



# National Weather Service

## Storm Data and Unusual Weather Phenomena



January 1996

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Property Damage	Crops	Character of Storm
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### DISTRICT OF COLUMBIA

**DCZ001**

**District Of Columbia**

**07 0300EST**  
**08 1200EST**

**0      0**

**Blizzard**

An historic winter storm, known as the "Blizzard of '96", crippled the Greater Washington, DC metropolitan region during the first full weekend of January. In general, snow totals ranged from 17.1 inches at Washington/National airport (DCA) to 21 inches in Northwest Washington. Gusty winds produced drifts to 5 feet in some places. The storm produced the largest storm total since the "Megalopolitan Storm" of February 11th, 1983. Numerous 24-hour accumulation records were shattered at airports from southwest Virginia through New England. For the city as a whole, the storm ranked 4th all-time; for modern records (taken at DCA), the storm ranked 2nd, with only the "Presidents Day" storm of February 18th-19th, 1979, dumping more (18.7 inches).

The storm was induced by a digging upper level trough over the eastern Great Plains. At the surface, an inverted trough extended from the Gulf of Mexico through the Deep South. Surface pressures began falling as the upper trough approached on the afternoon of the 7th. Meanwhile, confluent flow, behind an upper-level arctic vortex over the Canadian Maritimes, maintained strong (1034 mb) surface high pressure over northern New York state. As the upper-level trough approached the southeast U.S. on the 8th, a new surface low developed along the Georgia coast. The low deepened explosively while the arctic high remained in place. Copious Gulf of Mexico and Atlantic moisture was entrained into the system, producing heavy snow; the increasing gradient between the intensifying low and the arctic high caused winds to strengthen to 25 mph with gusts to 35 mph.

The system moved slowly from South Carolina to the mouth of the Chesapeake Bay overnight on the 7th. The slow movement prolonged near-blizzard conditions into the 8th. The storm finally moved towards New England later on the 8th, ending the snow but maintaining gusty north winds (and substantial blowing and drifting snow) until evening.

All major highways were effectively closed through the 7th, as snow removal equipment fought a losing battle with the considerable blowing and drifting snow. However, residential areas remained unplowed for up to one week following the storm; FEMA provided funding for additional snow removal equipment to clear the streets by the weekend of the 13th/14th. Subway transit was impacted as well, as the Washington subway system was effectively shut down through Tuesday, and above-ground stations opened sporadically throughout the following work week. The combination of warming temperatures and concerted snow removal efforts opened all roads by the 17th.

All federal, state, and local governments, as well as public schools, were closed Monday (the 8th) and Tuesday (the 9th). Road damage - especially from potholes and related pavement failures - was excessive. Estimated commercial losses to the northeastern U.S. for the week of January 7-13 were between \$7 and \$10 billion - this on top of a sluggish holiday season and federal government shutdowns.

**DCZ001**

**District Of Columbia**

**09 1500EST**  
**1700EST**

**0      0**

**Heavy Snow**

Low- and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96" ended, dumping 4 more inches of snow in a 4-hour period on the beleaguered city. The snow forced road crews to re-double their efforts on main highways, keeping most residential streets unplowed for yet another day.

**DCZ001**

**District Of Columbia**

**12 0900EST**  
**1200EST**

**0      0**

**Heavy Snow**

Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow on the city. Additional snowfall totalled generally 5 to 6 inches, with lesser amounts (4 inches) along the Potomac and Anacostia Rivers. The weekly snowfall of 23.9 inches at DCA broke the all-time record at that location, and ranked it second (since official city records have been kept) behind the famous "Knickerbocker" storm of January 25-27, 1922.

The storm developed as an area of low pressure in the midwest, which became an elongated trough extending from the Tennessee Valley through southeastern North Carolina. As the upper-level trough approached the North Carolina low became dominant, intensifying slowly as it moved through the mouth of the Chesapeake Bay by midday, then off the Delaware coast, by late afternoon. Unlike the "Blizzard of '96", a lack of cold air behind the surface low, combined with the somewhat weaker and more progressive upper-level trough, kept the surface low from intensifying rapidly.

Travel was hampered yet again, and federal offices closed for a record fourth day in one week. Numerous residential streets remained unplowed, and main arteries continued to have only one of two lanes (per right-of-way) open. The storm forced the Federal Emergency Management Agency (FEMA) to release funds to help with snow removal. Some of the snow was reportedly dumped into the Potomac River.

Several residences reported "ice dams" at the base of roofs. Some ice dams caused gutters to collapse; others forced water leakage into the homes.



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### DISTRICT OF COLUMBIA

#### District Of Columbia

All	19	1100EST 1300EST			0	0			Flash Flood
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An unusually intense squall line, feeding on an unseasonably warm moist tropical air mass, dumped between 0.8 and 1.2 inches of rain in a two-hour period during the late morning of the 19th. The rain fell on oversaturated soil, a result of the previous night's rapid snow melt, producing flash floods throughout the city. During the overnight hours, the remaining water-logged snow pack of 3 to 6 inches was eaten away by strong southeasterly winds which carried low 60s temperatures and near 100 percent relative humidity into the area.

Prior to the onset of heavy rain, numerous creeks and streams feeding the Anacostia and Potomac Rivers were near bank full due to the rapid snow melt. Substantial flash flooding, in the form of overflowed creeks and streams and high standing water due to clogged storm drains, began around 1100EST and continued into the early afternoon. Rock Creek sustained the most flooding, causing the closure of Beach Drive and the Rock Creek Parkway over much of its route through the city. The flash flooding also inundated low-lying businesses and residences, and flooded several parking garages in Foggy Bottom and Georgetown.

#### DCZ001

District Of Columbia									
20	0730EST				0	0	10M		Flood
23	0500EST								

\*\*\* Potomac River Flooding \*\*\*

High dew point temperatures melted the entire snow pack within 12 hours, with liquid equivalents averaging 1 to 2 inches. Snowmelt combined with 1 to 3 inches of rain caused the worst regional flooding in over 10 years. No tidal variations were noted once the stage surpassed 10 feet. The river crested at 13.88 feet (Wisconsin Avenue in lower Georgetown) on the 21st, dropping below flood stage (7 feet) by the 23rd.

