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FORENSIC ANALYSIS

CLAIM

Location: 123 Sample Road, Duluth, MN

Event Date(s): 12:01 AM December 8th, 2013 through 2:00 PM December 12th, 2013

Prepared for: Sample Enterprises, Inc.

Scope: Review best available records of snowfall events occurring between 12:01 AM CDT December 8th, 2013 and 2 PM CDT December 12th, 2013.

All data, observations and conclusions included in this report are based on the following data and materials:

- Historical KDLH Doppler Radar located in Duluth, MN accessed via GR2Analyst
- Watches, warnings and storm reports issued by the National Weather Service (NWS) in Duluth, MN accessed via Iowa Environmental Mesonet (IEM)
- Hourly observations from the Duluth International Airport accessed via IEM
- NWS Area Forecast Discussions and Climate Reports accessed via IEM

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FORENSIC ANALYSIS

OVERVIEW

Sample Enterprises has requested a professional meteorological analysis of snowfall events at 123 Sample Road, Duluth, Minnesota leading up to a slip-and-fall accident that occurred at 1:51 PM on December 12th, 2013. At the request of the client, this analysis reviews snow events occurring between 12:01 AM CDT December 8th, 2013 and 2 PM CDT December 12th, 2013. In this analysis, the address in question is referred to as "the Property." Official airport data from the Duluth International Airport (aka Duluth Airport) is used, which is located 2.6 miles from the Property (Figure 1).

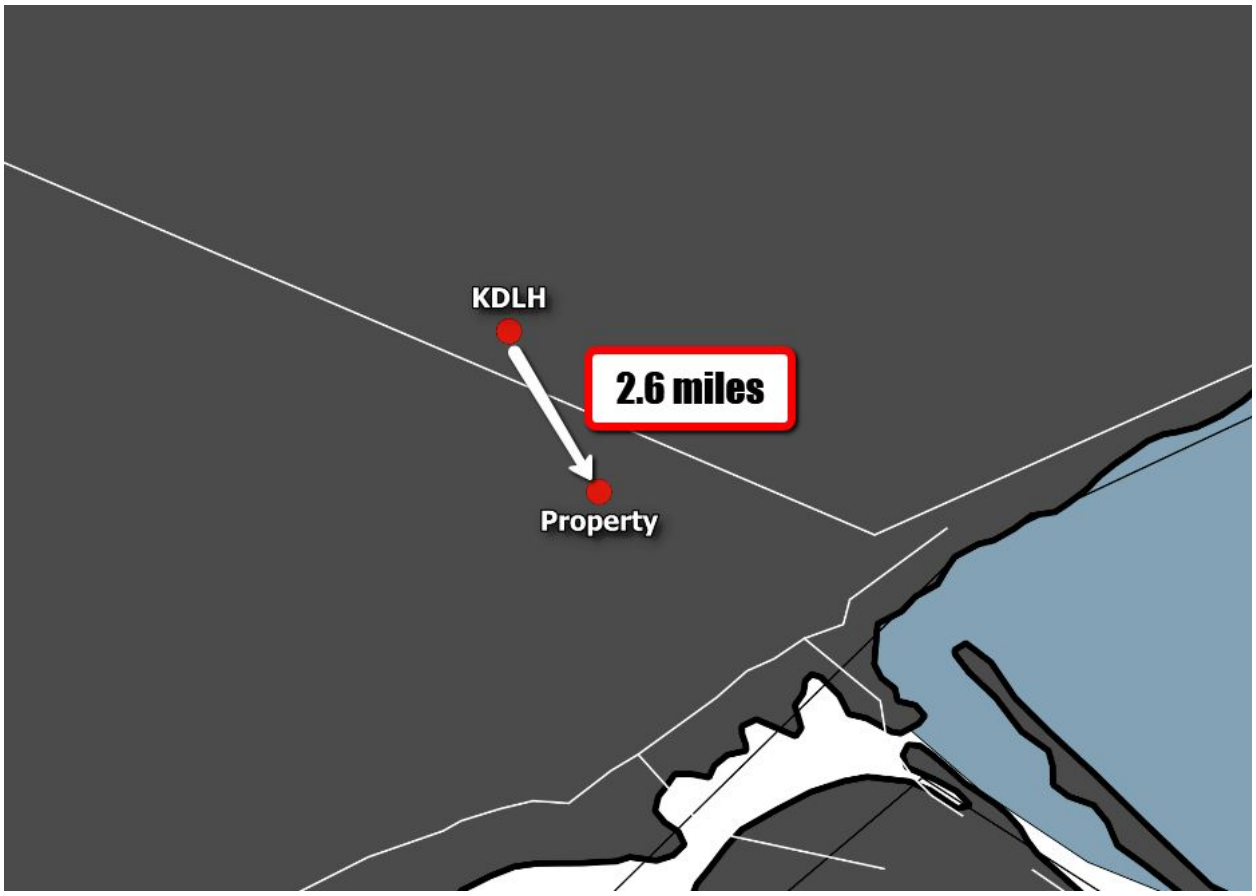

Figure 1. Location of Property and the nearest reporting airport (Duluth International Airport).

SNOWFALL EVENT SUMMARY: 12/8/2013 - 12/10/2013

Snow Event #1: December 8-9th, 2013. Light snow was reported for nearly 21 hours from 11:03 AM on December 8th until 7:55 AM on December 9th.[1&2] There were three observations in that time frame that did not report light snow falling (10:21 PM on December 8th, 5:55 AM on December 9th, and 6:55 AM on December 9th). Observations from the 8th and 9th show that no other snow fell before or after this event on those two dates. The official Climate Reports issued by the National Weather Service Duluth (NWS Duluth) show that 0.8" of snow fell on the 8th at the Duluth Airport (Figure 2), with an additional 0.1" on the 9th (Figure 3).

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CLIMATE REPORT
NATIONAL WEATHER SERVICE DULUTH MN
1225 AM CST MON DEC 9 2013


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...THE DULUTH MN CLIMATE SUMMARY FOR DECEMBER 8 2013...

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1870 TO 2013


WEATHER ITEM   OBSERVED TIME   RECORD YEAR NORMAL DEPARTURE LAST
                VALUE   (LST)  VALUE       VALUE  FROM      YEAR
                                                   NORMAL
.....................................................................
TEMPERATURE (F)
 YESTERDAY
  MAXIMUM         10    622 PM  45    1990  24    -14       26
  MINIMUM        -18    622 AM -23    1932  10    -28       16
                                      1876
  AVERAGE         -4                        17    -21       21

PRECIPITATION (IN)
  YESTERDAY        0.08          0.69 1963   0.04   0.04      T
  MONTH TO DATE    2.17                      0.36   1.81     0.11
  SINCE DEC 1      2.17                      0.36   1.81     0.11
  SINCE JAN 1     29.77                     30.11  -0.34    31.87

SNOWFALL (IN)
  YESTERDAY        0.8          11.9  1969   0.5    0.3       T
  MONTH TO DATE   24.1                      4.3   19.8       T
  SINCE DEC 1     24.1                      4.3   19.8       T
  SINCE JUL 1     29.1                     20.4    8.7     11.3
  SNOW DEPTH      16
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Figure 2. Climate Report for December 8th, 2013. Source: NWS Duluth/IEM.

