

 USDA Forest Service		Wildland Fire Origin and Cause Supplemental Incident Report (Reference FSH 5309.11, Chapter 20)				Incident Number 22-02-IAIP002	
						Incident Date 12/30/2021	
LOCATION							
Fire Name		Dispatch #	Account Code	Region	Forest	District	State
MARSHALL WILDFIRE		COBLX-995	PNPER9	02	10	1	CO
Origin Location: geographical landmarks, highways, roads, trails, etc.		Township	Range	Section	1/4 Sec	Meridian/Datum	
East of Highway 93, West of garden area at 5329 Eldorado Springs Drive, Boulder, Colorado		T1S	R70W	21	NE 1/4	WGS 84	
		Latitude (D-M'-S")			Longitude (D-M'-S")		
		39° 57' 23.10"			105° 51' 49.73"		
JURISDICTION							
USFS Only		Identify Other Agency(s)		Lead Origin & Cause Investigator		Est. Suppression Cost	
N/A		Boulder County Sheriff's Office		SA Travis Lunders		To Be Determined	
						Injuries/Deaths 2	
EVENT SEQUENCE							
Estimated Time of Ignition				Time Fire Reported			
Mo.	Day	Year	HHMM	Mo.	Day	Year	HHMM
12	30	2021	1100	12	30	2021	1104
Who SA Lunders				Who Judith Demarest			
				Who BCSO Deputy Stofcho			
				Who BCSO Det Sgt Pontiakos			
FIRE BEHAVIOR							
Estimated Acres		Fuel Type @ Ignition Area Material First Ignited		Weather Observer (On Scene)		Date	Time
6000		light grassy fuels mixed w/mulch		N/A			
Slope %		Aspect: N E S W	Elevation	Weather Station		Date	Time
0		FLAT	5736	Boulder South West		Dec 30	1100
						Temp	RH
						41 °F	26.8%
						Wind Dir	Wind Speed
						250.9°	49.7
CAUSE DETERMINATION CODE: (PS) = POSSIBLE, (PR) = PROBABLE, (EX) = EXCLUDED (EXPLAIN IN NARRATIVE)							
EX Lightning (Detection Method)							
Weather system associated with fire ignition did not contain lightning, commercial lightning detection services detected no cloud to ground lightning strikes in the surrounding area.							
EX Equipment Use (Exhaust, Brake Shoe, Mechanical, Friction, Aircraft, Vehicle Fire, Other)							
No evidence of recent mechanized equipment use observed or reported in general origin area at the time of ignition.							
EX Smoking (Tobacco, Other)							
Smoking material not located in area of general origin. Conditions not within environmental parameters for a smoking ignition.							
EX Campfire (Cooking, Warming, Ceremonial, Other)							
No evidence of campfires observed in the general origin area.							
PR Debris Burning (Land, Slash, Refuse, Other)							
Residents of surrounding communal properties conducted debris (pile) burning on 12/24/2021.							
EX Railroad (Ignition Activities Associated with Railroad Companies)							
No active railroads or trains in or near the general origin area.							
EX Incendiary (Ignition Component / Material First Ignited)							
No recent evidence of arson fire activity known to Boulder County Sheriff's Office and or other local law enforcement agencies. No ignition devices located in specific origin area.							
EX Children (Ignition Activities Associated with Children; 12- years and younger)							
No evidence of fire play in the general origin area. No report of children observed in or near the general origin area at or before the fire was reported.							
EX Miscellaneous (Blasting, Structure, Fireworks, Welding, Cutting, Grinding, Pest Control, Power Line, Glass, Target Shooting, Spontaneous Combustion, Other)							
Nearest power line is approximately 190 feet downwind of specific origin area. No evidence of other miscellaneous causes identified or observed.							
Cause Determined: State brief reason & explain in the narrative				Cause Undetermined: State brief reason & explain in the narrative			
Embers blown and or escaped from debris burn pile during extreme high wind event ignited fine grassy fuels near fence line.				N/A			
PREPARED BY		TRAVIS LUNDERS		Date	Submitted to		PATRICK BROWN
		Digitally signed by TRAVIS LUNDERS Date: 2023.05.01 14:59:00 -0600			Digitally signed by PATRICK BROWN Date: 2023.05.01 17:03:39 -0600		
ATTACHMENTS - IF INCLUDED		LE Incident Report		<input checked="" type="checkbox"/>	Supplemental Reports		<input type="checkbox"/>
		Fire Stat Report		<input checked="" type="checkbox"/>	Sketches / Diagrams		<input checked="" type="checkbox"/>
				<input checked="" type="checkbox"/>	Maps		<input checked="" type="checkbox"/>
				<input checked="" type="checkbox"/>	Photographs		<input checked="" type="checkbox"/>
				<input checked="" type="checkbox"/>	Other		<input checked="" type="checkbox"/>

 USDA Forest Service	Wildland Fire Origin and Cause Supplemental Incident Report (Reference FSH 5309.11, Chapter 20)		Incident Number		22-02-IAIP002		
			Incident Date		12/30/2021		
(CODE: S – SUBJECT, W – WITNESS, V – VICTIM, RP – REPORTING PARTY, O – OTHER)							
Name (Last, First, Middle)		Alias	DOB	Race	Gender		
RP	DEMAREST, Judith H.	Judy		White	Female		
Address (Home)		Phone (Home)	Hair Color	Eye Color	SSN		
Address (Business) (Tax Identification Number if Required)		Phone (Work)	Height	Weight	License / ID		
Name (Last, First, Middle)		Alias	DOB	Race	Gender		
W	ZOLTOWSKI, Michael			White	Male		
Address (Home)		Phone (Home)	Hair Color	Eye Color	SSN		
Address (Business) (Tax Identification Number if Required)		Phone (Work)	Height	Weight	License / ID		
Name (Last, First, Middle)		Alias	DOB	Race	Gender		
S	Twelve Tribes/Common Life Dewllings LLC						
Address (Home)		Phone (Home)	Hair Color	Eye Color	SSN		
5329 Eldorado Springs Drive Boulder, CO							
Address (Business) (Tax Identification Number if Required)		Phone (Work)	Height	Weight	License / ID		
VEHICLE INFORMATION (CODE: D – DAMAGED, E – EVIDENCE, I – IMPOUND, S – SUBJECT W – WITNESS, O – OTHER)							
	License Number	State	VIN	Year	Make	Style	Other Information
	License Number	State	VIN	Year	Make	Style	Other Information
	License Number	State	VIN	Year	Make	Style	Other Information
	License Number	State	VIN	Year	Make	Style	Other Information
INSURANCE INFORMATION (HOME, AUTO, LIABILITY, OTHER)							
Insurance Company		Policy Number	Insurance Agent	Address		Phone Number	

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		Incident Date	12/30/2021
SYNOPSIS (DATE, FIRE NAME, ESTIMATED ACRES, LOCATION, JURISDICTION); (ESTIMATED COST, DAMAGE; PROPERTY / RESOURCE); (CAUSE; DETERMINED / UNDETERMINED)			
<p>The Marshall Wildfire ignited on 12/30/2021 at or shortly before 11:00 A.M. The first origin area is located near the western boundary of 5329 Eldorado Springs Drive Boulder, Colorado on what is referred to as the Twelve Tribes property. It is estimated the Marshall Fire burnt 6080 acres, and destroyed 936 houses and or housing units, affected 113 other residential properties, destroyed 7 commercial properties, and damaged 24 commercial properties in Louisville and Superior. In Unincorporated Boulder County the Marshall Fire affected 158 houses, 153 outbuildings, and damaged 2 commercial properties. Estimated value of losses after the Marshall Fire totals will be determined by Boulder County District Attorney's office.</p> <p>USFS Wildland Fire Investigators determined the first ignition associated with the Marshall Wildfire occurred on the Twelve Tribes property was Human Caused: resulting from Debris Burning</p> <p>Investigators identified a second origin area on the Marshall Fire south of the Marshall Mesa Trailhead on City of Boulder Open Space and Mountain Parks which ignited at approximately 12:20 P.M. on 12/30/2021. The origin and cause investigation for this origin area will be reported on a separate Wildland Fire Origin and Cause Supplemental Incident Report completed by United States Forest Service (USFS) Special Agent (SA) Aaron Henrichs.</p>			
DETAILS OF INVESTIGATION: (INITIAL REPORT, INITIAL ATTACK, INITIAL INVESTIGATION, FIRE BEHAVIOR ANALYSIS, STATEMENTS, ORIGIN EXAMINATION, CAUSE DETERMINATION)			

INITIAL REPORT

Judith (Judy) Demarest who resides at [REDACTED], Colorado called 911 to report seeing smoke rising from the Twelve Tribes property south of their residence at approximately 11:04 A.M on 12/30/2021.

Judith, her husband Charles (Chuck) Demarest, and their son Nicholas (Nick) Demarest were interviewed on 12/31/2021 by Detectives with the Boulder County Sheriff's Office (BCSO). ***Their interviews were recorded and are maintained by the BCSO.***

During Judith's interview she explained that she was looking out her kitchen window while washing dishes and her son, Nick, approached her and said I think that is smoke. Judith initially dismissed it as smoke and believed it was just dust blowing in the windy conditions. Her son insisted it was smoke and told her to call 911. Judith described a little plume of white smoke was rising straight up from the Twelve Tribes property just east of the highway. Judith described the smoke rising from an area just beyond the ridgeline in an area where equipment is frequently parked on the Twelve Tribes property. Approximately 20-30 minutes after reporting the fire she reported seeing a line of fire coming. Judith stated that the responding fire truck stopped at the traffic light, and she felt guilty for not explaining better where the fire was. **Investigator's Note: Judith was asked to identify on an image where she estimated the smoke was originating from by the BCSO Detective that was conducting the interview. USFS SA Lunders examined this area without viewing this image.**

Chuck explained that he worked with Rocky Mountain Rescue for 50 years. He confirmed that Judith, Nick, and he were all standing together. He believed that his wife called 911 to report the fire approximately 1 to 2 minutes after first seeing the smoke. Nick first saw the smoke and brought it to their attention. Chuck stated Judy thought it was a woodstove or something; he looked at it a moment longer and realized it was a fire and told her to call 911. The fire was slowly growing for 4-5 minutes, after that it grew very rapidly. He estimated the fire department arrived approximately 5 minutes after the initial 911 call. Chuck was frustrated that the fire department did not call her back, subsequently they did not drive right up to the origin. He stated the responding fire truck sat at the intersection of Marshall Road and Highway 93 for quite a long time. Chuck estimated wind gusts were over 100 mph at their residence. He did not see any fire suppression efforts at the fire's origin. Approximately 20 minutes later he observed flames come over the ridge and began moving down the valley on the far side of Marshall Road. Chuck described the fire starting on the Twelve Tribes complex in an open area near a dirt road off Highway 93. **Investigator's Note: Chuck drew an X on an image for the BCSO Detective that was conducting the interview indicating where he estimated the fire ignited. SA Lunders examined this area without viewing this image.** He described the smoke was gray to light gray like a grass fire, and clarified it was not a residence fire because the smoke was not dark.

Nick lived in an apartment on his parent's property. **Investigator's Note: Nick was presented an image by the BCSO Detective that was conducting the interview. Nick marked on the image indicating where he estimated the smoke was originating from. SA Lunders examined this area without viewing this image.** Nick confirmed he first saw the smoke while he was looking out the kitchen window of his parents' house. He estimated seeing the smoke at 11:03 because his mother called 911 at 11:04. Nick described the smoke as light gray and likened it to the size of a large campfire in size. He confirmed the smoke was first observed coming from the Twelve Tribes property, east of Highway 93.

INITIAL ATTACK**Mountain View Rescue Engine #2209**

On 01/04/2022, BCSO Detective Asa Merriam and Adams County Chief Fire Investigator (CFI) Jerry Means interviewed fire personnel from Mountain View Rescue Station #9 who were the first fire personnel to respond to the initial report of smoke/fire. ***The body worn camera footage and associated interview reports are maintained by the respective departments responsible for conducting those interviews.*** Details of the interviews were shared with USFS SA Travis Lunders in the days following the interviews. SA Lunders was also present on January 4th when Detective Asa and CFI Means walked through the Marshall Fire general origin area with the responding fire personnel. The following narrative is a summary of their initial observations and the initial attack on the Marshall Fire.

Mountain View Fire Rescue Engine #2209 responded to an Active 911 page which was received at 11:06 A.M. on 12/30/2021. The crew consisted of Lieutenant Michael Ivancic, Fire Medic Benjamin O'Connell, and Engineer Ryan Sheppard. While responding to the area the crew was informed that the fire may have been ignited by downed powerlines. As the crew approached the intersection of Highway 93 and Eldorado Springs Drive, they noticed a sagging telecommunications line over Eldorado Springs Drive, east of Highway 93, at approximately windshield height. Sheppard parked the engine on Eldorado Springs Drive in order to prevent any traffic from turning east off Highway 93. While parked at this location Lt. Ivancic was scanning the area for signs of the reported smoke and or fire. He confirmed he did not observe any smoke or flames east of Highway 93 on lands managed by City of Boulder Open Space and Mountain Parks or near the Marshall Mesa Trailhead. Lt. Ivancic continued to scan from north to south and back again without seeing any signs of an active fire. He recalled there was a moment where the winds let up and he saw smoke rising from the Twelve Tribes property north of the intersection they were parked at.

Engineer Sheppard drove to the general origin area and parked the engine parallel to several pieces of heavy equipment parked on the Twelve Tribes property. Sheppard confirmed he parked south of the fuel tanks near the general origin area. Medic O'Connell exited the engine and began to pull a line from the engine and began advancing toward visible flames located along a fence line on the west end of a garden area, close to a shed located immediately west of the same fence line. Engineer Sheppard exited the engine and began sizing up the fire.

Lt. Ivancic who was still seated in the engine, recalled seeing a slash pile which he described as being covered by dirt south of the shed's location. He described the pile being approximately waste high and arms length wide. Lt. Ivancic stated he saw sparks blowing out of the pile in the extremely high winds and explained the fire was quickly moving east into the garden area.

Medic O'Connell said he did not notice the slash pile which Lt. Ivancic spoke of. O'Connell recalled smoke and small flames along the east side of the shed, and stated the shed was not burning at the time of their arrival. The fire was burning in light grassy fuels along the fence just east of the shed and small spot fires were forming further into the garden area east of the shed. He described the flames were only a few inches high. O'Connell said the largest most active fire was along the fence line south of the shed. His suppression efforts consisted of spraying water on the fire along the fence line.

Engineer Sheppard walked to the north side of a chip pile, immediately north of the shed location. There he observed smoke and flames beginning to make a run-down slope toward Marshall Drive advancing in a northeast direction. Engineer Sheppard described, big beefy, and or larger dimensional treated lumber actively burning on the west end of the garden near the fence line. He recalled O'Connell putting water on what looked like 4X6 pieces lumber and or fence posts that had fallen down wind of the shed. Sheppard speculated the only reason the larger dimensional lumber was burning was due to extreme wind influence.

Lt. Ivancic decided to relocate the engine west of the intersection of Marshall Drive and Eldorado Springs Drive in order to begin protecting structures in the path of the rapidly advancing fire. They were unsuccessful at applying water between the hillside and an area west of a two-story structure at [REDACTED] due to how strong the wind was blowing out of the west. As the structure began to catch fire, Lt. Ivancic approached the door and began banging on the door to alert those who may have been inside, to inform them that they needed to evacuate. He later learned the occupants had already left the residence. While on scene at this location Lt. Ivancic described "it was raining embers." He reported sustaining burns to his neck and chest while being exposed to the ember cast event.

INITIAL INVESTIGATION

Fire Investigators Initial Walk Through of Origin Area

On 12/31/2021 CFI Jerry Means, Hygiene Fire Department Investigator Travis Homyak, Mountain View Fire Department Fire Marshal Doug Saba, and USFS Assistant Special Agent in Charge (ASAC) Patrick Brown met at the Eldorado Park and Ride. BCSO Detective Sergeant Conner Pontiakos secured a signed search warrant for the properties of interest, consisting of what is known as and referred to as the Twelve Tribes property. The property had been evacuated by its occupants and was secured by several local law enforcement officers. The Marshall Mesa Trailhead was also being secured by BCSO Deputies. *(See CFI Means Investigative Report for complete details)*

Upon Sergeant Pontiakos' arrival the investigative group began an exterior examination of the properties in question. A snowstorm was forecast to impact the origin area and snow was already beginning to fall and was starting to accumulate.

During the investigator's initial investigation, they identified two separate areas that exhibited signs of recent fire activity. CFI Means observed an area of what he described as smoldering soil near the western end of the shop/garage located on the south end of the Twelve Tribes property. He further noted observing the remains of a charred tree stump with light smoke radiating upward from the surrounding soils and determined the root structure was still actively burning. **Investigator's Note: Investigators later learned members of the Twelve Tribes intentionally burnt the remains of the stump on 12/27/2021.**

Near the center of the property CFI Means observed a charred spot approximately 10 feet north of an elevated fuel tank rack. CFI Means noted that the center of the charred spot appeared to be warmer than the surrounding soils as the center of the charred area was void of accumulating snow. Investigators also observed several mounds of rocky dirt along the western edge of a fence line surrounding what appeared to be a garden. Smoke was observed rising from several of these piles. As the investigators continued east through the garden ASAC Brown noted observing advancing fire indicators originating from the west and progressing to the east.

BCSO detectives advised the group that there may have been an additional fire which may have originated at an area near powerlines south of the Marshall Mesa Trailhead.

At this time CFI Means requested that ASAC Brown assemble a team of USFS fire investigators to conduct the origin and cause investigation. ASAC Brown assigned SA Lunders as the lead USFS wildland fire investigator. SA Lunders would be assisted by SA Aaron Henrichs and SA Hannah Nadeau. The USFS investigators were instructed to arrive on 01/03/2022 following the impending snowstorm.

Colorado Division of Fire Prevention and Control (DFPC) Investigator Dawn Tollis was requested to examine the origin area with a K-9 Survey. DFPC Investigator Colton Balthazor also arrived and assisted Investigator Tollis. Investigator Tollis and her accelerant detection K-9 "JOJO" traveled around the exterior west and northwest areas of the origin area and conducted a survey. K-9 JOJO had numerous alerts in the northwest area of the origin area. The alerts were marked with small plastic tokens by Investigator Tollis. Members of the investigative team collected samples of debris at their discretion. *(See DFPC Tollis Investigative Report for complete details).*

CFI Means used a Milwaukee Temperature gauge to measure the temperature around the mounds of rocky soil on the north end of the origin area, and west end of the garden area. He registered 342 degrees Fahrenheit (F) on the south side of the large/north pile, 259 degrees F on the north side of the large/north pile, and 281 degrees F on the east side of the large/north pile. Several locations were still producing smoke/steam. The examination of the suspected origin area was suspended for the evening due to the snowstorm, and the property was secured.

Drone Overflight of Suspected Origin Area 12/31/2021

Boulder Police Department flew a remote-controlled drone aircraft over the suspected general origin area on 12/31/2021. Video and photographic imagery was captured documenting the general origin area in standard and thermal imagery formatting. *(Video/Photographic footage is maintained by Boulder County Sheriff's Office) (Exhibit 1 Marshall Fire Origin & Cause Drone Footage 12/31/2021)*

SA Lunders viewed this evidence on 01/03/2022 and 01/04/2022. During his examination he noted the video/photographic footage showed the burn scar did not extend beyond the piles of dirt on the west end of the fire, indicating the heel of the fire was at/under the piles of dirt. The right flank of the fire did not extend beyond the south fence line of the garden area. A transition zone was observed north of the southern fence line. The degree of fuel consumption and char on the surface fuels significantly lessened in a linear pattern extending from the west to the east and from the center of the garden area to the south fence line. Advancing fire indicators were observed originating near the center of the western fence line and extending through the center of the north fence line. Those advancing fire indicators included a greater degree of surface fuel consumption and degree of char on the surface fuels. This fire pattern indicator is often referred to as Damage Differential. SA Lunders noted most of the wooden fence post on the north fence line were burnt off at or near ground level. The advancing fire continued down and across slope in an easterly direction consistent with the prevailing winds. The left flank of the fire was impacted by lack of receptive fuels

on or near Marshall Road below the slope on the northern side of the garden area. The fire scar formed a distinctive narrow V pattern commonly associated with strong winds.

