

Hazard Creep

How it can affect SWM retrofit projects

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by

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Many dams were originally constructed in rural areas with little or no development downstream and were designed according to lower risk criteria.



www.damsafety.org/media/Documents/Images-Animations/Dam Animations/Hazard Creep.wmv



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Over time, roads and homes are constructed.





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with large scale residential, commercial, and
even Industrial development taking place.*





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100-Year Floodplain

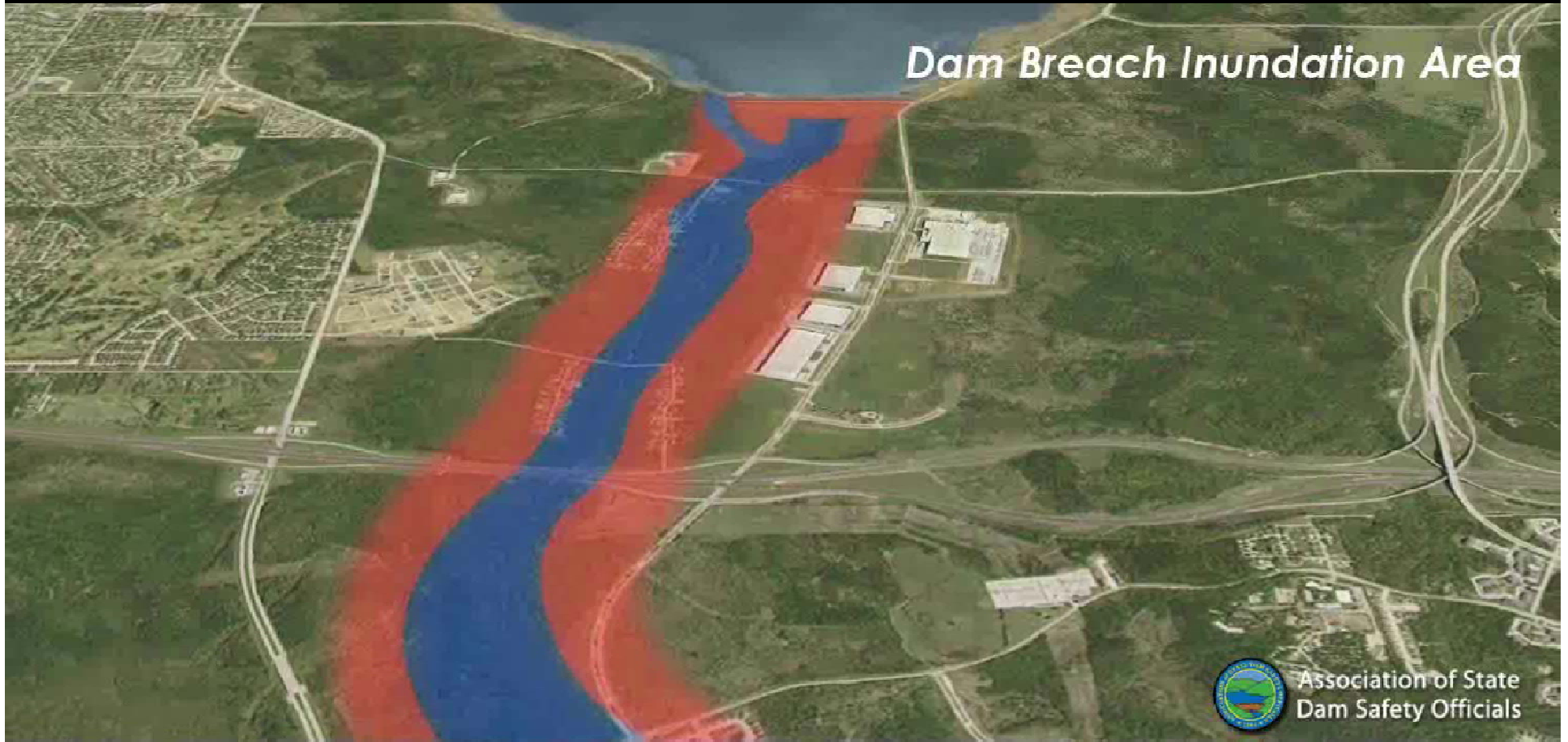


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In many cases, typical regulations related to the 100 year floodplain have not been rigorously enforced until more recent times.