River flooding in the city was limited to Georgetown, Foggy Bottom, and the Haines Point/Washington Marina area. High water forced the closure of some waterfront property for several days, damaged homes and businesses, and brought heavy debris to the city's edge. Portions of the George Washington Memorial Parkway, as well as ramps to the Memorial Bridge and Clara Barton Parkway, were closed on the 22nd, causing the morning commute from the western suburbs to back up for miles. Portions of Independence Avenue and Water Street SW, Wisconsin Avenue and K Street NW (Georgetown), and the Jefferson Memorial were closed. A family of 7 deer was washed through the streets of lower Georgetown before making it to dry land.

### MARYLAND, Central

#### MDZ002>007-009>011-013>014-016>018 Allegany - Washington - Frederick - Carroll - Northern Baltimore - Harford - Montgomery - Howard - Southern Baltimore - Prince Georges - Anne Arundel - Charles - St. Mary'S - Calvert

07	0200EST				2	150	160K		Blizzard
08	1300EST								

An historic winter storm, known as the "Blizzard of '96", crippled all of Maryland west of the Chesapeake Bay during the first full weekend of January. In general, snow totals were as follows: 20 inches in lower southern Maryland (MDZ016>018), 20 to 26 inches in central Maryland (MDZ009>011, 013), and 26 to 36 inches to over the northern tier (MDZ002>007). To complicate matters, winds gusting in excess of 35 mph produced drifts of 4 to 7 feet, except over 10 feet in the mountains. The storm produced the largest statewide storm totals since the "Megalopolitan Storm" of February 11th, 1983. Numerous 24-hour accumulation records were shattered at airports from southwest Virginia through New England; Baltimore/Washington International (BWI; MDZ011) nearly equalled its record of 22.8 inches in 24 hours (22.5 inches fell), set in 1983.

The storm was induced by a digging upper level trough over the eastern Great Plains. At the surface, an inverted trough extended from the Gulf of Mexico through the Deep South. Surface pressures began falling as the upper trough approached on the afternoon of the 7th. Meanwhile, confluent flow, behind an upper-level arctic vortex over the Canadian Maritimes, maintained strong (1034 mb) surface high pressure over northern New York state. As the upper-level trough approached the southeast U.S. on the 8th, a new surface low developed along the Georgia coast. The low deepened explosively while the arctic high remained in place. Copious Gulf of Mexico and Atlantic moisture was entrained into the system, producing heavy snow; the increasing gradient between the intensifying low and the arctic high caused winds to strengthen to 25 mph with gusts to 35 mph.

The system moved slowly from South Carolina to the mouth of the Chesapeake Bay overnight on the 7th. The slow movement prolonged near-blizzard conditions into the 8th. The storm finally moved towards New England later on the 8th, ending the snow but maintaining gusty north winds (and substantial blowing and drifting snow) until evening.

The storm effectively closed all major highways on the 7th, but interstates were "open" by the 8th, even though snow removal equipment fought a losing battle with the considerable blowing and drifting snow. The Washington subway system suffered several above-ground mishaps in Maryland. Shortly after the onset of the storm, a train, with three persons aboard (including the driver), slid into another in central Montgomery Co (MDZ009), killing the driver. The following evening, 80 passengers were stranded when a train got stuck between stations. Many above-ground stations remained closed throughout the following work week.



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### MARYLAND, Central

Two persons perished directly from hypothermia the day after the blizzard. Over 150 injuries were reported at area hospitals and clinics shortly after the blizzard, most due to over-exertion from shoveling snow, but some due to slipping on ice.

All federal, state, and local governments were closed Monday (the 8th) and Tuesday (the 9th). Most school districts remained closed for the week. A federal state of emergency was declared the following Friday (the 12th). Snow removal/damage costs exceeded \$70 million (state and county combined), a state record for an individual winter storm. The vast majority was incurred by snow removal operations; another \$3.7 million was budgeted for repairs to highways including potholes, guard rails, and side banks.

The weight of the snow caused several area roofs to collapse. In Clinton (MDZ013), the roof of a nursing home dining room caved in at 0730 EST on the 8th, displacing up to 120 residents. Fortunately, disaster was averted because breakfast was served in the dormitories rather than in the dining room due to staff shortages. No injuries were reported. In Frederick Co (MDZ004), a barn collapsed, killing 100 cows and injuring about 100 more. Two barns collapsed in Clear Spring (MDZ003), and 100 cows escaped unharmed.

M52OU, M50OU

**MDZ006>007-011-013>014-016>017**

**Northern Baltimore - Harford - Southern Baltimore - Prince Georges - Anne Arundel - Charles - St. Mary'S**

<b>09</b>	<b>1400EST 1800EST</b>	<b>0</b>	<b>0</b>		<b>Heavy Snow</b>
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Low- and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96," dumping 4 to 6 inches of snow in a 5-hour period from lower southern Maryland through the northern suburbs of Baltimore. The additional snowfall produced total snow depths similar to those over the Maryland and Virginia piedmont.

**MDZ002>007-009>011-013>014-016>018**

**Allegany - Washington - Frederick - Carroll - Northern Baltimore - Harford - Montgomery - Howard - Southern Baltimore - Prince Georges - Anne Arundel - Charles - St. Mary'S - Calvert**

<b>12</b>	<b>0700EST 1300EST</b>	<b>0</b>	<b>0</b>	<b>100K</b>	<b>Heavy Snow</b>
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Less than one week after the crippling "Blizzard of '96," a new winter storm dumped substantial snow across Maryland west of the Chesapeake Bay. The snow changed to freezing rain and sleet from the Chesapeake Bay through the eastern and southern suburbs of the Baltimore/Washington area before tapering off. The changeover suppressed accumulations to 4 to 6 inches in this region. Elsewhere in Maryland, snow amounts ranged from 6 to 8 inches, with amounts up to 1 foot at higher elevations in Frederick and Washington Cos (MDZ003>004).

