calif.: The committee, 1975), 1.

[110] *The Isleton May Festival: May 3rd & 4rth, 1975***,** 1.

[111] Crawford, *Images of America: Isleton*, 38.

[112] Isleton Chamber of Commerce, "Bridge Dedication program," Saturday, October 27, 1923, available at the Sacramento History online Website: Hhttp://www.sacramentohistory.org/search.php?imageid=710H (accessed 8 June 2005). The original copy of this program is available at the Center for Sacramento History, which is located in Sacramento, California.

be opened during an emergency by three men in the space of about one hour.[113] During the 1920s the town "began to see better times with the construction of important state highways in the Delta and the demands created for farm crops as a result of World War II."[114]

Isleton housed many canneries, factories and plants.[115] It was a major sugar beet, peach and apricot producer until the late 1870s, but farmers switched to pear orchards because of mining debris seepage on fruits.[116] Asparagus was planted on land unsuited for pears. The Delta's asparagus boom reached Isleton after 1900 and was so successful that Isleton claimed to be the "Asparagus Capital of the World."[117] Although there were once five to seven canneries in the area, the canning industry declined in the 1930s.[118] Isleton canneries included: Libby McNeil & Libby, Bayside Cannery, National Cannery, and Barsoon Cannery. By 1950, all canneries in Walnut Grove, Rio Vista and Isleton had closed.[119] The Great Depression negatively affected Isleton as,

the river boat traffic had practically ceased and the main railroad and highway routes by-passed the area. It was not until the building of state highways through the Delta and the advent of the truck that business began to improve. The economy recovered somewhat during World War II at which time a shortage of labor brought mechanized equipment to the croplands.[120]

Part II. Structural/ Design Information

A. General Statement:

1. **Character:** The Isleton Bridge is one of five unmodified examples in California of a double-leaf Strauss Heel Trunnion Bascule Bridge, one of the most important patented bascules. Joseph Strauss's Bascule design used concrete, a cheaper

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[113] "Bridge-Isleton-Sacramento River,"1924. Photograph caption available online at the Sacramento History Online Website: Hhttp://www.sacramentohistory.org/search.php?imageid=484H (accessed 8 June 2005). The original photograph is owned by the Sacramento Public Library, Sacramento Room, which is located in downtown Sacramento.

[114] Bohakel, *The Historic Delta Country*, 21.

[115] Graham, *Discovering the Sacramento River Delta*, 21.

[116] *The Isleton May Festival*, 2.

[117] *The Isleton May Festival*, 2.

[118] There seems to be dispute about the number of canneries in Isleton exactly and the degree to which the canning industry began to die in the area. *The Isleton May Festival* states, "In the 1920's the canning industry began to decline and the great depression of the 30's hit Isleton hard economically…" (page 2). Yet, Richard Dillon's work, *The Delta Country*, claims a somewhat contradicting picture, "In the 1920s and thirties, three large canneries followed the rails to Isleton and others were built on Bouldin, Andrus, and Grand islands for quick sales of field-fresh 'grass' to be canned with none of the usual transit loss" (page 106). Hal Schell's description of Isleton claims that the canning industry began to decline in the thirties, but two canneries remained until the mid-1940s. Schell also claims that at one time there were five canneries in Isleton. Bruce Crawford in *Images of America: Isleton* (Charleston, SC: Arcadia Publishing, 2003) claimed that there were seven canneries in the area when the population of Isleton was over 3,000 people (pages 7-8).

[119] Crawford, *Images of America: Isleton*, 79-85; Dillon, *The Delta Country*, 97.

[120] *The Isleton May Festival*, 2.

alternative to iron, for the above-deck counterweights. Furthermore, the bridge's moveable spans pivots on a trunnion upward instead of swinging out. Bascules, then, are more time efficient because they can adjust to the height of approaching vessels. The bascule design was only used for spanning navigable water.

2. **Condition of Fabric:** The Isleton Bridge has been in service since its construction in 1923. Its historic fabric appears to be in fair condition, with few alterations, other than repair and replacement of worn material and parts. The structural integrity of the bridge's individual components is fair, and the bridge operator's controls are worn.

