



**Extreme Weather Prediction LLC DBA HailTrace**

**80 E 5th St Suite 100  
Edmond, OK 73034**

**80 E 5<sup>th</sup> St, Ste 100  
Edmond, OK 73034**

The follow report was created for example purposes. The purpose of this report is to analyze the weather events that occurred on April 19, 2023, at 80 E 5<sup>th</sup> St, Ste 100, Edmond, OK 73034. This is a commercial property surrounded by other commercial and residential properties, located in northwestern Oklahoma County, Oklahoma.

The weather events occurred shortly before 6:00 PM CDT on April 19, 2023. The property being analyzed in this report is in the central time zone, so the time zone is Central Daylight Time (CDT). Most of the storm data in this report is originally in the Universal Time Coordinated (UTC), which is the global time zone. To convert the UTC times to CDT times, a subtraction of five hours needs to be done. For example, 00 UTC on April 20, 2023, is 7 PM CDT on April 19, 2023. In addition, the storm reports are in Central Standard Time (CST), which is an hour difference from CDT.

A Google Earth image of the property with a red pushpin of the property's location can be seen below.

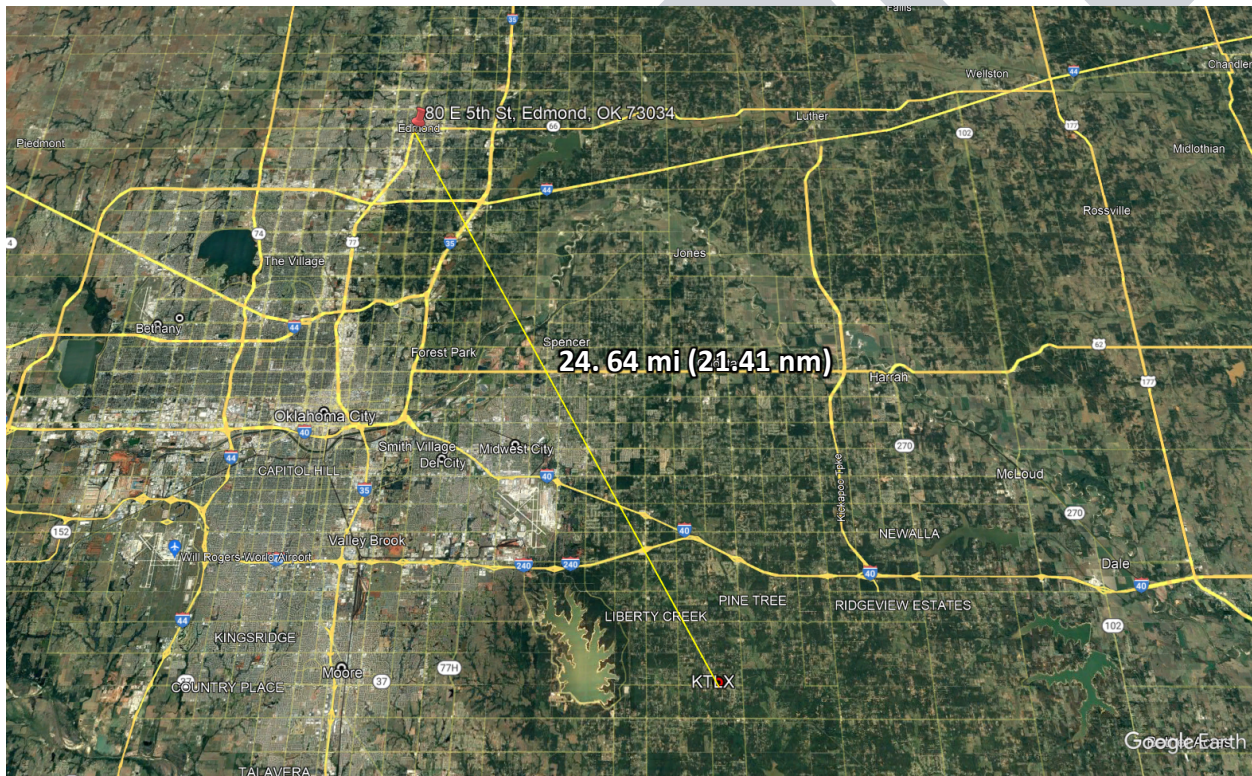


## SOURCES USED IN ANALYSIS

- Google Earth Imagery
- National Center for Environmental Information (NCEI)
- National Oceanic and Atmospheric Administration (NOAA)
- Weather Prediction Center (WPC) Surface Analysis Archive
- Local Climatological Data (LCD) from National Climatic Data Center (NCDC)
- National Climatic Data Center (NCDC) Storm Events Database (SED)
- NEXRAD Level II Dual Pol Radar Data from KTLX – Norman, Oklahoma
- GR2Analyst Program – KTLX
- National Weather Service (NWS) in Norman, Oklahoma
- Storm Warnings from Iowa Environmental Mesonet (IEM) via Iowa State University
- National Severe Storms Laboratory (NSSL)
- Sounding Data from Norman, Oklahoma
- Dual Pol Warning Decision Training from the National Weather Service in Louisville, Kentucky

## RADAR USED IN ANALYSIS

There is one federal radar that covers the Edmond, OK area. It is a WSR-88D radar from the Next Generation Weather Radar (NEXRAD) System, which provides 60 meteorological products for 160 radars across the United States, Puerto Rico, and several islands in the Pacific. These radars are jointly operated by the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the U.S. Air Force. The NEXRAD system's radars work by sending out a pulse of energy. The radar calculates the amount of time it takes for a pulse to be transmitted, striking a target like a raindrop, and returning to the radar's antenna. This then determines the distance those targets are from the radar. WSR-88D radars have a maximum range of 124 nautical miles. The NEXRAD radar used in this case is KTLX. It is located 24.64 miles southeast of the property. The lowest radar scan at the property is located 1,411 ft above the ground. A Google Earth image of the property with its distance from KTLX is shown below.



Distance of property from KTLX – 24.64 miles (21.41 nautical miles)

