HISTORICAL AND ARCHAEOLOGICAL PATTERNS OF WATER USE IN SAN DIEGO COUNTY: A CASE STUDY OF THE WHALEY HOUSE CISTERN/WELL

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by
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ABSTRACT OF THE THESIS

Historical and Archaeological Patterns of Water Use in San Diego County: A Case Study of the Whaley House Cistern/Well

by

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Master of Art in Anthropology
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This thesis examines the historical and archaeological patterns of water use in San Diego County. It then situates the recently excavated Whaley House cistern/well in temporal, spatial and formal context. The Whaley House, located in Old Town San Diego, is well known for being the first two-story brick structure in Southern California. The Whaley House cistern/well has been the subject of archaeological investigations for the past four years. Research on the cistern/well and its fill will offer insight into the Whaley family and San Diego County’s water use. In addition, a comparative analysis of various well and cistern structures prevalent in San Diego during the 19th and 20th centuries will be conducted in order to determine if and how the Whaley cistern/well corresponds with historical San Diego County water use patterns. This study evaluates the normalcy of the Whaley House cistern/well by comparing it with historical photographs, site records, and reports of archaeologically excavated historical wells and cisterns.
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CHAPTER 1
INTRODUCTION

Archaeological excavations have been undertaken every summer since 2007 at the Whaley House site in Old Town San Diego. The excavations have mainly focused on the 19th-century Whaley House cistern/well structure. One of the prevailing questions concerning the structure is whether it is a cistern or a well. Cisterns are reservoirs, tanks, or containers for storing water (Mallios 2009:12). Wells are holes dug into the ground with the purpose of reaching groundwater (Mallios 2009:12). Investigation of the Whaley cistern/well has included compiling historical documents associated with the Whaley family and archaeological excavation at the Whaley house site. The results of this research are documented in *The Whaley House Historical Archaeology Project* (Mallios 2008, 2009, 2010). These annual technical reports detail the progress of the project. Based on excavations, the Whaley House cistern/well has proved to be quite unusual because it is not a straightforward or simple water supply structure.

This thesis examines the normalcy of the Whaley House cistern/well by comparing it with historical documentation, photographs, site records, and reports of archaeologically excavated historical wells and cisterns found in San Diego. Before examining the Whaley House cistern/well in further detail, questions relating to San Diego County’s historical water use must be addressed first. The first set of questions is specific to the comparative analysis of wells and cisterns in San Diego County. These questions are:

- What are the historical and archaeological San Diego patterns for wells and cisterns?
- What materials were commonly used to construct the wells and cisterns?
- Do the construction materials vary in relation to location?
- Do we see a change in structure or location due to different time periods?
- What are the reasons behind the San Diego pattern?

The second set of questions deals specifically with the Whaley House well and how it fits into San Diego’s water use pattern.

- Is the Whaley House water source a well or a cistern?
How does the Whaley House well or cistern fit into the San Diego Pattern?
How did the Whaley House water source change over time?

The methodology I employed to obtain answers to these questions is described in further detail in the Methodology chapter (Chapter 6). In brief, in order to answer the first set of questions, I conducted an archaeological site record and report search at the South Coastal Information Center (SCIC). I also contacted Cultural Resource Management Firms (CRM) in San Diego County inquiring about archaeologically excavated historical wells and cisterns in the county.

In addition to my archaeological site record and report search, I searched the Journal of San Diego History and the San Diego History Center for historical documentation on San Diego wells and cisterns. I also went to the Mormon Battalion Museum in Old Town San Diego to find historical information on wells after learning that the Mormon Battalion had once been involved with well digging in the mid-1800s.

Chapter 2 of this thesis provides the general history of San Diego County’s water use. Chapter 3 outlines the potential theoretical basis for this current study. The theories of historical particularism, structuralism, and environmental anthropology will be discussed in further detail in order to demonstrate how they may be applied to San Diego County’s historical water use pattern and to the Whaley House cistern/well.

Chapter 4 provides information on various well structures from different parts of North America. Chapter 5 discusses various cistern structures in the nation. Chapter 6 describes the research methodologies employed in developing this thesis. Chapter 7 presents descriptions of various archaeologically excavated historical wells and cisterns in San Diego County (see Figure 1). Chapter 8 is the analysis and will reveal general findings. Chapter 9 will be the analysis of the Whaley House cistern/well. Chapter 10 discusses which theories mentioned in Chapter 3 is applicable to this thesis. The theories will help explain the reasoning behind the San Diego water use patterns. Chapter 11 will present a summary and conclusion.
Figure 1. Overview map of project area.
CHAPTER 2

BACKGROUND

The geology of San Diego County varies from region to region.

**GEOLOGICAL DESCRIPTIONS OF SAN DIEGO REGIONS**

According to the geologic map of San Diego, downtown San Diego (see Figure 2) is characterized by old paralic deposits, Unit 6 (Qop6) and young alluvial flood plain deposits (Qya; California Department of Conservation 2005). The geologic map describes Qop6 as “poorly sorted, moderately permeable, reddish-brown, inter-fingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate” (California Department of Conservation 2005). Qya is described as being “mostly poorly consolidated, poorly sorted, and permeable flood plain deposits” (California Department of Conservation 2005).

The Old Town region (see Figure 2) of the county is classified as Very old paralic deposits, Unit 10 (Qvop10). The region is “mostly poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate” (California Department of Conservation 2005).

The geologic map of San Diego characterizes the rural regions (see Figure 3) of San Diego as young alluvial flood plain deposits (Qya); metasedimentary and metavolcanic rocks undivided (MzU), and the Otay Formation (To) (California Department of Conservation 2005). MzU is described as “low-grade metasedimentary rocks (conglomerate, sandstone and siltstone) interlayered and mixed with metavolcanic rocks consisting of flows, tuffs and volcaniclastic breccias” (California Department of Conservation 2005). The To formation consists of “light-gray and light-brown, medium-and coarsegrained, nonmarine arkosic sandstone intertongued with light-brown siltstone and light-gray claystone” (California Department of Conservation 2005).

Each of the three regions varies from one another geologically. Downtown and Old Town San Diego are both located in moderately permeable regions of the county. The rural
regions of San Diego are less permeable than downtown and Old Town San Diego due to the higher concentration of clay.

**Prehistory of San Diego Water Use**

Spanish missionaries gave the term “Diegueno” to the Kumeyaay of San Diego County in 1542 (Luksic and Kendzorski 1999:191; Mills 1967:4, 1968:4). Although many San Diegans continue to use the term “Diegueno” today; there is prehistoric significance to the name. Linguists, historians, and anthropologists have labeled those groups north of the San Diego River as Tipai and those south and Baja California as Ipai (Carrico 1983:87). The Tipai and Ipai are distinguished north and south by their Kumeyaay dialects (Mills 1967:4). These terms replace and may be synonymous with the terms Northern Diegueno and Southern Diegueno. The Tipai and the Ipai groups avoid using the term Diegueno because it is a term given to them by the Spanish (Carrico 1983:87; Mills 1967:4, 1968:4). According to Carrico (1983:87), “several local reservation groups and individuals have formed a cultural
and political group called the Kumeyaay Inc. The Kumeyaay group and anthropologists have urged that the term Kumeyaay be used rather than Diegueno.” Myra Masizl-Zamora states that the “Native American groups that are commonly recognized in San Diego County are: the Luiseno (located in the northern part of San Diego County) and the Kumeyaay” (personal communication, May 5, 2010). Numerous bands and clans, like the Tipai and Ipai, exist within the Kumeyaay group (Carrico 1983:86-87; Mills 1967:4, 1968:4).

Water greatly impacted Kumeyaay settlement patterns. For thousands of years before contact with Spanish missionaries, Kumeyaay families were located along the coast and the inlands of San Diego County. Dwellings of Kumeyaay familial and clan groups were gathered together in villages whose population reached into the hundreds. They populated areas within valleys, such as San Diego River area, due to the existence of trees, animals and most importantly water. The Kumeyaay and Luiseno practiced their various land management techniques in the foothills, the canyons, the river bottoms, basins, and marshes

Figure 3. Geological map of northern San Diego.
Luomala posits that “a campsite was selected for access to water, drainage […] and abundant flora and fauna of that ecological niche” (Sturtevant 1978:597). The Kumeyaay possessed a flexible agricultural practice which, depending on rainfall and the location of a water source, allowed them to move from coastal shores to coastal valleys and foothills (Shipek 1981:296). They commonly used pottery as a means for the storage and transportation of water and food (Mills 1967:4-6, 1968:4).

**General History of San Diego Water Use**

Across the United States, people living in large cities need an ample water supply in order to maximize opportunities for commerce, recreation, and most importantly to ensure drinking water for the population (Sholders 2002:60). San Diego County includes 4,200 square miles and is a semiarid section of the United States (Hill 2002:49; Sholders 2002:60). As a result of its aridity, San Diego County’s history has been greatly influenced by the issue of attaining a reliable water source (Hill 2002:49). During San Diego County’s historical water use, people obtained water for the County either by reservoirs, such as ponds and lakes, or from groundwater wells, which suppliers brought water in buckets, by wagon, to the consumers (Coutemanche 1982:5). Mountain streams and other natural water resources located within San Diego County provided only a limited and variable water supply (Sholders 2002:60). Sholders maintains that “in San Diego County, natural streams and lakes are very small, compared to other large cities, and most are in the coastal range many miles from the metropolitan area” (2002:60).

Summers and years of low rainfall severely restrict the amount of water available for drinking, agriculture and other important activities (Hill 2002:48). Sholders states that “the average annual rainfall on the County’s coastal plain over the last 150 years is about 10 inches” (2002:60). Due to little rainfall the agricultural area is continuously dependent on irrigation. Reservoirs have been constructed to store water for use during the dry periods to aid in the variable water supply. Only a few watersheds have reliable groundwater and they only supply a small percentage of water needed for the County’s large agricultural producers (Sholders 2002:60). In order to support the large population, San Diego County today
imports about 80 to 90 percent of its water from the Colorado River (City of San Diego 2010).

San Diego City planners have responded to San Diego County’s semi-arid environment by constructing dams in order to create a viable water source that can support a growing city. Hill maintains that “in a semi-arid environment, dams serve two purposes. Water for such needs as drinking, cooking, and agriculture are essential and require the dedication of resources and the creation of infrastructure to allow an adequate annual supply. Additionally, dams provide flood control in an area prone to unpredictable rainfall” (2002:49). Dams have been constructed in the foothills to collect winter runoff from the higher elevations of the coastal slope; they also prevent the water from infiltrating into the groundwater basins and ending up in the ocean (Hill 2002:49).

**Mission Period (1769 to 1834)**

In San Diego there is a direct correlation between the amount of water available and the number of people in an area. During San Diego’s Mission Period, from 1769 to 1834 (Sholders 2002:60-61), the Kumeyaay and Luiseno are the two Native American groups that resided in San Diego County. The Kumeyaay during the Mission Period relied on San Diego’s natural water supply. They migrated toward the coast during periods of ample rain and retreated toward the mountains when the weather was dry for an extended time (Hill 2002:49). According to Hill, “estimates place the Native (Native American) population in the County just prior to 1850 at 2,000 to 5,000 people. This provides an indication of the population that could be sustained without manmade water resource facilities” (2002:49).

The Spanish established the San Diego Mission and the Presidio in 1769. In 1773, the Spanish missionaries moved the San Diego Mission away from the Presidio and up the San Diego River about three miles to its present location, in today’s Mission Valley, in order to be closer to a reliable water source that would better support agricultural fields (Hill 2002:50, Smith and Greene 2007:3.0-3). The San Diego missionaries made several attempts to obtain a good and reliable water source. The first attempt was to dig wells in the gravels of the San Diego River. Later efforts to obtain a good water supply included the construction of ditches with sand and brush diversion dams, and the storage of water in small reservoirs and cisterns (Sholders 2002:61). However, a viable water supply was difficult to establish. Due to the
scarcity of water, the missionaries found it necessary to construct the Padre Dam (Old Mission Dam) at Mission Gorge. Dam builders completed the Padre Dam in 1816. The dam brought water to the mission and the mission lands through the use of the Padre Dam flume, an open artificial water channel that led water from a diversion dam (Hennessey 1978:36; Hill 2002:50; Sholders 2002:59).

**California Period (1835 to 1885)**

Sholders (2002) describes the California Period, from 1835 to 1885, as a period during which San Diegans failed to create a reliable water supply for San Diego County (60-61). From 1834 to 1872, most of the water obtained for San Diego County came from hand dug wells and trucked water (Clowery-Moreno and Smith 2005:1.0-2). These were the only sources of fresh water in downtown (New Town) San Diego (Sholders 2002:61; Smith and Greene 2007:3.0-5). Coutemanche (1982) argues that people in “small communities of the county had no control over how the water was distributed or how much they could obtain” (5). A problem with water being brought in from a purveyor was that the cost of water was high since private control of the water supply left the issue of distribution up to those who owned it (Coutemanche 1982:22; Russell 1975:5). People had to pay a good price for the little amount of water that was actually being delivered (Smith and Greene 2007:3.0-5). Regular suppliers brought water in horse-drawn wagons and barrels from the San Diego River and sold it for as much as twenty-five cents a pail (Melbourne 1986:255; Schaefer 2009b:20). It was not until 1873 when the first planned development of water started with the incorporation of the San Diego Water Company. At its inception, the San Diego Water Company continued to pump water from wells and distributed the water to the public in San Diego (Sholders 2002:60). However, many people who lived in downtown San Diego did not view the water supply from the wells as quality drinking water (Melbourne 1986:255). Sullivan maintains that consumers usually considered well water to be bad tasting and brackish (1985:15).

San Diego City planners drilled a well during the mid 1870s in the City Park (Balboa Park). They thought that the drilled well along with two reservoirs were capable of supplying enough water for the growing population of San Diego (Smith and Greene 2007:3.0-7). However, the City Park well and reservoirs were not sufficient in supplying water to the city.
Before the installment of a municipal water system in the late 1800s, households in downtown San Diego not only contracted for water deliveries but also dug their own wells and cisterns or piped water from other wells for a fee (Schaefer 2009b:20). In 1869, Alonzo Horton built a commercial well on 8th Street between E and F Streets (Schaefer 2009b:20). Wells located on the property of wealthy citizens were marked by windmills and water towers (Schaefer 2009b:20; Sullivan 1985). Windmills serve the purpose of pumping water out of wells either to supply residents with water or to move water from wells to cisterns for storage (Wolfe 2010:13). Privately owned wells existed until public demand caused water to be piped in from the San Diego River (Sullivan 1985). San Diegans began abandoning the use of wells and cisterns in the late 1870s to about the mid 1880s in downtown San Diego due to the installment of a piped water system (Smith and Greene 2007:3.0-7). Most homes were connected to the San Diego water reservoirs by the early 1900s by the piped water system (Smith and Greene 2007:3.0-7). By 1905, windmills could no longer be seen in downtown photographs (Smith and Greene 2007:3.0-7). Once residents abandoned the wells and cisterns, they often became refuse pits (Smith and Greene 2007:3.0-7). Residents usually filled the wells, cisterns and privies with refuse and soil once they became unnecessary because it would be unsafe to leave the holes open (Noel Hume 1969b:144).

**Boom Period (1886-1895)**

San Diego’s population grew rapidly during the Boom period, especially during the years of 1886 to 1888 (Kelly 2002:242; Sholders 2002:61-62). After the California Southern Railroad connected San Diego to the East Coast in 1885, a surge of people moved west (Kelly 2002:242). In 1888, San Diego’s population grew to from 8,600 to 35,000 (Melbourne 1986:255; Russell 1975:24). The need for a better water supply grew along with the increasing population. Since the Boom period, the development of a sufficient water supply has been a fundamental asset to San Diego’s growth (Hennessey 1978:367). Within a short period of fourteen years, developers planned water conservation projects which resulted in the creation of multiple water companies. The companies that came to fruition were: the San Diego Land and Town Company in 1881, the Otay Water Company in 1886, Linda Vista Irrigation District […] in 1886, the San Diego Flume Company in 1886, the Mount Tecarte Land and Water Company in 1897, the Pamo Water Company in 1888, and the Southern
California Mountain Water Company in 1895 (Sholders 2002:62). An 1890 article in the *San Diego Union* promoted the idea that the City of San Diego should be in control of the water supply instead of relying on the private corporations. Privately owned corporations often abused the power of privilege and set high prices for water consumption (Russell 1975:26). The *San Diego Union* supported water development projects in San Diego County. The newspaper’s editors viewed the water development as the key to the prosperity of San Diego (Russell 1975:26).

In 1889, San Diego city planners had the Cuyamaca Dam and flume built on Boulder Creek in the Cuyamaca Mountains and held a celebration after its completion. San Diegans claimed that the water from the newly constructed flume was fresh and pure compared to what they were drinking before. What they were not aware of was that they were drinking the same old water with which they had been so dissatisfied. On a side note, according to Lockwood (1997), the flume company failed to put ventilating vales on their pipes which caused the water to become air locked. Water could not flow freely through the pipes. The flume company purchased water from the river water company and ran river water through the pipes for the celebration of the new flume. The water from the actual Cuyamaca Mountains did not arrive until three weeks after the celebration. Nevertheless San Diegans considered the Cuyamaca Dam and flume as an achievement; however, it alone could not supply adequate water supply to San Diego County. After the construction of the Cuyamaca Dam and flume, the City of San Diego purchased water from the San Diego Flume Company and distributed it to local citizens. By the turn of the century, six reservoirs were in use and diversion structures and canals were providing water for San Diego County (Hill 2002:54-56; Sholders 2002:62).

Along with the need for an improved water supply for a growing population, San Diego needed to construct a better sewer disposal system. Sewer lines were installed in 1887 and according to Smith and Greene (2007), this marked the beginning of residential privy abandonment. When privy pits became full and outhouses were shifted to new location, the old privy pits had to be filled. Like wells and cisterns, refuse was often the first thing to go into the abandoned privy pit before the pit was completely backfilled (Smith and Greene 2007).
Planned Development (1896 to Present)

After the boom period, only three of the companies that came into fruition during the 1880s survived the drought of 1895 to 1904: the Otay Company, the San Diego Flume Company, and the Mountain Water Company (Sholders 2002:62). Sholders (2002) posits that “at the turn of the last century the City of San Diego began purchasing some of the properties of the existing water companies to ensure a reliable water supply for its population” (62). San Diego also began work on water projects during the early part of the 1900s. In 1913, San Diego built the Mission Valley pumping station (Hill 2002:52). The next year the Bonita pipeline was constructed. During the 1916 flood, the Otay Dam, which was 130 feet in height, was overtopped and destroyed (Hill 2002:55; Sholders 2002:62). Following the 1916 flood, damaged or destroyed water structures were repaired and additional reservoirs were constructed by San Diego County. The Otay Dam was replaced in 1918; the new Otay dam is 15 feet higher than the original dam. In addition, the Barrett Dam was constructed in 1923, measured 171 feet in height. In 1927, San Diego city planners installed the Lakeside-University Heights pipe line and the Lakeside and River view pumping plants. They improved the Hodges Dam in 1931 with a hollow gravity multi-arch. In 1935, the County constructed the El Capitan Dam and the Henshaw Dam in 1927 (Hill 2002:55-58; Sholders 2002:62).

San Diego could not be sustained by only using its own water resources. During the early 1900s, city planners began searching for outside sources of water to bring into San Diego (Sholders 2002:64). If the county only relied on its water sources, San Diego would not be capable to support more than 50,000 people (Melbourne 1986:254). In 1902, civil engineers began work on the development of the Colorado River as a California water source (Sholders 2002:64). In 1921, the San Diego City Council discussed the necessity for bringing water from the Colorado River to San Diego (Sholders 2002:65). Five years later, the City of San Diego filed an application with the California Division of Water resources for a permit to bring water from the Colorado River to San Diego County (Melbourne 1986:259). The Boulder Dam and aqueduct was constructed in 1941, bringing water from the Colorado River into Southern California (Melbourne 1986:259). However, San Diego County did not benefit from the aqueduct. It was not until World War II it became imperative for water from the Colorado River to be brought to San Diego County. World War II caused an increase in
water usage within San Diego County due to the heavy concentration of military activity (Melbourne 1986:259; Sholders 2002:67). The federal government and military ensured that the water supply would support the military first; the rest of the population came second (Fraser 2007:53). However, the limited water supply of San Diego County could not sustain the excessive overdraft of water by the military without risking the overuse of the water supply for the rest of the population (Fraser 2007:53). If no other water source was obtained outside of San Diego’s natural resources then San Diego’s water supply would have been exhausted by 1947 (Fraser 2007:56). San Diego was considered to be of strategic importance to military installations, which encouraged the Roosevelt Administration to take action. The Roosevelt Administration took the necessary steps and began the construction of the San Diego Aqueduct which joined the Metropolitan Water District’s Colorado River Aqueduct at San Jacinto in 1945. Water was first imported from the Colorado River to San Diego in 1947, providing half of the amount needed to support San Diego’s population (Fraser 2007:56; Melbourne 1986:257; Sholders 2002:66).

According to Sholders (2002), San Diego County relies on imported water for 75 to 95 percent of its total supply (69). The San Diego County Water Authority (SDCWA) was organized in 1944 under the County Water Authority Act and consists of a number of coastal and foothill communities (Melbourne 1986:257; Sholders 2002:69). Their main purpose is to import water to San Diego County in order to sustain the needs of the population (Fraser 2007:56; Sholders 2002:69). Currently, the engineers and staff of SDCWA are planning projects that will improve the San Diego water system to accommodate the predicted population of 2050 (Sholders 2002:69). SDCWA is constantly evaluating the possibility of other sources of water such as sea water distillation and waste water reclamation (Sholders 2002:71).

The city of Carlsbad, located in north San Diego County, is currently working on the Carlsbad Desalination Project. The Carlsbad Desalination Project is “a 50-million gallon a day seawater desalination plant that will supply the San Diego region with approximately 10 percent of its drinking water needs” (City of Carlsbad 2010). Essentially, the purpose of the desalination plant is to convert seawater into drinking water. The project will be completed by Poseidon Resources Corp in 2013 (City of Carlsbad 2010).
SAN DIEGO WELLS

The Mormon Battalion, which consisted of 500 men and 80 women and children, arrived in San Diego in 1847 after traveling 2,000 miles from Council Bluffs, Iowa in order to aid in the Mexican War (The Mormon Battalion Museum 2010). However, the war was over when they arrived in San Diego (Wolfe 2010:64). They occupied Fort Stockton (present day Presidio Hill) and hired themselves out to the people of Old Town San Diego (Smythe 1907; The Mormon Battalion Museum 2010; Wolfe 2010:8). The members of the Battalion “built a bakery, fired brick, built log pumps, dug wells, did blacksmithing, and repaired carts” (Wolfe 2010:64). They dug a total of 20 wells in Old Town San Diego (The Mormon Battalion Museum 2010).

According to Wolfe, “the presence of American-style brick corresponds with the arrival of the “Mormon Battalion” [...] The American-style of brick is easily recognizable as it has a variation of red color, a relatively uniform rectangular shape, and has been evenly fired” (2010:64). Wolfe’s statement corresponds with the Mormon missionaries claim that the Mormon Battalion introduced kiln-fired brick making to San Diego (The Mormon Battalion Museum 2010). Juan Bandini hired a group from the Mormon Battalion in the mid 1800s to build the first brickyard in San Diego (The Mormon Battalion Museum 2010). The kiln-fired bricks were more durable than the adobe bricks (see Figure 4). Residents of Old Town used adobe as the main construction material for wells before the Battalion introduced American-Style brick making (The Mormon Battalion Museum 2010). The American-style bricks were not only used to line wells but were used to build other structures like the first courthouse in Old Town. One of the well shafts that the Mormon Battalion dug for San Diego was about 30 feet in depth (The Mormon Battalion Museum 2010).

With reference to downtown San Diego, a 1928 article in the San Diego Union claims that the first city owned well was located on 11th and Beech Street and soldiers had dug the well to a depth of 24 feet during the civil war (1861 to 1865).

Wells may have been abandoned by the early 1900s in Old Town and downtown San Diego; however, other parts of the county continued relying on wells well after the early 1900s. According to a 1993 article published by the Los Angeles Times, a demand for more wells in San Diego County was high in the 1990s. The wells were located in the front and
backyards of suburban areas. They estimated that San Diegans drilled a total of 1,410 wells in Escondido, San Marcos, Del Mar, Rancho Santa Fe, Poway, and Clairemont in the 1990s (Lockwood 1997).

**CISTERN USE IN SAN DIEGO**

San Diego County has a long history of struggling to find a reliable water supply that would support its growing population and their needs. Before the installment of a municipal water system in the late 1800s, households in downtown San Diego not only contracted for water deliveries but also dug their own wells and cisterns or piped water from other wells for a fee (Schaefer 2009b:20). Cisterns stored rainwater and well water (Wolfe 2010:13). San Diegans began abandoning the use of cisterns in the late 1870s to about the mid 1880s in downtown San Diego due to the installment of a piped water system (Smith and Greene 2007:3.0-7).

San Francisco has a history of using cisterns for the main purpose of emergency fire control. San Diegans have considered cisterns for fire emergency cases. Historically, water supplied by San Diego cisterns was not strictly restricted to firefighting purposes. Based on my research, San Diego cisterns usually served the purpose of storing water for household or commercial use. During the early development of the City Park (Balboa Park), 1868 to 1902, the idea of using cisterns were included in the fire protection plan. In Montes’ (1976) article, San Diego city planners posited that they needed a “first-rate system of protection from fire...
losses, storage reservoirs and cisterns for this special use […].” However, it is unclear if cisterns were ever constructed for the City Park.

**WHALEY HOUSE HISTORICAL BACKGROUND**

The Whaley House is located in Old Town San Diego at 2476 San Diego Avenue (Mallios 2008:8). The Whaley family originated from New York and came to San Francisco, California in 1849 during the Gold Rush (Save Our Heritage Organization [SOHO] 2010). In 1851, Thomas Whaley, the head of the family, moved to San Diego, California upon the advice of his business partner Lewis Franklin and built a home (SOHO 2010). The construction of the Whaley brick home began in 1856 and was completed in 1857 (Mallios 2008:8). The bricks were made in Thomas Whaley’s brickyard on Conde Street, San Diego (SOHO 2010). The Whales were a wealthy family, as evidenced by the brick house which contained mahogany and rosewood furniture, damask drapes, and Brussels carpets (SOHO 2010). The home functioned as a residence, general store, courthouse, granary, etc (Mallios 2008:8).

By 1858, Thomas and Anna Whaley had three children: Francis Hinton, Thomas (who died at just 18 months), and Anna Amelia. In August 1858, an arson-set fire destroyed Whaley’s business on the Plaza. Due to the loss of a child and the fire the Whaleys moved to San Francisco (SOHO 2010). While in San Francisco, Thomas Whaley worked as an U.S. Army Commissary Storekeeper. In Northern California, Anna Whaley gave birth to three more children, George Hays Ringgold, Violet Eloise, and Corinne Lillian (SOHO 2010).