The storm developed as an area of low pressure in the midwest, which became an elongated trough extending from the Tennessee Valley through southeastern North Carolina. As the upper-level trough approached, the North Carolina low became dominant, intensifying slowly as it moved through the mouth of the Chesapeake Bay, then off the Delaware coast by late afternoon. Unlike the "Blizzard of '96," a lack of cold air behind the surface low, combined with the fact that the upper-level trough was significantly weaker and more progressive, kept the surface low from rapidly intensifying. Nonetheless, west-central Maryland received some of the highest snow totals in the Eastern U.S.

Travel was slowed yet again, but by evening main arteries were cleared. Excessive speed contributed to numerous accidents, the most impressive on the Capital Beltway in Montgomery Co (MDZ009) which involved four tractor-trailers. Most local, state, and federal offices were closed. School districts remained closed, giving children an extra week of winter vacation. Unfortunately, the week of storms also wiped out their allotment of snow days.

The additional snow load caused several structures to partially fail. In Westminster (MDZ005), a bowling alley was damaged when an exterior wall caved in. In Bethesda (MDZ009), a roof partially failed at a printing center. A tire warehouse in Upper Marlboro (MDZ013) collapsed, and another warehouse in nearby Beltsville had a sagging roof. Gutters were torn from numerous homes as a result of "ice dams," which also caused interior leaks.

### **Allegany County**

**All**

<b>19</b>	<b>0300EST 1200EST</b>	<b>0</b>	<b>0</b>	<b>7M</b>	<b>Flash Flood</b>
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### **Washington County**

**All**

<b>19</b>	<b>0500EST 1200EST</b>	<b>0</b>	<b>0</b>	<b>1M</b>	<b>Flash Flood</b>
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\*\*\*Flood/Flash Flood\*\*\*

An unprecedented combination, in recent history, of unseasonably warm, humid air overriding a dense snow pack estimated between 12 and 18 inches (but up to 2 feet or more at higher elevations) caused nearly all of the pack to vanish in a 12-hour period. The unseasonably warm air was drawn northward around the circulation of a deepening storm west of the Appalachians late on the 18th and early on the 19th. The melting snow and heavy rains caused widespread, and in some cases, catastrophic flooding and flash flooding on the 19th.



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### MARYLAND, Central

Strong low-level southeast flow developed by late afternoon on the 18th. Initially, colder temperatures in sheltered valleys slowed the rate of snow melt while the warm moist air mass attacked the snow pack at higher elevations. By mid-evening, however, even lower elevations were warming rapidly. Flash flooding began at around the same time as the onset of heavy pre-frontal rains. These heavier showers fell repeatedly over the region between 0400 and 0800EST, causing acute and widespread flooding and flash flooding. Some areas received between 2 and 4 inches of rain during this period.

Some of the most pronounced damage occurred in Allegany Co, where an estimated \$7 million in damage was reported from the initial floods alone. Two permanent homes were destroyed, 20 had major damage, and 205 had minor damage. Two mobile homes were destroyed, and 8 others had major damage; several apartments were flooded, and 32 businesses were damaged. Washington Co estimated over \$1 million dollars in damage from flood waters. Five single-family homes had major damage; 2 had minor damage. Eleven mobile homes in Funkstown sustained major damage, 13 had minor damage; 2 apartments had major damage and 3 minor damage. An oil spill also occurred in Williamsport.

#### Frederick County

All	19	0700EST 1300EST							Flash Flood
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#### Carroll County

All	19	0700EST 1300EST							Flash Flood
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#### Montgomery County

All	19	0900EST 1300EST			0	1			Flash Flood
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\*\*\* Continuation of this event (several flood/flash flood counties grouped together) continues after the following \*\*\*

#### Howard County

All	19	0900EST 1300EST							Flash Flood
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#### Baltimore County

All	19	0900EST 1300EST							Flash Flood
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#### Harford County

All	19	0900EST 1500EST							Flash Flood
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#### MDZ002>004-009

**Allegany - Washington - Frederick - Montgomery**

19	0900EST					0	0	60M	Flood
22	2200EST								

\*\*\* River Flooding \*\*\*

High dew point temperatures melted most of the snow on the ground within 12 hours, with liquid water equivalent ranging from 1 to 3 inches. Snowmelt combined with 1 to 3 inches of rain (some locations received 5 inches) to produce, in some cases, catastrophic river flooding. The flooding was the worst in the region since 1985. River flooding began during the flood/flash flood event along the headwaters of the basins and continued downstream through the 22nd. Crests ranged from 3 to 21 feet above flood stage. Record flooding occurred on Wills Creek near Cumberland (MDZ002), damaging all dwellings in the town of Locust Grove. Almost all dwellings in the town of Point of Rocks (MDZ004) were damaged by the flood waters in some way.

Unfortunately, the National Park Service's C&O Canal and towpath was also severely damaged. Improvements made since the 1972 flooding (Tropical Storm Agnes) and 1985 were virtually destroyed once again. Damage was estimated at \$20 million for the park that runs along the Potomac from western Maryland the Washington, DC. Largest losses were sustained just outside of Cumberland and along the southernmost stretch from Great Falls into Northwest Washington (MDZ009). Flood waters covered 80 percent of the 184.5 mile canal. Helicopter rescues continued for 24 hours across much of the state during the onset through peak flooding. Antietam Battlefield National Park (MDZ003) estimated \$11 thousand damage along Antietam Creek.

There were several water and sewage plant failures. Water line breaks occurred in Lavale (MDZ002), and failures at Sharpsburg and Hagerstown (MDZ003) forced residents to boil water for 3 to 5 days (thousands of others were without water for 1 to 2 days). The plants in Brunswick (MDZ004) and Havre De Grace (MDZ007) were shut down for 1 to 3 days due to flood waters and high turbidity.