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CLIMATE REPORT
NATIONAL WEATHER SERVICE DULUTH MN
1224 AM CST TUE DEC 10 2013


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...THE DULUTH MN CLIMATE SUMMARY FOR DECEMBER 9 2013...

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1870 TO 2013


WEATHER ITEM   OBSERVED TIME   RECORD YEAR NORMAL DEPARTURE LAST
               VALUE   (LST)  VALUE       VALUE  FROM      YEAR
                                                 NORMAL
.............................................................
TEMPERATURE (F)
 YESTERDAY
  MAXIMUM          5    234 AM  54    1939  24    -19       29
  MINIMUM         -9   1159 PM -30    1876  10    -19       15
  AVERAGE         -2                        17    -19       22

PRECIPITATION (IN)
  YESTERDAY        0.02          1.03 1879   0.04  -0.02     0.63
  MONTH TO DATE    2.19                      0.40   1.79     0.74
  SINCE DEC 1      2.19                      0.40   1.79     0.74
  SINCE JAN 1     29.79                     30.15  -0.36    32.50

SNOWFALL (IN)
  YESTERDAY        0.1           7.1  1961   0.6   -0.5      6.5
  MONTH TO DATE   24.2                       4.9   19.3      6.5
  SINCE DEC 1     24.2                       4.9   19.3      6.5
  SINCE JUL 1     29.2                      21.0    8.2     17.8
  SNOW DEPTH      17
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Figure 3. Climate Report for December 9th, 2013. Source: NWS Duluth/IEM.

Local spotters mainly reported less than 1" of snow in the area, with the exception of a report in Duluth Heights, where 1.7" was reported by a National Weather Service employee (Figure 4). Most locations likely saw less than 1" with this event.

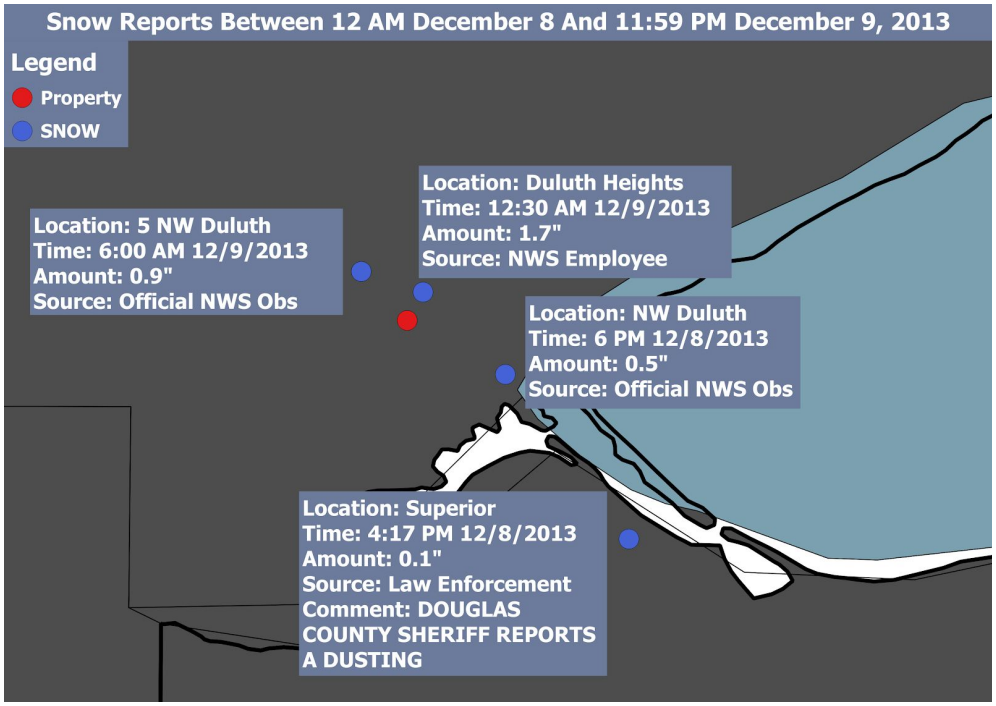

Figure 4. Storm reports from December 8th and 9th, 2013. Source: NWS Duluth.

Snow Event #2: December 10th, 2013. A quick-moving disturbance tracked through northeast Minnesota during the early morning hours, bringing light snow between 1:51 AM and 5:02 AM to the Duluth area.[3] No other snow occurred during the day according to Duluth Airport observations. The official Climate Report and the Local Storm Report show a total of 0.2" of snow was measured at the Duluth Airport with this event (Figures 5 & 6).

CLIMATE REPORT
NATIONAL WEATHER SERVICE DULUTH MN
1253 AM CST WED DEC 11 2013

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...THE DULUTH MN CLIMATE SUMMARY FOR DECEMBER 10 2013...

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1870 TO 2013

WEATHER ITEM	OBSERVED VALUE	TIME (LST)	RECORD VALUE	YEAR	NORMAL VALUE	DEPARTURE FROM NORMAL	LAST YEAR
TEMPERATURE (F)							
YESTERDAY							
MAXIMUM	2	149 PM	46	1896 1891	24	-22	18
MINIMUM	-11	555 AM	-25	1977	9	-20	1
AVERAGE	-4				16	-20	10
PRECIPITATION (IN)							
YESTERDAY	0.01		0.47	1942	0.04	-0.03	0.03
MONTH TO DATE	2.20				0.44	1.76	0.77
SINCE DEC 1	2.20				0.44	1.76	0.77
SINCE JAN 1	29.80				30.19	-0.39	32.53
SNOWFALL (IN)							
YESTERDAY	0.2		7.3	1983	0.5	-0.3	0.8
MONTH TO DATE	24.4				5.4	19.0	7.3
SINCE DEC 1	24.4				5.4	19.0	7.3
SINCE JUL 1	29.4				21.5	7.9	18.6
SNOW DEPTH	15						

Figure 5. Climate Report for December 10th, 2013. Source: NWS Duluth/IEM.

