

CHAPMAN'S MILLRACE
438 South Mission Drive
San Gabriel
Los Angeles County
California

HAER CA-2305

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED & INTERPRETATIVE DRAWINGS

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service
U.S. Department of Interior
1849 C Street, NW
Washington, DC 20240

HISTORIC AMERICAN ENGINEERING RECORD

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David Greenwood, photographer, May 11, 2012

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HISTORIC AMERICAN ENGINEERING RECORD

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Historic American Engineering Record

Chapman's Millrace

HAER CA-2305

Location: 438 South Mission Drive
San Gabriel, California
Los Angeles County

UTM Coordinates: (NAD 83) 397899 m E/ 3773355 m N

Date(s) of Construction: ca. 1821–1823

**Architect/Engineer/
Builder:** Joseph Chapman

**Original Owner/
Occupant and Use:** Country of Spain / Franciscan order, millrace

**Present Owner/
Occupant and Use:** Union Pacific Railroad and City of San Gabriel / Vacant, water feature that powered a gristmill

Significance: The millrace is an unreinforced masonry water conveyance feature with a U-shaped plan made with procured stone and cement mortar. The structure consists of two millrace “walls,” which contained with water flow and a raceway “floor” that directed the water flow toward the mill. It powered Chapman’s Mill, the key innovation of which was its mechanization through the addition of gears, transferring wheel from vertical to horizontal, adjustable speed and torque, and adjustable millstone spacing for different grains, making the mill one of the first examples of the Industrial Revolution in California.

Description: During an archaeological excavation in 2009, a 30-foot segment of the millrace was discovered roughly 25 feet south of the Union Pacific railroad tracks, along with a much shorter section north of the tracks. The remainder of the millrace was demolished by railroad, road, and civic construction between 1834 and the present. The millrace was once part of a larger conveyance system that powered a gristmill known as Chapman’s Mill. A small remnant of the foundations of Chapman’s Mill is located immediately south of the millrace.

Constructed out of procured stone and cement mortar, the primary remaining millrace segment measures roughly 6.0 feet wide, 30 feet long, and 2.5 feet deep.

The millrace consists of a long, straight water conveyance feature that is shaped like a squared U in cross section, and is aligned to 350°.

History:

The first permanent Euro-American settlement in Los Angeles County came with the founding of the fourth Alta California mission. Fathers Pedro Benito Cambón and Josef Angel Fernandez de la Somera established Mission San Gabriel Arcángel (the San Gabriel Mission) on September 8, 1771, on the banks of the *Rio de los Temblores* (near the present confluence of the Rio Hondo and San Gabriel Rivers). Because the site of *La Misión Vieja*, as the original location came to be known, flooded frequently, the mission was moved 5 miles northwest to its current site in 1775¹. Having learned that being too close to a water course in southern California is a dangerous proposition, the padres chose a new location on high ground. Although this decreased the threat of flooding, the need to bring water to the mission community had an important role in shaping the development of mission infrastructure in subsequent years.

In addition to the large church, the San Gabriel Mission's facilities included priests' quarters, guest rooms, neophyte housing, shops, a kitchen, a cemetery, and many other structures. Although many of these buildings were made with adobe, the Gabrielino residents of the mission community lived in traditional brush structures². The physical center of the community initially consisted of a large, open plaza. The mission complex expanded as the community grew. By 1790, a quadrangle formed by the adobe church, residential apartments, and storerooms had been built. A grand new stone and masonry church was constructed between 1790 and about 1801, featuring unique architectural details such as capped buttresses and long, narrow windows that give the building a distinctly Moorish appearance, evoking the cathedral in Cordova, Spain. Later additions to the community include a second quadrangle, a tannery, at least 10 granaries, a hospital, several water-powered mills, a henhouse, a fountain, a girl's dormitory, and soldiers' barracks³. Four rows of neophyte apartments were constructed to the southwest of the main quadrangle in 1807 and 1808⁴.

Mission Agriculture

An agricultural settlement at its heart, the gardens, vineyards, animal pens, and grazing lands—along with the aqueduct that watered them—were also essential elements of the San Gabriel Mission. Due to its extensive and productive land holdings—including 24 associated ranchos⁵—and large pool of Native American labor, estimated at more than 1,000 people by 1826, the San Gabriel Mission was among the most

¹ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

² Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

³ Weber, Msgr. Francis J. 1979. *Indian Life at the Old Missions: A Documentary History of San Gabriel Mission*. Libra Press Limited, Hong Kong.

⁴ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

⁵ Older, Fremont. 1938. *California Missions and Their Romances*. Coward-McCann, Inc., New York.

prosperous missions in Alta California⁶. The mission community reached the pinnacle of its development around 1830, when it boasted an expansive and self-sufficient religious, residential, agricultural, and industrial complex. At its peak, mission resources included approximately 105,000 oxen, 20,000 horses, 40,000 sheep, 31,600 bushels of grain, and 500 barrels of wine and brandy⁷. The mission's productivity supported a winery, a lumber mill, carpentry and leather shops, a tile kiln, and facilities for the industrial production of hides, tallow, soap, leather, and tiles⁸. In the first quarter of the nineteenth century, the mission shipped an estimated \$20,000 to \$25,000 worth of hides and tallow, and nearly \$20,000 worth of soap annually⁹.

Documentary sources indicate that Chapman's Mill was constructed in the center of the *huerta* (garden and orchard) associated with the San Gabriel Mission. The *huerta* was established prior to 1783 and enclosed by a wooden wall by 1830¹⁰. The cultivated area was known as Bishop's Garden^{11 12}. The cultivated area was expanded south and east in 1809 with the planting of an innovative hedge of prickly pear cactus that enclosed 40 acres (16 hectares [ha]). The garden was enclosed by an adobe wall measuring 6 feet high and 2 feet wide sometime before 1852, and continued to be used into the early twentieth century. An 1855 surveyor's description lists among church property at San Gabriel "an orchard and garden, situated in front, and south of said Church, at a distance of some seventy or eighty feet from the same, as the same is enclosed with adobe walls and a fence, being the same which was long used by the Padres of said Mission"¹³. The San Gabriel garden may have contained vegetable plots, and a separate orchard area is depicted in its southwest corner on an 1854 map. The garden and orchard were watered by stone-lined irrigation ditches (*zanjas*), and probably produced a wide variety of grains, fruits, vegetables, spices, nuts, flowers, medicinal herbs, and other plants such as cotton, gourds, and tobacco.

The Mission Water System

Key to the success of the mission was the development of an extensive water conveyance system. During the initial settlement of the Spanish, water was taken directly from the *Rio de los Temblores* and other small creeks and springs in the surrounding plains¹⁴. Following the relocation of the mission to its current site in 1775, water was initially directed via an earthen ditch from a spring to the north for domestic and agricultural uses. The ditch passed between the dwellings of the padres and the neophytes before running

⁶ Rogers, Harrison G. Originally published 1826. "The Journals of Harrison G. Rogers." In *American Journeys Collection*. Wisconsin Historical Society Digital Library and Archives 2003. 197-271.

⁷ Sugranes, Eugene. 1909. *The Old San Gabriel Mission*. Self-published, Los Angeles, California.

⁸ Williams, Jack S. 2005. *A Phase One Archaeology Study of 400-412 West Mission Boulevard*. Prepared for Great Urban Places, Culver City, California. Center For Spanish Colonial Research, San Diego, California.

⁹ Rogers, Harrison G. Originally published 1826. "The Journals of Harrison G. Rogers." In *American Journeys Collection*. Wisconsin Historical Society Digital Library and Archives 2003. 197-271

¹⁰ Williams, Jack S. 2005. *A Phase One Archaeology Study of 400-412 West Mission Boulevard*. Prepared for Great Urban Places, Culver City, California. Center For Spanish Colonial Research, San Diego, California.

¹¹ Reid, Hiram A. 1895. *History of Pasadena*. Pasadena History Company, Pasadena, California.

¹² Webb, Edith Buckland. 1952. *Indian Life at the Old Missions: A Documentary History of San Gabriel Mission*. Libra Press, Limited, Hong Kong.

¹³ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

¹⁴ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

into the adjacent agricultural fields¹⁵. With the continued growth of the mission came an increasing demand for additional water sources, and to fill this need the padres looked to the hills to the north where water flowed abundantly. A small system of brush and dirt dams and unlined earthen ditches was developed to direct water from Mission Canyon and Wilson Lake to the mission settlement below^{16 17 18}.