SA Lunders also noted that thermal images captured during the overflight indicated the area of the debris burn that took place on 12/24/2021 still held significant heat in comparison to the surrounding soils and ground surface. Additionally, the piles of dirt located along the western fence line surrounding the garden also held significant heat.

USFS Investigators Arrival and Initial Walk Through 01/03/2022

On 01/03/2022 SA Lunders and SA Nadeau arrived at the BCSO headquarters. Both were introduced to a group of investigators and Assistant District Attorneys that had been actively conducting witness interviews, collecting video and photographs of the fire activity in, and surrounding the general origin area. BCSO Detective Katie Tkach gave a power point presentation to the group which outlined a timeline of events and facts known to that point of the investigation.

The investigative group then traveled to the suspected origin area located on the Twelve Tribes property. SA Lunders noted the ground was covered with 4-6 inches of snow. The origin area had been impacted by the installation of a temporary chain link fence that surrounded an equipment parking area, fuel tanks, garden, and residential structures to the east.

The group walked in a westerly direction south of the garage/shop and past a tan metal conex container on the southern end of the Twelve Tribes property. West of the conex investigators observed recently split and unsplit piles of pine firewood. There was no sign of fire activity in this area.

The investigators then examined the area west of the garage/shop area where the remains of the burnt stump was observed by CFI Means on 12/31/2021. SA Lunders did not see any signs and or indications that fire had progressed from and or escaped from this location. There was no evidence that embers had been blown from this location thereby igniting any downwind fuels and or structures.

The group continued north along a powerline that ran parallel to the residential backyards of the Twelve Tribes property. The poles appeared to have been recently installed along with new hardware associated with the single-phase conductor and neutral line. There was no visible signs of arcing or faults on this section of powerline. Telecommunication and data lines were also present on the poles. There was no sign of fire activity in or originating from this area.

Investigators walked west across a large equipment parking area near the center of the Twelve Tribes property. Standing at the southwest corner of a large fenced in garden area SA Lunders observed the western edge of the gardens fence line had been significantly impacted by fire. Near the center of the western fence line several wooden fence posts had been burnt near their bases and had fallen into the garden area. Many of the metal T posts in this area were bent and leaning in toward the interior of the garden. T posts on the southwest corner had little to no damage, and unburnt vegetation remained woven into the fence material itself. A wooden garden structure, and other wooden materials in the southwest corner of the garden remain relatively unburnt. The heel of the fire appeared to extend several feet west of the western garden fence line near the reported location of a wooden garden shed. SA Lunders noted a visible difference in the damage differential of the surface fuels along the right flank of the fire. Specifically observing the wood mulch that covered the surface soils had a greater degree of char and consumption near the center and northern edge of the garden. Additional indications such as sooting, staining, spalling was observed indicating the fire advanced from the western fence line progressing to the east.

SA Lunders noted a circular area approximately 8 feet in diameter void of any snow cover. This area of interest was approximately 10 feet north of an elevated fuel tank rack and approximately 30 feet west of the western garden fence line. Exposed charred wood material was observed on and protruding from the surface soils. The area was slightly depressed on the northern edge. SA Lunders was informed by CFI Means that Michael Morgan, a resident of the Twelve Tribes property, had conducted a debris pile burn in this location on 12/24/2021.

Numerous piles of dirt and rock mix were observed along the western edge of the garden fence line, as well as a much larger area located west of the northwest corner of the garden area. Several of these piles had smoke and or steam rising from them. Detective Tkach advised SA Lunders that an associate of Michael Morgan had utilized a front-end loader to

dump the dirt/rock mixed soil in the afternoon hours of 12/30/2021. SA Lunders noted the heel of the fire had been heavily impacted by suppression efforts prior to the scene being secured by BCSO on 12/31/2021. Additional post fire pedestrian foot traffic was observed in and around the general origin area as well.

SA Lunders then moved to the northwestern corner of the garden area and observed the majority of the wooden fence posts located near the middle of northern fence line had been burnt off at ground level. The woven wire fence was laying on the ground with the top of the fence pointing in a northern direction. This indicated a hot advancing, wind driven head fire which consumed the bases of the fence posts and pushed the fence over in a northern direction. The left flank of the fire traversed the downslope to the north and intersected Marshall Drive.

Near the northwestern corner of the garden area SA Lunders observed multiple areas where woven wire fencing had been utilized to form circular mulching containers. Other commercial plastic mulching devices and containers were also observed near this area. The mulch material inside of these containers had a charred appearance due to exposure to open flame and heat.

SA Lunders continued to walk the perimeter of the garden in a counterclockwise direction. Unburnt grassy materials were observed in and along the eastern fence line of the garden. SA Lunders noted the more complete consumption of fuels occurred along the northern fence line. Initial observations of macro fire behavior indicators showed the most probable point or points of ignition occurred along the western fence line near the reported location of the garden shed. The wind driven fire advanced across the interior of the garden in an easterly direction, progressing downslope to the intersection of Marshall Drive, Marshall Road, and Eldorado Springs Drive. The primary surface fuels within the garden area consisted of fine grassy fuels and wood chip mulch. Evidence of burnt wood mulch was observed on Marshall Drive and on the hillside west of the structure that burnt at [REDACTED]. These observations are consistent with Lt. Ivancic account of the ember cast he witnessed on 12/30/2021 during initial attack efforts.

Due to the amount of snow cover on the ground a more detailed origin examination was not completed at that time.

USFS Review of Witness Video and Photographs

Mathew Morgan (Twelve Tribes Debris Burn)

Morgan provided BCSO a copy of a photograph taken with his cell phone on 12/24/2021. The photograph depicts a debris burn on the Twelve Tribes property north of the fuel tanks and west of the garden area. Brush and debris are actively burning in the photograph. The area surrounding the burn consists of light grassy and brushy fuels. The area surrounding the burn was not cleared of fine fuels and has no safety berm constructed. *(Photographic footage is maintained by Boulder County Sheriff's Office)*

Eli Gabriella

Gabriella provided BCSO with three photographs taken on 12/30/2021 in or near the garden on the Twelve Tribes property shortly after the fire was reported. The first was taken at 11:19:39 depicting active fire near his boot. The second was taken at 11:24:51 on the east end of the garden area depicting a fire engine and firemen on scene. The fuels in the middle to southern edge of the garden are mostly unburned. A shed is visible through the white smoke as well as a wood trellis to the southeast of the door on the shed. *(Photographic footage is maintained by Boulder County Sheriff's Office)*

Jack Pommer YouTube

On 01/04/2022 SA Lunders viewed video and photographs taken by witnesses near the origin of the Marshall Fire. One of the first videos viewed was a compilation of short videos titled "Marshall Fire" posted on YouTube by Jack Pommer. <https://www.youtube.com/watch?v=tKz2bKEltY> the first video clip is taken facing north and depicts the heavy equipment parked on the Twelve Tribes property. In the foreground a white garden shed with dark trim is seen to the west of the fenced in garden area. White smoke is observed rising immediately east of the shed and across garden area. No visible flames can be seen in the video. In the 4th video clip of the posting, it shows the east side of the side engulfed

in flames. With flames beginning to lap over the roof line and around the front of the shed. *(Video footage is maintained by Boulder County Sheriff's Office)*

Xfinity Employee

Unknown Xfinity employee provided BCSO with a video taken at 11:41 on 12/30/2021 that depicted the first minutes the shed began to burn. Mulch piles north of shed do not show signs of burning. *(Video footage is maintained by Boulder County Sheriff's Office)*

Michael Zoltowski

Zoltowski who resides at [REDACTED] provides BCSO multiple videos documenting the Marshall Fire. IMG_3823.MOV was taken at 11:44:27 on 12/30/2021. Video depicts the shed burning. Mulch piles north of shed do not show signs of burning. IMG_3826.MOV was taken at 11:54:38 and depicts shed almost entirely consumed by fire. Mulch piles north of the shed are burning with flames and smoke rising from the piles. *(Video footage is maintained by Boulder County Sheriff's Office)*

Jonathon Reed (Twelve Tribes Resident)

Reed submitted a video taken at 11:46 on 12/30/2021. Video depicts the residence at [REDACTED] begin to burn. *(Video footage is maintained by Boulder County Sheriff's Office)*

Michael Mawn

Mawn submitted IMG_4524 video taken at 11:47 on 12/30/2021 from intersection of Hwy 170 and Hwy 93. Video depicts the shed burning on Twelve Tribes Property. Mulch piles north of shed are now burning with flames and smoke rising from with northern edge. Data line over Hwy 93 is hanging low across the highway. No visible smoke or fire is observed east of Hwy 93, and or south of Hwy 170. Data line is resting in tree branch southeast of the intersection. *(Video footage is maintained by Boulder County Sheriff's Office)*

FORECASTED WEATHER

SA Nadeau began gathering weather data from surrounding weather stations on 1/3/2022. Preliminary weather conditions collected by SA Nadeau were considered during the specific origin examination conducted by investigators on 1/5/2022.

SA Nadeau later contacted Paul Schlatter, Science and Operations Officer, with the National Weather Service Forecast Office located in Boulder, CO. Schlatter explained that the geographical area near the Marshall Fire origin is frequently subjected to extreme downslope windstorms due to specific geographical factors and weather patterns. He explained the winds in this area during December and January typically exceed 80 mph nearly every year, with wind gust exceeding 100 mph every couple years. Schlatter agreed to meet with investigators and prosecutors assigned to the Marshall Fire on 1/6/2022 to further explain this weather occurrence and his weather observations from 12/30/2021.

During the meeting at BCSO Headquarters Schlatter explained the Highway 93 corridor is susceptible to historically extreme wind events due to the unbroken ridge line which is oriented north to south. Predominate westerly winds are squeezed through this ridge line and strong temperature inversions thousands of feet above the ridge line. As the air is forced through the narrow zone above the ridge line and below the inversion above the air rapidly accelerates as it descends onto the foothills and adjacent plains near Boulder, CO. He further explained that the strongest winds typically occur at the base of the foothills along Highway 93 between Lyons and Golden. Schlatter described the constant downslope accelerating wind as a mountain wave, which he explained could last for hours. He further explained that the wind will eventually begin to rise in a "jump region" with weaker winds to the east of this region forming a rotor. The rotor is a horizontal rolling of the wind, parallel to the foothills to the west, where wind flow reverses in response to the mountain wave. This weather event accounts for the many meteorologic observations of winds flowing in multiple directions and varying wind speeds during the Marshall Fire. Schlatter presented multiple videos to the group which

depicted the mountain wave and rotors from horizontal and satellite views. Schlatter was asked to prepare an official report which explained the mountain waves and rotors discussed in the meeting. Additionally, Schlatter was asked to document the historical weather conditions leading up to and factoring into the ignition and spread of the Marshall Fire. **(Exhibit 2 Paul Schlatter Weather Report)** Included in this report are links to the videos presented to the group which depict the formation of the mountain wave and associated rotors that occurred during the Marshall Fire.

Schlatter document in his report that an unusually wet spring in 2021 caused grasses to grow tall and thick. The rains ended in late spring and early summer leading to the driest period on record between June and December. He further noted it was also the warmest period on record. The Boulder area went from a classification of no drought to level 3 extreme on a scale of 0-4 by December 2021.

Schlatter summarized in his report what the wind conditions were near the Marshall Fire origin area between 10A.M and 2P.M. His summary is based on the surface observational data, eyewitness account of the wind near the Marshall Fire origin area, and his expert opinion of how extreme winds behave in the mountain waves along the Highway 93 corridor.

- West to west southwest winds (from 270-250 degrees on a wind compass) sustained at 50 mph with gusts reaching 90-100 mph at the 10-meter height. The strongest winds were around between 11 AM and 1 PM MST, but gusts exceeding 80 mph were occurring from 10 - 2 PM.
- Occasionally an abrupt wind shift occurred, with winds shifting to the north or northeast for a few minutes (maybe as long as 10 minutes), associated with the mountain wave briefly “reloading” or the rotor moving slightly westward over the area.
- The NWTC (National Wind Technology Wind Center) winds did not capture any abrupt changes in wind direction in the high quality 1-minute data because the location of the rotor and mountain wave never shifted far enough west along that part of CO-93, probably due to an absence of local terrain effects.
- BLD01 (Boulder South West) also did not capture those brief and significant shifts in the wind because the data are only available every 15 minutes. Eyewitness accounts confirm these brief winds shifts occurred in the area. These abrupt changes in wind direction to north or northeast with speeds 30-50 mph occur near rotors (see Figure 1) and fit the eyewitness description from the area.
- Once the fire became very hot, it was able to locally modify the atmosphere around the fire, resulting in vortices and locally enhanced wind speeds, as well as rapidly shifting winds in and around the fire. These locally enhanced winds because of the heat of the fire occur on the order of 100s of m in space and were not captured by any available surface observing equipment. They were however captured by local Doppler radar, and they no doubt led to the erratic and extreme behavior of the fire as it raced to the east.

SA Nadeau compiled weather data from the trusted weather observations stations recommend by Schlatter. Those stations include Boulder South West (BLD01), 093S00755RWS1SEC at Coal Creek Canyon RD/CO-72 (CO109), FW0869 Arvada (F0869), Boulder Municipal Airport (KBDU), National Renewable Energy Laboratory Flatirons Campus (M2). Data captured in those reports include: Air Temp, Relative Humidity [%], Wind Speed [mph], Wind Direction, and Wind Gust [%]. **(Exhibit 3 RAWs Weather)**

MATHEW MORGAN INTERVIEW

Morgan was interviewed by BCSO Detective Sophie Berman on 01/01/2022. Morgan had been interviewed previously by Detective Berman. During those interviews Morgan had stated he was in Colorado Springs, CO at the time the Marshall Fire had started. Upon learning of the fire Morgan contacted Steve Orloff and asked that he drive to the Twelve Tribes property where the Marshall Fire started in order to help move the heavy machinery parked near the fire.

Morgan provided Detective Berman with more detail regarding the debris burn he conducted on 12/24/2021. Morgan said the issue had been weighing on his mind and wanted to make sure the investigators knew about it. Morgan assumed they did as the fire department and a Boulder County Deputy had responded to the debris burn on 12/24/2021 and issued him a verbal warning about obtaining a permit next time.

Morgan explained that he had burnt a pile of old trash consisting of old fences, scrap wood, etc. He started the fire in a 1-foot indentation in the ground just west of the shed and north of the fuel tanks. He burnt the trash and debris for several hours. Around 5 P.M. the fire had died down to hot coals and he covered them with dirt to suffocate it. He stated the mound over the hot coals was about 1 foot tall. **Investigator's Note: Drone footage from 12/31/2021 shows that there is no pile of dirt over the burnt remains of the debris burn, dark charred remains are visible on the surface.**

During SA Lunders walk through on 01/03/2022 he noted the area where the debris burn was located was primarily flat with the surround soils, and slight depression on the northern edge. Exposed charred wood material was observed on and protruding from the surface soils. There was no pile of dirt on top of the burnt remains of the debris burn. The body worn camera footage, video from in-room recording equipment and associated interview reports are maintained by the BCSO.

On 02/25/2022 a follow up interview of Morgan was conducted by BCSO Detective Tkach. During the interview Morgan stated he burnt brush, miscellaneous lumber, 6X6 garden timber, and two pallets. He clarified he did not burn any trash, treated wood, or railroad ties. He said he did not use accelerants to start the fire and described lighting it with a lighter and possibly some cardboard.

Morgan said he extinguished the fire around 5:00 P.M. by burying it with dirt. He did not put any water on the fire. During the following week he did not notice any smoke or smoldering from the pile while he was in the area. He could not specifically remember checking on the burn but repeated that he did not notice anything that would indicate it was still burning. He stated he did not move any part of the burn pile to another location on the property.

Morgan confirmed there was no gas or electricity in the shed.

Morgan also stated, "the idea of that [controlled burn] being a contributor never entered my mind until after the fire". ***The body worn camera footage, and associated interview report is maintained by the BCSO.***

STEVE ORLOFF INTERVIEW

On 01/04/2022 BCSO Detective Tkach and SA Lunders met with Orloff for a walk through at the Twelve Tribes property. During the meeting Orloff confirmed he had been called by Mathew Morgan on 12/30/2021 and was asked to help move heavy machinery parked near the origin area. Orloff estimated he arrived at approximately 12:00. He recalled seeing flames on the western end of the garden area but did not remember seeing a shed. He believed the shed had already burnt to the ground by the time he had arrived.

Orloff explained that he got into a Komatsu wheeled front end loader that was all ready running. Orloff began taking loads of dirt and rock mix from a pile located south of the fuel tanks and began dumping the dirt and rock mix anywhere he saw flames. Orloff identified several areas on the interior and exterior along the western edge of the fence line surrounding the garden area. To include a large pile of wood chips, mulch, and composting bins near the northwest corner of the garden, along the southern fence line, southeast corner, and the residence at 5329 Eldorado Springs Drive. ***The body worn camera footage, and associated interview report is maintained by the BCSO.***

SPECIFIC ORIGIN EXAMINATION

On 01/05/2022 SA Lunders, SA Henrich, and SA Nadeau arrived on scene at the Twelve Tribes property. SA Lunders video recorded the general origin area at approximately 8:35 A.M. prior to the investigators beginning their origin examination. ***(Exhibit 4 Origin Examination Video)***

SA Lunders observed numerous pieces of charred cinders east of the debris burn location, extending toward the western fence line of the garden in the front direction of the shed that was consumed in the fire. These cinders were not visible previously due to the amount of snow cover on the ground during prior visits. The damage differential was significantly less near the southwest corner of the garden. Several wooden fence posts and other wooden structures were partially consumed or damaged by the fire. Unburnt light grasses and smaller diameter dried plant stems were observed in and along the southern fence line. Upon entering the garden on the southeast corner SA Lunders observed numerous areas of unburnt chipped wooden mulch on the surface. Walking to the north he observed the degree of consumption of the wood

chipped mulch began to increase, the transition area between the degree of consumption was relatively narrow which is commonly observed on fires that are influenced by high winds. These observations identified the right flank of a fire as it transitioned to the higher intensity of the advancing head fire.

Near the drop off on the northern side of the garden area SA Lunders noted the majority of the wooden fence post were burnt off near the surface level and had fallen to the north. Most of the fuels on the surface had been entirely consumed in the advancing fire, and or blown from the surface in the extremely high winds.

The remains of a wooden trellis that was constructed on the west fence was observed partially buried under the dirt and rock mixed dumped by Orloff on 12/30/2021. The area of the trellis remains is inline with the transition between lateral and advancing fire indicators. The heel of the fire was significantly impacted by Orloff dumping numerous bucket loads of dirt and rock in the area.

Following the video documentation of the general origin area, SA Lunders, SA Henrich, and SA Nadeau began examining the scene beginning at the east end of the garden and working toward the west. Primary fuels observed in the garden consisted of wood chip mulch, mixed with light grassy fuels, and small diameter plant stems. Most indicators observed within the advancing fire consisted of charring and or degree of consumption of the fuels. Metal T posts within the advancing fire displayed a greater amount of ash deposits, sooting as well as staining on the western exposure. Rocks and bricks within the advancing fire contained a greater degree of ash deposits and sooting on the western exposure compared to those observed near the right flank. As investigators neared the western fence line the green paint coating on the T posts was entirely consumed near their bases. T posts within the fence line near the shed location contained no evidence of remaining paint. These T posts were also consistently bent toward the east as a result of the exposure to the heat and extreme wind influence. Rocks inside the fence line near the shed location showed some signs of spalling, however the spalling was limited due to the lack of larger diameter fuels, and the fast wind driven advancing fire.

Damage differential was primarily used to identify the fires transition on the right flank. Consumption of the wood chip mulch was significantly less and in many locations the fuels were not burnt at all. Metal T post within the garden area along the right flank contained little to no ash deposits, and or sooting.

The left flank of the fire progressed in a northerly direction over the drop off on the north side of the garden area consuming light grassy fuels and areas of leaf litter found nears the deciduous trees on the slope. The slope was near vertical and contained little to no vegetation in places. Embers were blown over the drop off and across Marshall Drive.

The heel of the fire was difficult to establish due to the large amount of soil and rock dumped in the area by Orloff. Light grassy fuels were observed in and near the fence line north of the shed. It is unknown how much of the light grassy fuel observed at the time of the scene examination was blown up against the fence after the fire had advanced past that point. Most of the light grassy fuel observed in this location was not attached to a root system and displayed signs of being burnt on one end.