Dam Breach Inundation Area



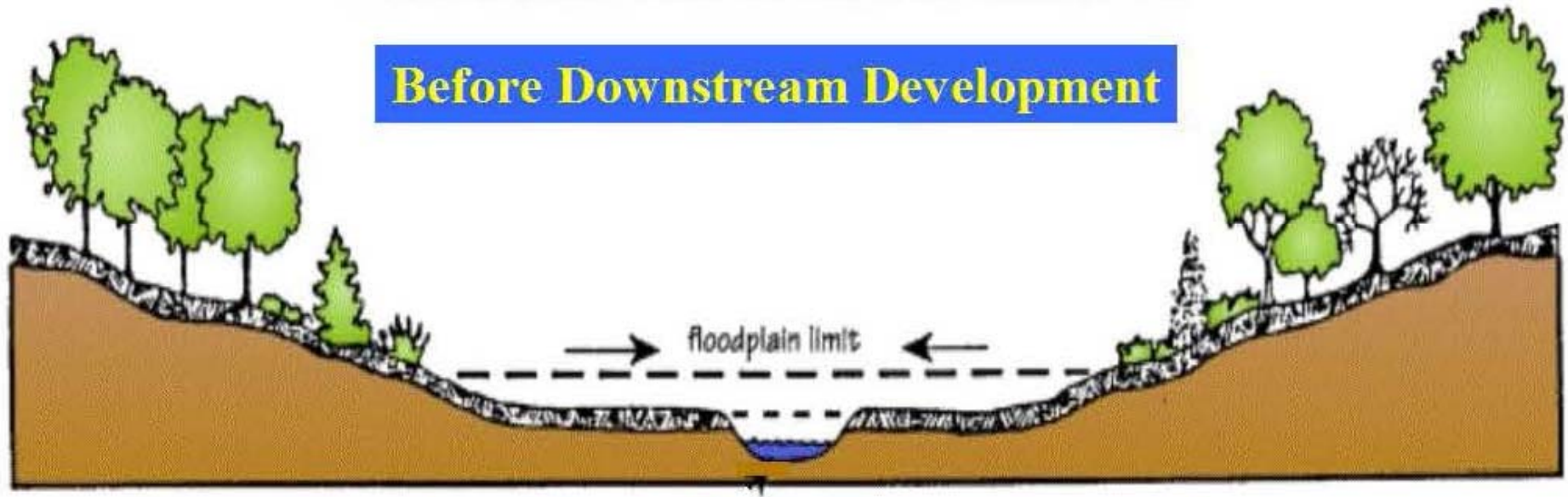
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Breach inundation zones are typically much larger than the regulated 100 year floodplain and much development has often occurred in the fringe area.

**FREESE
AND
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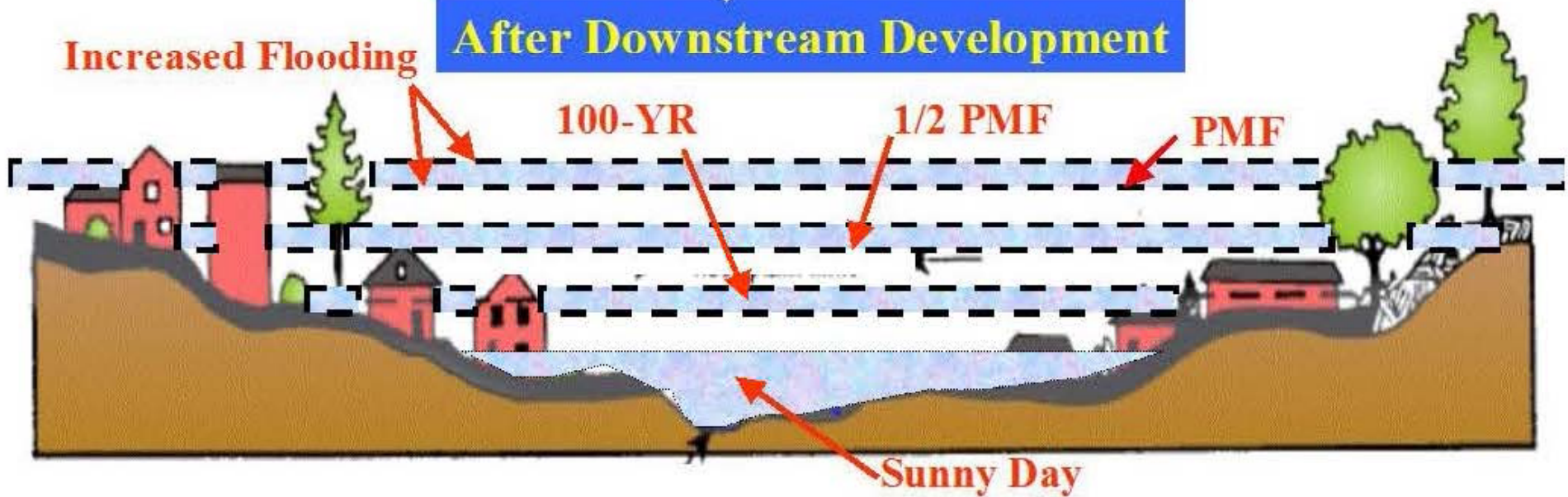
Increased Flood Risks

