

A PRIMER ON FLOODPLAINS AND FLOODPLAIN MANAGEMENT



As first-choice areas are developed and less desirable areas remain, you might find yourself underwater as you site and maintain the right of way.

Part 1

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As we build out the first-choice developable areas, we may find that the only remaining sites to choose from are in areas that are less suitable for our specific use. Floodplains are an environmental land use restriction that may be regulated by law, or may simply dictate land use through Mother Nature's own laws. Land that may be periodically covered by water is possibly the most desirable location for a proposed right of way, but what difficulties are we likely to encounter in terms of construction, facility maintenance or disaster planning in the face of possible or probable flooding?

When floodplains are involved, we should be aware of the significance to our intended plans, as floodplains can be dangerous to lives and property if not respected.

WHAT IS A FLOODPLAIN?

As we all know, a flood is a general but temporary condition of partial or complete inundation of normally dry land areas from the overflow of streams, rivers, or lakes."¹ Floodplains are the areas along rivers, lakes, streams or ocean coasts "that have been or may be expected to be inundated by floodwaters in a 100-year frequency flood."²

Obvious floodplains are visible along ocean beaches and areas along shallow rivers and streams that often overflow their banks. Less obvious are the floodplains that are only covered by water in extreme conditions, such as during hurricanes or after sudden snowmelts. Floodplains can also be found where poor drainage has caused water

to accumulate long enough to become a nuisance, such as streets with inadequate storm sewers or too few inlets to carry away rainwater. Floodplains have also been referred to as flood hazard areas or flood-prone areas.

It should be noted that floodplains and wetlands are not the same creatures, although both contain the same basic ingredients: a mixture of land and water. Some floodplains are wetlands, but not all. Similarly, not all wetlands are floodplains. In the U.S., wetlands are defined by the "three prong parameter," meaning that the presence of certain soils, hydrology and vegetation are necessary to label a site as "wetland." It is possible that flooding on a site may be due to presence of wetland factors upstream, but not necessarily on the site in question.

WHAT IS THE 1%-ANNUAL CHANCE FLOOD AND ITS SIGNIFICANCE?

