

History of Weather Observing at Santa Fe, New Mexico 1871-1949

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Executive Summary

The Santa Fe area has a long, rich history of weather observing beginning in 1849. A central path of weather observing was established early in Santa Fe when U.S. Army surgeons at Fort Marcy took the first weather observations at their hospital on January 1, 1849. Although Fort Marcy was planned for construction on a mesa about 600 yards northeast of the Santa Fe Plaza, the hospital, most support functions, and officer/soldier quarters were located in the city of Santa Fe just north of the Plaza. Hence, weather observations for Fort Marcy actually were taken near the Santa Fe Plaza. Although the Signal Service assumed responsibility for weather observing in late 1871, the Fort Marcy surgeons continued to take observations until at least 1892 (as indicated by the records; Fort Marcy was closed in 1894).

From late 1871 through early 1938, Signal Service and Weather Bureau observing sites moved relatively frequently, with all locations on, or near the Santa Fe Plaza. During this approximately 65 year period, weather observations were taken at 11 locations within Santa Fe. Eight of the sites were within the immediate vicinity of the Plaza (i.e., within one block), with the most distant location less than one-quarter mile from Plaza center. When considering the location of weather observations for Fort Marcy which were taken at the hospital, all weather observing at Santa Fe were taken near the Plaza from about 1849 into 1938.

The focus on the Santa Fe Plaza for weather observing begin to change on March 19, 1938 when a new Weather Bureau office was opened at the old Santa Fe airport approximately seven miles from the Plaza. Over the next three years, the airport office assumed additional responsibility, and on May 27, 1941, responsibility for the airport office transferred from the Weather Bureau to the Civil Aeronautical Administration (CAA). On Jun 15, 1941, the Weather Bureau city office was closed.

On Aug 20, 1943, the CAA weather station moved approximately two and one-half miles west to the new Santa Fe airport where it remained through 1949.

Goal of the Study

The goal of this study is to document the primary weather observational path at Santa Fe, NM leading to the Weather Bureau observing program in the first half of the 20th Century. Descriptions of Santa Fe weather observations since around 1950 are available through easily obtainable climatic records, with the challenge being to identify and define the roots of the path that began in the 1800s and continued through times of significant transition in the early 1900s. Extrinsic observations, i.e., those by Smithsonian and Voluntary (or Cooperative) observers, are considered in relation to the beginning of the central observational stream eventually established by the Army surgeons, Signal Service, or Weather Bureau. This does not minimize the importance of these collateral observations, but rather to focus on the original events that led to the routine, formal weather observing program of modern times.

Santa Fe Historical Overview

The city of Santa Fe has a long and rich history. As the nation's second oldest city, Santa Fe was initially settled by Pueblo Indians between 1050 and 1150. Spanish colonists first settled in northern New Mexico in 1598 and Santa Fe was established in 1610. The Santa Fe Plaza also was established in 1610, serving as the focus for city activities.

Weather observing history in the Santa Fe area began in 1846 when the United States Army marched into Santa Fe, NM and quickly built Fort Marcy on a 100 foot high mesa approximately 600 yards northeast of the city center, but with officer and soldier quarters, as well as the hospital, placed immediately north of the Plaza. Here, Army surgeons began taking weather observations on January 1, 1849, beginning a path of weather observations around the Plaza that continued until mid 1941.

Location Descriptions

Due to the proximity of weather observing locations in Santa Fe from the mid 1800s to mid 1900s, the weather observing history of Santa Fe and Fort Marcy overlap, as do the operations of the Army surgeons, U.S. Signal Service, and the Weather Bureau. To fully understand the history of weather observing in the Santa Fe area, it is essential to comprehend the evolution of weather observing at Fort Marcy since the two are intertwined. Although Fort Marcy observing history is contained in a separate report, proximity and natural functional linkages require cross references between the two documents.

Below are important national dates that relate to the early weather observing history at Santa Fe.

May 2, 1814 – Army Surgeon General orders field surgeons to keep routine weather diaries.

November 1, 1871 – The Army Signal Service's new Division of Telegrams and Reports for the Benefit of Commerce begins operations as the nation's weather service.

July 1, 1891 – The U.S. Army Signal Service transfers civilian meteorological services to the Weather Bureau.

