THE LOS ANGELES CITY OIL FIELD
CALIFORNIA’S FIRST OIL BOOM DURING THE REVITALIZATION PERIOD (1875-1900)

Stephen M. Testa
Consulting geologist and President, Testa Environmental Corporation, 19814 Jesus Maria Road, Mokelumne Hill, CA 95245
stesta@goldrush.com

ABSTRACT: Oil seeps have been noted by Native Americans and Spanish explorers in the vicinity of Los Angeles since about 1543. The Los Angeles oil field was discovered in 1892 by Edward L. Doheny, Sr. The original oil field was located along Glendale Boulevard between Beverly Boulevard and Colton Avenue, near present-day Dodger Stadium. Doheny’s well, which extended to a depth of about 460 feet, produced 45 barrels a day, put him on the road to becoming one of the wealthiest men in America. The discovery, situated in what is now Echo Park, would set off California’s first oil boom during the revitalization period (1875-1900). Being in close proximity to downtown Los Angeles, its discovery sparked one of the first major land booms in the city. By the second year of production following the discovery, 750,000 barrels of oil were produced, bringing California’s output in excess of 1 million barrels. Within two years, 80 wells were producing oil in the area bounded by Figueroa, First, Union and Temple Streets, and by 1897 more than 500 producing wells existed. By 1898, the Los Angeles field made up 65 percent of the total quantity of oil produced in California for that year. Within a few years there were over 200 oil companies and 2500 wells within the city limits. As of 1913, the Los Angeles City Field encompassed about 0.6 square miles or 380 acres of proved land, with 400 wells (1000 original, some abandoned) or 4 acres per well (typically 4 to 8 acres per well was the economic limit). Of most importance is the effect this field had on the industry, attracting many due to its peculiar location to downtown Los Angeles. The discovery of the Los Angeles City Oil Field would soon lead to other fields being discovered throughout the Los Angeles Basin during the early 20th Century, including the proving of seven giant fields, with the Los Angeles Basin area becoming one of the major oil-producing areas in the world. The Los Angeles City Oil Field continues to remain active today, albeit wells continue to be abandoned, and concerns regarding vapor migration creating a significant risk to public health, safety and welfare exist. The Los Angeles City oil field would become the largest producer in California, and the world, in the late 19th Century, and although other fields yet to be discovered would prove to be larger, the Los Angeles City oil field was the most influential producing field in California’s oil history.

INTRODUCTION

It is sometimes hard to imagine that the City of Angels, Los Angeles, the current day home to over 3.9 million people in a very dense urban environment (7,873 persons per square mile) encompassing 469.3 square miles, has been built over an oil field. The Los Angeles City oil field is located in the north-central part of the Los Angeles Basin, Los Angeles County, California, about one mile north of the Los Angeles Civic Center (Fig. 1). During the latter part of the 19th Century, Los Angeles was not much more than a small sleepy town situated among east-west oriented, gently rolling hills, which grade to a flat coastal plain toward the west.

Oil seeps have historically been noted by Native Americans and Spanish explorers in the vicinity of Los Angeles since about 1543. William Phipps Blake (1826-1910), was the first professional geologist to remark about the oil potential in the Los Angeles area and elsewhere throughout southern California while serving as geologist and mineralogist for the Pacific Railroad Survey (Testa 2001), and his geological report for this region provided the first printed view of the town.

The early history of oil in California can be traced to the latter half of the 19th Century, and can be divided into four major periods: the Early Reconnaissances (1849-1864), California’s First Oil Boom (1865-1866), The Doldrums (1865-1875) and the Revitalization Period (1875 to 1900; Pemberton 1943 and Testa 2001). In 1865, only six years following the monumental discovery of oil by Edwin Drake in Pennsylvania, and following Benjamin Silliman, Jr.’s 1864 prospectus for oil in California, California’s first productive well was drilled by the Union Matolle Company east of San Francisco. This area would become the focus of much of the drilling activity in the latter half of the 1800s. Although the wells drilled in this portion of the Central Valley of California were not considered major discoveries, they did provide oil for the nearby market of San Francisco, which during this period was the largest population center in California during the post-gold rush era.

California’s first oil boom during the years of 1865 and 1866 was followed by a period of decline referred to as The Doldrums (1865-1875). Following 1875, the oil industry in California would start to show signs of revival, although most of the work done up to this time was performed blindly and relied heavily on known occurrences of surface seepages. Ten years following California’s first oil boom, the Revitalization Period would run from 1875 to 1900. Surface seepages would continue to play a significant role during the Revitalization Period; however, other important factors included the recognition for scientific guidance, the completion of the Southern Pacific Railroad from San Francisco to Los Angeles in 1876, changes in drilling techniques, and the use of steam machinery in 1877.