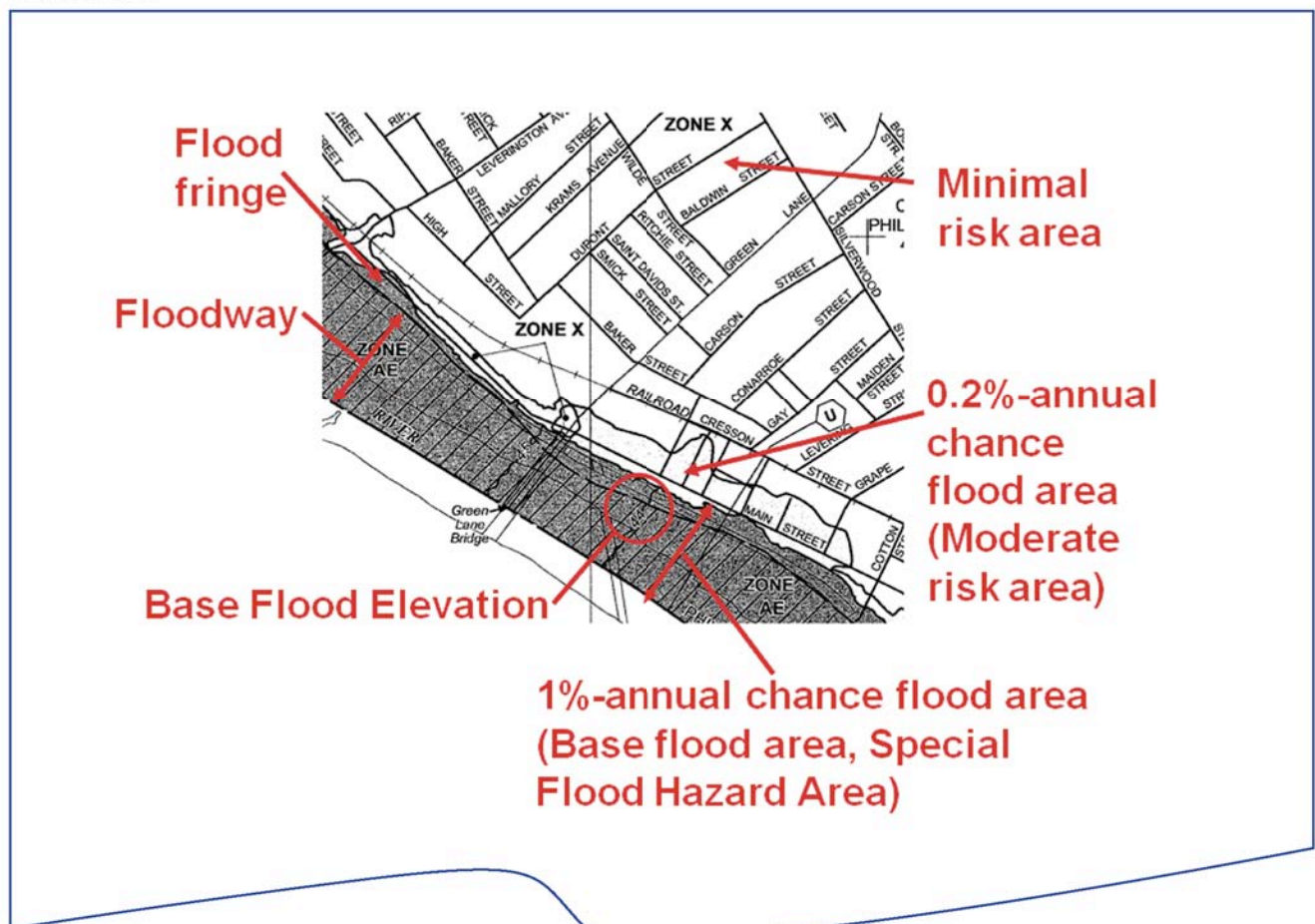
The 1% annual chance flood (or base flood), sometimes called the 100-year-frequency flood, is a flood event with a 1% probability of being equaled or exceeded in any given year. This flooding level is the standard by which most flood regulations in the U.S. are enforced at federal, state and community levels of government. There are floods that occur more or less frequently that are also of concern, and are

considered during planning and design for development, but the 1% annual chance flood is the trigger for most local, state, and federal laws to take effect. The height reached - or exceeded - by water during a base flood or 1%-annual chance flood event is called the base flood elevation. Water may rise above this level during a flood, but this is considered the official regulatory flood stage.

In the U.S., the area affected by the 1%-annual chance or base flood is also known as the Special Flood Hazard Area. These areas are subject to federal, state, and local land use and floodplain management regulations, as well as mandatory flood insurance coverage for any loans issued by a government-regulated lender for improved properties.

A 0.2% annual chance flood, sometimes called the 500-year frequency flood, is one with a probability of one in 500 chance of being equaled or exceeded in any year. On the federally issued flood mapping in the U.S., these are termed areas of moderate flood hazards, and while federal regulations are not mandatory, a local government may decide to regulate more stringently than those federal guidelines in order to safeguard the health, safety and welfare of the public. Similarly, in these areas, government-regulated lending institutions are not mandated to require flood insurance coverage, but may decide to impose insurance as protection for the collateral on loans they issue.

FLOOD MAP



In the U.S., the Federal Emergency Management Agency (FEMA) publishes maps showing identified flood hazards in thousands of communities across the nation. On these maps, most of which are Flood Insurance Rate Maps (FIRMs), the areas subject to flooding are highlighted with different color shading. In Canada, a federal-provincial collaboration also produces flood risk maps identifying provincial regulatory floodplains.

Other specific frequencies or probable flooding events are not indicated on the FEMA-issued mapping of floodplains, but are calculated and depicted in detailed studies of Special Flood Hazard Areas. Although all frequencies may be considered in the design of development in an area prone to flooding, the 1%-annual chance flood event is the one serving as the standard for most regulations.

