

Date: July 18, 2014  
File No.: D15-146

**Subject:** Hydrologic and Hydraulic Review and Update  
Milltown Dam

**To:** File  
DEP Division of Dam Safety

**From:** Ronald Mease, P.E.  
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DEP Division of Dam Safety

By letter dated June 17, 2014, this office requested an incremental analysis to determine the design flood for Milltown Dam. Following this letter, I received a phone call from Rick Smith of East Goshen Township. The request for the analysis was based on the PMF determined during the Phase I inspection in 1981. Therefore, prior to the Township engaging an engineer, this review was conducted to determine whether an incremental analysis was warranted. During this review, an "in-house" incremental analysis was conducted along with a review of the history of the existing structure. The following comments are applicable:

1. The 1981 Phase I study assigned the  $\frac{1}{2}$  PMF as the design flood. The peak flow from this design flood was 6500 cfs, and it was determined that the 69-foot long ogee spillway had a capacity of 2063 cfs. This was approximately 26% of the SDF. The spillway capacity was limited by a low point on the top of dam.
2. In 1985, a rehabilitation project was completed based on the 1981 Phase I hydrology. The project include leveling the top of dam and providing riprap overtopping protection. The leveling of the top of dam at EL 350.3 increased the spillway capacity to 3083 cfs. A depth of overtopping for the design flood was estimated at 2.7 feet, with the maximum WSEL at EL 353.
3. Since the 1985 project approval and construction, there have been pertinent changes in dam safety regulations, policy, and engineering methodology. Also, it appears that there is additional development (apartments buildings or townhouses) located downstream of the dam which could be impacted due to a failure of the dam. The following changes are relevant in a reassessment of the dam:
  - Under the 2011 changes in the dam safety regulations for Pennsylvania, the spillway design flood for a high hazard dam is determined by an incremental dam breach analysis. The 1981 assignment of the  $\frac{1}{2}$  PMF design flood is no longer applicable.
  - The precipitation data and methodology for determining the Probable Maximum Flood have been revised since 1981.
  - The use of riprap for providing overtopping protection on a high hazard dam is no longer an acceptable practice.
4. An existing HEC-1 model of the dam and watershed were utilized to assess the incremental impacts of a dam failure. NOAA precipitation data for West Chester was utilized to model the 100-year and 500-year floods. The watershed model's computation of the 100-year flood was of the same magnitude as the 100-year flood as determined by USGS regression equations in Streamstats. HMR-51 precipitation was then used to compute an updated  $\frac{1}{2}$  PMF.

5. The downstream highway bridge was added to the HEC-1 model, and the HEC-1 model. Breach and non-breach hydrographs were computed for the 100-year flood, the 500-year flood and the ½ PMF. These hydrographs were entered into a HEC-RAS model of the downstream waterway.
6. The HEC-RAS model of downstream conditions was developed using LIDAR 2-foot contours, Arc-GIS and HEC-GeoRAS. Flood levels were compared for breach and non-breach conditions. The HEC-RAS results were exported into Arc-GIS to determine the inundation boundaries.
7. Based on the results of this “in-house” incremental analysis of breach and non-breach flood levels, the updated ½ PMF appears to be the appropriate spillway design flood as required by the Chapter 105 regulations (Section 105.98). This peak flow for this updated ½ PMF is significantly greater than the 1981 design flood. The peak inflow to Milltown Dam for the ½ PMF is 12,704 cfs, whereas spillway capacity is approximately 3000 cfs. The overtopping depth during the ½ PMF is 4.12 feet. Spillway adequacy (prior to overtopping) was determined to be 0.14 PMF.

***Attachments:***

- *Inundation mapping, HEC-RAS results, and the HEC-1 models for breach and non-breach conditions during the 100-year flood, the 500-year flood, and the ½ PMF.*
- *HEC-1 Model showing existing spillway adequacy of 0.14 PMF.*
- *Other items used in modeling update including NOAA rainfall, Streamstats output, curve number computation, stage-area, etc.*