There was structural damage to several bridges which cross the Potomac. Three counties in central Maryland were declared under a federal state of emergency: Washington, Allegany, and Frederick.

Refer to the narrative on Flood/Flash Flood for a more detailed breakdown of damage estimates.



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January 1996

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### MARYLAND, Central

#### Prince George's County

All	19	1000EST 1400EST			0	0			Flash Flood
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#### Anne Arundel County

All	19	1100EST 1500EST			0	0	5K		Flash Flood
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#### Baltimore City (C)

All	19	1100EST 1500EST			0	0			Flash Flood
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\*\*\* Flood/Flash Flood Summary \*\*\*

A waterlogged snow pack, ranging (roughly) in depth from 3 to 12 inches, was eaten away when subtropical moisture fed into the region ahead of a strong cold front. The warm moist air mass contained temperatures in the upper 50s and lower 60s, along with relative humidity near 100 percent. A deepening storm moving north through the Ohio Valley drew the subtropical air into the region. Minor flash flooding began during the pre-dawn hours, but more significant flooding occurred with the passage of an intense and unusual squall line, which moved through between 0900 and 1200EST. The squall line dumped rainfall amounts of 1.5 to 2.5 inches in less than 3 hours at any one location. Streams quickly overflowed their banks, and water ponded quickly from clogged storm drains and saturated ground.

Flash flooding, due to streams and creeks out of their banks, began in northern Montgomery, western Carroll, and much of Frederick Co around 0700EST. The onset of heavy rains, between 0900 and 1000EST over the piedmont, and 1000 and 1200EST elsewhere, produced more substantial flash flooding. In Frederick Co, flash floods caused mud slides, knocked down trees, and closed roads. Numerous rescues were undertaken, mostly due to stranded vehicles. At the height of the storm, 52 roads were closed. Three hundred seventy-eight homes sustained flood-related damage. Fortunately, there were no fatalities, but there were a number of minor injuries. Rapid flooding of the Monocacy River (Frederick Co) caused problems, and there was flooding reported at Point of Rocks. In Carroll Co, 75 acres were reported under water, and several homes were evacuated in Detour, a result of a flood-related HAZMAT incident. Another oil spill also occurred at Owings Mills in Baltimore Co.

In Montgomery Co, an elderly woman was in fair condition after her car was submerged along White's Ferry Road near Poolesville. Numerous creeks and streams were out of their banks countywide, including Rock Creek near Kensington. The flooded creek left large deposits of sediment in its wake. In Prince George's Co, over a dozen cars were towed out of high water along federal highway 1, which was temporarily closed.

Farther east, in the Baltimore vicinity, several water rescues were reported. Just south of Baltimore City, Interstate 695 was closed briefly near Arbutus. An automobile was swept away in Harford Co.

#### MDZ004

##### Frederick

28	0000EST				0	0			Flood
29	0500EST								

\*\*\* River Flooding \*\*\*

As river levels receded after the snow melt/rainfall on the 19th, additional rainfall on the 28th caused portions of the Lower Potomac basin to flood once again. Rainfall totals ranging from 0.7 to 3.5 inches over the Potomac Highlands brought crests between 0.5 and 1.5 feet above flood stage.

### VIRGINIA, North

VAZ021-025>031-  
036>042-050>057

**Highland - Augusta - Rockingham - Shenandoah - Frederick - Page - Warren - Clarke - Nelson - Albemarle - Greene - Madison - Rappahannock - Fauquier - Loudoun - Orange - Culpeper - Prince William - Fairfax - Arlington - Stafford - Spotsylvania - King George**

06	2300EST				1	1	350K		Blizzard
08	1100EST								

An historic winter storm, known as the "Blizzard of '96", crippled all of northern Virginia during the first full weekend of January. In general, snow totals ranged from 20 inches on the coastal plain (VAZ052>53; 055>057) to over 3 feet at the higher elevations of the central and northern Shenandoah Valley. To complicate matters, winds gusting in excess of 35 mph produced drifts of 4 to 7 feet, except over 10 feet in the mountains. The storm produced the largest statewide storm totals since the "Megalopolitan Storm" of February 11th, 1983. Numerous 24-hour accumulation records were shattered at airports from southwest Virginia through New England; Washington/Dulles airport (IAD; VAZ042) accumulated 24.6 inches., 19.8 of which fell on the 8th. The 19.8 inches broke the all-time 24-hour accumulation record by 4.4 inches.

The storm was induced by a digging upper level trough over the eastern Great Plains. At the surface, an inverted trough extended from the Gulf of Mexico through the Deep South. Surface pressures began falling as the upper trough approached on the afternoon of the 7th. Meanwhile, confluent flow, behind an upper-level arctic vortex over the Canadian Maritimes, maintained strong (1034





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### VIRGINIA, North

mb) surface high pressure over northern New York state. As the upper-level trough approached the southeast U.S. on the 8th, a new surface low developed along the Georgia coast. The low deepened explosively while the arctic high remained in place. Copious Gulf of Mexico and Atlantic moisture was entrained into the system, producing heavy snow; the increasing gradient between the intensifying low and the arctic high caused winds to strengthen to 25 mph with gusts to 35 mph.

The system moved slowly from South Carolina to the mouth of the Chesapeake Bay overnight on the 7th. The slow movement prolonged near-blizzard conditions into the 8th. The storm finally moved towards New England later on the 8th, ending the snow but maintaining gusty north winds (and substantial blowing and drifting snow) until evening.

The storm effectively closed all major highways on the 7th, as snow removal equipment fought a losing battle with the considerable blowing and drifting snow. By the 8th, major interstate highways were open statewide; however, 75-100% of state and local highways remained impassible. Highway clean-up and repair costs were remarkable across northern Virginia. An estimated \$50 million was spent on snow removal alone. Repairs to pavement, guardrails, and side banks were estimated between \$5 and \$7 million.