Before Downstream Development



After Downstream Development

Increased Flooding



Embankment Retrofit Design

April 2015



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HAZARD CLASSIFICATIONS & DANGER REACH STUDIES FOR DAMS

By
Bruce W. Harrington, P.E.
MD Dept. of The Environment
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To determine the hazard classification of a proposed dam¹ or reevaluate the hazard classification of an existing dam, an *incremental flood analysis* is required. The first step in an incremental flood analysis is to determine downstream flood depths and velocities without the dam failing to establish baseline flooding conditions. The second step is to determine the increased flood depths and velocities associated with dam failures during the same storm loading conditions. These loading conditions include several storm events that will or could occur during the lifespan of the dam. The storms to be examined include the following loading conditions: 1) *normal pool*, 2) *100-year flood*, 3) *brim-up flood*, 4) *50% probable maximum flood (PMF)* and 5) *PMF*.

The normal pool or sunny day loading condition is the breach flow released from a normal pool failure. If there is no permanent pool, a sunny day failure would be the first large opening in the principal spillway above the low flow outlet of the reservoir up to the top of dam is the brim-up storm event. This very quickly by selecting a few rainfall events larger than the design of the spillways. The PMF is the largest flood that is expected to occur based on the most severe combination of meteorological conditions.

In Maryland, **all significant and high hazard dams** must have a *Danger Reach Study* performed. The purpose of a *Danger Reach Study* is to determine the hazard classification of an existing dam and to develop a plan for an existing or proposed dam to determine the hazard classification of a downstream reach that will be affected by a dam failure.

The hazard classification of a dam is determined by the type of structure, the dam's location, and the type of structure. The hazard classification is determined by the type of structure, the dam's location, and the type of structure. The hazard classification is determined by the type of structure, the dam's location, and the type of structure.

HAZARD CLASSIFICATIONS FOR SMALL PONDS & DAMS

By
Bruce W. Harrington, P.E.
MD Dept. of The Environment
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September 2010

For small ponds & dams¹ no more than 15 feet in height, storage volumes less than 20 acre-feet, and watershed areas less than 640 acres, only a brim-up storm may be necessary to determine the hazard classification. The brim-up storm is the 24-hour rainfall loading condition that fills up the reservoir to the lowest point on top of the dam.

