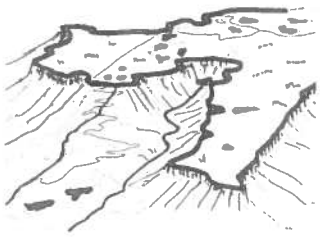
Grand Mesa Reservoir Company



Final Report

For

Water Supply Reserve Account Grant:

Repairing Grand Mesa Reservoir #6 - Lining Outlet Pipe

November 13, 2012

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Grand Mesa Reservoir Company

The Grand Mesa Reservoir Company (GMRC) is a small, non-profit corporation formed in 1888 by a group of ranchers in the Kannah Creek area southeast of Whitewater, Colorado. The GMRC currently owns five reservoirs on the top of Grand Mesa with a total decreed capacity (1916 decree) of 1286 acre feet and actual capacity of 1036 acre feet. At the request of the state dam engineer, the 104 foot long, 12" diameter outlet pipe of Grand Mesa Reservoir #6 (GM#6) was inspected using a closed circuit television camera in the fall of 2010. The inspection showed that the outlet pipe had exceeded its expected lifetime. The GMRC decided to have a cured-in-place pipe (CIPP) installed inside of the existing outlet pipe as soon as financially possible. Because of the damage discovered in the outlet pipe, the City of Grand Junction (City) installed a siphon to empty the reservoir during irrigation season in the summers of 2011 and 2012 to avoid compromising the dam structure of GM#6.

The GMRC asked the City's Water Services Department for their expertise and help in arranging and hiring a contractor to install a CIPP in the outlet of GM#6. Professional engineers for the City did the engineering design for the project and one was present to oversee the actual repair of the pipe. Layne Inliner, LLC installed the CIPP on September 24, 2012. The following is an illustrated description of the process used to repair the outlet pipe of GM#6.

The two part, 12" diameter liner used to make the cured-in-place pipe was inserted in two parts. The first was a heavy, ½ inch thick, relatively stiff plastic outer liner. It was pulled through the outlet pipe from inside the reservoir, starting at the slide gate entrance to the outlet pipe.

Figure 1 Workers laying out the liner along the inner face of the dam

Figure 2 Wrapping a rope around the end of the heavy liner before using the rope to carefully pull the liner through the steel pipe to the exit on the outside of the dam.

The second layer is a very light, thin fabric liner that is impregnated with a chemical that causes the inner liner to adhere to the thick outer liner. This liner is inserted though rollers using a stream of air from the exit end of the outlet pipe. The thin liner is fed carefully to avoid any twists in the fabric.

Figure 3 Inner liner going through the rollers. The 2 ½ inch air hose is visible on the far right in the hand of one of the workmen.

Figure 4 Checking the alignment of the liner feeding through the rollers.

When both liners were inside the steel outlet pipe, the air hose was exchanged for a steam line. Water was heated in one of the large trucks to make steam which was fed through the liners to make the cured-in-place pipe. Steam was maintained at 160° during the curing process.

Figure 5 Steam being generated by the trucks.

Figure 6 & 7 Steam showing at both ends of the outlet pipe.

Figure 8 Close up view of the apparatus used to cure the CIPP. Both the inner and outer liner layers used to make the CIPP are visible.

Once the liner has been treated with steam long enough to form the cured-in-place pipe, the pipe is allowed to cool. It is then cut to finish and both ends of the new CIPP outlet pipe are attached to the old steel one. The exhaust manifold on the inside of the dam is removed close to the slide gate with a grinder. The CIPP is glued to the old pipe with epoxy to form a water-tight seal, Figure 9. The excess CIPP at the exit end of the outlet is removed with a saws all and clamped to the metal pipe, Figure 10.

Figure 9 Water-tight seal at the slide gate.

Figure 10 Finished CIPP at the outlet of the reservoir.

The newly repaired outlet pipe was inspected using a closed circuit camera which showed everything was as it should be. A copy of the video logs taken before and after the repair will be sent separately.