In 1890, the sleepy seaside village of Los Angeles would boast a population of about 50,395 people (Fig. 2). After a decade of what could be termed a relatively small and static oil industry, the discovery, situated in what is now Echo Park, and being in close proximity to downtown Los Angeles, would not only re-ignite the oil industry, but also

Oil-Industry History, v. 6, no. 1, 2005, p. 79-100
The first oil well within the city of Los Angeles was dug by hand in 1857 a short distance west of Coronado Street and south of Third Street (Crowder 1961), although Watts (1897) shows this well as being in the vicinity of the 200 block of Coronado Street South (immediately north of Third Street). Known as the Dryden well, depth and production is unknown, but it is known that the well produced a considerable amount of heavy oil for several years (Fig. 3). In fact, for the next 30 to 35 years, minor amounts of brea and tar was sold to the city of Los Angeles for two dollars a ton to oil the streets. Although other minor attempts were made, most noteworthy was in 1865 when Mr. A. Polhemus dug a well at the corner of Temple and Boylston Streets to a depth of 390 feet before encountering sulphurous gases and tar fumes (Goodyear 1888). This well yielded water and some gas. Goodyear (1888) also notes another well being drilled near the Southern Pacific Railroad station, in the bed of the Los Angeles River. This well terminated at 80 feet and encountered asphaltum with some gas.

Serious attempts to develop oil resources within the city limits began around 1890 (Preston 1890). The Maltman Oil Company drilled nine wells in the Maltman Tract situated in the northwest portion of the field, and another 12 wells
would be dug in the Ruhland Tract, about one-half mile south of the Maltman wells (Crowder 1961). Within the Maltman Tract, producing depths would vary from 140 to 285 feet. It was reported that these two groups of wells would produce about two barrels of 21-degree gravity oil a day per well. Other prospect wells were drilled at various times, but without appreciable success, and production from the Maltman and Ruhland wells was not significant enough to generate much interest.

Credit for the first well to yield appreciable oil in Southern California and ignite an oil boom is given to Edward L. Doheny (Fig. 4a), an unsuccessful gold and silver prospector, and Charles A. Canfield, his old mining partner (Fig. 4b). For many years, a small deposit of brea was known to exist on West State Street near Douglas Street in the city of Los Angeles (Watts 1897). In 1892, Doheny arrived in Los Angeles from Wisconsin almost broke. While in the downtown area of Los Angeles, he observed a cart whose wheels were coated in tar and hauling a substance called “brea”, the Spanish word for pitch, to be used at a nearby ice factory as fuel in place of coal (Davis 1998). Inquiring as to the source of the tarry substance, Doheny was directed to an area a short distance to the northeast at Westlake Park where the material was unearthed. Doheny would later recall: I had found gold and I had found silver and I had found lead, but this ugly-looking substance…was the key to something more valuable than any or all of these metals. (Forbes 1923, p. 108).

Being a miner, Canfield was skeptical, but Doheny convinced him and pooling their resources in 1892, that being $400, they leased a three-parcel lot at the corner of Patton and State Streets. Interest in their endeavor was shared by a mining acquaintance of Canfield, H. B. Ailman,
and a local banker named Sam Cannon, even before they sunk their first well (Davis 1998). In any case, their first well was situated in downtown Los Angeles along Glendale Boulevard between Beverly Boulevard and Colton Avenue, although Watts (1897) shows Doheny’s well to be located between Second Street Park and the Dryden Well in the vicinity of the 100 block of Coronado Street South (Fig. 3). Oil seeped from the sides of the shaft at seven feet below the ground surface, and despite the presence of gas, they continued digging. Initially, they began digging a 4 by 6 foot miner’s shaft. Working from dawn to dusk, they hit oil-soaked shale at about 60 feet. They would give up at a depth of 155 feet, being nearly overcome by fumes, and without a gusher (Rintoul 1976). They then made a crude drill utilizing a sharpened end of a 60-foot long eucalyptus tree, and drilling an 18-inch hole, this well would yield about 7 barrels a day for several weeks; by July 1894, yields would decrease to about 2 barrels a day.

The crew became dangerously ill from the fumes, and Doheny could not entice Canfield to stay. Doheny was able to get some additional financial support from Cannon, and with his new partner, moved across Colton Street to what was then known as Second Street Park (Putzman 1913). They erected a twenty-foot high oil derrick out of four-by-fours, with the actual drill being a cross-shaped bit attached to a three-inch iron rod, and assembled a horse-driven pump. At about 200 feet, they broke through a hard material and plunged through soft strata. Curious, they pulled the drill upward to find it soaked with oil. The well extended to a depth of about 460 feet, where on the fortieth day, gas burst out of the hole, and oil bubbled upward into the shaft. This well at State and Colton Streets, would become the first free-flowing oil well ever drilled in the city of Los Angeles.

With their success in November, 1892, other wells were sunk on adjacent lots, and the Los Angeles City Oil Field, or then referred to as the Second-Street Park Oil Field, grew quickly.