A significant amount of charred cinders were observed between the area of the debris burn location from 12/24/2021 and the western fence line of the garden. An area of smoldering fire creep to the north of the debris burn location was also documented. This area is primarily void of vegetative fuels. The surface is composed of a rock/light gravel/soil mix with intermittent wood chip mulch pieces across the area.

The debris burn pile was further examined by USFS fire investigators. The burnt dimensional lumber, branches, and brush was buried with a mixed rock/sandy/clay soil mix. Depths of the soil mix varied from no soil to a few inches of cover. The depth of the burnt material was approximately 1 foot deep on average. Numerous nails and other various metal objects were also observed in the burnt remains.

Indicators were flagged as investigators examined the general origin area from the head of the fire through the specific origin area progressing toward the debris burn location. The scene was photographed by SA Nadeau. (**Exhibit 5 Origin Photographs, Photolog, Photograph Location Diagram**) Colorado Bureau of Investigations scanned the scene with terrestrial based three-dimensional image scanning devices to document the general and specific origin areas. (**Exhibit 6 3D Image Scans Marshall Fire Origin Area**) The general origin area was documented via a drone equipped with video and still picture capabilities by Boulder City Police Department. (**Exhibit 7 Marshall Fire Origin & Cause Drone Footage 01/05/2022**)

CFI Jerry Means Scene Examination of Buried Shed

CFI Means, Investigators Tollis, Homyak, and Fire Marshal Saba photographed the area of the buried shed west of the garden following the USFS Investigators specific origin examination. The group began to dig the soil and rock mix from the area of interest by hand. This process was slow going given the amount of large rocks in the soil mix. Conditions were further worsened by snow, high winds, and colder weather moving into the area. CFI Means decided to suspend examination efforts until such time a backhoe was located to assist with the layer search.

The layer search was resumed on 01/07/2022 by the same group of investigators. CFI Means was able to identify the exact location of the shed prior to it burning on 12/30/2021. During the layer search investigators located a roll of fencing on the west side of the shed, the roll of fencing contained unburnt grass and vines. They observed charred wood chips on the ground near the southeast corner of the shed. The west seal plate of the shed was intact, while the east seal plate was nearly consumed in the fire. These observations are consistent with witness statements, still photographs, and video of the fire first burning east of the shed near the western fence line surrounding the garden area.

CFI Means instructed the backhoe operator to dig an examination ditch around the perimeter of the shed remains in order to confirm there was no underground power source to the shed. CFI Means also confirmed there was no underground gas line installed near/to the shed. (*See CFI Means Investigative Report for complete details*)

CAUSE DETERMINATION

Debris Burning - Wildland fires caused by debris burning activities including residential (pile, barrel, hazard reduction) and industrial (logging operations, land clearing, agricultural, forestry, right-of-way hazard reduction, or other controlled burning). “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 211, (2016).

Debris Burning was determined to be the cause of the Marshall Fire. Mathew Morgan (member of the Twelve Tribes) stated he had burnt brush and dimensional lumber on 12/24/2021 without the proper permit issued by Boulder County officials. Hot coals were buried with a dry loose mix of rocks/sandy clay soil mix by Morgan at approximately 5:00 P.M. that evening. No water was applied to the burn area or burning materials. Morgan stated in an interview given to BCSO Detective Tkach that he did not routinely monitor the debris burn in the following days. Embers were blown from the debris burn on 12/30/2021 during a high wind event. The windblown embers landed in dry grassy fuels along the western fence line of a garden area down wind of the debris burn location. The growing fire ignited chipped wooden mulch which covered the garden surface. Burning wooden mulch was blown across and from the garden in the extreme westerly winds. The exact area of ignition was not located due to the ignition source being consistent with the receptive fuels located near the fence line. The amount of disturbance as a result of the fire suppression effort in and near the specific origin area impacted the investigators’ ability to identify the exact area of ignition.

Other Fire Cause Categories Investigated

Lightning - Lightning is discharged static electricity associated with thunderstorm activity. Lightning is typically a series of short bursts approximately two inches in diameter, lasting for about one-half second. These lightning discharges include cloud-to-ground strikes which are in the range of 100 million volts, 200,000 amperes, and 54,000 °F. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 197, (2016).

The circumstances indicating a possible lightning strike as a cause includes recent electrical storm (hours/days/weeks) activity in the area, the presence of indicators of *sleepers* and *holdovers*, scarring on trees or snags, precipitated sap, *needle shower*, ballistic penetration of adjoining vegetation by needles and small twigs or splinters, *blow-holes* at base of tree, fulgurites, and splintered wood or vegetation. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 197, (2016).

Earth Networks, a private company contracted to detect cloud to ground and cloud to cloud lightning, verified zero cloud-to-ground lightning strokes detected within a .8-mile radius of the GPS coordinates provided for the dates between 12/16/2021 through 12/30/2021. No lightning scars were observed on any of trees or shrubs in the incident area. No blowholes or fulgurites were observed in the incident area. For these reasons, Lightning can be excluded as a possible cause. (Exhibit 8, Earth Networks Inquiry Response)

Equipment Use - Wildland fires resulting from the operation of mechanical equipment excluding railroads. Types of mechanical equipment range from heavy construction to small portable engines. Equipment use caused fires may be viewed in five parts:

1. Exhaust system particles.
2. Friction and sparks.
3. Fuel, lubricant, fluids.
4. Mechanical breakdown or another malfunction.
5. Radiant or conductive heat transfer.

“NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 215, (2016).

No evidence of equipment use (prior to equipment utilized during suppression efforts) was discovered in the specific origin area of the fire. For these reasons, Equipment Use can be excluded as a possible cause.

Smoking - Wildfires caused by smoking activities or accoutrements, including matches, cigarettes, cigars, pipes, illegal substances, etc. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 207, (2016).

To effectively assess the probability of a cigarette as a competent ignition source, consider the following: physical characteristics of the cigarette, environmental factors, physical placement factors. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 207, (2016).

Cigarette ignition factors are; 0% Relative Humidity (RH) = Start Likely, 10% RH = Start Possible, 18% RH = Start Unlikely and 22% RH = No Start. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 208, (2016).

Environmental factors include: finely particulated fuel bed, loose fuel arrangement, fine dead fuel moisture (FDFM) less than 14%, 80 °F + ambient temperature, microclimate location (temperature at ground level vs. temperature at higher level), Relative Humidity (RH) of 22% or less. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 208, (2016).

Relative Humidity was measured at or near 22% at several weather stations in the area of the fire but temperatures at the time of ignition ranged from 39 to 45 degrees. The relative humidity range is unlikely to no start. According to the NWCG Handbook cigarette ignition cannot occur at temperatures 39 and 45 degrees. No evidence of cigarettes or smoking was discovered in the general or specific origin areas. For these reasons, Smoking can be excluded as a possible cause.

Camp Fire - Any fire kindled for warmth, cooking, light, religious or ceremonial purpose. Campfires may occur at any location. Responsible parties may include hunters, campers, anglers, hikers or transients (homeless). Regulations often address attendance, clearance, and periods of use, suppression tools, and proper extinguishment. Violations of these regulations often result in escaped fires. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 202, (2016).

No evidence of a campfire ring, or any other evidence of recreational camping was observed in the general or specific origin areas. For these reasons, Camp Fire can be excluded as a possible cause.

Railroad - Fires caused by any railroad operations, personnel, rolling stock and can include track and right-of-way maintenance. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 229, (2016).

Railroad structures such as trestles, bridges, and ties, are included in this category of fire cause. “NWCG

Handbook”, PMS 412, NFES 1874, Chapter 6, page 229, (2016).

General railroad ignition factors include; exhaust carbon, brake shoe particles, track maintenance, right-of-way maintenance, dynamic grid failure, signal flares, wheel slip, wheel bearing failure (hotbox) and transients. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 230, (2016).

There are no known railroad operations in or near the general origin area. For these reasons, Railroad can be excluded as a possible cause.

Incendiary - Wildfires deliberately or maliciously set with the intent to damage or defraud. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 215, (2016).

Arson: The intentional and wrongful burning of someone else’s property or one’s own property (as to fraudulently collect insurance). (Garner, 2009) “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 299, (2016).

Incendiary: Deliberately and unlawfully set fire to property. (Garner, 2009) “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 299, (2016). These terms are often used interchangeably.

No evidence of arson or incendiary activity was discovered in the general or specific origin areas. No incendiary devices; mechanical, chemical, or electrical were observed and or recovered. Boulder County Sheriff’s Office and City of Boulder Open Space Rangers were asked about outstanding arson reports in the area and could not recall any cases that would raise suspicion of an arson ignition. No modified fuel beds were observed in the general origin area. Portions of the general origin area were searched by Dawn Tollis of the Division of Fire Prevention and Control with her K9 JO-JO. JO-JO alerted to the presence of petroleum-based substances in multiple locations. The samples were collected by Tollis and submitted for analysis. Soil staining from petroleum-based fluids was observed in the general origin area likely due to the presence of fuel tanks, heavy equipment, and dump trucks and trailers in the area. Incendiary can be excluded as a possible cause.

Children - Wildfires started by persons 12 years of age or younger. The child may be motivated by normal curiosity and use fire in experimental or play fashion. Matches or lighters are the most frequent ignition source. It often involves multiple children. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 243, (2016).

No report of children observed in or near the general or specific origin areas at or before the fire was reported. Investigators did not observe or uncover any evidence of Child play in the general or specific origin areas. Investigators with BCSO interviewed the children who resided in the residences surrounding the origin area and found no reason to suspect they were responsible for the cause of the fire. For these reasons, Children can be excluded as a possible cause.

Miscellaneous - Wildfires that cannot be properly classified under other standard causes. Some of these are listed below but can include other ignition sources that are not listed. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 245, (2016).

Powerlines: The category of powerlines includes all electrical equipment associated with the production, transmission, and use of electricity. The electrical grid or system for the transmission, distribution, and service of customers forms a complex web and is governed by regulations. The transmission of electricity has long been recognized as having an inherent danger above and beyond typical hazards. Early electrical distribution systems caused numerous fires, better engineering and prevention efforts have reduced the number. Powerlines are an ignition source that can lead to major fires, as many of the conditions that contribute to system faults and failures coincide with extreme fire behavior. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 245, (2016).

The nearest power line is approximately 190 feet downwind of specific origin area. No downed power

lines were reported or observed prior to or during the examination of the general and or specific origin areas. No faults or arcing was observed on the associated lines or electrical equipment. For these reasons powerlines can be excluded as a possible cause.

Fireworks: Fireworks may be classified in several different ways depending upon the jurisdiction. Most fireworks will fall into one of three categories, ground based and hand-held, aerial, or explosive. Fireworks are known to cause major property damage annually including fires to both wildland and structures. Used in an unsafe manner, fireworks can discharge burning material into flammable vegetation. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 263, (2016).

There was no evidence of fireworks found in the general and or specific origin areas, including packaging, fuses, matches, mortar tubes or the remains of spent fireworks. There were no reports of fireworks being seen or heard in the area. For these reasons, fireworks can be excluded as a possible cause.

Firearms and Ammunition: Black powder discharge, tracer, incendiary, solid copper and copper jacketed and various types of ammunition are capable of causing wildfires through the discharge of hot materials or mechanical sparks caused when a bullet strikes a hard object and fragments, creating hot particles which land in the dry fuels. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 266, (2016).

There was no evidence of firearm use in or near the general and or specific origin areas. There was no ammunition packaging or targets found in the general origin area and specific origin areas. The area is a residential area within city limits where firearms use is not allowed. For these reasons, firearms and ammunition use can be excluded as a cause.

Exploding Targets: Exploding targets detonate upon impact of the projectile, sending out hot particles. Exploding targets are typically a mixture of more than one compound which is generally not considered an explosive until combined. Exploding targets come commercially manufactured in either low or high velocity types. Homemade versions are also being used with similar effects. Once mixed, the compounds form an explosive device. Wildland fire investigators working a scene which may include an exploding target should use caution when handling, collecting, packaging and storing residue or devices. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 270, (2016).

There was no evidence of exploding targets being used in the general and or specific origin areas. The general origin area and specific origin area are in a residential area within Boulder city limits and is bordered by a highly traveled highway where exploding targets would have been noticed. No spent bullet casings or ammunition packaging were found in the general origin area and specific origin area. For these reasons, exploding targets can be excluded as a cause.

Cutting, Welding, and Grinding: These types of ignitions are normally caused by an industrial or agricultural operation, but may also result from an individual or residential activity. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 274, (2016).

There was no evidence of cutting, welding and/or grinding in the general and or specific origin areas. For these reasons, cutting, welding, and grinding can be excluded as a cause.

Spontaneous Heating: Certain fuels will self-heat and ignite spontaneously when conditions support a combination of biological and chemical processes. This action is most likely to occur after periods of warm humid days in decomposing piles of organic material such as hay, grains, feeds, manure, sawdust, wood chip piles, and piled peat moss. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 277, (2016).

Composting materials were observed in the general origin area. However, required environmental conditions necessary for a spontaneous heating ignition were not present. For this reason, spontaneous heating can be excluded as a cause.

Coal Seam Fires: Coal seams may be ignited by lightning, wildfires, or other ignition sources. Fires typically burn slowly along the seam and may resurface when seam nears the surface which cracks, and oxygen is introduced to the burning seam. These fires are dangerous to investigate as the burning coal seam may lie just under the surface. Coal seam fires may be visible in the winter with steam plumes and random bare patches in the snow from underground heating. Patches of dead vegetation may also be a tip that underground heating from a coal seam fire is taking place. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 282, (2016).

Two known active underground coal seam fires exist in the neighboring area. The closest to the fire originating at 5329 Eldorado Springs Drive, is approximately two tenths of a mile to the south/southeast near Marshall Mesa Trailhead on lands managed by City of Boulder Open Space and Mountain Park. For this reason, coal seam fires can be excluded as a cause of the fire originating at 5329 Eldorado Springs Drive.

Electric Fences: Fires originating from electric fences used to contain domestic animals. Rapid electric pulse cycle does not allow fuel to cool down. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 283, (2016).

Electric fence material was observed surrounding a garden within the general origin area. The wires were not connected where they crossed entrances on the west and east ends of the garden. Additionally, the battery connected to the solar charging unit located on the east end of the garden no longer held a charge at the time of this investigation. For this reason, electric fences can be excluded as a cause.

Refraction (Reflection): The sun’s rays can be focused to a point of intense heat if concentrated by certain glass or shiny objects. This refraction or reflection process bends light rays, similar to that which occurs through a magnifying glass. The shiny, concave end of a metal-can may focus sunlight, but its short focal distance makes the potential as a possible cause highly unlikely. Fires started by these items are extremely rare occurrences; however, objects possessing these characteristics recovered from the specific origin Area may need to be carefully examined to determine their fire-starting potential. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 285- 286, (2016).

Small pieces of flat glass were observed in the interior portion of the garden near the northern fence line was observed. The location of the glass was approximately 75 feet northeast of the general origin area. The glass was slightly opaque, and the sun was not particularly strong in the late December sky. No other glass or other light-focusing materials were found in the general and or specific origin areas. For these reasons, refraction (reflection) can be excluded as a cause.

Blasting: Fires started by flaming debris associated with blasting activities. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 286, (2016).

No blasting had been conducted in the general origin area. For this reason, blasting can be excluded as a cause.

Flares: Fires resulting from commercial, industrial, or military flares. Compound is usually a mixture of sawdust, wax, sulphur, strontium nitrate, and potassium perchlorate. Flares burn at approximately 3600°F. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 287, (2016).

No burned-out flares, slag, plastic caps or other discarded parts of a flare were discovered in the general and or specific origin areas. For these reasons, flares can be excluded as a cause.

Oil and Gas Fires: Fires associated with the recovery and pumping of oil and gas products in the wildland. Flare pit and stack fires are among some types of oil and gas fires which may be encountered in the wildland environment. Flare pit and stack operations are designed to burn off excess or unwanted petroleum by-products. Occasionally these will start fires from direct flame impingement, the igniter flare or stack particles. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 290, (2016).

Neither gas nor oil extraction operations exist in the vicinity of the general origin area. For

this reason, oil and gas fires can be excluded as a cause.

Flying Lanterns: Flying lanterns are miniature hot air balloons made from paper or plastic, bamboo or lightweight wood, and wire with a solid fuel package. Homemade lanterns may use plastic garbage sacks. Originating in Asia and called happiness balloons or wish balloons their use has spread around the world, and they are commonly used during weddings or other celebrations. Experimentation by young adults or teenagers is commonly associated to fires caused by flying lanterns, particularly if homemade. Manufacturers claim that the paper is treated with a fire retardant, but many are not. Flying lanterns can travel miles away from release site and are capable of reaching several thousand feet in altitude. Multiple lanterns may be released at a single time. Releases typically occur during nighttime hours for full visual effect but can also be deployed during daytime activities. Note: Oregon has classified flying lanterns as fireworks and banned them from use within the state. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 293, (2016).

No remains of a flying lantern were found in the general and or specific origin areas. There were no reports of flying lanterns being seen in the area prior to discovery of the fire. Flying Lanterns are uncommon for the area and would be difficult to impossible to launch in the strong winds on December 30, 2021, due to it being unable to keep the fabric from collapsing as it collects the hot air needed to attain lift. For these reasons, flying lanterns can be excluded as a cause.

Wind Turbines: Wind turbines use wind flow to generate electrical energy and are increasingly being placed into the wildland environment. Where more than one wind turbine is in the same area, the term wind farm may be used. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 295, (2016).

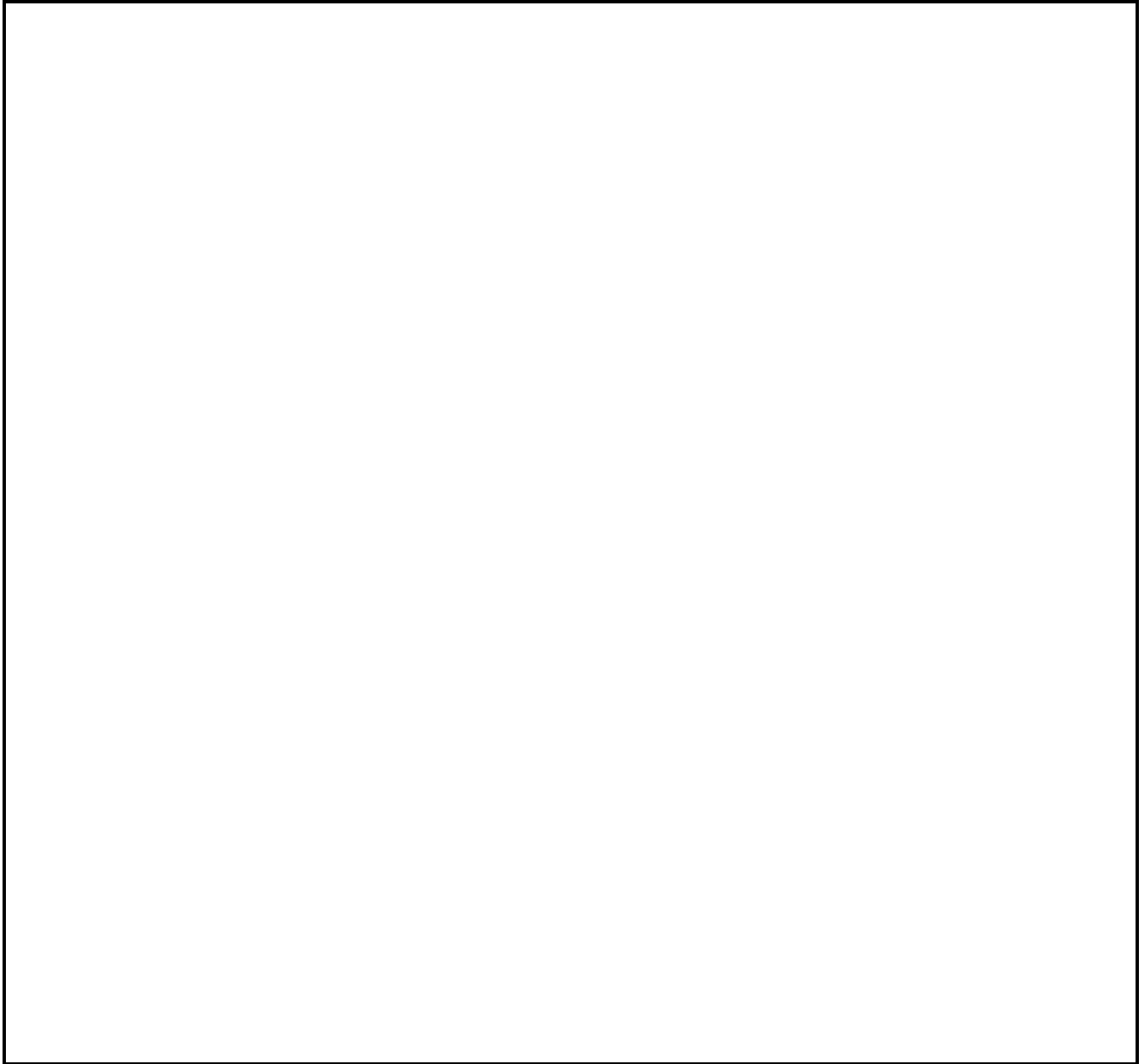
Wind turbines do not exist in the vicinity of the Marshall Fire. The nearest wind turbines are found 3.25 miles south of the fire. For this reason, wind turbines can be excluded as a cause.