After an earthquake in 1868, the Whaleys left San Francisco and moved back to the brick house in San Diego. There are thousands of historical documents that record the Whaley family’s daily lives in San Diego (Mallios 2008:26). The suicide of Thomas Whaley’s daughter, Violet Whaley, is one of the most well known events that occurred at the Whaley House. In 1885, Violet Whaley first attempted suicide by throwing herself into the family well or cistern. Thomas Whaley found Violet and rescued her. Violet took her own life three weeks later by shooting herself in the chest with her father’s pistol in the privy in 1885. After the death of Violet Whaley, Thomas Whaley moved his family to downtown (New Town) San Diego. Thomas Whaley died in the downtown home in 1890 (Mallios 2008:26; SOHO 2010).
The Whaley House brick house remained unoccupied and fell into disrepair until late 1909 when Francis Whaley, Thomas Whaley’s eldest son, returned and restored the home. Anna Whaley, Lillian, and Francis all lived in the Whaley House in 1912. Anna Whaley passed away in 1913 followed by Francis Whaley in 1914. Lillian Whaley lived in the home until her own death in 1953 (Mallios 2008:22; SOHO 2010).

Today, the Whaley House is owned by San Diego County and managed by the Save Our Heritage Organization (Mallios 2008:26; SOHO 2010). The Whaley House functions as a museum. The Whaley House is also in the process of being restored to its original design based on photographs from the mid-1800s (SOHO 2010).

**Archaeological Field Seasons**

The executive director of Save Our Heritage Organization (SOHO), Bruce Coons, and San Diego County’s historian Dr. Lynne Christenson contacted Dr. Seth Mallios in 2006, in hopes that he would be able to locate and excavate the Whaley well (Mallios 2009:12). Mallios agreed and began excavating in the summer of 2007. San Diego State University students conducted the excavations at the Whaley House site and have continued to for four summer field seasons; 2007 to 2010 (Mallios 2008, 2009, 2010).

Various historical records refer to the 19th-century Whaley House water source as a cistern and a well, and the terms are apparently used interchangeably (Mallios 2008:26). A ca. 1870 map, sketched by Thomas Whaley, of the Whaley House property identified a feature of a circle inside a square, about 20 feet behind the house (Mallios 2008:29). The details of this map were important factors in determining the placement, size of the excavation units (Mallios 2008:26). In addition to the ca. 1870 map, there are two historical references that aid in the determining of location and existence of the well. According to an 1885 article in the *San Diego Union* (Mallios 2008:26), the water supply structure that Violet Whaley attempted to commit suicide in is referred to as a cistern. The second reference is an 1885 article in the *San Diego Sun*. The article documents that Violet Whaley jumped into the well. These two references use two different terms when referring to the same water storage structure located on the Whaley property (Mallios 2008:26).

Members of the Whaley family also alternate between the terms “well” and “cistern” (Mallios 2008:26). There is an advertisement for the sale of the Whaley home from Thomas
Whaley in 1868 that refers to the water source as a well. George Whaley, Thomas Whaley’s son, wrote a letter in 1878 which states that work was done on the cistern while his father was away (Mallios 2008:26).

According to Mallios (2009) “wells are holes that are bored into the earth to obtain groundwater. Cisterns are reservoirs, tanks, or containers for storing water, frequently supplied by a drain” (12). A further distinction between a well and a cistern is that cisterns are flexible when it comes to the placement of the structure, as long as it is located within an area where the structure is able to catch rainwater; while wells have to be planned out and dug in areas where there is access to groundwater in order to achieve a reliable water source for a working well.

Other common water sources frequently used are flumes, an open artificial water channel that leads water from a diversion dam (Hennessey 1978:368-370), and aquifers, any unit of rock or sediment, such as sand, that is capable of both storing water and transmitting water to wells and springs, if a sufficient amount exists (Lindsay 1973:79-80; San Diego County Water Authority [SDCWA] 2010).

When typically excavating a water source structure, if an archaeologist reaches groundwater then the feature is considered a well. When groundwater is not reached it is usually classified as a cistern. However, the Whaley house water source may be an exception. The water table for San Diego County may be significantly lower in the 2000s than in the 1800s due to population growth and water use. Complete excavation of the Whaley House water source structure would be able to determine if it is a well or a cistern (Mallios 2008:26-29).

**Summer 2007**

During the 2007 archaeological field season excavation, excavators located a large historical cylindrical feature, measuring over eight feet in diameter at its uppermost stratum. Excavators were able to remove the top five feet of fill from the feature and were able to uncover the top of a wooden box that excavators located within the well/cistern fill. The excavators discontinued work for the season when shoring became necessary (Mallios 2008:32). For safety precautions shoring is needed for every five feet that is excavated before continuing any deeper. The location of the cylindrical feature corresponded to the location of
the structure on the ca. 1870 Whaley House map. The feature and the structure that was
drawn on the 1870 map are both roughly ten feet past the northeast corner of the large brick
building (Mallios 2008:29).

**Summer 2008**

The 2008 archaeological field season continued the excavation on the well/cistern
feature. Excavators added more units next to the modern bathrooms in order to verify if the
19th-century privy truly existed. The location of the historical privy is marked on the ca.
1870 Whaley House map. Excavators working in the well/cistern removed another three feet
of fill after removing subsoil, from the first five feet that the 2007 field school crew dug, in
order to make room for shoring (Mallios 2009:14-18). When excavators removed the subsoil
for the top five feet, “a small wood, brick lined drain was exposed” (Mallios 2009:31). The
wooden box that excavators discovered in the 2007 field season remained intact and seemed
to continue on deeper within the well/cistern feature.

**Summer 2009**

Excavators removed eight feet of additional fill from the well/cistern feature during
the 2009 archaeological field season. The wooden box located within the well/cistern feature
was fully excavated and it appeared to have functioned as the cistern lining (Mallios
2010:11). Excavators working in the privy area continued the work that was left behind from
the 2008 field season. Excavators were able to remove a clay cap, which was thought to be
subsoil; from the privy area which revealed late to early 20th-century features and artifacts
(Mallios 2010:26).

**Summer 2010**

Excavators reached the bottom of the well feature by the end of the 2010 field season.
They excavated the feature manually until about 25 feet in depth. In order to determine the
maximum depth of the feature a soil auger was used. The auger determined that the bottom
of the feature was approximately 38 feet below modern grade. Excavators determined that
the well is approximately 23 feet deep before the cistern wooden box (located in the upper
portion of the feature) was added in. They never found a well lining; however, they did find a
wooden curb. The curb suggests that the feature was once lined with brick because curbs are
typically associated with a brick lining. Dr. Mallios posits that the curb would keep the lining level once placed underground (personal communication, March 14, 2011).
CHAPTER 3

THEORY

HISTORICAL ARCHAEOLOGY

Historical archaeology is the study of the recent past; people who have built the “modern” world (Orser 2004:4-5). Historical archaeology is becoming closely aligned with applied anthropology, which is geared towards applying the lessons of research to real world issues of present day people. Gilchrist writes “historical archaeology dominates the practice of professional and contract archeology across the globe, as urban development and historic building conservation field massive archaeological data sets deriving from recent centuries” (as cited in Little 2007:21). Little (2007) states that historical archaeology is capable of providing public benefits if it is done as public archaeology (22). Through the work of historical archaeology, the public benefits from the knowledge and understanding gained from the research of historical sites and collections for purposes such as education and community cohesion; one of the goals of applied anthropology (Little 2007:22).

Cultural values and beliefs are incorporated into and reflected by material culture (Berger 2009:81-82). Through the use of material culture archaeologists are able to learn how certain objects play a role within daily lives of people. However, interpreting the meanings of artifacts is a constant challenge for archaeologists (Berger 2009:81-83). It is the participants in a culture who give meaning to objects. Hall argues that “things “in themselves” rarely if ever have any one single, fixed and unchanging meaning” (Berger 2009:82). It is important that all archaeologists focus on the meanings that people give to objects since meanings can vary and change with time (Berger 2009:82).

THEORY

Theoretical approaches employed in this study of historical well and cistern structures and locations in San Diego County revolve around three major theoretical paradigms. The first is the theory of historical particularism. Historical particularism emphasizes the idea that every society has its own unique history. Ivor Noel Hume (1969a, 1969b) firmly believes that
archaeologists have to first learn about a past culture’s history before being able to understand fully what the material culture reveals about past culture. Second is the theory of structuralism, a construct used by James Deetz (1996) in his study of early American colonial times. This theory contends that the material culture is a reflection of the mental processes of a past culture. The last theory used in this thesis is environmental anthropology. Environmental anthropology theorists argues that material culture reflects how people reacted and responded to their environment. Florence Shipek (1981), an American anthropologist, is a firm believer that the natural environment has always affected human populations.

**HISTORICAL PARTICULARISM**

Historical particularists, inspired by legendary anthropologist Franz Boas, argue that each society is a collective representation of its own unique historical past. In order to represent the past accurately, archaeologists must conduct careful research on the history on the area being excavated. One cannot make generalizations on the discovered artifacts alone (Noel Hume 1969a:27). Noel Hume stresses that “the best way to study the artifacts of the past is through finding them in archaeological contexts, for they are related to each other both in time and space” (1969a:27). Information can be derived from artifacts, such as why and when it was deposited into the archaeological record. Nevertheless, archaeologists must be conscious that artifacts will only reveal their full histories when compared to other artifacts and in relation to the documentary record (Noel Hume 1969a:6).

Noel Hume argues that “rarity in anything tends to create value, sometimes legitimately […] but often misleadingly when an object’s original scarcity was occasioned not by its high value or intentionally limited availability but by the public’s rejection of it” (1969a:26). Noel Hume presents in his book, *A Guide to Artifacts of Colonial America* (1969a), an example of how archaeologists working on colonial sites may interpret an unpopular ceramic ware as evidence of wealth due to its scarcity; while, by 18th-century standards, the reverse may have been true. The style of the ceramic ware may have not been desired and deemed as nothing more than junk by the people of the 18th century. The example demonstrates that it is imperative to be well versed in an area’s history before excavating and determining what the artifacts reveal about the past culture.
Historical particularism provides a framework for determining the reasoning behind the San Diego water use pattern. The pattern may reveal that the structure and placement of the wells and cisterns of San Diego County may reflect what San Diego considered to be the norm during a specific time period. For example, wells may have been constructed with cobble linings during the Mission period because cobble may have been the preferred material of the period while a brick lining was the preferred building material during the Boom period.

**STRUCTURALISM**

Structuralism is the belief that culture is governed by rules analogous to those of language (Johnson 1999:90-91). Structuralism, when used in the field of archaeology, deals with the material remains of products created by mental concepts. Deetz posits that “culture is socially transmitted rules for behavior, ways of thinking about and doing things [...] all such behavior is reflected in subtle and important ways in the manner in which we shape our physical world” (1996:35). The study of material culture allows archaeologists to understand the cultural institutions and mindsets of past cultures. In Deetz’s book *In Small Things Forgotten* (1996) he argues that early 17th-century New England culture was similar to that of England and uses a structuralist approach in his study. One of the studies that Deetz presents in his book that supports his argument is the analysis of gravestone. Deetz divided colonial America into three periods based on their cultural affiliation with England over time. New Englanders designed gravestones with death-heads during the first period which reflected a close connection to England (Deetz 1996:96, 121). The death-head design symbolized the reality of death (Deetz 1996:96). Regional variation and cultural independence from England develops in the second period with gravestones being designed with cherubs (Deetz 1996:98, 122). The shift to the cherub design indicated a change in mental processes concerning death. The cherub symbolized the resurrection of the soul after death (Deetz 1996:98). The third period marks America’s cultural affiliation with England being reestablished and the willow and urn design is used on gravestones as a symbol of commemoration, a contrast to the earlier periods (Deetz 1996:99, 123). Structuralism is evident in Deetz’s work because he not only attempts to analyze and understand the material
culture; he also attempts to address the mental processes behind the creation and use of past objects.

Structuralism is important to consider because it attempts to answer questions concerning how people modify and react to their physical world. Changes in mindsets can be reflected in material culture. This theory also stresses that all cultural groups have similarities. We may see that the San Diego water use pattern is similar to other areas in the region and the changes in well and cistern structure and location reflects the change in mindsets of San Diegans during different time periods.

**ENVIRONMENTAL ANTHROPOLOGY**

The Society for Applied Anthropology (2010) website defines environmental anthropology as a field that “assists in policy-making and program planning by combining expertise in ecology with methods and tools for understanding of the social and cultural dynamics of communities potentially affected by policy decisions.” One of the areas that environmental anthropologists focus on is the understanding of social organization of communities in larger social systems in identifying and solving environmental problems (Society for Applied Anthropology 2010).

In the field of archaeology, an environmental approach argues that the material culture reflects how people reacted and responded to their environment. Shipek (1981) suggests that natural environmental changes have always had an impact on living populations. For instance, a fertile and lush environment may encourage population growth while areas with extreme weather such as cold, heat, drought, causes population decrease or movement. In a prehistoric example, the Kumeyaay were able to shift their maize agriculture between the mountain valleys, the New River, and the Colorado River depending on the amount of rainfall and the location of a water resource (Shipek 1981:296). An historical example of how the environment determined the movement of a population is the San Diego Mission. The Mission San Diego de Alcala (San Diego Mission) and the Presidio were established in 1769 on a hill that overlooked the land. In 1773, the missionaries moved the San Diego Mission away from the Presidio and moved closer to the San Diego River in order to be closer to a reliable water source that would better support the agricultural fields (Hill
These two examples demonstrate how the environment affects the decision making of people.

In the case of San Diego County’s water use pattern, the environmental anthropological theory suggests that the availability of a reliable water source may be the sole reason as to where the wells are located in certain areas of San Diego. Also, access to the highest quality of water may have determined the depth of the well. It is important to note that the environmental anthropological theory can run the risk of suggesting that objects are void of human meaning and are created only as a response to the environment.
CHAPTER 4

WELLS OF NORTH AMERICA

WELLS

Locations of wells have to be planned out and dug in areas where there is reliable access to groundwater in order to attain a viable water source for a working well. The location of a well is determined by the structure’s purpose (Harter 2003:1). In order to have a successful working well it needs to be able to serve its function whether it is used for domestic or agricultural purposes.

Information on historical North American wells is surprisingly deficient. The wells described in this chapter are included in this study because they have sufficient information regarding the location (space), temporal (time) and structure (form) of the wells.

PREHISTORIC WELLS

According to *The Texas Journal of Science*, “the first wells in North America were hand dug by Native Americans” (Mace 1994:2). Archaeologists discovered prehistoric shaft-like wells in 1949 and 1950 “at a well-known early man site 12 miles southwest of Clovis and 7 miles north of Portales New Mexico” (Evans 1951:1). They determined that there were 13 wells located near and on two abandoned gravel quarries (Evans 1951:1). The gravel quarries contained remains of fossil bison as well as early man artifacts (Evans 1951:1). Archaeologists determined that the wells were later than the fossils and “begin on a buried erosional surface separating the lake deposits from overlying, younger beds, and extend downward through the lake deposits to gravel bedrock” (Evans 1951:1).

The archaeological crew only conducted a complete excavation of four of the 13 discovered wells. The other wells were partially excavated and investigated from vertically sectioned exposures (Evans 1951:1). The wells range from five to about seven feet in depth. The top diameter of the wells range from three to five feet and it decreases to one to two feet at the bottom (Evans 1951:5). The well walls vary from vertical, stepped or steeply inclined (Evans 1951:5). From the excavations, archaeologists determined that the wells were
dug for water. Evans maintains that “there is not evidence in support of other possibilities (1951:6). Evans also suggests that they were filled not too long after being dug (1951:5). Based on the well feature’s fossils and early artifacts, the estimated the age of the wells is circa 10,000 and 13,000 years (Evans 1951:7).

**18th-Century Wells of Virginia**

There is a limited resource of contemporary descriptions of colonial Virginia wells (Noel Hume 1969c:12). Most of the information regarding well construction comes from historical archaeology (Noel Hume 1969c:12). Noel Hume writes, “the methods of constructing wells in the eighteenth century varied from place to place depending on the depth of the water-bearing strata and upon geological character of the ground through which they were dug” (1969c:10). In low lying areas such as Jamestown, Virginia, well diggers usually dug well shafts to eight feet in depth and they would rarely dig to more than 14 feet in depth (Noel Hume 1969c:10-12). In Williamsburg, Virginia, most well depths range from 28 to 40 feet. Williamsburg’s wells are deeper than those found in Jamestown because Williamsburg is located on much higher ground (Noel Hume 1969c:12). A similarity between Williamsburg and Jamestown is that they both have the same methods of well construction. According to Noel Hume, “both Jamestown and Williamsburg are built on thick tidewater clay and consequently well digging was a comparatively straightforward undertaking; but further inland, where clay gives way to rock […] techniques were different (1969c:12).

The wells of tidewater Virginia were largely of brick construction, however, a few colonial wells that archaeologists uncovered at Jamestown were lined with barrels or with rectangular wood framings (Noel Hume 1969c:12). Noel Hume posits that “barrel lining and wood framing techniques can be traced back in England to at least as early as the first century A.D.” (1969c:12). When Virginians dug wells into rock, they rarely constructed a brick-lining for the well shafts (Noel Hume 1969c:28).

Archaeologists found evidence of the “bottom up” method in some of Williamsburg’s early 20th-century wells (Noel Hume 1969c:17). This method is not reflected in the wells of Colonial Williamsburg (Noel Hume 1969c:17). The “bottom up” method requires well diggers to construct the well lining as they dig down into the ground (Noel Hume 1969c:14).
Richard Neve describes the “bottom up” method in Noel Hume’s *The Wells of Williamsburg* and *Colonial Time Capsules* (1969c):

A strong timber curb is formed on the ground; the brickwork is carried up a certain height, and then the ground is dug out on the inside and beneath the curb, which allows the whole to sink; the same operation of building up and digging, is continued; and the top covered over and arched over. If the shaft refuses to descend, any brickwork added.

Williamsburg’s 18th-century wells also show evidence of wedge-shaped bricks specially made for constructing wells and designed so that they would not slide out of place as the well lining moved down. The wedge-shaped bricks “abutted against one another throughout their full lengths and once they were under the curb is called “under pinning.” (19)

A well curb is a circular cutting edge located at the bottom of the steining (lining), for sinking of open wells (Michael et al. 2008:112). The well lining is built on top of the well curb, which is laid on the underground soft soil. Well curbs may be made of wood or reinforced concrete (Michael et al. 2008:112). The curb keeps the brick lining level as the soil is removed from beneath the two structures (Noel Hume 1969c:19).

Based on historical documents and archaeological evidence, Williamsburg’s 18th-century wells were lined from top down (Noel Hume 1969c:27). The “top down” method requires well diggers to dig the well shaft first and then place a lining to the hole (Noel Hume 1969c:14). placed on the curb they could not be easily dislodged” (Noel Hume 1969c:24). Neve termed the wedge-shaped bricks as “compass-bricks” (Noel Hume 1969c:24). After the early 1800s, Williamsburg’s wells no longer possessed wedge-shaped bricks, only rectangular bricks (Noel Hume 1969c:27). Percy Lemon states, “none of the later wells has been taken apart to determine the method of construction, […] quite possible that the use of regular bricks made the old “top down” method of steining impracticable […] they chose to build up from the bottom” (Noel Hume 1969c:28).

**SPANISH WELL IN ST. AUGUSTINE, FLORIDA**

In 1974, workmen of the Florida Power and Light Company discovered a well curb capped by a coquina (sedimentary rock) slab (Bostwick 1980:73). In 1975, archaeologists excavated the northern half of the well feature. The crew determined that the well dated to circa 1700 “due to the absence of Puebla Blue on White majolica (ceramic) in the […] well construction pit” (Bostwick 1980:79). Bostwick states that Puebla Blue on White was
introduced to St. Augustine after 1700 and is commonly found in archaeological sites from the area (1980:79). Based on the well’s fill, archaeologists determined that the well was filled and capped circa 1780 (Bostwick 1980:79). St. Augustine reconstructed the well after its discovery and excavation and it still stands today (Bostwick 1980:79).

The well has an octagonal curb that measures 4.1 feet in the interior diameter (Bostwick 1980:79). The curb’s interior is circular in shape. Archaeologists estimated that the curb was originally three feet in height (Bostwick 1980:79). They could not determine the original depth of the well due to past cultural disturbances (Bostwick 1980:73). Bostwick posits that the casing of the well continued down to 7.8 feet below ground level and that “it was evident that the lower courses were put in place from inside the well shaft” (1980:73). It is unclear what material was used for the lining of the well, however it was evident that the feature once had a lining (Bostwick 1980:73). The well did not possess any Spanish artifacts at the bottom which would suggest that the feature was cleaned periodically in the past (Bostwick 1980:79).

A Colonial Well at Fort Loudoun, Pennsylvania

In 1980, archaeologists discovered a well in the southwestern corner of Fort Loudoun, Pennsylvania (Denton and Gardner 1983:96). The fort dates circa 1756 to 1765. The well was dry-laid and stone-walled. The feature measured seven feet in diameter with a well shaft aperture of 30 inches in diameter at the subsoil surface (Denton and Gardner 1983:96). Denton and Gardner posit that the “well’s stonework was seated on shale bedrock, 14 feet, 3 inches from the subsoil surface level at which point the well shaft was approximately 40 inches diameter” (1983:96). The last five to six feet of the well shaft was below the water table (Denton and Gardner 1983:96).

Wells of Ellis County, Texas

A geological group conducted an intensive well inventory in North Ellis County, Texas, as part of a hydrogeologic characterization of the Superconducting Super Collider (SSC) site project in the early 1990s (Mace 1994:1). The group located a total of 811 hand dug wells for the county (Mace 1994:1). Most of the wells were dug by farmers in order to supply the water for domestic and livestock needs. They were not used for irrigation
purposes due to low yields (Mace 1994:5). Many of the hand dug wells in the area date from 1850 to 1930 (Mace 1994:2). Since springs and surface water could not supply a reliable water supply to farms located on upland prairies, farmers dug wells in limestone and alluvium (soil deposited by flowing water; Mace 1994:2). After the 1930s, deeper wells were more commonly drilled into regional sandstone aquifers at depths of 820 to 1,968 feet. Mace reports that “as water supply districts expanded into rural areas, dug wells became less important as sources of portable water” (1994:2).

During the well inventory project, the geological group documented the forms of the well structures in Ellis County. The average depth of the wells is 22 feet, ranging from 1.9 to 50 feet (Mace 1994:4). Mace posits that “the depths are likely correlated to weathered zone thickness” (1994:4). The group conducting the inventory interviewed landowners living in the area and learned that the farmers dug their wells until “blue rock,” or unweathered chalk, was reached” (Mace 1994:4). The hand dug wells typically had large diameters. The well hole has to be large enough to accommodate a person to work with a shovel or handpick (Mace 1994:4). Mace of Science maintains that “well diameters in many hand dug wells in the Austin Chalk widen with increasing depth […] thus increasing the usefulness of the well […] these wells are referred to as “jug” wells because their shape resembles a narrow-necked jug” (1994:4-5). Thirty-two wells dug in Austin Chalk are grouped into four shapes: jug, conical, shaft, and miscellaneous (Mace 1994:5). The general design of Austin Chalk wells includes a brick collar extending 2.9 to 5.9 feet. However, some of the wells vary from having cement collars, mortared pieces of chalk collars, or being collarless (Mace 1994:5).

Wells dug into alluvium have a consistent diameter and “are cased in unmortared brick at depth” (Mace 1994:5). More recently hand dug wells are cased in plastic or steel pipe (Mace 1994:5).

David C. Paul, a native to Ellis County, provided a detailed description on the construction of a hand dug well built in 1939 or 1940 by him and his uncle (Mace 1994:3). According to Paul’s unpublished memoirs, well sinking consisted of five stages:

1. digging through the soil horizon,
2. breaking through the highly weathered zone,
3. blasting through the consolidated rock,
4. constructing the well curb and pump platform,
5. placing the pump.

A pick and shovel were used to clear the soil from the well site. The ground was loosened in a 1.5-m-diameter
circle and removed until weathered chalk was reached. [...] About 1 m into the ground, solid rock was encountered. At this point, the well radius was reduced about 0.1 m to provide a ledge on which to rest the well curb. (Mace 1994:3)

Paul and his uncle dug to a depth of approximately 30 feet before stopping. The well was not completed because they did not reach the water table (Mace 1994:4). This was due to the fact that they dug the well during a dry period in Ellis County. However, the well was eventually filled with water after the rain period occurred in the winter months (Mace 1994:4). When Paul and his uncle realized that the well was capable of providing water, they finished the construction of the well by building a curb and platform. The well was in use for about 15 years (Mace 1994:4).

**CALIFORNIA WELLS**

In California, vertical water wells are primarily for domestic, municipal and, agricultural uses (Harter 2003:1). Most wells are vertical shafts; however, they may also be horizontal or constructed at an inclined angle (Harter 2003:1). Harter posits that hand dug horizontal wells “are commonly used in bank filtration, where surface water is extracted via recharge through river bed sediments into horizontal wells located underneath or next to a stream” (2003:1; National Driller 2005:1).

Harter maintains that the location of a well is determined by the structure’s purpose (2003:1). In order to have a successful well, well diggers must find a reliable source of groundwater that will meet the pumping requirements of the well (Harter 2003:1). Contemporary large municipal and agricultural wells pump about 500 to 4,000 gallons per minute (gpm). Contemporary individual domestic wells pump “as few as one to five gpm” (Harter 2003:1).

Well diggers and groundwater consultants “rely on their prior knowledge of the local groundwater system, experience in similar areas, and a diverse array of information “such as [...] permeability of local aquifers from existing wells, groundwater levels [...]” (Harter 2003:1-2). An additional essential factor to consider when choosing a location for a well is the proximity of possible sources of contamination such as nearby streams, sewer lines, and septic tanks (Harter 2003:2; State of California Department of Water Resources 2010). Wells need to be able to provide clean, safe, and reliable water.
CALIFORNIA WELL DRILLING

Today, the most common well drilling techniques used by well contractors in California are rotary, air rotary, and cable tool (American Ground Water Trust 2008:1; Harter 2003:2). The process of rotary drilling includes a rotating drill that grinds up the rock and flushes the broken rock fragments up to the surface as it drills down to the water table. In areas with hard rock, well drillers prefer the air hammer method (American Ground Water Trust 2008:2). The air hammer uses compressed air to break up hard rocks and blows the broken fragments back up to the surface along with water that may flow into the hole while drilling (American Ground Water Trust 2008:2). The last method, cable tool, uses a heavy bit attached to a cable that is raised and dropped repeatedly, pounding down to the water table. The cable tool is a slower method and some well drillers may prefer to use the rotary drilling method instead (American Ground Water Trust 2008:1). Each of these methods require that the top part of the well to be lined with a steel or plastic well casing (American Ground Water Trust 2008:2).

