

**WINTER STORM SUMMARY FOR
MARCH 12, 2010 TO MARCH 15, 2010 EVENT**

Synopsis

A severe nor'easter impacted the region from Friday March 12th through Monday March 15th. A slow moving upper level low drifted into the eastern United States and spawned a surface low pressure system off the South Carolina coast on the morning of Friday March 12th. Light to moderate rain spread north across the entire region through the day on Friday as the low pressure drifted north and slowly strengthened. With a strong fetch off the Atlantic Ocean, rainfall rates became heavy overnight Friday and through the evening of Saturday March 13th, resulting in small stream and eventually major river flooding. Meanwhile a high pressure system anchored in the Canadian Maritimes also strengthened and a very strong pressure gradient developed between these pressure systems overnight Friday. This resulted in strong, damaging easterly winds across much of the area through the day Saturday, especially along the New Jersey coast where minor to moderate coastal flooding also occurred. The strong winds and widespread heavy rains slackened off overnight Saturday as the surface low was stationary across the Delmarva region. Showers and even a few thunderstorms continued to rotate in off of the Atlantic through the day on Sunday March 14th and continued into Monday March 15th as the low slowly moved eastward and finally out to sea by Tuesday morning March 16th.

Watches/Warnings/Advisories

Model guidance for days in advance was consistently showing a heavy rainfall threat for the mid-Atlantic region during the event period and the potential for flooding was the overall major concern leading into the storm. A Flood Watch was first issued at 344pm EST on Thursday March 11th and included the entire Mount Holly county warning area. It remained in place until 349am EDT Sunday March 15th when it was lifted, but not before numerous Flood Warnings had been issued for areas along small streams and rivers. Several counties in eastern Pennsylvania, northern Delaware and New Jersey were first issued Flood Warnings starting Saturday afternoon on March 13th as small streams and tributaries initially filled and went above flood stage in response to the copious amounts of rainfall. Eventually many downstream major tributaries would rise far above flood stage as well, particularly in New Jersey where the worst of the flooding was observed. A Flood Warning was first issued for the Passaic River basin affecting Morris and Somerset counties in New Jersey at 316pm EST on Saturday. Major flooding on the main branch Passaic continued through the following week and the warnings were not canceled until the waters fell below flood stage in the worst spots late Sunday March 21st. A Flood Warning was first issued within the Raritan River basin affecting Somerset and Middlesex counties in New Jersey beginning 331pm EST on Saturday March 13th. The Flood Warnings were cancelled when the Raritan River and upstream Millstone River waters subsided below flood stage on the afternoon of Monday March 15th. In Burlington county in New Jersey, a Flood Warning was first issued for the North Branch Rancocas Creek in Pemberton at 326pm EST on Saturday March 13th. The Flood Warning did not expire until the morning of Friday March 19th. Flood Warnings were issued for the majority of the county warning area at some point during the event due to smaller creeks and rivers overflowing their banks.

Damaging high winds also occurred in the county warning area on Saturday March 13th. A Wind Advisory was first issued at 1120am EST on Friday March 12th for the following counties: Kent and Sussex in Delaware; Cape May, Atlantic, southeastern Burlington, Ocean, Monmouth and Middlesex in New Jersey. At 1225pm EST on Saturday March 13th the Wind Advisory was cancelled for Kent and Sussex counties in