Mission Gristmills

The system became more complex following the arrival of master masons and potters from Mexico in the 1790s, who were able to construct substantial structures with stone and fired tiles set in mortar¹⁹. This led to the construction of the San Gabriel Mission's first gristmill, which was constructed under the direction of Father José María de Zalvidea in 1816. The mill was a dramatic improvement over the manual grain processing via manos and metates that the mission had previously relied upon. It was built northwest of the mission at the confluence of two small arroyos in present-day San Marino. This facility, later known as *El Molino Viejo* (the Old Mill), was the first water-propelled gristmill in the state. After turning the mill's wheel, the water ran into a pond known variously as Mission Lake, Wilson Lake, and Kewen Lake (today's Lacy Park). The mill, constructed with sturdy adobe and volcanic tuff walls, suffered from a critical design flaw. The newly ground meal was dampened as it was produced by the water that powered the mill, necessitating a labor-intensive drying operation. Because of this inconvenience, the Old Mill was abandoned in favor of a new facility soon after its construction²⁰.

In September 1821, Governor Pablo Vicente de Solá ordered American Joseph Chapman to construct a mill at Mission San Gabriel²¹. Born in Ipswich, Massachusetts, sometime between 1788 and 1789, Chapman was educated as a young boy before becoming an apprentice to a Boston shipwright as a teenager²². By the time he was 20, Chapman was serving on a whaling ship headed to the Sandwich Islands (near Hawaii), where soon after his arrival he boarded a privateer (either willingly or by force) en route to California. Chapman was briefly captured and detained after a raid in Monterey in late November 1818, but was quickly reunited with the pirates before sailing south along the coast. During his imprisonment, Chapman was "astonished by the essential honesty and kindness of the Californians," and absconded from the pirates when they landed in Santa Barbara the following month²³.

Chapman was arrested, and as a prisoner set to work at the Mission Santa Inés. There, he won over the trust and loyalty of corporal Antonio Lugo, the governor, and the mission padres with his fierce work ethic, Christian beliefs, and ability to work and communicate with the Native Americans. While at Santa Inés in 1820, he engineered a fulling mill for the padres, using some elements of an existing mill.

¹⁵ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

¹⁶ Dryden, Gene. 2008. "Early Waterways in the San Gabriel Valley." *The Grapevine*. Spring 2008: 3-4.

¹⁷ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

¹⁸ Reid, Hiram A. 1895. *History of Pasadena*. Pasadena History Company, Pasadena, California.

¹⁹ Dryden, Gene. 2008. "Early Waterways in the San Gabriel Valley." *The Grapevine*. Spring 2008: 3-4.

²⁰ Cleland, Robert C. 1951. *El Molino Viejo*. The Ward Ritchie Press, San Francisco, California.

²¹ Bancroft, Hubert Howe. 1886. *History of California, Volume III 1825-1840*. The History Company Publishers, San Francisco, California.

²² Sweet, Irene and Cynthia L. Bradshaw. 1989. *The Californians*. Sweet and Associates, Teasdale Utah.

²³ Scott, Paul T. 1956. "Why Joseph Chapman Adopted California and 'Why California Adopted Him.'" *The Historical Society of Southern California Quarterly* 38(3):239-246.

Completed in 1821, the New England-type mill was a significant improvement from the Spanish style that had been in place, and could be adjusted to grind both corn and wheat²⁴. New England mills were different from Spanish-type mills in that they were made with vertical water wheels. The wheels generated power by turning wooden gears that provided quiet and efficient power, and helped turn the grinding stones. The teeth on the gears were easy to create, replace, and maintain. Obtaining and maintaining the grinding stones was more complex and difficult considering the weight of such stones. They required weekly resharpening and occasional leveling²⁵.

Pleased with the Santa Inés mill, Governor Solá sent Chapman to the San Gabriel Mission to construct a similar mill later that year. As he had at Mission Santa Inés, Chapman used existing infrastructure for the foundation of his new mill and its millrace. Archaeological data indicate that his San Gabriel mill used the walls of two earlier water reservoirs to frame its foundation, and he situated the mill in the center of the garden to take advantage of pre-existing water lines. Completed in 1823, it came to be called Chapman's Mill. It stood about 246 feet south of the mission and featured a 13.5-foot-diameter undershot waterwheel housed in a masonry chamber that drove large millstones in a separate gear room. Chapman dug the wheel pit low into the ground to gain as much power from the rushing water as possible, and created high-foundation walls to keep water out of the mill itself to avoid humidity. The grinding stones were made of either granite or syenite boulders from the Santa Anita canyon, and were roughly 3.5 feet in diameter and about one foot thick²⁶.

In addition to constructing the mill itself, Chapman improved the water system in several key locations to increase the power of the mill's water supply. He constructed a new stone and mortar dam at the lower end of Mission Lake, approximately 1.9 miles northwest of the mill; this was coupled with another dam now referred to as *La Presa*, which still stands on the property owned by the Sunny Slope Water Company approximately 2.5 miles) northeast of the mission church^{27 28 29}. He brought water to the new mill from the Mission Lake and La Presa dams; each forced water into a narrow channel, thus increasing its rate of flow. Zanjias from these two sources joined together about a tenth of a mile northwest of the mill, next to the mission quadrangle and across *El Camino Real* (the Royal Road), California's principal north-south roadway. To move the water from that point to the mill while minimizing the disturbance to El Camino Real, a large S-curve was needed. To contain the high volume of water, Chapman engineered a robust masonry millrace, with a broad channel and high sides.

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²⁴ Webb, Edith Buckland. 1952. *Indian Life at the Old Missions: A Documentary History of San Gabriel Mission*. Libra Press, Limited, Hong Kong.

²⁵ Hamilton, Edward P. 1964. *The Village in Early New England*. Meriden Gravure Company. Meriden, Connecticut.

²⁶ Reid, Hiram A. 1895. *History of Pasadena*. Pasadena History Company, Pasadena, California.

²⁷ Cleland, Robert C. 1951. *El Molino Viego*. The Ward Ritchie Press, San Francisco, California.

²⁸ Engelhardt, Zephyrin. 1927. *San Gabriel Mission and the Beginning of Los Angeles*. Mission San Gabriel, San Gabriel, California.

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Williams, Jack S.

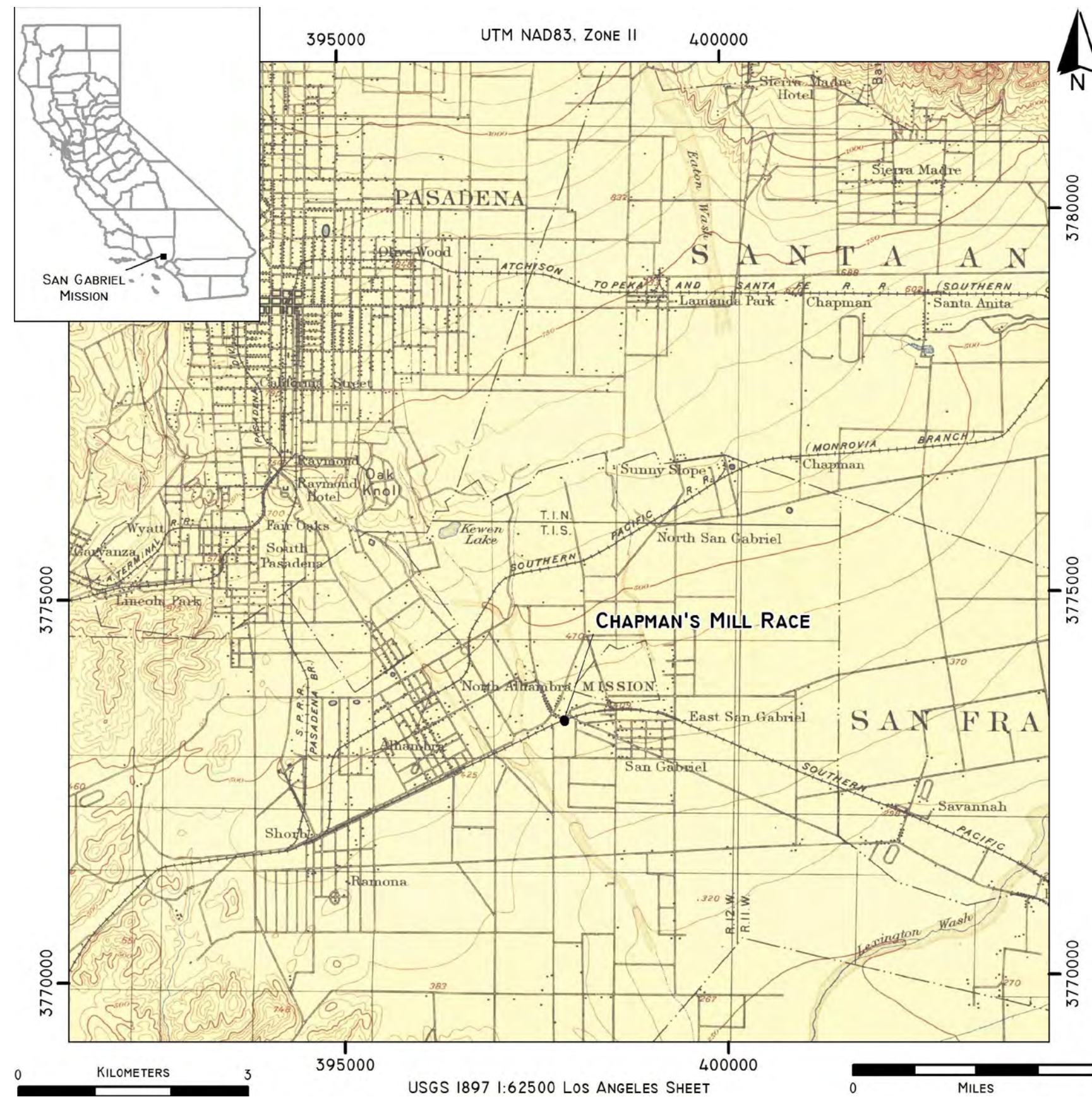
2005 *A Phase One Archaeological Study of 400-412 West Mission Boulevard*. Prepared for Great Urban Places, Culver City, California. Center for Spanish Colonial Research, San Diego, California.