Prior to the onset of precipitation, the governor declared a state of emergency for the entire Commonwealth. This allowed for quick deployment of Virginia National Guardsmen, primarily from the Piedmont through the western highlands. HMMWV's (Humvees) were dispatched to the region, and proved very effective in moving the medically impaired to area hospitals. Despite the Guard's help, important services were significantly reduced; food, fuel, and medical supplies began to dry up. All federal, state, and local governments, as well as all area school districts, were closed Monday (the 8th) and Tuesday (the 9th); most school districts remained closed for the entire week.

One person perished from exposure (VAZ053) the day after the storm ended (January 9th); ten others perished as a result of heart failure while shoveling snow. Dozens of hikers and outdoorsmen were stranded in the Shenandoah Valley during the height of the blizzard. Virtually all made it to prefabricated shelters in the park, where food and blankets were airlifted for several days until nearby roads could be cleared. Statewide, 800 persons required shelter during the storm, the majority of whom were stranded travelers.

The combination of powdery snow and moderate winds did not allow significant accumulations on trees or power lines; thus outages were minimal. The only substantial damage was noted near Stanardsville (VAZ038), where 51 power poles were damaged or destroyed during the storm.

The weight of the snow on roofs, especially where drifts formed, caused scattered collapses across the area. Many of the reported collapses were to structures unable to support the snow pack. Such structures included greenhouses, poultry houses, porches and awnings, and a few mobile homes. A man was injured when a greenhouse collapsed on him in Stephens City (VAZ031). Most of the damage was reported in the Shenandoah Valley. Noteworthy damage was reported to a church gymnasium in West Springfield, causing thousands of dollars in damage. In Dale City (VAZ052), the Potomac Mills shopping mall remained closed for several days after the blizzard due to a large area of sagging roof which required extensive repair. In Clarke Co (VAZ031), one barn collapsed. In Burke (VAZ053), a fire began in a high school theater when a roof collapsed onto a natural gas line. The blaze caused \$8000 in damage.

M67OU

VAZ052-057

**Prince William - King George**

<b>09</b>	<b>1500EST 1700EST</b>	<b>0</b>	<b>0</b>	<b>350K</b>	<b>Heavy Snow</b>
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Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River. The additional snow slowed removal efforts in the wake of the previous storm, but was otherwise only a nuisance.

VAZ021-025>031-  
036>042-050>057

**Highland - Augusta - Rockingham - Shenandoah - Frederick - Page - Warren - Clarke - Nelson - Albemarle - Greene - Madison - Rappahannock - Fauquier - Loudoun - Orange - Culpeper - Prince William - Fairfax - Arlington - Stafford - Spotsylvania - King George**

<b>12</b>	<b>0700EST 1100EST</b>	<b>0</b>	<b>1</b>	<b>350K</b>	<b>Heavy Snow</b>
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Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: In the Shenandoah Valley, 4 to 6 inches; in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches.

The storm developed as an area of low pressure in the midwest, which became an elongated trough extending from the Tennessee Valley through southeastern North Carolina. As the upper-level trough approached, the North Carolina low became dominant, intensifying slowly as it moved through the mouth of the Chesapeake Bay, then off the Delaware coast by late afternoon. Unlike the "Blizzard of '96", a lack of cold air behind the surface low, combined with the fact that the upper-level trough was significantly weaker and more progressive, kept the surface low from rapidly intensifying. Nonetheless, the northern Virginia region received some of the highest snow totals in the East.



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### VIRGINIA, North

Travel was hampered yet again, but by evening most main arteries were cleared. A DC-9 slid off the runway at IAD at 0915EST, causing inconvenience to the 30 passengers on board but no damage. Most local, state, and federal offices closed. Nearly all school districts in northern Virginia remained closed for a fifth day, providing school children an extra week of winter vacation. However, the week of storms and clean-up also wiped out their allotment of snow days.

The weight of the snow from all three events during the week of January 7th through 13th caused several related problems. The worst damage was reported in Montpelier (VAZ050) between the 13th and 14th, when a large horse stable sustained substantial roof damage. Damage was estimated at \$250,000. Damage was also reported at a Winchester (VAZ028) strip mall, where a sagging roof forced the evacuation of over a dozen children from a day care center on the 13th. In Sterling, a shopping center lost a 10x12 section of walkway covering.

In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered. Portions of the roof at Potomac Mills Mall in Woodbridge (VAZ052) continued on the verge of collapse, forcing the mall's closure on the 13th. A nearby grocery store was evacuated for similar reasons. Lastly, numerous homes had their gutters ripped off by "ice dams", which also caused interior leaks during the week following the event.

### **Rockingham County**

<b>All</b>	<b>19</b>	<b>0130EST 1200EST</b>							
			<b>0</b>	<b>0</b>	<b>7M</b>				<b>Flash Flood</b>

An unprecedented combination, in recent history, of unseasonably warm, humid air overriding a dense snowpack estimated between 6 and 15 inches (but up to 2 feet or more at higher elevations) caused nearly all of the pack to vanish in a 12-hour period. The unseasonably warm air was drawn northward around the circulation of a deepening storm west of the Appalachians late on the 18th and early on the 19th. The melting snow and additional rainfall produced widespread flooding and flash flooding on the 19th.

Strong low-level southeast flow developed by late afternoon on the 18th, and pockets of light to moderate rain occurred along the foothills. Initial flash flooding, in the form of creeks and streams out of their banks and low-lying areas covered in standing water, began around 0000EST on the 19th. More widespread flooding ensued between 0100 and 0200EST.

A pre-frontal line of heavy showers and embedded thunderstorms moved into the region shortly after dawn on the 19th, causing widespread acute flooding and flash flooding which lasted until around noon. The line of heavy precipitation moved slowly through the area between 0600 and 0900EST, prolonging the flooding. Some of the higher totals reported by automated rain gages (which contained some melted snow) were in excess of 5 inches. Montebello (Nelson Co) received 5.22 inches, Big Meadows (Page Co) had 5.12 inches, Long Run (Rockingham Co) reported 4.47 inches, and Sherando (Augusta Co) had 4.16 inches.

