

FLOODING IN WESTERN PENNSYLVANIA

Civilization exists by geological consent, subject to change without notice.
Will Durant

Rivers and streams often have to carry more water than their channels can contain. The excess water spills onto adjacent lowlands, the **floodplain**, until the water volume decreases enough to be contained within the channel again. If flooding is severe enough, a new channel might form. Flooding has been an integral part of western Pennsylvania history since the first European settlers came to the region, due mainly to the large number of flood-prone streams in the area. Added to this are the effects of construction due to population and economic pressures on the land.

Flood experts generally describe floods statistically. For example, some flooding is expected to occur on an average of 1½ years (Figure 1). Large, damaging floods occur statistically once every 100 years, and truly devastating floods occur once every 500 years. In reality, floods occur at very irregular intervals, and the severity of flooding varies greatly as well. In downtown Pittsburgh, where the normal pool elevation of the three rivers is 710 feet above sea level, a "100-year" flood would raise the water level 20 feet or more. But downtown Pittsburgh has suffered from at least four "100-year" floods this century alone, and many others rose to within a foot or two of the classification. The disastrous St. Patrick's Day flood of 1936, which peaked at 30.2 feet above normal pool level, was a "500-year" flood.

NATURAL VS MAN-MADE FLOODS

Under natural conditions, flooding is controlled by landscape and weather. The sizes and shapes of streams, floodplains, and their enclosing valleys (Figure 1) is as important in the development of floods as is the frequency and intensity of rainfalls and snowfalls. Flooding in western Pennsylvania in late winter or early spring, due to snow and ice melt enhanced by spring rains, typically is an annual event. In downtown Pittsburgh, for example, the wharves along the Allegheny and Monongahela rivers, and even part of the Parkway East near river level, have to be closed for several days almost every spring because of flooding. The occasional hurricane or severe storm might cause very intense floods, but these, fortunately, are relatively rare in western Pennsylvania. The floods caused by Hurricane Agnes in 1972 (Figure 2) were of record proportions throughout much of the northeastern United States, including western Pennsylvania. Despite the apparent severity of flooding in western Pennsylvania, however, this area was not as badly affected as other regions of the state.

Man also greatly influences the frequency and intensity of flooding. Where there once were forests, meadows, and wetlands with soils that soaked up much of the rainfall and snow melt,

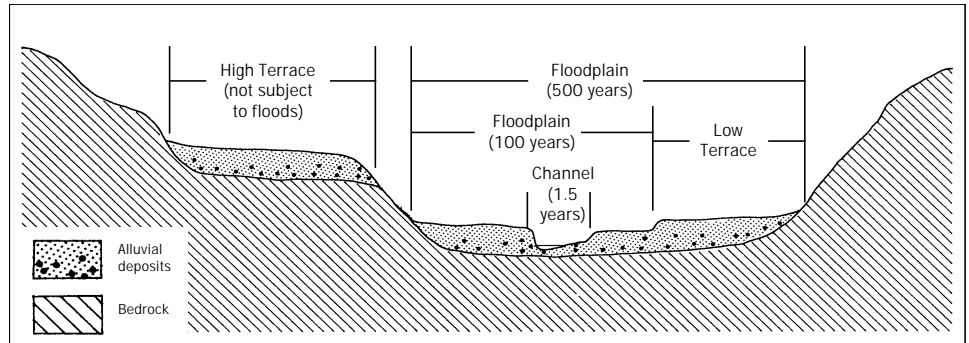


Figure 1. Cross section of a typical western Pennsylvania river valley showing extent of flooding from periodic (1.5 year), 100-year, and 500-year floods. High terraces, formed before and during the Ice Age, commonly occur between 150 and 250 feet above current river levels.

there are now hundreds of square miles of impermeable concrete and asphalt highways, sidewalks, parking lots, and roofs. Water has nowhere to go but overland, contributing significantly to runoff. Higher runoff leads to higher peak flows and higher flood levels. And extensive storm sewer systems now allow runoff to get to the streams more quickly instead of taking hours or days to flow overland through soils and along tributary streams. If rainfall is intense enough and the storm sewer system is inadequate, the runoff builds dramatically and causes flash flooding that can wash out roads, destroy property, and cause loss of life in a matter of minutes.