CHAPMAN'S MILL AND MILLRACE

Chapman's Mill
Built 1822-1825 by Joseph Chapman
at
Mission San Gabriel Arcángel
founded Sept. 8, 1771

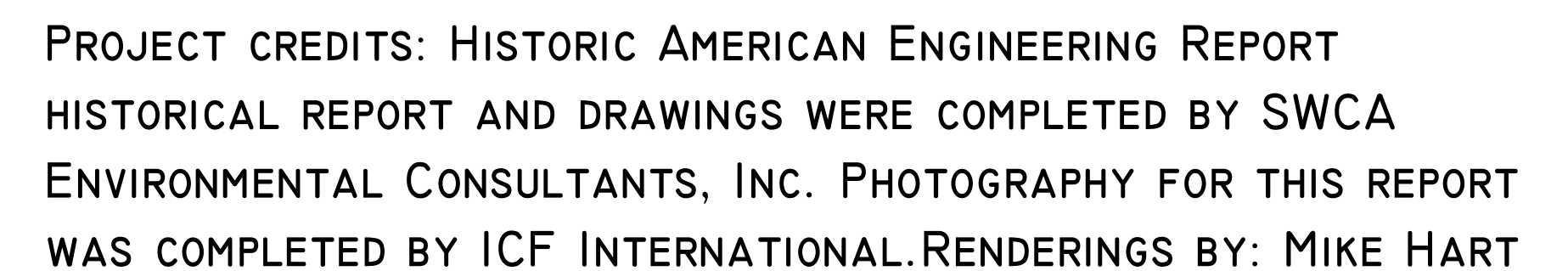
THE FIRST PERMANENT
EURO-AMERICAN SETTLEMENT IN
LOS ANGELES COUNTY CAME WITH
THE FOUNDING OF THE FOURTH
ALTA CALIFORNIA MISSION,
MISSION SAN GABRIEL ARCÁNGEL
(THE SAN GABRIEL MISSION) ON

KEY TO THE SUCCESS OF THE AGRICULTURAL ACTIVITIES, AND THE MISSION ITSELF, WAS THE DEVELOPMENT OF AN EXTENSIVE WATER CONVEYANCE SYSTEM. A SMALL SYSTEM OF BRUSH AND DIRT DAMS AND UNLINED DITCHES WAS DEVELOPED TO DIRECT WATER FROM MISSION CANYON TO THE MISSION SETTLEMENT BELOW. THE SYSTEM BECAME INCREASINGLY COMPLEX FOLLOWING THE ARRIVAL OF MASTER MASONS AND POTTERS FROM MEXICO IN THE 1790S, WHO WERE ABLE TO CONSTRUCT SUBSTANTIAL STRUCTURES WITH STONE AND FIRED TILES SET IN MORTAR. THIS LED TO THE CONSTRUCTION OF THE SAN GABRIEL MISSION'S FIRST GRISTMILL IN 1816 (KNOWN AS EL MOLINO VIEJO, IN SAN MARINO).



IN SEPTEMBER 1821, GOVERNOR PABLO VICENTE DE SOLÁ ORDERED AMERICAN JOSEPH CHAPMAN TO CONSTRUCT A REPLACEMENT GRIST AT MISSION SAN GABRIEL. COMPLETED IN 1823, THE NEW ENGLAND-STYLE MILL WAS A SIGNIFICANT IMPROVEMENT FROM THE OLDER SPANISH-STYLE MILL, BEING LOCATED CLOSER TO THE MISSION AND SOLVING THE FLAWS OF ITS PREDECESSOR. CHAPMAN'S MILL REPORTEDLY FEATURED A 13.5-FOOT-DIAMETER UNDERSHOT WATERWHEEL HOUSED IN A MASONRY CHAMBER THAT DROVE LARGE MILLSTONES IN A SEPARATE GEAR ROOM. CHAPMAN DUG THE WHEEL PIT LOW INTO THE GROUND TO GAIN AS MUCH POWER FROM THE RUSHING WATER AS POSSIBLE AND CREATED HIGH FOUNDATION WALLS TO KEEP WATER FROM MILL MECHANISM AND GRAIN. A POWERFUL FLOW OF WATER WAS DIRECTED TO THE MILL THROUGH A MASONRY MILLRACE. THE MILLRACE CONSISTED OF TWO WALLS THAT CONTAINED THE WATER FLOW AND A RACEWAY

THE STANDING RUINS OF CHAPMAN'S MILL WERE DEMOLISHED IN 1941, BUT NOT BEFORE IT WAS THE SUBJECT OF TWO EXCAVATIONS/STUDIES IN 1894 AND 1934. SWCA ENVIRONMENTAL CONSULTANTS ARCHAEOLOGISTS EXCAVATED THE REMAINING MILL AND MILLRACE FOUNDATIONS BETWEEN 2009 AND 2012.