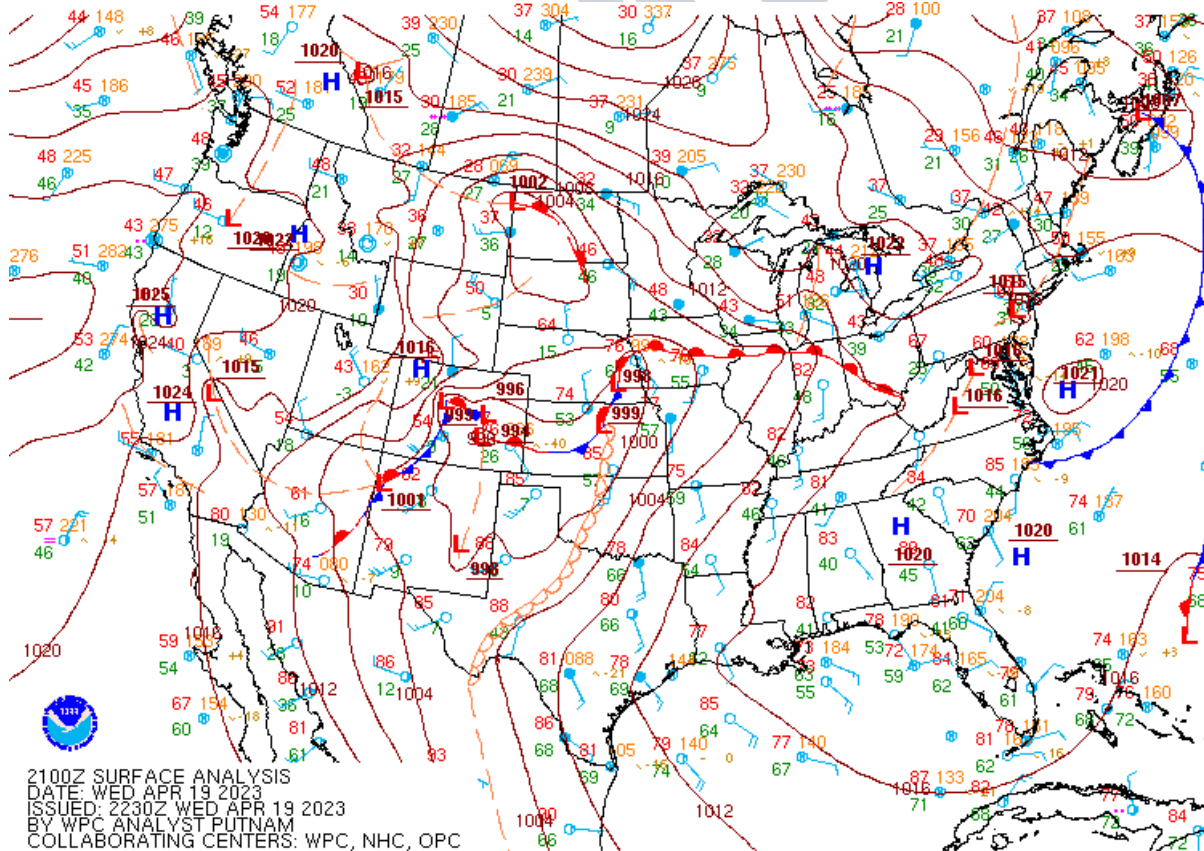
From 2011 until 2013, the WSR-88D radars were upgraded to dual-polarization (dual-pol) technology. With the upgrades, 14 new radar products were introduced. Dual-Pol Radar transmits and receives pulses of electromagnetic energy in both the horizontal and vertical directions. This results in the returning frequencies providing measurements of the horizontal and vertical dimensions of targets, which leads to forecasters to have a better idea of the shape, size, and type of targets are present. For example, a raindrop is oblate or flat in shape, while a hail stone is assumed by radar to be spherical as hail tumbles as it falls. In addition, the

radar upgrades can distinguish between birds, smoke, bats, and bugs. Three dual-pol products will be used in the analysis of the radar data in this case: Differential Reflectivity (ZDR), Correlation Coefficient (CC), and Specific Differential Phase (KDP).

### APRIL 19, 2023 SURFACE ANALYSIS

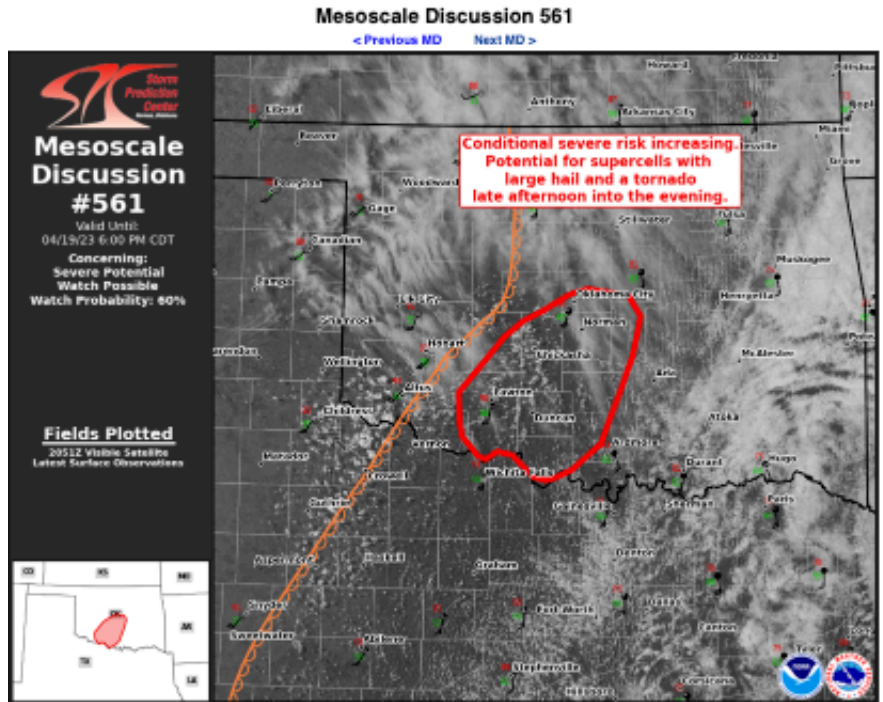
On the evening of April 19, 2023, a dryline was present in central Oklahoma. Temperatures were in the upper 70s with dew points in the upper 60s Fahrenheit, which provided ample heat and moisture for storm development. This can all be seen in the 4 PM CDT April 19, 2023, surface map below. The NCDCE Storm Events Database summary for April 19, 2023, in the Edmond area is as follows:

*Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.*



Weather Prediction Center (WPC) Surface Map Analysis – 2100 UTC April 19, 2023  
(4 PM CDT April 19, 2023)

Due to the potential for severe weather increasing, the Storm Prediction Center issued a mesoscale discussion shortly before 4 PM CDT on April 19, 2023. The discussion mentioned the threat for very large hail and tornadoes developing in the region over the next few hours:



Mesoscale Discussion 0561  
 NWS Storm Prediction Center Norman OK  
 0357 PM CDT Wed Apr 19 2023

Areas affected...Portions of southwestern and south-central Oklahoma

Concerning...Severe potential...Watch possible

Valid 192057Z - 192300Z

Probability of Watch Issuance...60 percent

**SUMMARY**...Conditional severe threat increasing. Potential for supercells with large hail and a couple tornadoes late afternoon into the evening. A watch will be possible in the next few hours.

**DISCUSSION**...A conditional severe threat is increasing across portions of southwestern and south-central Oklahoma. A surface dryline continues to mix eastward across Oklahoma and Texas. Ahead of the dryline, mid 60s dew points have moved north of the Red River across southern Oklahoma. 19z RAOB from OUN indicates moistening and a weakening cap beneath an elevated mixed layer with steep lapse rates (around 8 C/km). Temperatures have warmed into the 80s with strong daytime heating, with MLCAPE around 2500-3000 J/kg. Further indication of the weakening cap can be seen in satellite, as cumulus fields continue to show increasing development. The 19z OUN RAOB and surface objective analysis also indicate deep layer shear around 35-40 kts. The main risk with any initial storm development would be large hail, given steep lapse rates. As the main wave approaches from the west with deepening low pressure across the Central Plains, 850 mb flow will increase through the evening, further elongating hodographs and increasing risk of a couple tornadoes. Trends will be monitored closely with a watch will be possible within few hours.

