Deep Shaft Pipe Rigging - Lake Mead, Nevada
David J. Berti, Senior Consultant

Lake Mead, which supplies 90 percent of Southern Nevada’s water, has dropped 110-ft since 2000, a trend that is expected to continue into the foreseeable future. Given the circumstances and the need to have a reliable water supply, Southern Nevada Water Authority (SNWA) developed a plan to construct a third deep-water intake in Lake Mead. The Lake Mead Intake No. 3 project consists of these major components: a deep-water intake riser and inlet structure, an intake tunnel driven beneath the lake and a portion of Saddle Island, a pumping station on Saddle Island, and a pipeline connection to the existing Alfred Merritt Smith WTF.

Brierley Associates has provided a variety of geotechnical, geostuctural, tunnel, and shaft design services during the course of the Lake Mead Third Intake program. We teamed with Arup on the Design-Build Contract for the Shaft and Tunnels for Intake No.3 which was led by Vegas Tunnel Constructors (VTC), a joint venture of Impregilo SpA and SA Healy. Additionally, Renda Pacific (Southland Holdings) retained Brierley Associates for construction engineering services when they were awarded the contract to construct a 26-ft diameter, 450-ft deep surge shaft, and approximately 2,500 linear feet of 14-ft and 20-ft horseshoe-shaped drill-and-blast tunnels.

When Renda Pacific finished its work at Lake Mead, a steel bulkhead was erected at the bottom of the completed access shaft to facilitate future work. Barnard of Nevada followed on and constructed a 525-ft deep by 26-ft diameter access shaft to facilitate construction of the Forebay. That project included the installation of an almost identical bulkhead, also for future expansion. Additionally, Barnard removed the previously placed bulkhead (by Renda) for its work. The pipe (spool) sections of the two bulkheads were encased in concrete at the bottom of each 26-ft diameter access shaft, followed by bolting a torispherical (elliptical) cap onto the pipe, and then flooding.

Both Renda and Barnard retained Brierley Associates to design a rigging scheme for setting its 16.0-ft ID x 18.25-ft long pipe section in place and then securing it against movement when encased completely by high slump, self-consolidating concrete, which Brierley designed as fully liquid. This caused a computed uplift force of 500 kips, as shown on Figure 2 which illustrates the results of our analysis using RISA. The analysis included a check of the ovaling of the flange to assure that the elliptical bulkhead could be bolted on after the pipe had been encased.
Barnard also retained Brierley to analyze the Renda bulkhead to determine if they could remove every 2nd or 3rd bolt in the dry before removing the remaining bolts in the wet with a remotely operated submarine, after flooding. Our design work was led by David Berti in our Moraga, CA office with Bill Zietlow in our Denver office serving as Engineer-of-Record. Figures within this article are from the project work for Barnard.

The two 16.0-ft ID x 18.2-ft long pipe sections were fabricated off site, shipped via tractor-trailer, and stored horizontally at the site. The pipe had to be vertical when lowered down each shaft for clearance, and then be horizontal when set in place.

Our chosen method was to rotate the pipe in the air both on top and at the shaft bottom to avoid damaging it, as illustrated in Figures 3 and 4. Two-point or three-point picks were used in all cases, with fabricated padeyes bolted onto the heavy steel flange of the pipe sections.

Brierley designed work was completed in 2018 and flooding of the Forebay with Lake Mead water was accomplished in January 2019. Barnard continues their work to complete the installation of pumps and the aboveground pumping station, with project completion scheduled for early 2020.