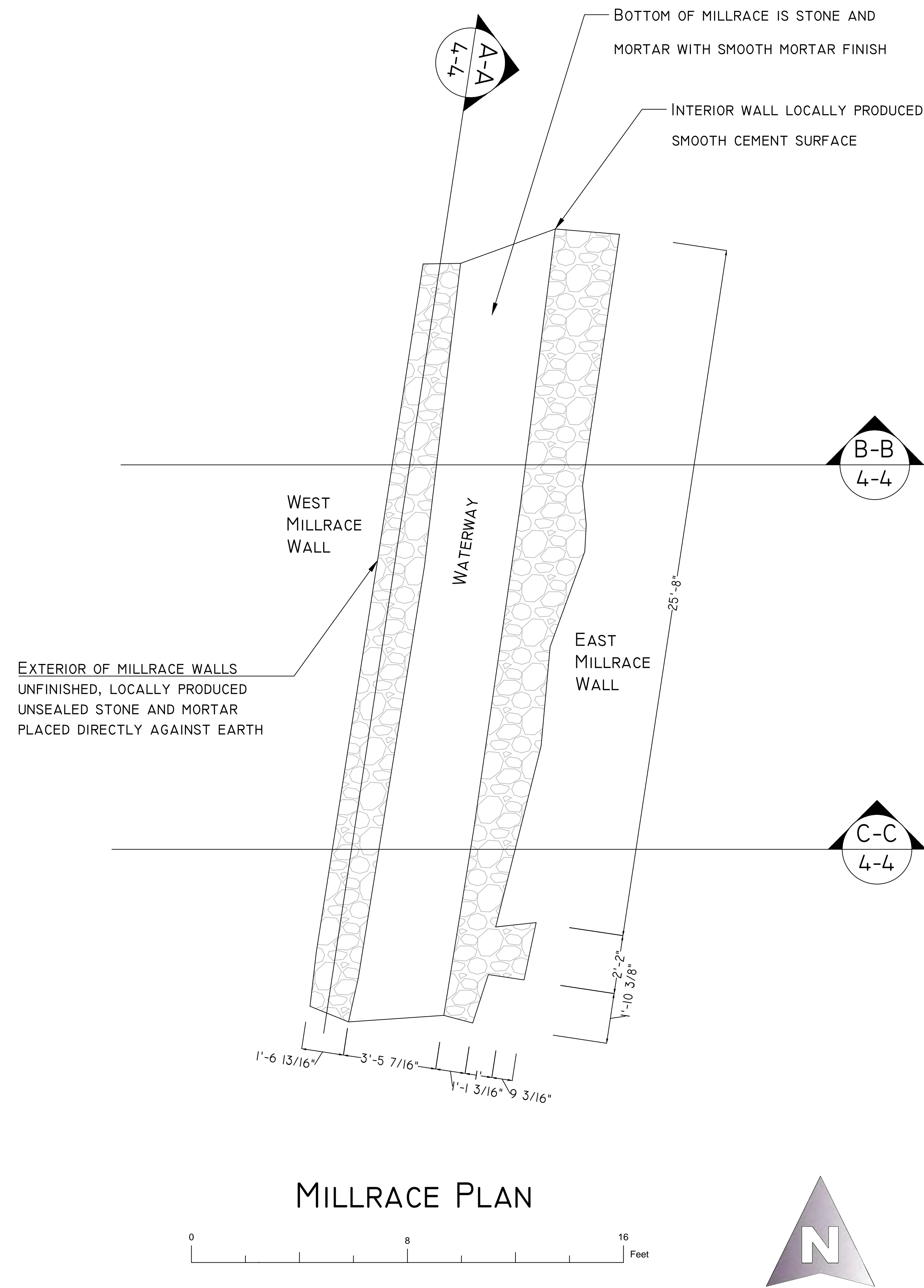


CHAPMAN MILLRACE
RELOCATION PROJECT
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

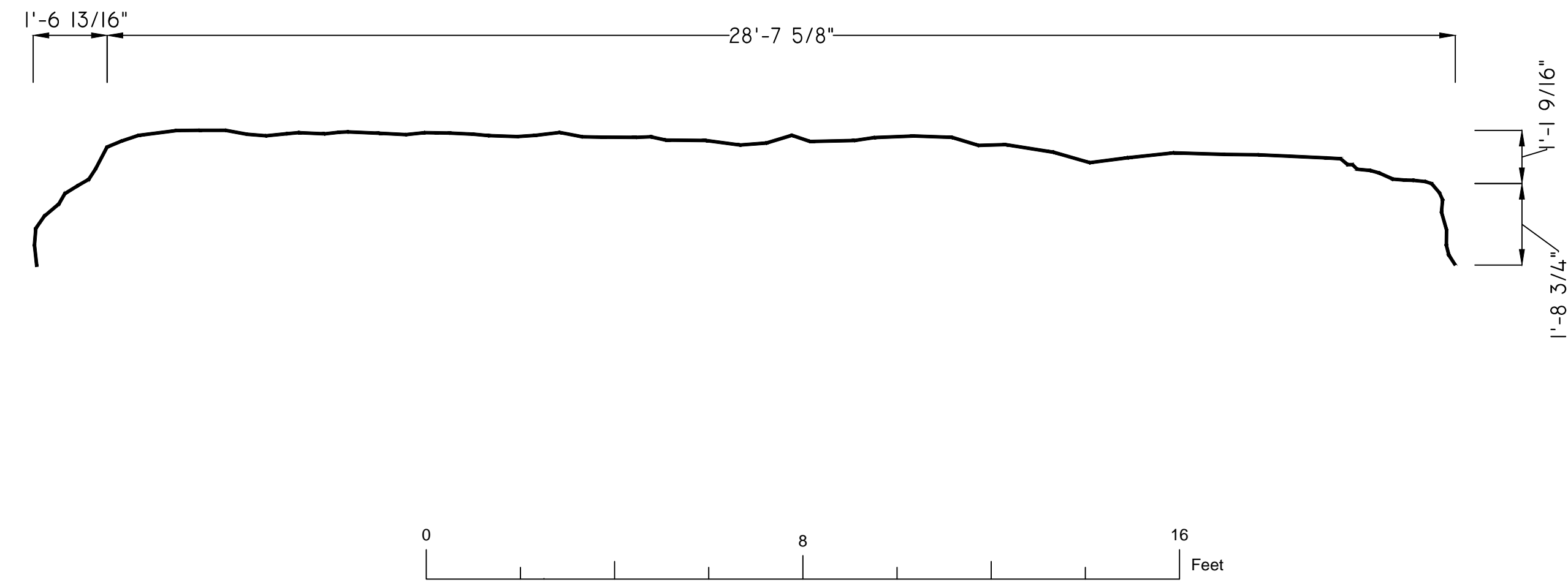
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CHAPMAN'S MILLRACE
438 SOUTH MISSION DRIVE
LOS ANGELES COUNTY