WELL ABANDONMENT

Many wells are still in use all over the world; however, in developed countries, such as the United States, people who once relied on wells to supply water to homes and irrigation tend to abandon them (Mace 1994:1). Typically wells become trash repositories once they are no longer needed (Noel Hume 1969c:31; Smith and Greene 2007:3.0-7). Noel Hume maintains that “there could be various reasons for a shaft’s abandonment, the most obvious being its failure to provide water” (1969c:31). Another common reason for the abandonment of wells is the installment of a municipal water system that can sustain a larger population than a well (Noel Hume 1969c:32; Smith and Greene 2007).
CISTERNS OF NORTH AMERICA

CISTERNS

In areas of low permeability and poor water quality, residents prefer cisterns over wells (Mace 1994:2). Cisterns are reservoirs, tanks, or containers used to store water or to collect rainfall (Mallios 2009:12; Mace 1994:2; Toulouse 1945:362). Cisterns usually have a sealed lining, either on the interior, exterior, or both sides of the cistern’s walls to prevent water from leaking out of the structure (Mace 1994:2). Cisterns are flexible when it comes to the placement of the structure because it does not have to be located in an area accessible to groundwater. Cisterns just need to be located within an area where the structure is able to catch rainwater or receive water from another source, such as a well, to store it. They can be constructed above or underground.

HOUSEHOLD CISTERNS

In the United States, cisterns were common in homes throughout the 19th century (Kibbel 2010). The cisterns provided homes with water for washing and irrigation purposes (Kibbel 2010). Kibbel (2010) maintains that there are a few known 18th-century homes and some homes dating to the 1940s that have cisterns. Kibbel does not mention the exact location of these homes. Most of the cisterns were constructed of brick or stone and located below ground. They can also be constructed of iron, steel or wood (Kibbel 2010).

The cisterns vary in shape (rectangular, bell, beehive, jug or flat-topped; Kibbel 2010). Kibbel (2010) mentions that he has observed large rectangular cisterns located under the porches of some homes. He reveals that some cisterns had a dividing wall, sometimes more than one, which would serve the purpose of filtering out debris from the water as the water passed through porous brick or stone partitions (Kibbel 2010).
CISTERN USE IN SAN FRANCISCO, CALIFORNIA

In the mid 19th century, San Franciscans acquired drinking water from barrels and buckets (The Regents of the University of California 2007). It was not until the Gold Rush in 1849 that San Francisco realized that it was imperative to obtain water sources outside of their own natural water resources in order to accommodate a rapidly growing population (The Regents of the University of California 2007). From 1849 to 1906, San Francisco imported water from Marin County, located north of the San Francisco Bay area, and constructed a few dams and reservoirs. In 1856, the county laid the first pipelines in San Francisco (The Regents of the University of California 2007). According to Allison Moore of the California Historical Society, the city has cisterns; however, these structures were used primarily for firefighting water storage rather than drinking water and were not developed by water companies (personal communication, November 3, 2010). The Historical Society could not provide further detail about San Francisco cisterns.

In 1906, San Francisco suffered from an earthquake that ruptured gas mains which consequently resulted in a massive fire that ravaged the city (Van Dyke 2010). The city’s main water supplies were destroyed by the earthquake and firefighters exhausted their water resources and were forced to draw water from the sewers in attempts to stop the fires (Van Dyke 2010). According to a 1906 article in *The Argonaut* (semi-annual journal of the San Francisco Museum and Historical Society 1906) during the great fire, two cisterns located at 19th and Folsom and 22nd and Shotwell streets supplied 100,000 gallons of water that helped save blocks in the Mission district of the city. *The Argonaut* documented that in there were 57 fire protection cisterns located in various parts of San Francisco during the great fire, however, due to poor maintenance only 24 cisterns were ready for use (San Francisco Museum and Historical Society 1906). Even though the 24 cisterns supplied water to help with the great fire, they required repair.

After the 1906 earthquake and fire, city planners searched for solutions to efficiently stop fires in the city more. San Francisco had been burned down a total of six times from 1849 to 1906 and the city was in need of a more reliable water system (Van Dyke 2010). The solution that the city came up with was the “Auxiliary Water Supply System” (AWSS; Van Dyke 2010). This water supply system is designated for fire protection only (Van Dyke 2010). The system is made up of various water systems, including quake resistant water
pipes, fire boats, seawater pumping stations, and storage cisterns (Van Dyke 2010). As a last resort for a fire emergency water resource supply, city planners constructed a total of 175 independent underground cisterns located underneath street intersections throughout the city (Van Dyke 2010). The cisterns are marked by circles of red brick and a fire hydrant topped with a green cap (Atlas Obscura 2010). They are maintained by the San Francisco Fire Department (Atlas Obscura 2010). The cistern’s capacities range from 75,000 to 200,000 gallons of water (Atlas Obscura 2010; Van Dyke 2010). Along with the AWSS cisterns, *The Argonaut* documents that the Supervisors’ Fire Committee compelled the light, water, railroad and telephone companies to repair the older 57 fire protection cisterns and to build more reinforced cement cisterns for future fire fighting uses (San Francisco Museum and Historical Society 1906).

**Cistern Abandonment**

Cisterns are still in use all over the world; however, once they are no longer needed they become trash repositories (Smith and Greene 2007:3.0-7). Another common reason for the abandonment is the installment of a municipal water system that can sustain a larger population without the help of cisterns (Smith and Greene 2007).
CHAPTER 6

METHODOLOGY

ARCHAEOLOGICAL SITE RECORDS SEARCH

I began archival research in the spring of 2010 to determine the location of all known wells and cisterns that have been previously recorded in San Diego County. The initial step of my archival search was to conduct an extensive search at the South Coastal Information Center (SCIC), the state sponsored archaeological archive for San Diego County. I dedicated 10 to 15 hours a week from January 2010 through May of 2010 to site record and report searches.

I accessed the National Archaeological Database (NADB) at SCIC to locate the site records that had any information on wells and cisterns in San Diego County. These records then led the way to more detailed site reports. Site reports usually offer additional descriptions of the structure, location, and the time period of the well or cistern in question. I gathered all the reports that revealed any information pertaining to wells or cisterns. The goal is to build a comprehensive inventory of wells and cisterns that will aid me in my research. I gave special attention to reports that mentioned excavated well and cistern features.

After I gathered reports from the NADB search I went through each site record manually (approximately 20,000 records) to ensure that I acquired all important documentation that would aid in my research. I located a few site records that documented wells and cisterns that had not been previously found through the NADB search. After going through all the site records and reports at the SCIC I came up with 47 sites and 86 excavated wells and/or cisterns that I could use in my research to determine a San Diego pattern.

CULTURAL RESOURCE MANAGEMENT FIRMS

The next step in my data collection process was to contact every individual and Cultural Resource Management firm (CRM) through the means of email, phone calls and appointments. Many of the informants confirmed what I had already gathered from my search at the SCIC. I was able to collect information on two wells and two cisterns that had
not been originally included in my data set. There are a couple of cisterns that I had learned about recently, unfortunately, I was unable to schedule an appointment to meet with the firms that had worked on the cisterns. I decided that if I had not acquired documents on wells and cisterns by the end of May 2010, they would not be included into my data set.

**HISTORICAL DOCUMENTS**

In addition to the documentation of the known wells and cisterns within San Diego County, my research included historical documentation on San Diego’s water utilization history, starting with the Native American history of water use and ending with where San Diego obtains the majority of its water supply in the 2000s. This required the examination of additional archaeological records and documentary evidence from the Journal of San Diego History and the San Diego History Center in Balboa Park. I also gathered information from the Mormon Battalion Museum located in Old Town San Diego.

**ANALYSIS**

Once I accumulated all documentations, I analyzed the data on wells and cisterns in order to determine a San Diego water use pattern(s). I hoped to be able to uncover trends in relation to the location (space), temporal (time) and structure (form) of wells and cisterns for San Diego County. After establishing the San Diego water use pattern(s) I determined if this pattern is specific to San Diego County or if the same pattern is seen elsewhere within North America. In order to determine if the San Diego water use pattern is specific to the region or not, I compared the San Diego well and cistern structures to other known wells and cisterns found in other parts of the nation. Finally, I determined if the Whaley House cistern/well fits into the San Diego County water use pattern.
CHAPTER 7

SAN DIEGO COUNTY WELLS AND CISTERNS

Each archaeological site has a permanent trinomial or primary number. A trinomial is an identification given to a recorded archaeological site. It identifies the state, county and a number is given in the order the site is recorded, i.e. CA (California)-SD (San Diego County) and the 48th site recorded would be presented as CA-SDI-48.

ARCHAEOLOGICAL SITES WITH EXCAVATED WELLS

This chapter is an inventory of 47 San Diego County archaeological sites with known excavated historical wells and cisterns. There are a total of 28 historical wells, 46 historical cisterns, and 12 historical well/cistern structures. The information presented for each site and water-source structure derived from archaeological site survey records and reports. Descriptions of each water source structure vary in detail depending on the information recorded for them by various Cultural Resource Management (CRM) firms.

CA-SDI-4,611

ASM Affiliates, Inc. (ASM) monitored and excavated at CA-SDI-4,611, the Seely Stables, located in Old Town San Diego State Historic Park, City of San Diego, California, in 2007 to 2008 (Wolfe 2010:3). CA-SDI-4,611 is located on the USGS La Jolla 7.5 minute quadrangle in an unsectioned portion of the Pueblo Lands of San Diego in Township 16 South, Range 3 West (Wolfe 2010:3). The features recorded during this project included two historic well features, and eight historic cobble features (Wolfe 2010:4). The well features are the Seeley 1872 well (Feature 1) and the 1874 well (Feature 2).

Archaeologists first encountered Feature 1, a dirt-lined well, at a depth of 1.4 feet below the ground surface; the actual depth of the feature was not explored and remains undetermined (Wolfe 2010:37). This historical feature was the remains of a well that was located directly underneath the Tustin Windmill (Wolfe 2010:37). The well measured six feet in diameter. It was apparent to the archaeological crew that any remnants of this feature, as
well as any historical occupational sediment above 17 inches below the ground surface, were disturbed or completely removed during modern construction activities (Wolfe 2010:37).

Archaeologists encountered the second well feature, Feature 2 (see Figure 5); at a depth of 2.6 feet below the ground surface (Wolfe 2010:43). They were not able to determine the original depth of the well feature. Feature 2 was the remains of a water well that was located directly underneath the Tustin Windmill originally photographed in the 1874 Godfrey image (Wolfe 2010:42). Wolfe reports that “historic photographs clearly demonstrate that the Seeley windmill/well, located in the Stables area, was a Tustin self-regulating windmill as recorded in patent sketches” (2010:42). Feature 2 consisted of an “un-cemented, American style, brick-lined well with a diameter of four feet” (see Figure 6; Wolfe 2010:42).


According to Wolfe, “the American-style of brick is easily recognizable as it has a variation of red color, a relatively uniform rectangular shape, and has been evenly fired” (2010:64). Historic evidence reveals that the well may have been re-lined with brick in 1930, which suggests that the well was probably originally dirt-lined (Wolfe 2010:42). A section of cemented brick that consisted of approximately three to four American style bricks connected with mortar cement was encountered at 2.5 feet below the surface (Wolfe 2010:42). Wolfe posits that “due to the specific deposition of this cemented brick, it appeared that this was a part of the well feature, but during closer investigation, archaeologists determined the cemented brick could not be specifically identified as part of the well feature” (2010:43).

CA-SDI-11,824

In 1989 the Rose-Robinson adobe structure, originally built in 1853, was reconstructed by California State Parks and Recreation. The original date of construction was taken from San Diego County Deed book D:196. The Rose-Robinson Adobe is now the State Park Visitor Center for Old Town San Diego, 4002 Wallace Street San Diego California, 92110 (Colombo 1990:1-3; Felton 2006:1-2; Schulz 1987: 1).

Archaeologists documented the Rose Robinson site; CA-SDI-11,824, three different times (Felton 2006:1). S. Fulmer and R. Quinn first recorded CA-SDI-11,824 in 1987. Marilyn Colombo recorded this site in 1996. Finally, D. L. Felton (2006:1) recorded CA-SDI-11,824 in 1996 for the California Department of Parks and Recreation. This site is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle of Township 16 South, Range 3 West, Section 28. Archaeological investigations at CA-SDI-11,824 included the excavation of the foundation of an early adobe structure, a well and three discrete trash features (Felton 2006:1).

During the 1996 excavation, archaeologists discovered a trash deposit from the late 1840s to early 1850s and a well backfilled in the 1890s (Felton 2006:1-2). The well feature was circular and measured 7 feet in diameter. The archaeological crew excavated the well to a depth of eight feet. The well shaft continued down past 8 feet, however, there was evidence that the sides of the well had caved in before. The report does not report if the well feature had a lining or not. Even if shoring was placed in the feature further excavation was considered unsafe (Felton 2006:2). Excavation to sterile soil was not possible. The fill inside
the well feature was softer and easier to excavate than the surrounding clay soil. The well fill contained broken and partially melted adobe bricks, tile fragments, cobbles, and large quantities of cattle bone (Colombo 1990:1-3).

CA-SDI-14,410

Archaeologists of Caltrans District 11 and Rob Case of Brian Mooney and Associates excavated at CA-SDI-14,410, the Jones Ranch site, in 1996. CA-SDI-14,410 is located in San Luis Rey, Oceanside, California (Van Bueren 2001:4). A different archaeological group first recorded the site in 1977 during an architectural survey for the Oceanside Bypass Project (Van Bueren 2001:iii). Archaeologists from the 1996 excavation discovered an abandoned well (Van Bueren 2001:iii).

The archaeologists uncovered a 60 foot deep, hand dug octagonal well that was once lined with redwood timbers (Van Bueren 2001:19). The upper portion of the well feature was disturbed by Dave Jones, who moved to the property in 1911 (Van Bueren 2001:21). Caltrans District 11 and Rob Case excavated and investigated the well through the use of a backhoe (Van Bueren 2001:22). They only manually excavated the feature at layer interfaces to separate soil strata (Van Bueren 2001:22). The upper portion of the well was roughly circular in shape with a diameter of about 11 feet. The diameter gradually narrowed until a clearly defined circular cut was revealed at a depth of 10 feet below the starting grade (Van Bueren 2001:19). The project grading plan required a cut of about 18 feet in the feature vicinity. The cut was made at 10 feet below ground surface. It measured four feet in diameter and continued to a depth of about 22 feet (Van Bueren 2001:19). Van Bueren reports that the well was essentially unlined, although the archaeological crew found a single fragment of a one inch thick redwood plank, between nine and thirteen feet below starting grade, that most likely came from the original well lining (2001:19). The archaeological crew excavated to 22 feet below the original ground surface (Van Bueren 2001:31).

The archaeological crew reported that the cultural fill layers for the well feature were all likely deposited circa 1934 (see Figure 7; Van Bueren 2001:31). According to Dave Jones, the well feature was abandoned when the well diggers encountered saline water during the construction of the well (Van Bueren 2001:19). Jones removed the lining from the well for reuse in a second well. Jones suggested that the well may have been dug by the Freeman
family, who occupied the site prior to 1911 (Van Bueren 2001:19). Alfred A. Freeman is listed as the owner of the ranch from the mid 1890s to 1911 (Van Bueren 2001:8). Jones added that the abandoned well was used for refuse disposal by the Jones family possibly beginning in the 1920s and continuing through the 1930s (Van Bueren 2001:19).

**CA-SDI-16,055**

Archaeologists of Brian F. Smith and Associates monitored and investigated CA-SDI-16,055, the Renaissance Park Project, from 2000 to 2001. The site is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Pierson 2001:1.0-1). The archaeological crew discovered an industrial refuse
deposit and two hand dug wells (Pierson 2001:5.0-1). The hand-dug wells date to the early
1870s and were filled with 1895-1935 domestic and automotive refuse (Pierson 2001:1.0-1).

Brian F. Smith and Associates located Feature 2, a well feature, in the northeast
quadrant of the block (see Figure 8). They mechanically excavated the first three feet of the
well before manually excavated the rest of the well feature in decimeter levels (Pierson
2001:5.0-1). The project contractor used a backhoe to remove the native soil on the north side of the well for a distance of 15 feet because the well feature was more than five feet deep and would have required shoring for safety precautions. The backhoe allowed excavators to work in a safe, accessible and unconfined environment (Pierson 2001:5.0-1).

Brian F. Smith and Associates recovered a total of 6,849 artifacts. Items from the well that could be quantified by count were household, building materials, personal, electrical, munitions and miscellaneous (Pierson 2001:6.0-10).

Feature 2 was 4.8 feet in diameter and 25 feet below the project area’s present street level. The interior of the well was constructed of brick and redwood boards measuring three inches in width, a half inch thick and butted together (Pierson 2001:6.0-10). The excavated portion of the well measured about 10.17 feet from the discovery elevation (13 feet below street level) to the base of the feature (Pierson 2001:6.0-10). This revealed that the well was about 25 feet in depth (Pierson 2001:6.0-10).

The second feature for CA-SDI-16,055 was another hand dug well, Feature 3, located south of the refuse deposit feature (see Figure 9). Archaeologists mechanically excavated the north half of the well feature to the bottom of the feature. The excavation revealed the well feature profile. The south half of the well feature was excavated by hand. The soil was wet screened and artifacts were collected (Pierson 2001:5.0-2). Wood and brick were recovered from this well feature, however, the materials in Feature 3 were not arranged in the bottom of the feature as it was in Feature 2 (Pierson 2001:6.0-34). Pierson reports that the wood well casing may have been destroyed from refuse burning activities in Feature 3 (2001:6.0-34).

The well feature hole was 4.7 feet in diameter and 31.4 feet below the present street level (Pierson 2001:6.0-34). Brian F. Smith and Associates reported that only the lower 6.4 feet of the well feature was found intact. The interior of the well feature was possibly made of redwood boards similar to that of the first well, Feature 2 (Pierson 2001:6.0-34). The archaeological crew did not encounter a intact wood or brick lining in the well (Pierson
Archaeologists recovered a total of 4,209 artifacts from the well feature. Quantifiable items discovered included: building materials, undetermined items, household items, personal items, electrical, munitions and farming items (Pierson 2001:6.0-34).
**CA-SDI-16,888**

Archaeologists of Brian F. Smith and Associates monitored and excavated at CA-SDI-16,888, The Trellis Project at 5th and K Street, in 2004. CA-SDI-16,888 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Buysse 2004:1). The archaeological crew identified a historical privy and well for the project (Buysse 2004:6.0-25).

Construction grading exposed the historical hexagonal wood-lined well feature (see Figure 10). Archaeologists discovered the top of the well feature at approximately 16 feet below the ground surface level (Buysse 2004:6.0-79). The construction of the well was elaborate, consisting of 26 to 28 inch long planks at the top of the feature creating a four foot diameter hole (Buysse 2004:6.0-79). The size of the planks gradually decreased between 60 (1.9 feet) and 80 centimeters (2.6 feet) from the top, decreasing the overall diameter of the feature at the bottom (Buysse 2004:6.0-79).

Brian F. Smith and Associates excavated the well to a maximum depth of 80 centimeters (2.6 feet). The bottom of the well feature was marked by the discontinuation of wood planks and the light sand bottom (Buysse 2004:6.0-60-79). Archaeologists observed a dark ring of organic material surrounded by light relatively sterile sand near the bottom of the well feature (Buysse 2004:6.0-79). Eighty percent of the well's contents were sawdust (see Figure 11). Buysse posits that the “sawdust might suggest the well was filled during the time the lot was used for furniture storage in the mid to late 1880s and again near the turn of the century, […] no archival indication that furniture was actually constructed on site” (2004:7.0-2). The remaining contents of the well fill included leather fragments, glass, and wood fragments (Buysse 2004:6.0-79). Analysis of the materials indicates that the well was possibly constructed in the 1870s and refuse was deposited as late as the 1890s (Buysse 2004:6.0-90). The specific construction date of the well is undetermined. San Diego city water was delivered to Fifth and K Streets by 1874, which suggests that the well must have been before 1874 (Buysse 2004:7.0-2). Brian F. Smith and Associates noted that a portion of the well artifacts appear to date from the 1880s to the 1890s. This means that the well was probably capped until the end of the 19th century (Buysse 2004:7.0-2).
CA-SDI-17,082

Brian F. Smith and Associates conducted an archaeological investigation at CA-SDI-17,082, The Broadway 655 Project, from 2003 to 2004. CA-SDI-17,082 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Buysse 2005a:1.0-1). Archaeologists discovered five isolated finds, eight artifact concentrations and one historical brick and wood lined well (Buysse 2005a:1.0-1).
The top of the historical well was exposed during the construction grading. The well initially appeared to be a round deposit measuring 4.5 feet east to west by 3.9 feet north to south. Archaeologists identified the well feature at about 4.5 feet below the current ground surface (Buysse 2005a:6.0-24). Construction grading had disturbed the upper 20 centimeter levels of the well feature. Archaeologists excavated the rest of the well in 10 centimeter levels. They did not encounter the well feature lining until 30 centimeters deep. The deposit developed into a hexagonal shape with remains of a redwood lining (see Figure 12; Buysse 2005a:6.0-24). The wood planks were butted up against one another. The six sides were slightly different in lengths, ranging from 60 (1.9 feet) to 70 centimeters (2.2 feet; Buysse 2005a:6.0-24). The redwood lining continued down until 210 centimeters (6.7 feet) when excavators encountered a slightly smaller, circular, red brick lining (see Figure 13; Buysse 2005a:6.0-24). The external diameter of the of the brick lining was 110 centimeters (3.6 feet) west to east by 100 centimeters (3.3 feet) north to south. The interior diameter was 90 centimeters (2.9 feet; Buysse 2005a:6.0-24). The bricks measured 7.8 inches by 2.1 inches and no mortar was used between the bricks.

Brian F. Smith and Associates removed the soil from the side of the brick structure in order to examine the feature profile and to access the remaining deposit in the bottom of the structure. They had to remove the wood lining on the north side of the well feature to access the brick fill lining fill (Buysse 2005a:6.0-24). The brick lining was about 110 centimeters (3.6 feet) in height (see Figure 14). As the excavation continued the brick lining was removed. The floor of the brick lining was lined with thin wood planking and a 0.5 feet layer of sand. The depth of the brick lining was 320 centimeters (10.5 feet). Archaeologists determined that the well feature was originally 530 (17.3 feet) to 550 centimeters (18 feet) deep (Buysse 2005a:6.0-24).

The archaeological crew recovered minimal evidence that would help to identify the date of the well construction. Based on the artifacts from the well, San Diego residents appear to have deposited trash into the well in the early to mid-1890s (Buysse 2005a:7.0-1). Buysse reports that the digging of wells in downtown San Diego was common in the late 1860s and early 1870s (2005a:7.0-4). Downtown San Diego had piped water by the mid-1870s (Buysse 2005a:8.0-1). Buysse reports that it is likely that the well for CA-SDI-17,082 was constructed before the mid-1870s (2005a:7.0-4, 8.0-1).
CA-SDI-17,311

S. Rose and Cheryl Bowden-Renna of EDAW monitored and excavated at CA-SDI-17,311, Block 124, in 2000. CA-SDI-17,311 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Dolan and Bowden-Renna 2005:1). Upon excavation, EDAW discovered an abandoned unlined well (Dolan and Bowden-Renna 2005:1). The well feature is associated with a boarding house identified on the 1888 and 1906 Sanborn Fire Insurance Maps (Dolan and Bowden-Renna 2005:1).

The well feature measured about five feet in diameter. Archaeologists excavated the well to a depth of three feet and nine inches (Dolan and Bowden-Renna 2005:3). The well
appears to have been filled with debris from the late 1800s (Dolan and Bowden-Renna 2005:3).

**CA-SDI-17,663**

Brian F. Smith and Associates excavated at CA-SDI-17,663, The Alta Project, in 2005. CA-SDI-17,663 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Buysse 2005b:1.0-1). Archaeologists discovered a historical well, trash deposits, a concrete drainage trough and isolated artifacts (Buysse 2005b:1.0-1).

Brian F. Smith and Associates archaeological crew discovered the well feature during grading of the site at a depth of approximately five feet below street level. They noted a distinct circular outline of stained soil that measured about 130 centimeters (4.2 feet; Buysse 2005b:1.0-1). Archaeologists investigated the well feature by bisecting the feature into north and south halves (Buysse 2005b:6.0-23). The backhoe operator mechanically excavated the north half of the well features. Archaeologists sorted through the multiple two-foot levels that
were removed from the feature by the backhoe (2005b:6.0-23). They recovered few artifacts. Ninety percent of the artifacts consisted of construction debris, including bricks, nails, glass, and metal (Buysse 2005b:6.0-23).

Archaeologists hand excavated the south half of the feature in 10-centimeter levels. The fill contained a high percentage of construction debris throughout the first 90 centimeters of excavation. Household and construction debris were located between 90 (2.9 feet) and 110 centimeters (3.6 feet; Buysse 2005b:6.0-23). Archaeologists found the bottom of the feature at 150 centimeters (4.9 feet). They determined that the well feature was about 302 centimeters (10 feet) deep. The crew incorporated two depths to determine the approximate depth of the entire well feature; depth at first contact (5 feet below street level) and the depth of when they reached the bottom of the feature (Buysse 2005b:6.0-23). They also never encountered a lining for the feature (Buysse 2005b:6.0-23).

Brian F. Smith and Associates recovered 539 artifacts. The largest quantity of artifacts consisted of metal fragments then construction/maintenance items (brick fragments, glass, and nails). They do not believe that the brick fragments originated from the well feature because there was no evidence that the well ever had a brick lining (Buysse 2005b:6.0-23). Buysse reports that it probably came from previous building activities (2005b:6.0-23, 6.0-24).

Brian F. Smith and Associates cataloged a total of 14 diagnostic artifacts. The most common diagnostic artifact types included bottles and bottle/jar glass with visible maker’s mark or identifiable manufacturing methods. The artifacts overlap in dates but they suggest that the well was likely filled during the 1910s (Buysse 2005b:6.0-24).

Archaeologists interpreted that well feature as a 19th-century well based on the depth and size of the feature (Buysse 2005b:6.0-24). Buysse notes that this historical well is relatively shallow compared to other wells discovered in downtown San Diego (2005b:6.0-24).

**CA-SDI-18,358**

Archaeologist of Brian F. Smith and Associates monitored and excavated at CA-SDI-18,358, The Bayside at the Embarcadero Project, in 2006 to 2007. This site is located at the southeast corner of Pacific Highway and Ash Street in the Columbia
neighborhood of downtown San Diego, California (Pierson 2007b:1.0-1). The historical features identified were a well and a trash pit (Pierson 2007b:1.0-1).

