

PROJECT PROFILE

DESIGN OF REHABILITATION MEASURES FOR WISECARVER RESERVOIR DAM

D'Appolonia designed rehabilitation measures for Wisecarver Reservoir Dam and associated hydraulic structures for the Southwestern Pennsylvania Water Authority (SPWA). The dam was classified by the Pennsylvania Department of Environmental Protection – Bureau of Waterways Engineering (PADEP-BWE) as an unsafe dam due to the deterioration of the existing overtopping system. The PADEP-BWE presented three remedial options to the SPWA: (1) increase the size of the spillway, (2) construct a new overtopping protection system, or (3) breach the dam.

The SPWA decided to rehabilitate the dam by providing overtopping protection for the Probable Maximum Flood (PMF) event. The overtopping protection will consist of a roller-compacted concrete (RCC) embankment constructed on the crest and downstream face of the dam. The RCC embankment will be constructed at a less steep slope than the existing downstream slope.

The dam was originally constructed in 1931 and consists of an earthen embankment about 40 feet high and 260 feet long with a reinforced concrete spillway located along the left abutment. The downstream and upstream slopes are 2 horizontal to 1 vertical (2H:1V), and 2.5H:1V, respectively. Based upon the original design drawings, a clay puddle foundation cutoff trench is centered with the upstream limits of the crest.

Riprap-filled gabion baskets were installed on the downstream slope of the dam in 1985. The gabions were intended to provide erosion protection during overtopping events caused by the PMF storm event. The gabion baskets began to exhibit movement in 1993 and subsequent unsuccessful repair attempts were made to secure the gabion baskets to the downstream slope of the dam.

To remediate the deficiencies of the dam, D'Appolonia developed a design incorporating the following measures:

- Construction of RCC overtopping protection to reduce potential erosion or breaching of the dam
- Installation of an underdrain beneath the RCC embankment to collect and convey seepage in a controlled manner and prevent the development of uplift pressures
- Placement of a vegetated soil cover overtop the RCC for aesthetic and recreational purposes
- Installation of erosion protection above the left spillway retaining wall for protection during the PMF event
- Improvement of the dam's outlet works, including installation of hydraulically controlled valves at the upstream intakes and extending the outlet works to discharge into the lower spillway as originally constructed
- Rehabilitation of the spillway channel concrete lining, retaining walls and sill
- Installation of piezometers to monitor the embankment phreatic surface.



Aerial view of Wisecarver Dam and associated spillway and impoundment.

As part of its work scope, D'Appolonia performed hydrologic and hydraulic analyses to verify the PMF and the capacity of the spillway and dam overflow under PMF conditions. These analyses included design of a USBR Type II stilling basin to dissipate the energy associated with high flows. D'Appolonia also performed seepage and slope stability analyses for the new dam configuration and developed material parameters based on laboratory test data, subsurface exploration information, published correlations, and typical values for similar soils. Our analyses included evaluation of the stability of the spillway walls and the development of repairs for portions of deteriorated portions of the spillway. D'Appolonia assisted with preparation of bidding documents for the rehabilitation work and the successful bid was very close to our cost estimate.