WHAT FACTORS AFFECT FLOODING?

The topography of an area, or the shape of the ground, can affect the extent of a floodplain. Shallow sided watercourses in flat terrain allow water to overflow the banks quickly, but then spread out for far-reaching flooding, which is not necessarily deep. Areas with steeper slopes will channel water into a more confined area, making the water rise more rapidly and increasing the velocity at which the water travels through the channel.

Whether water is flowing through a flat-sided or a steep-sided floodplain, the same volume will have very different effects. In the flatter area, water will extend over a greater horizontal distance, but will travel more slowly and not rise as high as in the restricted steep-sided floodplain.



TERMINOLOGY

Base flood elevation (in Canada: Flood level) - the height reached by water in a base flood or 1%-annual chance frequency flood. Water may rise above this level during a flood, but this is the base elevation at which water is considered to have reached flood stage.

Flood - a general but temporary condition of partial or complete inundation of normally dry land areas from the overflow of streams, rivers, or other waters.

Flood fringe - the portion of the floodplain not in the floodway.

Floodplain - the area along rivers, streams, lakes or ocean coasts that is/ may be expected to be inundated by floodwaters in a 1%-annual chance flood. Includes both flood fringe and floodway when both exist.

Floodplain management - a program or activities that may include both corrective and preventive measures for reducing flood damage. Includes both structural and non-structural approaches.

Floodplain management regulations - zoning ordinances, subdivision and land development regulations, building codes, health regulations, and other federal, provincial, state and/or local regulations that set standards to prevent or reduce flood damages.

Floodway - the area carrying the bulk of floodwaters; endangered by waters traveling at greatest velocity as well as greatest depth of water. Subject to the most stringent controls to prevent damage with and beyond limits of the Special Flood Hazard Area to which floodwaters might extend if obstructed within the floodway.

Moderate Flood Hazard Area (U.S.) - the area calculated to be affected by the 0.2%-chance or 500-year flood; the 0.2%-annual chance floodplain.

Special Flood Hazard Area (U.S.) - the area calculated to be affected by the 1%-annual chance or base flood; the 1%-annual chance or regulatory floodplain.

1%-annual chance flood, 100-year frequency flood, 100-year flood, or base flood - a flood that has a one in 100 or 1% chance of being equaled or exceeded in any year. The federally identified minimum standard for floodplain management for U.S. regulations.

0.2%-annual chance flood, 500-year frequency flood, or 500-year flood - a flood that has a one in 500 or 0.2% chance of being equaled or exceeded in any year.

Note: While the term "100-year flood" has been commonly used for decades, the misperception that such a flood will only occur once each century led FEMA and others to change the nomenclature to the more accurate "1%-annual chance" flood event. While the meaning is the same, the sense of probability is more clearly conveyed. In fact, it is possible to experience multiple 100-year or 1%-annual chance floods in a single 365-day time span. Over the span of a typical 30-year mortgage, the chances of experiencing a flood are 26%, an event not covered in a homeowner's policy and requiring a special flood insurance policy. In the same time span, there is a 4% chance of fire, which is covered by a typical homeowner's insurance policy.

For comparison, consider what happens when an ice cube is placed in a bowl of soup to cool it down. The soup bowl is wide with gradually sloping sides, so the height of the soup may only rise about 1/8 of an inch. When placing the same size ice cube into a tall glass of water, the glass has a smaller diameter and steeper sides than the bowl, restricting where the water can go. As a result, the water height may rise to a 1/2 inch or more.

Straight runs of water will travel more rapidly than watercourses with meandering curves. For this reason, when water accumulates upstream due to heavy precipitation, the flooding will arrive at the downstream site more rapidly than if obstructions exist to slow the water down. At the same time, rapidly moving water causes far greater erosion, so that the floodwaters will carry more mud and debris in faster moving water.