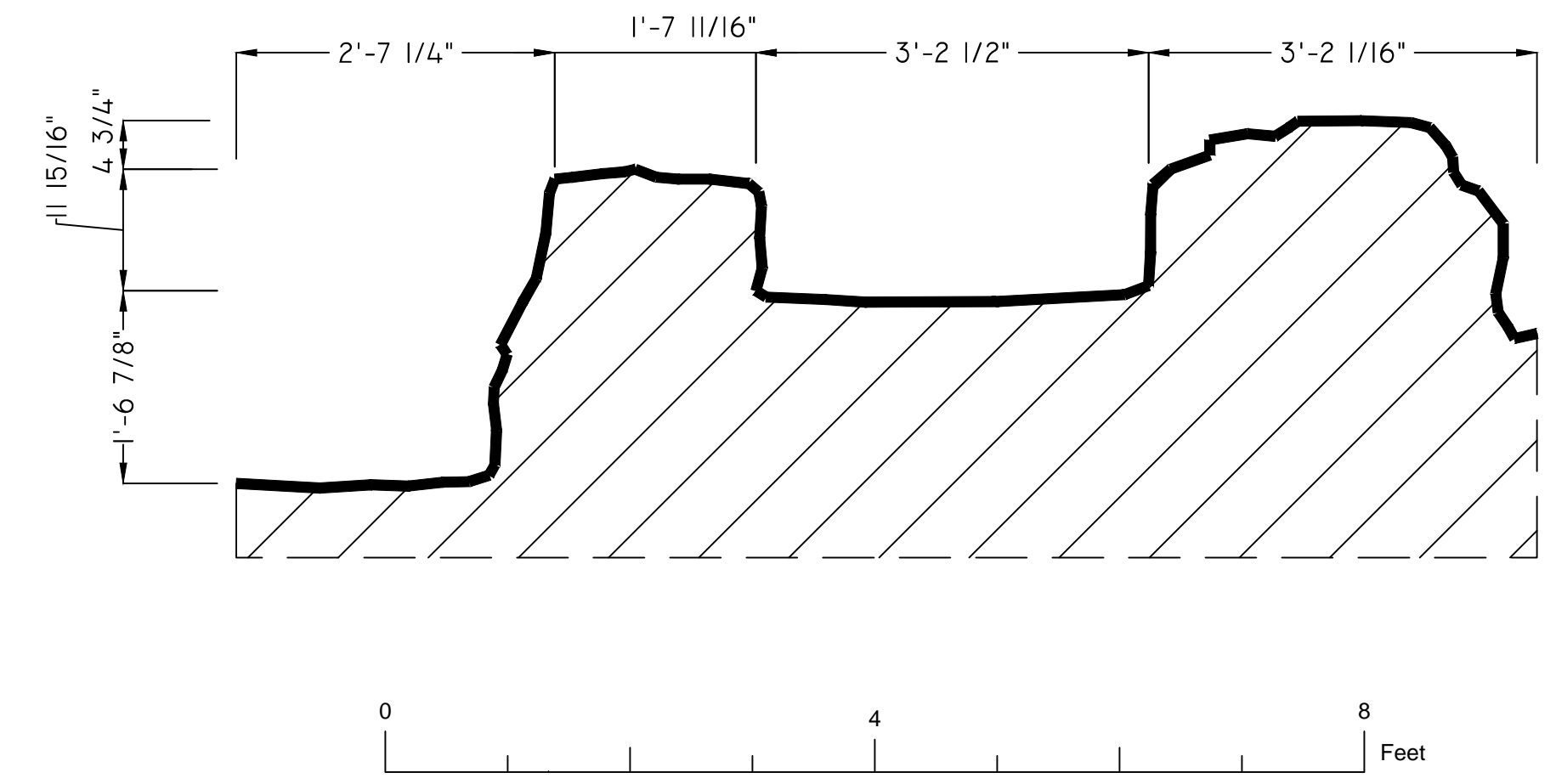
CHAPMAN'S MILLRACE



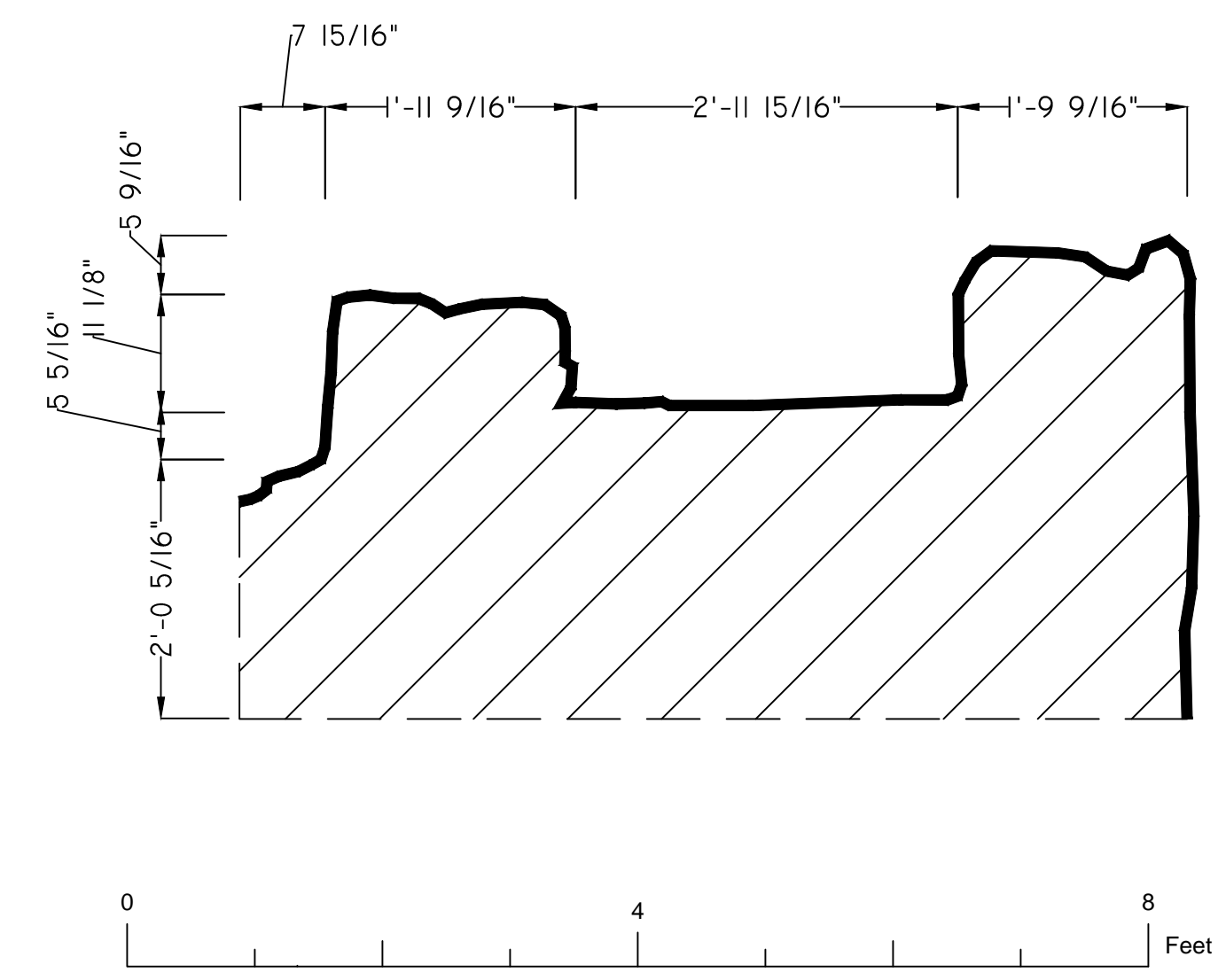
SECTION A-A



SECTION B-B



SECTION C-C



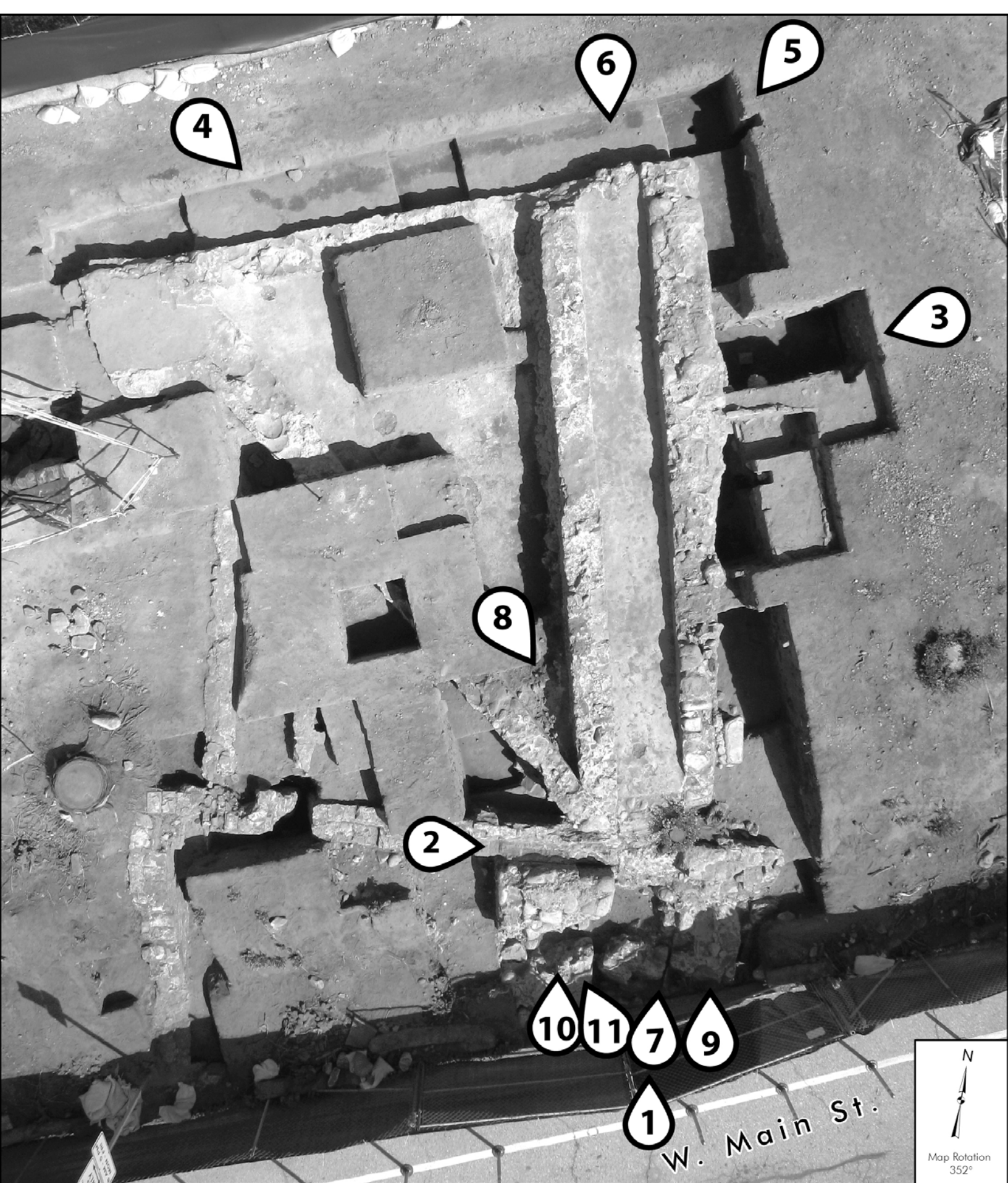
CHAPMAN'S MILLRACE
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Los Angeles County
California