..Thornton/Grass.. 04/19/2023

...Please see [www.spc.noaa.gov](http://www.spc.noaa.gov) for graphic product...

ATTN...WFO...FWD...OUN...

LAT...LON    34169733 33999757 33929774 33909784 33949796 34139818  
 34159835 34089846 34129855 34299871 34439874 34669876  
 35169828 35299807 35399786 35489766 35529759 35589739  
 35519695 35349683 35099688 34989692 34669705 34509713  
 34239726 34169733

MCD 561

Below is a list of storm reports that occurred in Oklahoma County, Oklahoma on April 19, 2023, from the National Climatological Data Center's Storm Events Database (SED). The storm in question was a prolific hail producer, with numerous reports of large hail of 1.00" or greater:



NCEI > Storm Events Database (Select State) > (Select Date/County/Event)

**Storm Events Database**

**Data Access**

- Search
- Bulk Data Download (CSV)
- Storm Data Publication

**Documentation**

- Database Details
- Version History
- Storm Data FAQ
- NOAA's NWS Documentation
- Tornado EF Scale

**External Resources**

- NOAA's SPC Reports
- NOAA's SPC WCM Page
- NOAA's NWS Damage Assessment Toolkit
- NOAA's Tsunami Database
- ESRI/FEMA Civil Air Patrol Images
- SHELDUS
- USDA Cause of Loss Data

**Storm Events Database**

**Search Results for Oklahoma County, Oklahoma**

Event Types: **Hail**

47 events were reported on 04/19/2023

**Summary Info:**

Number of County/Zone areas affected:	1
Number of Days with Event:	1
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

**Column Definitions:**

'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

**Data Export:** (current results)



[CSV Download](#) / [Documentation](#)

Click on **Location** below to display details.

Available Event Types have changed over time. Please refer to the [Database Details](#) for more information.

Select:  ▼

Sort By:  ▼

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	16:31	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	16:37	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">WHEATLAND</a>	OKLAHOMA CO.	OK	04/19/2023	16:37	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">NICHOLS HILLS</a>	OKLAHOMA CO.	OK	04/19/2023	16:40	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">NICHOLS HILLS</a>	OKLAHOMA CO.	OK	04/19/2023	16:43	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	16:45	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">NICHOLS HILLS</a>	OKLAHOMA CO.	OK	04/19/2023	16:45	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:47	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:51	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	16:53	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:53	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:55	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:55	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">ARCADIA LAKE</a>	OKLAHOMA CO.	OK	04/19/2023	16:56	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">ARCADIA LAKE</a>	OKLAHOMA CO.	OK	04/19/2023	16:58	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:58	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">ARCADIA LAKE</a>	OKLAHOMA CO.	OK	04/19/2023	16:59	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	17:01	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:01	CST-6	Hail	2.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:03	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:09	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:13	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K

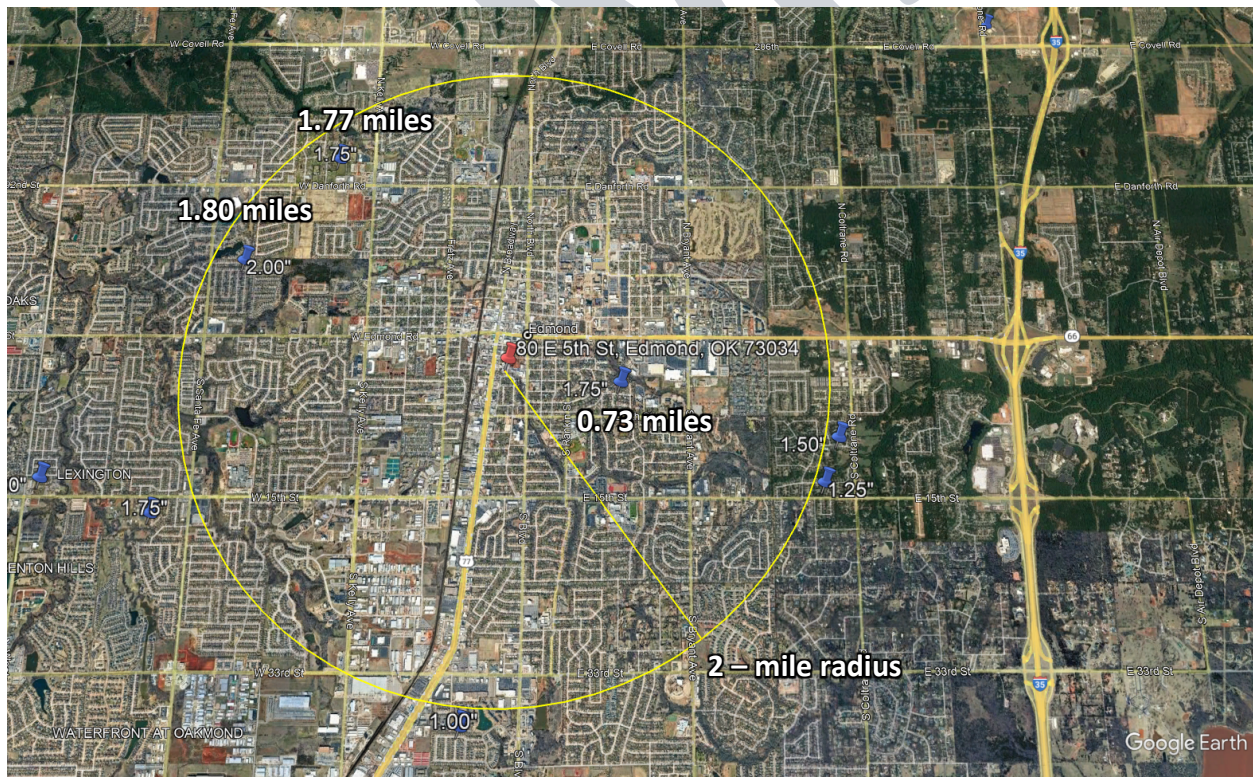
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	17:15	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:15	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:18	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:18	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:21	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:22	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:23	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:24	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	17:25	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(TIK)TINKER AFB</a>	OKLAHOMA CO.	OK	04/19/2023	17:52	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">CHOCTAW</a>	OKLAHOMA CO.	OK	04/19/2023	17:59	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">MIDWEST CITY</a>	OKLAHOMA CO.	OK	04/19/2023	18:12	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">CHOCTAW</a>	OKLAHOMA CO.	OK	04/19/2023	18:25	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	19:04	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	19:15	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">NICOMA PARK</a>	OKLAHOMA CO.	OK	04/19/2023	20:23	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">HARRAH</a>	OKLAHOMA CO.	OK	04/19/2023	20:29	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

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### Storm Events Database (SED) – Oklahoma County, OK April 19, 2023

Three of the reports from the list above were within two miles of the property. The reports as well as their distances from the property are shown as blue pins on the Google Earth image below.