B. Bridge Description:

1. **Substructure:** The Isleton Bridge substructure is comprised of two reinforced concrete seat abutments, and eight concrete piers with curved wing walls. The piers are made of solid reinforced concrete set on timber piles. They are located at 19, 39, 97 and 323 feet from the west bank, and 19, 39, 141, and 243 feet from the east bank.

   There are a total of nine spans. The main 226-foot long span is a riveted steel, rigid-connected Bascule through truss of Pratt configuration. The two secondary spans measure 102 feet each and are tied arch through truss spans made of reinforced concrete. There are also two concrete girder spans of 18 and 20 feet at each end of the bridge. The total length of the bridge is 624 feet.

   There are seven, seven-pile dolphins made of treated Douglas fir wood. Three are located on the east side of the bridge and four on the west. One navigation light is located at the top of each dolphin.[121]

2. **Superstructure:** Isleton Bridge carries two lanes of traffic measuring 18 feet wide. There is a height clearance of 14.80 feet. The deck elevation is at 21 feet. The deck is made of concrete on the approach spans and a steel grid deck on the bascule leaves. The railing is composed of steel lattice, and there are wood plank curbs. There are two large concrete counter-weights mounted in the steel frame 15 feet over the roadway at each abutment.

3. **Gear houses:** There is one gear house (two total) located at each counterweight tower next to the counterweight trunnion. The gear houses are triangular in design and identical. The gear houses are supported by steel framing approximately fifteen feet above the deck. The framing supports the gear houses' forty-five degree slope flooring. The main façades face inward on the bridge and have a single, six-paned, fixed-sash, window. The windows have simple wood casings. The exterior of the gear houses are clad in vertically lain channel wood boards. There are two wood doors, one on the north and south façades. The roof is half-gabled with open eaves, exposed rafters, and simple wood board fascia on only the front façades. The side roof lines

[121] Federal Highway Administration, "Finding of No Adverse Effect," 5.

have no detailing. The roof is made of asphalt to match the control house. Steel staircases with steel guardrails lead to the gear houses from the main deck to the gear house platform.

4. **Gates, navigation lights, etc:** On each end of the bridge there are traffic lights, bells, and signs as protective measures for crossing road traffic. On the east end of the bridge the stop light is located on the northern decorative concrete approach. Attached to the back of the stop light is a bell which dings when the crossing gate is lowered and the center spans rises. The red and green traffic light is located above a sign that reads "STOP HERE ON RED," and has an arrow pointing to a line on the roadway. The same sign, stop light, and bell is located on the west end of the bridge on the southern decorative concrete approach.

   Directly across from the west-end stop light, on the northern decorative concrete approach, is a single crossing-gate arm. Three yellow caution lights are located on the crossing gate and blink when the crossing-gate lowers. The east end crossing-gate arm is located on the north side of the bridge at the beginning of the center spans. It is next to the bridge control operator's house and below the concrete counterweight. The crossing-gate arm is identical to the west end crossing-gate.

   There is a fog bell located on a steel truss on the west side of the bridge operator's control house on the north side of the bridge. The bell is metal and is rigged so the bridge control operator can warn oncoming water traffic. There are also two fog horns located on the same steel truss. The horns are positioned above the bridge control operator's house and the fog bell.

   There are two blinking navigation lights at the center opening of each side of the bridge. A single navigation light is also located at the top of each of the seven dolphins.

5. **Approaches**: There are white, painted decorative concrete approaches approximately fifteen feet long and three feet tall on both the east and west approaches. Each has an open-spandrel balustrade with concrete recessed-panel end posts.

6. **Original Control House Exterior**[122]

   a. **Overall dimensions:** The bridge operator's control house is a one story rectangular structure measuring approximately 20 x 9 feet. There is one bathroom measuring approximately 4.5 x 4.5 feet, and an engine room measuring approximately 8 x 4.5 feet. The main control room measures approximately 12 x 9 feet.

