

SOUTH MOUNTAIN TUNNEL – A UNIQUE PIECE OF THE CITY OF PHOENIX SOUTH MOUNTAIN WATER FACILITIES

Brandy A. Watkins, PE, HDR Engineering Inc.; Gerald Arakaki, PE, City of Phoenix Water Services Department; Stan Tax, City of Phoenix Water Services Department; James P. Pembroke, PE, HDR Engineering Inc.

It was a typical hot August day in Phoenix, Arizona. Almost two dozen spectators gathered around the large open hole at the base of South Mountain. It seemed as if everyone was there including TV Stations and other media personnel. The crowd grew quiet as the call was made to start the machine. Within minutes everyone could see the ground start to crumble on the opposite side of the large hole. Shortly thereafter, the tunnel boring machine (TBM) saw daylight for the first time in nine months and the tunnel through South Mountain was complete.

The City of Phoenix is currently embarking on the design and construction of a regional facility to deliver a redundant water supply to the world's largest cul-de-sac, Ahwatukee. The City's existing water system supplies potable water to the Foothills/Mountain Park Ranch area via a transmission system around the east side of South Mountain. This transmission system has a capacity of 37 million gallons per day (MGD) while the peak demand is 31 MGD. Recognizing the need for additional capacity and the desire for service redundancy to this area, the City developed the South Mountain Water Facilities (SMWF). The SMWF consists of a new 64-MGD water booster pump station, the South Mountain Booster Pump Station, and approximately 17 miles of 48- and 54-inch pipeline around the west side of South Mountain. With these new facilities, the delivery capacity to the area will be increased to 84 MGD (47 MGD from the west and 37 MGD from the east), and service redundancy will be provided by means of the dual-feed (east and west) delivery system.

Due to the magnitude of this project, the City elected to divide the transmission main into seven pipeline segments. The tunnel comprises one segment of the transmission main that passes through South Mountain. The tunnel is approximately 6,060 linear feet. Due to the size of the TBM, the tunnel diameter is eight feet. The tunnel will house one 48-inch waterline and several 4-inch conduits.

The South Mountain tunnel is located along the western boundary of South Mountain underneath two prominent ridges. Early speculation assumed that the ground between the two ridges would be rock. However, during the design of the tunnel, the geotechnical consultant observed several different soil conditions including rock, caliche, and soil. This resulted in a unique TBM design and tunnel support system. The TBM needed to be able to cut through the hard rock conditions as well as remove the softer soil. The tunnel support system included rock bolts, wood lagging, and grout stabilization measures.

As the tunnel was being excavated, a small support system was being built. The support system included electrical and telephone lines, water supply lines for TBM cooling, and supply and exhaust air ducts for ventilation. In addition, rail track was added every day to haul the muck back to the tunnel's opening.

Now as the tunnel operations are complete, the work to clean and prepare the tunnel for pipeline installation has begun. Within several months the 48-inch waterline will be placed within the tunnel. The annular space between the waterline and the tunnel will be completely grouted; thus, leaving only the markings of a unique South Mountain Water Facilities feature.

