NWS Form (04-2006) (PRES. BY NWS	E-5 U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION Instruction 10-924) NATIONAL WEATHER SERVICE	HYDROLOGIC S	SERVICE AREA (HSA)	
		WFO Caribou, Maine		
		REPORT FOR: MONTH	YEAR	
		December	2023	
TO:	Hydrologic Information Center, W/OS31	SIGNATURE		
NO/ 132	NOAA's National Weather Service 1325 East West Highway	James Sinko Hydrology P	o - Meteorologist rogram Manager	
		DATE		
		January 13,	2024	
When no flo	oding occurs, include missellaneous river conditions below the small bey	auch og gignifigg	nt rises record low stages iss	

When no flooding occurs, include miscellaneous river conditions below the small box, such as significant rises, record low stages, ice conditions, snow cover, droughts, and hydrologic products issued (NWS Instruction 10-924).

An X inside this box indicates that no flooding occurred within this hydrologic service area.

December 2023

December 2023 featured a significant pattern shift with the North Atlantic Oscillation (NAO) monthly mean going very positive at +1.94SD. At the same time the Pacific North American Pattern (PNA) remained positive for the 7th month in a row. This pattern resulted within a strong positive El Niño-Southern Oscillation (ENSO) eastern regime that saw increasing NINO 3.4 SST anomalies. Looking at the reanalysis of December via the 500mb Geopotential Heights below it was notable zonal flow across Maine supporting that the month ended significantly above normal temperatures. This pattern resulted in highly anomalous higher 500mb heights over Maine in the month of December as seen below. The 500mb trough was focused to the east but did allow brief cold snaps but nothing of prolonged significance unlike November 2023. The southern branch of the Jet Stream was the dominant storm system focus.



Source: NOAA Physical Sciences Laboratory

Location	Total Precip	Normal Precip	Departure from Normal	% of Normal	Snowfall	Normal Snowfall	Departure from Normal	Greatest Snow Depth	Monthly Average Snow Depth
Frenchville*	2.67	2.27	0.40	117.6%					
Fort Kent	4.49	3.38	1.11	132.8%	9.9	22.3	-12.4	7	3.5
Van Buren	3.79	3.38	0.41	112.1%	4.8	20.7	-15.9	2	0.5
Caribou	3.47	3.60	-0.13	96.4%	9.9	25.2	-15.3	4	1.2
Houlton	4.98	3.37	1.61	147.8%					
Millinocket*	3.64	3.45	0.19	105.5%	10.5			8	1.3
Greenville*	7.33	4.33	3.00	169.3%					
Moosehead*	6.59	3.50	3.09	188.3%	12.5	22.6	-10.1	10	2.9
Corinna	7.24	4.34	2.90	166.8%	8.6	16.5	-7.9	7	1.1
Bangor	7.00	3.72	3.28	188.2%	7.3	14.7	-7.4	6	1.2
Grand Lake Stream	9.32	4.93	4.39	189.0%	5.8	16.6	-10.8	5	0.8
Robbinston*	7.72	6.27	1.45	123.1%	8.6	19.3	-10.7	7	1.2
Topsfield*	7.41	5.20	2.21	142.5%	9.3	24.3	-15.0	5	1.0

Precipitation Totals for Select Locations with all units in inches

*Millinocket snowfall measured at CoOp site, not the ASOS site. Departure data is not available. *Moosehead Site is in GYX CWA *Topsfield Records date back to 2000, *Robbinston Records date back to 1994, *Greenville data gap between 1975 and 1999 *Frenchville ASOS has documented issues with precipitation measurements in the winter months

Rainfall (including melted snowfall) varied from around 90 percent of normal in the northeast portion of the County Warning Area and 200 percent of normal across the southwest. Snowfall was well below average and it was the first Christmas with no snow on the ground in Caribou since 2010. Only 9.9 inches of snow was observed in Caribou all month, which tied with 1947 for the 9th least snowy December on record. The most significant event of the month was a storm on the 18th that produced upwards of 5 inches of rain over the central highlands. More details about the most significant storm of the month below... By the end of the month there was 3 inches of snow on the ground in Caribou, 4 to 7 inches in the Saint John Valley, and up to 9 inches in western portions of the North Woods along and near the Quebec Border. There was 2-4 inches by the end of the month across portions of the Central Highlands, Interior Downeast and into the Moosehead Region. By the end of the month much of Northern Maine had a frost depth of 5-8 inches despite the warm up storm the frost depth didn't change. Frost was completely lost in the Central Highlands and Downeast coast that helped aid in the significant rainfall flooding event. By the last day frost was developing once again in the Central Highlands generally 1-2 inches.