Home Outdoor Wood Burning Furnaces: Referred to as outdoor wood furnaces or outdoor wood boilers, these devices can be modern manufactured models or homemade. They can be used to heat a structure by way of connecting to a central heating unit and/or are used to provide hot water. Either way, the furnace operates by burning firewood and may be burning wood even in the warmer parts of the year if it is being used to heat water also. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 296, (2016).


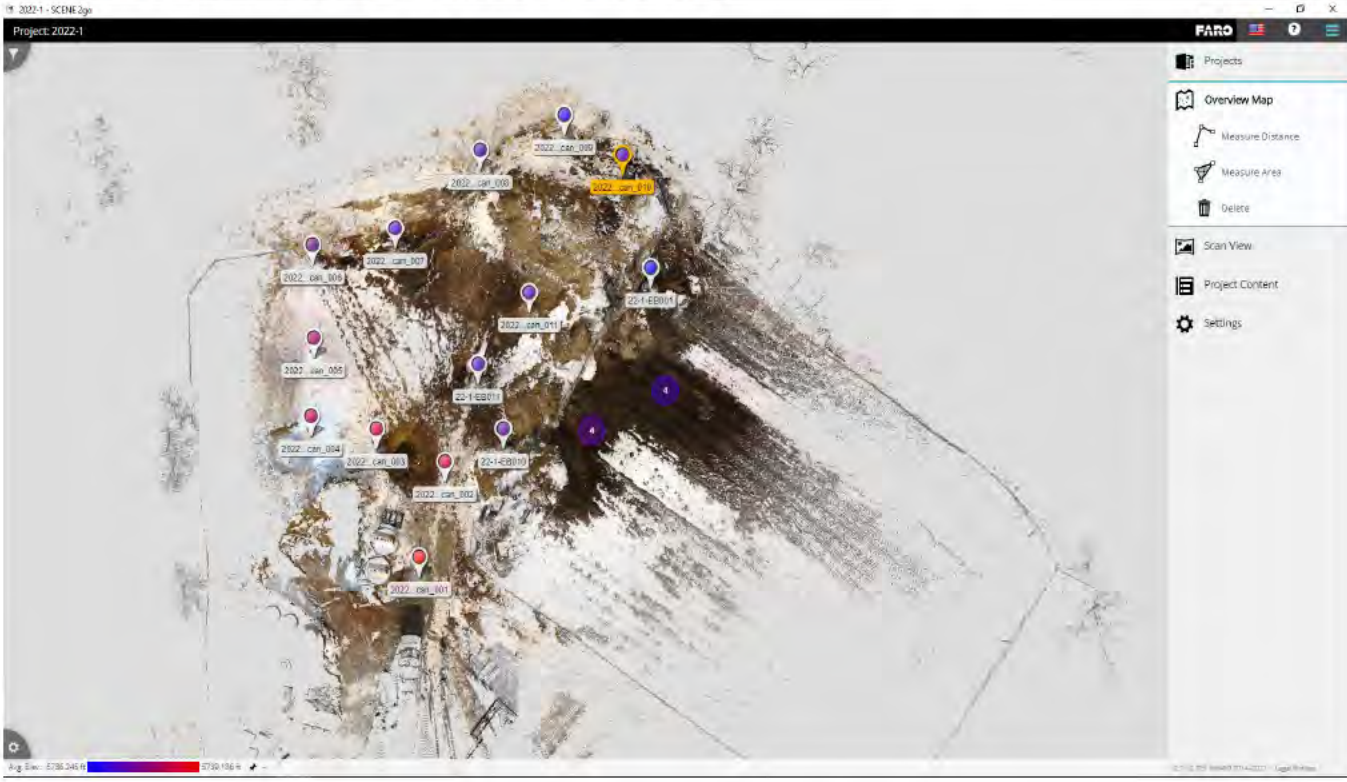
No wood burning furnaces or boilers exist in the general origin area of the Marshall fire. A wood burning stove and associated flue and spark arrestor was examined at a residence west northwest of the general origin area. Investigators discovered two pieces of unburnt wood inside the stove. For this reason, home outdoor wood burning furnaces can be excluded as a cause.

Structures: Fire spreading to the wildland due to failures or activities associated with a structure. “NWCG Handbook”, PMS 412, NFES 1874, Chapter 6, page 296, (2016).

A burnt wooden shed was exhumed by the Fire Marshal. He did not discover any electrical line service to the shed, nor were any other utilities observed originating and or terminating at the wooden shed. Several videos and photographs taken at the time the fire was reported show fuels near the shed were burning however the shed itself was not. Accounts of responding fire fighters also confirm the shed was not on fire at the time of their initial response. For this reason, structures can be excluded as a cause.



		Wildland Fire Origin and Cause Supplemental Incident Report (Reference FSH 5309.11, Chapter 20)						Incident Number	22-02-IAIP002
								Incident Date	12/30/2021
Fire Name	Marshall Wildfire								
Latitude	39°	57'	23.10"	Longitude	105°	51'	49.73"	Datum	WGS 84
FIRE SCENE SKETCH (INCLUDE SCALE, TITLE, AUTHOR, NORTH ARROW, DATE AND TIME)									
									
<p style="text-align: center;">LEGEND</p> <div style="display: flex; align-items: center; justify-content: center;"> ↑ Advancing Fire Progression Symbol </div> <div style="display: flex; align-items: center; justify-content: center;"> ↖ Lateral Fire Progression Symbol </div> <div style="display: flex; align-items: center; justify-content: center;"> ↻ Backing Fire Progression Symbol </div> <div style="display: flex; align-items: center; justify-content: center;"> ○ Item/Point of Interest Symbol </div>									
SCALE	NOT TO SCALE	AUTHOR	SA LUNDERS	DATE	01/05/2021	TIME	1030 HRS		

 USDA Forest Service		Wildland Fire Origin and Cause Supplemental Incident Report (Reference FSH 5309.11, Chapter 20)						Incident Number		22-02-IAIP002									
								Incident Date		12/30/2021									
Fire Name		Marshall Wildfire																	
Latitude		39°		57'		23.10"		Longitude		105°		51'		49.73"		Datum		WGS 84	
FIRE SCENE SKETCH (INCLUDE SCALE, TITLE, AUTHOR, NORTH ARROW, DATE AND TIME)																			
																			
3D Laser scan completed by Colorado Bureau of Investigation. See attached Exhibit for to scale measurements and scene documentation.																			
SCALE		TO SCALE		AUTHOR		SA LUNDERS		DATE		1/5/2022		TIME		13:50 HRS					



Approximate locations of photos taken on 01/05/2021. Arrows indicate approximate direction of photo vantage. Points with no arrows were taken at an overall downward angle. Base photo was taken by drone on 12/31/2021.

PHOTOGRAPH LOCATION POINTS AND DIRECTION OF PHOTOGRAPH TAKEN

Exhibit 1

Marshall Fire Origin & Cause Drone Footage 12/31/2021

SEE ELECTRONIC FILE

Exhibit 2

Paul Schlatter Weather Report

Report on The Climatology and Meteorology Associated with the Marshall Fire on December 30, 2021

Paul Schlatter

Science and Operations Officer

National Weather Service Forecast Office, Boulder, CO

Overview:

The geography of the Front Range of Colorado is the primary reason extreme downslope windstorms are so common along and just east of the mountains. In particular, the CO-93 corridor from Boulder to Golden is notoriously capable of generating wind gusts well over 80 mph every year.

Just west of the CO-93 corridor lies an unbroken ridge with an average elevation exceeding 12,000 feet, oriented roughly north to south, over 100 miles long. Weather patterns across the U.S. favor strong westerly flow aloft (i.e. winds blowing from west to east) in the winter months. Much like water in a river flowing over obstacles like boulders, the atmosphere behaves similarly when westerly winds flow over the Rocky Mountains and the 12,000+ ft ridge to the west of the Boulder area. Under the right conditions, strong west flow perpendicular to the ridge west of Boulder can get squeezed through a horizontal channel created by the terrain and a strong temperature inversion 1000s of feet above the top of the ridge. A temperature inversion is a layer of much warmer air aloft, creating an invisible but just as effective barrier or cap in the atmosphere that forces air through the narrow zone at ridgetop level. As the air emerges downwind of the ridge, i.e. in the foothills and adjacent plains in and around Boulder, it greatly accelerates the same way water crashes on the downstream side of a boulder in a stream.

The strongest winds occur at the base of the foothills and along the CO-93 region from Lyons to Golden, though high winds can also occur further east. A “mountain wave” sets up that can last for hours (sometimes 6 or more hours), with continuous high winds occurring at the base of the foothills associated with the constant downslope acceleration of the winds flowing over the ridge west of Boulder. Figure one shows the important features that cause a mountain wave to develop, the general location of the strongest winds, and other features associated with the mountain wave. Note that in this graphic, the strongest winds typically occur in the Boulder to Louisville area just west of the “jump region”, which is referred to as a hydraulic jump, with weaker winds further east towards Lafayette and Broomfield. This is because a standing wave

occurs in these specific meteorological conditions, and there comes a point downwind where a rotor forms.

The rotor is a horizontal roll of wind, oriented parallel to the foothills, where wind flow reverses in response to the mountain wave. It is important to note that not all mountain wave events result in the development of rotors. In this idealized graphic, the rotor is over Lafayette and is located just downwind (east) of the strongest winds at the surface. Air rises rapidly on the upwind (west) side of the rotor in the jump region, while winds under the rising branch of the rotor and just east of the rotor are much weaker, or even reverse flow from an easterly direction. This idealized situation is essentially what happened on 12/30/2021, when wind speeds in Louisville were 30 mph gusting to 40 mph, even as stronger winds continued in Marshall and Superior.

Plenty of video evidence shows the fire and smoke racing off the east, and at some point lifting upward. The rapid rise of the smoke plume is within the jump region, and clouds form on the eastern fringe of this, or on the rising portion of the rotor, shown in Fig. 1 and also in the videos linked below the graphic. As the strong winds continue east, additional waves form further downstream, just as additional ripples form in a stream below a boulder. These appear as alternating areas of clouds in the upward motion areas, and clear skies where the air is sinking.

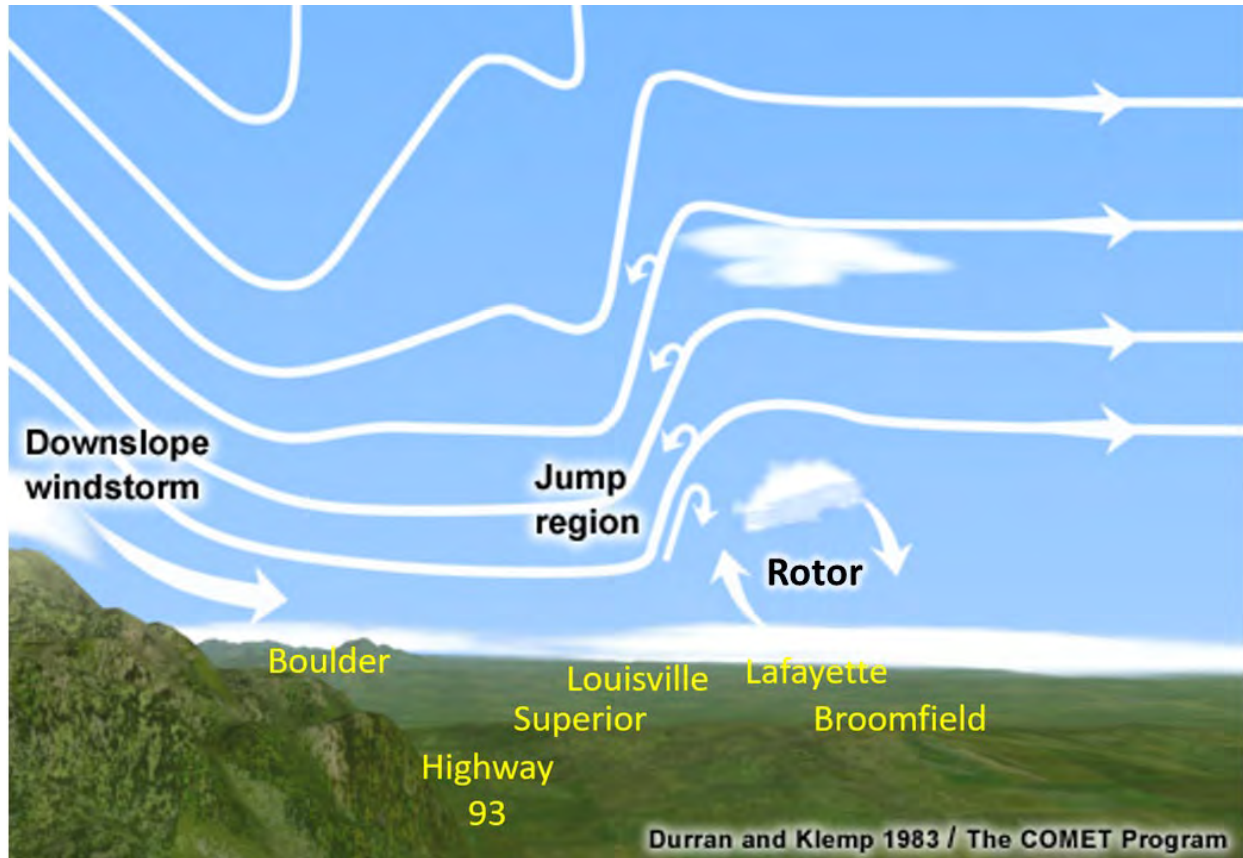


Figure 1: An idealized schematic of how downslope wind storms occur in the lee of the Rocky Mountains. The typical set up is shown, and the strongest winds occur along and west of the “Jump Region with locations shown in yellow. A rotor is shown over Lafayette, along with a rotor cloud.

- [REDACTED] This time lapse video is taken from the south of the fire, and shows the standing waves/rotors in the smoke plumes
- <https://twitter.com/weatherdak/status/1476682724148539409> This is a satellite image showing the waves/rotors downstream of the fire. The red glow is the infrared retrieval from the fire as detected from 22,236 miles away in space.
- [REDACTED] This is a time lapse of the fire and smoke plume taken from quite a distance north of the fire, shows the wave/rotor downwind of the fire with rotor clouds and the upward vertical motion associated with the rotor downwind of the fire.
- https://rammb.cira.colostate.edu/templates/loop_directory.asp?data_folder=dev/lindsy/loops/dec2021_fires&loop_speed_ms=100 Satellite image from GOES-W of the smoke and fire

Climatology of Wind in the CO-93 Corridor:

Extreme winds are common along the CO-93 corridor. A thorough but not exhaustive summary of the high winds experienced in the Boulder area over the last 50+ years is available at this link: <https://psl.noaa.gov/boulder/wind.html>. A cursory look at the record of winds in the Boulder area shows that winds exceeding 80 mph occur nearly every year, with wind gusts exceeding 100 mph every couple of years. The maximum wind gust in the last 50 years has been an incredible 147 mph at the NCAR Mesa Laboratory, 3 miles northwest and over 500 feet higher from the Marshall fire ignition point. Needless to say, the winds on 12/30/2021 where the Marshall fire started and spread were extreme, but certainly not unusual. The National Wind Technology Center has a high quality surface observation, located about 2 miles south of the ignition area, and it is one of the best observations in the country for wind. Wind gusts for various thresholds were tabulated over the last 20 years in Figure 2, and it shows that for 75 mph gusts and stronger, the event on 12/30/2021 had the most. Examining Fig. 2, one can see that for higher magnitude gusts, there have been several events with more extreme gusts in the last 20 years.

NREL Flatirons (1-minute observations)							
number of 75-mph gusts		number of 80-mph gusts		number of 85-mph gusts		number of 90-mph gusts	
date		date		date		date	
2021-12-30	111	2005-12-05	53	2015-11-18	24	2005-12-05	11
2005-12-05	110	2021-12-30	48	2005-12-05	23	2004-12-20	10
2016-12-25	85	2007-01-07	36	2021-12-30	20	2015-11-18	9
2006-01-03	61	2004-12-20	34	2004-12-20	19	2007-01-08	6
2007-01-08	58	2015-11-18	34	2007-01-08	18	2007-01-07	5
2004-12-20	57	2007-01-08	29	2007-01-07	16	2021-12-30	5
		2006-01-03	27				
*data since 2001; winds at 10 m AGL							

Figure 2: National Wind Technology Center wind observations since 2001. Each occurrence of 1-min wind gusts exceeding the listed thresholds were counted by calendar day.

The wind event on 12/30/2021 occurred in the time of year that is normal for extreme wind events. December and January normally see the most extreme downslope windstorms along the CO-93 corridor.

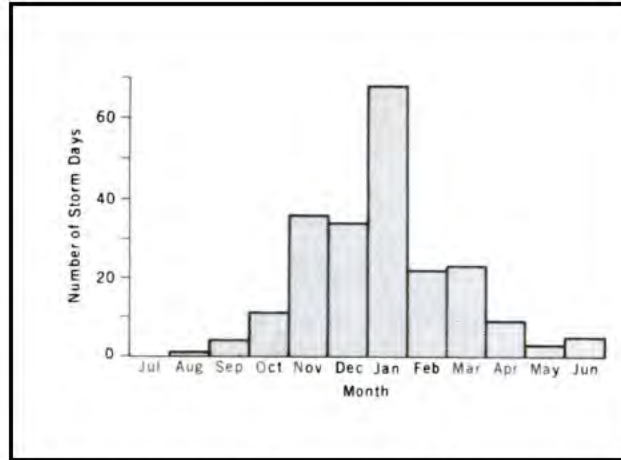


Figure 3: Taken from NOAA technical report Whiteman and Whiteman (1974). These are 151 identified wind storms in Boulder, defined as having at least one gust > 58 mph in the Boulder area during the period of study ending in 1974.

Figure 3 shows the peak occurring in the cold season and in particular in January. This graphic is from the 1970s but the trends are the same as today. An updated study looking at months with gusts greater than or equal to 70 mph from 1969-2021 in the Boulder area shows a similar trend to the dataset that ended in 1974. There is a distinct peak in the occurrence of extreme downslope wind in December and January. Here is the table of days by month with at least one wind gust > 70 mph across the CO-93 corridor from 1969-2021:

Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
2	1	2	2	11	19	49	57	21	19	13	4
# Days with a Gust >70mph in the CO-93 Corridor, by month 1969-2021 Note that in the warm season (Apr-Sep) many/most of those events occurred with severe convective storms, rather than downslope winds.											

Fuel Status on 12/30/2021: Another factor that contributed to the rapid fire spread were the fuels in the area. First, Boulder was unusually wet from spring into mid-summer 2021. Grasses grew tall and thick. Then, the precipitation abruptly shut off, leading to the driest period on record along the Front Range from June through December. Though Figure 4 only shows the Denver data, Boulder was close to the same situation. It was also the warmest such period on record, drying out the fuels significantly by December. The Boulder area went from no drought to level 3 (extreme, on a scale of 0-4) drought by December 2021.