Hail reports and their distances from the property

## Storm Events Database

### Event Details:

Event	Hail
Magnitude	1.75 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Emergency Manager
NCEI Data Source	CSV
Begin Date	2023-04-19 16:55 CST-6
Begin Location	2NW EDMOND
Begin Lat/Lon	35.67/-97.5
End Date	2023-04-19 16:55 CST-6
End Location	2NW EDMOND
End Lat/Lon	35.67/-97.5
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	
Crop Damage	
Episode Narrative	Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.
Event Narrative	

Storm Events Database (SED) – Oklahoma County, OK 5:55 PM CDT April 19, 2023

## Storm Events Database

### Event Details:

Event	Hail
Magnitude	2.00 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Public
NCEI Data Source	CSV
Begin Date	2023-04-19 16:55 CST-6
Begin Location	2WNW EDMOND
Begin Lat/Lon	35.66/-97.51
End Date	2023-04-19 16:55 CST-6
End Location	2WNW EDMOND
End Lat/Lon	35.66/-97.51
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	
Crop Damage	
Episode Narrative	Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.
Event Narrative	MPing report.

Storm Events Database (SED) – Oklahoma County, OK 5:55 PM CDT April 19, 2023



## Storm Events Database

### Event Details:

Event	Hail
Magnitude	1.75 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Public
NCEI Data Source	CSV
Begin Date	2023-04-19 16:58 CST-6
Begin Location	1E EDMOND
Begin Lat/Lon	35.6485/-97.4677
End Date	2023-04-19 16:58 CST-6
End Location	1E EDMOND
End Lat/Lon	35.6485/-97.4677
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	
Crop Damage	
Episode Narrative	Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.
Event Narrative	

Storm Events Database (SED) – Oklahoma County, OK 5:58 PM CDT April 19, 2023

### **WARNINGS ISSUED FOR PROPERTY**

At 5:45 PM CDT, the National Weather Service in Norman, Oklahoma issued a Severe Thunderstorm Warning for Oklahoma County, including the property. It mentioned hail up to 1.75" in diameter:

758  
WUUS54 KOUN 192245  
SVROUN  
OKC083-109-192330-  
/O.NEW.KOUN.SV.W.0125.230419T2245Z-230419T2330Z/

*BULLETIN - IMMEDIATE BROADCAST REQUESTED  
Severe Thunderstorm Warning  
National Weather Service Norman OK  
545 PM CDT Wed Apr 19 2023*

*The National Weather Service in Norman has issued a*

*\* Severe Thunderstorm Warning for...  
Northern Oklahoma County in central Oklahoma...  
Southeastern Logan County in central Oklahoma...*

\* Until 630 PM CDT.

\* At 545 PM CDT, a severe thunderstorm was located over northwestern Oklahoma City, or near The Village, moving northeast at 40 mph.

HAZARD...Golf ball size hail and 60 mph wind gusts.

SOURCE...Radar indicated.

IMPACT...People and animals outdoors will be injured. Expect hail damage to roofs, siding, windows, and vehicles. Expect wind damage to roofs, siding, and trees.

\* Locations impacted include...

Northern Oklahoma City, Edmond, Guthrie, Warr Acres, The Village, Nichols Hills, Jones, Langston, Arcadia, Meridian, Forest Park, Lake Aluma, and Seward.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

This storm is producing large hail. SEEK SHELTER NOW inside a sturdy structure and stay away from windows!

A Tornado Watch remains in effect for the warned area.

&&

LAT...LON 3594 9714 3572 9714 3551 9743 3555 9766  
3595 9746

TIME...MOT...LOC 2245Z 208DEG 34KT 3559 9753

THUNDERSTORM DAMAGE THREAT...CONSIDERABLE

HAIL THREAT...RADAR INDICATED

MAX HAIL SIZE...1.75 IN

WIND THREAT...RADAR INDICATED

MAX WIND GUST...60 MPH

\$\$

Mahale

An updated warning was issued at 5:56 PM CDT with the maximum hail size remaining at 1.75":

378

WWUS54 KOUN 192256

SVSOUN

Severe Weather Statement

National Weather Service Norman OK

556 PM CDT Wed Apr 19 2023

OKC083-109-192330-  
/O.CON.KOUN.SV.W.0125.000000T0000Z-230419T2330Z/  
Oklahoma OK-Logan OK-  
556 PM CDT Wed Apr 19 2023

...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 630 PM CDT  
FOR NORTHERN OKLAHOMA AND SOUTHEASTERN LOGAN COUNTIES...

At 555 PM CDT, a severe thunderstorm was located over western Edmond,  
or near Downtown Edmond, moving northeast at 40 mph.

HAZARD...Golf ball size hail and 60 mph wind gusts.

SOURCE...Trained weather spotters reported golf ball size hail in  
Edmond.

IMPACT...People and animals outdoors will be injured. Expect hail  
damage to roofs, siding, windows, and vehicles. Expect wind  
damage to roofs, siding, and trees.

Locations impacted include...  
Northeastern Oklahoma City, Edmond, Guthrie, Langston, Arcadia,  
Meridian, and Seward.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A tornado watch remains in effect for the warned area. Tornadoes can  
develop quickly from severe thunderstorms.

This storm is producing large hail. SEEK SHELTER NOW inside a sturdy  
structure and stay away from windows.

&&

LAT...LON 3594 9714 3572 9714 3558 9734 3562 9763  
3595 9746  
TIME...MOT...LOC 2255Z 208DEG 34KT 3568 9747

THUNDERSTORM DAMAGE THREAT...CONSIDERABLE  
HAIL THREAT...OBSERVED  
MAX HAIL SIZE...1.75 IN  
WIND THREAT...RADAR INDICATED  
MAX WIND GUST...60 MPH

