

Lake Holiday Dam Spillway Reconstruction; Project Description

Overview

Lake Holiday, a 250-acre recreational lake located in Frederick County, Virginia, is the centerpiece of the Lake Holiday community. The lake is formed by the Lake Holiday Dam. Lake Holiday Country Club, Inc. (LHCC) owns and maintains the Lake Holiday Dam. The lake is used for recreation by the residents and is regulated by the Virginia Department of Conservation and Recreation, Dam Safety Division (DCR) as a High Hazard, large dam.

On the 29th of October, 2009 in response to a petition filed by landowners within the Lake Holiday community, the Circuit Court of Frederick County created the Lake Holiday Sanitary District. (A copy of the Court Order is included as Attachment A) On June 9th, 2010 the LHCC Board of Directors and the County of Frederick entered into an agreement which describes the purpose and direction of the Lake Holiday Sanitary District. The agreement established a Lake Holiday Sanitary District Working Committee for the purpose of developing a course of action which would result in completion of the design and construction of the modified spillway, as well as securing funding for the project. (A copy of this agreement is included as Attachment B)

Frederick County, LHCC and DCR recognize that the dam does not satisfy the spillway design flood (SDF) requirements in the recently updated dam safety regulations. As a result, LHCC contracted Black & Veatch Corporation to examine ways to satisfy the SDF requirements. A preferred solution was selected and completion of the final design documents is anticipated in September, 2010. Construction will be financed by the Sanitary District. A referendum on borrowing was held in conjunction with the November, 2010 election. (Court Order is included as Attachment C) The referendum was approved by a vote of 633 to 58. Once financing is secured, the project will be competitively bid and managed by Frederick County.

The following discussion outlines the proposed spillway rehabilitation project, as well as the proposed budget, financing and repayment strategy.

Existing conditions

The Lake Holiday Dam was designed by Martin, Clifford & Associates around 1970. Construction of the dam was completed in 1971 and filled very quickly as a result of precipitation from Hurricane Agnes.

The dam is a 102-foot high zoned earth/rockfill dam with a central core. The dam is about 1,000 feet long with a crest width of about 45 feet. The crest carries South Lakeview Drive which is the only approved means of ingress and egress to more than 100 residents of the Lake Holiday community who live south of the lake.

The spillway is an approximately 110 feet wide, reinforced concrete chute structure with training walls. The spillway is crossed near the crest by the South Lakeview Drive structure, which routes flows through six Corrugated Metal Pipe (CMP) arch conduits.



View of spillway



View of downstream slope of dam

Need for the proposed improvements

DCR classified Lake Holiday Dam as a high hazard potential structure. This classification is due in part to the presence of 47 downstream properties or structures that exist within the potential area of inundation were the Dam to fail. As such, the dam and spillway configuration is required to safely pass (i.e., the dam and spillway remain intact) 100 percent of the probable maximum flood (PMF) or, as a result of legislation passed in 2010, pass two thirds (2/3) of that volume and meet eight associated criteria. Designed in the early 1970s and without the benefit of state dam safety regulations, the dam and spillway were not originally designed to manage a storm event of this magnitude. Based on the new criteria the spillway is severely undersized. In addition, the exposed rock immediately downstream of the concrete-lined section has become severely eroded over the 37 years. DCR issued the LHCC a series of 2-year Conditional Use Certificates rather than a 6-year Regular Use Certificate as a result of the inadequate spillway. The current Conditional Use Certificate expires on March 31, 2010.

Evaluation of possible solutions

Black & Veatch examined several approaches to managing the spillway design flood (SDF) flows for the Lake Holiday Dam. Flows of the SDF can be routed around, over, or through the existing dam and spillway. Multiple alternatives for the Lake Holiday Dam and spillway were considered with regard for safety, constructability, community impact, cost, and operation.

Black & Veatch broadly considered multiple spillway configurations including a new spillway in the left abutment; overtopping protection of the main embankment in concert with a rehabilitated spillway; and a new spillway in the right abutment. However, given various site restraints, access issues and clear constructability concerns, Black & Veatch focused their attention on the three alternatives described below. Ultimately, these three alternatives were considered viable and worthy of continued consideration.