The well measured two feet six inches by two feet six inches with a depth of at least seven feet and six inches. The original depth is unknown. The archaeologists removed the soil before the well feature was identified (Pierson 2007b:6.0-11). They excavated the well feature in 10 centimeter increments. The soil between zero and 30 centimeters was a black greasy silty loam. From 30 centimeters to the base of the excavation at 90 centimeters, the soil was a black greasy silty loam with a blue tint (Pierson 2007b:6.0-15). The perimeter of the feature narrowed between 50 and 60 centimeter levels to about five to six inches closer to the center than at the opening. At 90 centimeters deep, the well feature once again measured two feet six inches by two feet six inches (Pierson 2007b:6.0-15). Pierson reports that although there was no lining clearly visible, the high amounts of wood in the well feature may represent remains of a possible lining (2007b:6.0-15).

Brian F. Smith and Associates recovered a total of 259 artifacts were collected from the excavation. The majority of the materials were household items. The artifact collection from the well feature dates from about 1885 to 1910, corresponding with the late 1800s time period of when wells and cisterns were abandoned (Pierson 2007b:6.0-15, 20). The date range suggests that the well was built before the 1900s (Pierson 2007b:6.0-20).

**CA-SDI-18,399**

Archaeologists of Brian F. Smith and Associates excavated at CA-SDI-18,399, The Lofts at 707 10th Avenue Project, from 2006 to 2007. CA-SDI-18,399 is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle in an unsectioned portion of Township 15 south, Range 4 west (Rosenberg and Smith 2007:1.0-1). Archaeologists discovered a well during monitoring processes (Rosenberg and Smith 2007:1.0-1).

Brian F. Smith and Associates located the well feature at 10 feet below street surface during backhoe excavations along the north wall of the project boundary (Rosenberg and Smith 2007:6.0-20). Rosenberg and Smith maintain that the shape, size and depth of the feature suggest that it was a well (2007:6.0-25). The edges of the feature were round and the walls bowed out slightly. The feature measured four feet and three inches north to south and four feet and three inches east to west. Soil in the well feature was a light gray sandy loam.
with burnt ash and charcoal found throughout the feature fill (Rosenberg and Smith 2007:6.0-20). Archaeologists manually excavated the well feature in decimeter levels. They excavated until they reached sterile soil at 50 centimeters (1.6 feet; Rosenberg and Smith 2007:6.0-21). Rosenberg and Smith report that 50 centimeters is shallow for a well located in downtown San Diego (2007:1.0-1). The diameter and shape of the feature remained consistent. The crew did not encounter a lining for the well feature (Rosenberg and Smith 2007:6.0-20).

The archaeological crew recovered 51 temporally diagnostic artifacts. The artifacts range from the mid 1800s through the 1920s (Rosenberg and Smith 2007:6.0-21). Rosenberg and Smith posit that the date range suggests that multiple deposition episodes may have occurred anytime during this period (2007:6.0-21).

**CA-SDI-18,997**

Brian F. Smith and Associates monitored and excavated at CA-SDI-18,997 in 2008. CA-SDI-18,997 is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle in an unsectioned portion of Township 15 south, Range 4 west (Clowery-Moreno and Smith 2008:1). They uncovered three small trash deposits, an isolate find and one well feature (Clowery-Moreno and Smith 2008:1).

The historical well feature measured 3.9 feet north to south by 3.9 feet east to west. Archaeologists excavated to the bottom of the feature, which reached 9.1 feet (Clowery-Moreno and Smith 2008:2). The well had an upper octagonal shaped wood lining that was supported by a lower brick and wood construction (see Figure 15; Clowery-Moreno and Smith 2008:2). The upper wood portion of the well feature measured about 3.9 feet in height. The wood planks used to construct the well measured one inch in height, 18 inches in length and six inches in breath (Clowery-Moreno and Smith 2008:2). The lower brick construction measured about 5.2 feet in height. The bricks measured 2.25 by 3.75 by 8 inches. The lower part of the brick portion of the well rested on a circular wood frame (Clowery-Moreno and Smith 2008:2). Artifacts were embedded within moist, lead contaminated dark brown sandy silt soil (Clowery-Moreno and Smith 2008:2). Archaeologists recovered little temporally diagnostic material from the well (Clowery-Moreno and Smith 2008:2).
ASM Affiliates discovered a total of 16 late 19th-century and 20th-century features at CA-SDI-19,465, Petco Park at the Park-Block 125, in 2001 (Schaefer 2009b:1). One of the features was a historical well. CA-SDI-19,465 is located at 100 Park Boulevard, San Diego, 92101 (Schaefer 2009b:1).

Archaeologists uncovered a well defined circular impression of a well at a depth of 120 centimeters (3.9 feet) below the surface level (Schaefer 2009b:2). It was 4.2 feet in diameter and more than 16 feet deep. The well was unlined and was cut into very hard clay (see Figure 16). Schaefer notes that the perfect symmetry and uniform, vertical walls of the well shaft are indications of a professional well digger (2009a:2). The archaeological crew encountered a sewer pipe fragment at 5.2 feet. Schaefer reports that the pipe suggests that the well may have been abandoned in the 1900s when water and sewer service was installed (2009a:6). Schaefer does not mention a lining for the well.

ASM Affiliates recovered 310 artifacts from the well (Schaefer 2009b:6). The date range of the temporally diagnostic artifacts is from 1860 to 1900 (Schaefer 2009b:5).
The mean date for when residents deposited refuse into the well is 1885.68 (Schaefer 2009b:5).

CA-SDI-19,714

Shelby Gunderman and Scott Wolfe of ASM Affiliates recorded and excavated at CA-SDI-19,714 during a construction monitoring project on September 9 2009. The site is located on the U.S. Geological Survey (USGS) 7.5 minute El Cajon Quadrangle in an unsectioned portion of Township 16 south, Range 1 west (Gunderman and Becker 2010:1). CA-SDI-19714 consists of an isolated feature of an unlined round historical well. The historical well feature is about 365 feet east of the intersection of Rea Avenue and Magnolia Avenue. The well measures three feet and eight inches in diameter with a depth of approximately seven feet. Gunderman and Wolfe used an augor probe to evacuate the northern half of the well feature encountered the water table at 82 inches (6.8 feet).

Additionally, they came across a solid clay stratum at 88 inches (7.3 feet) that most likely represents the bottom of the excavated well (Gunderman and Becker 2010:9).
Gunderman and Wolfe recovered 1,597 artifacts by hand using trowels and handpicks (Gunderman and Becker 2010:15). The well feature contained deposits of historical bottles, metal fragments, ceramic plates, bowls, toys and other artifacts (see Figure 17). The archaeologists note one machine-cut nail during excavation. The majority of artifacts are building materials, consumer goods and kitchen goods (Gunderman and Becker 2010:15). The artifacts seem to represent the early 1900s to 1940s, with dates clustering from 1910 to 1930. Due excavation and construction grading of a parking lot in the 1960s, the project area was significantly disturbed (Gunderman and Becker 2010:5-9).


**ARCHAEOLOGICAL SITES WITH EXCAVATED CISTERNs**

Primary numbers are given to archaeological sites with a single artifact or structure unassociated with any other site, structure, or artifact. Primary numbers identify the county and a number given in the order that the site was recorded. Since San Diego County is the 37th county in California, the primary number is represented as P-37-000000.
P-37-027126

Archaeologists of Brian F. Smith and Associates excavated at P-37-027126, The Seacliff House, in 2006. The site is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle in an unsectioned portion of Township 15 south, Range 4 west (Pierson 2006b:1). During the monitoring process, three isolated lithic artifacts and a historical cistern were exposed at the front side of the house (Pierson 2006b:2).

Pierson reports that the cistern is probably associated with the original structure on the lot (2006b:3). The Seacliff House was not included on the 1909 Sarn born Map but the project architect, Anthony Ciani, provided an original construction date of 1901 (Pierson 2006b:3). The 1901 date is used to mark the earliest construction date of the cistern. City water did not reach this portion of La Jolla, California until 1910, which may mark the approximate terminal date for the use of the cistern (Pierson 2006b:3). The City water pipes were installed within ten years of the construction of the house, the use of the cistern was likely short lived (Pierson 2006b:3).

The cistern is not unusual and is a simple storage device that was common in the late 1800s and early 1900s households (Pierson 2006b:3). The cistern was constructed of brick because it was located in a very sandy soil at the top of sea cliffs. The environment, unstable soil and the weight of the cistern would require some stability beyond a plastered hole in the ground (Pierson 2006b:3). The cistern measured about five feet in diameter and approximately five feet in depth. The cistern walls and floor were coated with plaster, inside and out. No artifacts were collected and the cistern was backfilled with sand. Brian F. Smith and Associates reported that the cistern is standard for cisterns in the San Diego area (Pierson 2006b:3).

CA-SDI-4,897

Archaeologists of Wirth Environmental Services surveyed CA-SDI-4897 in 1985. Little is known about the history of CA-SDI-4897. There are no records of structures on the property after 1890. Research determined that the development of the site took place before 1887 and the site was abandoned by 1890. CA-SDI-4897 is tentatively dated 1880 to 1890 (McCorkle Apple et al. 1986:142).
During the survey, archaeologists discovered Locus E; an area that extended over 45,380 square feet (McCorkle Apple et al. 1986:41). Locus E had both prehistoric and historical artifacts. Archaeologists documented a brick roofed cistern in the survey. They did not find a historical building in association with the cistern (McCorkle Apple et al. 1986:41).

The archaeological crew excavated the cistern with the help of a backhoe. The cistern was constructed by digging a large hole and working from the bottom up (McCorkle Apple et al. 1986:188). The foundation of the cistern rests on brown soil. Alternating layers of bricks and mortar were laid to form a circular vertical foundation three feet high. From the foundation to the center if the cistern is a bowl shaped circular depression plastered with a two inch thick lining of mortar (see Figure 18). The mortar was a mixture of cement, gypsum plaster and sand (McCorkle Apple et al. 1986:188). The brick measurements vary but the average size is 8.25 by 4 by 2.5 inches (see Figure 19). From the top of the vertical foundation, the bricks were gradually stepped inward. The inside of the cistern was plastered in mortar. The upper outer two-thirds of the cistern were also mortared (McCorkle Apple et al. 1986:188).

The excavation of the cistern revealed it was filled with concrete and rock. One of the concrete fragments was inscribed “tino,” a material of recent origin (McCorkle Apple et al. 1986:188). At the bottom of the cistern there were bone, wood and barbed wire. Archaeologists determined that the artifacts were deposited after the structure was abandoned. This conclusion was supported by the number and nature of the artifacts recovered (McCorkle Apple et al. 1986:188). The cistern was associated with shell, brick, glass and ceramic scatters. The patterning demonstrates refuse disposal patterns of a non-random fashion (McCorkle Apple et al. 1986:188).

**CA-SDI-10,668**

Archaeologists of WESTEC Services excavated at CA-SDI-10,668, Henry A. Schott’s late 1800’s farm site, in 1987. CA-SDI-10,668 is located on the U.S. Geological Survey (USGS) 7.5 minute Otay Mesa Quadrangle of Township 18 South, Range 1 East, Section 19 (Kyle et al. 1988:6-1). WESTEC discovered a historical cistern at CA-SDI-10,668 (Kyle et al. 1988:6-1).
WESTEC conducted a field test at CA-SDI-10,668 for the purpose of locating historical features and artifacts that could provide information on early farming activities in Otay Mesa (Kyle et al. 1988:6-5). The archaeological crew discovered a cobble plaster-lined cistern feature for the historical farm site (see Figure 20). The cistern was filled with rocks, bone, trash, and a limited quantity of historic debris (Kyle et al. 1988:6-1). The crew mechanically excavated the cistern and scraped the surface area immediately adjacent to the cistern (Kyle et al. 1988:6-1). The cistern was cylindrical in shape (Kyle et al. 1988:6-7).


WESTEC recovered artifacts from the cistern and the surface area located adjacent to the cistern (Kyle et al. 1988:6-9). Temporally diagnostic artifacts collected were glass bottle fragments and house hardware items. Most of the bottle fragments date from 1880 to 1920. The hardware items are associated with buildings constructed in either the late 19th century or early 20th century (Kyle et al. 1988:6-1). The archaeologists did not mention a date of construction for the cistern feature (Kyle et al. 1988:6-1).
CA-SDI-11,802

Mary Robbins-Wade recorded CA-SDI-11,802 in 2005. CA-SDI-11,802 is located on the U.S. Geological Survey (USGS) 7.5 minute Otay Mesa Quadrangle of Township 18 South, Range 1 West, Section 31 (Robbins-Wade 2006:1). This is the Peter Beckley homestead site.

CA-SDI-11,802 was recorded as part of the Southeast Otay Mesa Sludge Processing Facilitates study. During the first half of the 20th century, the Beckleys owned a house, barn, a grove of eucalyptus trees, and a small orchard. The homestead was a sheep camp during the late 1870s to the early 1880s (Robbins-Wade 2006:1). During the 2005 testing program, archaeologist mechanically excavated a series of 20 trenches across CA-SDI-11,802 in attempts to locate subsurface cultural features associated with the historical farmstead (Robbins-Wade 2006:1). Robbins-Wade 2006 encountered a cistern at 20 centimeters (0.6 feet) below ground. One of the Beckley family members informed excavators that a cistern had once been located off the front porch of the farmhouse (2006:1). They mechanically removed soil and debris from the cistern feature. The cylindrical cistern measured 10 feet wide and 12 feet deep (Robbins-Wade 2006:1). The crew did not mention a lining for the cistern. Stephen Van Wormer, an archaeologist, determined that the cultural material was essentially modern and that collection of the material was unnecessary (Robbins-Wade 2006:1-2).

CA-SDI-12,253

Linda Roth and Judy Berryman of Roth and Associates surveyed and excavated at CA-SDI-12,253 in 1991. This site is located on the Sherman Heights Community Center property (Roth 1991:16).

The archaeological crew mechanically excavated 17 trenches throughout the undeveloped portions of the property (see Figure 21). The units were excavated in levels established in accordance with the discernible cultural and natural stratigraphy (Roth 1991:18). Excavations revealed four features, one being a historical cistern. The cistern feature measured eight feet in diameter with an unknown depth. At a depth of eleven feet water poured into the feature and excavations stopped (Roth 1991:18). Roth and Berryman observed brick fragments along the wall surface of the cistern. The original cement lining
was partially intact from four and a half feet below the current surface. The cistern was filled with recent deposits such as trash filled garbage bags, carpet, brooms, bottles, and other domestic items (Roth 1991:18).

Due to safety precautions and the presence of water, Roth and Berryman had to backfill the cistern with the removed soil. The cistern was believed to be filled with compacted fill prior to excavation. However, during excavation Roth and Berryman learned
that the cistern was never backfilled with soil and it was only filled with recent household refuse (Roth 1991:26).

**CA-SDI-14,147**

Archaeologists of Kyle Consulting excavated at CA-SDI-14,147, a historical site, in 2000. The site is located east of Interstate 805 on central Del Mar Mesa (Kyle 2001:iii). The archaeological crew discovered a historical rectangular cistern during test excavations of the site (Kyle 2001:iii, 2-1)

Kyle consulting identified a rectangular depression as a cement cistern that measured seven and a half feet in diameter (Kyle 2001:iii). William Manley of Manley Consulting mechanically excavated the cistern to a depth of eight feet (Kyle 2001:2-1). They could not continue with the cistern excavation past eight feet because the backhoe bucket was too large to remove the rest of the feature’s soil (Kyle 2001:2-1). Kyle reported that cisterns could reach up to 30 feet in depth for the Del Mar Mesa (2001:3-3).

The cistern is associated with a building shown on the 1903 15 minute La Jolla U.S. Geological (USGS) quadrangle map (Kyle 2001:3-3). Historical sites within the study area represent components of a farming settlement on the Del Mar Mesa in the late 1880s and early 1900s (Kyle 2001:1-6). The cistern fill did contain any cultural material (Kyle 2001:1-6).

**CA-SDI-14,604**

Archaeologists of ASM Affiliates monitored and excavated at CA-SDI-14,604, situated in the Torrey Highlands area of San Diego, in 1997. CA-SDI-14,604 is a multi-component site, consisting of a historical homestead and a prehistoric lithic scatter (City of San Diego 2000:iv). The site is located on a knoll top overlooking Deer Canyon at an elevation of 400 feet (City of San Diego 2000:1). The prehistoric component of CA-SDI-14,604 is identified as lithic procurement locale (City of San Diego 2000:iv). The historical component of the site consists of a cobble-lined feature, several eucalyptus trees, historic road and a sparse scatter of historic glass and ceramics.

ASM Affiliates mechanically excavated the cobble-lined feature (City of San Diego 2000:16). The cistern was oval in shape and slightly bell-shaped (City of San Diego
The cistern measured nine feet two inches by eight feet three inches at the top and was nine feet two inches deep. The sides of the cistern are lined with tightly packed small cobbles (8 to 10 centimeters long) with concrete mortar (City of San Diego 2000:16). The floor was constructed of concrete with a plaster-lining. The fill of the cistern consisted of modern trash such as a wheelbarrow and a Coca Cola vending machine (City of San Diego 2000:16).

Investigations could not determine a date of construction for the cistern. However, debris at the base of the cistern indicates that it was backfilled during the 1970s (City of San Diego 2000:16). ASM reports that it is possible that the cistern was backfilled at the time that extensive bulldozing took place on the knoll (City of San Diego 2000:16). The cistern may have been constructed early in the 1900s; during the same time that the homestead site was occupied. The cobble construction is consistent with a date circa 1910 to 1920 (City of San Diego 2000:16). The late backfilling suggests that it either continued in use over a long period or it was covered over in some way between the abandonment of the homestead and the backfilling in the 1970s (City of San Diego 2000:16).

**CA-SDI-14,605**

Brian F. Smith and Associates monitored and excavated at CA-SDI-14,605, The Oak Knoll Project at 12718 Oak Knoll Road, in 1997. The project area is located within the southwestern section of Poway, California (Pierson and Kirkish 1998:1.0-1). Archaeologists discovered a 20th-century cistern that is assumed to be contemporary with the residence that was also present on the lot, which was built in the 1920s (Pierson and Kirkish 1998:1.0-1).

Archaeologists manually investigated the cistern feature with a one meter square test unit (Pierson and Kirkish 1998:4.0-1). To further investigate the exposed cistern, Brian F. Smith and Associates used a backhoe to remove the remaining soil in one foot levels (Pierson and Kirkish 1998:4.0-1). A total of eight levels were mechanically excavated within the cistern. The cistern feature was a conical pit lined with plaster. Also, during excavation, the backhoe trenched the outside wall of the cistern to determine the depth of the feature. The trench revealed that the cistern continued to a depth of eight feet (Pierson and Kirkish 1998:5.0-2). The cistern’s cultural materials mainly consisted of household items from the 1930s and 1940s (Pierson and Kirkish 1998:1.0-1).
CA-SDI-15,127

Lawrence Monserrate (2000:iv-85) of Environmental Impact Reports reported that CA-SDI-15,127 was surveyed in 1999 for the Draft EIR Black Mountain Water Treatment Plant and Land Acquisition.

The intensive survey resulted in two historical isolated finds (bottles) and two small concrete-lined rock and earthen cisterns with cement encased clay pipes (Monserrate 2000:iv-85). The cisterns are located on either side of a small ridge-line at the base of Black Mountain, San Diego. The cisterns were circular and constructed of unmortared volcanic and granitic boulders lined with a thin layer of cement mortar. The larger of the two cisterns measures eight feet in diameter (Monserrate 2000:iv-85). The cisterns date from the 1920s to the 1930s based on construction methods. Both cisterns are impacted by weathering, dumping and used for target practice (Monserrate 2000:iv-86).

CA-SDI-16,214

Brian F. Smith and Associates monitored at CA-SDI-16,214, The Laurel Bay Apartments Project, in 2001. CA-SDI-16,214 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Smith 2002:1.0-1). Archaeologists discovered a refuse deposit and two cisterns that date to the early 1870s (Smith 2002:1.0-1).

The archaeological crew discovered the brick cistern, Feature 1, during excavations for the underground parking project at CA-SDI-16,214 approximately eight feet below ground level (Smith 2002:6.0-1). They mechanically removed the soil and building debris (mortar, plaster, nails and glass) from the exterior of the cistern feature. Smith reports that typically once cisterns were no longer necessary they were used as refuse deposits by residents (2002:6.0-1). The cistern appeared to be untouched until a nearby structure was demolished and building debris was dumped into the cistern (Smith 2002:6.0-1). The brick cistern was a large circular hand dug hole with a plaster lining. The feature’s interior measured 14 feet in diameter and was eight feet deep (Smith 2002:6.0-1). Brian F. Smith and Associates encountered an internal wall within the cistern that divided the interior into north and south (see Figure 22; Smith 2002:6.0-1). The dividing wall was curved and set off about
one-third of the interior volume of the cistern (Smith 2002:6.0-1). The brick wall probably served as a sediment trap (Smith 2002:7.0-1).

Archaeologists discovered the second cistern, Feature 2, during the grading process of the project. The cistern measured 11.5 feet in diameter and was eight feet deep. It was a hand dug and plaster lined cistern (Smith 2002:6.0-8). Similar to the first cistern, Feature 2 had an interior dividing brick wall which could have been used as a sediment trap (Smith 2002:6.0-8). Differing from the first cistern, Feature 2 was almost completely filled with domestic refuse. Brian F. Smith and Associates collected 7,973 artifacts from the second
cistern. Dateable artifacts suggest that the cistern was filled from the mid to late 1920s (Smith 2002:6.0-8). Smith notes that the time period is consistent with the estimated period when the existing homes and cisterns fell into disuse and the block was redeveloped with commercial structures (2002:6.0-8).

CA-SDI-16,264


Archaeologists discovered a Cistern 1 during the data recovery program for CA-SDI-16,264 (Gallegos and Bugee 2002:iv). Above ground, the cistern had a pentagonal concrete block which measured 17 inches high by 52 inches across its widest point (Gallegos and Bugee 2002:3-6). The western edge of the cistern’s cap was damaged due to impact or by deterioration. The opening in the cistern’s cap revealed large, irregular cobbles in the concrete of the feature (Gallegos and Bugee 2002:3-6). The opening Cistern 1 measured 2.8 feet in diameter (interior). The cistern showed evidence of a hand pump device or some other type of water extraction apparatus (Gallegos and Bugee 2002:3-6).

Gallegos and Bugee (2002:3-8) removed the concrete cap from the neck of the cistern structure during initial investigation of the feature, which revealed an internal structure of brick and mortar with a plaster lining. The archaeological crew reported a collar of exposed brick at the base of the cistern neck. Below the collar, the cistern gradually flared to a width of 6.1 feet at a depth of four feet from the base of the cistern neck (see Figure 23; Gallegos and Bugee 2002:3-8). The crew removed a section of the cistern wall with a backhoe to expose a side profile of the feature (see Figure 24). They removed the cistern fill with the backhoe and monitored for historical material (Gallegos and Bugee 2002:3-8). The bottle and cans from the cistern date to the 1970s (Gallegos and Bugee 2002:3-8).

At a depth of nine feet the cistern diameter increased to 10 feet in diameter. The rest of the cistern tapered towards the bottom and formed a bowl shape (Gallegos and Bugee 2002:3-8). The final depth of the Cistern 1 was 15 feet from the exposed brick collar to the
bottom of the feature. Due to equipment safety and limitations, a small amount of soil remained at the bottom of the cistern (Gallegos and Bugee 2002:3-8).

The other three cisterns at CA-SDI-16,264 were made of brick and were similar to the first cistern in construction style (Gallegos and Bugee 2002:IV, V). The three cisterns were damaged by a San Diego Gas and Electric (SDG&E) trench (Gallegos and Bugee 2002:V).

**CA-SDI-16,395**

Archaeologists of Brian F. Smith and Associates conducted archaeological investigations at CA-SDI-16,395, The Acqua Vista Project in Little Italy, San Diego, in 2002. CA-SDI-16,395 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Pierson 2003a:1). The discoveries made at this site consisted of two cisterns and eight trash pits/privy pits. The construction of the two cisterns date to the early 1870s and contained 1895 to 1935 refuse (Pierson 2003a:6.0-1).
Figure 24. Profile of the intact cistern. 

The first cistern, Feature 9, was an in-ground, plaster-lined (see Figure 25; Pierson 2003a:6.0-1-3). The interior diameter of the cistern measured about 8.5 feet on the inside diameter. Archaeologists could not determine the depth of the cistern because the upper portion of the cistern was missing. The cistern did not possess any diagnostic artifacts (Pierson 2003a:6.0-1). Pierson reports that the typical use period for these cisterns was from the early 1880s (2003a:6.0-1). The 1886 Sanborn Map suggests that the owner of the adjacent house, located at 1445 Columbia Street, may have owned the cistern and used it (Pierson 2003a:6.0-1).
The second cistern, Feature 10, was located on 1445 Columbia Street and contained a large quantity of household refuse (see Figure 26; Pierson 2003a:6.0-1). Brian F. Smith and Associates completely excavated Feature 10. They only collected and cataloged diagnostic artifacts (Pierson 2003a:6.0-3). Feature 10 was larger than the first cistern, Feature 9. It was constructed of brick reinforced sides (Pierson 2003a:6.0-1). The inside of the cistern was plaster-lined in order to make the structure watertight (Pierson 2003a:6.0-3). The inside diameter is 11 feet and the depth is unknown because, similar to the first cistern, Feature 9, the upper portion is missing (Pierson 2003a:6.0-1).

**CA-SDI-16,496**

Archaeologists of Brian F. Smith and Associates excavated at CA-SDI-16,496, The La Vita Project in Little Italy, San Diego, in 2002. CA-SDI-16,496 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Pierson 2003b:1.0-1). The historical features for the site were two cisterns, a septic tank, and four privy pits (Pierson 2003b:5.0-1). The cisterns date
to the 1870s. Pierson reports that cisterns in Middletown (Little Italy, Mission Hills and Hillcrest) date to the 1870s (2003b:5.0-1).

The first discovery for CA-SDI-16,496 was the lower portion of a cistern, Feature A. Once the archaeological crew exposed the profile of the cistern, the feature was measured, described, sketched and photographed. The crew collected the few artifacts in the interior of the cistern (Pierson 2003b:5.0-1). They describe the cistern as a simple plaster-lined hole with brick at the top to support the lid. The cistern was probably built during the late 19th century. The artifacts recovered suggest that they were deposited in the feature between 1920 and 1940 (Pierson 2003b:6.0-1).

The second discovery of CA-SDI-16,496 was the lower portion of another cistern, Feature B (Pierson 2003b:5.0-1). At first, the cistern did not reveal any artifacts. When the archaeologists removed the cistern, a small cache of artifacts was revealed in the lowest part of the feature. The artifacts were mainly whole bottles and a few brick fragments (Pierson 2003b:5.0-1). The artifacts indicate that they were deposited between 1900 and 1920 (Pierson 2003b:6.0-1).
CA-SDI-16,848

Archaeologists of Brian F. Smith and Associates monitored and excavated at CA-SDI-16,848, The Entrada Apartments Project, in 2003. CA-SDI-16,848 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Smith and Benjamin-Ma 2004:1.0-1). Archaeologists discovered a 19th-century cistern during monitoring procedures (Smith and Benjamin-Ma 2004:1.0-1).