FLOODS AND FLOOD CONTROLS

Floods would be little worse than a navigation hazard if people did not build on floodplains. There are numerous reasons why people live and work on floodplains, most of them having to do with convenience. These include: 1) building on flat, easily worked ground at relatively low elevation; 2) the fertility of



Figure 2. Downtown Pittsburgh during the height of the 1972 flood. The arrow points to the boom of a crane that was used in installing the fountain at Point State Park.

stream-deposited soils; 3) being near a major transportation network - the river - and jobs such as shipbuilding, fishing, or ferrying associated with it; 4) being close to a recreation network; 5) the splendor of having property among the willows and sycamores along the river; and 6) sheer ignorance. Regardless of the particular reason, people have been living and working in flood-prone areas for as long as humanity has been in existence.

The rivers and larger streams of western Pennsylvania formed floodplains (actually parts of the streams) during the last Ice Age, long before anyone settled in the area. Frequent flooding of these rivers and streams only became a problem when Europeans moved into the area and began using these flat lowlands for permanent housing and industry.

The development of flood controls on the rivers following the St. Patrick's Day flood in March, 1936 has helped alleviate the worst flooding problems along the rivers. For example, record flooding during Hurricane Agnes in 1972 occurred in the upper Allegheny River drainage basin in New York and northern Pennsylvania. However, the severity of flooding was greatly reduced in western Pennsylvania by the Kinzua Dam in McKean County and the locks-and-dams system along the river. Along the Ohio River at Sewickley the peak flood stage was 10.3 feet lower than that of the 1936 flood. A lot of water went down the river (Figure 3), but not as much as would have if the controls were not in place. Flood stage was also lower during the flood of January, 1996. As effective as the controls are, however, even they cannot completely alleviate flooding problems. Man-made flood control systems are designed primarily to maintain floodwaters within a narrower area than they would cover naturally. To compensate for that part of the floodplain protected by the flood control system, backup of the floodwaters will occur, thus increasing the elevation of floodwaters upstream.

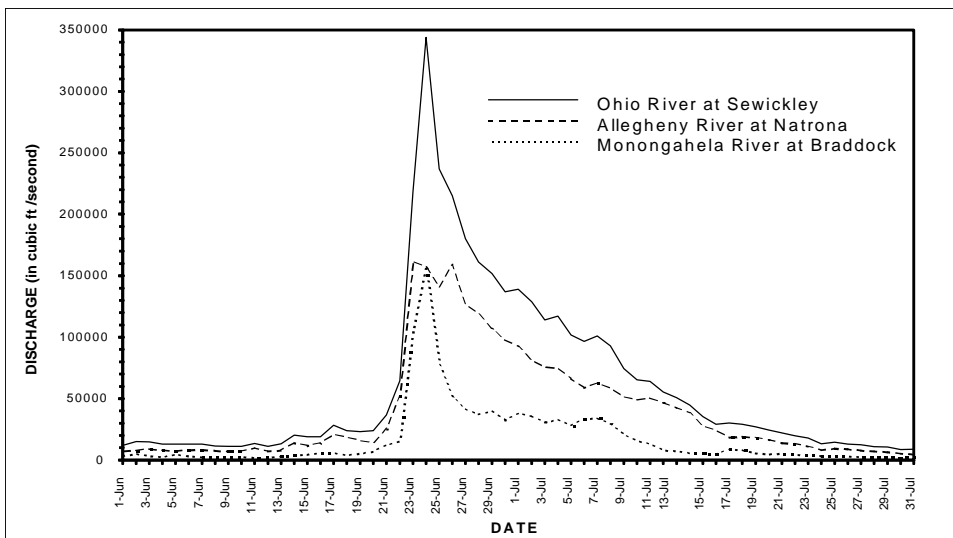


Figure 3. Daily discharge rates for the Ohio, Allegheny, and Monongahela rivers between June 1 and July 31, 1972. The peaks indicate the maximum flood stage during Hurricane Agnes.

FLASH FLOODS

Most of the recent damage caused by flooding in western Pennsylvania is directly related to flash floods in uplands and along the smaller streams with few or no flood control systems. Normally, water from rain or snow falling on impermeable concrete and asphalt flows along gutters and into storm sewers where it is channeled into nearby streams. If the rainfall is heavy enough, however, the gutters and storm sewers are inadequate to handle the runoff. The water then flows across the ground surface, gathering momentum as more water joins the new stream. Eventually, the water can become powerful enough to rip up asphalt roads, scour gullies in yards and hillsides, tear up trees and shrubs, destroy buildings, and wash away people and animals.