\$\$

Mahale

## RADAR ANALYSIS

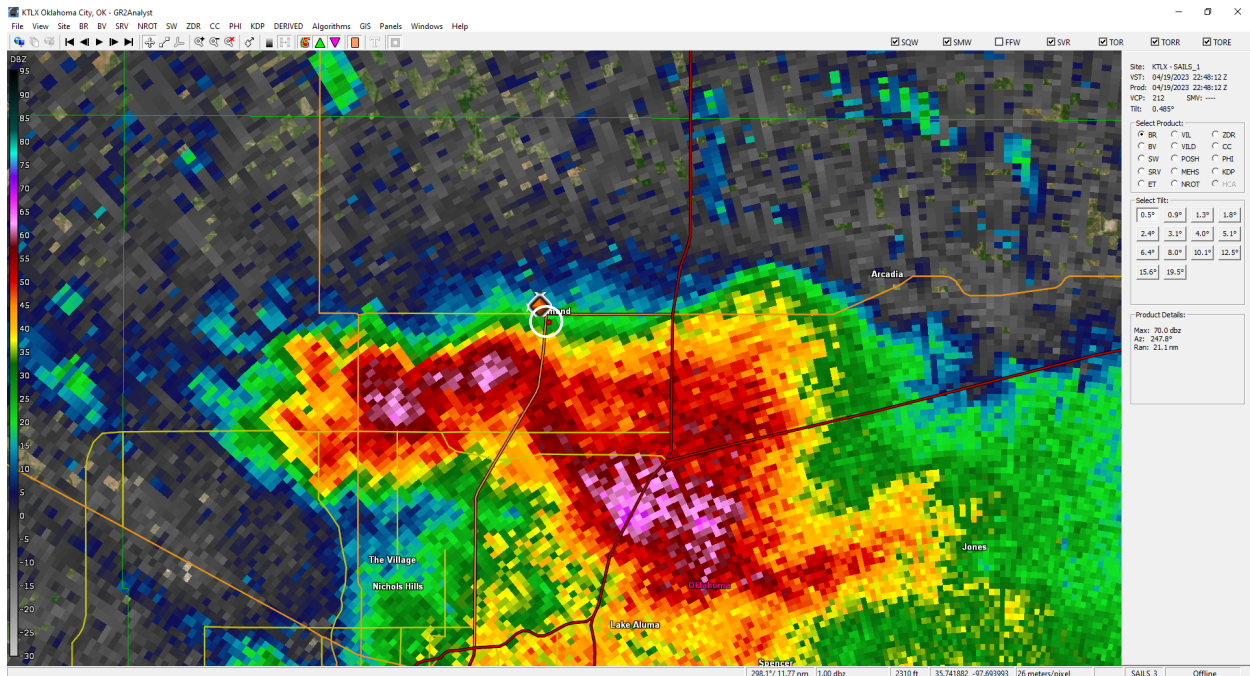
After analysis of Storm Reports and NWS Warning text, I determined that the most likely timeframe that storms impacted the property was roughly around 6:00 PM CDT on April 19, 2023. As mentioned earlier, the radar that will be used in the analysis of the storm that affected the property will be KTLX. The height of the lowest radar beam is located 1,411 ft above the property.

When it comes to radar analysis for hail occurrence, there are some basic thresholds that must be met before analyzing a storm. According to the Federal Meteorological Handbook, Part D:

***4.8.1 Recognition of Hail Potential.*** Historically, one of the first techniques used to identify storms producing hail was to identify storms that possessed high reflectivity  $> \sim 55$  dBZ. Subsequently, storms that possessed unusually high reflectivity at unusually high altitudes within the storm were found to produce hail, often large in size.

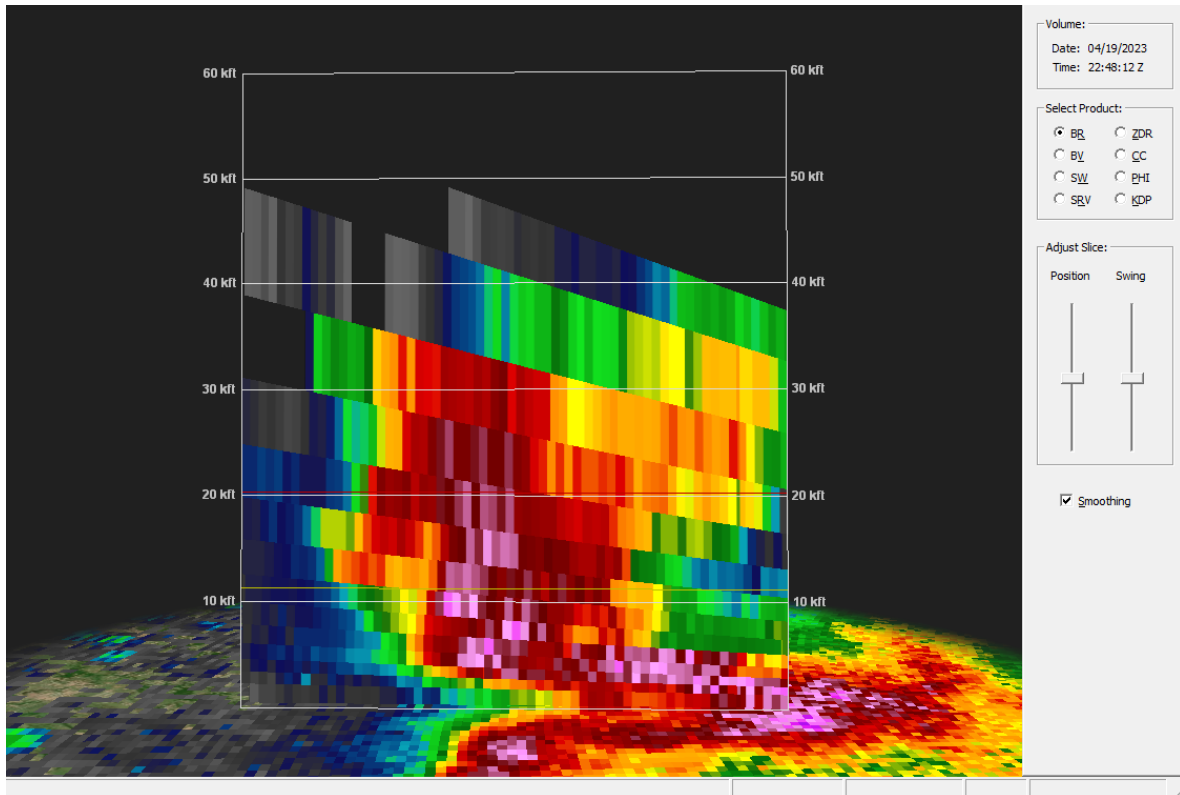
***4.8.2 Considerations.*** High, near-surface reflectivity values (over  $\sim 60$  dBZ) often indicate that the precipitation is in the form of hail and not rain. The existence of sidelobe contamination may also indicate the presence of hail.

I used a product called GR2Analyst to analyze the NEXRAD base reflectivity radar data that I downloaded from KTLX from 5:30 PM CDT to 6:30 PM CDT on April 19, 2023. Base Reflectivity is a radar product that determines what the reflectivity values are at near the surface. Below is a radar frame at 2248 UTC (5:48 PM CDT) on April 19, 2023, that shows the reflectivity values of the storm prior to impact of the property (marked by the red dot and surrounded with a white oval). Notice that there are maximum reflectivity values of up to 63 dBZ nearby to the southwest of the property.