The absorbency of the soil will also have an effect on the extent of the flooding, as will the type of vegetation, amount of paving or rooftops acting as impervious surfaces and the number of structures impeding the flow of water. The more obstructions there are to water flow or to water penetration into the ground, then the faster water will flow over the ground surface and the higher it will rise.

While we have generally considered dams and levees to protect us from flooding in the U.S., the events following Hurricane Katrina should awaken us from that dream. Living in the shadow of a levee or dam can offer a false sense of security, and indeed there is a risk involved in those areas if the protective structure were to breach or overtop.

IS THE RISK OF DAMAGE UNIFORM THROUGHOUT THE FLOODPLAIN?

Within the floodplain may be an area known as the floodway (not every Special Flood Hazard Area has a defined floodway, due to physical site factors such as topography or the presence of tidally influenced waters). It is an area computed by modeling the results of filling the floodplain on both sides of a watercourse equally, until the water in the center is constricted to the point that it rises no more than one foot. Note that some jurisdictions may compute their floodway areas more stringently, sometimes permitting no rise at all. When the computation of simulated filling starts to affect the water elevation, the limit of the floodway is established.

The floodway is delineated so that even if the rest of the floodplain is filled and unavailable to carry floodwater, there would still be capacity in the floodway to convey all of the water associated with the 1%-annual chance flood event.³ Thus, it carries the bulk of floodwaters, meaning it is endangered by the waters traveling at the greatest velocity as well as at the greatest depth during flood. For these reasons, the floodway is subject to the most stringent controls to prevent damage both in and beyond the limits of the Special Flood Hazard Area, to which floodwaters might extend if obstructed within the floodway. No development may be allowed that would obstruct or impede the flood. On Flood Insurance Rate Maps issued by the FEMA, the floodway is shown as cross-hatched between heavy solid or dashed lines within the dark gray shading of the Special Flood Hazard Area.

CAN FLOODING BE CONTROLLED?

There are two ways in which flooding can be managed, but like weather, flooding can never be fully controlled. Generically floodplain management can be defined as follows: "...the operation of a program or activities which may consist of both corrective and preventive measures for reducing flood damage, including, but not limited to, such things as emergency preparedness plans, flood control works, and floodplain management regulations."⁴

To better understand this definition, floodplain management regulations are defined as: "zoning ordinances, subdivision and land development regulations, building codes, health regulations, special purpose ordinances and other applications of the police power. The term describes the State or local regulations or any combination thereof, which provide standards for the purpose of flood damage prevention and reduction."⁵

The two methods of managing floods are structural and non-structural approaches. Structural methods include construction of floodwalls and levees, and techniques to make structures more resistant to water penetration and pressure. Non-structural methods include the use of regulations limiting new construction in floodplains to prevent additional damage to already developed flood-prone areas and to prevent more buildings from being constructed in a way that makes them vulnerable to flooding. Such regulations may also call for the removal of existing flood-prone buildings and the protection of open space along watercourses. To keep from adding to the dangers inherent in floodplains, non-structural methods are preferred.

State and local floodplain regulations are based on the code of Federal Regulations, and are therefore similar in all jurisdictions participating in the National Flood Insurance Program.



CONCLUSION

Understanding that floodplains are not evil impediments to our development plans is an important step in protecting these valuable natural resources. As we learn to respect floodplains for the safeguards they offer other sites and acknowledge that natural forces will ultimately prevail, we can determine how best to utilize them.

For more information visit FEMA's website at www.fema.gov. Federal regulations are published at Title 44 of the Code of Federal Regulations (44 CFR), Sections 59 through 79. Remember to check state and local community governments for other guidance and restrictions regarding floodplain use. 🌟

¹From PA Administrative Code Title 25, Chapter 105, Section 105.1, regarding Dam Safety and Water Management by the Department of Environmental Protection.

²Id.

³Code of Federal Regulations, Title 44, Section 60.3(d)(2).

⁴PA Administrative Code, Title 12, Chapter 113, Section 113.1, under "Floodplain Management" regulations issued by the Department of Community Affairs.

⁵Id.