One death was reported by Albemarle Co authorities, as a motorist lost control of his vehicle in high water and struck a tree just south of Charlottesville. High water closed numerous local roads, and several major arteries as well, including federal highway 33 near Harrisonburg (Rockingham Co). Also in Rockingham Co, authorities evacuated the main street in Broadway when a 20 ton fuel oil tank and two 1000-lb propane tanks broke loose from their moorings and began floating down the street. In Page Co, 200 residents below the Skyline Lakes Dam were evacuated as the dam threatened to break. Hundreds of roads were closed statewide due to flooding; the Virginia Department of Transportation reported 23 primaries and 250 secondaries blocked off.

States of Emergency were either declared or extended for 12 counties and 2 independent cities.

### **Augusta County**

<b>All</b>	<b>19</b>	<b>0130EST 1200EST</b>							
			<b>0</b>	<b>0</b>	<b>900K</b>				<b>Flash Flood</b>

### **Nelson County**

<b>All</b>	<b>19</b>	<b>0130EST 1200EST</b>							
			<b>0</b>	<b>0</b>					<b>Flash Flood</b>

### **Albemarle County**

<b>All</b>	<b>19</b>	<b>0130EST 1200EST</b>							
			<b>1</b>	<b>0</b>					<b>Flash Flood</b>

M?VE

### **Greene County**

<b>All</b>	<b>19</b>	<b>0130EST 1200EST</b>							
			<b>0</b>	<b>0</b>	<b>1K</b>				<b>Flash Flood</b>

### **Madison County**

<b>All</b>	<b>19</b>	<b>0130EST 1200EST</b>							
			<b>0</b>	<b>0</b>					<b>Flash Flood</b>



# National Weather Service

## Storm Data and Unusual Weather Phenomena



January 1996

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed    Injured		Estimated Damage Property    Crops		Character of Storm
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### VIRGINIA, North

#### Page County

All	19	0130EST 1200EST			0	0	700K		Flash Flood
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#### Rappahannock County

All	19	0130EST 1200EST			0	0			Flash Flood
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#### VAZ025>027-029>031-038>042-050>051-053>056

**Augusta - Rockingham - Shenandoah - Page - Warren - Clarke - Greene - Madison - Rappahannock - Fauquier - Loudoun - Orange - Culpeper - Fairfax - Arlington - Stafford - Spotsylvania**

19 22	0130EST 1630EST			4	0	15M	81K	Flood
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\*\*\*River Flooding\*\*\*

High dewpoint temperatures melted most of the snow on the ground within 12 hours. The snow pack had a liquid equivalent between 2 to 3 inches. Snowmelt, combined with 1 to 3 inches of rain (some locations received nearly 5 inches), caused the worst regional flooding in over 10 years. River flooding began during the flood/flash flood event along the headwaters of all basins and continued downstream through the 22nd. Crests ranged from 3 to 21 feet above flood stage.

High water caused millions of dollars in damage, closed roads, destroyed homes and businesses, and forced the evacuation of several towns. Four people were rescued by the National Park Service and Fairfax County Fire Department at Great Falls (VAZ053) when they wandered onto the rocks to view the raging Potomac and became stranded. Several kayakers were also rescued while trying to sail the rough waters. Although low-water bridges remained closed, a vehicle carrying three teenagers and one adult dared the high waters of the Hazel River (VAZ051) -- and lost. All four perished as the automobile was swept downstream.

Flood waters covered Union Street and the lower part of King Street along the river in Old Town Alexandria (VAZ053), and affected Washington National Airport, but not the runways. The city of Waynesboro (VAZ025) estimated \$3 million in damage (\$1 million to residential areas; \$2 million to businesses). In Rockingham Co (VAZ025), \$2.2 million in damage was attributed to the loss of inventory at Hartz Corporation, an apparel manufacturer. High water also caused \$70 thousand in damage to Opequon Water Reclamation Facility in Frederick Co (VAZ028).

Refer to Flood/Flash Flood events in this report for a more detailed breakdown of damage estimates. M20VE, M16VE, F15VE, F14VE

#### Highland County

All	19	0400EST 1200EST			0	0			Flash Flood
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#### Shenandoah County

All	19	0500EST 1300EST			0	0	27M		Flash Flood
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#### Frederick County

All	19	0500EST 1300EST			0	0	2M		Flash Flood
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#### Warren County

All	19	0600EST 1300EST			0	0	2M		Flash Flood
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#### Clarke County

All	19	0600EST 1300EST			0	0	600K		Flash Flood
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#### Loudoun County

All	19	0700EST 1300EST			0	0	1M		Flash Flood
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An unprecedented combination, in recent history, of unseasonably warm, humid air overriding a dense snowpack estimated between 12 and 18 inches (but up to 2 feet or more at higher elevations) caused nearly the entire pack to vanish in a 12-hour period. The unseasonably warm air was drawn northward around the circulation of a deepening storm west of the Appalachians late on the 18th and early on the 19th. The melting snow and additional rainfall produced widespread flooding and flash flooding on the 19th.

Strong low-level southeast flow developed by late afternoon on the 18th. Initially, colder temperatures in sheltered valleys slowed the rate of snow melt while the warm moist air mass attacked the snow pack at higher elevations. By mid-evening, however, even the lower elevations were warming rapidly. Flash flooding began at around the same time as the onset of heavy pre-frontal rains. Heavier showers fell over the same areas between 0400 and 0800EST, causing acute and widespread flooding and flash flooding.





# National Weather Service

## Storm Data and Unusual Weather Phenomena



January 1996

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

### VIRGINIA, North

Some areas received between 2 and 4 inches of rain during this period. Thunderstorms developed as the line moved into eastern Loudoun Co between 0900 and 0930EST. Some of the higher totals reported by automated rain gages (including some snow melt) were nearly 5 inches. Monterey (Highland Co) received 4.71 inches, Front Royal (Frederick Co) had 4.32 inches, Hogback Mountain (Warren Co) reported 3.76 inches, and Woodstock (Shenandoah Co) had 2.43 inches.