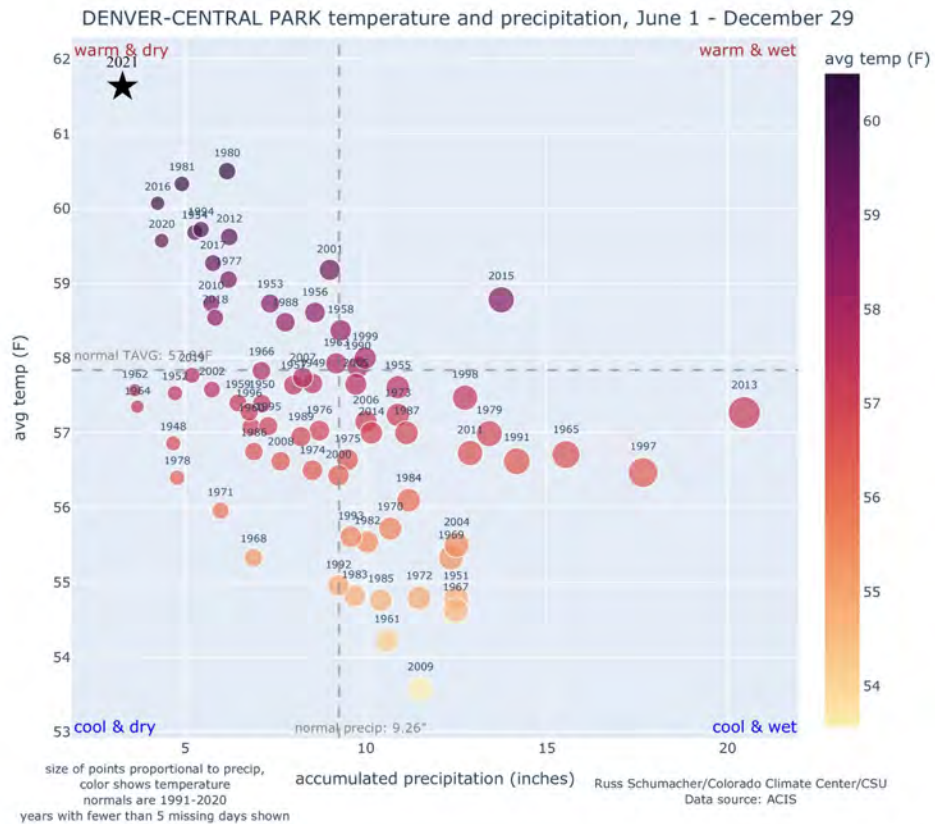


Figure 4: Climate data from Denver-Central Park that combines the effects of temperature and precipitation. Warmest/driest years on record appear in the top left, while cool and wet in the bottom right. 2021 was far and away the warmest and driest on record over the last ~75 years.

There had only been 2 light snows the entire season through December 30th. Normally snow does not remain on the ground along the CO-93 corridor for long even in December, but any amount of snow on the ground would have slowed or prevented the fire from spreading. Given record dryness and no snow on the ground for weeks prior to December 30th, the fuels were prone to rapid fire spread. A final graphic showing how dry the fuels were is included in Figure 5. Overall, the drought, extremely dry fuels that were thicker/taller than normal, and record warmth and dryness in the months leading up to December 30, combined to make a worst case scenario for any fire that started along CO-93 in late December.

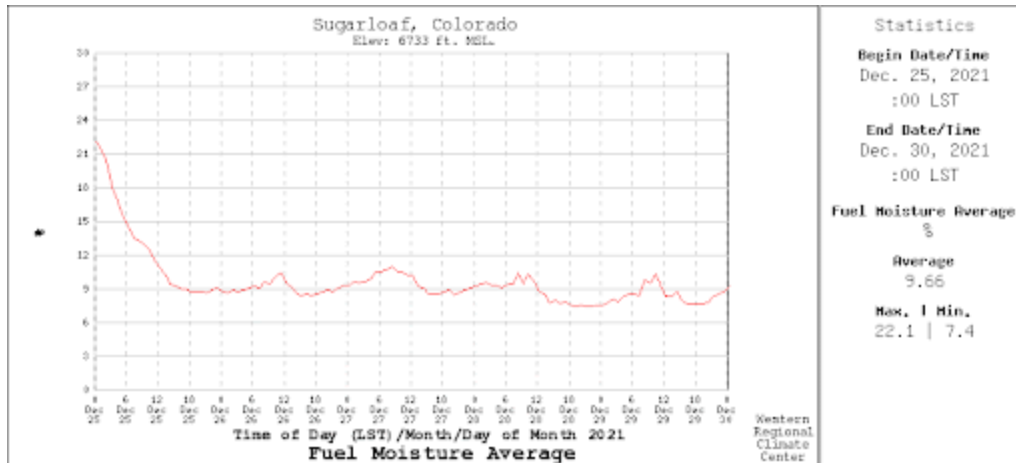


Figure 5: This is the fuel moisture trace for December, 2021 from Sugarloaf, Colorado, which is approximately 10 miles northwest of the Marshall fire ignition area. Fuels were near record dry at the end of December.

Fires Associated with Downslope Winds in Boulder's History: Fires associated with extreme downslope winds in the Boulder area are rare, but have occurred several times in the record. A significant fire occurred with an extreme mountain wave-induced downslope windstorm on January 11, 1972, when a trailer park in north Boulder caught fire and damaged/destroyed many of those homes. Another extreme event in January 1969 resulted in the death of a firefighter. Here's the excerpt from the Daily Camera, Boulder's local newspaper:

Boulder Daily Camera
January 8, 1969
[Wednesday]

Fires Widespread; Local Man Killed

Boulder and rural firemen summed up Tuesday night's firefighting activities in two words -- miraculous and tragic.

The miracle, they said, was getting through the night with no more fire damage than resulted. Tragic was the death of one of their own, Raymond E. Dovala, 34, a Cherryvale volunteer fireman who died this morning of head injuries suffered in a fall from a pumper truck. . . . [The truck was] traveling about 20 miles per hour, but the wind was fierce and may have blown Dovala from the vehicle, the chief said.

A significant difference between the fire that occurred on 12/30/2021 and other fires in the Boulder area associated with downslope windstorms is the population increase, especially in the areas adjacent to grasslands. Another major difference that seems apparent on 12/30/2021 compared to other storms in the historical record is the sheer duration of the extreme west winds on 12/30, which were persistently gusting over 70 mph for over 5 hours. In most other downslope wind events in winter associated with mountain waves, the winds often weaken for brief periods, which could allow firefighting efforts to gain control of the fire before it spreads into a firestorm. The intensity and persistence of the extreme winds on

12/30/2021 did not allow firefighters to get control of the fire until winds weakened significantly in the early evening hours.

Meteorological Conditions Near the Marshall Fire Ignition Area: There are several high quality wind observations within a few miles of the ignition area. There are also several sites that shouldn't be used for analysis because they are sited improperly. Improper siting occurs if the observation is too sheltered to the wind, because the sensor is too low to the ground or placed in between trees or structures, or both. A properly sited anemometer should be at least 10 m off the ground, and this corresponds to the NWS definition for taking official wind measurements. The best observations to use near the ignition site are BLD01, which is next to Fairview High School in south Boulder, and the National Wind Technology Center (NWTC) observation which is in the northeast corner of Rocky Flats, just up the hill from the ignition site (same as Fig. 2). All other observations within 3-5 miles of the ignition point are not sited well enough to use for analysis.

The NWTC observation provides wind information at various heights (including 10 m) every minute. On 12/30/21, the winds increased significantly at the NWTC starting around 8 AM, in response to the mountain wave setting up with the strongest winds along the CO-93 corridor but not extending too far east yet. Gusts in the 8 AM hour were generally in the 40-65 mph range. By 10 AM, wind increased at NWTC with most gusts exceeding 70 mph. In general, wind gusts did not drop below 70 mph at NWTC until 4 PM. That's not to say high winds didn't continue, because they certainly did. Wind gusts exceeding 40-60 mph occurred until 7 PM, and gradually they weakened to less than 40 mph after 11 PM. The winds at the NWTC were likely a little stronger and lasted longer than what the wind conditions were at the ignition site, given local terrain differences.

Taking a look at the BLD01 observation, which is about 100 feet higher in elevation than near the ignition site and 1.5 miles to the northwest, winds also picked up after 8 AM, gusting to 60 mph. One thing to note is that BLD01 is sited at just over 6 m off the ground, so actual wind speeds at the preferred measurement height of 10 m may have been 10-20% higher than reported. A gust to 80 mph occurred at BLD01 just before 11 AM, and through 6 PM wind gusts generally remained above 60 mph. The strongest wind gusts in the ignition area occurred from 11 AM to 2 PM, with 80-100 mph gusts during this three hour window.

In terms of direction, NWTC is on top of a ridge without any terrain higher than it other than the Front Range Mountains to the west. Thus, wind direction at NWTC is not influenced by local terrain (other than the mountains to the west of course). The strongest winds from 10 AM - 2 PM, when gusts frequently exceeded 80 mph, had a wind direction of due west (270 degrees

on a wind compass) or WNW (280 degrees on a wind compass). There were no significant fluctuations in wind speed or direction during the 10 AM to 2 PM window at NWTC. This implies that a standing mountain wave and rotor was always to the east of CO-93, and that the strongest winds associated with the mountain wave were focused right along CO-93. The BLD01 wind observation direction is influenced by local geography. The South Boulder Creek valley is just south of the observation, which runs from the southwest out of Eldorado Canyon, towards the northeast along the Davidson Mesa. Here, winds in a mountain wave are forced downward, as occurred on 12/30/21, and would tend to be more out of the west-southwest in the South Boulder Creek valley. BLDR01 winds from 10 AM - 2 PM, when they were strongest, indeed tended to be out of the west-southwest (250 degrees on a wind compass). A well-known meteorologist, Dr. Howie Bluestein, with expertise in downslope wind storms in the Boulder area, lives near Fairview High School. He took photos of the start of the fire from his vantage point on Shanahan Ridge around noon MST. He also noted the winds in his area. For the most part the strongest winds were out of the WSW and gusting 80-90 mph (his estimation), but occasionally he noted an abrupt shift to the N or NE, lasting several minutes, with weaker gusts. Then just as quickly, winds would shift back to the WSW and gust around 80-90 mph again. What explains what Dr. Bluestein experienced is the phenomena of rotors (refer back to Figure 1). If a rotor moves or oscillates a little west from it's position, in that area winds will shift quickly and reduce in magnitude, only to switch back if/when the rotor moves back, or when the mountain wave "reloads", meaning it reforms the standing wave once again after a brief, chaotic break in the flow over the mountains. Other wind observations from north and east of the ignition area support the presence of several rotors east of the Front Range, including weaker winds out of the east and northeast just downstream of them.

The strongest wind gust anywhere on 12/30/21 occurred just south of the NWTC, at the intersection of CO-93 and CO-72, where a gust of 110 mph was recorded at 11:12 AM MST. Note that a home weather station just east of CO-93/72 measured a gust to 115 mph around noon, but because the wind direction was listed as east-southeast, that gust measurement is suspect, and that particular observation is known to have potential issues with wind speed and direction. Wind gusts along the CO-93 corridor were strongest in the 11 AM to 1 PM range, with frequent gusts exceeding 90 and 100 mph.

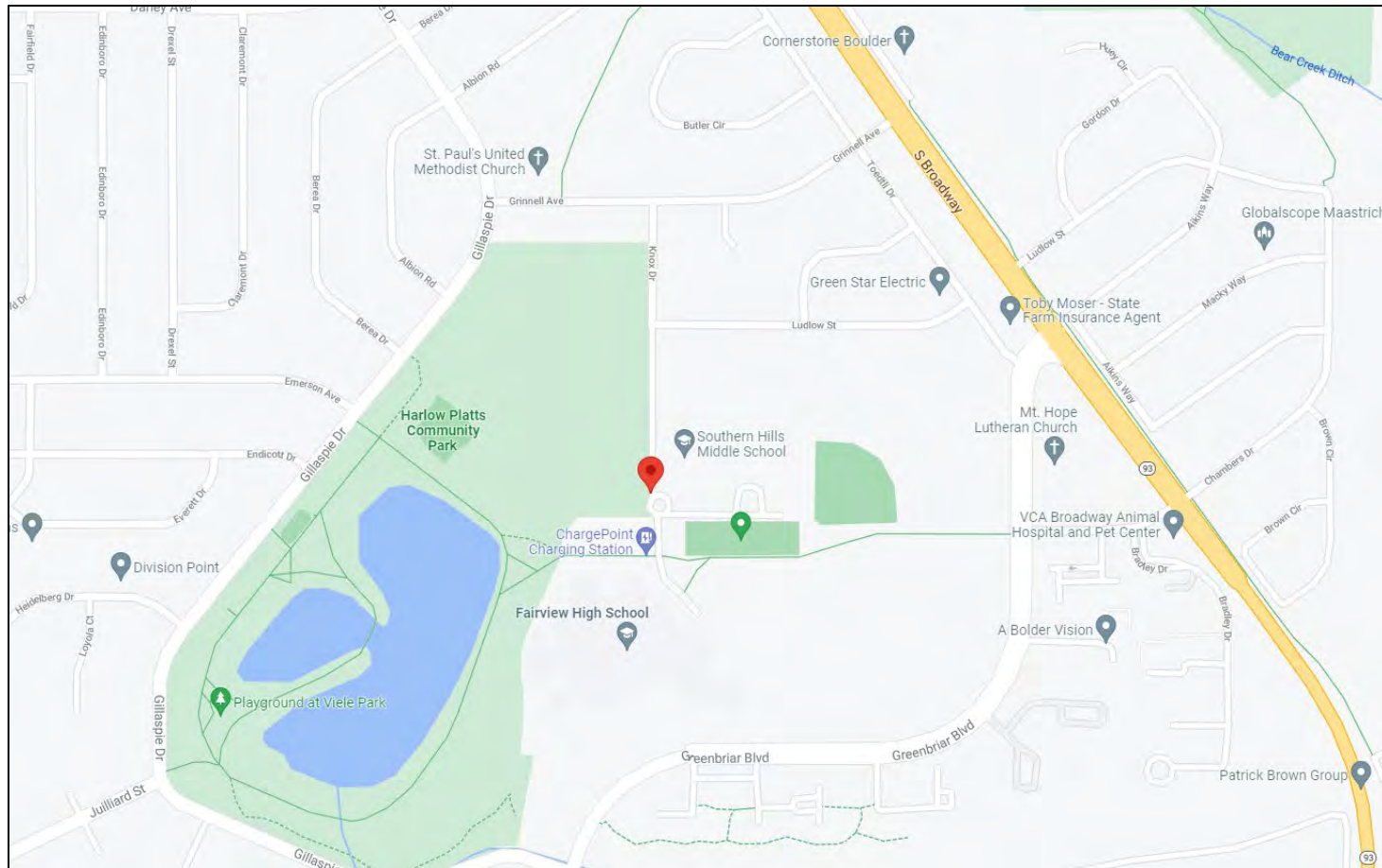
Based on the evidence in the surface observational data, the eyewitness account of the wind in the area of the Marshall fire start, and incorporating my expert opinion of how extreme winds behave in mountain waves along the CO-93 corridor, here is what I believe the winds were doing near the ignition area along CO-93 near Marshall Road from 10 AM - 2 PM:

- West to west southwest winds (from 270-250 degrees on a wind compass) sustained at 50 mph with gusts reaching 90-100 mph at the 10 m height. The strongest winds were around between 11 AM and 1 PM MST, but gusts exceeding 80 mph were occurring from 10 - 2 PM.
- Occasionally an abrupt wind shift occurred, with winds shifting to the north or northeast for a few minutes (maybe as long as 10 minutes), associated with the mountain wave briefly “reloading” or the rotor moving slightly westward over the area.
- The NWTC winds did not capture any abrupt changes in wind direction in the high quality 1-minute data because the location of the rotor and mountain wave never shifted far enough west along that part of CO-93, probably due to an absence of local terrain effects.
- BLD01 also did not capture those brief and significant shifts in the wind because the data are only available every 15 minutes. Eyewitness accounts confirm these brief winds shifts occurred in the area. These abrupt changes in wind direction to north or northeast with speeds 30-50 mph occur near rotors (see Figure 1), and fit the eyewitness description from the area.
- Once the fire became very hot, it was able to locally modify the atmosphere around the fire, resulting in vortices and locally enhanced wind speeds, as well as rapidly shifting winds in and around the fire. These locally enhanced winds because of the heat of the fire occur on the order of 100s of m in space, and were not captured by any available surface observing equipment. They were however captured by local Doppler radar, and they no doubt led to the erratic and extreme behavior of the fire as it raced to the east.

Exhibit 3

RAWS Weather

Boulder South West



Station ID: BLD01

Station Name: Boulder South West

Mesonet ID: NORTHERN-WATER

Latitude: 39.97400

Longitude: -105.24600

Elevation (feet): 5515

County: Boulder

State: CO

Country: US

Timezone: Mountain

Local Region Category:

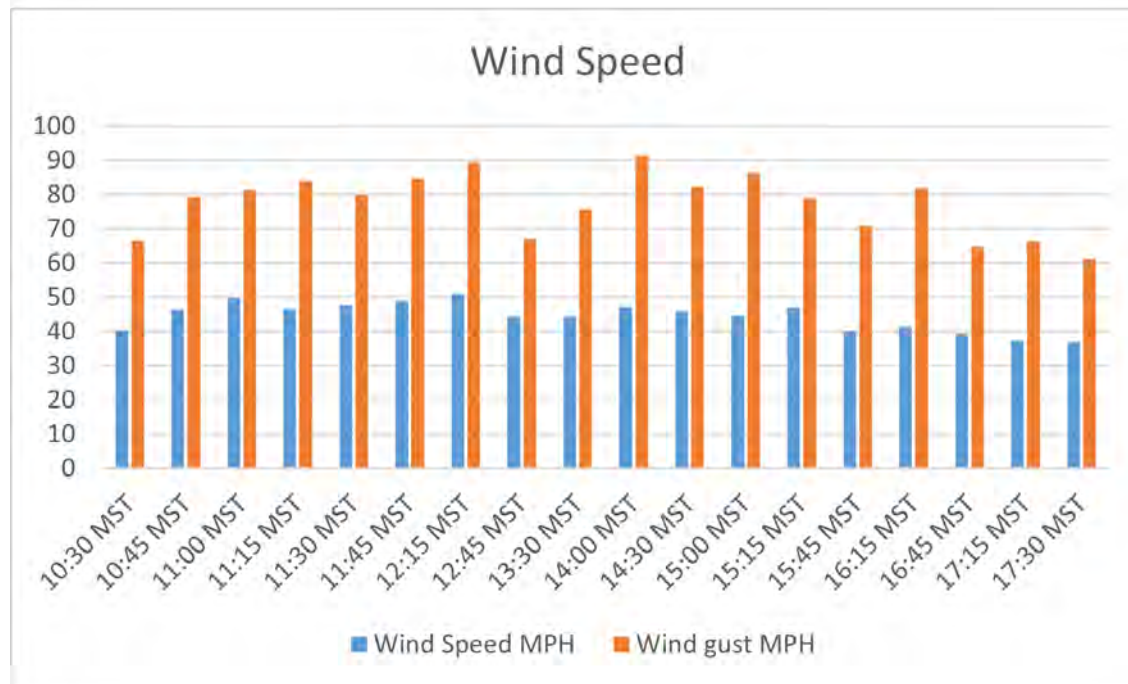
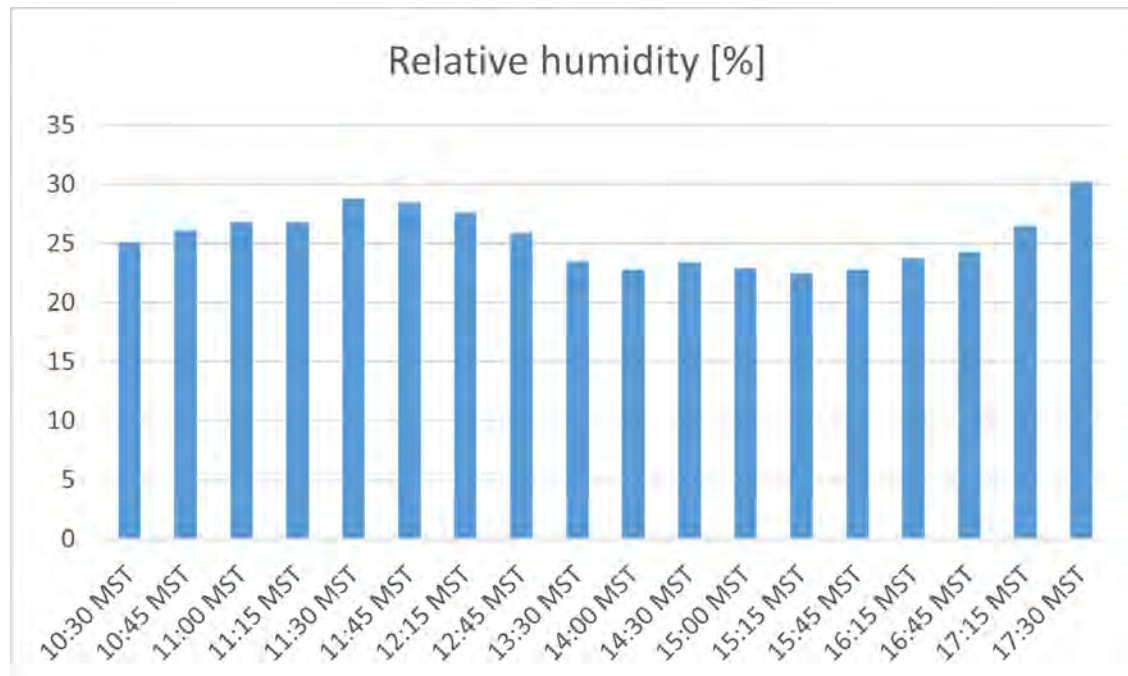
NWS Region: Central