Delaware as the core of strong winds had already moved through these most southern areas. Further north, the Wind Advisories continued for the other coastal counties previously mentioned, and were also expanded inland to include the entire rest of the county warning area, excluding Kent, Queen Anne's, Caroline and Talbot counties in eastern Maryland. However, by 201pm EST on Saturday stronger wind gusts were occurring particularly near the coast where the following areas were upgraded to a High Wind Warning: coastal Cape May, Atlantic, coastal Ocean and eastern Monmouth counties in New Jersey. At 431pm EST on Saturday the core of strongest winds continued to move to the north and were proving to be not only stronger, but also more widespread than initially anticipated. The High Wind Warnings were expanded inland to include all of Burlington, Ocean, Monmouth, Mercer and Middlesex counties in New Jersey. Further south as winds died down, High Wind Warnings were downgraded to a Wind Advisory in coastal Cape May and Atlantic counties in New Jersey while the Wind Advisories were cancelled for the following areas: New Castle county in Delaware, Cecil County in eastern Maryland, Cumberland, Salem and Cape May counties in New Jersey. By Saturday evening winds were continuing to let up from southwest to northeast. At 749pm EST the High Wind Warning was downgraded to a Wind Advisory for Ocean, Burlington, and Mercer counties; however they continued for Monmouth and Middlesex counties. Also at this time the Wind Advisories were cancelled for Atlantic, Gloucester and Camden Counties in New Jersey; Berks, Chester, Montgomery, Delaware and Philadelphia Counties in Pennsylvania. The Wind Advisory continued elsewhere to the north. At 931 EST the last of these High Wind Warnings were cancelled and Wind Advisories continued only for Monmouth, Middlesex, Somerset and Morris Counties in New Jersey as they were cancelled elsewhere. Finally, by 100am EST on Sunday March 14th the last Wind Advisory was allowed to expire.

Precipitation/Temperatures/Winds

Light to moderate rainfall overspread the area from south to north starting early Friday morning March 12th and continued through the day. Rain became heavy throughout most of the area from overnight Friday through the evening of Saturday March 13th before significantly letting up. Periods of showers and areas of steadier rain would continue to rotate in off of the Atlantic Ocean through the day on Monday March 15th, adding to the already impressive rainfall totals. The heaviest rainfall amounts averaging 4-6 inches with isolated amounts to 7 inches were reported in the northeastern sections of the Mount Holly county warning area, including the northern New Jersey coastline, east-central New Jersey and northeastern New Jersey. Rainfall totals averaged 3-5 inches with isolated higher amounts in southern New Jersey, west central New Jersey and extreme southeastern Pennsylvania. In a band stretching from northwest New Jersey to just northwest of Philadelphia and down into Delaware and eastern Maryland, lighter amounts averaging 2-4 inches were observed. The lightest amounts were observed over the western sections of the Mount Holly area in the Pennsylvania counties of Berks, Lehigh, Carbon and Monroe where only 1-3 inches fell.

In response to the widespread heavy rainfall, many small creeks and eventually some larger rivers across Delaware, southeastern Pennsylvania, eastern Maryland and New Jersey would rise above their banks resulting in widespread minor to major flooding. The Passaic and Raritan River basins in particular experienced the most severe flooding. In the Passaic River basin affecting Morris and Somerset counties in New Jersey, a historic flood crest was achieved along the Pompton River at Pompton Plains on Sunday afternoon March 14th. At the same time major flooding was also cresting along the Ramapo and Rockaway River branches. Along the main stream Passaic River, high end moderate flooding was achieved at both Chatham and Millington by Monday morning March 15th. Further downstream along the Passaic River at Little Falls and Pine Brook, a top 3 historic flood crest and top 4 historic flood crest respectively occurred. Major flood stage was met at both these sites early Monday morning March 15th and occurred into Friday

March 19th, when moderate and then minor flooding continued through the weekend of March 20th-21st. In the Raritan River basin affecting Somerset and Middlesex counties in New Jersey, the Millstone River at Blackwells Mills went above flood stage by 7pm Saturday evening and peaked above major flood stage overnight, reaching a top 5 historical crest. The waters receded below flood stage by Tuesday morning March 16th. Along the North Branch Raritan River in Raritan, high end moderate flooding crested early Sunday Morning and receded below flood stage later that afternoon. Later along the main branch Raritan River, major flooding occurred during the day on Sunday at both Bound Brook and Manville where a 4th highest historical crest and 5th highest historical crest respectively was observed. The Raritan River waters subsided below flood stage by the afternoon on Monday March 15th. Finally, in Burlington county significant river flooding occurred along the North Branch Rancocas Creek at Pemberton. the Rancocas crested at moderate flood stage during the evening of Monday March 15th, and persistently remained above flood stage through the morning of Friday March 19th. Flooding occurred for the majority of the county warning area at some point during the event due to smaller creeks and rivers overflowing their banks. In certain vulnerable areas, flooding was further exacerbated when excessive runoff combined with coastal tidal surges.