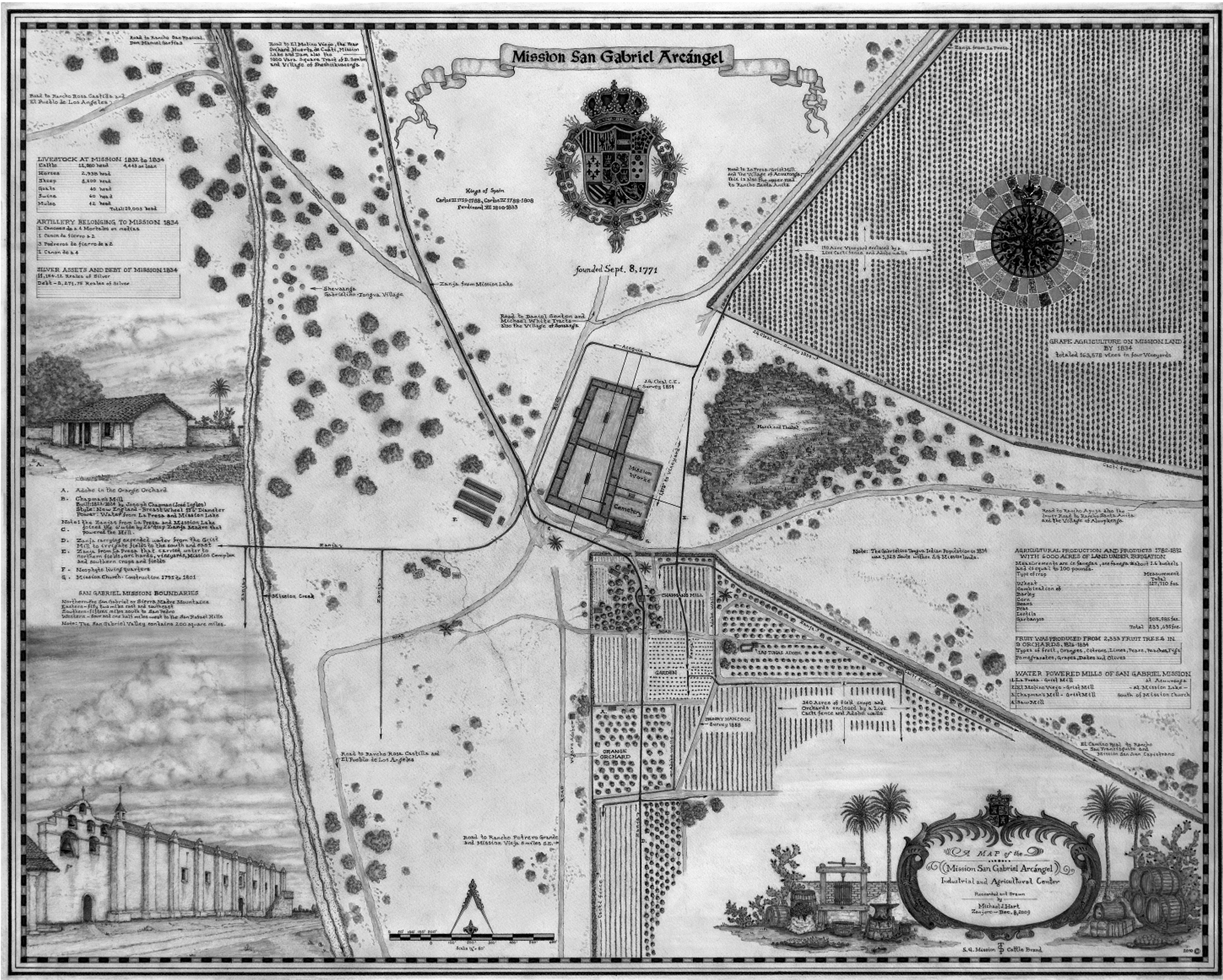
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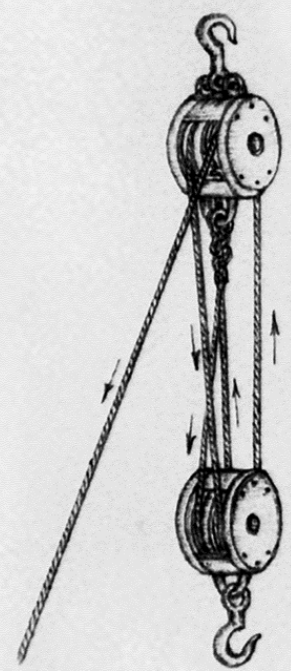