NWS CWA: BOU - Denver/Boulder

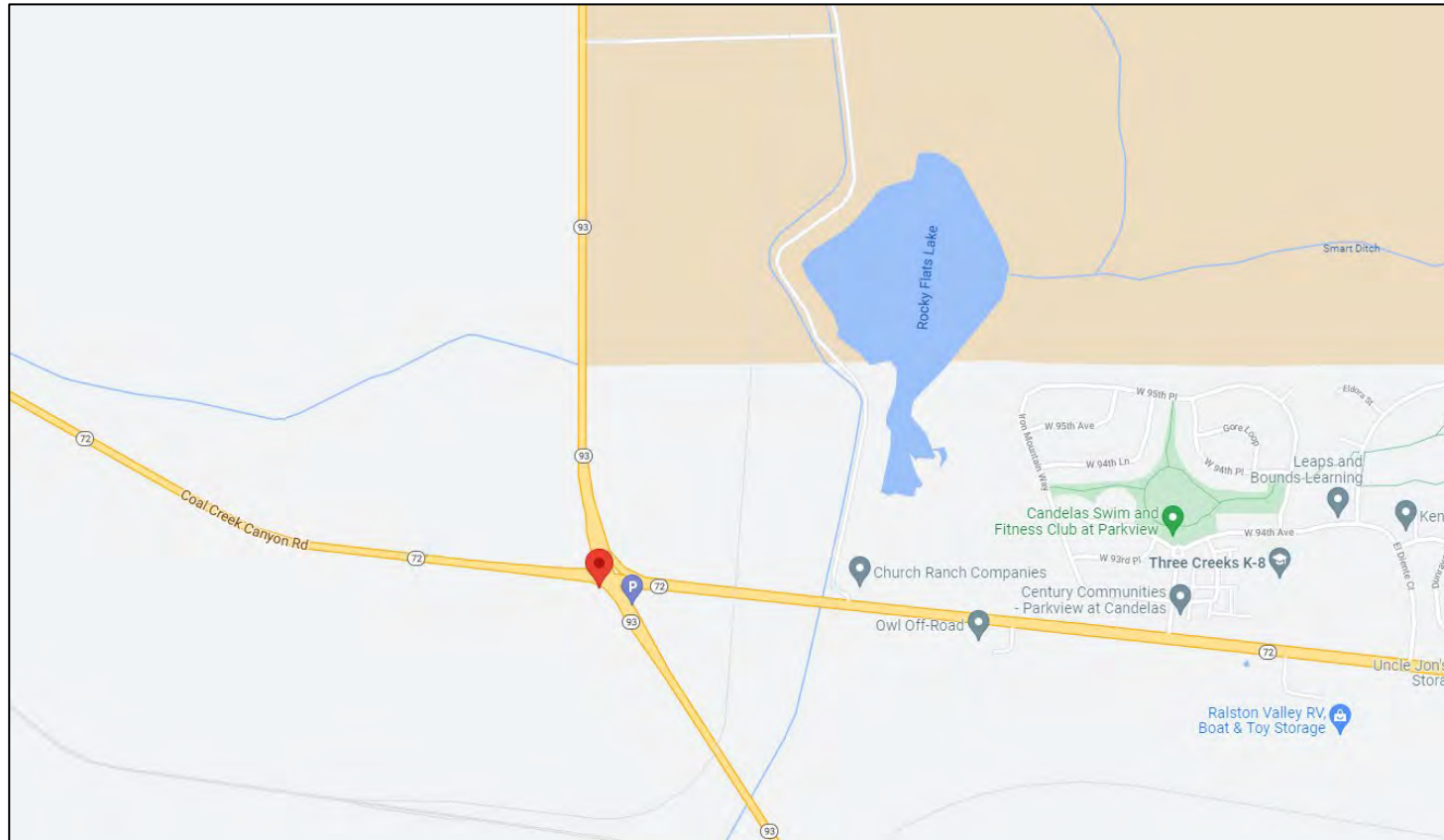
NWS Zone: CO039 - Boulder And Jefferson Counties Below 6000 Feet/West Broomfield County

Boulder South West Weather Summary

Date and Time	Air Temperature	Relative Humidity [%]	Wind Speed [MPH]	Wind Direction	Wind gust [MPH]
12/30/2021 10:30 MST	41.43	25.1	40.35	249.6	66.49
12/30/2021 10:45 MST	41.4	26.1	46.45	247.8	79.28
12/30/2021 11:00 MST	41.22	26.8	49.7	250.9	81.4
12/30/2021 11:15 MST	41.36	26.8	46.63	248.8	83.99
12/30/2021 11:30 MST	41.02	28.8	47.76	249.4	79.86
12/30/2021 11:45 MST	41.18	28.5	48.7	250.8	84.7
12/30/2021 12:15 MST	41.61	27.6	50.96	247.9	89.4
12/30/2021 12:45 MST	41.86	25.9	44.44	250.6	67.08
12/30/2021 13:30 MST	42.6	23.5	44.3	244.9	75.7
12/30/2021 14:00 MST	43.02	22.8	47.15	249.6	91.39
12/30/2021 14:30 MST	42.93	23.4	46.03	247.3	82.3
12/30/2021 15:00 MST	43.2	22.9	44.6	249.4	86.4
12/30/2021 15:15 MST	43.38	22.5	46.94	245.6	78.99
12/30/2021 15:45 MST	43.48	22.8	40.2	246.1	70.94
12/30/2021 16:15 MST	43.11	23.8	41.36	245	81.9
12/30/2021 16:45 MST	42.78	24.3	39.37	245.4	64.96
12/30/2021 17:15 MST	42.37	26.5	37.32	241.5	66.34
12/30/2021 17:30 MST	41.49	30.2	36.92	246.3	61.16



CO93-72



Station ID: CO109

Station Name: 093S00755RWS1SEC at Coal Creek Canyon Rd/CO-72

Mesonet ID: CDOT

Latitude: 39.86567

Longitude: -105.24060

Elevation (feet): 6250

County: Jefferson

State: CO

Country: US

Timezone: Mountain

Local Region Category: Metropolitan

NWS Region: Central

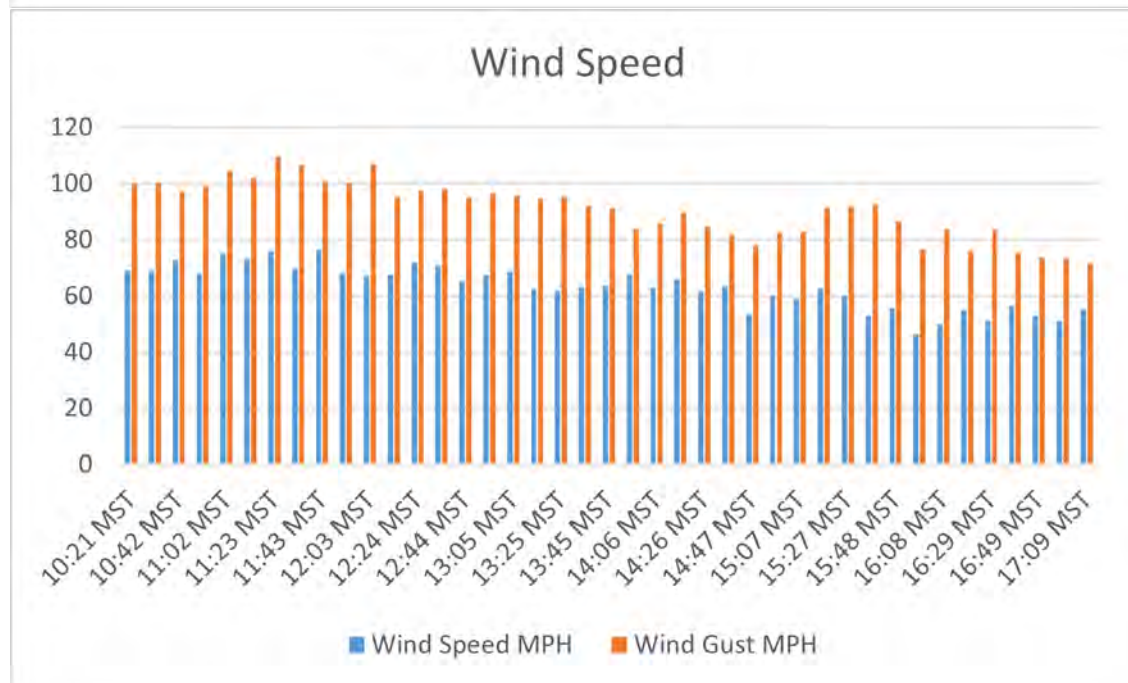
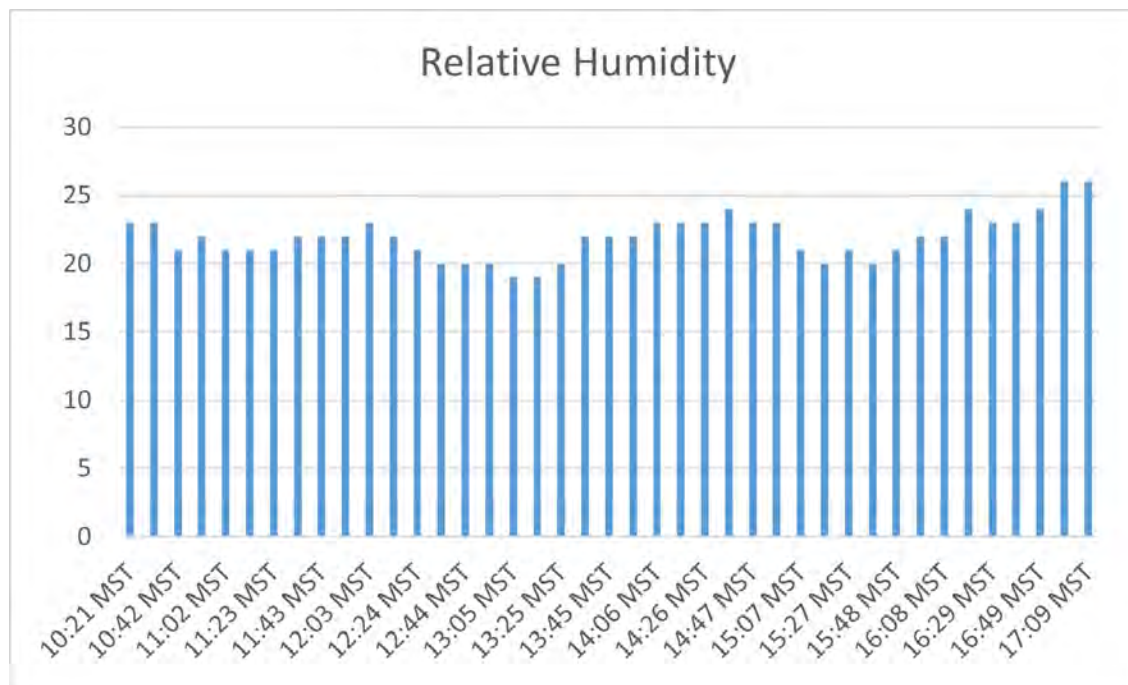
NWS CWA: BOU - Denver/Boulder

NWS Zone: CO036 - Jefferson and West Douglas Counties Above 6000 Feet/Gilpin/Clear Creek/Northeast

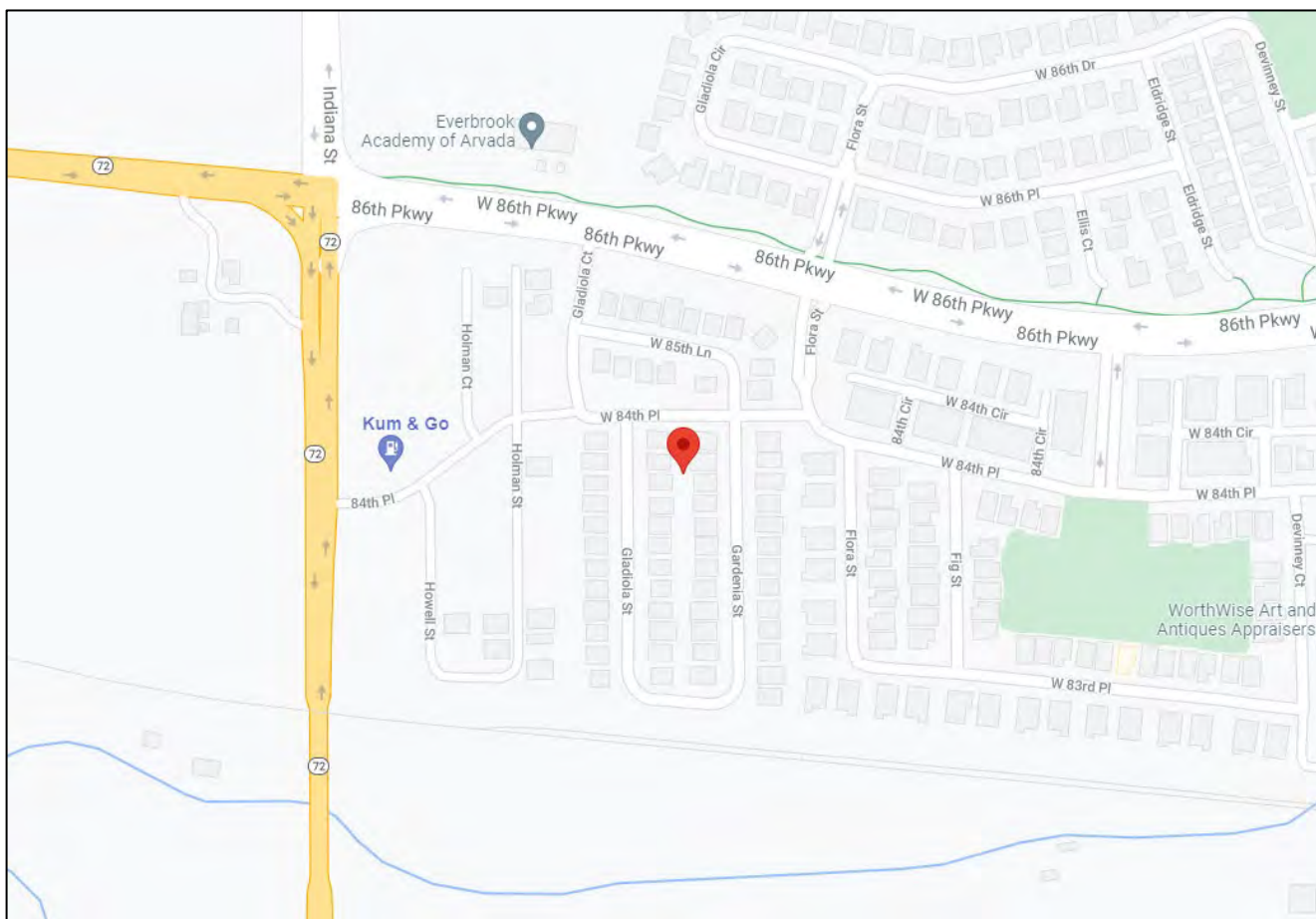
CO93-72 Weather summary

Date and Time	Air Temperature	Relative Humidity	Wind Speed MPH	Wind Direction Degrees	Wind Gust Speed
12/30/2021 10:21 MST	38.48	23	69.12	270	99.99
12/30/2021 10:32 MST	38.84	23	68.9	270	100.44
12/30/2021 10:42 MST	39.2	21	72.69	270	97.08
12/30/2021 10:52 MST	39.02	22	68.23	225	98.87
12/30/2021 11:02 MST	39.2	21	74.94	270	104.47
12/30/2021 11:12 MST	39.2	21	73.14	270	102.22
12/30/2021 11:23 MST	39.56	21	76.06	270	109.61
12/30/2021 11:33 MST	39.38	22	69.79	270	106.7
12/30/2021 11:43 MST	39.38	22	76.5	270	100.89
12/30/2021 11:53 MST	39.74	22	68.23	270	100.21
12/30/2021 12:03 MST	39.74	23	67.11	270	106.93
12/30/2021 12:14 MST	39.92	22	67.55	270	95.51
12/30/2021 12:24 MST	39.92	21	71.81	270	97.53
12/30/2021 12:34 MST	40.28	20	70.69	270	98.2
12/30/2021 12:44 MST	40.46	20	65.1	270	95.3
12/30/2021 12:54 MST	40.46	20	67.33	270	96.41
12/30/2021 13:05 MST	40.46	19	68.68	270	95.75
12/30/2021 13:15 MST	40.46	19	62.41	270	94.85
12/30/2021 13:25 MST	40.46	20	61.74	270	95.51
12/30/2021 13:35 MST	40.28	22	63.31	270	92.17
12/30/2021 13:45 MST	40.28	22	63.75	270	91.27
12/30/2021 13:56 MST	40.28	22	67.78	270	84.11
12/30/2021 14:06 MST	40.28	23	63.09	270	85.67
12/30/2021 14:16 MST	40.28	23	65.99	270	89.7
12/30/2021 14:26 MST	40.1	23	61.52	270	84.78
12/30/2021 14:36 MST	40.1	24	63.53	270	81.87
12/30/2021 14:47 MST	40.28	23	53.47	270	78.07
12/30/2021 14:57 MST	40.28	23	60.17	270	82.55
12/30/2021 15:07 MST	40.64	21	58.83	225	82.76
12/30/2021 15:17 MST	40.82	20	62.64	270	91.49
12/30/2021 15:27 MST	40.82	21	60.17	270	91.72
12/30/2021 15:38 MST	40.82	20	53.02	225	92.6
12/30/2021 15:48 MST	40.64	21	55.7	270	86.34
12/30/2021 15:58 MST	40.1	22	46.53	270	76.72
12/30/2021 16:08 MST	40.1	22	50.11	270	83.66

12/30/2021 16:18 MST	39.74	24	55.03	270	76.27
12/30/2021 16:29 MST	39.74	23	51.22	270	83.88
12/30/2021 16:39 MST	39.92	23	56.36	270	75.16
12/30/2021 16:49 MST	39.38	24	53.02	225	73.82
12/30/2021 16:59 MST	39.02	26	51	270	73.59
12/30/2021 17:09 MST	39.02	26	55.25	270	71.58



FW0869 Arvada



Station ID: F0869

Station Name: FW0869 Arvada

Mesonet ID: APRSWXNET/CWOP

Latitude: 39.84879

Longitude: -105.16221

Elevation (feet): 5708

County: Jefferson

State: CO

Country: US

Timezone: Mountain

Local Region Category:

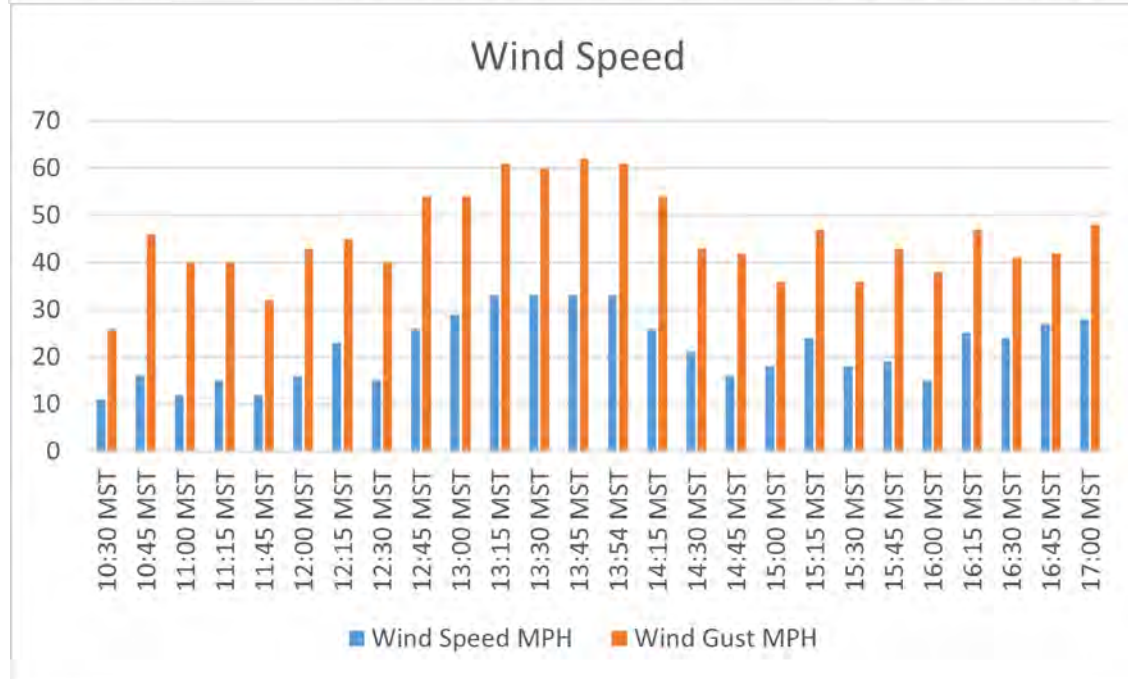
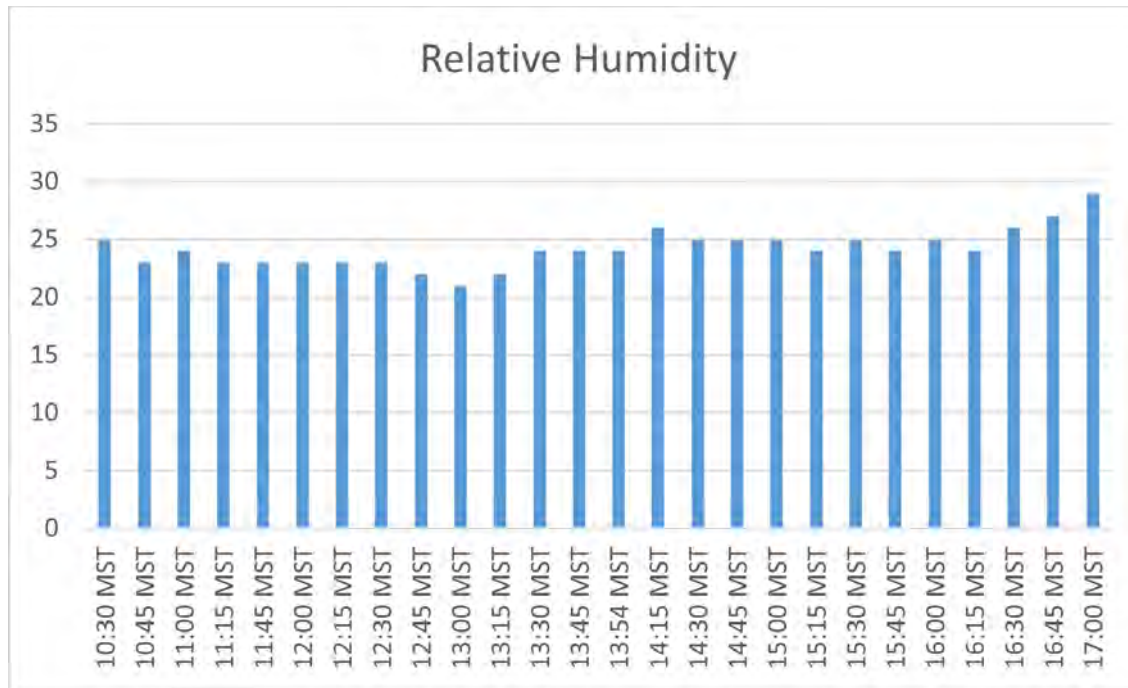
NWS Region: Central

NWS CWA: BOU - Denver/Boulder

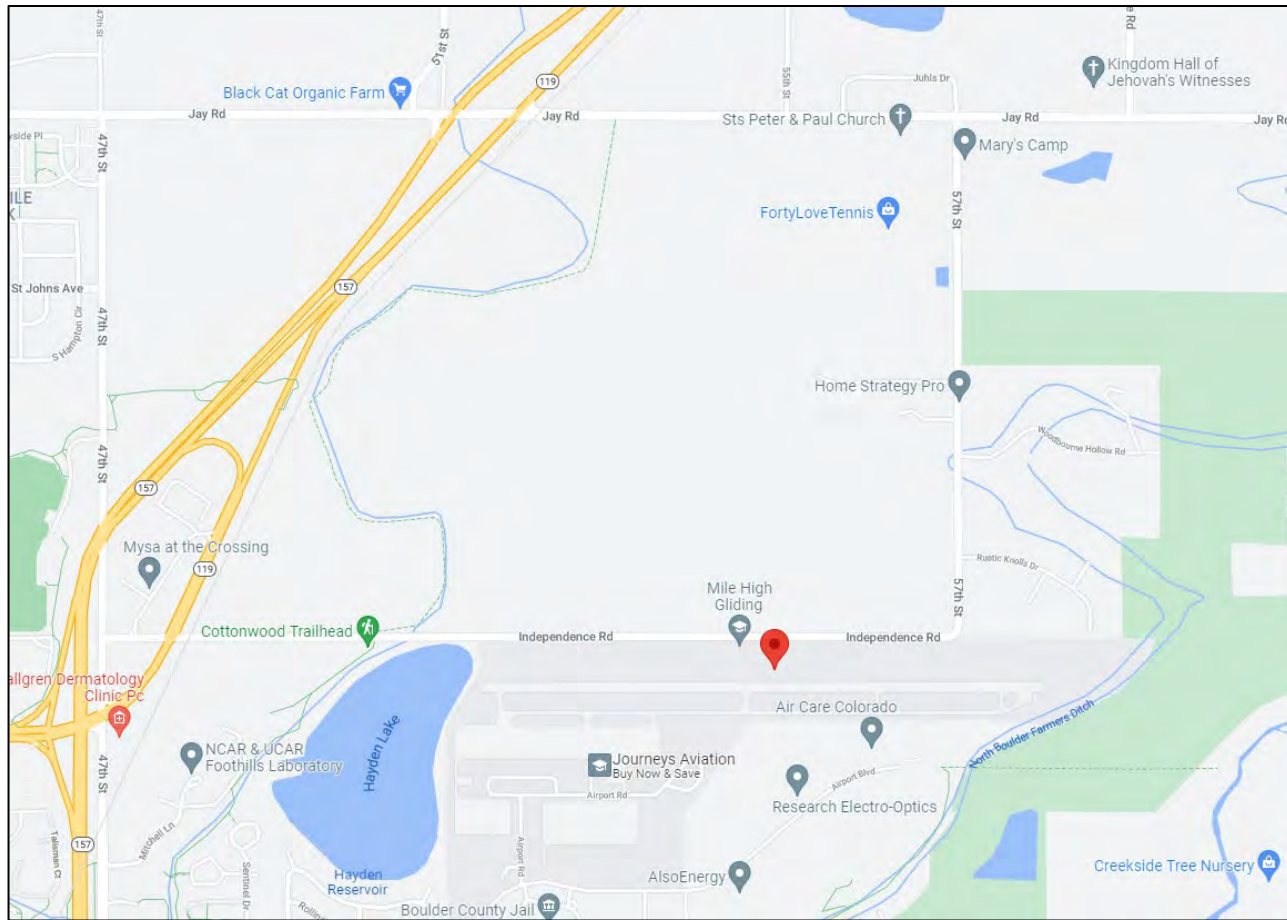
NWS Zone: CO039 - Boulder And Jefferson Counties Below 6000 Feet/West Broomfield County

FW0869 Arvada Weather summary

Date and Time	Air Temperature	Relative Humidity [%]	Wind Speed MPH	Wind Direction Degrees	Wind Gust MPH
12/30/2021 10:30 MST	44	25	11	89	26
12/30/2021 10:45 MST	44	23	16	115	46
12/30/2021 11:00 MST	44	24	12	212	40
12/30/2021 11:15 MST	45	23	14.99	200	40
12/30/2021 11:45 MST	46	23	12	165	32
12/30/2021 12:00 MST	45	23	16	190	43.01
12/30/2021 12:15 MST	45	23	23	289	45
12/30/2021 12:30 MST	45	23	14.99	222	40
12/30/2021 12:45 MST	45	22	26	248	54
12/30/2021 13:00 MST	45	21	29	271	54
12/30/2021 13:15 MST	45	22	33	292	61
12/30/2021 13:30 MST	45	24	33	286	60
12/30/2021 13:45 MST	45	24	33	257	62
12/30/2021 13:54 MST	45	24	33	260	61
12/30/2021 14:15 MST	45	26	26	211	54
12/30/2021 14:30 MST	45	25	21	190	43.01
12/30/2021 14:45 MST	44	25	16	239	42
12/30/2021 15:00 MST	44	25	18	240	36
12/30/2021 15:15 MST	44	24	24	247	47
12/30/2021 15:30 MST	44	25	18	206	36
12/30/2021 15:45 MST	44	24	19	169	43.01
12/30/2021 16:00 MST	43	25	14.99	233	38
12/30/2021 16:15 MST	43	24	25	261	47
12/30/2021 16:30 MST	42	26	24	257	41
12/30/2021 16:45 MST	42	27	27	257	42
12/30/2021 17:00 MST	42	29	28	240	48



Boulder Municipal Airport



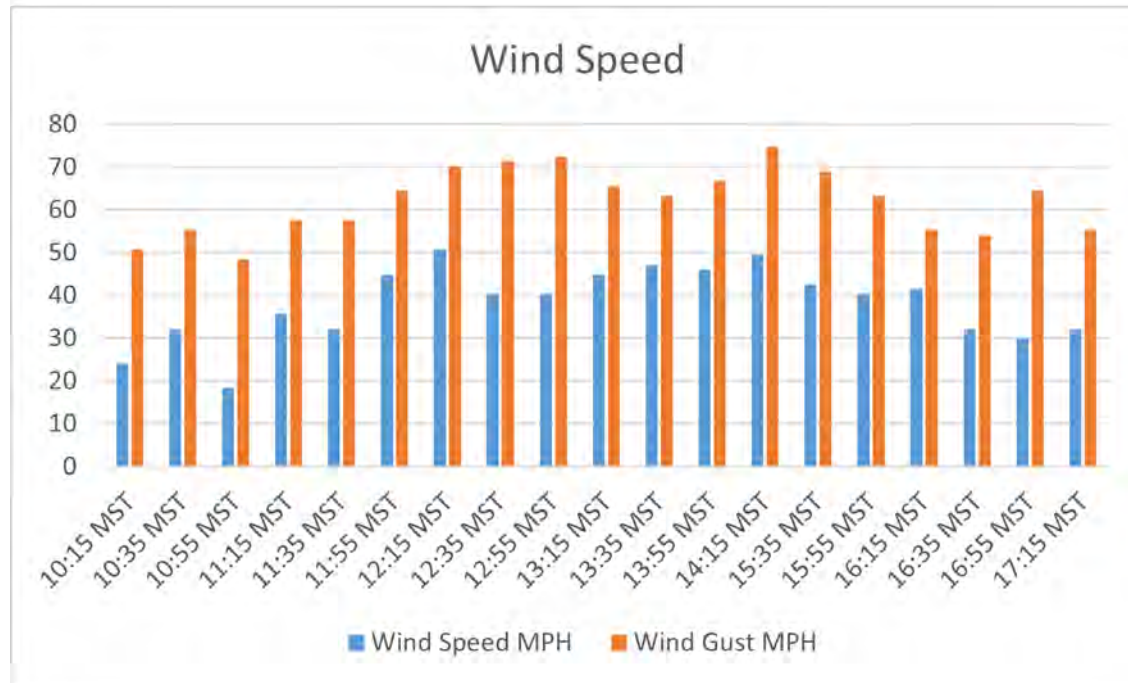
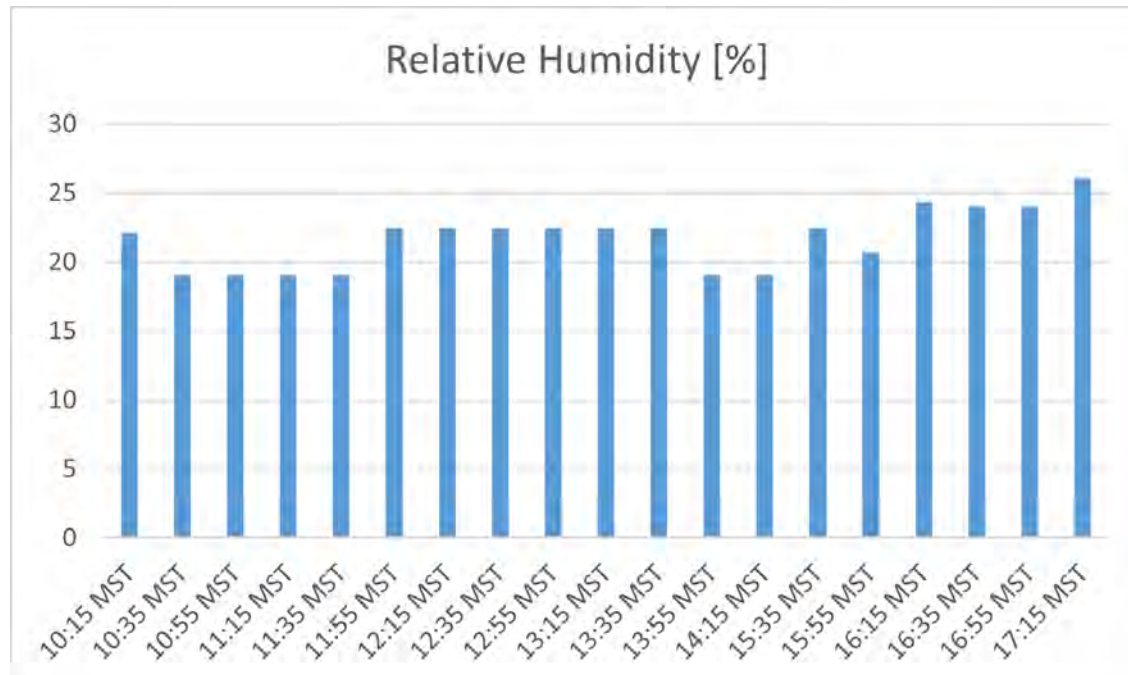
Station ID: KBDU
Station Name: Boulder Municipal Airport
Mesonet ID: NWS/FAA
Latitude: 40.0394297
Longitude: -105.2258217
Elevation (feet): 5288

County: Boulder
State: CO
Country: US
Timezone: Mountain
Local Region Category: Metropolitan
NWS Region: Central
NWS CWA: BOU - Denver/Boulder
NWS Zone: CO039 - Boulder And Jefferson Counties Below 6000 Feet/West Broomfield County

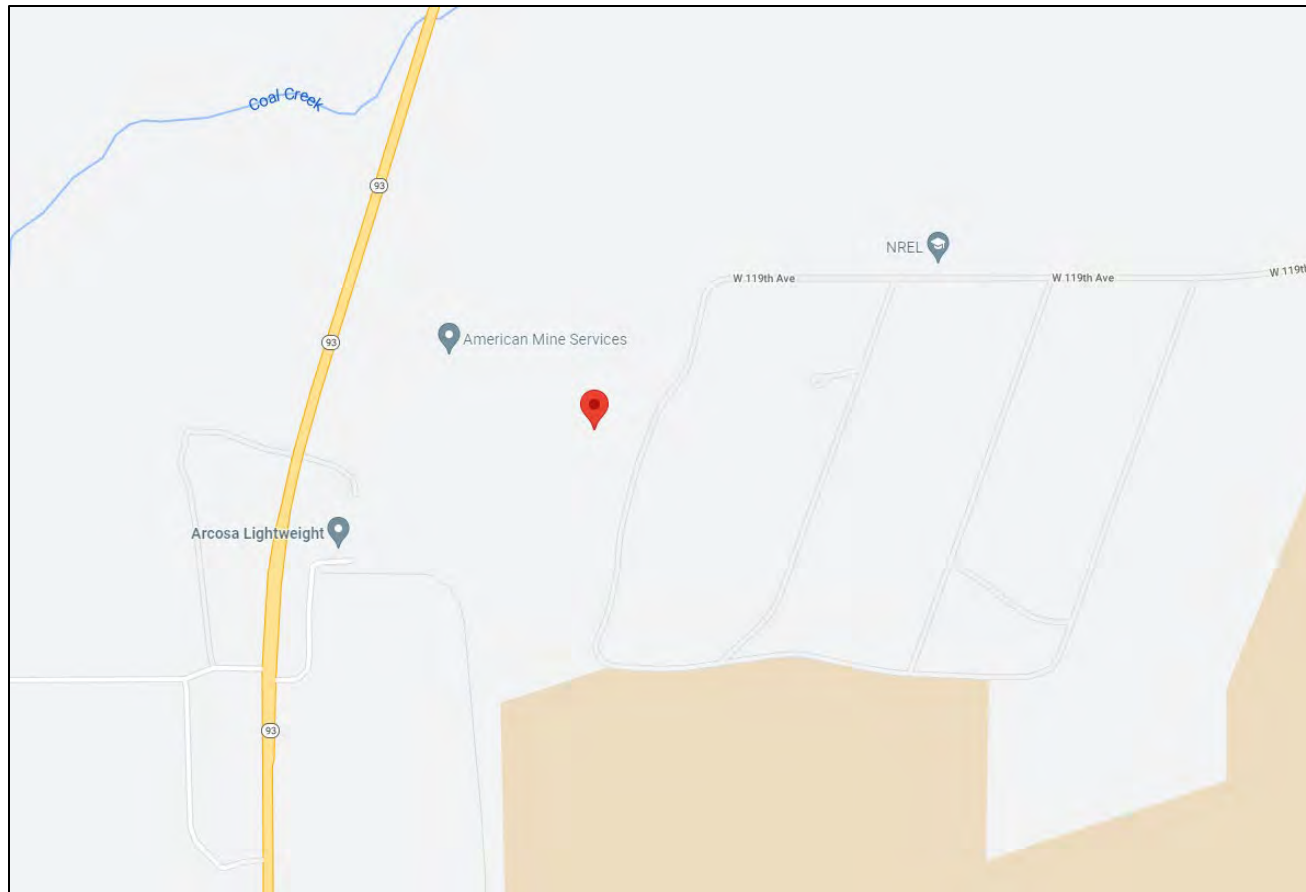
Boulder Municipal Airport

Weather summary

Date and Time	Air Temp	Relative Humidity	Wind Speed MPH	Wind Direction [Degrees]	Wind Gust MPH	Wind Direction [Cardinal]	Pressure	Sea Level Pressure
12/30/2021 10:15 MST	42.8	22.18	24.17	290	50.64	WNW	24.25	27.38
12/30/2021 10:35 MST	44.6	19.07	32.22	300	55.24	WNW	24.25	27.44
12/30/2021 10:55 MST	44.6	19.07	18.41	300	48.33	WNW	24.24	27.43
12/30/2021 11:15 MST	44.6	19.07	35.67	290	57.54	WNW	24.22	27.4
12/30/2021 11:35 MST	44.6	19.07	32.22	270	57.54	W	24.2	27.38
12/30/2021 11:55 MST	44.6	22.47	44.88	260	64.44	W	24.15	27.09
12/30/2021 12:15 MST	44.6	22.47	50.64	250	70.2	WSW	24.14	27.08
12/30/2021 12:35 MST	44.6	22.47	40.28	250	71.35	WSW	24.13	27.07
12/30/2021 12:55 MST	44.6	22.47	40.28	240	72.5	WSW	24.13	27.07
12/30/2021 13:15 MST	44.6	22.47	44.88	250	65.59	WSW	24.13	27.07
12/30/2021 13:35 MST	44.6	22.47	47.18	250	63.29	WSW	24.12	27.06
12/30/2021 13:55 MST	44.6	19.07	46.03	250	66.75	WSW	24.12	27.29
12/30/2021 14:15 MST	44.6	19.07	49.48	250	74.8	WSW	24.12	27.29
12/30/2021 15:35 MST	44.6	22.47	42.58	250	69.05	WSW	24.15	27.09
12/30/2021 15:55 MST	44.6	20.7	40.28	250	63.29	WSW	24.15	27.21
12/30/2021 16:15 MST	44.6	24.36	41.43	250	55.24	WSW	24.15	26.96
12/30/2021 16:35 MST	42.8	24.07	32.22	250	54.09	WSW	24.16	27.16
12/30/2021 16:55 MST	42.8	24.07	29.92	240	64.44	WSW	24.16	27.16
12/30/2021 17:15 MST	42.8	26.1	32.22	250	55.24	WSW	24.17	27.04



National Renewable Energy Laboratory (NREL)



NREL Flatirons Campus (M2)

Latitude: 39.9106° North

Longitude: 105.2347° West

Elevation: 1855 AMSL

Time Zone: MST

Elevation: 6085

The readings displayed are derived from instruments mounted on or near a 82 meter (270 foot) meteorological tower located at the western edge of the Flatirons Campus (formerly NWTC) and about 11 km (7 miles) west of Broomfield, and approximately 8 km (5 miles) south of Boulder, Colorado.