High winds out of the easterly direction occurred on Saturday March 13th and were generated by the pressure gradient between the strengthening low pressure system to the south and a strengthening high pressure system to the northeast. The most impressive winds within the county warning area occurred during Saturday morning and early afternoon near the coast in Delaware and Southern New Jersey, and later during the afternoon and evening further north along the northern New Jersey coastline near the Raritan Bay and extending well inland over central and northeastern New Jersey. Some of the highest wind gusts recorded include 73 mph at the Marina in Atlantic City, NJ; 70 mph at Keansburg, NJ; 67 mph at Atlantic City International Airport; 67 mph at Sandy Hook, NJ; 67 mph at Lakehurst, NJ; 67 mph at Seaside Heights, NJ; 65 mph at Brant Beach, NJ; 65 mph at Chatsworth, NJ; 65mph at Monmouth Beach, NJ; 63mph at Trenton, NJ; 63 mph at McGuire AFB in Wrightstown, NJ; and 58 mph at Dover AFB in Dover, DE. Along with these frequent damaging wind gusts, sustained winds in the hardest hit areas were between 30-50 mph for several hours at the height of the storm. Elsewhere across the area winds were weaker, but still gusted between 40-55 mph. The strong fetch of wind off of the cool Atlantic Ocean also kept temperatures throughout the area ranging from the low 40s to low 50s for the duration of the storm.

Significant Impacts/Aspects

The strong winds and heavy rainfall produced widespread damage and impacts across the Mount Holly county warning area. Even before rivers rose above flood stage, widespread flooding because of the heavy rainfall rates was forcing the closure of many major and secondary area roadways. New Jersey was particularly hard hit with flooding and wind damage and a state of emergency was declared as a result. The strong winds which frequently gusted 50-60 mph in most areas and up to 70 mph in spots wreaked the most havoc statewide, toppling numerous trees onto roads, cars, houses, and power lines causing widespread power outages. In Middlesex County, a large tree fell on a vehicle injuring two people. Wind and rain forced the closure of parts of the New Jersey Turnpike, a near complete shutdown of the NJ-Transit system, and toppled a high rise crane in Atlantic City, NJ causing dangerous debris to drop to the ground. PSE&G reported about 459,000 customers lost power during the height of the storm on Saturday March 13th, making it the worst storm in the utility's history. According to Karen A. Johnson, a PSE&G spokeswoman, the previous worst storm was Tropical Storm David in September, 1979 when 432,000 lost power. On Friday morning March 19th, nearly a week after the storm, 2,200 people in the state were still without power and many folks along the Passaic river in northeastern New Jersey still were still dealing with major flooding.

Thousands of businesses and residents in flood prone areas across the state received damage where major flooding occurred. Officials say more than 1,300 buildings in Morris County alone were damaged because of flooding along the Passaic, Ramapo and Pompton rivers. Preliminary estimates from flooding and wind damage in New Jersey alone are in the millions of dollars. Elsewhere in the area, flooding and wind damage was not as severe, but impacts from minor river flooding and downed trees and power lines were still felt in many areas. In southeastern Pennsylvania, PECO said that 135,000 customers lost power in the Philadelphia region, with Bucks county bearing the brunt. All of these customers had their power restored by Tuesday March 16th.

Widespread minor tidal flooding occurred along the coasts of New Jersey and Delaware on the 13th. During the evening high tide on the 13th, moderate tidal flooding occurred in Monmouth County, New Jersey. The tide gauge at Sandy Hook reached 8.34 feet MLLW.

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PUBLIC INFORMATION STATEMENT
 SPOTTER REPORTS
 NATIONAL WEATHER SERVICE MOUNT HOLLY NJ
 405 AM EDT SUN MAR 14 2010

THE FOLLOWING ARE UNOFFICIAL OBSERVATIONS TAKEN DURING THE PAST 48 HOURS FOR THE STORM THAT HAS BEEN AFFECTING OUR REGION. APPRECIATION IS EXTENDED TO HIGHWAY DEPARTMENTS...COOPERATIVE OBSERVERS...SKYWARN SPOTTERS AND MEDIA FOR THESE REPORTS. THIS SUMMARY IS ALSO AVAILABLE ON OUR HOME PAGE AT WEATHER.GOV/PHI

*****STORM TOTAL RAINFALL*****

LOCATION	STORM TOTAL RAINFALL (INCHES)	TIME/DATE OF MEASUREMENT	COMMENTS
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DELAWARE

...KENT COUNTY...
 WEST DOVER HUNDRED 3.10 700 PM 3/13

...NEW CASTLE COUNTY...
 NEWARK 2.54 400 PM 3/13
 BEAR 2.23 745 PM 3/13
 WILMINGTON 1.92 401 AM 3/14 COUNTY AIRPORT
 CLAYMONT 1.86 300 PM 3/13

...SUSSEX COUNTY...