This area immediately became known as the Second Street Park Oil Field due to its close proximity to the Second Street Park (Fig. 5). Second Street Park was situated on what was then called Crown Hill. Now cradled in the arms of the Hollywood and Harbor Freeways, Crown Hill was one of several hills that rimmed the original City of Angels, and once termed a “howling wilderness”, was at the time of the discovery by Doheny and Canfield, an elite area occupied by elegant Victorian mansions (Rasmussen 1999). Nestled in its center and bordered by a white picket fence, including a playground and lagoon for boating, was Second Street Park. This name would last for several years before becoming known as the Los Angeles Oil Field, then The Old Field, and now formally designated as the Central Area of the Los Angeles City oil field. The original field has long-since disappeared, but in its heyday and being a land with few trees, Los Angeles had the appearance of a forest (Figs. 6 and 7). The area now occupied by Dodger Stadium and portions of the Santa Ana and Hollywood freeways, was notably named City Field (Rintoul 1976).
Doheny would later report on the following formations from wells now drilled by the Doheny Oil Co. in the Second Street Park area, in the northeastern portion of the field:

Sandy and clayey strata, with thin strata
Of hard rock 650'
Oil-sand, interstratified with sandy clay 125'
Tough clay (putty) 200'
Oil-sand with water 3'
Sand, with water undetermined

The oil-sand was more than 100 feet thick, with the richest portion being 45 feet in thickness. The prevailing dip of the strata was 40 degrees, but not uniform. Other portions of the field would show:

Adobe soil 3'
Yellow clay 20'
Tough blue clay 20'-30'

Clay shale with thin strata of sand and hard calcareous strata, “shells” 200' to 700'
Oil-sand 70' to 145'

Within two years, 80 wells were producing oil from the area bounded by Figueroa, First, Union and Temple Streets (Figs. 7 and 8). By June of 1894, the “Second Street” men were producing about 115 barrels per day, and five months later Los Angeles producers were developing more oil than all of the other oil fields in California combined (White, 1962). By 1895, more than 300 wells existed within an area of less than 4,000 square feet. Thirty-one wells would be abandoned in 1895 due to water for the most part, although significant amounts of gas and sulphur water were encountered in some wells situated west of downtown (i.e., in the vicinity of Rancho La Brea and), but little oil. Crowder (1961) reported that between the period of 1892 and 1895, over 500 wells were completed by 105 oil
Lubricating distillate 51.50%
Asphalt and loss 25.00%

This crude oil also contained usually about 3.5% to 7% water, and 0.16% to 2% suspended mineral matter, typically as a fine siliceous clay. According to Watts (1896), oil was largely used for fuel on the Southern California Railroad, a portion of the Santa Fe railroad system between Barstow and San Diego. By 1896, more than half of their locomotives were adapted to the use of oil as fuel.

Due to a lack of cooperation among producers, and lack of facilities for storage and handling, the price of oil dropped to “ruinously low rates”. The average price for 1895 was about 60 cents a barrel, and as low as 25 cents a barrel. The price per barrel would recover in 1896 reaching $1 per barrel by July, reflecting diminishing supply, organization of the producers, and increased number of facilities for storage and handling. The two primary pipelines were operated by Pacific Oil Refinery and Supply Company, and the Union Oil Company (Watts 1897). Pacific Oil Refinery and Supply Company constructed a pipeline from Second Street Park oil field to its tanks on Santa Fe Avenue. The line consisted of one-mile of 6-inch pipe, 4 miles of 4-inch pipe, and ½-mile of 3.5-inch pipe, with tankage storage capacity of 75,000 barrels. The Union Oil Company also had a line that extended from the Second Street Park oil field to Palmetto Street, on the Southern California Railway. This line consisted of 5 miles of 4-inch pipe, with a tankage capacity of 32,000 barrels. With a daily yield of more than 2,000 barrels, production would decline to 1,400 barrels in the early part of 1896. Regardless, at least eight companies were providing tankage as of May 1896 (Table 1). By 1910, eight-inch lines would become the norm (Wolbert, 1979).

The second year of production (1895) following discovery by Doheny and Canfield, the Los Angeles City Oil Field produced 729,695 barrels of oil (Watts 1897) pushing California’s output past one-million barrels for the first time, and accounting for three out of every five barrels of the state’s 1,209,000 barrels of oil by 1895 (Rintoul 1990). The deepest well extended to a depth of 1,140 feet, being drilled by Frank McCabe, but hitting the first oil sand at 700 feet. The Doheny-Canfield Oil Company, one of 67 operators that reported well information to the state, drilled 28 wells alone, producing 100,000 barrels in 1895. By 1897, the number of wells increased to 500. Within a few years, there were over 200 oil companies and 2500 wells within the city limits (Figs. 6, 7, 8, 9, 10, 11 and 12).

Doheny borrowed money to buy 1000 acres of land in what is now the Echo Park area. His efforts would put Doheny on the road to becoming one of the wealthiest men in America, and later be in a position to challenge for the Democratic nomination for Vice-President of the United States (Davis...
Table 1

Tankage Storage Capacity as of May, 1896
(after Watts 1897).

<table>
<thead>
<tr>
<th>Company</th>
<th>Storage Capacity (in barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within the Second Street Park</td>
<td>70,000</td>
</tr>
<tr>
<td>Outside the Second Street Park</td>
<td></td>
</tr>
<tr>
<td>Southern California Supply Company</td>
<td>70,000</td>
</tr>
<tr>
<td>Union Oil Company</td>
<td>32,000</td>
</tr>
<tr>
<td>Puente</td>
<td>6,500</td>
</tr>
<tr>
<td>Standard Oil</td>
<td>45,000</td>
</tr>
<tr>
<td>Oil Exchange</td>
<td>3,600</td>
</tr>
<tr>
<td>Hoffman &amp; Weller</td>
<td>2,400</td>
</tr>
<tr>
<td>Pritchard &amp; Company</td>
<td>2,400</td>
</tr>
<tr>
<td>Southern Pacific Railroad Company</td>
<td>20,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>251,900</strong></td>
</tr>
</tbody>
</table>