Important local dates relating to early weather observing history at Santa Fe include:

August 10, 1846 - General Stephen Kearny's forces arrived in Santa Fe to proclaim New Mexico a part of the U.S. Fort Marcy was established immediately north and northeast of the center of the town of Santa Fe.

January 1, 1849 – Army surgeons at Fort Marcy began keeping daily weather diaries.

November 18, 1871 – U.S. Signal Service assumes responsibility for weather services in Santa Fe. Army surgeons continued to take routine weather observations until July 1873, then intermittently took observations through February 1892.

July 1, 1891 – U.S. Weather Bureau began taking routine weather observations at Santa Fe.

Weather Observing Timeline for Santa Fe

Based on records at NCDC, the beginning of weather observations in the immediate Santa Fe area began on January 1, 1849 when Army surgeons at Fort Marcy began making daily reports. Specific information regarding weather observing at Fort Marcy is contained in a separate report. With few interruptions, e.g., over six months during the Civil War, the observations were continued into the early 1890s although less consistently following assumption of weather responsibilities by the U.S. Signal Service.

Cooperative Observers in Santa Fe – The NWS publication on substation history for New Mexico indicates no record for any Cooperative (or volunteer) Observer for the Santa Fe area prior to the establishment of the Weather Bureau in 1891. This lack of Cooperative Observer observations may be the result of the extensive weather observation program by the U.S. Army surgeons at Fort Marcy and continuing with the U.S. Signal Service.

Figures 1 through 3 depict the locations of Signal Service, Weather Bureau, and CAA (Civil Aeronautical Administration) weather observing stations at Santa Fe from 1871 through 1949.

