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THE 100 YEAR FLOOD MYTH

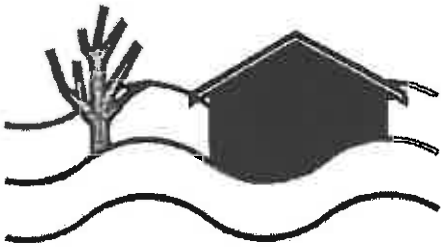
FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION 10

THE 100 YEAR FLOOD MYTH

The myth: Every flood is a 100 year flood. If it isn't a 100 year flood, then it can't be a "real" flood.

Where is the term heard? What it really is? Where did the term come from? How did it become so popular? How are flood frequencies calculated? What are some of the characteristics of the 10, 50, 100, 500 year floods in Western Washington? Why does flooding seem to be getting worse?

This paper will attempt to answer these questions.



WHERE IS THE TERM HEARD?

"The latest 100 year flood swept through the County yesterday and reeked its usual havoc."

"Last week saw a repeat of the devastating 100 year flood that occurred in Xville five years ago."

"Residents of Watermax, WA, again experienced a flood disaster that's being called by residents another 100 year flood just like the one they saw last year."

Every newsworthy flooding event in the last decade or so has been discussed in context of the 100 year flood frequency. Lacking any other label for "a big flood," the 100 year label is the most commonly heard moniker placed on the event. This is unfortunate since the term's common misuse leads listeners to conclude that an event that is definitionally supposed to return every 100 years, is, instead, happening every time flood waters spill over the river bank. This paper will attempt to dispel some of the misconceptions regarding the 100 year flood by explaining its origin, purpose, and regional characteristics.

WHAT REALLY IS THE 100 YEAR FLOOD?

The 100 year flood has a one percent chance of being equaled or exceeded during any given year. It can also be termed the "one percent "flood since this relates the event to an annual time period instead of a 100 year time period. Sometimes it is easier for people to relate to the one year time interval than the 100 year interval.

As the term indicates, the 100 year flood is not an event that occurs frequently. It is relatively rare. If projected accurately, 100 year floods will rarely be experienced. It should be noted that the majority of floods consist of lesser frequency events such as one year, five year, or ten year floods. It is never the case that an area experiences either no flooding or only 100 year flooding.

WHERE DID THE TERM COME FROM?

Every time a flood occurs, those effected by the event feel compelled to assign some kind of a relative label to its size. One measurement of size is stage or height of the water above a reference point. This is the measurement most often heard when flood warnings are issued. These usually forecast flood levels to be a given number of feet "above flood level." Flood level is normally the water surface level at which water begins going over the banks of a given watercourse. This measurement is logically the most important to potential flood victims since it is the height of the water or depth of the water which will actually determine how badly they are affected by the floodwaters.

Another measurement is the volume of water that causes a given flood. Scientifically savvy observers often talk in terms of cubic feet per second or "CFS" when referring to the size of a flood. While this is the term used by professional water managers, it may not be readily understandable to the laymen. Also, water volume does not always correlate directly to flood stage. In other words, twice the volume of flood water does not necessarily mean that the flood stage will be twice as high. The shape of the flood plain or the valley topography which will contain the flood waters will determine how high the water gets based on how much the waters are confined by topography and manmade obstructions. It is more often the dam operators, irrigation district managers, and levee maintenance staff who use the volume terms because it is a measurement of "amount," and amounts of water are what they manage.

The last term of measurement is frequency. This is also called the "return period" or "probability of return." The frequency is actually just how often a flood of this magnitude can be expected to occur. The frequency can be expressed as the interval of time expected to pass between occurrences of a certain size flood or the probability, expressed as a percentage, that an event of this size will occur in any given year. For instance, A FLOOD THAT OCCURS STATISTICALLY ONCE EVERY 100 YEARS ALSO HAS A 1% CHANCE OF OCCURRENCE IN ANY GIVEN YEAR. Frequency is the measurement of choice when evaluating the costs/benefits of potential solutions to flooding problems or when one attempts to look at flooding events of the same magnitude in a number of different communities.

When the National Flood Insurance Program (NFIP) was mandated to map all the floodplains in the U.S., it became necessary to determine a standard "size" event in order that all communities would be treated equitably. Using the "flood of record" for each community for mapping, and eventually floodplain development control, was seen as unfair because some "unlucky" communities may have seen the 500 year event last year while a neighboring community which is actually just as floodprone, but hasn't had its 500 year event since records have been kept (20 to 100 years). The relatively short period in the Northwest for which flood records have been kept doesn't really allow a long frequency analysis to be done. Lacking a long period of record, those attempting to study the flooding phenomenon must work with whatever records they have and force longer term projections from these short term facts.

HOW DID THE TERM BECOME SO POPULAR?

In 1973, when the National Flood Insurance Program was setting its standards for mapping the flood hazard areas and for issuing regulations for development standards in those floodprone areas, the 100 year flood standard was established as a compromise. It fell between what the Corps of Engineers had used as the protection level when they built dams and levees and what most communities used when they designed their stormwater systems.