The oil boom attracted many including prostitutes, gamblers and con-men. One of the more celebrated characters was a woman named Emma A. (McCUTCHEON) Summers, a deeply religious local piano teacher turned wildcatter, and one of the most successful investors in the first years of the initial boom. Arriving in Los Angeles nine years prior to the discovery, Summers used her earnings to dabble in real estate, and was an occasional investor. Following Doheny’s discovery, she purchased for $700 a half-interest in a well between Court and Temple Streets, what is now the Civic Center (Rasmussen 1999). Even before the well was completed, she purchased interest in a number of other wells. Now in debt for several thousand dollars, she continued in the night teaching music in order to gather enough funds to oversee and increase her investments. By the early 1900s, Summers had control of much of the sales market, and this monopoly allowed her to control about half of the total production in the original Doheny-Canfield Los Angeles City Oil Field, while producing 50,000 barrels a month. Expanding her business interests, she sold her oil to downtown hotels, factories, Pacific Light and Power Company, and several railroad trolley lines. It was not long before she was being treated like royalty and would become known as the “Oil Queen of California”. At one point, she was selling more than 50,000 barrels of oil a month to downtown hotels, factories, several commuter railroads and trolley lines, and The Pacific Light and Power Company. The need for oil during World War I, and the upward spiral of automobile use (Fig. 13), would make the Oil Queen a wealthy woman.

FIELD DESCRIPTION

The earliest geological sketch map of Los Angeles and vicinity was prepared by W. L. Watts under the State Mineralogist J. J. Crawford (Watts 1897). This map was prepared to show description of rock types, surface orientation of certain structural elements (i.e., direction and degree of dip), location of bituminous shale and sandstone, surface seeps, surficial faulting, and well locations (Fig. 14). Early structural elements were also developed by Watts, and illustrated in cross section (Figs. 15a, b). Early photographs
of many of the oil fields throughout California for the period from 1865 through 1940, including the Los Angeles City oil field, are presented in Franks and Lambert (1985).

Comprehensive discussion of the geology of the field is presented by Kew (1924), Eldridge and Arnold (1907), Soper (1943) and Crowder (1961). The Los Angeles City fields lie in the region between West Lake Park and Elysian Park. Structurally, the field is located along the south side of a narrow zone of minor faulting and sharp folding (Figure 16, Soper 1943), which occurs as one of several secondary structural features on the south limb of the Elysian Park Anticline. The east end of the field shows surface evidence of normal faulting. The area is also part of the Elysian Park blind thrust system. This system generally has an east-west trend, and in part, accounts for the uplift and tilting of petroliferous strata as shown in Fig. 17.

Oil is found in the late Miocene Puente formation, characterized as a series of small folds and faults (Fig. 17). It was noted early on that although the majority of the wells extend down to the Fernando formation, most wells draw their production from the Puente (Leck 1921). The field is divided into three separate fields with a total of 416 operating wells as of 1913: Western, Central and Eastern fields Fig. 18). As of 1913, the field was about 4 miles in length, and a third of a mile in maximum width. The

Figure 8. 1st and Belmont Avenue about 1895 (a) (Taylor and Welty 1950), present day (b), and circa 1907 (c and d; viewing east) (Eldridge and Arnold 1907).
productive portion of the field was confined to wells east of Coronado Street, with exception to a block bounded by Commonwealth Avenue and Fourth Street, where there were 21 operating wells. The Eastern field extended from Buena Vista Street to Sunset Boulevard. As of 1913, the Eastern field had 221 operating wells. The Central field extended from Sunset Boulevard to Coronado Street. The Central field as of 1913 had 174 operating wells. The Western field as of 1913 was essentially abandoned.

Three producing zones have been identified: first, second and third, and averaging 900, 1,100 and 1,500 feet in depth, respectively (Fig. 16; California Division of Oil, Gas and Geothermal Resources 1992). Overall average net thickness for the three zones is 125, 30 and 30 feet, respectively. Porosity of at least the first and second zones is 34 percent. The oil varies from 11° to 18° Baume in gravity, averaging 14° (Leck, 1921). API gravity for the three pools has been reported at 18-20, 12-16 and 14, respectively; salinity has ranges from 1,000, 3,300 and 3,400 respectively (California Division of Oil, Gas and Geothermal Resources 1992).

Figure 9. Oil fields near Westlake Park area taken by U.S.G.S. geologist Ralph Arnold in 1906 (a) (Taylor and Welty 1950) and waste oil pooled in vacant lots (b) (Henry E. Huntington Library and Art Gallery).

Figure 10. Court Street near Douglas Street (a) during the Turn-of-the-Century (Henry E. Huntington Library and Art Gallery) and present day (b, viewing northwest).

It was noted by 1914 that the Central and Western fields are situated along the south flank of an anticline in the Puente formation (Fig. 16). The anticline is faulted from Sunset Boulevard eastward, and oil has accumulated within the sandstones and interbedded fractured Puente Shale on the south side of the fault (McLaughlin and Waring 1914). Surface seepages are along the fault.