[122] The original control house was replaced in 2007, and its description here is the major reason in the FHWA FNAE that this documentation was written.

b. Foundation: The control house is cantilevered over the Sacramento River on the north side of the bridge. It is supported by three steel brackets across its width, and three galvanized iron soffits across its length bracing the house to the brackets. Above the soffits is a galvanized iron water table. The house is level with the bridge's main deck.

c. Walls: The control house is clad with horizontal beveled wood siding originally noted in the June 1917 blueprint as kiln dried Yellow Pine. [123] There are simple vertical wood corner finishing boards.

d. Structural system, framing: The control house is wood framed. The roof has a common hipped rafter system with notched raters.

e. Walkways: On the east side of the control house is a wood plank walkway with a metal guard rail.

f. Doors: There are three doors on the control house. In the 1917 blueprint the doors were noted to be made of kiln dried Yellow Pine, and the door frames were to be made of Oregon pine wood.[124] On the east façade of the control house is one wood door and one metal-framed security screen door. On the south façade in the west corner there is a wood door with a metal-framed security screen. The eastern corner of the south façade has a wood door blocked by an air compressor.

g. Windows: On the north façade of the control house there are five, single-paned, double hung windows. One window is smaller than the other four. On the south façade there are two, single-paned, double-hung windows. The windows are protected by iron security bars. On the west façade there are two, single-paned, double-hung windows. On the east façade there is one boarded window located next to the wood door. All the windows have simple wood frames and sills.

h. Roof: The control house has a simple hipped roof. The original June 1917 blueprints show the roof composed of galvanized corrugated iron; however the roof was later sheathed in asphalt shingles. The roof has open eaves with exposed rafters and no moldings. The gutter system is made of galvanized iron. It runs along the roof line and has galvanized iron drainage pipes.

7. Original Control House Interior

a. Flooring: The flooring is made up of 1-inch maple wood boards.

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[123] The Strauss Bascule Bridge Co., "Strauss Trunnion Bascule Bridge Patented Over Sacramento River at Isleton for Sacramento County, Cal," blueprint dated March 29, 1917, accessed through Bridge Inspection Records Information System (BIRIS) on September 12, 2011.

[124] The Strauss Bascule Bridge Co., "Strauss Trunnion Bascule Bridge" blueprint dated March 29, 1917, accessed through BIRIS on September 12, 2011.

b. Wall and ceiling finish: The walls and the ceiling are sheathed in vertical channel wood boards. The window casings are made of simple wood boards. There is crown molding and plain wood base boards throughout the interior. The interior is painted.

c. Decorative features: On an east interior wall there is a wood shelving unit, and along the top of the west wall there is wood lattice covering a storage space.

d. Heating and air: A window mounted air conditioner is located in the southwestern window on the east façade.

e. Plumbing: The 1917 BIRIS report notes the toilet as a "porcelain lined cast iron ¼ circle slab with integral 8" back and 5" apron & nickel plated fittings." It also specifies the water closet fixtures to have soil, vent, and supply pipe connections, "all in accordance with local ordinances."[125]

C. Mechanicals/Operation: The Heel Trunnion Bascule operates "with concrete counterweights to distribute loads throughout the opening process and to reduce the motor power necessary to lift the bridge and with four trunnions to ensure that the counterweight and lift spans are balanced at all points while the bridges are being lifted."[126]

In the August 1923 blueprints the bridge's motor was noted to be a three-phase, alternating-current (AC) motor with 15 horse power. The motor has 850 rotations per minute (RPM) and has normal running torque of 90 inches and normal starting torque at 180 inches. The four counterweight trunnions and heel trunnions have the Caltrans product number 44 MPG.[127]

The bridge gearing is triple pinion-and-spur reduction before final rack-and-pinion.

The bridge operator's control house contains electric control panels and other equipment necessary to operate the movable span. Along the eastern wall is the engine generator. Along the southern wall there are bridge controls and electrical panels.

D. Site Information: The Isleton Bridge spans the Sacramento River at Postmile 5.95 on State Highway 160 in Sacramento County; the road is on top of the levees on either side of the river. The Isleton Bridge carries two lanes of traffic in opposing directions as a

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[125] The Strauss Bascule Bridge Co., "Strauss Trunnion Bascule Bridge" blueprint dated March 29, 1917, accessed through BIRIS on September 12, 2011.

[126] Chester, *Joseph Strauss*, 32,33,34,36, 40,42; PBS, "Golden Gate Bridge," <http://www.pbs.org/wgbh/amex/goldengate/peopleevents/p_strauss.html>;and *Port of Los Angeles Virtual History Tour*, "Badger Avenue Bridge, People," <http://laporthistory.org/level4/Badger/badger_people.html>

[127] Moore Shipbuilding Co. Oakland California Engineering Department, "Operating Machinery," blueprint dated August 6, 1923, accessed through BIRIS on September 12, 2011.

component of California State Highway 160. The bridge is surrounded by flat farm fields and sparsely scattered single family houses and farm structures.