A good example of a small stream that experiences severe flash flooding problems is Pine Creek in the North Hills of Allegheny County (Figure 4). This creek and its tributary network

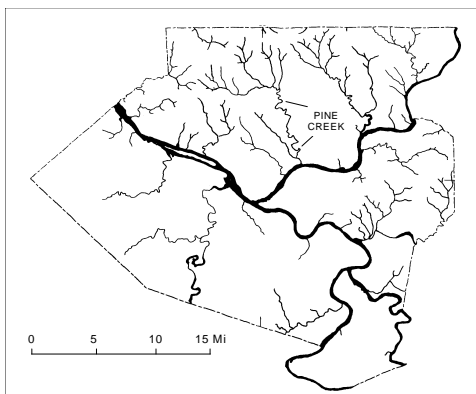


Figure 4. Flood-prone areas (black) of Allegheny County, Pennsylvania showing the location of Pine Creek. Modified from U.S. Geological Survey Circular 747, fig. 9.

drain a large area of northern Allegheny County, from near the Butler County line to the Allegheny River at Etna. The stream channel is about 50 feet wide in the lower reaches, and the floodplain is about five times wider than the channel. The floodplain has become a high density manufacturing and housing area. In order to keep the creek from undercutting valuable property through normal processes, the channel has been reinforced in places with concrete and rock. Spring runoff causes some property damage along the creek every year. However, intense rainfall in May of 1986 and 1987 caused very damaging floods along the creek and its tributaries, particularly in Hampton and Shaler Townships. Roads washed out, property was destroyed, and lives were lost in some of the worst flooding in the area in 50 years. Unusual rainstorms such as these are as difficult to predict as they are impossible to control.

Fortunately, hurricanes and unusually intense rainfalls are relatively rare in western Pennsylvania. Therefore, the major flooding problems facing citizens of the region occur in association with the small, often intermittent streams that flow across or adjacent to backyards. Even during flood stage such streams generally are not large enough to wash away houses or major highways. However, they can adversely affect property by washing away yards, fills, and dirt roads, and by filling the yard or basement with flood waters.

FLOOD INSURANCE

Citizens living in flood-prone areas of western Pennsylvania should be aware that the federal government provides flood insurance through the National Flood Insurance Program, set up in 1968. However, the insurance will be provided only if the local community enacts and enforces land-use control standards in their flood-prone areas. Early results of the program were not encouraging because many

communities did not want to voluntarily restrict development in their floodplains. The federal Flood Disaster Protection Act of 1973 tried to remedy this by requiring communities to participate in the National Flood Insurance Program in order to receive federal financial assistance and loans for structures in the flood-prone areas. Unfortunately, this program has its drawbacks, including: 1) participation in the program is completely at the discretion of the local municipality; if the mayor and town council aren't interested in restricting land-use in flood-prone areas under their jurisdiction, homeowners will be unable to apply for insurance; and 2) only citizens living within the "100-year" flood elevation (Figure 1) are eligible.

WHAT CAN YOU DO?

Floods can be controlled, but they cannot be stopped completely. No matter what kinds of physical structures can be built to control floods, eventually there will be a flood large enough to cause damage. Flood controls tend to provide a false sense of security. Most people believe locks-and-dams systems will prevent large floods. They think it is perfectly safe to continue developing the already overtaxed floodplains. When a flood does occur, not only is damage repair expensive, it is often necessary to strengthen and enlarge existing flood controls at great public expense.

The wise use of flood-prone areas is imperative. Instead of constructing airports, highways, buildings, and parking lots on floodplains, these areas should be reconsidered for use as cropland, recreational areas, or simply left in a wild state, perhaps for wildlife management. These alternative uses involve a minimum of structures that could be subject to damage or could impede water flow and cause a backup of floodwaters. By removing concrete and asphalt, the soils will soak up water that otherwise contribute to increased water levels in the streams or intensify flash flooding in populated areas. Land-use planning and/or adequate zoning ordinances need to be passed and enforced by each affected municipality in the region. Concerned citizens should lobby their municipal and state governments for these reforms.

Western Pennsylvania residents wishing to determine if their property lies in a flood-prone area are encouraged to call the Pittsburgh office of the Pennsylvania Geological Survey at (412) 442-4235 and request assistance. A good guide to the hazards of owning a home or office in western Pennsylvania is "*Lots of Danger! Property Buyer's Guide to Land Hazards of South-western Pennsylvania*, which is available for \$4.00 + \$1.50 for shipping and handling from the Pittsburgh Geological Society, PO Box 58172, Pittsburgh, PA 15209, or call (412) 928-2255.

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