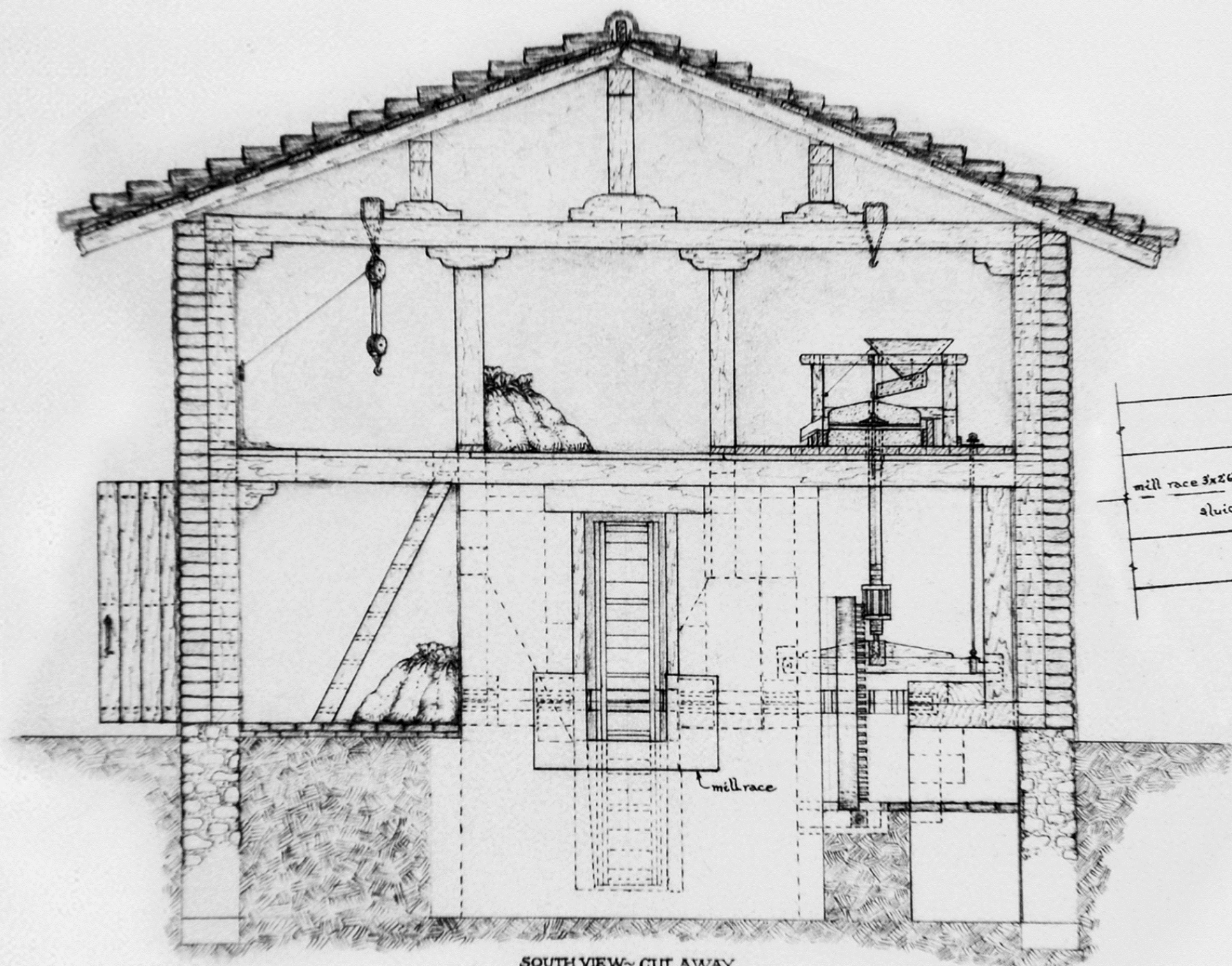
Chapman's Mill
Built 1822-1825 by Joseph Chapman
at
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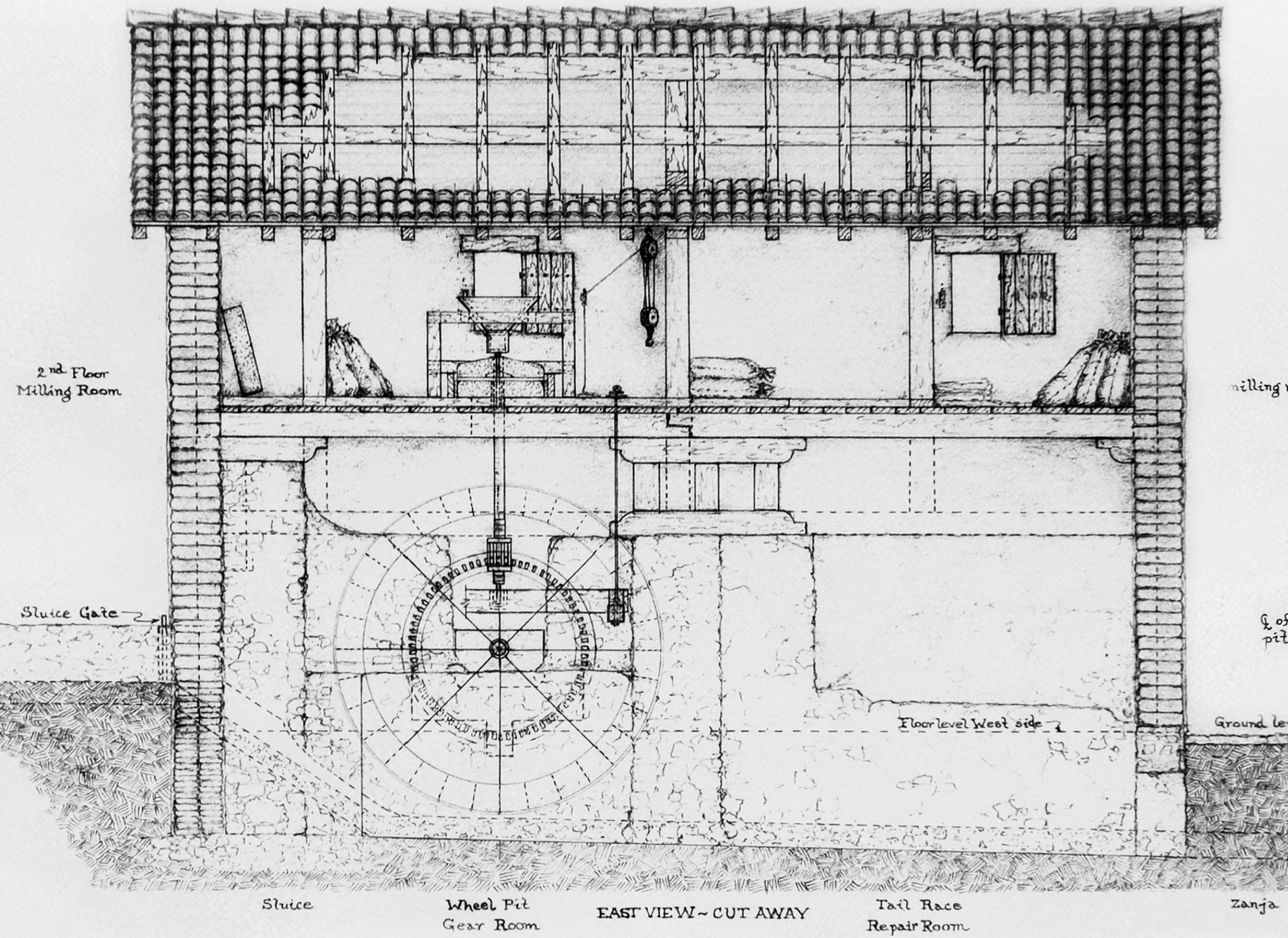
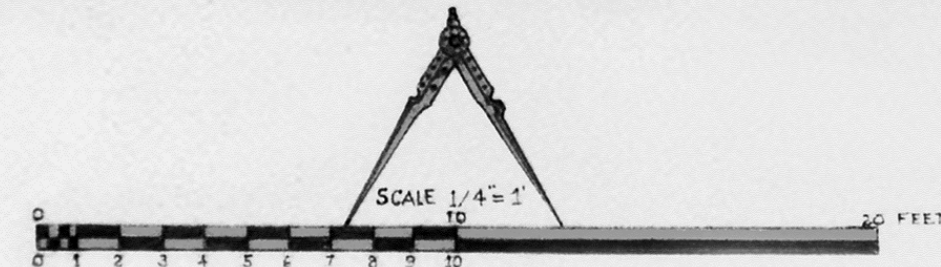
"TYPICAL"
DOUBLE PULLEY BLOCK
HOIST



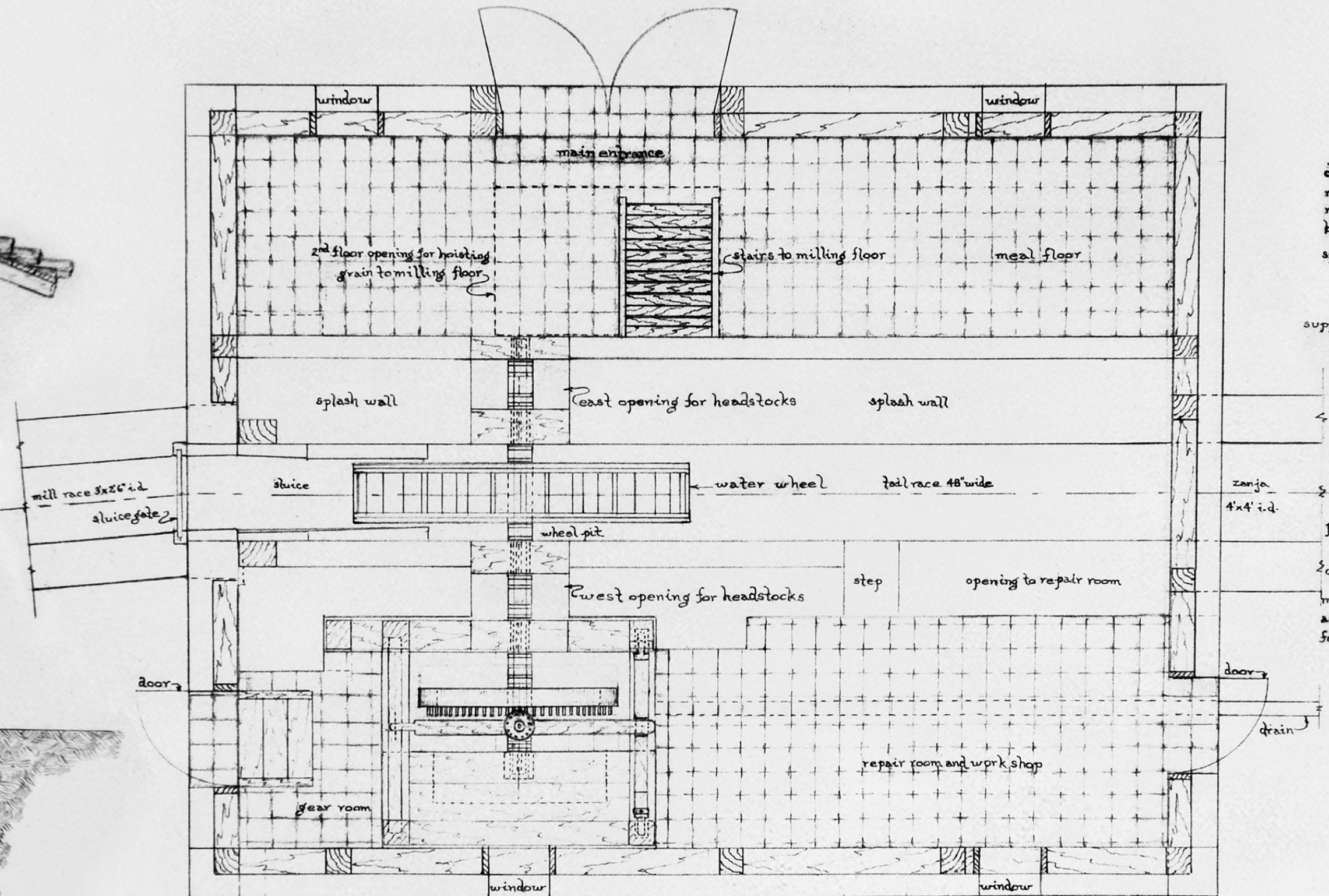
- DIMENSIONS**
- | | |
|---|---|
| 1 North end of building - height above ground level - 27'6" | 6 South end of building - 33'0" wide |
| 2 South end of building - height above ground level - 30'0" | 7 Water Wheel 13'6" diameter by 2'6" wide - estimate by J.M.M. in 1934. |
| 3 East side of building - 45'8" long | 8 Pit Wheel or Gear Wheel approx. 8' in diameter |
| 4 West side of building - 45'8" long | 9 Mill Stones 3'6" in diameter |
| 5 North end of building - 33'0" wide | |