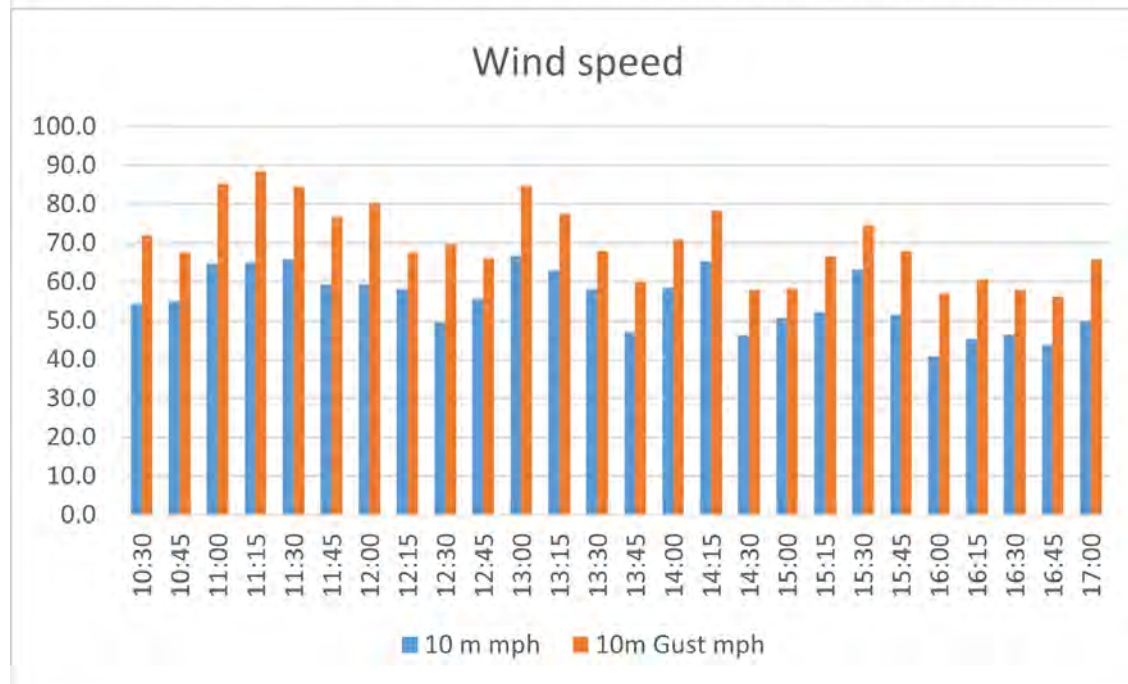
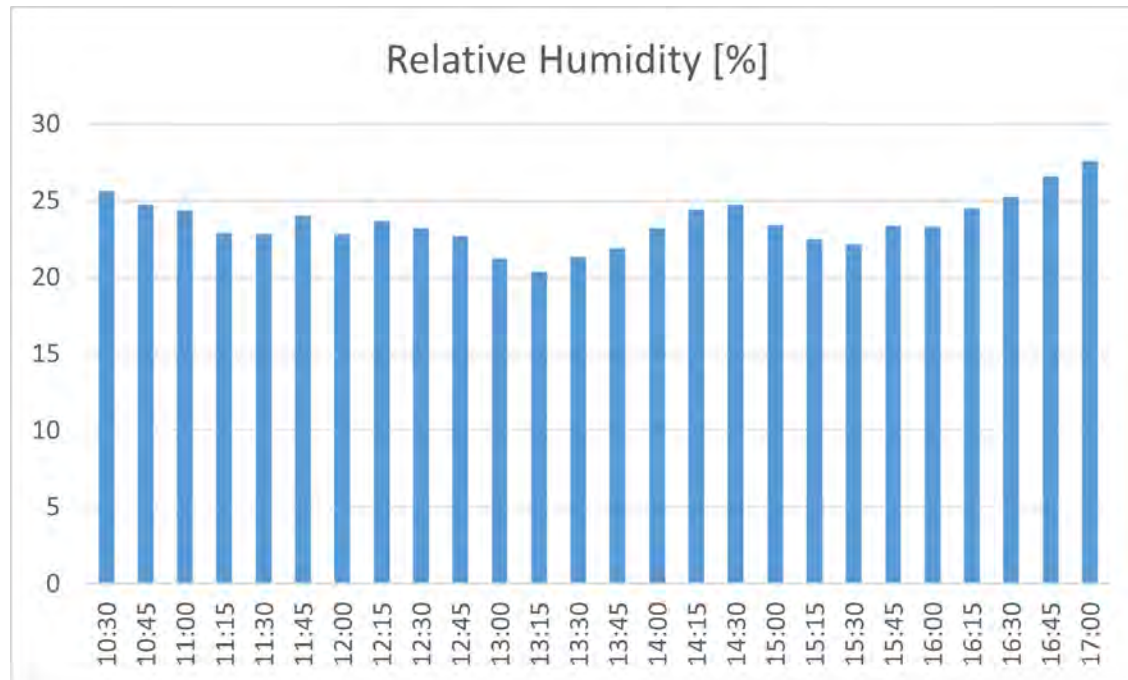
Jager, D.; Andreas, A.; (1996). NREL National Wind Technology Center (NWTC):

M2 Tower; Boulder, Colorado (Data); NREL Report No. DA-5500-56489.

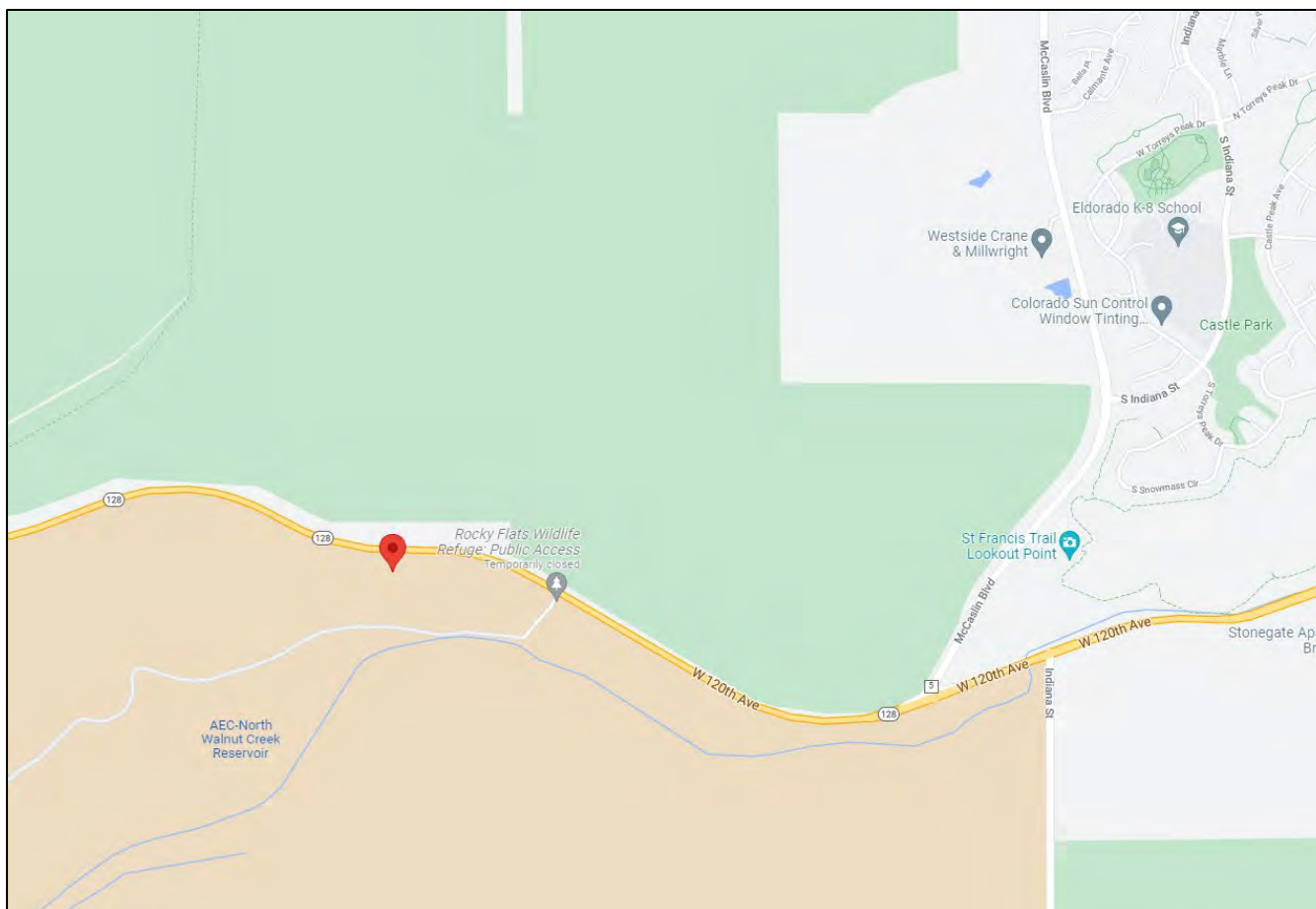
<https://midcdmz.nrel.gov/apps/sitehome.pl?site=NWTC>

NREL Weather summary

DATE (MM/DD/YYYY)	Time (MST)	Relative Humidity [%]	10 m mph	10m Gust mph	Avg Wind Direction at 10m (degrees)	Wind Direction at peak wind speed (10m)
12/30/2021	10:30	25.63	54.4	72.2	266.7	264.1
12/30/2021	10:45	24.76	55.0	67.5	274.9	270.1
12/30/2021	11:00	24.36	64.7	85.2	272.4	259.9
12/30/2021	11:15	22.96	64.9	88.5	272.1	268.3
12/30/2021	11:30	22.85	65.8	84.6	275.3	279.6
12/30/2021	11:45	24.07	59.5	76.9	277.1	276.8
12/30/2021	12:00	22.83	59.4	80.3	280.5	284.5
12/30/2021	12:15	23.66	58.2	67.5	275.7	265.3
12/30/2021	12:30	23.22	49.7	69.6	269.3	263.9
12/30/2021	12:45	22.72	55.7	66.1	279.1	285.9
12/30/2021	13:00	21.23	66.9	84.7	273.8	263.8
12/30/2021	13:15	20.37	63.0	77.5	267.8	277.9
12/30/2021	13:30	21.33	58.2	67.9	272	285.6
12/30/2021	13:45	21.92	47.2	60.0	273.6	291.2
12/30/2021	14:00	23.19	58.5	70.9	271.4	275.4
12/30/2021	14:15	24.42	65.3	78.3	266	260.4
12/30/2021	14:30	24.78	46.2	58.0	262.5	268.7
12/30/2021	15:00	23.44	50.7	58.4	269.9	273.6
12/30/2021	15:15	22.48	52.4	66.7	262.1	257.8
12/30/2021	15:30	22.16	63.1	74.6	266.8	259.6
12/30/2021	15:45	23.4	51.7	67.9	273.1	277.8
12/30/2021	16:00	23.29	40.8	57.2	261.3	259.8
12/30/2021	16:15	24.52	45.3	60.6	254.9	253.7
12/30/2021	16:30	25.26	46.6	58.0	267.1	269.7
12/30/2021	16:45	26.62	43.7	56.3	263.2	264.8
12/30/2021	17:00	27.61	49.7	65.9	269.3	274.3



Rocky Flats - North



Station ID: RFN
Station Name: Rocky Flats - North
Mesonet ID: CDPHE
Latitude: 39.912799
Longitude: -105.188587
Elevation (feet): 5912

County: Jefferson
State: CO
Country: US
Timezone: Mountain
Local Region Category: Metropolitan
NWS Region: Central
NWS CWA: BOU - Denver/Boulder
NWS Zone: CO039 - Boulder And Jefferson Counties Below 6000 Feet/West Broomfield County

Rocky Flats- North Weather summary

Date and Time	Air Temperature	Wind Speed MPH	Wind Direction Degrees	Wind Direction (Cardinal)
12/30/2021 10:00 MST	39.3	31	292	WNW
12/30/2021 10:15 MST	39.6	43.99	283	WNW
12/30/2021 10:30 MST	39.9	52.99	278	W
12/30/2021 10:45 MST	40.4	56	278	W
12/30/2021 11:00 MST	40.9	52.99	280	W
12/30/2021 11:15 MST	41.4	55	281	W
12/30/2021 11:30 MST	41.5	61.99	281	W
12/30/2021 11:45 MST	41.6	65	279	W
12/30/2021 12:00 MST	41.6	69.99	279	W
12/30/2021 12:15 MST	41.7	77.99	282	WNW
12/30/2021 12:30 MST	41.6	75	282	WNW
12/30/2021 12:45 MST	42.3	66	279	W
12/30/2021 13:00 MST	42.5	68.99	274	W
12/30/2021 13:15 MST	42.7	71.99	273	W
12/30/2021 13:30 MST	42.7	70.99	271	W
12/30/2021 13:45 MST	42.8	67	271	W
12/30/2021 14:00 MST				
12/30/2021 14:15 MST	42.6	62.99	272	W
12/30/2021 14:30 MST	42.4	62.99	272	W
12/30/2021 14:45 MST	42.4	62.99	271	W
12/30/2021 15:00 MST	42.3	62.99	273	W
12/30/2021 15:15 MST	42.5	61.99	273	W
12/30/2021 15:30 MST	42.6	56	272	W
12/30/2021 15:45 MST	42.6	52.99	270	W
12/30/2021 16:00 MST	42.4	54	268	W
12/30/2021 16:15 MST	42	55	268	W
12/30/2021 16:30 MST	41.4	59	267	W
12/30/2021 16:45 MST	40.9	54	271	W
12/30/2021 17:00 MST	40.9	55	270	W

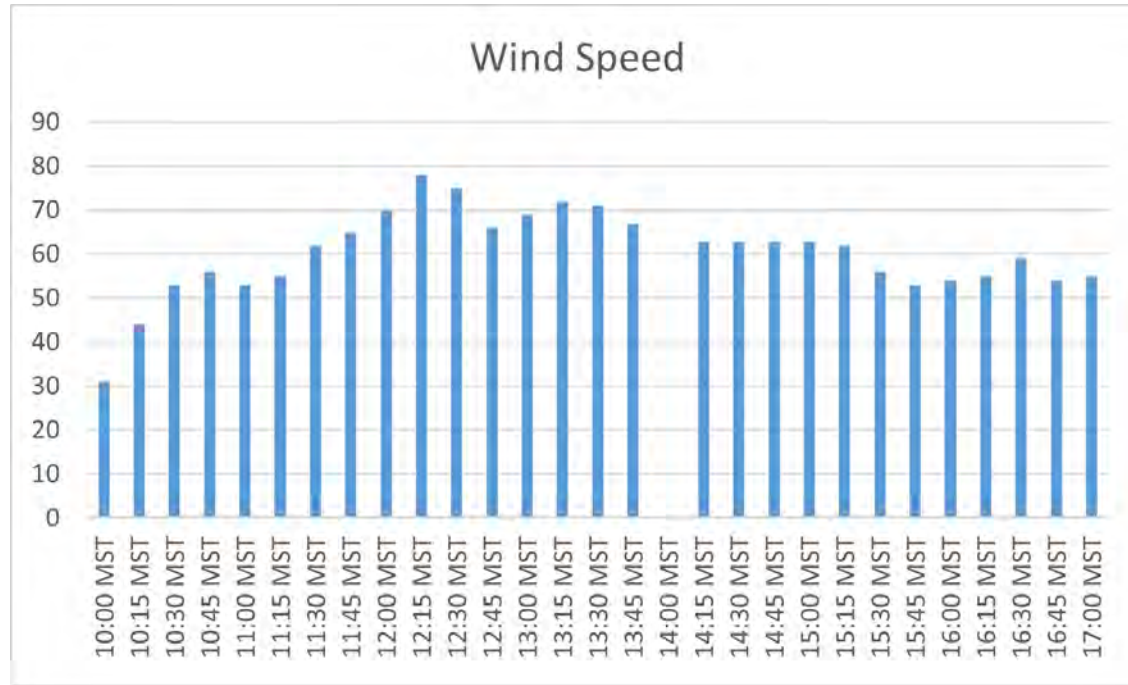


Exhibit 4

Marshall Fire Origin Examination Video

SEE ELECTRONIC FILE

Exhibit 5

Marshall Fire Origin & Cause Photographs, Photolog, and
Photograph Location Diagram

Page 5 of 5



Approximate locations of photos taken on 01/05/2021. Arrows indicate approximate direction of photo vantage. Points with no arrows were taken at an overall downward angle. Base photo was taken by drone on 12/31/2021.























































Exhibit 6

3D Image Scans Marshall Fire General Origin Area

SEE ELECTRONIC FILE

Exhibit 7

Marshall Fire Origin & Cause Drone Footage 01/05/2022

SEE ELECTRONIC FILE

Exhibit 8

Earth Networks Inquiry Response

From: no-reply@earthnetworks.com
To: [Lunders, Travis -FS](#)
Subject: [External Email]Lightning Archive - [Marshall Fire] - Success with No Results
Date: Friday, January 14, 2022 4:56:24 PM

[External Email]

If this message comes from an **unexpected sender** or references a **vague/unexpected topic**;
Use caution before clicking links or opening attachments.
Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

Your report completed successfully. There was no lightning for the requested time and geographic area.

Name: Marshall Fire

File Size: 0.13281 KB

Format: CSV

Start Time: 2021-12-16 07:00 PM UTC

End Time: 2021-12-30 07:00 PM UTC

Lightning Type: Pulse

Stroke Type: Cloud to Ground

Additional Options: Location Accuracy

Area Definition type : Circle

Center: 39.9527, -105.2319

Radius: 0.7965 miles

Report ID: 4e679cda-1db9-405b-858e-4ffef562548b

From: no-reply@earthnetworks.com
To: [Lunders, Travis -FS](#)
Subject: [External Email]Lightning Archive - [Marshall Fire] - Success with No Results
Date: Friday, January 14, 2022 4:58:25 PM

[External Email]

If this message comes from an **unexpected sender** or references a **vague/unexpected topic**;
Use caution before clicking links or opening attachments.
Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

Your report completed successfully. There was no lightning for the requested time and geographic area.

Name: Marshall Fire

Format: KMZ

Start Time: 2021-12-16 07:00 PM UTC

End Time: 2021-12-30 07:00 PM UTC

Lightning Type: Pulse

Stroke Type: Cloud to Ground

Additional Options: Location Accuracy

Area Definition type : Circle

Center: 39.9527, -105.2319

Radius: 0.7965 miles

Report ID: 7eae292d-13d8-41bf-b7bc-03683db3a33e