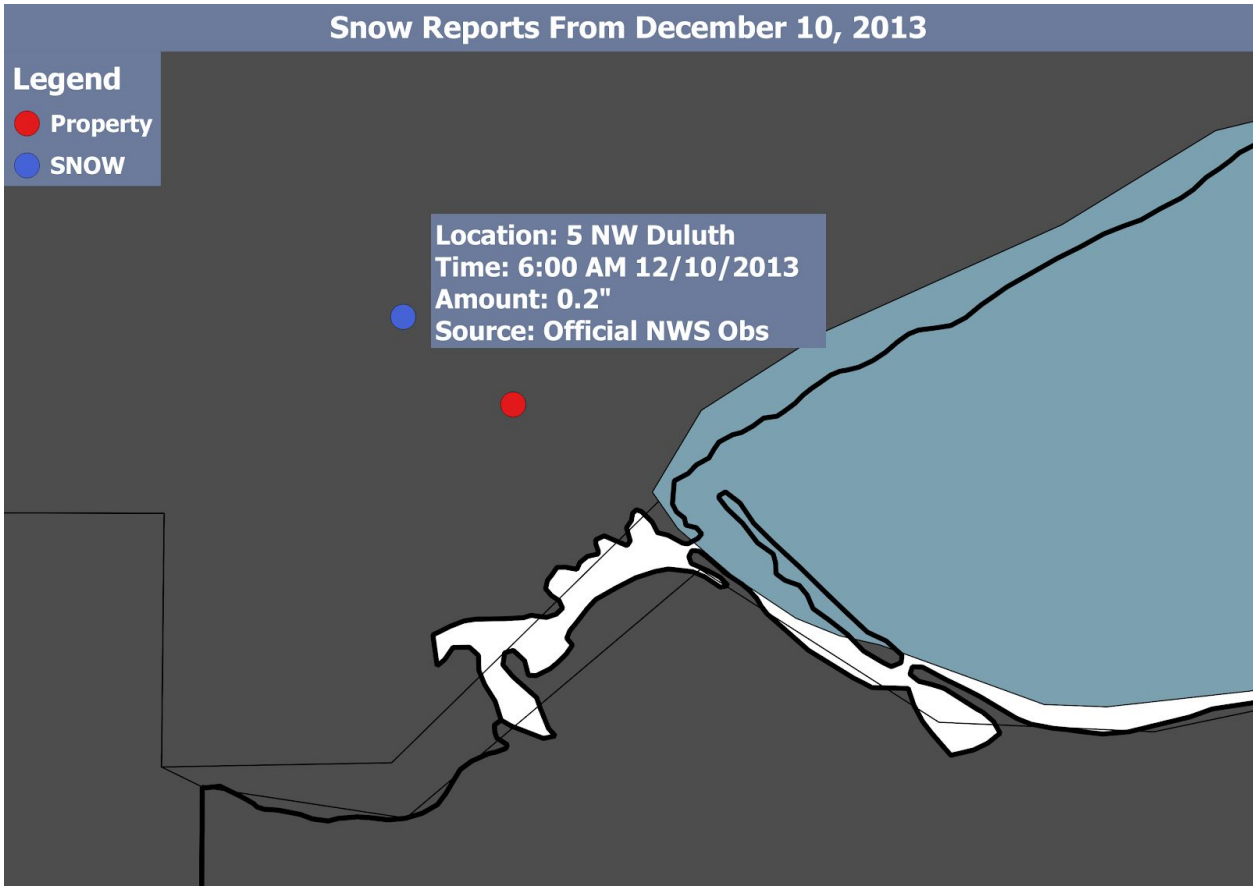

Figure 6. Storm reports from December 10th, 2013 showing 0.2" of snow was reported at the Duluth Airport. Source: NWS Duluth.

SNOWFALL EVENT SUMMARY: 12/11/2013 - 12/12/2013

Final Snow Event Before Accident December 11th-12th, 2013: One additional snowfall event occurred before the accident, starting during the evening of December 11th and lasting into the morning hours of the 12th. Radar from 11:02 PM on December 11th to 4:09 AM on December 12th shows light snow falling across the region (Figure 7).

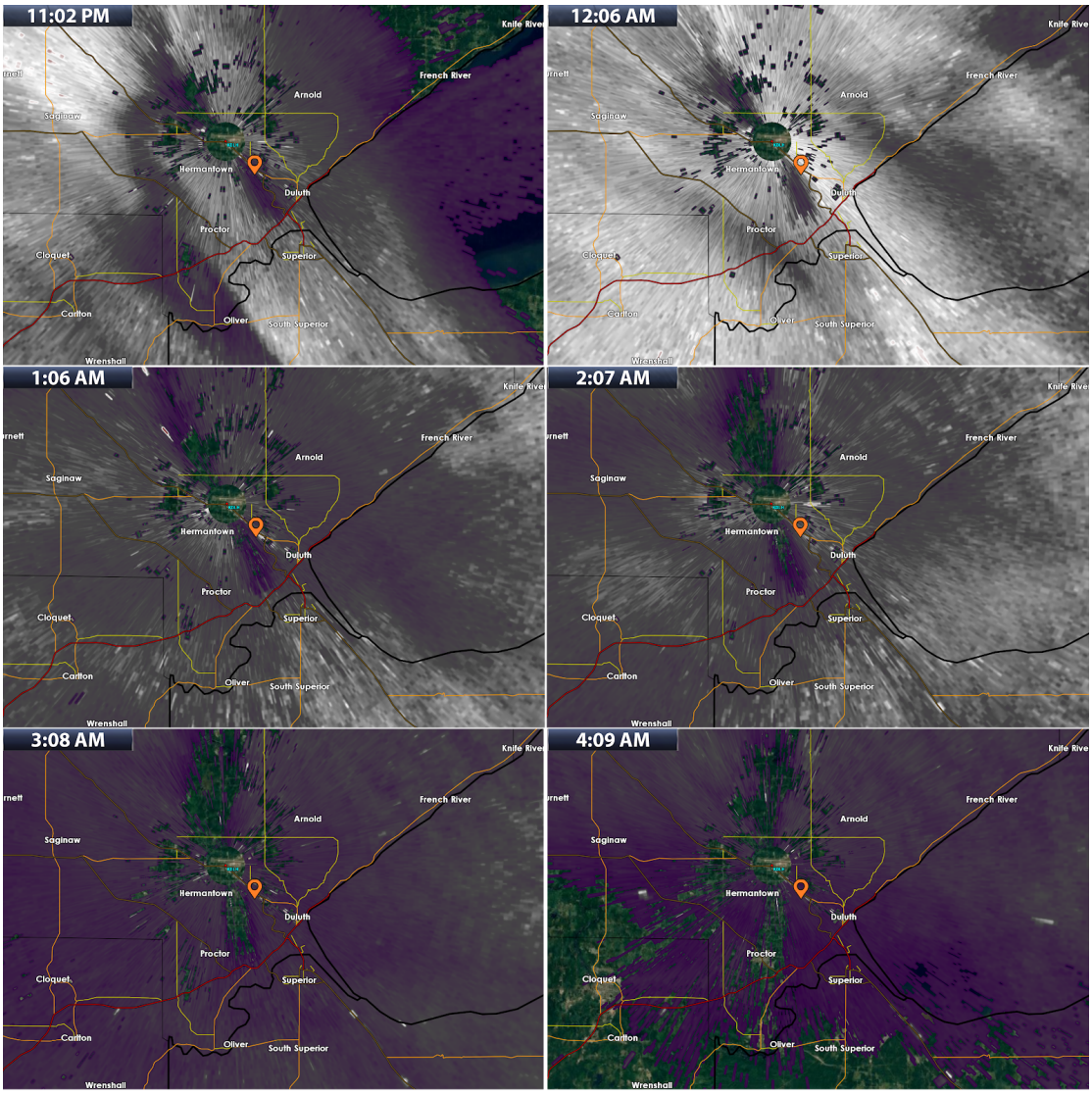

Figure 7. Radar from 11:02 PM on December 11, 2013 to 4:09 AM on December 12, 2013. Source: KDLH.