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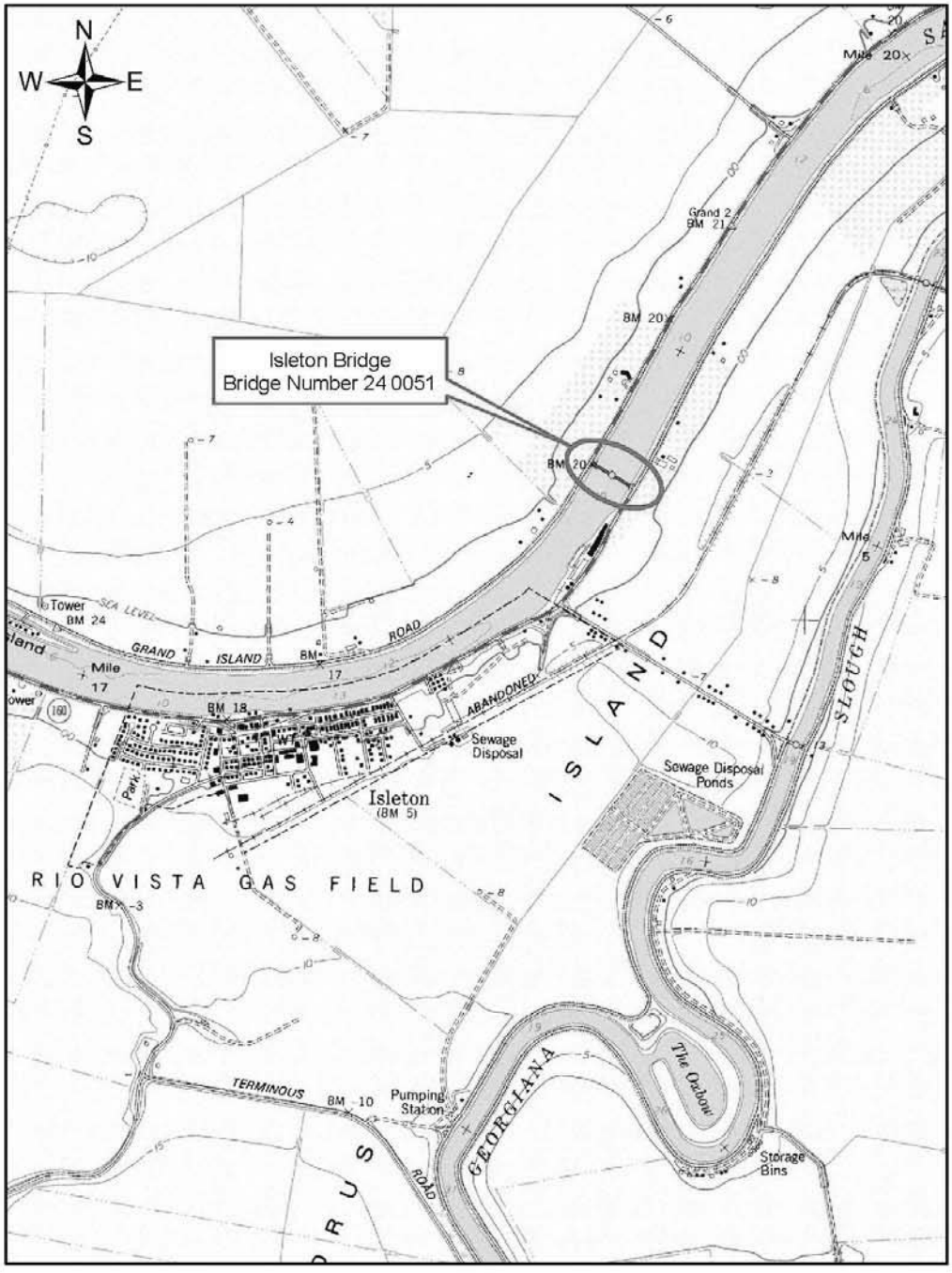

Isleton, CA, U.S.G.S. 7.5' Quadrangle
Scale 1:24,000