WATER’S END

Mobile Mapping
Indoor application

Station to Station
Implementing BIM

Decided Guidance
A fixed boundary
During the 1920s, the city of Los Angeles was burgeoning. Demographics were changing and geographic boundaries were being pushed out in all directions. Oil was booming, industrialization was in full swing, and water was in high demand. Southern California was very dry and thirsty, on the heels of a drought and on the verge of the Great Depression. Importing water to its residents was a high priority, and in many ways, circumstances then were comparable to California’s present-day drought scenario.

The City of Los Angeles began exploring water supply options and soon set its sights east to the Colorado River, it being the only local source to meet their needs. Famed City Engineer William Mulholland set out 16 survey crews in 1923 to survey and map potential routes for a future aqueduct. Their task was to find the safest, most economical route to bring water to a dry and populated Southern California region. These surveyors became the pioneers of today’s Colorado River Aqueduct.

The search for the CRA route continued from 1923 to 1930, during which the project was taken over by the newly formed Metropolitan Water District of Southern California. Metropolitan was established in 1928 by the California Legislature for the purpose of building, operating and maintaining the CRA.

» SHERRI LEE BARNES AND PAUL L. TUCKER, PS
Along the way, these CRA pioneers continued their work on horseback, surveying and mapping their way over towering mountains and trampling across dry sunbaked desert floors. They covered 25,000 square miles through parts of Arizona, California, Nevada and Utah and from the Grand Canyon to the Mexican border. They carried canvas water bags and salt tablets to keep hydrated. The work took seven years to complete and, at the time, was the largest survey and mapping project in this country by any public agency other than the federal government. Expert draftsmen created a three-dimensional topographic map on fiberboard which was brought to Washington, D.C. during...
Congressional hearings, helping pave the way for Metropolitan’s creation. This topographic model is currently on display and is in the process of being refurbished at the General Patton Memorial Museum at Chiriaco Summit in California.

As land surveyors, we all know that surveying and mapping is an integral part of the early stages of every major engineering project. Land surveyor contributions to design and construction were as critical in the 1920s as they are today. The methodology of choice at that time was triangulation, utilizing higher land positions to set monuments. The more precise the angles were measured, the more accurate the distances were calculated. Care was taken to measure angles in the early light of the day, or through use of fires at night to illuminate triangulation stations along the ridgelines of mountains to achieve the greatest accuracy and precision.

First-order control surveys were executed to furnish control for detailed studies, final location, and construction. William L. Sanders, Senior Inspector, and Floyd W. Hough, Chief Geodetic Engineer (a famous American Military Engineer), were in charge of the project. From the survey records we read that vertical control for the mapping consisted of elevations established by wye-levels run in one direction only and originating from benchmarks from several different organizations. Observations on the triangulation scheme were made at night with nine-inch direction-type Parkhurst theodolite. Striding-level readings were taken on sights at steep vertical angles.

Now, just let your mind wander and wonder, if even for a moment, whether those vintage surveyors could have even begun to imagine how that same project would have been mapped and measured in, let’s say, the year 2017? Picture an old bearded party chief gazing up into the sky on a hot summer’s desert night in 1926 and dreaming.... “Maybe one day there will be a man-made constellation of stars in outer space orbiting the earth 12,550 miles above ground? Stars that might be monitored by the U.S. Department of Defense, with corrections for precise time applied to accurate positions on the earth’s surface?” “No way man, it will never happen!” If they only knew.

Upon completion of the survey and mapping, eight routes were considered. Ultimately, the 242-mile-long Parker Route was selected—Mulholland’s initial choice. The father of the CRA was correct from the beginning about his initial assessment.

The year was 1933 and the Great Depression was in full stride. The CRA project brought the hope of employment to the residents of California, and employed 35,000 people. At the time, it was the largest local public works project and was...
considered “the greatest aqueduct in the history of the world.”

Digging through Metropolitan’s archives, there are countless memories from the field crews, just waiting for the perfect time to be retold. Recollections include life in the fly camps: survey crews in hot pursuit of a Billy goat that took off with the map of one of the field draftsmen. Another retells the tale of finding the remains of old Indian watch towers, sun altars, petroglyphs, and trails along the river banks. Surveyor Joe Chiriaco’s daughter, Margit Chiriaco Rusche, shared a story that her father told her as a child “meals were cooked over an open flame and you didn’t dare complain or you’d be cooking the meal for yourself. They’d say the meal was way too salty, just the way they liked it!”

Our archives tell stories of playing baseball, and evening entertainment that included dressing up cactuses as cowboys. Cooks that told stories in the likeness of Mark Twain: how the river water was so dirty that they had to stir four spoons of canned milk into a bucket of water to coagulate the mud sufficiently at the bottom to make it drinkable; and how they had to strip naked to swim in the river to cool off because the weight of the dirty silty water would make clothes so heavy you could drown.

In 1934, Construction Superintendent, R. M. Merriman, told stories in the Aqueduct News to the workforce about water supply systems in ancient Athens, and then compared them to the work of the CRA project. National Geographic gave a colorful description in its magazine of...
the CRA in an article entitled “Southern California at Work.” They described the CRA as “a supreme engineering effort. In all the history of great waterworks, the whole world has seen nothing like it.”

Contained within the archives are many reminders of the drought these people faced, and their hard work and dedication, to fill the need by finding other water resources to help a thirsty Southern California thrive.

Nearly 14 years were spent building four dams, five pumping plants, 92 miles of tunnel and 150 miles of canal and pipelines. The task included the construction of Parker Dam, which created Lake Havasu. In 1941, the project was completed as a valve was turned at the newly opened Weymouth water treatment plant in La Verne, Calif.

The aqueduct has received many awards and has been recognized as a significant achievement. In 1955, it was recognized by the American Society of Civil Engineers as one of the “Seven Engineering Wonders of American Engineering.” In 1999, ASCE designated the aqueduct as a national historic engineering landmark. It has been recognized by the Department of the Interior’s National Park Service, which documented the CRA’s historic value as part of the Historic American Engineering Record, HAER-CA226. The Colorado River Aqueduct continues to be seen as an historic engineering and construction achievement and is the largest domestic water supply system in the world.

These are distinguished engineering awards, but we all know that every good engineering project begins and ends with surveying!

Metropolitan just celebrated 75 years of water distribution to Southern California, inaugurated with the completion of the CRA in 1941 and water first being delivered. Today, Metropolitan delivers an average of 1.5 billion gallons of water per day to a 5,200-square-mile service area of nearly 19 million people.

With California heading into its sixth year of record drought, history seems to be repeating itself. To meet future needs, Metropolitan has taken an even more active role in educating the public on ways...
to conserve water. Along the way, brown residential lawns are being replaced with drought friendly plants and are starting to look like those of neighboring states Arizona and Nevada.

Metropolitan surveyors take pride in their work of maintaining such a great historical and essential water system. In partnership with engineering, they are once again leading the charge to discover new methods of water delivery to a growing, dry, and thirsty California. Again, every great engineering project begins and ends with surveying.

It’s interesting how history repeats itself. Drought, population growth, the need for a reliable water source and of course... Surveyors. Throw in some conservation and the mighty Metropolitan Water District and you have a thriving Southern California.

For more information on the history of the Colorado River Aqueduct and the status of California’s current drought, go to www.mwdh2o.com or mwdh2o.com/WhoWeAre/History.

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