Development of the Eastern area occurred rapidly in 1896 and 1897, following the completion of a well by Maier-Zobel in Brewing Company in November 1896. The initial well was situated east of a fault zone at the northeast corner of Adobe and College Streets. Initial production was 12 barrels a day, accompanied by a small amount of gas. Subsequent wells produced a reported amount in excess of 60 barrels a day. Originally named the Eastern Oil Field, the name was later changed to the Eastern area of the Los Angeles City oil field (Crowder 1961). Over 270 wells were completed in the first year or two, creating a chaotic environment as previously experienced in the Central area.

Following development of the Central and Eastern fields, emphasis was placed in the Western area. Commencing in
the summer of 1899 and continuing through 1900, approximately 300 wells were drilled. In this third and last important drilling phase of the Los Angeles City oil field, the chaotic frenzy was not evident. This subdued mood reflected heavier gravity oil (12 degrees), small production (one barrel a day), greater hauling distance to downtown Los Angeles, and by now most of the land was leased in large blocks (Crowder 1961).

**PRODUCTION HISTORY**

The field was at its peak in 1901, with 1,150 producing wells with as many as 200 companies operating (Figs. 19 and 20). The high density of wells would eventually have reduced what little reservoir pressure there was, and daily production would experience a sharp decline.

A review of the overall production history of the field is presented by McLaughlin and Waring (1914) and Crowder (1961). The field has always been characterized by shallow wells and small production. Following the initial discovery

in 1892, more than 300 wells existed by the end of 1895, with a cumulative production of 729,695 barrels (6 or 7 barrels per well per day, 2,000 barrels of oil per day), 60 percent of the State’s total oil production of 1,245,339 barrels. The average price of oil was as low as 60 cents per barrel, but increased to $1.00 the following year (McLaughlin and Waring 1914). The drilling of a 1,000 foot well and installing a pumping plant was reported as costing less than $2.50 per foot (McLaughlin and Waring 1914). Peak production was in 1901, with the field producing 830,000 barrels (Fig. 20; California Division of Oil, Gas and Geothermal Resources 1992).

Following the boom, extensive drilling would continue to about 1907. The impact of Los Angeles County in 1898 on overall oil production in the State, with the notable contribution being from the Los Angeles City field, is
restrictions placed upon the drilling of new wells within the city limits (Leck 1921). Between 1910 and 1914, the number of wells remained nearly constant at a little over 400, with monthly production declining from about 60,000 to 30,000 barrels between 1907 and 1913 (McLaughlin and Waring 1914). Total production at the end of 1913 was 16,700,000 barrels, or 40,170 barrels per acre, exceeding all other major fields in southern California and rivalling the McKittrick Field which was discovered in 1898 (Table 2). The rate per well at this time was fairly constant at four to two barrels, but pumped only occasionally. About 400 of the old wells were in fact still pumping in 1921, with a total average production on the order of 1000 barrels per day. As of the latter half of 1957, the Los Angeles City oil field had 90 wells producing 38,901 barrels for the six month period, totaling 20,902,934 barrels to date (Musser 1957). As late as 1980, the Los Angeles City oil field still had almost 40 producing wells, with a cumulative production of about 50,000 barrels annually.

ENVIRONMENTAL LEGACY

The discovery and operation of a major oil field in an urban environment was a first for the burgeoning petroleum industry, and generated unique issues the citizens of Los Angeles had to contend with. The drilling and operation of wells in an urban environment did not exist without having some adverse impact on the environment. Between the noise, traffic, odors, waste storage and handling, and spillage, operators, and citizens and home owners, had to improvise. In some cases, if a homeowner had a rig in their backyard but no place for a sump for storage and handling of waste water and mud, they may have used their basements.

The City of Los Angeles would lead in the establishment of strategies to combat the environmental concerns (Fig. 22). With the dramatic increase in population, noise abatement became an issue, and by the 1930s and 1940s, downtown wells were soundproofed. This would be initially accomplished using vinyl-coated glass cloth, with one-inch sheet fiberglass filling to abate the noise. With the burgeoning population, aesthetics also became an issue, and camouflage strategies would first be used in the country. This strategy would eventually be extended to offshore fields as well.

The Central Los Angeles High School No # 1

Today, the potential for gas migration to enclosed space presenting a potential hazard to public health, safety and welfare, remains. Hydrogen sulfide and methane gas, derived from naturally occurring crude oil, occurs beneath portions of the city. Hydrogen sulfide gas can be toxic at low levels and build up in enclosed spaces such as buildings and utility vaults. Methane, although not toxic, can be a hazard should it catch fire, and it can cause asphyxiation.
### Table 2
Comparative Summary of California Oil Fields Production as of 1913(a)