Some of the most pronounced damage occurred in Shenandoah Co near the town of Woodstock. One hundred acres of farmland were inundated, a reported 799 homes sustained damage from flood waters, as did a restaurant in Edinburg. There were numerous water rescues, but no fatalities were reported. Numerous local roads were closed, as were several state and federal highways, due to high standing water or creeks raging out of their banks.

<b>Fauquier County</b>									
All	19	0700EST 1300EST			0	0	200K		Flash Flood
<b>Culpeper County</b>									
All	19	0800EST 1300EST			0	0			Flash Flood
<b>Orange County</b>									
All	19	0800EST 1300EST			0	0			Flash Flood
<b>Fairfax County</b>									
All	19	0900EST 1300EST			0	0			Flash Flood
<b>Prince William County</b>									
All	19	0900EST 1300EST			0	0	10K		Flash Flood
<b>Stafford County</b>									
All	19	1000EST 1400EST			0	0	5K		Flash Flood
<b>Spotsylvania County</b>									
All	19	1000EST 1400EST			0	0	3K		Flash Flood
<b>Arlington County</b>									
All	19	1100EST 1400EST			0	0	3K		Flash Flood

An unusually intense squall line, feeding on an unseasonably warm moist tropical air mass, dumped an estimated 1.5 to 2.5 inches of rain in a two-hour period during the mid and late morning of the 19th, causing widespread flash flooding. The rain fell on oversaturated soil, a result of the previous night's rapid snow melt. During the overnight hours, the remaining water-logged snow pack of 3 to 8 inches was eaten away by strong southeasterly winds which carried low 60s temperatures and near 100 percent relative humidity into the region.

Prior to the onset of heavy rain, numerous creeks and streams were near bank full due to the rapid snow melt. Minor flash flooding began at most locations in the piedmont prior to the squall line; the more serious flooding was associated with the line's passage from west to east, between 0900 and 1130EST.

In Orange Co, as in many other counties, schools were closed early due to the continued flood threat. One school reported damage from a leaking roof. In Stafford Co, four roads were closed early due to high water. In Fairfax Co, several automobiles were swept off area roadways inundated by raging creeks and streams. One of the more prone locations was along state route 7 near the Difficult Run (just south of Great Falls). Three persons were rescued from stranded vehicles between 1000 and 1200EST. Two others escaped. No injuries were reported, but all 5 persons were treated at the scene for hypothermia. The combination of flooding rains, gusty winds, and lightning knocked out power to around 8000 Virginia Power customers in the Washington, DC suburbs.

After the storm and associated cold front passed, gusty northwest winds 35 to 40 mph blew down a few trees rendered unstable by waterlogged soil. A 100-foot tree fell in Culpeper Co, near the Rappahannock Co line. Numerous creeks and streams remained out of their banks well into the evening, even as temperatures plummeted into the upper teens.

<b>Augusta County</b>									
Southern	27	0430EST 0630EST			0	0	10K		Flash Flood
<b>Rappahannock County</b>									
Western	27	0800EST 0900EST			0	0	2K		Flash Flood



# National Weather Service

## Storm Data and Unusual Weather Phenomena



January 1996

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Number of Persons Injured	Estimated Damage Property	Estimated Damage Crops	Character of Storm
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### VIRGINIA, North

Isolated flash flooding was reported in western Virginia early on the 27th. The most serious flooding occurred in southern Augusta Co, where high water was reported in low-lying areas, and 15 secondary roads were closed. In Rappahannock Co, the Thornton River was out of its banks and covered a low-water bridge, forcing one road closure.

### WEST VIRGINIA, East

**WVZ048>055**

**Grant - Mineral - Hampshire - Morgan - Berkeley - Jefferson - Pendleton - Hardy**

<b>07</b>	<b>0100EST</b>								
<b>08</b>	<b>1100EST</b>				<b>0</b>	<b>0</b>			<b>Blizzard</b>

An historic winter storm, known as the "Blizzard of '96", crippled all of eastern West Virginia during the first full weekend of January. In general, snow totals ranged from 28 to 36 inches at most locations in the Potomac Highlands and the eastern Panhandle. Gusty winds produced drifts between 6 and 10 feet. The storm produced the largest storm totals since the "Superstorm of March 12-14, 1993", which dumped similar amounts of snow across the region.

The storm was induced by a digging upper level trough over the eastern Great Plains. At the surface, an inverted trough extended from the Gulf of Mexico through the Deep South. Surface pressures began falling as the upper trough approached on the afternoon of the 7th. Meanwhile, confluent flow, behind an upper-level arctic vortex over the Canadian Maritimes, maintained strong (1034 mb) surface high pressure over northern New York state. As the upper-level trough approached the southeast U.S. on the 8th, a new surface low developed along the Georgia coast. The low deepened explosively while the arctic high remained in place. Copious Gulf of Mexico and Atlantic moisture was entrained into the system, producing heavy snow; the increasing gradient between the intensifying low and the arctic high caused winds to strengthen to 25 mph with gusts to 35 mph.

The system moved slowly from South Carolina to the mouth of the Chesapeake Bay overnight on the 7th. The slow movement prolonged near-blizzard conditions into the 8th. The storm finally moved towards New England later on the 8th, ending the snow but maintaining gusty north winds (and substantial blowing and drifting snow) until evening.

All major highways were effectively closed through the 7th, as snow removal equipment fought a losing battle with the considerable blowing and drifting snow. All state and local governments, as well as all area school districts, were closed Monday (the 8th) and Tuesday (the 9th).