Archaeologists exposed the top of the cistern feature during excavation activities. A concrete cap was present on the cistern. They suspect that the cistern was constructed between 1867 and 1888 during the same time period when water was obtained from hand dug wells and trucks (Smith and Benjamin-Ma 2004:1.0-1). The cistern was 10 feet in diameter and 10 feet deep (see Figure 27). It was filled with household refuse and building materials (Smith and Benjamin-Ma 2004:6.0-1). The feature’s walls measured six to eight inches wide and were constructed of bricks and mortar and they were lined with concrete. Brian F. Smith and Associates excavated the cistern mechanically, removing two feet of deposit per level (Smith and Benjamin-Ma 2004:6.0-1). They fully excavated the cistern after five levels (Smith and Benjamin-Ma 2004:6.0-21).

Brian F. Smith and Associates recovered 365 temporally diagnostic artifacts from the cistern feature. The artifacts provide a range of dates starting in the 1910s and ending in the 1960s. The majority of the artifacts date to the 1920s and 1930s (Smith and Benjamin-Ma 2004:6.0-21). An Owens-Illinois Company bottle embossed with “Qualitee Dairy” dates from 1962 to 1964. Brian F. Smith and Associates suggests that the bottle indicates that the cistern was capped in 1964 (Smith and Benjamin-Ma 2004:6.0-21). They posit that the artifacts indicate that the cistern was open from the 1910s to 1964 with the majority of the refuse being deposited in the 1920s and 1940s (Smith and Benjamin-Ma 2004:1.0-1).

CA-SDI-17,546

Brian F. Smith and Associates monitored at CA-SDI-17,546, The Lofts at 677 7th Avenue Project, from 2004 to 2005. CA-SDI-17,546 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Smith and Rosenberg 2005:1.0-1). During monitoring activities,
archaeologists discovered one historical cistern, seven deposits, one artifact scatter and isolated artifacts (Smith and Rosenberg 2005:1.0-1).

The archaeological crew uncovered the plaster-lined cistern feature in the northwest portion of the project area (see Figure 28). Only the southern half of the cistern feature remained. The crew excavated the southern half in three-one-foot levels (see Figure 29; Smith and Rosenberg 2005:6.0-13). They excavated to a total depth of three feet and eight inches. The bottom of the cistern had a hard plaster floor (Smith and Rosenberg 2005:6.0-14). The cistern measured 10 feet in diameter and was filled grayish brown semi-compact silty loam (Smith and Rosenberg 2005:6.0-14).

Brian F. Smith and Associates found little evidence of when the cistern was constructed. The cistern’s artifacts suggest that the deposition of materials into the feature may have occurred from the 1900s to the 1910s (Smith and Rosenberg 2005:7.0-2). The artifacts’ date range suggests that the cistern is from the 19th century. According to Brian F. Smith and Associates’ site report, residents who once lived in and around CA-SDI-17,546 may have contributed to the filling of the cistern (Smith and Rosenberg 2005:7.0-2).


CA-SDI-17,581

Archaeologists from SWCA Environmental Consultants recorded and excavated CA-SDI-17,581, The Market Street Village Project, in 2004. During excavation, the archaeological crew discovered a historical cistern, MSV-16. The cistern contained a refuse deposit (Hunt et al. 2005:43). Due to safety concerns, the crew was assisted by construction personnel who mechanically excavated the artifacts from the feature and laid them out on the surface for archaeologists to recover. The mechanical excavation did not reveal stratification
of the deposit within the cistern; the deposit appeared to be homogeneous in nature. SWCA recovered a total of 29 five-gallon buckets from the cistern feature (Hunt et al. 2005:77).

Seven of the 29 buckets were sent to the lab for analysis (Hunt et al. 2005:77). SWCA lab personnel analyzed ninety five artifacts from the cistern. Ninety three of the artifacts were glass bottles or bottle fragments. These bottles were beverage containers, chemical bottles and condiment bottles. The remainder of artifacts consisted of one silver plated spoon and one steel license plate. Many of the bottles revealed identifiable maker’s marks, SWCA used to determine a date range for the collection (Hunt et al. 2005:77-83). The most inclusive date range for the bottles in the collection is from 1929 to 1957 (Hunt et al. 2005:77). The date range was determined by combining the earliest production stop date with the latest production start date. Based on the artifacts from the cistern feature, it is possible that the cistern was filled during the 1950s (Hunt et al. 2005:77-78, 95). The date cannot be positively determined because a systematic stratigraphic excavation of the feature was not possible due to safety precautions. The collection of bottles recovered from the cistern date to the 1930s and 1940s (Hunt et al. 2005:77-78, 95).

**CA-SDI-17,583**

Archaeologists of Brian F. Smith and Associates excavated CA-SDI-17,583, The Aloft on Cortez Hill Project, in 2005. CA-SDI-17,583 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle of Township 11 (Clowery-Moreno and Smith 2005:1). The archaeological crew encountered trash filled cylindrical. They determined the historical cistern as potentially significant because of the age, construction style of the cistern and the research value of the artifact deposit within the cistern feature (Clowery-Moreno and Smith 2005:1.0).

The cistern measured eight feet by 6.2 feet. Brian F. Smith and Associates excavated down to a depth of 100 centimeters (3.2 feet; see Figure 30). It was not possible for them to determine the full depth of the cistern because the upper portion of the feature was missing and damaged (Clowery-Moreno and Smith 2005:6.0-1). The cistern’s walls consisted of a plaster-lining placed within a dirt hole that was dug for the feature (Clowery-Moreno and Smith 2005:6.0-1). The contents of the cistern represent domestic household refuse from the mid-1920s to the mid-1940s (Clowery-Moreno and Smith 2005:7.0-2). The largest and most
Figure 30. Profile of the cistern.

datable portion of the refuse contents were expendable bottles and jars, followed by non-expendable tableware (Clowery-Moreno and Smith 2005:7.0-2). The construction of the cistern likely accompanied the construction of a domestic residence between 1887 and 1888 (Clowery-Moreno and Smith 2005:8.0-1).

CA-SDI-18,005

Archaeologists of Brian F. Smith and Associates excavated CA-SDI-18,005, The Metro Work Project, in the Columbia neighborhood of downtown San Diego, in 2005 to 2006. CA-SDI-18,005 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Pierson
A cistern, trash pit, a nebulous refuse deposit, an artifact scatter and a collection of artifacts from monitoring and trenching were noted for CA-SDI-18,005 (Pierson 2007a:1.0-1).

The archaeological crew discovered a refuse filled historical cistern, Feature B, at the ground surface level of the project area (see Figure 31; Pierson 2007a:6.0-15). They found cistern with a concrete cap and a 40 centimeters (1.3 feet) layer of sterile soil on top. The cistern feature was investigated with the placement of a single excavation unit. The majority of the cistern is under a building located on lot 4 of 1331 India Street (Pierson 2007a:6.0-15). The edges of the exposed cistern feature were curved. Archaeologists reported a plaster-lining for the cistern (Pierson 2007a:6.0-15). Excavation of the cistern started at ground surface level and went down to 80 centimeters in depth (1.9 feet; Pierson 2007a:6.0-15).

The dates of the artifacts recovered from the cistern feature range from the early 19th century to 1965 (Pierson 2007a:6.0-17). The majority of the debris on the ground level and in the cistern date to the early 1900s (Pierson 2007a:7.0-1). From the full analysis of the artifacts, Brian F. Smith and Associates determined that the artifacts found within the cistern reflect the time period of when downtown San Diego abandoned cisterns (Pierson 2007a:2). They determined that the cistern was constructed in the 1870s.

CA-SDI-18,314

The archaeological crew of Brian F. Smith and Associates excavated at CA-SDI-18,314, The Vantage Pointe Project, between 2005 and 2006. CA-SDI-18,314 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Rosenberg 2007:1.0-1). The crew discovered a 19th-century cistern structure (Rosenberg 2007:1.0-1). The crew uncovered the historical cistern at six feet below ground surface during soil removal (Rosenberg 2007:6.0-46). The feature had a round shape. The mechanical excavator damaged the cistern’s structure by removing the upper portion of the feature (Rosenberg 2007:6.0-46). An archaeologist observed that approximately six feet of the cistern’s upper portion was removed before archaeological investigation began (Rosenberg 2007:6.0-46). The cistern’s internal diameter measured 12 feet with a six inch cement lining. The six inch
lining included five and a half inches of a cement mixture with small to medium round cobbles and a half an inch layer of plaster (Rosenberg 2007:6.0-46).

The archaeological crew investigated the cistern with a single test unit placed inside the feature (see Figure 32). They excavated the feature to 60 centimeters (1.97 feet) deep and encountered a concave cement bottom (Rosenberg 2007:6.0-46). They could not determine the maximum depth of the cistern due to construction damage (Rosenberg 2007:6.0-46). Based on artifact date ranges, the cistern was likely filled in the 1950s. Rosenberg posits that it is a late date for the infilling of a cistern since residents of downtown San Diego began filling cisterns and wells with refuse and soil beginning in the 1870s to the end of the 19th century (Rosenberg 2007:6.0-55).
Figure 32. Plan view of the cistern.

CA-SDI-18,317

Brian F. Smith and Associates monitored and excavated at CA-SDI-18,317, The Lofts at 655 6th Avenue Project, in 2006. CA-SDI-18,317 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Pierson 2007c:1.0-1). The archaeological crew encountered a historical cistern during the monitoring project (Pierson 2007c:1.0-1).

Archaeologists mechanically excavated the cistern, Feature B, without vertical control due to previous impacts to the cistern from geophysical testing (see Figure 33; Pierson 2007c:6.0-14). The crew observed brick in the upper portion of the feature which suggests that there had existed reinforcement for a cistern cover (Pierson 2007c:6.0-14).
Remnants of wood planks found during excavation may have come from the upper portion of the cistern. The crew only found a portion of the cistern lining intact (Pierson 2007c:6.0-14).

Brian F. Smith and Associates recovered a total of 33 from the cistern (Pierson 2007c:6.0-14). The majority of the artifacts date to 1905/1910+; however, artifacts dating up to 1919 were also identified. The later artifacts suggest that disposition occurred during the 1920s or later (Pierson 2007c:6.0-14).
CA-SDI-18,360

Archaeologists of Jones and Stokes excavated CA-SDI-18,360 in 2006. They uncovered a brick and mortar cylindrical cistern during excavation of the site. The uppermost portion of the feature, approximately four feet in height, was destroyed by later development (Case 2007:20). The cistern feature was eight feet in diameter with a depth of eight to nine feet below the current surface. The archaeological crew excavated to a depth of 11 feet deep. The excavation of the cistern exposed the feature; however, it created a potential collapse hazard for the cistern walls (Case 2007:20). Due to safety precautions, archaeologists had to stop all excavation of the feature. Normal recording procedures were hindered; nevertheless, it was still possible for the crew to determine the basic construction methods of the cistern (Case 2007:20).

The wall and floor of the cistern feature were constructed of two layers of brick (Case 2007:23). The walls seem to be composed of a complex bond pattern with some brick laid in parallel pairs to form concentric circles while others were laid at right angles as though forming radii from the center of the circle (Case 2007:23). Archaeologists could not determine the exact sequence of bond patterns. The mortar used was of high quality with little to no signs of degradation due to leaching. The bricks themselves were red clay, of standard measurement and well-fired (Case 2007:23). The interior of the cistern’s walls and floor were coated with a quarter inch thick layer of finely applied mortar. The mortared interior suggests “that the function of the feature was to store water by preventing seepage or to reduce coarse surfaces where sludge could accumulate” (Case 2007:23). The exterior of the wall had the same coating as the interior. Archaeologists working on CA-SDI-18,360 suggests that the original construction pit would have been over sized to allow workers access to be able to coat the exterior walls (Case 2007:23, 38).

Archaeologists found bricks in the well fill but they did not provide maker’s marks. Other than the bricks discovered in the upper portion of the well feature no other artifactual materials were reported for the cistern (Case 2007:20). Due to the structure’s complex construction methods Jones and Stokes determined that the builder of the feature was a person of wealth. H.P. Whitely, a realtor, owned the property and the cistern, yet, he never resided on the property. They also report that it is likely that the dwelling was a boarding house with rooms rented to single adults (Case 2007:38). According to Case, “a primarily
adult residency would increase water consumption requirements which would explain the size and construction of the cistern feature” (2007:38).

**CA-SDI-19,118**

Archaeologists of ASM Affiliates excavated at CA-SDI-19,118, 1050 B Street San Diego, California, in 2008. CA-SDI-19,118 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quandrangle in an unsectioned portion of Township 17 south, Range 3 west (Potter 2008:1). ASM Affiliates uncovered a foundation, a rectangular cistern feature and one round historical cistern feature (Potter 2008:1).

Elizabeth Potter of ASM Affiliates discovered the cistern, Feature 1; at a depth of four feet below ground level (Potter 2008:16). The cistern measured about 10.3 feet in diameter and it was seven feet deep (see Figure 34). The cistern was located in the northwestern portion of the project area and according to Sanborn Maps, it is associated with the Victorian era dwellings constructed between 1869 and 1876 (Potter 2008:16). ASM was assisted by a small construction machine excavator that removed artifacts from the cistern fill (Potter 2008:16).

![Figure 34. Photo of Feature 1 excavation. Source: Potter, Elizabeth. 2008. Results of the Archaeological Monitoring of the Ten Fifty B Street, San Diego, California. ASM Affiliates. Submitted to Affirmed Housing Group. Unpublished Report on file at South Coastal Information Center, San Diego State University:18.](image-url)
ASM uncovered and mechanically excavated a plaster-lined rectangular shaped brick cistern, Feature 2 (see Figure 35; Potter 2008:19). The feature measured 14 feet by nine feet with a depth of 3.75 feet deep from the south wall and 5.3 feet deep from the north wall (Potter 2008:19). ASM interpreted the feature as a small cistern located under the floor of a back room of one of the Victorian dwellings that was once located in the project area, possibly the kitchen area (Potter 2008:19).

![Figure 35. Photo of Feature 2 excavation. Source: Potter, Elizabeth. 2008. Results of the Archaeological Monitoring of the Ten Fifty B Street, San Diego, California. ASM Affiliates. Submitted to Affirmed Housing Group. Unpublished Report on file at South Coastal Information Center, San Diego State University:19.](image)

Sanborn Maps show two homes present in the 1800s to the early 1900s for CA-SDI-19,118 (Potter 2008:2). The artifacts from the two historical cistern features at suggest occupancy from the early 1800s to the late 1900s (Potter 2008:2).

**CA-SDI-19,262**

Archaeologists of Brian F. Smith and Associates excavated at CA-SDI-19,262, The Parkside Terrace Project between 13th and 14th Streets of downtown San Diego, in 2008. CA-SDI-19,262 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west
During mechanical excavations, Brian F. Smith and Associates uncovered a cistern feature (see Figure 36; Clowery-Moreno and Smith 2009:6.0-58). The backhoe disturbed the plaster-lined brick cap cover of the cistern (Clowery-Moreno and Smith 2009:6.0-58). The cistern measured 12 feet in diameter and 11 feet deep (see Figure 37). The walls and floor of the cistern were coated with a thin layer of plaster. The bottom of the feature was slightly rounded on the edges (Clowery-Moreno and Smith 2009:6.0-58). The archaeological crew decided to mechanically excavate the cistern due to its size and high building debris content (Clowery-Moreno and Smith 2009:6.0-58). They divided the cistern into three levels (upper, middle and lower; Clowery-Moreno and Smith 2009:6.0-58).

The majority of temporally diagnostic artifacts from the cistern were bottles and bottle fragments (Clowery-Moreno and Smith 2009:6.0-59). Most of the bottles were machine-made and date between the 1920s and early 1960s (Clowery-Moreno and Smith 2009:6.0-59). The date range indicates that the cistern could not have been sealed and
covered before the 1920s and that it remained open at least until the 1960s (Clowery-Moreno and Smith 2009:6.0-60). Brian F. Smith and Associates reports that materials from the cistern were most likely deposited by residents in a single extended dumping episode between 1921 and 1949 (Clowery-Moreno and Smith 2009:6.0-60). The 1949 through 1960 Sanborn Maps indicate that a residential structure covered the cistern during those times (Clower 2009:6.0-60). However, large amounts of construction related materials within the cistern suggests that it may have been filled and sealed as a result of the building activity between 1940 and 1949 that demolished buildings on 510 14th Street and constructed six new residences (Clowery-Moreno and Smith 2009:7.0-4).

CA-SDI-19,958

Brian F. Smith and Associates uncovered two cisterns at CA-SDI-19,958, located in Bankers Hill, San Diego, in 2010. It is not clear what materials were used for the construction of the cisterns. Jessica Auck of Brian F. Smith and Associates informed that both cisterns were partially bucket excavated to about four to six feet then manually
excavated down to another 30 (0.9 feet) to 60 centimeters (1.9 feet). Both cisterns are round in shape. The cisterns belonged to a single residential unit, possibly housing multiple families. They both had high quality, expensive, and often imported goods suggesting wealthy individuals used them. Dates of the items range from 1895 to 1925 with earlier items being less expendable. The majority of items date to about 1910 (personal communication, June 1 2010).

ARCHAEOLOGICAL SITES WITH BOTH EXCAVATED WELLS AND CISTERNs

The following archaeological sites possess two different water supply structure types.

CA-SDI-16,915

Archaeologists of RECON monitored and excavated at CA-SDI-16,915, The M2i Project, from 2003 to 2004. CA-SDI-16,915 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Zepeda-Herman 2004:1). The project is on a San Diego city block bounded by Market Street on the north, 11th Avenue on the east, Island Avenue on the south and 10th Avenue on the west (Zepeda-Herman 2004:1). Archaeologists uncovered four cisterns and one well (Zepeda-Herman 2004:1).

An archaeological monitor discovered the first cistern, C-1, and the well, C-2, on November 21, 2003 (Zepeda-Herman 2004:1). They first cistern was approximately five feet down from the existing ground surface. The contractor of the project area scraped the top of the cistern with a backhoe (Zepeda-Herman 2004:1). The archaeological monitor inspected the cistern. Once the cistern was inspected and documented, the contractor assisted the archaeologist by using the backhoe to cut the cistern in half, digging out its contents and leaving a profile of the cistern behind (Zepeda-Herman 2004:1). The archaeologist described the cistern to be roughly egg-shaped in section view with a dome above its sides. The dome consisted of one course of red brick which was coated with a one-quarter-inch cement plaster on the outside and a one-half-inch cement plaster on the inside (see Figure 38; Zepeda-Herman 2004:1). The cistern feature was 10 feet and eight inches to 11 feet in diameter and 11.5 feet deep. It was filled with gray sand and historical refuse. A range of
dates for the cultural material suggests that the refuse was deposited by residents into the
cistern circa 1910s to 1950s (Zepeda-Herman 2004:1).

The archaeological monitor discovered the well, C-2, approximately 75 feet north of
the first cistern, C-1. It was five feet down from the existing ground level (Zepeda-Herman
2004:1). After the archaeologist documented the well, the contractor once again assisted the
archaeologist by cutting the well in half with the backhoe, removing the fill and leaving a
profile (Zepeda-Herman 2004:1). The well consisted of two concentric circles composed of
one course of brick each and were separated by a six inch area filled with dirt (see Figure 39;
Zepeda-Herman 2004:1). The exception to the brick pattern was in the northeast area of the
well feature where there were four bricks lined up between the two concentric circles
(Zepeda-Herman 2004:1). The outer circle was nine feet in diameter and the inner circle was
eight feet in diameter. The sides of the well were constructed with brick for the entire eight-foot height of the well (Zepeda-Herman 2004:1). The well feature was filled with sand, native soil and various historical refuse. The project archaeologist observed metal pipes at the bottom of the well feature (Zepeda-Herman 2004:1). The date of the material culture suggests that the well was filled circa 1930 (Zepeda-Herman 2004:1).

RECON discovered the second cistern, C-3, on December 1, 2003, in the northwestern area of the property at a depth of 10 feet (Zepeda-Herman 2004:2). They located the cistern, C-3, further from the existing ground level than the first two features for CA-SDI-16,915. Similar to the first two features, the contractor assisted the archaeologist by cutting the cistern in half, removing its contents and exposing the cistern profile. This cistern was 10 feet deep with no associated bricks or brick fragments (Zepeda-Herman 2004:2). The RECON archaeologist speculates that the top of the cistern was probably removed before it
was filled (Zepeda-Herman 2004:2). The depth of the second cistern’s upper edge was four feet below the street level. It had a diameter varying from 9.5 feet to 10 feet. The second cistern was egg-shaped similar to the first cistern, C-1 (Zepeda-Herman 2004:2). The interior of the cistern walls was lined with a one inch thick cement plaster (Zepeda-Herman 2004:2). RECON reports that it can be assumed that the dome part of the cistern was similar to the first cistern and consisted of one course of brick coated inside and out with cement plaster (Zepeda-Herman 2004:3). They recovered only one glass bottle and some brick at the bottom of the cistern feature. The cultural material from C-3 suggests that deposition occurred circa 1901 or 1908 (Zepeda-Herman 2004:3).

RECON uncovered the third cistern, C-4 in the southwestern corner of the project area on January 8, 2004 (Zepeda-Herman 2004:3). The top of the cistern was missing. The cistern measured 11 feet in diameter and eight feet deep. The cistern’s structure was the same as the first two cisterns (Zepeda-Herman 2004:3). It was filled with gray sand and historical material. The cultural material dated from the 1920s to the 1950s. This suggests that the materials were deposited in the cistern around the 1870s to 1950s (Zepeda-Herman 2004:3).

RECON archaeologists discovered the fourth cistern (C-5) on the southeastern corner of the site on January 9, 2004. It was five feet below ground surface (Zepeda-Herman 2004:3). This cistern was excavated in the same manner as the other three cisterns. The feature was about 10 feet in diameter and four feet deep. The cistern’s structure was also similar to the other three cisterns (Zepeda-Herman 2004:3). The dome-shaped top was missing and was probably removed prior to it being filled with sand. The artifacts recovered by RECON suggest that the cistern was filled circa 1920s to 1964 (Zepeda-Herman 2004:3).

Based on the Sanborn Fire Insurance Maps (1888-1956), the project area has been developed multiple times (Zepeda-Herman 2004:3). The well and four cisterns date to the 19th century. Zepeda-Herman reports that wells and cistern were common in the late 19th century before piped water was installed in downtown San Diego (2004:4). By the 1920, a municipal water system was available and it was a common practice for residents to fill the unused wells and cisterns with trash (Zepeda-Herman 2004:4).
**CA-SDI-17,590**

Brian Smith and Associates discovered two wells and three cisterns at CA-SDI-17,590, The Park Terrace Project, from 2004 to 2005. CA-SDI-17,590 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in an unsectioned portion of Township 17 south, Range 3 west (Buysse 2005c:1.0-1). Archaeologists identified two historical wells and three historical cisterns for this site.

Archaeologists discovered the first well feature, Feature K, at about 10 feet below the street level (Buysse 2005c:6.0-70). The exposed well feature was round in plan view. Archaeologists determined that the well feature was significant in the field. They documented the feature and the entire contents of the feature were recovered through excavation (Buysse 2005c:6.0-70). The well feature fill was approximately 40 percent artifacts and 60 percent soil. The maximum depth of the feature was 320 centimeters (10.2 feet). At 30 centimeters (0.9 feet) the well measured 130 centimeters (4.2 feet) north to south by 125 centimeters (4.1 feet) west to east (see Figure 40; Buysse 2005c:6.0-70). At 110 centimeters (3.6 feet), the well feature expanded to a diameter of 140 centimeters (4.5 feet; Buysse 2005c:6.0-70). Several vertical pipes were encountered during the excavations. At 130 centimeters (4.2 feet), archaeologists encountered the remains of a hexagonal wood lining. The remaining wood fragments were extremely soft and crumbly (Buysse 2005c:6.0-70).

The archaeological crew encountered the brick lining of Feature K at 180 centimeters (5.9 feet; see Figure 41). At 180 centimeters, the interior diameter of Feature K measured 100 centimeters (3.2 feet) and the exterior diameter measured 140 centimeters (4.5 feet; Buysse 2005c:6.0-70). The upper row of bricks was oriented inward, leaving significant gaps in some places. The second layer of bricks were also oriented inward, however, they were broken in half. Individual bricks measured 8.25 by 4.25 by 2.25 inches (Buysse 2005c:6.0-70). The crew left the brick lining intact until it became difficult to remove the well fill. They removed one side of the brick lining in order for them to remove the fill from the side of the feature (Buysse 2005c:6.0-70). As the depth of excavation continued, the soil became more and more damp. Several vertical wood planks were encountered between 220 centimeters (7.2) and the bottom of the feature. The wood planks may have come from the wood lining of the well (Buysse 2005c:6.0-70). The diameter of the brick lining
decreased toward the bottom of the feature, sloping to a 90 centimeter diameter (2.9 feet). A total of 22 courses of brick extended from 180 (5.9 feet) to 320 centimeters (10.4 feet; Buysse 2005c:6.0-70). Below the third or forth course, the bricks appeared to be placed either perpendicular (inward) or parallel to the circular lining. Depending on what fit; some bricks were broken in half to fit in place (Buysse 2005c:6.0-70). Archaeologists observed that the overall appearance of the brick lining was somewhat disorganized. No mortar was used in the construction of the brick lining (Buysse 2005c:6.0-70). Underneath the bottom layer of brick was a series of small, wood planks forming a circle that supported the bricks (the well curb). However, they did not cross the bottom of the feature (Buysse 2005c:6.0-70). The wooden support consisted of two one-inch thick wood planks (Buysse 2005c:6.0-70).
Brian F. Smith and Associates recovered 2,511 artifacts from the well (Feature K). The artifacts included bottle and jar fragments, ceramic, personal items and faunal (Buysse 2005c:6.0-72). Most of the temporally diagnostic artifacts from the well dated to the last quarter of the 19th century. Several of the dates fall within the 1870s or earlier, however, these artifacts were recovered from different levels in the feature (Buysse 2005c:6.0-73). It is likely that the earlier dated items may have been kept within the household for a number of years before they were discarded. Archaeological lab analysis suggests that the dating of artifacts indicate that the artifacts were deposited from the 1890s to the early 1900s (Buysse 2005c:6.0-73). Buysse reports that the structure and manner of construction of the well suggests that it was built in the 19th century (2005c:6.0-73).

Archaeologists discovered the second historical well, Feature L, during the monitoring phase of CA-SDI-17,590 (see Figure 42). It was located at a depth of approximately 23 feet below street level (Buysse 2005c:6.0-46). The well feature consisted of a ring of 16 bricks placed end to end. Archaeologists determined the feature as a well based on its structure. They documented the well feature and recovered its contents through excavation procedures (Buysse 2005c:6.0-46). The crew excavated, Feature L, to a depth of 190 centimeters (6.2 feet); which was the same level as the final grading depth (30 feet) of the project (Buysse 2005c:6.0-46). The well feature continued below the grading depth, indicating the overall original depth of the well was over 29.2 feet from the original ground surface (Buysse 2005c:6.0-46). Archaeologists could not determine the exact the depth of the well. The interior diameter of the well measured 115 centimeters (3.9 feet) and the exterior diameter measured 125 centimeters (4.1 feet; see Figure 43; Buysse 2005c:6.0-46).