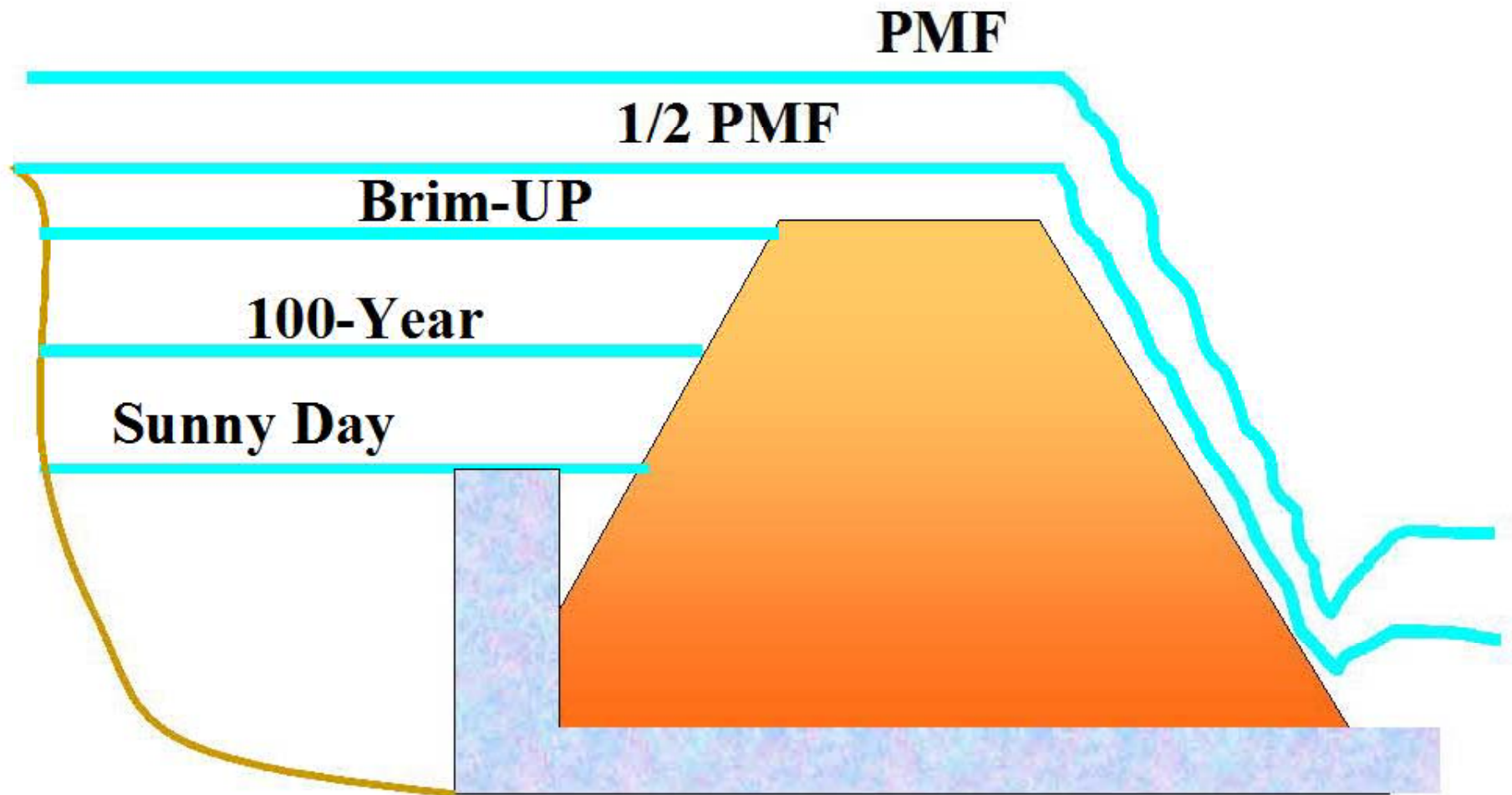
The breach flows may be determined by the National Weather Service (NWS) Simple Dambreak Equation if flow attenuation is not significant. The NRCS Breach Equation for small ponds is usually not recommended as it does not account for pond storage volumes. A spreadsheet (smpdbk.xls) of the NWS equation is available at the web link listed below. Otherwise the HEC-1, HMS, or Hydrocad Hydrology Models can be used to determine breach flows and floodplain flow attenuation. Breach flow attenuation may be used to determine breach hydrograph into the TR-20 Hydrology Model to determine flow attenuation as well.

http://mda.maryland.gov/programs/Water/DamSafety/TechnicalReferences/Cases/programs/waterprograms/dam_safetyspreadsheet/smpdbk.xls

The brim-up breach flow is used to evaluate flood impacts to any downstream structures in harms way. If there are no flood impacts, the analysis can stop at this point and the structure would be classified as low hazard. If the structure is low hazard, small pond approval can be obtained from the local soil conservation district and county government.

If flood risk occurs downstream from a brim-up failure to homes, buildings, or roads, it is necessary to perform an incremental flood evaluation during several storm loading conditions. These loading conditions include several storm events that will or could occur during the lifespan of the dam. The conditions to be examined include the following loading conditions: 1) *normal pool*, 2) *100-year flood*, 3) *brim-up flood*, 4) *50% probable maximum flood (PMF)* and 5) *PMF*. Refer to the report "Hazard Classifications and Danger Reach Studies for Dams" at the website listed above for the procedure to perform an incremental flood evaluation.

Failure Storms to Analyze



Questions?

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