**WVZ048>055**

**Grant - Mineral - Hampshire - Morgan - Berkeley - Jefferson - Pendleton - Hardy**

<b>12</b>	<b>0700EST</b>								
	<b>1200EST</b>				<b>0</b>	<b>0</b>			<b>Heavy Snow</b>

Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across eastern West Virginia. Total snowfall ranged from 5 to 8 inches, with some spots in the eastern Panhandle reporting up to 10 inches. The storm replenished snow depths, which had compacted during the week, back up to 30 to 36 inches.

The storm developed as an area of low pressure in the midwest, which became an elongated trough extending from the Tennessee Valley through southeastern North Carolina. As the upper-level trough approached, the North Carolina low became dominant, intensifying slowly as it moved through the mouth of the Chesapeake Bay, then to off the Delaware coast by late afternoon. Unlike the "Blizzard of '96", a lack of cold air behind the surface low, combined with a significantly weaker and more progressive upper-level trough, kept the surface low from intensifying rapidly. Nonetheless, eastern West Virginia received some of the highest snow totals in the East.

Travel was slowed early in the day, but by evening main arteries were clear.

#### **Mineral County**

<b>All</b>	<b>19</b>	<b>0300EST</b>							
		<b>1200EST</b>			<b>0</b>	<b>0</b>			<b>Flash Flood</b>

#### **Grant County**

<b>All</b>	<b>19</b>	<b>0300EST</b>							
		<b>1200EST</b>			<b>0</b>	<b>0</b>			<b>Flash Flood</b>

#### **Pendleton County**

<b>All</b>	<b>19</b>	<b>0400EST</b>							
		<b>1200EST</b>			<b>0</b>	<b>0</b>	<b>10M</b>		<b>Flash Flood</b>

#### **Hardy County**

<b>All</b>	<b>19</b>	<b>0400EST</b>							
		<b>1200EST</b>			<b>0</b>	<b>0</b>	<b>9.5M</b>		<b>Flash Flood</b>

#### **Hampshire County**

<b>All</b>	<b>19</b>	<b>0400EST</b>							
		<b>1200EST</b>			<b>0</b>	<b>0</b>			<b>Flash Flood</b>



# National Weather Service

## Storm Data and Unusual Weather Phenomena



January 1996

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Number of Persons Injured	Estimated Damage Property	Estimated Damage Crops	Character of Storm
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### WEST VIRGINIA, East

#### Morgan County

All	19	0500EST 1200EST			1	0	500K		Flash Flood
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F51VE

#### Berkeley County

All	19	0600EST 1200EST			0	0			Flash Flood
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#### Jefferson County

All	19	0600EST 1200EST			0	0			Flash Flood
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An unprecedented combination, in recent history, of unseasonably warm, humid air overriding a dense snow pack estimated between 12 and 18 inches (but up to 2 feet of more at higher elevations) caused nearly all of the pack to vanish in a 12-hour period. The unseasonably warm air was drawn northward around the circulation of a deepening storm west of the Appalachians late on the 18th and early on the 19th. The melting snow, combined with downpours, produced catastrophic flooding over portions of the Potomac Highlands on the 19th.

Strong low-level southeast flow developed by late afternoon on the 18th. Initially, colder temperatures in sheltered valleys slowed the rate of snow melt while the warm moist air mass attacked the snow pack at higher elevations. By mid-evening, however, even lower elevations were warming rapidly. Flash flooding began at around the same time as the onset of heavy pre-frontal rains. Heavier showers fell over the same areas between 0400 and 0800EST, causing acute and widespread flooding and flash flooding to occur. Some areas received between 3 and 5 inches of rain during this period.

The most serious flooding was reported in the Potomac Highlands, with Pendleton and Grant Cos receiving the worst of it. The towns of Franklin and Circleville (Pendleton Co), and Petersburg (Grant Co) were evacuated at around 0800EST. Damage was estimated to be around \$10 million in Pendleton Co alone. High water from an overflowing creek knocked homes off their foundations in Mathias (Hardy Co); major flooding was reported countywide, where the highest storm total rainfall was noted (5 inches). Flooding was also acute in Morgan Co, where Berkeley Springs was inundated by rising waters.

Across the entire region, numerous creeks and streams were out of their banks well into Friday morning, closing roads, damaging homes and businesses, and causing mud and debris slides. One death was reported by Morgan Co officials. A 51 year old woman drove through high water signs and her vehicle stalled. She inexplicably left her vehicle and tried to seek safety, but was swept to her death in the current.

#### WVZ048>055

#### Grant - Mineral - Hampshire - Morgan - Berkeley - Jefferson - Pendleton - Hardy

19	0600EST				0	0	20M	150K	Flood
21	0600EST								

\*\*\* River Flooding \*\*\*

High dew point temperatures melted most of the snow on the ground within 12 hours early on the 19th. The pack had a liquid equivalent of 2 to 3 inches. The snow melt, combined with 1 to 3 inches of rainfall (some locations received 5 inches), produced the worst regional flooding since 1985. River flooding began during the flood/flash flood event along the headwaters of the basin and continued downstream through the 21st. Crests ranged from 3 to 21 feet above flood stage. A flood of record was noted on Opequon Creek near Martinsburg (WVZ052).

High water caused millions of dollars in damage, closed roads, destroyed homes and businesses, and caused several towns to be evacuated. The National Park Service at historic Harpers Ferry (WVZ053) estimated damage to the park (and new construction within) at \$3 million, comparable to the 1985 damage figures. There was peripheral damage to other park property and cultural resources in Lower Town and along both the Shenandoah and Potomac rivers - from the Guard Locks on the Potomac Canal, to the rivers' confluence point. Additional damage was noted at the remaining bridge piers; on Virginius Island and its ruins; along and in other canals; and into Shenandoah Street/Lower Town sections.

Refer to Flood/Flash Flood section of this report for a more detailed breakdown of damage estimates.

#### Pendleton County

Sugar Grove	27	0700EST 0900EST			0	0			Flash Flood
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Isolated flash flooding was reported in the Potomac Highlands early on the 27th. In Pendleton Co, creeks flooded several low-water bridges near the town of Sugar Grove.