SOUTH VIEW - CUT AWAY



EAST VIEW - CUT AWAY

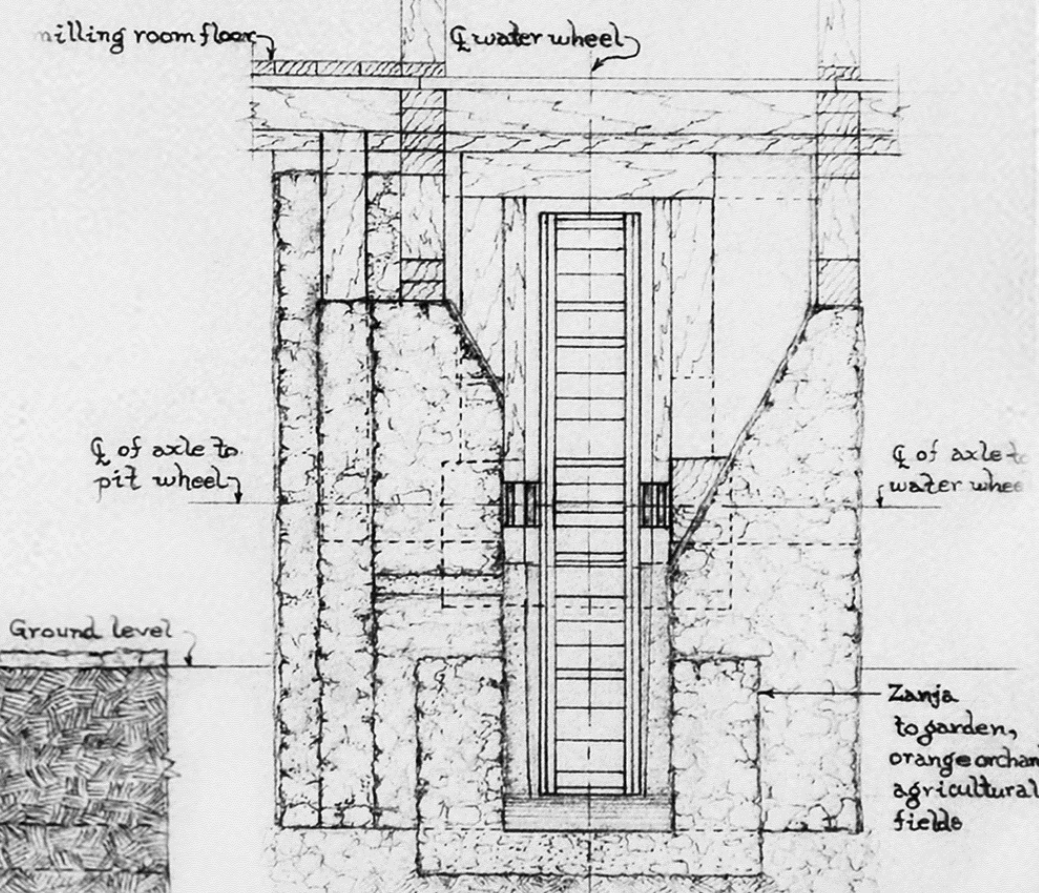


TOP VIEW - BOTTOM FLOOR

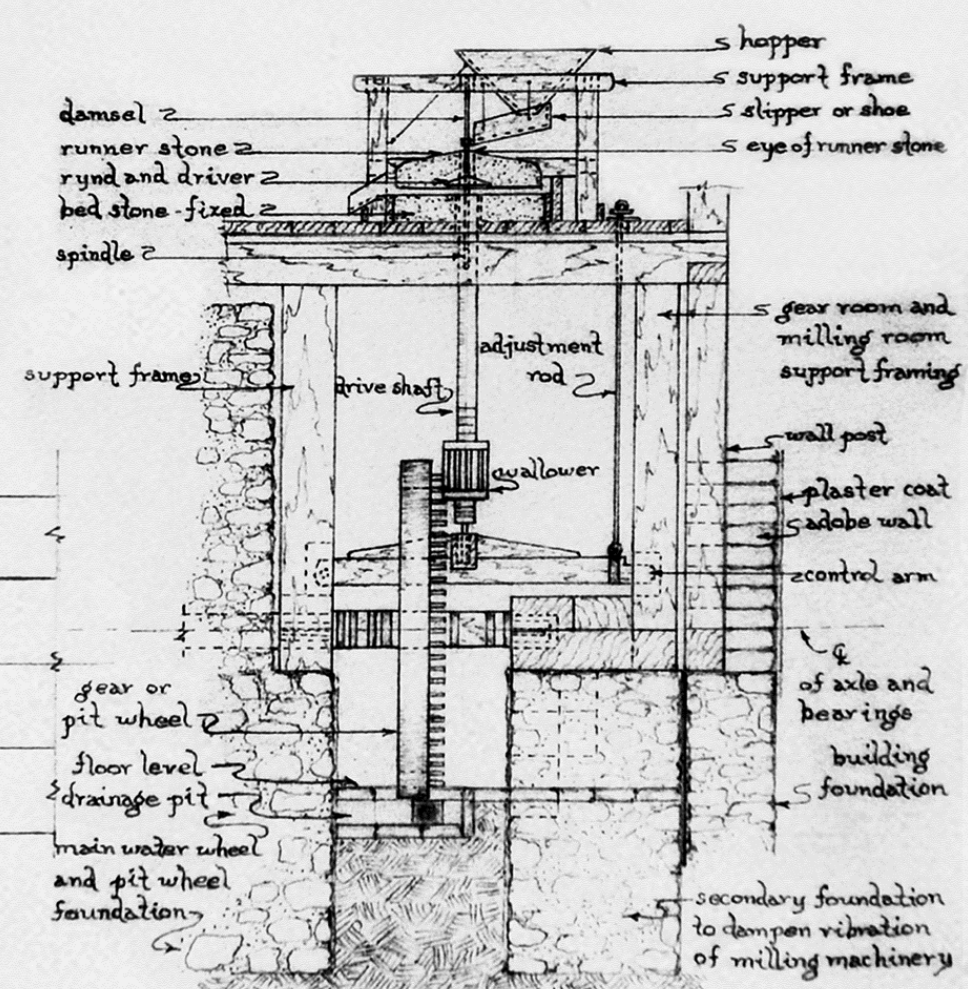
- EXPLORATION AND DOCUMENTATION HISTORY**
- 1 De Hiram A. Reid - excavation - documented in the History of Pasadena, 1895
 - 2 Edith Webb, J. Marshall Miller - excavation - photographic documentation limited measurements taken by J.M.M. - material presented to M.H. Hart by Dr. Norman Nevins Aug. 1930
 - 3 SWCA - John Dietler, ELL - RPA - archaeological excavation - Dec. April 2012
 - 4 M.H. Hart - measurements - photos at SWCA dig - March and April 2012

MILL OPERATION

- 1 Power Supply - water brought by zanja from the east and west north of the Raymond Fault line. This water was channelled into the mill race to the sluice gate which controlled the volume of water flowing under the water wheel.
- 2 The 13'6" water wheel rotated at a controlled speed of 10 rpm. This vertical rotation is transferred by a horizontal axle to the pit wheel.
- 3 The Pit Wheel rotates vertically on the same axle as the water wheel.
- 4 Wallower - This is a gear that is rotated horizontally by engaging rods protruding out from the gear wheel.
- 5 Drive Shaft - is rotated together with the wallower.
- 6 Spindle - is fitted to the upper end of the drive shaft.
- 7 Mill Stones are 3'6" in diameter and are connected to the spindle by the rynd and driver - runner stone turns at 120 rpm.



NORTH VIEW - THROUGH ZANJA, TAIL RACE AND INTO WHEEL PIT



SOUTH VIEW - GEAR ROOM AND MILLING MACHINERY