Streamflows... the monthly values ended up mostly around "much above normal" for much of the river gages in the Piscataquis and Penobscot basins, "normal" across much of the remainder basins in Eastern and Northern Maine. We had ice signatures with frazil and some areas of thicker ice across those basins leading up to the December 18th storm. Significant icing was present on the St. John and Aroostook rivers leading up to the December 18th storm. Much of the rivers lost all ice after the December 18th event, however the return to colder temperatures combined with elevated flows producing significant turbulence produced frazil ice on many rivers by December 22nd which continued to the end of the month but flow remained on the move. More on the December Flooding event below.

Groundwater was "Much Above Normal" across the Central Highlands, Downeast, Baxter Region into the St. John Valley including Eastern Aroostook. The only "Normal" to slightly "Above Normal" readings were in the North Woods which was continued from November 2023 since the ground was frozen around 6".

Temperatures... were much warmer than normal and temperatures averaged from 4 to 8 degrees above average. It was the 2nd warmest December on record in Caribou and Houlton, tied for the 3rd warmest in Millinocket, and was the 4th warmest on record in Bangor.

Town/City	Avg Monthly Temperature (°F)	Normal Monthly Temperature (°F)	Departure from Normal (°F)
Frenchville	25.7	19.3	6.4
Fort Kent	24.7	17.0	7.7
Van Buren	26.2	17.3	8.9
Caribou	27.3	19.9	7.4
Houlton	28.0	20.9	7.1
Millinocket	29.0	23.0	6.0
Greenville*	27.2	21.5	5.7
Moosehead	27.2	20.6	6.6
Corinna	30.1	25.0	5.1
Bangor	31.2	25.9	5.3
Grand Lake Stream	32.2	25.8	6.4
Robbinston*	31.0	26.9	4.1
Topsfield*	29.1	23.2	5.9

*Topsfield Records date back to 2000, *Robbinston Records date back to 1994 *Greenville data gap between 1975 and 1999 *Moosehead Site is in GYX CWA on CWA border

In regards to **Drought** monitoring there was no drought classification for the month of December

Read below for specific details & maps of Streamflows, Groundwater Levels, Non-Routine Hydrologic Products issued by WFO Caribou and Drought conditions.





Figure 7: Total Snowfall Departure for December Source: Northeast Regional Climate Center

Figure 8: Average Temperature Departure for December

River	Monthly Mean Flow (cfs)	% Normal (mean)	Percentile Class	Drainage (mi ²)	Years of Record
Big Black River near Depot Mtn	NA	NA	Ice Impacted	171	39
St. John River at Nine Mile Bridge	NA	NA	Ice Impacted	1341	72
Allagash River near Allagash	NA	NA	Ice Impacted	1478	93
St. John River at Dickey	NA	NA	Ice Impacted	2680	78
St. John River at Fort Kent	6906.44	112.94%	Normal	5929	96
Fish River near Fort Kent	1345.75	110.83%	Normal	873	93
Aroostook River near Masardis	NA	NA	Ice Impacted	892	65
Aroostook River at Washburn	NA	NA	Ice Impacted	1654	92
St. Croix River at Vanceboro	757.81	123.75%	Above Normal	413	95
St. Croix River at Baring	3360.24	110.30%	Normal	1374	64
Grand Lake Stream at Grand Lake Stream	273.64	103.92%	Normal	228.3	95
Narraguagus River at Cherryfield	1632.68	236.41%	Much Above Normal	227	74
East Branch Penobscot River at Grindstone	NA	NA	Ice Impacted	837	102
Mattawamkeag near Mattawamkeag	7307.04	250.92%	Much Above Normal	1418	88
Piscataquis River near Dover-Foxcroft	2106.03	356.12%	Much Above Normal	298	120
Sebec River at Sebec	1987.55	327.64%	Much Above Normal	326	67
Piscataquis River at Medford	NA	NA	Ice Impacted	1162	91
Penobscot River at West Enfield	30021.74	260.19%	Much Above Normal	6422	120

December Streamflows for Rivers *Data provided by the U.S. Geological Survey*

Station	Percentile Class	Years of Record
Hadley Lakes	Much Above Normal	38
Kenduskeag	Much Above Normal	45
Calais	Much Above Normal	24
Millinocket	Much Above Normal	29
Clayton Lake	Above Normal	45
Fort Kent	Above Normal	45

December Average Groundwater Levels







2023 - 2024

Plot created: 2023-12-14



Figure 9-14: Groundwater Level Yearly Plots to Current Source: <u>United States Geological Survey</u>

Flow or Water Level	Percentile Range	Explanation
Ice Impacted	NA	Ice impacted resulting in No Data available
Low	0 th	The monthly mean streamflow or median water level during this month is the lowest ever recorded during the period of record for this site.
Much Below Normal	0 th to 10 th	The monthly mean streamflow or median water level during this month is less than the 10 th percentile when compared to all of the months during the period of record for this site.
Below Normal	10^{th} to 25^{th}	The monthly mean streamflow or median water level during this month is between the 10 th and 25 th percentiles when compared to all of the months during the period of record for this site.
Normal	25 th to 75 th	The monthly mean streamflow or median water level during this month is between the 25 th and 75 th percentiles when compared to all of the months during the period of record for this site.
Above Normal	75 th to 90 th	The monthly mean streamflow or median water level during this month is between the 75 th and 90 th percentiles when compared to all of the months during the period of record for this site.
Much Above Normal	90 th to 100 th	The monthly mean streamflow or median water level during this month is greater than the 90 th percentile when compared to all of the months during the period of record for this site.
High	100 th	The monthly mean streamflow or median water level during this month is the highest ever recorded during the period of record for this site.