LEWES	3.01	430 PM	3/13
GEORGETOWN	2.25	402 AM	3/14

NEW JERSEY

...ATLANTIC COUNTY...

HAMMONTON	4.05	430 PM	3/13
ESTELL MANOR	3.92	400 PM	3/13
ATLANTIC CITY	2.67	401 AM	3/14 INTERNATIONAL AIRPORT

...BURLINGTON COUNTY...

WILLINGBORO	2.69	543 PM	3/13
MOUNT HOLLY NWS	2.16	700 PM	3/13
MARLTON	2.00	155 PM	3/13

...CAMDEN COUNTY...

MERCHANTVILLE	4.00	430 PM	3/13
BLACKWOOD	3.52	335 PM	3/13

...CAPE MAY COUNTY...

ERMA	2.38	200 PM	3/13
GREEN CREEK	2.25	200 PM	3/13
WEST CAPE MAY	2.08	228 PM	3/13
SEAVILLE	1.98	200 PM	3/13

...CUMBERLAND COUNTY...

NEWPORT	2.50	1256 PM	3/13
SHILOH	1.32	200 PM	3/13

...GLOUCESTER COUNTY...

SEWELL	4.00	500 PM	3/13
SEWELL	4.00	1122 PM	3/13

...HUNTERDON COUNTY...

LEBANON	2.47	355 AM	3/14
TEWKSBURY	1.88	548 PM	3/13 HELL MOUNTAIN

...MERCER COUNTY...

EWING	2.13	200 PM	3/13
TRENTON	1.94	400 AM	3/14

...MIDDLESEX COUNTY...

ISELIN	5.51	1200 AM	3/14
METUCHEN	4.00	524 PM	3/13

...OCEAN COUNTY...

PINE BEACH 1.80 700 AM 3/13

...SOMERSET COUNTY...

BRIDGEWATER 4.15 1120 PM 3/13

...SUSSEX COUNTY...

HIGH POINT STATE 1.25 430 PM 3/13

...WARREN COUNTY...

PHILLIPSBURG 1.45 730 PM 3/13

PHILLIPSBURG 1.45 1121 PM 3/13

PENNSYLVANIA

...BERKS COUNTY...

READING 1.19 401 AM 3/14

READING 1.10 700 PM 3/13

...BUCKS COUNTY...

PERKASIE 1.55 410 PM 3/13

...DELAWARE COUNTY...

DREXEL HILL 3.80 440 PM 3/13

FOLCROFT 3.70 400 PM 3/13

SECANE 3.10 400 PM 3/13

BOOTHWYN 3.00 400 PM 3/13

...LEHIGH COUNTY...

ALLENTOWN 1.77 359 AM 3/14 INTERNATIONAL AIRPORT

SLATINGTON 1.07 730 PM 3/13

...MONROE COUNTY...

MT. POCONO 1.37 402 AM 3/14

...MONTGOMERY COUNTY...

EAGLEVILLE 2.83 1121 PM 3/13

...PHILADELPHIA COUNTY...

PHILADELPHIA 3.11 700 PM 3/13 INTERNATIONAL AIRPORT

PHILADELPHIA 3.11 358 AM 3/14 INTERNATIONAL AIRPORT

*****PEAK WIND GUST*****

LOCATION	PEAK WIND	TIME/DATE	COMMENTS
	GUST	OF	
	(MPH)	MEASUREMENT	

DELAWARE

...KENT COUNTY...

DOVER AFB 58 526 AM 3/13

...NEW CASTLE COUNTY...

DELAWARE CITY 46 1100 AM 3/13

WILMINGTON 45 1056 AM 3/13

...SUSSEX COUNTY...