<table>
<thead>
<tr>
<th>Oil Field</th>
<th>Square miles</th>
<th>Acres</th>
<th>Wells producing</th>
<th>Acres per well</th>
<th>Total production</th>
<th>Barrels per acre</th>
<th>Monthly decline per well per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midway &amp; Sunset</td>
<td>59.00</td>
<td>37,800</td>
<td>1,222</td>
<td>30.8</td>
<td>94,566,895</td>
<td>3,350</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31,991,216</td>
<td></td>
<td>1.03</td>
</tr>
<tr>
<td>Coalinga</td>
<td>22.00</td>
<td>14,100</td>
<td>915</td>
<td>15.4</td>
<td>138,744,751</td>
<td>9,840</td>
<td>0.52</td>
</tr>
<tr>
<td>Kern River</td>
<td>10.10</td>
<td>6,450</td>
<td>1,675</td>
<td>3.9</td>
<td>167,357,375</td>
<td>25,900</td>
<td>0.32</td>
</tr>
<tr>
<td>Santa Maria</td>
<td>5.18</td>
<td>3,320</td>
<td>191</td>
<td>17.3</td>
<td>57,006,426</td>
<td>17,200</td>
<td>1.80</td>
</tr>
<tr>
<td>Whittier-Fullerton</td>
<td>4.70</td>
<td>3,010</td>
<td>514</td>
<td>5.8</td>
<td>59,007,620</td>
<td>19,600</td>
<td>Increase</td>
</tr>
<tr>
<td>Belridge &amp; Lost Hills</td>
<td>4.10</td>
<td>2,620</td>
<td>185</td>
<td>14.2</td>
<td>8,175,612</td>
<td>3,110</td>
<td>5.00</td>
</tr>
<tr>
<td>Ventura</td>
<td>2.50</td>
<td>1,600</td>
<td>332</td>
<td>4.8</td>
<td>12,482,947</td>
<td>7,800</td>
<td>High</td>
</tr>
<tr>
<td>Salt Lake</td>
<td>1.70</td>
<td>1,080</td>
<td>400</td>
<td>0.4</td>
<td>27,753,380</td>
<td>24,350</td>
<td>0.37</td>
</tr>
<tr>
<td>Lompoc</td>
<td>1.80</td>
<td>1,150</td>
<td>30</td>
<td>38.2</td>
<td>4,360,473</td>
<td>3,810</td>
<td></td>
</tr>
<tr>
<td>Mckittrick</td>
<td>1.40</td>
<td>895</td>
<td>270</td>
<td>3.3</td>
<td>37,103,169</td>
<td>41,450</td>
<td>1.33</td>
</tr>
<tr>
<td>Los Angeles City</td>
<td>0.60</td>
<td>380</td>
<td>400</td>
<td>0.4</td>
<td>16,700,000</td>
<td>40,170</td>
<td></td>
</tr>
<tr>
<td>Summerland</td>
<td>0.20</td>
<td>130</td>
<td>150</td>
<td>0.2</td>
<td>1,801,594</td>
<td>20,250</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>113.30</td>
<td>72,535</td>
<td>6,183</td>
<td></td>
<td>657,051,458</td>
<td>9,050 (ave.)</td>
<td></td>
</tr>
</tbody>
</table>

(a) Modified after McLaughlin and Waring (1914).
(b) 1,000 wells originally; some abandoned.
(c) 412 wells originally.

Should concentrations also build up in buildings and other enclosed spaces.

The Central Los Angeles High School #1 (formerly the Belmont Learning Center) is located at 1st Street and Beaudry Avenue (Fig. 23). Encompassing about 35 acres, the site is situated among a mixture of single-and multiple-family residential structures, vacant lots and commercial buildings. Because a portion of the site is located within the boundaries of the Los Angeles City Oil Field, naturally occurring crude oil methane and hydrogen sulfide exist in the underlying soil and as soil gas. Since current production from this field is from old wells utilizing archaic drilling and production practices, including four operational wells located on the northwest corner of the school property (Endres and Chilingar 2003). Unfortunately, environmental studies were not conducted until after construction was undertaken. Although gas seepage was encountered over most of the site, construction was halted when gas seepage was detected in the main electrical vault room, immediately before the power was to be turned on (Endres and Chilingar 2003). Studies conducted in 1999 confirmed such presence (Endres 1999 and Endres 2002), which embroiled the site in controversy and halted construction of the new High School, before being abandoned. Well head and surface seeps measurements noted hydrogen sulfide concentration releases.
to the air over 300 parts per million (ppm). At depth, hydrogen sulfide concentrations were measured at concentrations over 3000 ppm.

As of 2004, the site was about 60 percent completed, with cost to date estimated by the Los Angeles Unified School District to be on the order of $174 million, and by the California Joint Legislative Audit Committee to be $238 million, which includes 37 acres of the oil field in an “as is” condition. Some of the newly constructed Belmont buildings that were built over a fault and impacted by methane gas and hydrogen sulfide, were to be demolished in the Fall of 2004. Remediation cost estimates range from $14 to $107 million, raising the overall cost for the Belmont High School to just fewer than one-half a billion dollars, making it the most expensive high school ever built. State-of-the-art techniques for the passive venting, containment and monitoring have been and continue to be developed and employed.