Weather observations from the Duluth International Airport show that light snow (coded as "-SN")[4] started falling in the area at 10:55 PM on December 11th, 2013 and continued falling lightly until 4:55 AM on December 12th, 2013.[5&6] During this time, there was only 0.01" of liquid-equivalent precipitation that was measured from the amount of snow that fell. Officially, a "trace" of snow fell on December 11th according to the Climate Report from NWS Duluth (Figure 8). A "trace" is defined as less than 0.1" of snow.[7] An additional 0.1" of snow fell between midnight and 4 PM on December 12th according to the Climate Report that was later issued at 4 PM (Figure 9).

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CLIMATE REPORT
NATIONAL WEATHER SERVICE DULUTH MN
1219 AM CST THU DEC 12 2013


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...THE DULUTH MN CLIMATE SUMMARY FOR DECEMBER 11 2013...

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1870 TO 2013


WEATHER ITEM   OBSERVED TIME   RECORD YEAR NORMAL DEPARTURE LAST
                VALUE   (LST)  VALUE       VALUE  FROM      YEAR
                                                   NORMAL
.................................................................
TEMPERATURE (F)
 YESTERDAY
  MAXIMUM         -3    349 PM  53    1913  23    -26       14
  MINIMUM        -16    824 AM -27    1977   9    -25        3
  AVERAGE         -9                        16    -25        9

PRECIPITATION (IN)
  YESTERDAY       0.01          1.33 1949   0.04  -0.03     0.01
  MONTH TO DATE   2.21                      0.48   1.73     0.78
  SINCE DEC 1     2.21                      0.48   1.73     0.78
  SINCE JAN 1    29.81                     30.23  -0.42    32.54

SNOWFALL (IN)
  YESTERDAY       T             7.4  1983   0.6   -0.6      0.9
  MONTH TO DATE  24.4                       6.0   18.4      8.2
  SINCE DEC 1    24.4                       6.0   18.4      8.2
  SINCE JUL 1    29.4                      22.1    7.3     19.5
  SNOW DEPTH     15
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Figure 8. Climate Report for December 11th, 2013. Source: NWS Duluth/IEM.

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CLIMATE REPORT
NATIONAL WEATHER SERVICE DULUTH MN
423 PM CST THU DEC 12 2013


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...THE DULUTH MN CLIMATE SUMMARY FOR DECEMBER 12 2013...
VALID TODAY AS OF 0400 PM LOCAL TIME.

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1870 TO 2013


WEATHER ITEM   OBSERVED TIME   RECORD YEAR NORMAL DEPARTURE LAST
                VALUE   (LST)  VALUE       VALUE  FROM      YEAR
                                                   NORMAL
.....................................................................
TEMPERATURE (F)
 TODAY
  MAXIMUM          8    359 PM  54    1891  23    -15       30
  MINIMUM         -8    543 AM -23    1879   8    -16        1
  AVERAGE          0                        16    -16       16

PRECIPITATION (IN)
  TODAY            T             0.60 1968   0.04  -0.04      T
  MONTH TO DATE    2.21                      0.52   1.69     0.78
  SINCE DEC 1      2.21                      0.52   1.69     0.78
  SINCE JAN 1     29.81                     30.27  -0.46    32.54

SNOWFALL (IN)
  TODAY            0.1           2.7  1968   0.5   -0.4       T
  MONTH TO DATE   24.5                       6.5   18.0      8.2
  SINCE JUL 1     29.5                      22.6    6.9     19.5
  SNOW DEPTH      15
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Figure 9. Climate Report for December 12th, 2013 through 4 PM. Source: NWS Duluth/IEM.

Temperatures during the time of the event stayed well below freezing, which not only would have kept any existing ice intact, but falling snow at this temperature tends to be very light and fluffy. This would further exacerbate the "slippery" factor as the fluffy, light snow layers on top of existing ice and snow. In the forecast discussion issued by NWS Duluth at 3:27 PM on December 11th, 2013, they explain how although the expected snow amounts with the event listed above should be minimal, it could lead to very slippery conditions across the region (Figure 10).

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE DULUTH MN
327 PM CST WED DEC 11 2013

.SHORT TERM...(THIS EVENING THROUGH THURSDAY)
ISSUED AT 325 PM CST WED DEC 11 2013

AT 325PM/2125Z...THE NORTHLAND HAD CLEAR SKIES AND LIGHT WESTERLY WINDS AS A RIDGE OF HIGH PRESSURE MOVED ACROSS THE REGION. TEMPERATURES ACROSS THE WERE NEAR 0 DEGREES AND THE SINGLE DIGITS BELOW ZERO. THERE WAS A SHORTWAVE IN SOUTHERN MANITOBA MOVING TO THE SE... WHICH WAS RESULTING IN INCREASING CLOUD COVER ACROSS WESTERN MINNESOTA.

WHILE THERE WILL BE INCREASING CLOUD COVER ACROSS THE WESTERN FORECAST AREA THIS AFTERNOON AS THE SHORTWAVE IN MANITOBA APPROACHES THE NORTHLAND...THE LIGHT WINDS AND CLEAR SKIES EARLY THIS EVENING WILL ALLOW THE TEMPERATURES TO PLUMMET. I FORECASTED SLIGHTLY LOWER THAN THE MAJORITY OF THE MODEL AND MOS GUIDANCE...ESPECIALLY ACROSS FAR NORTHERN MINNESOTA. THE DANGEROUS WIND CHILL READINGS ARE EXPECTED TO REDEVELOP LATE THIS AFTERNOON AND CONTINUE THROUGH TONIGHT AND PART OF THURSDAY MORNING. WIDESPREAD WIND CHILL READINGS OF 25 TO 40 BELOW ARE EXPECTED TO DEVELOP BY EARLY THIS EVENING. I DO NOT THINK WE WILL NEED A WIND CHILL WARNING...BUT SOME PARTS OF FAR NORTHERN MINNESOTA MIGHT APPROACH WIND CHILL READINGS OF 40 DEGREES BELOW ZERO.

THE SHORTWAVE IN MANITOBA WILL BRING INCREASING CLOUD COVER TONIGHT...MAINLY ACROSS THE SOUTHERN HALF OF THE FORECAST AREA...AND SOME LIGHT SNOW. AMOUNTS SHOULD BE MINIMAL. HOWEVER...THE ALREADY TERRIBLE ROADS ACROSS THE REGION COULD BE MADE EVEN MORE SLIPPERY BY THE DUSTING OF LIGHT SNOW.

THURSDAY...TEMPERATURES LOOK SIGNIFICANTLY WARMER AS THE REALLY COLD AIR MOVES OUT OF THE NORTHLAND. HIGHS WILL BE BACK WELL INTO THE SINGLE DIGITS FOR MOST OF THE NORTHLAND AND MAYBE LOW TEENS IN THE BRAINERD LAKES REGION. A PRONOUNCED LOW/MID LEVEL BAROCLINIC ZONE WILL SET UP ACROSS THE REGION. SEVERAL MODELS CONTINUE TO INDICATE A BAND OF LIGHT SNOW WILL MOVE OUT OF THE DAKOTAS INTO THE NORTHLAND...PRIMARILY NE MINNESOTA...DURING THE AFTERNOON.