KTLX Base Reflectivity – 2248 UTC April 19, 2023  
(5:48 PM CDT April 19, 2023)

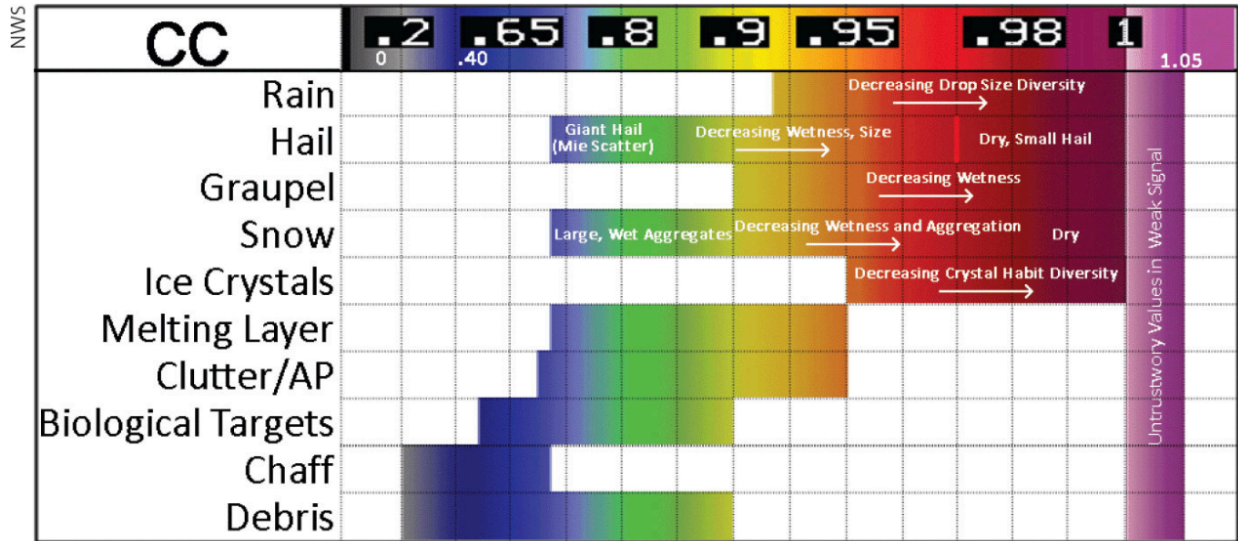
I then determined if the storm's reflectivity heights were above the freezing level. It is well known in the meteorological community that if the 50 dBZ reflectivity is well above the freezing level, severe hail is occurring. If the 50 dBZ reflectivity values are above the -20-degrees Celsius level, very large hail is likely occurring. In addition, according to Dennis and Kumjian (2017), over 50 years of studying hailstorms found that, when the right environmental conditions are present for hail formation and growth, the prime hail growth region is between at least -10 degrees Celsius and -20 degrees Celsius. To find out what the freezing level and -20-degrees Celsius level was in the region, I obtained a special sounding from the Norman, Oklahoma site at 19Z (2 PM CDT) on April 19, 2023. The 0-degree Celsius level was found to be at approximately 11,659 ft while the -20-degree Celsius height was found to be at approximately 20,868 ft. Below is a cross section of the storm at 2248 UTC (5:48 PM CDT). The 50 dBZ reflectivity values were at around 34,600 ft and the 60 dBZ reflectivity values were at around 21,400 ft.



KTLX Base Reflectivity Cross Section 2248 UTC April 19, 2023  
(5:48 PM CDT April 19, 2023)

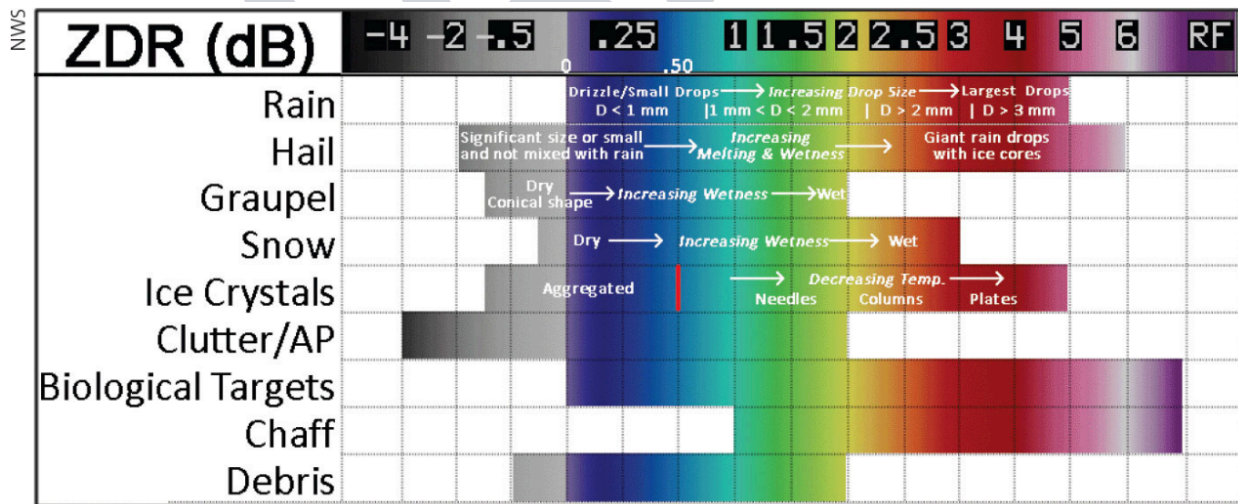
With the Federal Meteorological Handbook hail requirements being met, as well as the storm findings agreeing with previous hail research, I can move forward with the hail analysis in this storm and its impacts on the property. Along with Base Reflectivity (BR), I used three dual pol radar products in the analysis of this storm: Correlation Coefficient (CC), Differential Reflectivity (ZDR), and Specific Differential Phase (KDP). Below are some explanations from the Warning Detection Training (WDT) program at the National Weather Service (NWS) of these dual-pol products, as well as charts for these same products showing common values for various objects.

Correlation Coefficient (CC) is the measure of consistency of the shapes and sizes of targets that the radar beam is detecting. The higher the value, the more in common the objects have with each other and are therefore similar in shape and size. When the CC values are low, the objects that that radar is detecting vary widely in shape and size. CC values of 0.95 or lower indicate severe hail, with values of 0.85 or lower being an indication of very large hail of 2" or larger in diameter being possible.



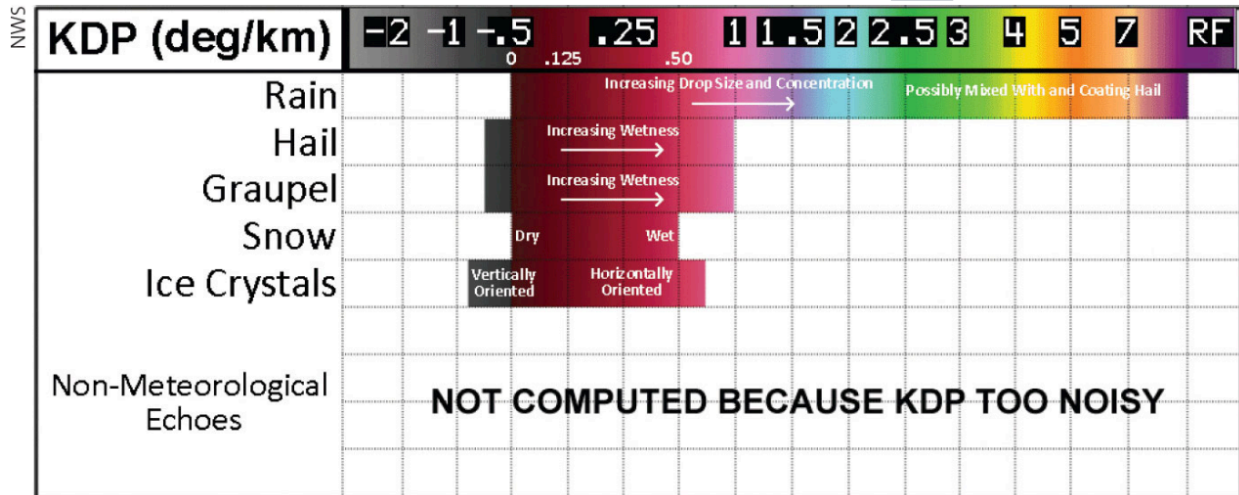
Correlation Coefficient (CC) chart of values for various objects

