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DNR Indiana Department of Natural Resources

February 11, 2014

Lake DeTurk Conservancy District
Ronald Reinhart, Chair
180 Byram Boulevard
Martinsville, IN 46151

Re: Lake DeTurk State ID # 55-76

Dear Mr. Reinhart:

As you may be aware, during Federal fiscal year 2012, DNR received limited grant money from FEMA for dam safety activities. In support of a federally required Incident and Emergency Action Plan (IEAP) initiative, a portion of this grant was used by DNR to retain the services of Christopher Burke Engineering (CBBEL) for the preparation of dam specific failure modeling and Dam Failure Flood Inundation Maps for 12 dams located in Morgan County. Lake DeTurk Dam was one of the dams included in this project. The mapping project is now complete and the DNR is able to provide you with a copy of the Dam Failure Inundation Map for your structure (along with the memorandum documenting the methodologies and modeling assumptions).

Although this dam was earlier tracked as a low hazard structure, it is now clear (with this recent failure modeling project) that the Lake DeTurk Dam has actually been a high hazard dam for some time. Hazard classifications reflect the current potential downstream consequences to human life and property should a dam fail. The hazard classification is not a reflection of current deterioration, or safety deficiencies of a structure. A high hazard dam is defined as a structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.

This inundation map is a valuable tool that should be incorporated into an Incident and Emergency Action Plan (IEAP). Refer to the Division of Water website for a template of an IEAP (http://www.in.gov/dnr/water/files/wa-IEAP.pdf). Please consider working with your engineer to develop an IEAP to further protect the downstream area. For future reference there is a cooperative IEAP initiative between the Indiana Department of Homeland Security (IDHS) and DNR that may provide assistance with this endeavor.

Through IC 14-27-7.5 (the Regulation of Dams), all State regulated dam owners are charged with perpetually maintaining and keeping their dam in the state of repair and operating condition required by the exercise of prudence, due regard for life and property, and the application of sound and accepted technical principles. As a high hazard dam owner, the conservancy district has an extraordinary responsibility for the safety of the downstream life and property in the event of a dam failure. Beyond the "statutory biennial inspection", you should continue your diligence to observe, maintain, and keep the structure and appurtenant works in an appropriate state of repair and operating condition.

This high hazard classification also means that engineered designed upgrades to the dam are needed to, exercise prudence, due regard for life and property, and apply sound and accepted technical principles. One such safety upgrade will be the needed improvements to the spillway capacity so it can

safely pass large design rainfall events without the possibility of a dam failure. In conjunction with the spillway design upgrade, a geotechnical evaluation of the embankment will be needed to determine if the configuration of the dam requires modification to provide for a safe structure under all possible loading conditions.

Regarding the statutory biennial inspection, IC 14-27-7.5 requires owners of high hazard dams to have a licensed professional engineer inspect their dams and submit reports to the Department once every two (2) years. Our database has been changed to reflect the Lake DeTurk Dam (State ID # 55-76) as a high hazard structure. DNR conducted an inspection of the Lake DeTurk Dam on June 22, 2011. Because of the classification change, the biennial inspection performed by a Professional Engineer experienced in dam safety must be conducted and a report submitted to the Division of Water by July 1, 2014. Please have your engineer notify the dam safety section that he/she is under contract to perform the inspection by April 1, 2014.

When you are responding to incidents or emergency conditions at your dam, the working relationship you have developed with the engineering firm inspecting your dam, should also help you receive timely, informed, technical advice.

If you have any questions or require additional information, please contact the Dam Safety Section of the Division of Water at (317) 232-4160 or toll free at (877) 928-3755.

Sincerely

Kenneth E. Smith, PE
Assistant Director
Division of Water

Attachments

KES/GWC/TCP

APPENDIX B
INUNDATION MAP DOCUMENTATION

INUNDATION AREA

The estimated dam failure flood inundation map, provided in Exhibit 5.3, shows the approximate hazard area that could be affected by the failure of the Lake DeTurk Dam. The dam breach inundation area mapping extends along a 5.5-mile stretch of Grassy Fork to its confluence with West Fork White River, where the breach wave reaches the floodplain of the West Fork White River. Downstream of this point, the flooding caused by a breach in the dam is expected to be less severe than regulatory 100-year floodplain for the West Fork White River.

DATA SOURCES

The following datasets were used in the development of the dam failure flood inundation map:

Topography:	2011 IndianaMap DEM
Aerial Photography:	2011 IndianaMap Orthophotography
Breach Parameters:	General Guidelines for New Dams and Improvements to Existing Dams in Indiana (IDNR 2001)
Dam Design History:	Construction in a Floodway Permit Approval Letter

INUNDATION MAPPING METHODOLOGY

The inundation map provided in Exhibit 5.3 was produced by Christopher B. Burke Engineering, LLC (CBBEL) using a simplified methodology known as Simplified Dam Break (SMPDBK) Flood Forecasting Model, originally developed by the National Weather Service. This procedure is incorporated in the Federal Emergency Management Agency's GeoDam-BREACH software add-in for ArcGIS as a Workflow and serves as the primary tool for developing the anticipated inundation area. The process for developing the approximate dam failure flood inundation limits consists of the following main steps:

1. Digitization of Breach Path Geometry – The breach flowpath centerline, inundation area cross-sections, upstream reservoir, and inactive flow areas were digitized for input into the SMPDBK Workflow. The breach flowpath centerline was digitized near the center of the river valley, not necessarily along the receiving stream thalweg. Cross-sections were drawn perpendicular to the anticipated path of the breach wave. The physical extent of the upstream reservoir was determined at the full pool stage. Finally, inactive areas were identified for portions of cross-sections that do not actively contribute to conveyance of the breach.
2. SMPDBK Pre-Processing Workflow – The SMPDBK Pre-Processing Workflow utilizes the geometry information provided in Step 1, along with other specified information pertaining to the type of breach to be modeled. Breach parameters were specified during this step following the General Guidelines for New Dams and Improvements to Existing Dams in Indiana proposed by IDNR for engineered and non-engineered earthen embankments. The digitized cross-sections were then converted to prismatic representations of the real-world cross-sections; this portion of the pre-processing can be problematic due to the nature of the simplification procedure.
3. Manual Prismatic Channel Cross-section Approximation – In instances where the SMPDBK Pre-Processing Workflow produced prismatic cross-sections with 'overhangs', a manual

cross-section simplification procedure was used. The elevation versus top-width pairs from the SMPDBK Input File were modified to more appropriate values derived from the real-world cross-section. An accurate representation of the elevation versus flow area relationship for the real-world cross-section was verified to maintain the validity of the SMPDBK flow calculations.

4. SMPDBK Post-Processing Workflow – The SMPDBK Input File was used to model the peak flow rate immediately downstream of the breached embankment. The peak flow rate was then attenuated at downstream cross-sections based the prismatic representation of the channel. For additional information on the flow attenuation process, see *The NWS Simplified Dam-Break Flood Forecasting Model* by Fread and Whetmore, which outlines the theoretical background for the SMPDBK procedure. Maximum water surface elevations are calculated by the model and stored in the SMPDBK Output File.
5. Mapping of Inundation Area – The inundation area is then mapped by comparing the predicted maximum water surface elevations and the ground surface along the breach flowpath. The inundation area was manually adjusted to extend across backwater areas and other regions outside of the physical extent of the breach flowpath cross-sections.
6. Mapping of Additional Evacuation Areas – Additional areas that are not inundated by the breach wave but may have limited or no access in the event of a dam breach were also identified. It was assumed that all roads and bridges within the dam breach inundation area will be impassable following the breach.

ANTICIPATED IMPACTS & RECOMMENDED USE OF INUNDATION MAP

The approximate dam breach inundation area shown on Exhibit 5.3 includes numerous single-family residences and businesses downstream of the dam along breach wave flowpath. A large portion of the inundation area is comprised of the fishery ponds immediately below the dam, agricultural land, and forest.

A high risk to human lives also exists to motorists on roads located within the dam failure flood inundation area, including, but not limited to, Grassy Fork Lane, Country Club Road, County Road 175, Carmichael Road, Maple Turn Road, Norich Place, Southampton Drive, and Old State Road 37. These roads may be impassible during and after a dam breach, severely limiting or preventing access to some areas.

It is expected that there could be numerous utilities within the dam breach inundation area, including, but not limited to, electric, gas, water, storm sewer, sanitary sewer, and septic tanks. Many of these utilities may be underground, but damage from a breach is still possible.

The approximate dam failure flood inundation area mapped by this study should be used for notification purposes only, due to the simplified nature of this analysis and the inherent assumptions; a more detailed study should be performed to obtain a better understanding of the possible range inundation area extents. The entire population in the floodplain valley area below the dam must be evacuated in the event of an emergency, regardless of whether such areas are shown within the inundation limits or not due to the uncertainty associated with the approximate nature of the determination method. Actual flooding limits may differ from the areas shown on the map and will depend on the characteristics of the actual dam failure.

GeoDam-BREACH – Summary of Analysis Input

Name of Dam:	Lake DeTurk Dam	**IDNR ID Number:**	55-76
Dam Location (County):	Morgan County	**Hazard Classification:**	High Hazard
Analysis Completed By:	Brian Meunier, P.E. (CBBEL)	**Date of Analysis:**	9/12/2013

Basic Setup

Default Manning's n-Value:	0.08		**Length of Channel:**	3.22	MI
Inactive Manning's n-Value:	0.40		**Number of Cross-sections:**	23	
Inactive Areas Used	☑ Yes	☐ No	**Depth of Flooding:**	0	FT

Breach Parameter Setup

☐	**Default Breach Parameters**	**Dam Type:**	Earthen	
☑	**User Defined Breach Parameters:**	**Final Breach Width:**	112	FT
		Breach Development Time:	6	MINUTES
Pool Elevation at Breach:	723.0 FT	**Breach Bottom Elevation:**	689.0	FT
Release Type:	Overtopping	**Non Breach Flow:**	0	CFS
Event Description:	Sunny Day			

Provide Brief Description of Event if 'Other':

Reservoir Parameter Setup

☑	**Reservoir Surface (Polygon Shapefile)**	**Reservoir Condition:**	Full Pool
☐	**Given Surface Area:** ACRES		
☐	**Given Volume:** ACRE-FEET		

GeoDam-BREACH – Summary of Analysis Overrides

Automatic Breach parameter adjustment

Breach Size Reduced	☑ Yes	☐ No	Revised Final Breach Width:	74.7	FT

Manual Prismatic Cross-section Approximation

Number of Cross-sections with Overhangs: 20

List of Cross-sections with Overhangs:

1, 2, 3, 26, 5, 6, 7, 8, 10, 11, 12, 13, 25, 24, 15, 17, 18, 20, 21, 22