Figure 10. Area Forecast Discussion issued at 3:27 PM on December 11th, 2013. Source: NWS Duluth/IEM.

Surveillance Video: Surveillance video of the accident at the Property on December 12th shows a light accumulation of snow on the ground. While it is not possible to know the exact amount of snow on the ground without formal measurement, it is very likely that there is approximately 0.5" (half an inch) of snow in the parking lot of the Property.

Figure 11. Screenshot of surveillance video taken at the time of the accident on December 12th, 2013. Source: Sample Store/Sample Law.

CONCLUSION

After exhaustive analysis of credible, industry-standard meteorological databases, including airport observations, National Weather Service Climate Reports, archived Doppler radar, professional storm spotter summaries, and the surveillance video at the Property we can conclude that there was likely around a half an inch of snow on the ground on the day of the accident, December 12th, 2013. A summary of all snow events between 12:01 AM December 8th, 2013 and 2:00 PM December 12th, 2013 is shown in the table below:

Snow Events		
Date	**Time Range (approx.)**	**Snow Total**
Dec. 8th - Dec. 9th, 2013	11:03 AM (12/8) - 7:55 AM (12/9)	0.9”
Dec. 10th, 2013	1:51 AM - 5:02 AM	0.2”
Dec. 11th-12th, 2013	10:55 PM (12/11) - 4:55 AM (12/12)	0.1”

Table 1. Summary of all snow events between 12:01 AM December 8th, 2013 and 2:00 PM December 12th, 2013.

Informally, the snow events that occurred in this time frame are generally not considered plowable by meteorologists.

I am confident that the data from the Duluth International Airport accurately reflects the conditions experienced at the Property due to the proximity of the two locations, the radar analysis and the minor geographical variations between the two locations. It is unlikely that the Property saw significantly more than what was reported by the airport. Any variations would be negligible in this instance.

The weather conditions on December 12th, 2013 were notably slippery. The National Weather Service in Duluth highlighted this threat in their Area Forecast Discussion stating that "the already terrible roads across the region could be made even more slippery by the dusting of light snow." It is likely that the slick conditions contributed to the slip-and-fall accident in question rather than the actual amount of snow on the ground.

Paul Douglas, Certified Broadcast Meteorologist, Founder and Senior Meteorologist, Praedictix

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Paul Douglas is Minnesota's first AMS-Certified Broadcast Meteorologist, with a 40 year career in television, print and radio. He is Founder and President of Praedictix Weather, with offices and TV studios in Minneapolis, Minnesota. In 2011 his on-air team and engineers helped to launch WeatherNation TV, a new 24/7 national weather channel dedicated to meteorology and storm coverage across the USA. His firm specializes in custom weather solutions for media and corporate weather briefings, helping to aid in productivity, efficiency and safety for weather-sensitive businesses, including forensic meteorological consulting. Douglas is also a founding investor and senior manager at AerisWeather, specializing in high-resolution weather data streams and APIs, available to power businesses worldwide.

Douglas has a meteorology degree from Penn State, where he sits on the Meteorology Advisory Board. In his television career he appeared on the CBS Evening News, Nightline, MSNBC and CNN. His broadcast meteorology positions took him from the New York City area and Chicago to the Twin Cities, his current home. In 2004 he wrote a book about extreme weather, "Restless Skies", for Barnes and Noble. In 2016 Douglas released a book focused on climate change, "Caring for Creation: The Evangelicals Guide to Climate Change and a Healthy Environment", highlighting not only the science, but the spiritual case for addressing climate volatility.

Previous companies include "EarthWatch Communication," which invented 3-D weather graphics licensed to television stations worldwide – and featured in Steve Spielberg's movies "Jurassic Park" and "Twister". His last venture was "Digital Cyclone", the first company in the world to put an app on a cellular phone in 2001. He sold that company to Garmin in 2007 to focus on his latest ventures.

Douglas writes a daily print and online column for the Star Tribune and the St. Cloud Times and WeatherNation. He contributes to the CSRRT, The Climate Science Rapid Response Team, and is a member of the board of EEN, the Evangelical Environmental Network. TV meteorologist, author and teacher, Douglas speaks to corporations about severe weather and climate trends - and his entrepreneurial ride launching 4 start-up companies. He is active in Boy Scouts and SAVE, Suicide Awareness, Voices of Education. Married to a professional architect for 33 years, Douglas has two sons: a digital marketing specialist and a Naval Academy graduate and helicopter pilot, currently based in San Diego.

APPENDIX

[1]: "IEM: Observation History (December 8th)" Iowa Environmental Mesonet. Accessed 5 June 2017. https://mesonet.agron.iastate.edu/sites/obhistory.php?network=MN_ASOS&station=DLH&year=2013&month=12&day=08 (Figures 1A and 2A)

[2]: "IEM: Observation History (December 9th)" Iowa Environmental Mesonet. Accessed 5 June 2017. https://mesonet.agron.iastate.edu/sites/obhistory.php?network=MN_ASOS&station=DLH&year=2013&month=12&day=09 (Figures 3A and 4A)

[3]: "IEM: Observation History (December 10th)" Iowa Environmental Mesonet. Accessed 5 June 2017. https://mesonet.agron.iastate.edu/sites/obhistory.php?network=MN_ASOS&station=DLH&year=2013&month=12&day=10 (Figure 5A)

[4]: "METAR HELP" College of Dupage. Accessed 13 June 2017. http://weather.cod.edu/notes/metar.html

[5]: "IEM: Observation History (December 11th)" Iowa Environmental Mesonet. Accessed 5 June 2017. https://mesonet.agron.iastate.edu/sites/obhistory.php?network=MN_ASOS&station=DLH&year=2013&month=12&day=11 (Figure 6A)

[6]: "IEM: Observation History (December 12th)" Iowa Environmental Mesonet. Accessed 5 June 2017. https://mesonet.agron.iastate.edu/sites/obhistory.php?network=MN_ASOS&station=DLH&year=2013&month=12&day=12 (Figure 7A)

[7]: "Snow Measurement Guidelines for National Weather Service Surface Observing Programs" National Weather Service. Accessed 8 June 2017. http://www.nws.noaa.gov/os/coop/reference/Snow_Measurement_Guidelines.pdf