CONCLUDING REMARKS

The Los Angeles City oil field initiated the first oil boom during the Revitalization Period, the first great land boom in Los Angeles, and marked the first significant oil boom leading into the 20th Century. A chronological sequence of important events pertaining to the Los Angeles City oil field is summarized in Table 3. Colorful as the oil boom was, its notoriety was not marked by any great gusher. Its importance was due to location, and more importantly, the effect it had on the industry as a whole, engaging a large number of persons directly involved in oil production. The field would reach its peak in 1901, with as many as 200 companies operating 1,150 producing wells. The impact on the economy of southern California was significant since it created a market for fuel oil in lieu of coal, in which California was in short supply. Like many other booms, this one did not last, but a lasting impression was made. Other individuals and operators were drilling wells in the Los Angeles Basin and throughout California, and many factors contributed to the oil and land boom that followed Doheny and Canfield’s venture in 1892. Certain individuals, notably Doheny, showed others how to make money, and would invest their monetary gains into exploration, opening other fields (Fig. 24). By 1894, Following Doheny and Canfield’s initial success in the Second Street Park area, they would drill three more wells in the City of Los Angeles, then drill wells in the nearby cities of Puente and Newhall. Obtaining a map of all known oil seeps from W. A. Goodman, a geologist employed by the State, Doheny would, with success, further invest time and money in Kern County. Canfield would do the same in Coalinga, where along with Joseph A. Chanslor, formed the Coalinga Oil Company.
Table 3
Chronological Summary of Significant Events Pertinent to the Los Angeles City Oil Field

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1853</td>
<td>William Phipps Blake, geologist and mineralogist with the Pacific Railroad Survey observes and notes the usefulness of oil near Los Angeles as an important resource of California.</td>
</tr>
<tr>
<td>1880</td>
<td>Oil discovered in the Los Angeles Basin.</td>
</tr>
<tr>
<td>1857</td>
<td>First well, known as the Dryden Well (or Old Well) dug by hand a short distance west of Coronado Street and south of Third Street (Refer to Figure 3a).</td>
</tr>
<tr>
<td>1890</td>
<td>Maltman Oil Company drilled nine wells in northwest portion of field, and an additional 12 wells ¼-mile south, producing about two barrels a day collectively. Yields were deemed insufficient to generate much interest.</td>
</tr>
<tr>
<td>1892</td>
<td>Edward L. Doheny and Charles A. Canfield drilled “discovery” well in area known as the Second Street Park.</td>
</tr>
<tr>
<td>1893</td>
<td>Doheny and Canfield invest and drilled wells in the cities of Puente and Newhall. Doheny further explored and drilled in Kern County, while Canfield invests and drills wells at Coalinga.</td>
</tr>
<tr>
<td>1895</td>
<td>The Los Angeles City Oil Field produces 729,695 barrels pushing California’s output over one million barrels.</td>
</tr>
<tr>
<td>1896</td>
<td>A.T. &amp; S.F. and Southern Pacific had converted all of their locomotive engines from coal to oil burning.</td>
</tr>
<tr>
<td>1900</td>
<td>Doheny and Canfield explored oil potential in Tampico, Mexico, and established the Mexico Petroleum Corporation.</td>
</tr>
<tr>
<td>1901</td>
<td>Peak production with the field producing 830,000 barrels, among 200 companies operating about 1,150 producing wells.</td>
</tr>
<tr>
<td>1909</td>
<td>Los Angeles Oil and Refining Company organized by T. A. Winters, J. R. Jacobs and George Gillons,</td>
</tr>
<tr>
<td>1915</td>
<td>California State Mining Bureau established State Oil and Gas Supervisor “to supervise the drilling, operation, maintenance and abandonment of oil or gas wells, and prevent damage to underground petroleum and gas deposits from infiltrating water and other causes and loss of petroleum and natural gas.”</td>
</tr>
</tbody>
</table>

Both men would later come together again along with others to form the Mexico Petroleum Corporation, initiating their operations in the Tampico region, Mexico. Even more importantly, Doheny with help from Canfield established a significant long-term market for oil. In search of a larger market base, Doheny pursued Atchison, Topeka, and Santa Fe Railway (A.T. & S.F.), the most important and largest passenger carrier in the West. A significant stockholder of the A.T. & S.F., Doheny urged railroad officials to substitute oil for coal in their locomotive engines (Davis 1998). The railway owned oil-rich land in Orange and Kern Counties. By the winter of 1899, Canfield’s Coalinga wells were the most prolific oil producers in all of California. Despite several setbacks, by 1899 Doheny’s continued persistence with officials of A.T. & S.F. railway and developmental assistance by Canfield with the installation of a force-fed burner and steam jet designed to facilitate oil uptake, all of A.T. & S.F. and Southern Pacific railway locomotive engines were converted from coal-to oil-burning. This event was the harbinger of a new era of petroleum-fueled transportation.

By 1910, three major fields were discovered: Los Angeles City (1892), and the Whittier and Fullerton fields (1897;
Figure 15a. Early geologic cross-sections depicting the Los Angeles City oil field prepared by the California State Mining Bureau 1897.

Figure 1). The discovery of the Los Angeles City oil field would soon lead to other fields being discovered throughout the Los Angeles Basin during the early 20th Century, including the proving of seven giant fields (Brea-Olinda, Beverly Hills, West Coyote, East Coyote, Montebello, Richmond and Santa Fe Springs), with the Los Angeles Basin area becoming one of the major oil-producing areas in the world.

By 1961, the surface area of the Los Angeles City Oil Field had been completely developed for industrial and residential use, and most of the productive area placed under the auspices of the Urban Renewal Association (Crowder 1961). Plans to abandon most of the existing wells and redevelop the area for residential usage were also in play by 1961. By 1961, the Eastern and Central areas remained industrial, with 93 wells operated by 22 companies. Later deep tests and drilled holes were abandoned without completion to the shallower sands.