Differential Reflectivity (ZDR) is the logarithmic ratio between the horizontal and vertical reflectivity factors. This calculation leads to the shape of the targets, which then gives more information on what type of precipitation is occurring. It is therefore a good indicator of the dominant precipitation type that is occurring. Rainfall droplets have a higher horizontal reflectivity factor compared to its vertical reflectivity vector. Therefore, ZDR values for rain are higher. Hail stones are seen by radar as spherical as hail tumbles as it falls. Therefore, the horizontal and vertical reflectivity factors are assumed to be the same, producing ZDR values of at or around 0 dB. However, the ZDR values can be as high as around 3 dB if the reflectivity values are also high. This is an indication of water coated hail being detected.



Differential Reflectivity (ZDR) chart of values for various objects

Specific Differential Phase (KDP) is the range derivative of the differential phase shift along a radial. Positive KDP values indicate greater phase shift in the horizontal than the vertical. An increase in KDP indicates an increase in the size and concentration of rain drops. In terms of hail detecting, KDP values can vary significantly depending on what type of hail is being detected by the radar. When values are close to or at zero, dry, non-water coated hail is present. KDP values as high as 3 degrees/km are an indication of melting hail. When KDP values are not detected in areas of CC and ZDR that are detecting hail, large hail of 2" or greater is present. This occurs when the CC values are less than 0.85.



Specific Differential Phase (KDP) chart of values for various objects

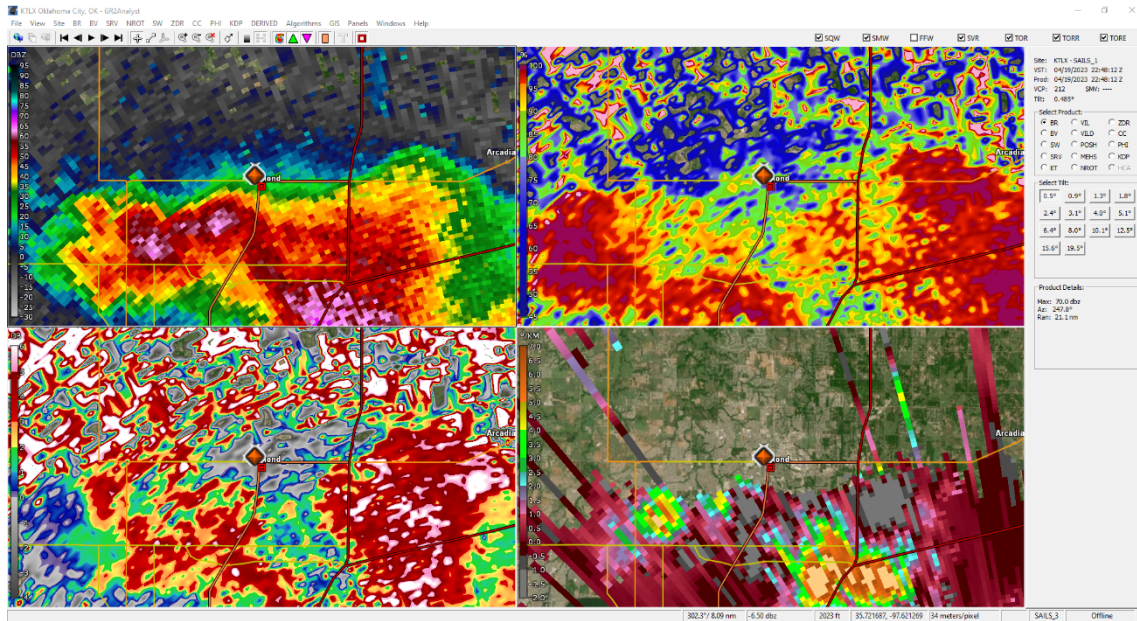
The following four panel radar images are taken from the time frame of 2248 UTC to 2256 UTC (5:48 PM CDT to 5:56 PM CDT) on April 19, 2023. They show the BR (top left), CC (top right), ZDR (bottom left), and KDP (bottom right).

At 2248 UTC (5:48 PM CDT), base reflectivity values of 55 dBZ or greater were southwest of the property, with values as high as 63 dBZ. CC values of at or below 0.95, in correlation to the high reflectivity values, were southwest of the property. ZDR values of at or around 0 dB, in correlation to the high reflectivity values, were southwest of the property. With the collocation of the high reflectivity values, low CC values, and low ZDR values, hail of 1.00" or larger was southwest of the property. By 2250 UTC (5:50 PM CDT), base reflectivity values of 55 to 60 dBZ were over and surrounding the property. CC values of at or below 0.95 were over and surrounding the property, with values as low as 0.74 in the vicinity of the property. ZDR values of at or around 0 dB were surrounding the property, with higher ZDR values over the property indicated likely a mixture of rain and water coated hail. This continued throughout the entirety that hail was falling at the property. KDP values indicated some melting hail. At 2253 UTC (5:53 PM CDT), base reflectivity values of 55 to 60 dBZ were over and surrounding the property. CC values of at or below 0.95 were over and surrounding the property, with values as low as 0.77 in the vicinity of the property. KDP values indicated little melting of the hail. By 2256 UTC (5:56