The Corps of Engineers has traditionally used what is called the Standard Project Flood (SPF) as its design event whenever a floodwater control structure was designed. This SPF did not have a uniform frequency such as 100 year or 200 year, but was a site specific determination made on the basis of flood frequency, damage potential, and cost of construction. It is generally understood that the SPF ranged in the vicinity of a 200 to 500 year event. Because the SPF for any particular location required a detailed site flood frequency analysis, it did not lend itself easily to being used as a national standard for mapping 17,000 communities. In addition, the SPF was determined to be overkill for requiring the purchase of flood insurance or building development.

Most communities in recent history have used a design frequency of 5 to 20 years for their stormwater systems. This level of protection takes care of the vast majority of surface water problems that are experienced. It also provides a reasonable balance between protection and cost.

It can be seen that the 100 year flood frequency falls between the two ends of the spectrum discussed above. Since the 100 year standard was adopted, it has become quite universally used to describe a reasonable flood protection level. It is now used throughout the U.S. and in many other countries as well.

Because it has been used to designate (map) the floodplain in every U.S. community and because banks and other lenders use the 100 year floodplain maps to require the purchase of flood insurance, the populace has come to believe that the 100 year flood is a reasonable label for any significant flood event. While floodplain professionals are happy that their term of reference has become so widely accepted, they are becoming increasingly uncomfortable to have the term applied to most floods that occur in Western Washington.

HOW ARE FLOOD FREQUENCIES CALCULATED?

Frequencies can be assigned to floods on a given watercourse once a period of record has been established for the watercourse. By plotting the stage or volume of the floods that have been observed against the time intervals in which they occurred, a relational curve can be established. Even if the period of record is only 10 or 20 years, a relationship between discharge and time can be established. The curve generated by this relationship can be projected out through 100 or even 500 years.

Establishing a period of record requires that a gauging station or system of stations to be in existence for the river or stream that is to be measured. If there are no gauge records for the watercourse in question, then what is called a regional analysis must be done. This is simply the application of frequency relationships taken from another nearby stream for which gauge data is known and applying it to the stream in question. This requires that the streams be similar enough in characteristic that the projections for one could reasonably be expected to reflect the projections of the other. While the rivers of Western Washington have a period of record of from 30 to 80 years, those in Eastern Washington may have only 2 to 40 if any. Generally, the bigger and longer the river, the longer the period of record. For example, the Columbia River has over 110 years of record. Typically, because of the relatively good period of record, regional analyses are not usually done west of the Cascades.

Once a flood frequency curve is established, ANY frequency event from a "one year flood" to a 500 year flood and greater can be picked from it. As can be imagined, it is the more frequent floods like the 1, 2, 5, and 10 year events will occur and will cause more frequent damage. The actual 100 year event will not be seen very often and, frankly, will not cause much more damage than the 10 year flood!

WHAT ARE DIFFERENCES BETWEEN 10, 50, 100, AND 500 YEAR FLOODS IN WESTERN WASHINGTON?

Because the rivers of Western Washington share some uniform geologic and hydrologic characteristics, their flood frequencies have some common traits. The most striking of these is that there is little difference between the 10 year flood elevation and the 100 year flood elevation. In every major river in this area, the difference at some point along the river is less than one foot. <u>This means that the 10 year flood, which occurs ten times more frequently than the 100 year flood is not very much lower</u>!

NOT EVERY FLOOD IS A 100 YEAR FLOOD.

The conclusion that this paper wishes to stress is that the vast majority of floods that occur in Western Washington , or for that matter most of the U.S., are NOT 100 YEAR FLOODS. The term is frequently applied to any overbank flooding simply because it is the only frequency that is used for mapping and development regulation. It is the term most familiar to the populace and it is the first term to come to mind when a flood occurs.

By using the term "100 year flood" inaccurately to describe floods that are actually much lesser floods, the misconception is spread that 100 year floods are occurring every few years! In fact, floods close to this are occurring, but they are only 5 or 10 year events that look so similar to the "big one" that they get labeled with the same name. This misapplication of the 100 year term leads to misplaced criticism of the analysis that produced it and of those engineers who generated it.

WHY DOES FLOODING SEEM TO BE GETTING WORSE?

Aside from the issue of misusing the terminology of the 100 year flood, there is a legitimate concern about flooding seemingly becoming worse over time. The growing WHY IS MISUSE OF THE 100 YEAR TERM A PROBLEM?

The concern over the misuse of the term, 100 year flood, is that it is causing floodplain residents to under-react to the threat of future flooding. If the last flood experienced is assumed to be a 100 year flood, then it could reasonably be assumed that a recurrence of a flood that bad is a long way off. Theoretically, around 100 years, but certainly at least 40 or 50 years away. THIS IS VERY MISLEADING, CONSIDERING THAT THE LAST FLOOD EXPERIENCED (1995) IN WESTERN WASHINGTON WAS IN THE 10 TO 30 YEAR RANGE! THIS IS ADDITIONALLY SUPPORTED BY THE FACT THE 1990 FLOODS RANGED FROM 20 TO 40 YEAR FREQUENCY AND THOSE, TOO, HAD BEEN CALLED 1OO YEAR EVENTS! If a flood victim believes that the last one was the "big one" and that he will not likely see a similar event again soon, he will not feel compelled to mitigate his damage potential.

On the other hand, if the flood victim understands accurately that the 1990 and 1995 floods were really events that will occur every few years, he will be more compelled to take action to prevent future damage. This is why disaster agencies want to correct the inappropriate use of the term "100 year flood."