The historic Los Angeles City oil field itself remains active today, with 29 producing wells, and 26 shut-in wells.
They constructed storage tanks, and devised means of transportation; they invented burners, and learned how to use crude oil for steam generation and brick-making; they learned how to utilize crude oil in road-making; they acquired the art and devised the apparatus for refining; they discovered a way for saving and utilizing the gas that had been escaping from their wells; they prospected with 'wild-cat' boring until they had extended the territory miles outside the originally developed area. In short, they established one of the greatest petroleum fields in the world. With such a record of courage, persistence and achievement, it is no wonder that Los Angeles began the new century with...
Figure 16. Geologic map of the Los Angeles City oil field and vicinity (Soper, 1943).

a stout heart and a confident air. (Weaver 1973, p. 56).

The Los Angeles City Field was the largest producer in California in the late 19th Century, and although other fields yet to be discovered would prove to be larger, the Los Angeles City oil field was the most influential producing field in California’s oil history.

ACKNOWLEDGEMENTS

I first wish to thank Mr. Don Clarke, formerly with the Long Beach Department of Oil Properties and currently an independent petroleum consultant (good luck), who got me interested in this historical and significant episode of California’s oil history. I also wish to extend my appreciation to the following individuals for their assistance in the preparation of this manuscript: Mr. Michael Mulhern with the City of Los Angeles, Executive Secretary Dr. John Parrish with the California State Mining and Geology Board, Ms. Joy Arthur-Silva and Mr. Robert Hauser with the California Division of Oil, Gas and Geothermal Resources, Mr. Dale M. Stickney with the California State Geological Survey Library, Mr. Robert Synder with the California Geological Survey, and Lydia Testa for her diligent editorial review. Their helpful assistance and comments regarding this subject matter was warmly received and the manuscript is much better for it.

REFERENCES


CALIFORNIA STATE MINING BUREAU, 1897, Thirteenth Report (Third Biennial) of the State Mineralogist for the Two Years Ending September 15, 1896. Sacramento, California, 726 p.
Figure 17. Plan view and Cross-sections of the Los Angeles City oil field (California Division of Oil, Gas and Geothermal Resources 1992).
Figure 18. Illustration showing the Western, Central and Eastern fields, and well locations as of 1912 (Prutzman, 1913).

Figure 19. Graph showing number of wells drilled upon discovery in 1892.

Figure 20. Graph showing overall oil production with time.
Figure 21. Graph showing impact of the Los Angeles City oil field on overall production in California in 1898 (data from Pemberton 1943).

Figure 22. Local ordinances in the 1920s caused operators to take precautions as shown by the addition of sheet-metal on side of derrick in case of a blow-out, explosion or fire (American Petroleum Institute).


Figure 23. Early 20th Century photograph of the Los Angeles High School with oil derricks in the background; (a) (California Department of Oil, Gas and Geothermal Resources), and (b) current view of the Central Los Angeles High School No. 1.


Figure 24. Doheny standing with his arms up in the air at the foot of a derrick reenacting his 1892 discovery in 1920 (a and b) (Henry E. Huntington Library and Art Gallery).

GOODYEAR, W. A., 1888, Petroleum, Asphaltum, and Natural Gas. In Seventh annual report of the California State Mineralogist, California State Mining Bureau, pp. 65-114.

KEW, WILLIAM S. W., 1924, Geology and Oil Resources of a Part of Los Angeles and Ventura Counties, California. United Stated Geological Survey, Bulletin No. 753, 202 p.

LECK, LAWRENCE VANDER, 1921, Petroleum Resources of California with Special Reference to Unproved Areas. California State Mining Bureau, Bulletin No. 89, Sacramento, California, 186 p.


RINTOUL, WILLIAM, 1990, Drilling Through Time, 75 Years with California’s Division of Oil and Gas, California Division of Oil and Gas Publication TR-40, Sacramento, California, 178 p.

SALATHE’, FREDERICK, 1897, Resume of Original Researches, Analysis, and Refining Methods of Petroleum, Mainly from the Southern Counties of California. in California State Mining Bureau Thirteenth Report of the State Mineralogist for the Years Ending September 15, 1896, p. 656-661.


WATTS, W. L., 1896, Oil and Gas Yielding Formations of Los Angeles, Ventura, and Santa Barbara Counties, Part I. California State Mining Bureau, Bulletin No. 11, December, 1896, San Francisco, California, 94 p.

WATTS, W. L., 1897, Oil as Fuel in Los Angeles County. in California State Mining Bureau Thirteenth Report of the State Mineralogist for the Years Ending September 15, 1896, p. 663-664.


About the Author: Stephen M. Testa is President of Testa Environmental Corporation, an environmental and engineering geology consulting firm located in the foothills of the Sierra Nevada mountain range of California. Stephen has been an instructor of geology and mineralogy at California State University at Fullerton, and petroleum environmental engineering at the University of Southern California. The author of several books and numerous papers, Testa has served as Editor-in-Chief of the American Association of Petroleum Geologists – Division of Environmental Geosciences peer-review journal Environmental Geosciences. Testa is a Past-President of the American Institute of Professional Geologists, and is the current president of the American Geological Institute.