The archaeological crew reported that the well bricks spiraled downward instead of being placed in distinct layers. They encountered several large planks of wood in the well fill between 20 (0.6 feet) and 50 centimeters (1.6 feet; Buysse 2005c:6.0-46). Additional scattered artifacts were encountered, such as ceramic tableware fragments, metal fragments, pieces of leather and a pair of boots. Soil made up about 80 percent of the well fill, while wood and scattered artifacts made up the remaining 20 percent (Buysse 2005c:6.0-46).

Brian F. Smith and Associates cataloged four artifacts, which included one ceramic fragment with a maker’s mark, a fragment of a ceramic chamber pot, and two boots. Buysse posits that the technique of using brass wires to attach the sole of the boots was used to
assign a date of post 1862 (2005c:6.0-47). The ceramic fragment’s maker’s mark date from circa 1869 to 1875. Based on the available information, archaeologists determined the well, Feature L, was a 19th-century well which was filled sometime after 1869. It is not clear if this well had a wood lining similar to the first well, Feature K because the upper portions of the well were missing (Buysse 2005c:6.0-47). Research conducted by Brian F. Smith and Associates determined that the well was probably constructed in the 1870s as a source of water (Buysse 2005c:6.0-59).

Archaeologists discovered Cistern 1 during project sampling for contaminated soil. The trench from which the samples were taken extended through the middle of the feature.
The cistern was probably associated with the dwellings along 1919 K Street, San Diego (Buysse 2005c:6.0-59). The crew investigated the cistern fill mechanically with a backhoe. Two-foot levels were removed on either side of the soil trench and placed on tarps, which archaeologists raked through for artifacts (Buysse 2005c:6.0-51). Only a sample of the high artifact recovery from the Cistern 1 was brought back to the lab (Buysse 2005c:6.0-51).

Cistern 1 measured 10 feet in diameter and 10 feet deep; archaeologists encountered water in the lower two feet of the cistern feature (see Figure 44; Buysse 2005c:6.0-51). The cistern was covered with a brick cap; however, it was disturbed during project soil trenching. The cistern’s walls and floor consisted of a thin layer of plaster. The floor was slightly rounded on the edges (Buysse 2005c:6.0-51). Artifacts consisted mainly of bottles, jars and building/construction materials. Archaeologists encountered most of the artifacts between three and eight feet in depth (Buysse 2005c:6.0-51). Most of the bottles date to the late 1910s and 1940s. A few later bottles date to the 1950s. Some of the recovered ceramic tiles recovered were stamped with Trent Tile, Trenton, New Jersey. The Trent Tile Company existed from the early 1880s to when the factory was closed in 1938 (Buysse 2005c:6.0-52).

Brian F. Smith and Associates uncovered Cistern 2 in Lot J of the project area. They reported that the cistern had been covered with a brick cap, however, only the outer ring of bricks remained when the cistern was discovered (Buysse 2005c:6.0-99). The cistern walls and bottom of the feature were lined with a thin layer of plaster. The bottom had slightly rounded edges. Buysse notes that the upper five feet of fill consisted of historic bottles from the 1930s to the 1950s (2005c:6.0-99). Below five feet, the fill consisted mainly of historical refuse. There were fewer artifacts in Cistern 2 than in Cistern 1 (Buysse 2005c:6.0-99).

Most of the artifacts from Cistern 2 were from the domestic expendable category (Buysse 2005c:6.0-100). Archaeologists recovered a total of 33 temporally diagnostic artifacts; most were bottles or bottle fragments (Buysse 2005c:6.0-100). One tooled finished bottle dates up to the early 1920s. The rest of the artifacts overlap within the 1930s (Buysse 2005c:6.0-100). The latest diagnostic bottle fragment identified had an Anchor Hocking mark that dates from 1938 to present. The marker’s mark suggests that refuse deposit in the Cistern 2 occurred during the late 1930s or 1940s, this is the earliest date for the three cistern deposits identified for CA-SDI-17,590 (Buysse 2005c:6.0-100).
Archaeologists discovered Cistern 3 during construction grading of the project area (Buysse 2005c:6.0-111). They reported that previous disturbances had removed a large portion of the north wall of the cistern (Buysse 2005c:6.0-111). They investigated the cistern fill through mechanical excavation (Buysse 2005c:6.0-111).

Cistern 3 is similar to the other two cisterns for CA-SDI-17,590. It measures about 9.5 feet in diameter and 10 feet deep (Buysse 2005c:6.0-111). Similar to Cistern 2, Cistern 3 had a brick cap but only the outer ring of bricks remained. The cistern’s walls and bottom had a thin layer of plaster and the bottom was slightly rounded on the edges (Buysse 2005c:6.0-111). The archaeological crew recovered several historical bottles were in the upper six feet of the fill. A porcelain toilet was recovered between six and eight feet of fill.
They did not find any artifacts in the lower two feet of the cistern. Archaeologists collected three temporally diagnostic artifacts. Two artifacts had general dates, 1905/1910+, and the third artifact had an Anchor Hocking mark dating from 1938 to present. The maker’s mark suggests that the cistern was filled during the 1930s to the early 1940s. However, due to the small number of temporally diagnostic artifacts, the date of deposition is only an approximation.

CA-SDI-17,667

Brian F. Smith and Associates and ASM Affiliates both excavated at CA-SDI-17,667. Brian F. Smith and Associates monitored and excavated at CA-SDI-17,667, The Smart Corner Project, in 2005. CA-SDI-17,667 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 17 south, Range 3 west of the San Bernardino Meridian (Rosenberg and Smith 2006:1.0-1). CA-SDI-17,667 was once the residence of Major Levi Chase, a lawyer and business man, and his family. The crew discovered three historical features which were interpreted as 1870s wells (Rosenberg and Smith 2006:1.0-1).

Archaeologists discovered the first well feature, Feature A, at 21 feet below ground surface during construction excavations (Rosenberg and Smith 2006:6.0-28). The feature was investigated with a placement of a single test unit (see Figure 45). The test unit conformed to the shape of the feature and revealed a deep intact historical deposit with an identifiable boundary (Rosenberg and Smith 2006:6.0-28). The well feature was circular in plan view. It measured 170 centimeters (5.6 feet) north to south and 163 (5.3 feet) east to west (Rosenberg and Smith 2006:6.0-28). As the depth of the unit increased, the interior diameter decreased to 120 centimeters (3.9 feet). The excavation revealed that feature extended to a maximum depth of 28.9 feet below ground surface (Rosenberg and Smith 2006:6.0-28). Brian F. Smith and Associates hand excavated levels 0 through 60 centimeters (1.9 feet) and 120 (3.9 feet) through 240 centimeters (7.8 feet) due to the high recovery of diagnostic artifacts (Rosenberg and Smith 2006:6.0-28). The crew mechanically excavated between 60 and 120 centimeters when diagnostic artifacts decreased significantly. They never found a lining for the feature (Rosenberg and Smith 2006 6.0-28). The soil within the feature ranged from semi-compact,
very dark grayish brown sandy loam to a black sandy loam (Rosenberg and Smith 2006:6.0-28).

Archaeologists recovered eight temporally diagnostic artifacts from the well feature (Rosenberg and Smith 2006:6.0-28). Lab personnel suggest that at least two filling episodes were probable for the feature. The first is between 1880s and early 1890s and the second is between 1907 and 1916 (Rosenberg and Smith 2006:6.0-28).

Rosenberg and Smith posit that the well, Feature A, lacks any usual lining associated with historical wells, however, the shape, size and depth of the feature led to the interpretation of a well (2006:6.0-29). Based on Sanborn Maps, the well was most likely built before 1888 and was used by two residential structures located in the northeast corner of the CA-SDI-17,667 (Rosenberg and Smith 2006:6.0-29).

Brian F. Smith and Associates discovered the second well feature, Feature B, at 9.5 feet below ground surface (Rosenberg and Smith 2006:6.0-35). An excavator mechanically cut and removed the top corner of the deposit which resulted in the exposure of an approximately five-foot deep slope cross section of the feature (Rosenberg and Smith 2006:6.0-32).
The archaeologists investigated the feature with a single test unit. The unit revealed a deep cylindrical deposit of artifacts and stained soil (Rosenberg and Smith 2006:6.0-35). The edges of the feature were symmetrical. Archaeologists did not observe a lining for the well feature (Rosenberg and Smith 2006:6.0-35). Based on the 1887, 1888, 1906 and 1921 Sanborn Maps, the well was most likely constructed for the dwelling at 1059 11th Street (Rosenberg and Smith 2006:6.0-36).

The top of Feature B measured about 110 centimeters (3 feet) east to west. An excavator removed the southern portion of the top of the feature (Rosenberg and Smith 2006:6.0-35). The archaeological crew excavated levels 0 to 200 centimeters (6.5 feet) manually in 10 centimeter (0.3 feet) levels (Rosenberg and Smith 2006:6.0-35). Due to the lack of artifacts, the crew excavated levels 200 to 380 centimeters (12.5 feet) mechanically (Rosenberg and Smith 2006:6.0-35). The well feature bowed inward gradually until 90 centimeters (2.9 feet) in depth. At 90 centimeters the feature expanded to a maximum of 130 (4.2 feet) to 140 centimeters (4.5 feet) in diameter (Rosenberg and Smith 2006:6.0-35). The well feature continued down to a depth of 380 centimeters (12.5 feet). The soil inside the feature ranged from semi-compact very dark grayish brown sandy loam to semi-compact compact black sandy loam (Rosenberg and Smith 2006:6.0-35).

Brian F. Smith and Associates recovered 55 temporally diagnostic artifacts from Feature B. Most of the artifacts were mold-blown bottles that date from the mid 19th century to the early 20th century (Rosenberg and Smith 2006:6.0-36). Rosenberg and Smith suggest that the earliest possible date for the deposition of material into the well feature is 1885 (2006:6.0-36). Based on the range of dates for a number of artifacts, Feature B was likely filled sometime between 1885 and the 1890s (Rosenberg and Smith 2006:6.0-36). Since many of the artifacts (tableware and bricks) were reused or kept past their final production dates the latest possible date for deposition was difficult to determine (Rosenberg and Smith 2006:6.0-36).

The archaeological crew discovered the third well, Feature C, at 22 feet below original ground surface (Rosenberg and Smith 2006:6.0-45). The feature was cylindrical and measured about 130 centimeters (4.2 feet) in diameter. The crew did not observe a lining for the feature. They mechanically excavated the well feature due to the lack of artifacts (Rosenberg and Smith 2006:6.0-45). The feature reached a total depth of 26 feet, which is
about 48 feet below the surface (Rosenberg and Smith 2006:6.0-45). The feature was 130 centimeters in diameter at the base (4.2 feet). Brian F. Smith and Associates interpreted Feature C as a well due to its shape, size and depth (Rosenberg and Smith 2006:6.0-45).

Based on Sanborn Maps, the location Feature C coincides with the location of the windmill/well situated behind Major Levi Chase’s residence. The residence was constructed no later than 1874 based the 1906 and 1921 Sanborn Maps (Rosenberg and Smith 2006:6.0-45). There were very few artifacts for Feature C (Rosenberg and Smith 2006:6.0-45). Rosenberg and Smith suggest that the lack of artifacts could be due the fact that Major Chase may have been able to afford to clean out the well and fill it with soil as was encouraged by city officials during the late 1800s (2006:6.0-45).

ASM Affiliates excavated at CA-SDI-17,667 in 2008 (Schaefer 2009a:1). ASM’s other identifier for CA-SDI-17,667 is Block H29. The ASM crew discovered a cistern with a distinctive filtering system during archaeological monitoring (Schaefer 2009a:23).

The location of the cistern, east Feature C, was in the location of the Levi Chase’s cistern indicated on the 1887 and 1888 Sanborn maps (Schaefer 2009a:23). The cistern was eight feet and three inches in diameter. About 40 percent of the perimeter of the preserved top of the cistern was lined with a single course of bricks (Schaefer 2009a:23). There was evidence that the bricks had lined the entire perimeter of the cistern, however, most of the bricks were dislodged by heavy equipment during demolition and construction grading (Schaefer 2009a:23). A layer of cement was lined to the side of the bricks facing the interior of the cistern and continued downward (Schaefer 2009a:23).

The archaeological crew mechanically excavated the eastern half of the cistern. The backhoe revealed that the cistern was filled with a thick layer of concrete, asphalt and brick rubble (Schaefer 2009a:24). The cistern cement floor was exposed at a depth of seven feet (Schaefer 2009a:24). The crew collected a few artifacts from the cistern fill that dated to from 1880 to 1910 (Schaefer 2009a:24).

Archaeologists of ASM Affiliates discovered a rectangular hollow brick column/shaft in the cistern, offset to the west side (Schaefer 2009a:24). They used hand tools in order to expose the column/shaft. After excavation, ASM identified the rectangular feature as a filter column (see Figure 46; Schaefer 2009a:25). The column/shaft measured 16 ¾ inch by 13 ½ inches on the outside (see Figure 47). The bricks were stacked on their edges, leaving
an interior hollow shaft of approximately 11 ¼ by eight inches (Schaefer 2009a:24). Bricks forming the shaft and the rim around the cistern are of the same manufacture, although unmarked (Schaefer 2009a:24).

**CA-SDI-17,712**

Archaeologists of Brian F. Smith and Associates conducted an archaeological study of CA-SDI-17,712, The Mark Project, from 2004 to 2005. CA-SDI-17,712 is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle, Township 17 south,
Archaeologists identified several historical resources. Among them were two wells and one cistern (Buysse 2006:1.0-1).

Archaeologists discovered the 19th-century cistern during the construction grading of the project area. Construction personnel exposed the eastern edge of the cistern feature through the use of a backhoe (Buysse 2006:6.0-31). They encountered the cistern at 8.5 feet below the original ground surface. Brian F. Smith and Associates noted that only the lower levels of the original cistern remained because the adjacent mechanical excavation revealed that the remaining portion of the cistern measured 30 centimeters (0.9 feet) from the top to bottom (Buysse 2006:6.0-32). Since the upper portions of the cistern were missing the original depth of the feature could not be determined. The cistern measured 12 feet in diameter. Buysse and Smith report that this cistern was similar to other cisterns discovered in the East Village area of downtown San Diego (Buysse 2006:6.0-32). The interior of the cistern was lined with plaster (see Figure 48; Buysse 2006:6.0-32).

Brian F. Smith and Associates investigated the cistern mechanically. In order for them to determine if artifacts were present in the cistern a small portion of the eastern side of the cistern fill was removed. When the presence of artifacts was confirmed, the crew divided
the remaining portion of the cistern fill into 50 centimeter (1.6 feet) strips; each excavated in 10 centimeter depth levels (Buysse 2006:6.0-32).

Archaeologists recovered 159 artifacts. A total of 61 artifacts were temporally diagnostic; the datable artifacts were bottles or bottle fragments (Buysse 2006:6.0-32). Many of the bottles date from the mid 1880s to circa 1920. Given the presence of several machine-made bottles, which dates post 1905/1910, the largest overlap of dates in the collections is between 1905/1910 to circa 1920 (Buysse 2006:6.0-32). From the analysis of artifacts, Brian F. Smith and Associates determined that the cistern was filled in the 1910s (Buysse 2006:6.0-33).

Brian F. Smith and Associates uncovered a 19th-century well, Deposit 10, during the construction grading of the area (see Figure 49). The upper levels of the well feature were identified at 6.5 feet below street level (Buysse 2006:6.0-57). Archaeologists investigated the feature with a placement of a single unit. The excavation of the feature revealed that it was originally round in plan view, however, due to a previous excavation trench, the eastern edge of the feature had been disturbed (Buysse 2006:6.0-57). Even though the feature was disturbed, enough of the feature remained intact (Buysse 2006:6.0-57). The archaeological crew found the original shape of the well feature at 80 (2.6 feet) to 90 centimeters (2.9 feet). At 90 centimeters (2.9 feet) the feature measured 130 centimeters in diameter (4.2 feet; Buysse 2006:6.0-57). The feature soil was highly organic and contained a wide range of artifacts (construction debris, household items and personal items; Buysse 2006:6.0-57).

Archaeologists hand excavated to 580 centimeters (19 feet). They found a soil filled seven-inch vertical pipe at 300 centimeters (9.8 feet). A second vertical pipe was exposed at 565 centimeters (18.5 feet; Buysse 2006:6.0-57). The second pipe was 7.5 inches in diameter and it was not filled with soil. The crew lowered a rock tied to a string into the second pipe. This allowed them to locate and determine that the water table was at 26 feet in depth for the project area (Buysse 2006:6.0-57).

The crew encountered toxic gases when the second pipe was exposed. Geologists sampled the air and determined that the levels were at a safe level in which manual excavations could continue (Buysse 2006:6.0-57). Archaeologists decided to continue the rest of the excavation mechanically instead because the well feature continued to go downward (Buysse 2006:6.0-57). They reached the bottom of the well at 1,067 centimeters.
(35 feet). The crew reported that below 570 centimeters (18.7 feet) the well fill was primarily soil, no artifacts (Buysse 2006:6.0-57). They did not encounter a well lining or a distinctive bottom for the feature (Buysse 2006:6.0-57). According to Brian F. Smith and Associates, “since the top of the well was at 8.5 feet below ground level and the top of the pipe was encountered at 18.5 feet below the top of the well and it extended down for another 26 feet; the total depth of the well was determined to be 53 feet” (Buysse 2006:6.0-57). They also concluded that Deposit 10 was a 19th-century well base on the shape, depth and present of vertical pipes (Buysse 2006:6.0-59).
Archaeologists collected 8,929 artifacts for the first well, Deposit 10. Lab Personnel identified 1,501 temporally diagnostic artifacts (Buysse 2006:6.0-58). The most reliable dates came from bottles. A significant quantity of the bottles exhibited applied finishes. American bottle manufactures commonly made applied finishes between about 1830 and 1885. The method entailed an application of additional glass at the point where the blowpipe was removed (the opening of the bottle; Lindsey 2010). The early date on applied finished bottles suggests that the well feature, or at least a portion of it, was earlier than other features discovered at CA-SDI-17,712 (Buysse 2006:6.0-59). Brian F. Smith and Associates posit that it is tempting to suggest an earlier date of deposition based on the large amount of early bottles. However, machine-made bottles (1905-1910) and one bottle maker’s mark dating to 1909 to 1961 were part of the collection (Buysse 2006:6.0-59). Lab personnel determined that the well was filled between 1890s and the 1910s based on the range of dates of the artifacts collected (Buysse 2006:6.0-59).

Brian F. Smith and Associates discovered the second 19th-century well, Deposit 11, during construction grading of the project area (Buysse 2006:6.0-77). The upper portions were identified at 4.5 feet below ground level and the feature was round in plan view (Buysse 2006:6.0-77). The feature measured 110 centimeters (3.6 feet) in diameter. Construction trenching immediately adjacent to the feature indicated that it extended at least four feet in depth. Archaeologists observed few artifacts in the feature so the first 30 centimeters (0.9 feet) were excavated mechanically (Buysse 2006:6.0-77). When artifacts became apparent at 30 centimeters, archaeologists continued the rest of the excavation manually and dug in 10 centimeter (0.3 feet) levels. At 100 centimeters (3.2 feet), the feature’s diameter increased to 120 centimeters (3.9 feet) and the frequency of bricks increased. The bricks did not display a pattern (Buysse 2006:6.0-77).

Archaeologists had to stop with work at 190 centimeters (6.2 feet) until the surrounding construction grading reached the level of the excavation (Buysse 2006:6.0-77). A month later Brian F. Smith and Associates continued the excavation of Deposit 11 mechanically because there was little evidence of artifacts in the well fill (Buysse 2006:6.0-77). At 914 centimeters (30 feet) below ground surface, the archaeological crew found a brick lining. The brick lining was 120 centimeters (3.9 feet) in diameter and continued downward for another 110 centimeters (3.6 feet). Native soil was at the bottom of
110 centimeters (Buysse 2006:6.0-77). The overall depth of the well feature was 34 feet from current ground surface to the bottom of the feature (Buysse 2006:6.0-77).

Archaeologists recovered two temporally diagnostic artifacts from the well (Deposit 11). The two bottles date the deposition of material in the well from 1910s to the 1920s (Buysse 2006:6.0-78).

**CA-SDI-17,847**

Brian F. Smith and Associates excavated at CA-SDI-17,847, The Legend Project, in 2006. The site is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle, Township 17 south, Range 3 west (Pierson 2006a:1). During archaeological monitoring of initial excavation and grading for CA-SDI-17,847 four historical features were identified. The features were two wells, a cistern and a privy pit (Pierson 2006a:6.0-1).

Archaeologists discovered Feature 1, a large cistern, during construction grading of the project (see Figure 50). Due to the grading, a large part of the cistern was removed before archaeological investigation (Pierson 2006a:6.0-1). Archaeologists dated the cistern to the late 1800s because most New Town (downtown San Diego) wells and cisterns date before City water was piped to residential areas in the late 1870s and early 1880s (Pierson 2006a:6.2-3). Brian F. Smith and Associates reported that the cistern’s large size indicates that it was used for commercial use (Pierson 2006a:6.2-3). The cistern measured 13 feet in diameter and 15 feet deep. The walls were reinforced with a single layer of brick. The interior and the bottom of the cistern were lined with a half inch of plaster or fine cement grout (Pierson 2006a:6.2-3). Archaeologists were informed by the environmental contractor that the upper three feet of the feature had no evidence of a lining (Pierson 2006a:6.2-3, 6.2-4). It is likely that the cistern had a roof or a cover, nevertheless, no evidence of either was observed during excavation (Pierson 2006a:6.2-4).

The crew collected a total of 103 artifacts from the cistern (Feature 1). Glass was the main material collected from the cistern (Pierson 2006a:6.3-4). The cluster of materials collected from the Feature 1 dates from 1905 to 1920 (Pierson 2006a:6.3-30).

Feature 2 (see Figure 51), a well, is associated with the cistern, Feature 1, because of the temporal and spatial relationships between the two. The large cistern would need to have
a constant water source to maintain usable supply (Pierson 2006a:6.2-6). Another reason why the two features are related is that the well and the cistern are in a location that was occupied by a large stable during the time of their primary function (Pierson 2006a:6.2-6).

Feature 2 went unnoticed until approximately 12 feet below the site’s surface. It is possible that a large portion of the upper part of the well had been backfilled with dirt closely matching the surrounding soil (Pierson 2006a:6.2-6). Archaeologists detected the well feature after they noticed a soil change (Pierson 2006a:6.2-6). The well feature is a standard hand dug well structure dating to the late 1860s or early 1870s. It measures approximately four feet in diameter and 32 feet deep (Pierson 2006a:6.2-6). The well was lined with wood boards down until the last seven feet where a brick base lining was encountered (Pierson 2006a:6.2-6).
crew observed brick in the upper levels of the feature but they were probably from the reinforced upper portion of the well. The feature’s soil was sandy and not hard packed. Pierson argues that wells would deteriorate quickly after abandonment due to this soil type (2006a:6.2-6).

Brian F. Smith and Associates collected a total of 483 artifacts from Feature 2. The majority of the materials collected were clay/ceramic, followed by glass, then metal (Pierson 2006a:6.3-4). Lab research indicates that the cultural deposits date to the late 1880s to shortly after 1900 (Pierson 2006a:6.3-10).

Feature 3 (see Figure 52), a hand dug well was discovered and partially excavated by Kleinfelder Environmental to remove contaminated soil prior to the project conducted by Brian F. Smith and Associates (Pierson 2006a:6.2-9). Feature 3 was similar to the first well, Feature 2. The feature was impacted by mechanical excavation to a depth of 15 feet below the site’s surface. Archaeologists excavated the well inside a one-meter square unit (Pierson 2006a 6.3-76). Less than 10 feet of the well feature was excavated until sterile soil was reached at about 25 feet below street level (Pierson 2006a:6.2-9). Feature 3 might be as deep as Feature 2. The site report suggests that the well may have begun to collapse before it became a refuse dump which might explain the several feet of sterile soil at the bottom of the well before refuse began to be deposited (Pierson 2006a:6.2-9). Archaeologists observed a wood lining and brick fragments in the upper portion of the feature suggests that the upper portion of the feature had been reinforced with brick, possibly to support a roof or some other form of covering (Pierson 2006a:6.2-9). Wooden boards were found in the lower part of the well but the excavators note that the boards could have fallen from the upper portion of the well (Pierson 2006a:6.2-9).

Archaeologists recovered a total of 292 artifacts from the well, Feature 3. The collection of artifacts were mainly household items that date before the 1890s (Pierson 2006a:6.2-9). Brian F. Smith and Associates estimated the time period for refuse disposal into Feature 3 was from 1870s to the 1880s (Pierson 2006a:6.3-33).

**CA-SDI-18,283**

Archaeologists of Brian F. Smith and Associates discovered two historical wells and a cistern at CA-SDI-18,283, The Icon Project, in 2006. CA-SDI-18,283 is located on the U.S.
Archaeologists discovered the first well feature, Deposit 2, during the general grading of the block at about one to two feet below street level (see Figure 53; Buysse and Pierson 2007:6.0-28). Initially, Deposit 2 consisted of dark brown sandy loam mixed with charcoal, burned areas and a sparse scatter of artifacts (Buysse and Pierson 2007:6.0-28). The exposed feature was round in plan view and measured 3.9 feet in diameter. The crew investigated the feature with the placement of a single test unit. A trench excavated on the west side of the feature revealed that the cultural material continued past a depth of six feet (Buysse and Pierson 2007:6.0-28). The trench caused the feature to become unstable, resulting in the...
collapse of the western one-third of the feature, between 0 and 160 (5.2 feet) in depth (Buysse and Pierson 2007:6.0-28). Archaeologists collected artifacts from the collapsed portion of the feature. They mechanically excavated the remaining eastern two-thirds of the feature in 20 centimeter (0.7 feet) levels. All exposed artifacts were collected (Buysse and Pierson 2007:6.0-29).

Brian F. Smith and Associates encountered a layer of ash between 60 (1.9 feet) and 80 centimeters (2.6 feet). At 160 centimeters (5.2 feet), the crew manually excavated the feature in 10 centimeter (0.3 feet) levels (Buysse and Pierson 2007:6.0-29). At 130 centimeters (4.2 feet), they decided to excavate a trench along the side of the side of the deposit to determine the vertical extent of the feature (Buysse and Pierson 2007:6.0-29).
Throughout the excavation of Deposit 2, the surrounding soil was mechanically removed so that the archaeologists were able to work in a safe environment (Buysse and Pierson 2007:6.0-29). At 670 centimeters (21.9 feet), Brian F. Smith and Associates were asked by construction personnel to temporarily discontinue excavation due to safety concerns (Buysse and Pierson 2007:6.0-31). When construction grading reached the depth of the feature, 22 feet, archaeologists of Brian F. Smith and Associates were to be notified by the construction personnel so that the excavation of this feature could continue (Buysse and Pierson 2007:6.0-32). However, archaeologists were not notified and the remaining levels of the well feature were destroyed by construction grading. The archaeologists reported that due to the decrease in artifact and wood noted in the last levels excavated and the increasing dampness, it is possible that the excavations had reached the lower levels of the feature (Buysse and Pierson 2007:6.0-32). They doubt that a significant portion of the feature was lost due to the inadvertent mechanical removal of the lower portions of the feature (Buysse and Pierson 2007:6.0-32). No lining was found during excavation (Buysse and Pierson 2007:6.0-32).