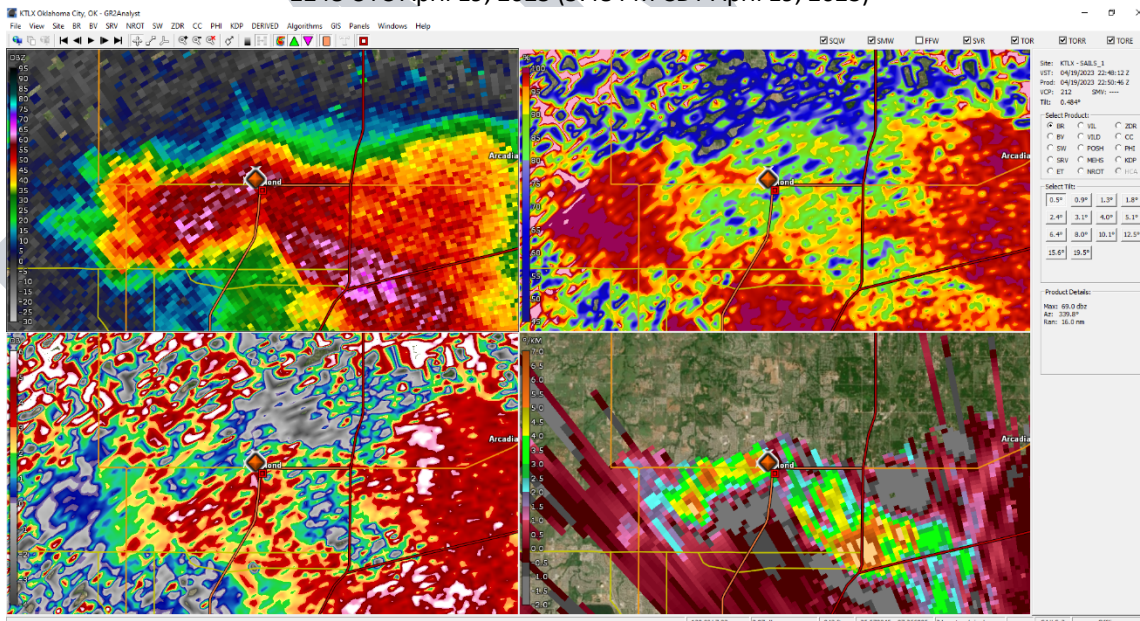


PM CDT), the 55 dBZ or greater reflectivity values were northeast of the property, indicating that the 1.00" or larger hail has ended.

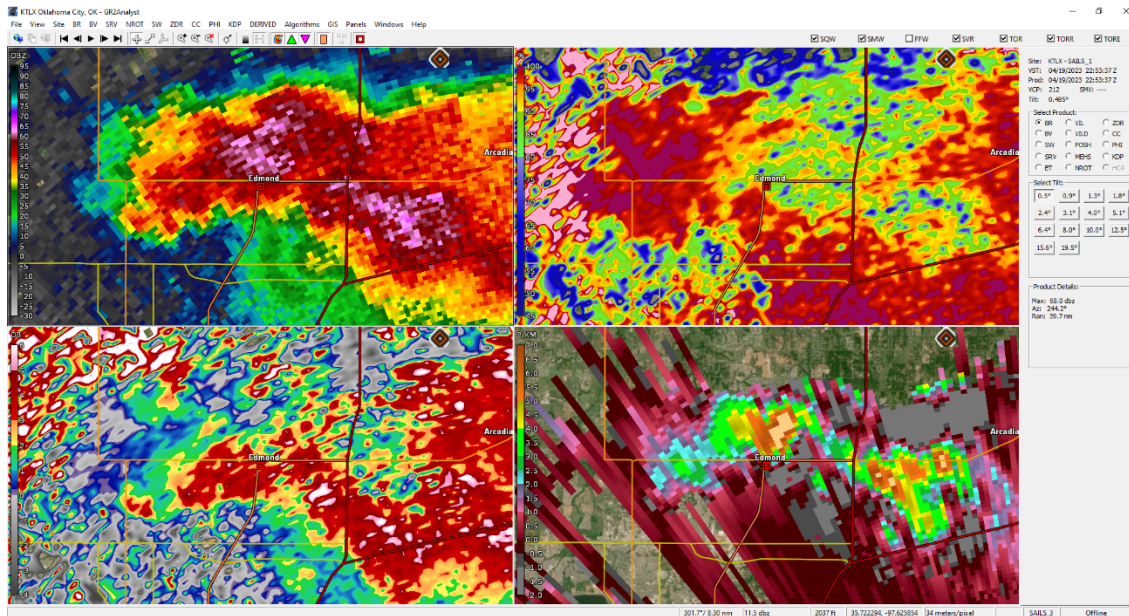
The combination of dual pol radar data analysis and storm reports indicate that up to 1.75" hail impacted the property.



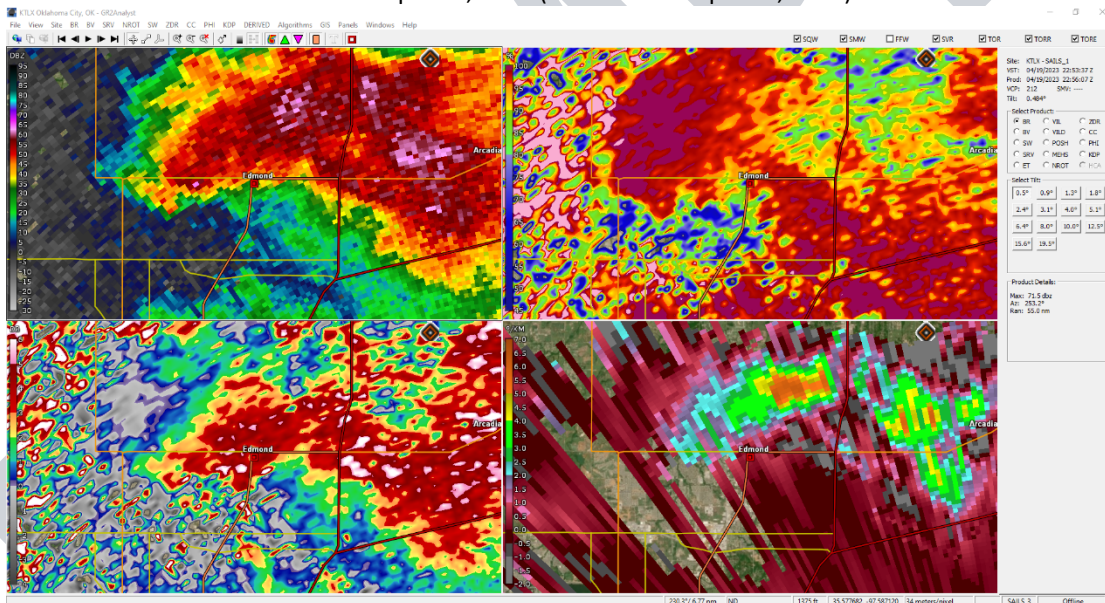
KTLX Radar Image – BR, CC, ZDR, and KDP  
2248 UTC April 19, 2023 (5:48 PM CDT April 19, 2023)



KTLX Radar Image – BR, CC, ZDR, and KDP  
2250 UTC April 19, 2023 (5:50 PM CDT April 19, 2023)



KTLX Radar Image – BR, CC, ZDR, and KDP  
2253 UTC April 19, 2023 (5:53 PM CDT April 19, 2023)



KTLX Radar Image – BR, CC, ZDR, and KDP  
2256 UTC April 19, 2023 (5:56 PM CDT April 19, 2023)

## CONCLUSION

It is my professional opinion that the following weather events occurred at 80 E 5<sup>th</sup> St, Ste 100, Edmond, OK 73034 on April 19, 2023:

1. Severe hail varying in size up to 1.75" in diameter impacted the property from approximately 5:49 PM CDT until approximately 5:54 PM CDT.

I certify that the above information contained in this report is true and accurate to the best of my ability and that all my opinions, findings, estimations and interpolations expressed in this report were made with accuracy as a professional meteorologist within a reasonable degree of meteorological certainty.

John Choquette  
Lead Forensic Meteorologist  
HailTrace

EXAMPLE