Product	How Many Issued	Reason for Issuance
Flood Watch	3	Heavy Rain + Snowmelt
Flood Advisory	10	Excessive Rainfall
Flood Advisory	3	Dam Discharge Flooding
Flood Warning (Areal)	6	Excessive Rainfall Flooding
Flash Flood Warning	1	Excessive Rainfall
River Flood Warning	6	Minor to Moderate River Flooding

Non-Routine Hydrologic Products from WFO Caribou, ME December 2023

December 18-20, 2023 Flooding Event

Synoptic Overview: Strong low pressure tracking west of the area, placing the forecast area in a warm sector through the duration of the event. With the synoptic trough remaining in touch with a tropical air mass, moisture will be funneled into the area leading to near record PWATs for this time of the year, and deepening low as it approaches will create a strong LLJ which could mix to the surface, bringing hazardous winds. 850mb winds of 84 kts from CAR 18z sounding would rank #2 all-time highest according to SPC sounding climatology site. This storm had some "subtropical" characteristics which essentially gave it extra fuel above what the baroclinic dynamics alone contributed to the storm. Initially, the southern branch wave developed the reflection of a subtropical low in the northeastern Gulf of Mexico. This gathered a lot of moisture and pounded the Carolina coasts. Although, from there, it was largely a frontal cyclone with a southern, central, and northern branch all phasing together, the amount of moisture and rainfall that occurred likely meant that subtropical characteristics persisted in the storm as it tracked north.

Storm Total QPF:



WPC EROs:

a. NWS WPC Excessive Rainfall Outlooks Valid 24-h ending 1200 UTC 18 Dec 2023



flood guidance within 25 miles of a point. Key: MDT: At least 40%, SLGT: At least 15%, MRGL: At least 5%

Excessive Rainfall Outlooks

The NWS Weather Prediction Center issued at least a marginal or slight risk for flash flooding in their excessive rainfall outlooks at leads times >5 days for all locations along the U.S. East Coast for the 24-hour periods ending at 1200 UTC 18 December 2023 and 1200 UTC 19 December 2023.

A Day-1 Moderate Risk for excessive rainfall was issued for New England at 1622 UTC on 18 December 2023 for the period from 1600 UTC 18 December 2023 through 1200 UTC 19 December 2023.

River Gage Reports:

Significant flooding took place on the night of December 18th into the day of December 19th from Guilford to Medford along the Piscataquis River. The hardest hit areas were the Guildford, Dover-Foxcroft to Medford area with significant flooding that was referred to as similar flooding as 1987. The DOVM1 (Dover-Foxcroft) gage on the Penobscot River reached the 4th Highest Level on record dating back to 1902. The crested stage was 16.77ft with a discharge of 22,900cfs at 6:15AM on December 19th (see photos below). The USGS gage (BLAM1) at Blanchard on the Piscataquis River recorded a crest of 13.40ft at 14,200cfs on December 18th at 8:45pm. This was the highest recorded stage on record with the records here dating back to 1996. There was minor to nearly moderate flooding on the Penobscot River from Grindstone gage down to Old Town (see photos below). In addition to river flooding on December 18th there was excessive runoff flooding likely enhanced because of the melting of ground frost across the Central Highlands into Downeast basins. This additional water release from the ground combined with up to 5 inches of rainfall caused small stream, creek and small river flooding then added to the catch into the larger river basins. Lastly, the combination of freshwater, storm surge and high tide resulted in flooding at the Bangor waterfront.

AHPS Gage Graphics



Storm Photos:

Brownville Jct. Pleasant River Flooding. Courtesy: Brownville - Brownville Jct Historical Museum



Milo. Pleasant River Flooding, Medford Road. Courtesy: Blaine Chadwick





Grindstone. Penobscot River Flooding, Route 11 near USGS Gage. Courtesy: Penobscot County EMA



Grindstone. Penobscot River, Route 11 @ Penobscot Trails. Courtesy: James Sinko - NWS Caribou HPM



Dover-Foxcroft. Piscataquis River. Courtesy: Piscataquis County EMA.



Sebois River near Shin Pond. Courtesy: James Sinko - NWS Caribou HPM







Jo Mary Road after Sanbord Brook. Courtesy: Jo Mary Lake Campground



Howland Penobscot River above Howland Dam Courtesy: Maine Forest Service



Penobscot River in Milford. Courtesy: Maine Forest Service



Penobscot River & Backwater Flooding in Milford Area. All Following Photos Courtesy: Bill Mackowski