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FORENSIC ANALYSIS

Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
3:55 PM	E 7	3	BKN027 OVC070	-SN,HZ	4	-1	-8			80%	30.11	1024.4	0.01		
3:42 PM	ESE 7	1.5	OVC020	-SN,HZ	3	-0	-9			85%	30.12		0		
3:32 PM	ESE 7	0.75	VV 020	-SN,HZ	3	-0	-9			85%	30.12		0		
3:17 PM	ESE 6	1.5	OVC020	-SN,HZ	3	-2	-8			78%	30.13		0		
3:06 PM	ESE 6	0.75	VV 020	-SN,HZ	3	-2	-8			78%	30.13		0		
2:55 PM	ESE 6	1.25	BKN029 BKN036	-SN,HZ	3	-3	-8			76%	30.13	1025.2	0.01	0.02	
2:10 PM	ESE 5	1	BKN025 OVC035	-SN,HZ	3	-2	-6			78%	30.14		0		
1:55 PM	ESE 6	0.75	BKN021 OVC027	-SN,HZ	2	-4	-9			76%	30.15	1025.9	0.01		
1:42 PM	E 5	0.75	BKN028 OVC036	-SN,HZ	1	-4	-8			77%	30.16		0.01		
1:23 PM	SE 5	1.5	BKN044 OVC055	-SN,HZ	1	-4	-8			77%	30.18		0		
12:55 PM	M	2	OVC055	-SN,HZ	1	-6	-7			72%	30.2	1027.4	0		
11:55 AM	N 0	3	BKN030 BKN039 OVC048	-SN,HZ	-1	-7		-1	-18	75%	30.23	1028.6	0		0
11:26 AM	SE 5	2.5	FEW036 BKN044 OVC055	-SN	-2	-9	-12			71%	30.25		0		
11:03 AM	SSE 5	1.75	OVC044	-SN	-4	-9	-15			77%	30.27		0		
10:55 AM	SSE 5	3	BKN044 OVC055	HZ	-4	-10	-15			75%	30.28	1030.4	0		
10:49 AM	SSE 6	3	OVC044	HZ	-4	-11	-16			70%	30.28		0		
10:27 AM	N 0	1.75	BKN046 OVC055	HZ	-6	-11				77%	30.29		0		
9:55 AM	M	6	OVC060	HZ	-7	-12	-16			79%	30.3	1031.2	0		
8:55 AM	N 0	10	BKN080 OVC100		-11	-17				74%	30.3	1031.5	0		
7:55 AM	N 0	10	OVC065		-13	-20				70%	30.31	1031.6	0		
6:55 AM	N 0	10	BKN065		-15	-22				70%	30.33	1032.4	0		
5:55 AM	NNW 3	10	CLR		-16	-22	-26	-13	-16	74%	30.33	1032.6	0		
4:55 AM	N 0	10	CLR		-15	-21				74%	30.35	1033.1	0		
3:55 AM	W 7	10	CLR		-15	-21	-31			74%	30.37	1033.5	0		
2:55 AM	W 6	10	CLR		-15	-21	-29			74%	30.39	1034.2	0		
1:55 AM	W 6	10	CLR		-15	-21	-29			74%	30.38	1034.1	0		
12:55 AM	W 7	10	CLR		-15	-22	-31			70%	30.41	1035	0		

Figure A1. Weather observations from December 8th, 2013 between 12:55 AM and 3:55 PM at the Duluth International Airport. Source: NWS/IEM.

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Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
11:55 PM	W 6	2.5	BKN041 OVC085	-SN	3	-2	-8	10	2	79%	29.93	1017.7	0		0.02
11:47 PM	W 7	2	BKN037 BKN070 OVC085	-SN	3	-2	-9			78%	29.94		0		
10:55 PM	WSW 5	7	FEW025 BKN075	-SN	3	-1	-6			83%	29.95	1018.5	0		
10:21 PM	SSW 3	8	SCT024 OVC070		5	1	-2			85%	29.96		0		
10:04 PM	SSW 3	3	OVC020	-SN	7	1				78%	29.97		0		
9:55 PM	SSW 3	2.5	OVC020	-SN	5	-0	-2			79%	29.98	1019.4	0		
9:48 PM	SSW 3	1.25	OVC022	-SN	7	1				78%	29.98		0		
9:33 PM	S 5	1.75	OVC039	-SN	7	1	-2			78%	29.98		0		
9:06 PM	S 6	3	BKN042 OVC070	-SN	7	1	-3			78%	29.99		0		
8:55 PM	S 6	1.25	OVC033	-SN	7	2	-3			79%	29.99	1020.1	0.01	0.02	
8:16 PM	S 5	1.75	BKN031 OVC080	-SN	7	1	-2			78%	30.01		0		
7:55 PM	SSE 5	6	FEW020 BKN080 OVC100	-SN,BR	7	3	-2			83%	30.01	1020.9	0		
7:37 PM	SSE 7	3	BKN033 BKN075 OVC090	-SN	9	3	-3			78%	30.02		0		
6:55 PM	SE 8	1.75	OVC033	-SN	9	4	-3			80%	30.04	1021.7	0.01		
6:46 PM	SSE 9	1.25	OVC025	-SN	9	3	-5			78%	30.04		0.01		
6:36 PM	SSE 8	0.75	VV 016	-SN	9	3	-4			78%	30.04		0		
6:09 PM	SE 9	1.25	OVC015	-SN	9	3	-5			78%	30.05		0		
5:55 PM	ESE 8	1	BKN012 OVC018	-SN	9	4	-3	9	-1	80%	30.05	1022.3	0.02		0.06
5:37 PM	ESE 8	1	VV 014	-SN	9	3	-4			78%	30.06		0.01		
5:24 PM	ESE 7	0.75	VV 016	-SN	7	1	-5			78%	30.06		0.01		
5:11 PM	ESE 6	1	OVC021	-SN,HZ	7	1	-3			78%	30.07		0		
5:02 PM	ESE 8	0.75	OVC023	-SN,HZ	7	1	-6			78%	30.07		0		
4:55 PM	E 7	1	OVC029	-SN,HZ	6	1	-6			79%	30.07	1023	0.01		
4:43 PM	E 7	1	OVC033	-SN,HZ	7	1	-5			78%	30.08		0.01		
4:36 PM	E 8	2	OVC040	-SN,HZ	7	1	-6			78%	30.08		0		
4:25 PM	E 7	1.5	OVC047	-SN,HZ	5	-0	-7			78%	30.09		0		
4:17 PM	E 6	2	BKN049 OVC070	-SN,HZ	5	-0	-6			78%	30.1		0		
4:04 PM	E 7	4	BKN044 OVC070	-SN,HZ	5	-0	-7			78%	30.1		0		

Figure A2. Weather observations from December 8th, 2013 between 4:04 PM and 11:55 PM at the Duluth International Airport. Source: NWS/IEM.