The LHCC Dam Task Force (DTF) met with Black & Veatch on August 20, 2009. Three alternatives were discussed at length including the labyrinth, fusegate and composite (Crump/overtopping) options. The alternatives were compared in terms of funding, aesthetics, constructability, long-term maintenance, and other various considerations. The DTF voted to select the labyrinth spillway alternative for detailed design and construction (see attached drawings). This fully passive system will have a total width of 120 feet along with a parapet crest wall that will allow for maximum reservoir surface EL. 832.

The fusegate system was not selected in part due to the possibility of future replacement of triggered gates, maintenance of seals and waterstop, as well as maintenance and aesthetics of the downstream energy dissipation pool. Additional design and patent fees for the fusegate system resulted in a total project cost essentially equal to the labyrinth alternative.

The composite option was not selected primarily due to an aggregate cost that was estimated at approximately 20 percent greater than the labyrinth and fusegate options.

Scope of project

The project includes replacing, in their entirety, the existing spillway and bridge and possibly constructing a parapet along the length of the dam crest. Specific elements of the alternative include: demolition of the existing spillway and bridge; construction of a new concrete spillway; construction of a new bridge; necessary roadway modifications leading to the spillway; parapet along the dam crest; and utility relocations across the new bridge. Construction is expected to take 18 to 24 month to complete.

Cost estimates

The preliminary site layouts for the alternatives were used to generate material quantities as a basis for cost comparison. Black & Veatch utilized unit costs from similar types of dam rehabilitation in the region, as well as estimated market values for construction materials. These cost figures are preliminary, and should be used for comparative purposes only. Unit prices, where applicable, are for July 2010 market values.

The Lake Holiday Dam Rehabilitation is a complex undertaking, and contingencies at this stage are considered reasonable. Traffic continuity and control of water are significant cost items that need to be addressed in more detail before their true costs can be fully realized. The table below shows an estimate of the low cost version of the selected alternative that satisfies the project criteria.

Labyrinth Spillway	Cost
Construction	\$7,500,000
Construction Management	\$480,000
Legal fees	\$31,000
20% contingency	\$1,500,000
Financing	\$485,000
equipment	\$4,000
Estimated total project	\$10,000,000

The 20% contingency and anticipated interest cost brings the estimated potential total project cost to \$10 million.

Annual operating budget

LHCC owns and maintains the existing dam, spillway and monitoring systems. These costs are covered as part of the annual operating budget of the POA. The labyrinth spillway option was chosen due to its passive functionality and low maintenance costs. No additional annual operating expenses are anticipated.

Preliminary plans and profiles

Black & Veatch is currently preparing the construction plan and profiles as well as other construction documents including Control of Water, Utility Relocation, Final Bridge Design, Underdrain Design, Crest Parapet Wall Design, Bridge Foundation Design, and Detailed Construction Sequencing.

Proposed Financing

As discussed above, a Sanitary District was created for the purpose of securing financing for the spillway project. The Lake Holiday community contains 2,731 residential lots, of those, 827 have single family homes constructed on them. The development is served by private roads which along with the lake and other amenities are maintained by a Property Owner's Association (POA). The community is also served by central sewer and water systems which are owned and operated by Aqua-America. Lots located beyond existing sewer and water lines are presently undevelopable. As a result of this disparity, as well as the natural variation and desirability of lake front properties versus others, the assessed values of properties within LHCC ranges from \$5,000 to \$845,000 with the total assessed value of properties within the Sanitary District being \$233,953,400.

Membership in the POA is a requirement of ownership. POA dues are assessed at a tiered rate whereby lots without access to utilities are assessed at 3/8 of the full assessment charged to buildable lots. This same tiered assessment is proposed to be used for the repayment of debt incurred by the SD for replacement of the Lake Holiday Dam spillway.

As set out in the agreement between LHCC and Frederick County, the anticipated approach to repayment of the spillway financing would be accomplished through the collection of Sanitary District fees. Fees would be set by the Board of Supervisors based on the ultimate amount borrowed and the associated terms, and collected by the County Treasurer as additional fee on the property owner's tax bill.

Conclusions

Given the scale of the undertaking and magnitude of the associated cost, obtaining competitive financing is essential in order for the project to commence. A sanitary district for the Lake Holiday Dam Reconstruction has been established in accordance with the Code of Virginia. The loan financing necessary to pay the construction cost is currently being sought. Once arranged a contract will be

awarded based on a competitive bid process of pre-qualified bidders. Based on the final construction cost appropriate assessment rates will be established to insure timely repayment of any loans.