Archaeologists recovered 2,205 artifacts from the well feature, Deposit 2. They collected 834 temporally diagnostic artifacts (Buysse and Pierson 2007:6.0-40). Lab personnel identified a wide range of manufacturing methods for the artifacts. They looked at the overlapping dates of the manufacturing methods as well as maker’s marks and determined that the well was filled between the mid to late 1880s to the early 1910s (Buysse and Pierson 2007:6.0:40). Several machine-made bottles indicate that the well was still open after 1905/1910. However, compared to the number of mold-blown bottles, machine-made bottles made up a small percentage of the temporally diagnostic artifacts. The glass and ceramic artifacts suggest that residents began filling the well in the 1880s (Buysse and Pierson 2007:6.0-41, 6.0-42). Filling may have occurred before the 1880s, however, the large quantity of tooled bottle finishes identified, which began use around 1885/1890, supports the interpretation that much of the fill accumulated beginning in the mid to late 1880s (Buysse and Pierson 2007:6.0-41).

Brian F. Smith and Associates determined that Deposit 2 was a 19th-century well based on the structure of the feature. Buysse and Pierson report that the well was associated with a one-and-a-half story building present on the lot in 1886 (2007:6.0-41). Based on the
time that water is known to have been made available to downtown San Diego, the well was probably not in use since the early 1880s or even 1870s (Buysse and Pierson 2007:6.0-41).

Archaeologists of Brian F. Smith and Associates discovered the second historical well feature, Deposit 4 (see Figure 54), during general grading at six to seven feet below street level (Buysse and Pierson 2007:6.0-55). The initial exposure revealed a four foot round area of damp, reddish brown sandy loam mixed with roots and artifacts (Buysse and Pierson 2007:6.0-55). Archaeologists investigated the feature with the placement of a single test unit. At first they excavated the feature by hand, however, as they continued down the feature fill became increasingly difficult to excavate due to the damp soil. They dug a trench on the south side of the well feature which revealed that the feature extended deeper than the maximum depth of the trench (four feet; Buysse and Pierson 2007:6.0-55). Beginning at 30 centimeters (0.9 feet), archaeologists mechanically excavated the well fill in 20 centimeter increments (Buysse and Pierson 2007:6.0-55). Mechanical excavation continued to a depth of 510 centimeters (16.7 feet). At 510 centimeters archaeologists encountered a hexagonal wooden lining at 510 centimeters (see Figure 55; Buysse and Pierson 2007:6.0-55).

Buysse and Pierson posit that the well structure was “similar to other wells discovered by Brian F. Smith and Associates in downtown San Diego” (2007:6.0-55). Archaeologists observed an outline of a hole located around the northern half of the wooden lining that was drilled for the well (Buysse and Pierson 2007:6.0-55). The redwood planks that constructed the lining measured half an inch thick, two feet long, and one foot high. At 530 (17.3 feet) and 540 centimeters (17.7) vertical posts were exposed at three of the six adjoining corners (Buysse and Pierson 2007:6.0-56). The wood planks were placed horizontally within the drilled hole and were joined using half-lap joints (Buysse and Pierson 2007:6.0-56). The crew excavated from the top of the wood lining to the bottom by hand in 10 centimeter levels. At first they only removed the feature fill until the depth of the feature increased. The lining was removed, measured and sent to the lab for analysis (Buysse and Pierson 2007:6.0-56).

The archaeological crew found the well’s brick lining at 570 centimeters (18.7 feet). At the junction of the brick and wood linings, the bricks were piled on top of one another length-wise. As the wooden lining disappeared, the bricks alternated with each course forming a running or stretcher bond (Buysse and Pierson 2007:6.0-56). No mortar was used
for the brick lining, allowing groundwater to pass through the lining and into the well (Buysse and Pierson 2007:6.0-56). Fourteen courses of bricks made up the brick lining, which extended from 570 (18.7 feet) to 665 centimeters (21.8 feet; Buysse and Pierson 2007:6.0-56). Groundwater seeped into the feature during excavation, indicating that excavations were nearing the water table. Brian F. Smith and Associates used a pump to remove as much water from the feature as possible (Buysse and Pierson 2007:6.0-56). Below the last course of brick, the soil changed to a natural reddish brown silty sand; with an exception of a slight iron ore stain, there were no more artifacts for the feature. No wood or bricks lined the bottom of the well feature (Buysse and Pierson 2007:6.0-56).

Adding to the initial six to seven feet below street level, the overall depth of the well feature was about 28 feet (Buysse and Pierson 2007:6.0-56). The overall structure of the well
suggests that it is from the 19th century and the artifacts indicate that the well was filled during the 1890s (Buysse and Pierson 2007:6.0-70). This well, Deposit 4, was similar to the wells found at CA-SDI-17,590, The Park Terrace Project, located adjacent to CA-SDI-18,283 (Buysse and Pierson 2007:7.0-2).

Archaeologists uncovered the 19th-century historical cistern, Deposit 3, during soil removal in the central part of the project’s block (see Figure 56; Buysse and Pierson 2007:6.0-48). A four-inch thick, slightly domed cement disk was exposed about two to three feet below street level (Buysse and Pierson 2007:6.0-48). The cement cap was approximately six feet in diameter. Beneath the cap was a concentration of dark brown to black, silty loam soil mixed with artifacts. The artifact’s included bottles, ceramics, flatware, battery cores, bone and metal fragments (Buysse and Pierson 2007:6.0-48). This cistern feature was located two feet north of the first well, Deposit 2. Construction personnel mechanically exposed the feature, revealing a circular, two inch thick cement lining. Archaeologists removed the surrounding sterile soil from the outer east, west and south edges of the feature revealing that it extended to a depth of 40 centimeters (1.3 feet; Buysse and Pierson 2007:6.0-48). Buysse

and Pierson note that this cistern is considerably shallow compared to the other cisterns discovered at nearby project areas located in downtown San Diego (2007:6.0-48).

Archaeologists placed a test unit in the middle of the Deposit 3 and manually excavated in 10 centimeter levels (Buysse and Pierson 2007:6.0-48). The upper 20 centimeters consisted of damp, dark brown to black silty loam with scattered artifacts. The archaeological crew reached the bottom of the cistern at 45 centimeters (1.4 feet). Brian F. Smith and Associates determined that the one test unit was sufficient for the investigation of the feature due to the fact that the feature was relatively shallow and that only 20 centimeters of the fill contained a significant amount of artifact (Buysse and Pierson 2007:6.0-48).
Buysse reports that this cistern, Deposit 3, was not similar to the cisterns located at CA-SDI-17,590, the Park Terrace Project, a project area located adjacent to this project area, CA-SDI-18,283 (Buysse and Pierson 2007:6.0-48). The cisterns at CA-SDI-17,590 were lined with half-inch thick plaster linings and they had brick caps (Buysse and Pierson 2007:6.0-48).

Brian F. Smith and Associates recovered 463 artifacts from Deposit 3. 141 artifacts were temporally diagnostic; most were bottles and a few ceramic fragments provided dates (Buysse and Pierson 2007:6.0-50). Lab analysis identified a wide variety of bottle manufacturing techniques, however, all were in use during the 1910s (Buysse and Pierson 2007:6.0-50). The techniques included mold blown (up to the late 1910s), tooled finishes (1885/1890 to circa 1920), improved tooled finishes (1895/1900 to circa 1920) and machine made (after 1905; Buysse and Pierson 2007:6.0-50). Two bottle fragments revealed Illinois Glass Company marks, which date from 1912 to 1929 (Buysse and Pierson 2007:6.0-50). These bottle fragments help to identify the date of refuse disposition into Deposit 3 to after 1912 (Buysse and Pierson 2007:6.0-50). Since none of the artifacts were dated exclusively to the 1920s or later, Brian F. Smith and Associates concluded that the date of deposition of the cistern feature was after 1912, but not as late as the 1920s (Buysse and Pierson 2007:6.0-50).

CA-SDI-18,289

Brian F. Smith and Associates excavated CA-SDI-18,289, The Aria Project, in 2006. The site is located on the U.S. Geological Survey (USGS) 7.5 minute Point Loma Quadrangle. Historical remains identified for the project area include one feature, two deposits and numerous isolated artifacts. The historical feature was and interpreted the feature as a well inside a cistern (Smith and Greene 2007:1.0-1).

Archaeologists discovered the well/cistern feature during monitoring when a circle of bricks and mortar fragments were exposed. They documented the feature and recovered artifacts through manual excavation (Smith and Greene 2007:6.0-21). They determined the feature to be a brick well inside of a concrete cistern (see Figure 57; Smith and Greene 2007:6.0-21). Research indicates that this historical feature was unusual because wells inside of cisterns were not common for San Diego County (Smith and Greene 2007:7.0-1). The brick well measured 110 centimeters (3.6 feet) for the exterior diameter and 90 centimeters
(2.9 feet) for the interior diameter. The well had eight rows of brick remaining and was 60 centimeters (1.6 feet) in height from the cistern floor (Smith and Greene 2007:6.0-21). The bricks were cut in half and mortared together. The well was located in the center of cistern. The cistern measured 80 centimeters (2.6 feet) from the surface to the floor of the cistern. The outside diameter was 250 centimeters (8.2 feet) and the inside diameter was 230 centimeters (7.5 feet; Smith and Greene 2007:6.0-21). The cistern wall was made out of small cobbles and compacted sand with a one centimeter thick concrete lining. The height of the cistern and the material found inside indicated that the feature had been disturbed in the past, possibly by previous demolition or construction (Smith and Greene 2007:6.0-21).

Archaeologists described the soil inside the well as loose, sandy, damp, and light brown in color. The soil within the cistern is described as a light brown gray colored, loose, damp, friable, sandy loam. All the artifacts recovered during the project came from inside the well feature (Smith and Greene 2007:6.0-21).

The crew collected a total of 23 artifacts and cataloged them for CA-SDI-18,289. Seventeen temporally diagnostic artifacts were recovered from the well (Smith and Greene 2007:6.0-21). The artifacts are domestic in origin. The artifacts range from 1905/1910 to 1950. One bottle had an earlier date of 1885 to 1920. Further analysis of the feature fill
suggests that the well/cistern was filled in the late 1910s to the early 1940s. According to the 1906 Sanborn Map, the well and cistern was probably constructed for a structure on 1411 9th Street (Smith and Greene 2007:6.0-22). The well may have not be used for a long period because San Diego City’s first reservoir and well was located approximately 300 feet from the cistern/well (Smith and Greene 2007:7.0-1).

**ARCHAEOLOGICAL SITES WITH UNDETERMINED WATER SOURCE STRUCTURES**

CA-SDI-17,690, CA-SDI-17,691 and CA-SDI-17,692 are from the Final Archaeological Monitoring and Trenching for the Caltrans District 11 Project conducted by EDAW (Dolan and Bowden-Renna 2006:55). Theses sites all contain well/cistern features. The project took place on the northern edge of Old Town State Historic Park, San Diego (Dolan and Bowden-Renna 2006:v). The project area is bounded by Taylor Street on the south, the major railroad tracks on the west and the on-ramps to Interstate 8 on the north and east (Dolan and Bowden-Renna 2006:55).

**CA-SDI-17,690**

Archaeologists of EDAW conducted the archaeological monitored for the pre-construction trenching at CA-SDI-17,690, Block 4549, for Caltrans District 11 from 2004 to 2005 (Dolan and Bowden-Renna 2006:v). CA-SDI-17,690 is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 16 south, Range 3 west of the San Bernardino Meridian (Dolan and Bowden-Renna 2006:v). Archaeologists discovered one brick-lined well/cistern for CA-SDI-17,690 (Dolan and Bowden-Renna 2006:34).

EDAW discovered Feature 9, a brick-lined well/cistern feature during the monitoring project (see Figure 58). They manually excavated the feature in one foot intervals in search of diagnostic materials and structural information (Dolan and Bowden-Renna 2006:43). It measured 2 1/2 feet in diameter and it was approximately six feet deep (Dolan and Bowden-Renna 2006:43). The bottom of the feature curved inward. The feature’s bricks were one layer thick. The top of the well/cistern feature was finished with a steel reinforced poured concrete cap (Dolan and Bowden-Renna 2006:43). It was filled with historical refuse. Archaeologists reported that a two inch in diameter pipe protruded from the wall of the
feature at about two feet from the top of the feature (Dolan and Bowden-Renna 2006:43). EDAW estimated the date range for the well/cistern feature to be from 1900 to 1933 (Dolan and Bowden-Renna 2006:43).

**CA-SDI-17,691**

Archaeologists of EDAW conducted the archaeological monitoring of pre-construction trenching at CA-SDI-17,691, Block 4550, for Caltrans District 11 from 2004 to 2005 (Dolan and Bowden-Renna 2006:v). CA-SDI-17,691 is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle in the unsectioned Pueblo Lands
of San Diego, Township 16 south, Range 3 west of the San Bernardino Meridian (Dolan and Bowden-Renna 2006:v). Archaeologists discovered two brick-lined well/cisterns for CA-SDI-17,691 (Dolan and Bowden-Renna 2006:34).

The EDAW crew uncovered Feature 23, the first brick-lined well/cistern feature for CA-SDI-17,691 (see Figure 59; Dolan and Bowden-Renna 2006:45). Feature 23 measured three feet in diameter and approximately six feet deep. Archaeologists observed a brick pad, measuring 4.8 feet north to south by four feet east to west, near the top of the feature. They found pieces of plaster in association with the well/cistern feature. The date range for the feature is between 1900 and 1940 (Dolan and Bowden-Renna 2006:45).

![Figure 59. Feature 23. Source: Dolan, Christy, and Cheryl Bowden-Renna. 2006. Final Archaeological Monitoring and Trenching for the Caltrans District 11 New Headquarters (Block 4535, 4536, 4550, 4553, 4554, and 4556) San Diego, California. EDAW, Inc. Submitted to CALTRANS District 11. Unpublished Report on file at South Coastal Information Center, San Diego State University:23.](image)

The second brick-lined well/cistern, Feature 26, measured three feet in diameter and was composed of mainly unmortared broken bricks and was (Dolan and Bowden-Renna 2006:46). Archaeologists noted a segment of a glazed ceramic pipe, measuring 5 1/2 inches in diameter, protruding from the west wall of the well/cistern feature (Dolan and Bowden-Renna 2006:46). The feature dates between 1900 and 1940 (Dolan and Bowden-Renna 2006:46).
CA-SDI-17,692

Archaeologists of EDAW conducted the archaeological monitoring of pre-construction trenching at CA-SDI-17,692, Block 4553, for Caltrans District 11 from 2004 to 2005 (Dolan and Bowden-Renna 2006:v). CA-SDI-17,692 is located on the U.S. Geological Survey (USGS) 7.5 minute La Jolla Quadrangle in the unsectioned Pueblo Lands of San Diego, Township 16 south, Range 3 west of the San Bernardino Meridian (Dolan and Bowden-Renna 2006:v). Archaeologists discovered nine brick-lined well/cisterns for CA-SDI-17,692 (Dolan and Bowden-Renna 2006:34).

Feature 1 was a round brick-lined well/cistern. It measured 4.3 feet in diameter and five feet deep (Dolan and Bowden-Renna 2006:49). The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:49). Archaeologists noted a vertically standing piece of one inch metal pipe in the feature. Two conduit wires crossed the top of the feature. The crew reported that the top of the feature appeared to have been capped with concrete at one time (Dolan and Bowden-Renna 2006:49). They concluded a date range of 1900 to 1940 for the well/cistern, Feature 1 (Dolan and Bowden-Renna 2006:49).

Archaeologists discovered Feature 32, a second brick-lined well/cistern for CA-SDI-17,692, near Feature 1 (Dolan and Bowden-Renna 2006:50). It was capped with a thin layer of concrete. The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:49). The well/cistern was 4.3 feet in diameter and five feet deep (Dolan and Bowden-Renna 2006:50). Several two inch in diameter metal pipes crossed the top of Feature 32. One large pipe entered into the eastern exposed portion of the feature. EDAW estimated a date range of 1900 to 1940 for the well/cistern feature (Dolan and Bowden-Renna 2006:50).

EDAW uncovered the third brick-lined well/cistern, Feature 49, 42 feet from Feature 1 and 14 1/2 feet from Feature 32 (Dolan and Bowden-Renna 2006:51). It was round in shape, 4.3 feet in diameter and about five feet deep. The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:49). Archaeologists estimated the date range for Feature 49 between 1900 and 1940 (Dolan and Bowden-Renna 2006:51).
The fourth brick-lined well/cistern, Feature 50, was round in shape 4.3 feet in diameter and about five feet deep (see Figure 60). Features 1, 32, 49 and 50 formed a rough square with interconnecting two inch in diameter metal pipes (Dolan and Bowden-Renna 2006:51). The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:51). EDAW estimated a date range of 1900 to 1940 for Feature 50 (Dolan and Bowden-Renna 2006:51).

The fifth brick-lined well/cistern, Feature 51, was south of Features 1, 32, 49 and 50 (Dolan and Bowden-Renna 2006:51). The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch.
EDAW estimated a date range of 1900 to 1940 for Feature 51 (Dolan and Bowden-Renna 2006:51).

The sixth brick-lined well/cistern, Feature 52, was south of Features 1, 32, 49 and 50 (Dolan and Bowden-Renna 2006:51). The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:51). EDAW estimated a date range of 1900 to 1940 for Feature 52 (Dolan and Bowden-Renna 2006:51).

The seventh brick-lined well/cistern, Feature 53, was south of Features 1, 32, 49 and 50 (Dolan and Bowden-Renna 2006:51). The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:49). EDAW estimated a date range of 1900 to 1940 for Feature 53 (Dolan and Bowden-Renna 2006:51).

The eighth brick-lined well/cistern, Feature 54, was round in shape 4.3 feet in diameter and about five feet deep. The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:52). EDAW estimated a date range of 1900 to 1940 for the well/cistern feature (Dolan and Bowden-Renna 2006:52).

The ninth brick-lined well/cistern, Feature 55, was round in shape 4.3 feet in diameter and about five feet deep. The well/cistern was feature was lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:52). EDAW estimated a date range of 1900 to 1940 for the well/cistern feature (Dolan and Bowden-Renna 2006:52-53).
CHAPTER 8

WELL AND CISTERN SPATIAL PATTERN ANALYSIS

SAN DIEGO WATER WELL AND CISTERN TYPES

In order refer to the 86 wells and cisterns in a simple manner; I divided them up by common water supply structure types found in San Diego County. I determined the different types based on the water supply structure’s form (construction style), depth, diameter, construction material, and time period.

Type 1: 1900s Undetermined Water Structure (Cistern/Well)

The first water supply structure type found in San Diego County is an undetermined water structure that has a date range from 1900 to 1940 (see Figure 61). The water structure is lined with unglazed, porous and corrugated bricks that measured 12 inch by four inch by one inch (Dolan and Bowden-Renna 2006:51). It is cylindrical in form and measures approximately four feet in diameter and five to six feet in depth. This type of structure is found only in Old Town San Diego (see Figure 62).

Type 2: Cylindrical Unlined Well

The second water supply structure type for San Diego County is the late 1800s unlined well found mainly in downtown San Diego (see Figure 63). This well type is cylindrical in form and typically measures 10 feet or more in depth and four feet in diameter. San Diego residents abandoned and filled this well type by the early 1900s.

Type 3: Cylindrical Wood and Brick Lined Well

The third water supply structure type found in San Diego County is the late 1800s wood and brick lined well located in the downtown area of San Diego (see Figure 64). This well type is typically abandoned and filled by San Diego residents by the early 1900s. The
well is cylindrical in form and measures approximately four feet in diameter and 10 feet or more in depth.

**Type 4: Cylindrical Brick Lined Well**

The fourth water supply structure type found in San Diego County is the brick lined well (see Figure 65). The bricks do not have to be mortared. This well type dates from the late 1800s to the early 1900s. It is cylindrical in form measures approximately five feet in
Figure 62. Overview map of undetermined water structures in San Diego.
diameter and 10 feet or more in depth. The Brick Lined Well is found in Old Town and Downtown San Diego.

**Type 5: Hexagonal Wood Lined Well**

The fifth water supply structure type for San Diego County is the hexagonal wood lined well (see Figure 66). The wooden lining is typically hexagonal in shape and is normally supported by a lower cylindrical brick lining. The well measures approximately four feet in diameter and 10 feet or more in depth. It is constructed in the 1870s and filled by the 1890s. This well type is located in the downtown area of San Diego.
Type 6: Octagonal Wood Lined Well

The sixth water supply structure type found in San Diego County is the octagonal wood lined well (see Figure 67). The well is constructed in the late 1800s and is filled by the early 1900s. It measures four feet in diameter and 10 feet or more in depth. This well type is not specific to one area of San Diego County. Archaeological crews have mainly uncovered wells in the downtown region of San Diego County (see Figure 68).

Type 7: Cylindrical Cistern

The seventh water supply structure type for San Diego County is the cylindrical cistern (see Figure 69). This cistern dates from the late 1800s to approximately the early
1900s. It measures approximately 10 feet in diameter and 10 feet in depth. Cylindrical cisterns typically have a lining (plaster, cement, or mortar lining) in order to store water for long periods of time. Common construction materials for cisterns are brick, cobble, or concrete. This cistern type is not specific to one area in San Diego County; however, many are located within the downtown area of San Diego.

**Type 8: Bell Shaped Cistern**

The eighth water supply structure type found in San Diego County is the bell shaped cistern (see Figure 70). The construction date for this cistern type is unknown. It is, however, abandoned by the 1970s. It measures 10 feet in diameter and 15 feet in depth. The cistern type is typically constructed with brick, mortar, and a plaster lining.

**Type 9: Rectangular Cistern**

The ninth water supply structure type for San Diego County is the rectangular cistern (see Figure 71). This cistern type was constructed in the late 1800s and filled in by the early
Figure 68. Overview map of well types in San Diego.

1900s. It is not specific to one part of San Diego County. It is constructed of cement or brick and plaster.

**Type 10: Egg Shaped Cistern**

The tenth water supply structure type for San Diego County in the egg shaped cistern (no figure). This cistern dates from the late 1800s to approximately the early 1900s. It measures 10 to 11 feet in diameter and about 10 feet in depth. It is constructed of concrete and plaster. This type is mainly found in the downtown area of San Diego.

Based on my analysis of archaeologically excavated San Diego wells and cisterns, I determined that there are ten different water supply structure types found within San Diego County. Archaeological crews have uncovered cisterns mainly in the downtown region of San Diego County (see Figure 72).

**San Diego Wells and Cisterns**

During the California water use period (1835 to 1885) residents of San Diego acquired water from wells and cisterns. Those who did not have their own water supply relied on water wagons to provide them with water. Regular suppliers brought water in
Figure 72. Overview map of cistern types in San Diego.
horse-drawn wagons and barrels from the San Diego River and sold it for as much as twenty-five cents a pail (Melbourne 1986:255; Schaefer 2009b:20). Not only did San Diegans consider the water supply expensive, they also considered well and river water to be of low quality (Lockwood 1997:31; Sullivan 1985:15). Once city planners installed the municipal water system, wells were no longer needed and by the early 20th century they were longer used in Old Town or downtown San Diego.

As evidenced from my research, Old Town only has wells and undetermined water source structures. Old Town does not have cisterns. They are typically found in the downtown area and other parts of the county. It is possible that early San Diegans did not realize the value of cisterns before the mid-1800s. It is also likely that cisterns were not introduced to the area until a later period than wells.

Cisterns located in downtown San Diego have a longer use period than the wells of the county. This could be due to the fact that this area was home to a rapidly growing population in the early to mid-1900s. During that time period cisterns were commonly associated with residential buildings that housed multiple families (Clowery-Moreno and Smith 2009:6.0-60; Rosenberg and Smith 2006:6.0-29). Their large sizes could accommodate more residential areas. Cisterns located in more rural areas of the county have a longer use period than those found in downtown San Diego due to agricultural reasons. They were abandoned by the mid-1900s

**Old Town Undetermined Water Structure Pattern**

The undetermined water structures are only located in Old Town San Diego. They are cylindrical in form and measure five to six feet in depth and four feet in diameter. They are only constructed of bricks. The estimated construction date for this structure is 1900 and it is abandoned and filled by 1940. The date range for this water structure type is later than the Old Town wells.

**Old Town Well Pattern**

Old Town historical wells are cylindrical in shape and measure less than 10 feet in diameter and 10 feet or more in depth. By the early 1900s, residents of Old Town abandoned the use of wells.
Wells established in Old Town San Diego are commonly associated with brick linings. The construction date for the wells and the use of bricks for well linings corresponds with the arrival of the Mormon Battalion in 1847 (Wolfe 2010:64). The Mormon Battalion introduced kiln-fired brick making to San Diego when they hired themselves out the residents of Old Town (The Mormon Battalion Museum 2010). Juan Bandini hired a group from the Mormon Battalion in the mid 1800s to build the first brickyard in San Diego (The Mormon Battalion Museum 2010). The kiln-fired bricks were considered by San Diegans as more durable than adobe bricks, which was a common construction material in Old Town prior to kiln-fired bricks (The Mormon Battalion Museum 2010). The bricks used in the construction of the well lining do not have to be mortared. Unmortared bricks would allow water to seep into the well. The bricks may also serve the purpose of filtering out debris from the water as the water passes through porous brick (Kibbel 2010).

**Downtown Well Pattern**

Wells located in the downtown area of the county are typically cylindrical in shape and measure less than 10 feet in diameter and 10 or more feet in depth. However, Buysse posits that a 10 foot deep well is considered shallow for the downtown area of San Diego (2005b:6.0-24). The late 19th-century to early 20th-century wells usually consist of a brick, wood, or a combination of a brick and wood lining. It is not uncommon to find a wood lining supported by a lower cylindrical brick lining. By the early 1900s, residents depended on the municipal water system to supply households with water. During the same time residents abandoned the use of wells and turned them into refuse deposits (Smith and Greene 2007:3.0-7).

Wood linings in cylindrical wells are typically constructed in the upper portions of the well shafts. The placement of the wood lining could be explained by the material’s lack of durability. Wood would deteriorate easily and at an increased rate if submerged in water for long periods of time. Also, wood linings located in the upper portions of the well shafts would allow the shaft to hold its structure while allowing San Diegans to save on expenses since wood linings would be cheaper to construct than brick linings.