Praedictix

FORENSIC ANALYSIS

Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
9:55 AM	WNW 15G 25	10	SCT013		-3	-10	-23			71%	29.8	1013.2	0		
8:55 AM	W 15	10	SCT044		-3	-9	-23			74%	29.8	1013.1	0	0	
7:55 AM	W 12	3	BKN048	-SN	-2	-8	-20			75%	29.78	1012.4	0		
6:55 AM	W 8	6	BKN050	BR	-5	-9	-20			82%	29.78	1012.5	0		
5:55 AM	W 8	6	FEW100	BR	-5	-9	-20	5	-5	82%	29.78	1012.7	0		0.02
4:55 AM	W 9	6	FEW065 SCT100	-SN	-1	-5	-16			82%	29.81	1013.3	0		
3:55 AM	W 9	6	SCT065	-SN	2	-3	-13			80%	29.83	1014	0		
3:34 AM	W 10	5	SCT022 BKN065	-SN	3	-2	-12			78%	29.84		0		
3:19 AM	W 9	2.5	OVC024	-SN	1	-2	-14			84%	29.85		0		
2:55 AM	W 9	4	BKN038 OVC085	-SN	3	-2	-12			79%	29.86	1015.2	0.01	0.02	
2:24 AM	W 7	3	SCT047 BKN070 OVC090	-SN	5	-0	-7			78%	29.87		0.01		
2:13 AM	W 7	2.5	BKN038 OVC070	-SN	5	-0	-7			78%	29.87		0		
1:55 AM	W 12	1.5	OVC036	-SN	5	-0	-11			79%	29.88	1015.6	0		
1:44 AM	W 9	2.5	OVC038	-SN	5	-0	-9			78%	29.88		0		
1:12 AM	W 13	1.75	BKN043 OVC085	-SN	5	-0	-12			78%	29.89		0		
12:55 AM	W 12	8	FEW045 SCT065 OVC085	-SN	4	-1	-12			80%	29.89	1016.3	0.01		
12:45 AM	W 12	3	SCT032 BKN085 OVC110	-SN	3	-0	-13			85%	29.9		0.01		
12:26 AM	W 7	1.75	OVC040	-SN	3	-0	-9			85%	29.91		0.01		
12:04 AM	W 6	3	BKN041 OVC085	-SN,BR	3	-0	-8			85%	29.93		0		

Figure A3. Weather observations from December 9th, 2013 between 12:55 AM and 9:55 AM at the Duluth International Airport. Source: NWS/IEM.

Praedictix

FORENSIC ANALYSIS

Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
11:55 PM	SSW 5	10	OVC100		-9	-14	-20	-6	-9	78%	29.81	1014	0		
10:55 PM	SW 6	10	BKN120		-9	-15	-22			74%	29.83	1015	0		
9:55 PM	SSW 7	10	BKN110		-9	-15	-24			74%	29.84	1015	0		
8:55 PM	WSW 9	10	FEW030		-8	-15	-25			71%	29.86	1015.8	0		
7:55 PM	WSW 12	10	CLR		-8	-15	-27			71%	29.88	1016.4	0		
6:55 PM	WSW 12	10	CLR		-7	-14	-26			71%	29.88	1016.5	0		
5:55 PM	WSW 9	10	FEW025		-6	-14	-23	-2	-6	67%	29.89	1016.8	0		0
4:55 PM	WSW 12	10	FEW025		-5	-14	-23			64%	29.89	1016.8	0		
3:55 PM	W 16	10	FEW025		-4	-14	-25			61%	29.86	1015.5	0		
2:55 PM	W 17	10	FEW025		-3	-14	-24			58%	29.84	1014.6	0	0	
1:55 PM	W 16G 32	7	SCT016		-3	-14	-24			58%	29.83	1014.2	0		
1:18 PM	W 17G 29	3	SCT016	BLSN	-2	-15	-23			54%	29.83		0		
12:55 PM	W 17G 26	2.5	SCT018	BLSN	-3	-13	-24			61%	29.83	1014.1	0		
12:48 PM	W 22G 28	2.5	SCT018	BLSN	-2	-11	-26			65%	29.82		0		
11:55 AM	WNW 20G 31	3	SCT015		-3	-13	-26	-2	-6	61%	29.81	1013.7	0		0
11:10 AM	WNW 21G 28	3	SCT015	BLSN	-4	-11	-28			70%	29.81		0		
10:55 AM	W 20G 29	2.5	SCT013	BLSN	-4	-12	-27			68%	29.81	1013.8	0		

Figure A4. Weather observations from December 9th, 2013 between 10:55 AM and 11:55 PM at the Duluth International Airport. Source: NWS/IEM.

Praedictix

FORENSIC ANALYSIS

Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
11:55 PM	WNW 9	10	CLR		-9	-15	-26	-4	-9	74%	30.11	1024.5	0		0
10:55 PM	NW 13	10	CLR		-7	-14	-27			71%	30.08	1023.3	0		
9:55 PM	NW 10	10	CLR		-6	-12	-24			75%	30.05	1022.3	0		
8:55 PM	WNW 8	6	FEW011	HZ	-7	-12	-23			79%	30.02	1021.5	0	0	
7:55 PM	W 6	7	CLR		-8	-12	-21			82%	30	1020.8	0		
6:55 PM	W 7	10	CLR		-5	-10	-19			79%	29.97	1019.7	0		
5:55 PM	W 8	10	FEW025		-4	-10	-19	2	-4	75%	29.95	1019.2	0		
4:55 PM	W 8	10	FEW025		-4	-11	-19			71%	29.93	1018.3	0		
3:55 PM	W 10	10	SCT022		-0	-10	-16			62%	29.9	1017	0		
2:55 PM	W 16	10	SCT022		1	-9	-19			62%	29.88	1016.3	0		
1:55 PM	W 16	10	SCT020 SCT100		1	-9	-19			62%	29.86	1015.6	0		
12:55 PM	W 15	10	SCT030 SCT100		-0	-10	-19			62%	29.85	1015.2	0		
11:55 AM	W 15	10	FEW030		-1	-10	-21	-1	-10	65%	29.82	1014.4	0		0
10:55 AM	WNW 10	10	CLR		-3	-11	-20			67%	29.81	1014.2	0		
9:55 AM	NW 10	10	CLR		-5	-12	-23			72%	29.8	1014	0		
8:55 AM	NW 10	10	CLR		-8	-14	-26			74%	29.78	1013.2	0	0	
7:55 AM	NW 9	10	CLR		-9	-16	-26			70%	29.76	1012.8	0		
6:55 AM	NW 5	10	FEW050		-10	-16	-21			74%	29.75	1012.3	0		
5:55 AM	NW 6	10	FEW018 SCT080		-11	-17	-25	-5	-11	74%	29.74	1012	0		0.01
5:02 AM	NNW 7	9	FEW018 BKN080	-SN	-8	-15	-22			70%	29.74		0		
4:55 AM	NNW 6	7	BKN022	-SN	-7	-13	-20			75%	29.73	1011.4	0		
4:48 AM	NNW 6	5	BKN022	-SN	-8	-13	-21			77%	29.73		0		
4:40 AM	NNW 3	2.5	OVC022	-SN	-8	-13	-17			77%	29.73		0		
3:55 AM	N 3	1.25	OVC026	-SN	-6	-12	-15			75%	29.72	1011.1	0.01		
3:13 AM	N 0	1.25	OVC026	-SN	-6	-11				77%	29.73		0		
2:55 AM	N 0	1.5	OVC036	-SN	-6	-12				75%	29.73	1011.2	0	0	
2:51 AM	N 0	1.75	OVC040	-SN	-6	-11				77%	29.73		0		
2:35 AM	N 0	4	OVC042	-SN	-6	-11				77%	29.74		0		
2:09 AM	N 0	2	OVC038	-SN	-8	-11				84%	29.74		0		
1:55 AM	SSE 3	1.5	OVC040	-SN	-7	-12	-16			79%	29.74	1011.6	0		
1:51 AM	N 0	1.75	OVC042	-SN	-8	-11				84%	29.74		0		
12:55 AM	S 3	10	OVC075		-8	-13	-17			78%	29.77	1012.7	0		

Figure A5. Weather observations from December 10, 2013 at the Duluth International Airport. Source: NWS/IEM.

Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
11:55 PM	WSW 9	1.5	BKN041 OVC080	-SN	-7	-14	-24	-7	-9	71%	30.16	1026.1	0.01		0.01
11:26 PM	WSW 9	1.75	OVC047	-SN	-8	-15	-25			70%	30.17		0.01		
11:08 PM	SW 9	3	BKN049 OVC070	-SN	-8	-15	-25			70%	30.17		0		
10:55 PM	SW 10	2.5	BKN050 OVC070	-SN	-8	-15	-26			71%	30.17	1026.8	0		
9:55 PM	SW 8	10	SCT080		-9	-17	-25			67%	30.19	1027.7	0		
8:55 PM	W 14	10	SCT110		-9	-17	-30			67%	30.23	1029	0		
7:55 PM	WSW 12	10	FEW120		-8	-16	-27			67%	30.24	1029.4	0		
6:55 PM	SW 12	10	CLR		-7	-15	-26			68%	30.24	1029.5	0		
5:55 PM	WSW 9	10	CLR		-8	-16	-25	-3	-8	67%	30.27	1030.5	0		
4:55 PM	W 9	10	CLR		-7	-16	-24			64%	30.29	1030.9	0		
3:55 PM	WSW 14	10	CLR		-4	-14	-24			61%	30.29	1030.9	0		
2:55 PM	W 13	10	CLR		-4	-14	-23			61%	30.3	1031	0		
1:55 PM	W 13	10	CLR		-5	-14	-24			64%	30.3	1031	0		
12:55 PM	W 13	10	FEW010		-5	-15	-24			61%	30.31	1031.6	0		
11:55 AM	W 12G 20	10	CLR		-7	-16	-26	-7	-16	64%	30.33	1032.1	0		
10:55 AM	WNW 13	10	CLR		-10	-18	-30			67%	30.35	1033	0		
9:55 AM	NW 12	10	CLR		-12	-20	-32			66%	30.35	1032.9	0		
8:55 AM	WNW 10G 17	10	CLR		-15	-22	-35			70%	30.32	1032.2	0		
7:55 AM	WNW 8	10	CLR		-16	-22	-34			74%	30.3	1031.4	0		
6:55 AM	WNW 12	10	CLR		-16	-22	-37			74%	30.28	1030.6	0		
5:55 AM	WNW 16	10	CLR		-15	-21	-39	-9	-15	74%	30.26	1029.8	0		
4:55 AM	WNW 14	10	CLR		-14	-21	-37			70%	30.23	1028.8	0		
3:55 AM	NW 15	10	CLR		-13	-19	-36			74%	30.2	1027.7	0		
2:55 AM	WNW 12	10	CLR		-12	-19	-32			70%	30.19	1027.1	0		
1:55 AM	WNW 10	10	CLR		-11	-18	-30			70%	30.16	1026	0		
12:55 AM	WNW 12	10	CLR		-10	-17	-30			70%	30.13	1025.1	0		

Figure A6. Weather observations from December 11, 2013 at the Duluth International Airport. Source: NWS/IEM.

Time	Wind (mph)	Vis. (mi.)	Sky Cond. (100s ft)	Present Wx	Temperature (°F)					Relative Humidity	Pressure		Precipitation (in.)		
					Air	Dwpt	Feels Like	6 hour Max.	6 hour Min.		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
5:55 PM	W 9	4	SCT043 BKN050 OVC070	-SN	8	-0	-5	8	4	69%	30.08	1022.9	0		0
4:55 PM	W 9	10	OVC046		8	-1	-5			66%	30.09	1023.3	0		
3:55 PM	W 10	10	FEW055 OVC075		8	-2	-6			63%	30.09	1023.1	0		
2:55 PM	W 9	10	BKN065 OVC080		7	-2	-7			66%	30.09	1023	0		
1:55 PM	W 10	10	FEW050 OVC080		7	-3	-8			63%	30.08	1022.9	0		
12:55 PM	W 12	10	BKN085		6	-4	-9			62%	30.1	1023.7	0		
11:55 AM	W 10	10	BKN090		4	-5	-11	4	-7	65%	30.11	1024.1	0		
10:55 AM	W 9	10	FEW120		2	-7	-13			65%	30.13	1024.9	0		
9:55 AM	WNW 8	10	FEW010		-1	-8	-15			71%	30.12	1024.8	0		
8:55 AM	WNW 8	10	SCT010		-4	-10	-19			75%	30.13	1025.1	0		
8:24 AM	W 9	10	SCT010		-6	-11	-22			77%	30.13		0		
7:55 AM	W 7	10	OVC010		-5	-10	-19			79%	30.12	1024.8	0		
6:55 AM	WNW 8	10	OVC012		-4	-10	-19			75%	30.12	1024.7	0		
6:21 AM	W 9	10	OVC012		-6	-11	-22			77%	30.12		0		
6:04 AM	W 9	10	FEW005 SCT035		-8	-13	-25			77%	30.12		0		
5:55 AM	W 8	10	FEW035		-7	-12	-23	-4	-8	79%	30.12	1024.9	0		0
4:55 AM	W 8	9	SCT040	-SN	-7	-12	-23			79%	30.12	1024.7	0		
3:55 AM	W 8	9	OVC044	-SN	-5	-11	-20			75%	30.13	1024.9	0		
2:55 AM	WSW 7	9	FEW031 OVC050	-SN	-4	-10	-18			75%	30.12	1024.7	0	0	
1:55 AM	W 7	6	OVC055	-SN	-4	-11	-18			71%	30.13	1024.8	0		
12:55 AM	WSW 9	4	OVC055	-SN	-6	-12	-23			75%	30.13	1024.9	0		
12:50 AM	WSW 9	3	OVC060	-SN	-6	-11	-22			77%	30.13		0		
12:35 AM	SW 9	2.5	BKN045 OVC060	-SN	-6	-11	-22			77%	30.14		0		

Figure A7. Weather observations from December 12, 2013 at the Duluth International Airport. Source: NWS/IEM.

National Weather Service (NWS) Duluth: Local National Weather Service office responsible for issuing forecasts and warnings for the claim location.

Figure A8. National Weather Service county responsibility map. Source: http://www.crh.noaa.gov/mpx/office.php

Other Links

Climate Reports

- December 8: https://mesonet.agron.iastate.edu/wx/afos/p.php?pil=CLIDLH&e=201312090625
- December 9: https://mesonet.agron.iastate.edu/wx/afos/p.php?pil=CLIDLH&e=201312100624
- December 10: https://mesonet.agron.iastate.edu/wx/afos/p.php?pil=CLIDLH&e=201312110653
- December 11: https://mesonet.agron.iastate.edu/wx/afos/p.php?pil=CLIDLH&e=201312120619
- December 12 (4 PM Issuance): https://mesonet.agron.iastate.edu/wx/afos/p.php?pil=CLIDLH&e=201312122223

Storm Reports

- December 8 and 9: http://mesonet.agron.iastate.edu/lsr/#DLH/201312080600/201312100559/0100
- December 10: http://mesonet.agron.iastate.edu/lsr/#DLH/201312100600/201312110559/0100