FRANKFORD 50 723 AM 3/13

GEORGETOWN 48 728 AM 3/13

PRIME HOOK NATIONAL 44 400 AM 3/13

MARYLAND

...CECIL COUNTY...

CHESAPEAKE CITY 40 700 AM 3/13

...TALBOT COUNTY...

EASTON 43 306 AM 3/13

NEW JERSEY

...ATLANTIC COUNTY...

ATLANTIC CITY 73 300 PM 3/13 MARINA

ATLANTIC CITY 67 237 PM 3/13 INTERNATIONAL AIRPORT

ATLANTIC CITY 67 239 PM 3/13 INTERNATIONAL AIRPORT

OCEANVILLE 53 300 PM 3/13

...BURLINGTON COUNTY...

CHATSWORTH 65 400 PM 3/13

WRIGHTST/MCGUIRE 63 349 PM 3/13

BURLINGTON 61 100 PM 3/13

SOUTHAMPTON 54 236 PM 3/13

MOUNT HOLLY 53 426 PM 3/13

...CAMDEN COUNTY...

JACKSON 40 300 PM 3/13

...CAPE MAY COUNTY...

OCEAN CITY 62 1255 PM 3/13

CAPE MAY 44 100 PM 3/13 FERRY

WOODBINE 41 900 AM 3/13

WILDWOOD 40 355 AM 3/13

...CUMBERLAND COUNTY...

MILLVILLE 48 914 AM 3/13

NEWPORT	41	1256	PM	3/13
UPPER DEERFIELD	41	1100	AM	3/13

...HUNTERDON COUNTY...

PITTSTOWN	45	500	PM	3/13
CALIFON	43	500	PM	3/13

...MERCER COUNTY...

LAWRENCEVILLE	63	354	PM	3/13
TRENTON	63	317	PM	3/13
EWING	56	200	PM	3/13

...MIDDLESEX COUNTY...

PERTH AMBOY	62	310	PM	3/13
DEANS	51	400	PM	3/13

...MONMOUTH COUNTY...

KEANSBURG	70	400	PM	3/13	
FORT HANCOCK	67	255	PM	3/13	SANDY HOOK
MONMOUTH BEACH	65	300	PM	3/13	
BELMAR/FARMDALE	59	155	PM	3/13	
SANDY HOOK	58	300	PM	3/13	
SEA GIRT	55	300	PM	3/13	
CREAM RIDGE	48	300	PM	3/13	

...MORRIS COUNTY...

MORRISTOWN MUNI	51	445	PM	3/13
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...OCEAN COUNTY...

LAKEHURST NAS	67	258	PM	3/13	
SEASIDE HEIGHTS	67	245	PM	3/13	
BRANT BEACH	65	159	PM	3/13	
HARVEY CEDARS	63	200	PM	3/13	
BARNEGAT BAY	61	315	PM	3/13	MARKER 74
BAYVILLE	60	415	PM	3/13	
TUCKERTON	55	130	PM	3/13	
TOMS RIVER	53	255	PM	3/13	
WEST CREEK	47	100	PM	3/13	

...SOMERSET COUNTY...

BRIDGEWATER	45	1120	PM	3/13
SOMERVILLE	43	406	PM	3/13

PENNSYLVANIA

...BERKS COUNTY...

READING	48	632	AM	3/13
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...BUCKS COUNTY...

DOYLESTOWN	41	245 PM	3/13
QUAKERTOWN	40	1055 AM	3/13

...CHESTER COUNTY...

COATESVILLE	41	820 AM	3/13
LONDON GROVE	41	600 AM	3/13

...LEHIGH COUNTY...

ALLENTOWN	56	525 PM	3/13	INTERNATIONAL AIRPORT
ALLENTOWN	46	520 PM	3/13	QUEEN CITY MUNICIPAL

...MONROE COUNTY...

MT. POCONO	47	445 PM	3/13
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...MONTGOMERY COUNTY...

WILLOW GROVE NAS	56	307 PM	3/13
PHILLY WINGS F	55	440 PM	3/13
POTTSTOWN	46	552 PM	3/13

...PHILADELPHIA COUNTY...

PHILADELPHIA/NE	56	344 PM	3/13	
PHILADELPHIA	47	1214 PM	3/13	INTERNATIONAL AIRPORT

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