Four of the 28 historical wells discussed earlier have a hexagonal shaped wood lining. One of the hexagonal shaped wood lining wells is located in the lower part of the well shaft.
but is still supported by a lower brick lining. Two of the 28 wells have an octagonal shaped wood lining. These two wood lining types have been placed into circular well shafts during construction and it not clear as to what purpose they serve. There is a dearth of information on them.

**Downtown Cistern Pattern**

Cisterns serve the purpose of collecting and storing water (Mallios 2009:12; Mace 1994:2; Toulouse 1945:362). Pierson posits that cisterns measuring five feet in diameter and five feet in depth is standard for downtown San Diego (2006b:3). However, excavations reveal that cisterns are approximately 10 feet in diameter and 10 feet in depth. They are constructed of brick, concrete or cobble. They typically have a lining (cement, plaster, or mortar) within the structure in order to ensure that it can store water for long periods of time (Case 2007:23). The cisterns found in downtown San Diego are commonly constructed in the late 19th century and are abandoned and filled by the mid 20th century.

Based on archaeological excavations and historical documents, San Diego historical cisterns are characteristically cylindrical in shape; however, they also vary in shape (rectangular, jug, egg or oval). Cisterns usually have an interior lining associated with them; most commonly a plaster lining. Three of the 46 cisterns that I discussed in the description chapter have an interior brick wall or column. Kibbel (2010) states that some cisterns found in North America have a dividing wall, sometimes more than one, which would serve the purpose of filtering out debris from the water as the water passed through porous brick or stone partitions. It is very plausible that Kibble’s description of a cistern filtering system explains what the dividing walls found in the San Diego cisterns are. Having clean water is imperative to San Diego residents.

**Rural Cistern Pattern**

Cisterns found outside the downtown area of San Diego County date from the late 1800s to the late 1900s. Cisterns located on farm lands tend to have a much longer use period than those found in downtown San Diego. They are cylindrical, bell, or rectangular in form. They are constructed of cobble, concrete, or brick and have a lining (interior or outer) in
order to store water for long periods of time. The cisterns measure approximately 10 feet in
diameter and 15 feet in depth.

**COMPARATIVE WELL ANALYSIS**

The wells mentioned in Chapter 4 provide valuable information for a comparative
analysis with San Diego County’s wells. They offer information regarding the location
(space), temporal (time) and structure (form) of wells in other areas of North America.

Wells from colonial (18\textsuperscript{th} century) Williamsburg, Virginia, ranges from 28 to 40 feet
in depth (Noel Hume 1969c:12). Wells from Jamestown, Virginia, range from eight to
14 feet in depth. Williamsburg’s well shafts are deeper because the area is located on higher
ground (Noel Hume 1969c:12). Jamestown’s wells are lined with bricks, barrels, or
rectangular wood linings (Noel Hume 1969c:12). Williamsburg’s wells are constructed with
wedge-shaped bricks. Well diggers preferred using wedge-shaped bricks because the bricks
would stay in place and would not be easily dislodged (Noel Hume 1969c:24). In addition,
wedge-shaped bricks were considers by well diggers to be more practical for the “top down”
method, excavating the well shaft before creating the well lining (Noel Hume 1969c:28).
Archaeologists have found evidence of the “bottom up” method, the curb and well lining
built before the excavation of the well shaft, in a few of Williamsburg’s 20th-century wells
(Noel Hume 1969c:28). Excavators typically observe a wooden well curb at the bottoms of
the well shafts. Curbs would ensure that the brick lining remained level. After the early
1800s, Williamsburg’s wells not longer possessed wedge-shaped bricks, only rectangular
bricks (Noel Hume 1969c:27).

At Fort Loudon, Pennsylvania, archaeologists excavated a colonial well in
1975 (Denton and Gardner 1983:96). The fort was in use from 1756 to 1765. Excavations
revealed that the well measured approximately 14 feet in depth, the lower portion of the well
was located below the water table, and three feet in diameter (Denton and Gardner 1983:96).
The well was dry-laid and stone walled. The shaft was located on shale bedrock (Denton and

In St. Augustine, Florida, archaeologists excavated a well dating to 1700 (Bostwick
1980:79). The well measured over eight feet in depth and 4.1 feet in diameter (Bostwick
1980:79). Excavators could not determine what type of lining was used for the well
They did find an octagonal well curb for the feature (Bostwick 1980:79).

Ellis County, Texas, provides information on wells dating from 1850 to 1930. The wells in this county were mainly used for farming purposes (Mace 1994:1). The average depth of wells for the county is 22 feet (Mace 1994:2). The diameter of the wells had to be large enough to accommodate a person working with a shovel (Mace 1994:4). All the wells had a curb. The geological group, who created the well inventory for Ellis Count, categorized well structures into four groups; jug, conical shaft, and miscellaneous (Mace 1994:5). Wells dug into alluvium are cased in unmortared brick. More recent wells are cased in steel or plastic (Mace 1994:5).

In general, all the wells mentioned measure over 10 feet in diameter and approximately three to four feet in depth. Most of the wells also have well curbs. They are also typically cylindrical in form with the exception of a few of Ellis County wells that are jug or miscellaneous shaped. For San Diego County, archaeologists did not always observe a well curb for the wells but it is highly plausible that many did have curbs. Well linings would need to be kept leveled as the well lining was built. Curbs would aid in keeping well linings leveled during construction.

Williamsburg and Ellis County both have wells with brick linings. Williamsburg’s 18th-century wells display brick linings constructed of wedge shaped bricks. However, after the early 1800s, rectangular bricks replaced wedge-shaped bricks. Rectangular bricks are common in San Diego after 1847 when the Mormon Battalion introduced fired brick making to Old Town San Diego (The Mormon Battalion Museum 2010). Wolfe refers to the bricks as “American Style” (2010:64). Archaeologically excavated 18th-century Jamestown wells have revealed that some wells have been lined with barrels or rectangular wood linings. Archaeologists in San Diego have not recovered barrel lined or rectangular wood lined wells. However, they have observed cylindrical, hexagonal and octagonal wood linings in a few of San Diego’s 19th-century wells.

Ellis County is the only area mentioned in this thesis that has wells with a similar use period as San Diego wells. San Diego wells date from the late 1800s to the early 1900s. Ellis County farming wells date from the mid-1800s to the early 1900s. Both areas have cylindrical wells, however, San Diegan wells do not vary in form as Ellis County wells do.
San Diego has octagonal and hexagonal wells; however, these shapes are achieved by wood linings. Ellis County does not have any wood linings.

Bricks used for the construction of San Diego well linings are rectangular in shape. There is no evidence of wedge-shaped bricks for the county. There is one well located in downtown San Diego (SDI-17,590) that had evidence of rectangular bricks being broken in half in order to fit the bricks in place better.

Overall, the form of San Diego wells is not specific to this county. Wells are roughly 10 feet or more in depth and measure three to four feet in this region and in other regions of North America. They are located in areas where a sufficient water supply can be accessed.

**Comparative Cistern Analysis**

Cisterns they provide water for domestic and irrigation purposes (Kibbel 2010). Kibbel (2010) contends that cisterns were common in homes throughout the 19th century. He mentions that there are known 1940s households in North America that have cisterns (Kibbel 2010). He also posits that common construction materials for cisterns are, brick, stone, iron, steel or wood (Kibbel 2010). Cisterns are not uniform in shape and vary from beehive, bell, jug, rectangular, cylindrical, or flat-topped (Kibbel 2010). They can be built above ground or underground. Kibbel (2010) also states that cisterns may have a dividing wall located within the structure, sometimes more than one, in order to filter out debris from the water. These filtering systems are typically constructed of unmortared brick or stone partitions (Kibbel 2010).

San Franciscan cisterns are mainly for fire emergency purposes. They are part of the “Auxiliary Water Supply System” (AWSS; Van Dyke 2010). The city constructed a total of 175 cisterns located underground and they are maintained by the San Francisco Fire Department (Atlas Obscura 2010; Van Dyke 2010). The cisterns can store from 75,000 to 200,000 gallons of water (Atlas Obscura 2010; Van Dyke 2010). They are most likely constructed of reinforced cement.

Based on Kibbel’s North American household cistern descriptions, San Diego’s downtown and rural cistern patterns are not specific to the county. Cisterns were frequently used in San Diego during the 19th century. The construction materials that Kibbel (2010) posits are common cistern construction materials are also common materials used by San
Diego citizens to construct cisterns. Also, San Diego cisterns are not specific to one form. They are cylindrical, egg, rectangular, or bell shaped. Another similarity between San Diego cisterns and other North American cisterns are the use of filtering systems. Kibbel (2010) states that it is not uncommon to find a filtering system constructed of brick inside cisterns. Three excavated San Diego cisterns showed evidence of an interior brick wall which archaeologists suspected as filtering systems. According to Kibbel’s cistern’s filtering system description, it is probable that the interior walls found in San Diego cisterns served as filtering systems.

Compared to San Francisco cisterns, San Diego cisterns are not mainly used for fire purposes. They can be employed in fire emergency plans; however, they were mainly relied on by the county to supply residents with a water source. A similarity between San Francisco cisterns and San Diego cisterns is the use of cement as a common construction material. Cement cisterns would last and hold water for quite some time after being constructed.

Based on Kibbel’s cistern descriptions and San Francisco’s cisterns, the San Diego downtown and rural cistern pattern is not specific to the area. There is a difference in what purpose(s) the cisterns serve, however, it is clear that the main purpose of the cisterns is to store and supply water. Cisterns do not seem to vary much around the nation.
CHAPTER 9

WELL AND CISTERN TEMPORAL PATTERN ANALYSIS

ARCHAEOLOGICAL SERIATION

In archaeology, seriation analysis is a method that allows archaeologists to create a relative chronology of artifacts based on type and regular change over time or space. When the pattern reveals either even gradual change or a holistic replacement of types, it follows a uni-modal normal curve and is often deemed a “perfect” seriation. The perfection is in how each type surveyed reveals consistency over time and does not peak in multiple occasions. For the study of San Diego historical wells and cisterns, the use of seriation helped in determining the evolution of water supply structure types over time. In order to conduct a seriation, I had to first determine the median date for each structure that had a construction date and a fill date. Once the median dates were determined, I organized the structure types into 20-year time periods. My sample of water supply structures was not robust enough to use 10-year intervals. I did this for each of the three San Diego regions (Old Town, rural, and downtown) in this study. Assuming normal change by the water supply structure types over time, the types were then sorted to reflect the evolutionary sequence. Once I determined the evolution of temporal type pattern by region, I combined the data from all the regions in order to analyze the evolution of water structure types for San Diego County as a whole.

Old Town

Type 4, the cylindrical brick lined well, and Type 1, the undetermined water structure, are the only two water structures found within Old Town San Diego. Type 4 is the main well type during time periods A and B. By time period C, Type 1 is the prevailing water structure type in Old Town. There are no archaeologically recovered water supply structures from time period D. Based on the table, we see that Type 4 and Type 1 do not overlap in time. The pattern over time is Type 4 to Type 1.
Old Town San Diego has a perfect pattern concerning the evolution of water source structures over time (see Table 1). Old Town relied on brick wells during the late 19th century, and by the early 20th century the wells were abandoned and a shift to the undetermined water supply structure occurred.

**Table 1. Old Town Structure Types Over Time**

<table>
<thead>
<tr>
<th>Type 4</th>
<th>Type 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Period A 1871-1890</td>
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</tr>
<tr>
<td>Time Period B 1891-1910</td>
<td>100%</td>
</tr>
<tr>
<td>Time Period C 1911-1930</td>
<td>100%</td>
</tr>
<tr>
<td>Time Period D 1931-1950</td>
<td></td>
</tr>
</tbody>
</table>

**Rural**

In the rural region of San Diego County there are four different water structure types: Type 9, the rectangular cistern; Type 2, the unlined well; Type 7, the cylindrical cistern; and Type 8, the bell shaped cistern (see Table 2). The pattern of change over time is Types 9 and 2 to Type 7 to Type 8.

**Table 2. Rural Structure Types Over Time**

<table>
<thead>
<tr>
<th>Type 9</th>
<th>Type 2</th>
<th>Type 7</th>
<th>Type 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Period A 1871-1890</td>
<td>25%</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>Time Period B 1891-1910</td>
<td></td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Time Period C 1911-1930</td>
<td></td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Time Period D 1931-1950</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Type 7 is the one water structure that exists in the rural region during three different time periods. The rural region also displays a perfect water structure evolution pattern over time. Types 9, 2, and 7 occur during time period A, but by period B Type 7 increases 50 percent from period A to period B and C. By time period D only Type 8 is observed for the region. Wells were used in the earlier period of this region but by the early 20th century only cisterns are used in this area. Rural San Diego has a perfect pattern concerning the evolution of water source structures over time.
Downtown

There are eight structure types located in downtown San Diego: Type 5, the hexagonal wood lined well; Type 6, the octagonal wood lined well; Type 9, the rectangular cistern; Type 2, the unlined well; Type 10, the egg shaped cistern; Type 4, the brick lined well; Type 7, the cylindrical cistern; and Type 3, the wood and brick lined well (see Table 3). The pattern over time is Types 5, 6, and 9 to Types 2, 10, 4, and 7 to Type 3.

Table 3. Downtown Structure Types Over Time

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Type 5</th>
<th>Type 6</th>
<th>Type 9</th>
<th>Type 2</th>
<th>Type 10</th>
<th>Type 4</th>
<th>Type 7</th>
<th>Type 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1871-1890</td>
<td>15%</td>
<td>5%</td>
<td>5%</td>
<td>20%</td>
<td>10%</td>
<td>5%</td>
<td>25%</td>
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<td>B 1891-1910</td>
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<td>70%</td>
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<td>C 1911-1930</td>
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<td>100%</td>
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<td>D 1931-1950</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

Similar to the first two regions discussed, wells were highly represented during the late 19\textsuperscript{th} century and by the 20\textsuperscript{th} century there was a shift to cistern use by San Diegans.

The water structures that stand out in downtown are Types 7 and 3. Types 1 and 10 decrease in number from time period A to B while Types 7 and 3 increase. Type 7 goes from 25 percent to 70 percent from time period A to time period B. In a matter of years this type became highly represented in downtown San Diego. Type 7 was abandoned by time period C. By time period C, Type 3 was the only water structure type in downtown San Diego. Type 3 went from five percent in time period A to 100 percent in time period C. Downtown San Diego displays a nearly perfect evolution of structure type over time. The pattern is not completely perfect because there is a gap in time from 1891 to 1910 where Type 3 does not register.

Comparative Analysis

The rural region and Old Town differ from one another when it comes to water structure patterns. Old Town only has two types-4 and 1-while rural San Diego has four types: 9, 2, 7, and 8. The types found in Old Town are not found in the rural region and vice versa. This suggests that either the residents from the two regions did not communicate with one another regarding how to acquire and store water or environmental factors resulted in entirely separate water-capture strategies.
Old Town and rural water structure types overlap with the water structure types in the downtown region. Type four is observed in downtown and Old Town during the same time periods (A and B). Types 9, 2, and 7 are located in downtown and the rural area of San Diego. The three types also overlap in time. The difference in pattern for the rural and downtown regions is that Type 7 in the rural region has a slightly longer use period than the ones located in downtown.

Downtown displays more variation in water structure types than Old Town and the rural region. Downtown has a total of eight different water structure types. Types 5, 6, 10, and 3 are only found in downtown San Diego.

Between the three regions, three water structure types stand out because they are isolated in time and space. Types 5 and 6 are only found in downtown San Diego and they only show up during time period A. Type 8 is only found in the rural region and only appears during time period D.

**SAN DIEGO COUNTY PATTERN**

In order to determine the entire County’s type pattern evolution over time I combined the type patterns from each of the previously discussed regions into one table. In order to clarify the results, I also conducted a presence and absence seriation. Not only did each region have a pattern but the County as a whole does as well. Tables 4 and 5 reveal that San Diego County has a nearly perfect evolution of water structure types over time. The pattern is Types 5, 6, 9 to Types 2, 10, 7, 3 to Type 1 to Type 8. The only slightly bi-modal type is Type 3, which goes from 10 percent in time period A to zero percent in time period B and to 20 percent in time period C. All the other types are uni-modal. The pattern also demonstrates that wells are commonly constructed during the earlier periods (A and B) and by the later periods (C and D) cisterns are the common water supply structures found in the county.

**WHALEY HOUSE CISTERN/WELL ANALYSIS**

After four archaeological field seasons at the Whaley House, excavators concluded that the 19th-century Whaley water supply structure is both a well and a cistern. The brick-lined chute attached to the wooden box located in the upper portion of the feature suggests that the water structure was once a cistern, running water from the upper portion of
the roof into the underground storage area. Complete excavation of the Whaley cistern/well revealed that the feature’s bottom was located at 38 feet below modern grade, likely deep enough to reach groundwater during the 19th century. The depth of the feature strangely suggests that the cistern/well was once a well. The crew never uncovered a well lining, but the wooden curb found at the bottom of the feature strongly suggests that it supported a brick lining at one time (Mallios 2008, 2009, 2010; personal communication, March 14, 2011).

The Whaley cistern/well fits perfectly into Old Town’s evolution of water structure types over time (see Table 6). It also fits into the overall San Diego historical water use pattern. The well portion of the Whaley feature fits description of Type A because it is cylindrical in form, more than 10 feet depth, has a diameter of less than 10 feet, once lined with brick, and dates to the late 1800s. The upper portion of the Whaley feature fits the description of Type 1 because it is located in Old Town, dates to the 1900s and is an undetermined water structure; a cistern/well.
<table>
<thead>
<tr>
<th>Time Period</th>
<th>Type 4</th>
<th>Whaley cistern/well</th>
<th>Type 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Period A 1871-1890</td>
<td>X</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Time Period B 1891-1910</td>
<td>X</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Time Period C 1911-1930</td>
<td>O</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Time Period D 1931-1950</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
CHAPTER 10

DISCUSSION

Based on the analysis in chapters 8 and 9, San Diego County has a consistent and cohesive historical water use pattern. What is the reasoning behind the county’s historical and archaeological water use pattern? Potential theories that answer this question were discussed in Chapter 3. This chapter will discuss if and how the theories mentioned in Chapter 3 are applicable to this thesis.

HISTORICAL PARTICULARISM

Historical Particularism argues that the material culture will only reveal their full histories when compared to other artifacts and in relation to the documentary record (Noel Hume 1969a:6). Historical particularism is helpful in explaining the reasoning behind the San Diego water use patterns. My analysis on historical San Diego wells and cisterns reveals that the construction of the wells and cisterns reflects what San Diego considered to be the norm during specific time periods. For instance, prior to 1847, wells dug in Old Town were constructed with adobe bricks (The Mormon Battalion Museum 2010). Bricks were introduced to the region after the arrival of the Mormon Battalion in 1847 (The Mormon Battalion Museum 2010; Wolfe 2010:64). Brick replaced adobe bricks because they are more durable than adobe (The Mormon Battalion Museum 2010). Brick lined wells are located in Old Town and downtown San Diego but not in the rural areas of the county. Downtown has brick lined wells because this region is close in proximity to Old Town and communication likely occurred between these two regions. Also, the Mormons resided in Old Town upon their arrival and they stayed within that region. The use of bricks would have not been introduced to the rural areas until a much later time than Old Town and downtown San Diego.

Downtown San Diego displays the most variation in water structure types because this region experienced a population increase during the Boom period, 1886 to 1895 (Kelly 2002:242; Sholders 2002:61-62). After the California Southern Railroad connected San
Diego to the East Coast in 1885, a surge of people moved west (Kelly 2002:242). Residents from Old Town also began to move to the downtown area during the late 1800s. The high variation in downtown water structure types is likely due to the variety of new residents and their many distinct historical and cultural traditions of how to acquire water. For example, Types 5 and 6 are isolated in time and space. They only show up in the downtown region from 1871 to 1890. These two types are not seen anywhere else in the county and they do not have a long use period. This reflects a water structure type tradition not specific to San Diego and how the new San Diego residents attempted to employ their own knowledge on how to acquire water; however, they quickly realized that their traditions do not fare well in the San Diego region. Downtown water structures become more uniform in type by the late 19th and 20th centuries. Type 7 is the most prevalent water structure type in the downtown region for quite some time. The rural region and Old Town San Diego also shifted from the use of wells to cylindrical cisterns by the 20th century. The high representation of cylindrical cisterns within San Diego County suggests cylindrical cisterns fit best as a water structure type for San Diego County than wells.

The Whaley House cistern/well also reflects the transition from well to cistern. The well was constructed during the earlier period of Old Town, however, once the population began to increase and the well failed to supply water of high quality it became imperative for the Whaley’s to find a new and more reliable water source. By the 1900s the Whaley well was transformed into a cistern. The Whaley’s well transformation into a cistern corresponds with when the rest of the county began relying on cisterns to supply water.

**STRUCTURALISM**

Structuralism contends that the material culture is a reflection of the mental processes of a past culture. Structuralism aids in the understanding of San Diego water use patterns because it answers questions concerning how San Diegans modified and reacted to their physical world during the 19th and 20th centuries. During the late 19th century, Old Town, rural and downtown San Diego relied on the use of wells as a water source. By the 20th century each region abandoned the use of wells and began relying on the use of cisterns. The evolution of wells to cistern types is seen throughout San Diego County. The use of wells during the earlier periods reflects an older tradition of acquiring water and the use of cisterns
in the later periods reflects a newer and more modern way of acquiring water. The change of structure types over time for the county is Type 2 to Type 7 to Type 1. There may be a mental shift among San Diegans from the late 19th century to the 20th century suggesting a structural significance for the evolution of types over time. However, to evaluate the truth of this argument, significant further analysis is needed. Other forms of material culture need to be analyzed along with the water structure types in order to determine the structural significance of the San Diego historical water use pattern.

The mental change that may have occurred in San Diego County during the 19th and 20th centuries concerning the evolution of water structure types could also be reflected in the Whaley cistern/well. The Whaley water source structure shifted from a well type to a cistern type during the same time that San Diego County began abandoning wells for the use of cisterns.

**Environmental Anthropology**

In the field of archaeology, an environmental approach argues that changes in material culture reflect how people reacted and responded to their environment. Old Town, rural, and downtown San Diego differ from one another environmentally and those differences are reflected by the water structure types found within the different regions. Brick lined wells are a better fit in Old Town and downtown during the late 1800s while unlined wells and cisterns are more practical for the rural regions due to the higher presence of hard clay. Well shafts dug into hard clay do not need a brick lining. Well shafts in the rural region tend to also be deeper than those found in Old Town and downtown. The reason for this difference in well depth is due to the variation in groundwater levels from region to region. The shallower depths of the wells in Old Town suggest that the water table is higher in this region than in the rural regions.

San Diego County displays a pattern of wells being common during the late 1800s but by the early 1900s they were abandoned and replaced by cisterns. Based on my research, cisterns are more practical environmentally than wells. Well digging is much more labor intensive than cistern construction. Also, wells did not work well within the San Diego region because the groundwater was never of high quality. In areas of low permeability and poor water quality, residents prefer cisterns over wells (Mace 1994:2). Cisterns provided
higher quality water because they were built to catch and store rainwater. Rainwater, especially in this region, is typically fresher than a groundwater source. Also, San Diego County receives a sufficient amount of rainfall in order to keep the cisterns filled. The average annual rainfall on the County’s coastal plain over the past 150 years is 10 inches. According to Lipkis (2009), when it rains an inch, large cities hemorrhage 7.6 billion gallons of water. Cisterns are constructed for the purpose of catching rainwater. They are environmentally more beneficial to the county than wells, and this is why we see the transition from wells to cisterns throughout the region by the 20th century. Cisterns can better support a growing population than wells.

The Whaley family probably realized that their well did not work well for the San Diego region and decided to change their water structure’s purpose. Since San Diego receives a supply of rainwater the family transformed the well into a cistern because it would be more practical environmentally and better provide them with water.

**HISTORICAL PARTICULARISM, STRUCTURALISM, AND ENVIRONMENTAL ANTHROPOLOGY**

Applied together, historical particularism, structuralism and environmental anthropology are important theories that explain the reasoning behind San Diego water use patterns. Historical particularism emphasizes San Diego’s history with water issues and constant struggles of developing new ways for attaining a reliable water source for a large and growing population. Structuralism hints that there might be a mental change among San Diegans during the 19th and 20th century. Finally, environmental anthropology underscores how the natural environment affected the decision making of San Diegans.
CHAPTER 11

SUMMARY AND CONCLUSION

**Whaley House Cistern/Well**

When compared to other San Diego County water supply structures, it is clear that the Whaley House feature is both a cistern and a well. The Whaley cistern/well fits into the San Diego historical water use pattern, specifically the Old Town pattern. The evolution of water structure types over time for Old Town is Type 4, the brick lined well, to Type 1, the 1900s undetermined water source structure; a cistern/well. The Whaley cistern/well fits perfectly into the pattern because the structure starts as Type 4 in the late 1800s and by the 1900s it shifts to Type 1.

The Whaley House water structure may fit into the San Diego water use pattern; however, it is also atypical for the region. The cistern aspect of the structure is associated with a wooden box they may have served as a lining of some sort. The wood lining is unusual for the cistern because all of the other cisterns found in San Diego County are not associated with wood lining. Another issue with the Whaley cistern/well is its location. The cistern/well is within close proximity to the Whaley privy and is located in an area that is prone to flooding. Owners of wells and cisterns typically try to keep their water supply structures away from sources of possible contamination. Finally, the last issue with the Whaley cistern/well is the absence of a brick lining. A wooden curb was located at the bottom of the feature by the archaeological crew in the summer of 2010, and it suggests that there was once a brick lining. It could be possible that the bricks were removed from the feature once the family turned it into a cistern. The bricks may have been used for the construction of other structures within Old Town.

**Limitations**

Throughout my research I experienced problems with archaeological and historical documents. Many of the documents could not provide detailed information concerning San Diego wells and cisterns or they could not be located. I was not able to determine many of
the water structures construction and fill dates based solely on the historical documents. Also, there were a few cisterns and wells that I could not include into my study due to time constraints.

**FUTURE RESEARCH AND SIGNIFICANCE**

My thesis is the only inventory of historical San Diego wells and cisterns. More information concerning San Diego’s water use pattern and water supply struggles can be extracted with further study of the water structure types found within the county. Future research could include a study on San Diego County’s geology and soil types in which wells and cisterns have been dug into, the artifacts found within the water structures, and the additional wells and cisterns not included within my thesis.

My thesis offers information that can be used to reconstruct further San Diego County’s history. It also highlights the importance of understanding San Diego’s history of capturing and storing water. In order to better confront unprecedented challenges of water management, San Diegans need to understand the county’s historical water use patterns. Historical San Diego water use patterns reveal what works and what does not work for the region.

In addition, this thesis can aid San Diego cultural resource management (CRM) firms in two ways. It can help them anticipate the kinds of water supply structures they will encounter in different areas of the county during specific time periods. Furthermore, it can help the firms in the identification of the specific water supply structure types once it is uncovered.
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