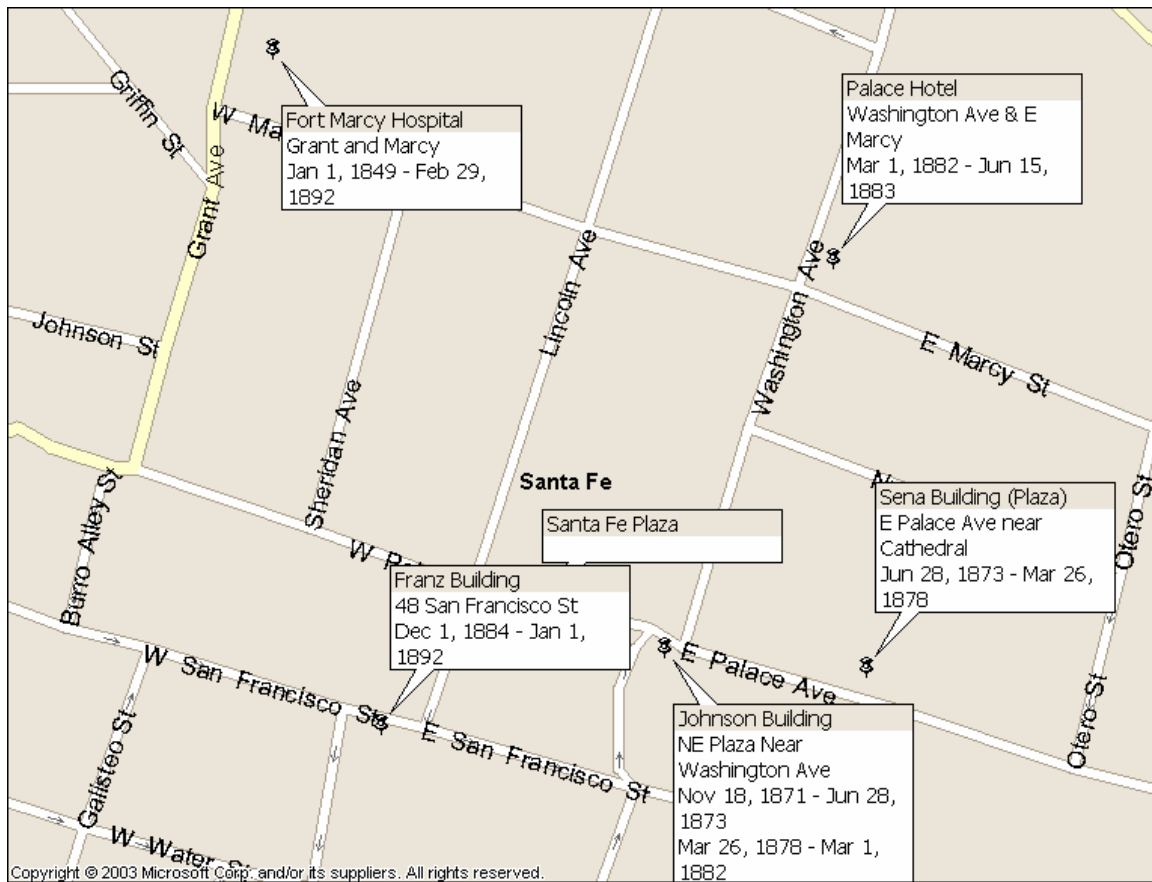


Figure 1. Signal Service and Weather Bureau stations in Santa Fe from 1871 through 1892. Also shown is the location of the Fort Marcy hospital where Army surgeons took observations 1849 through 1892.

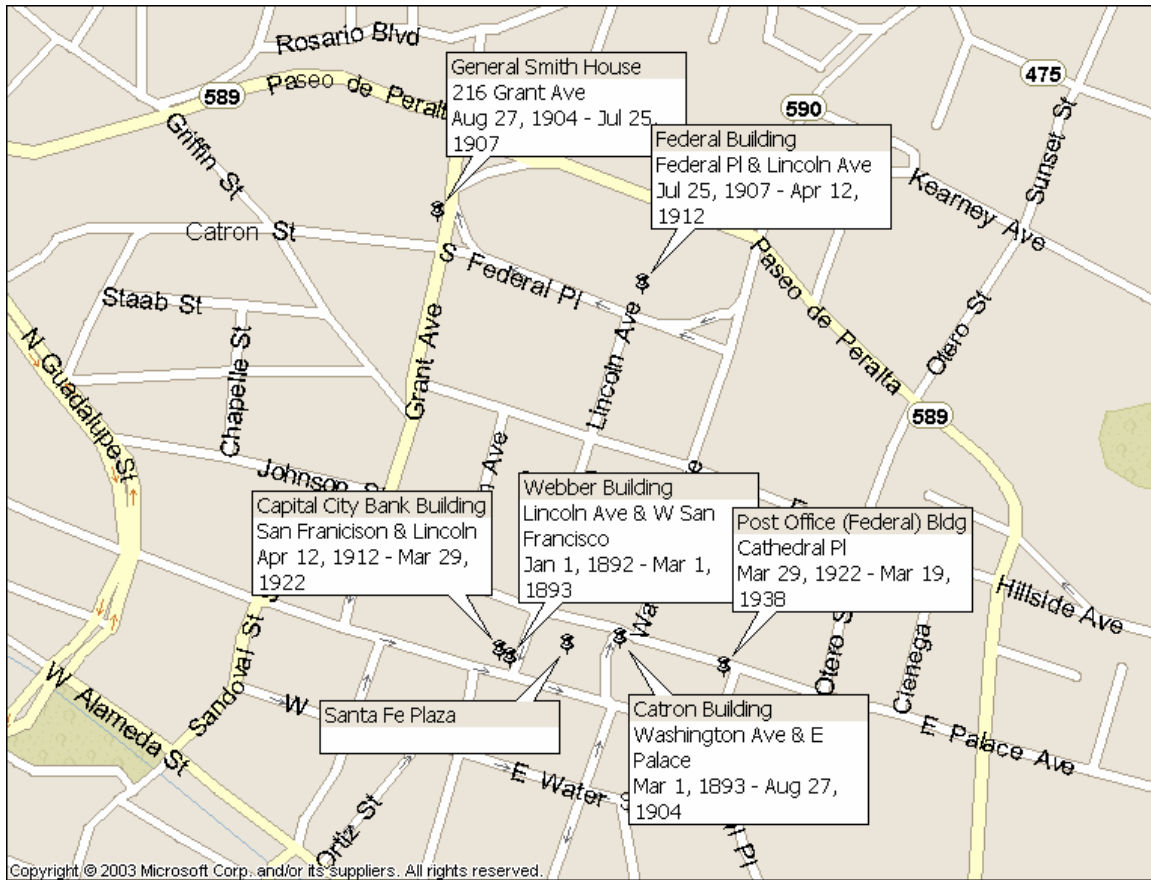


Figure 2. Weather Bureau stations in Santa Fe from 1892 to 1912.

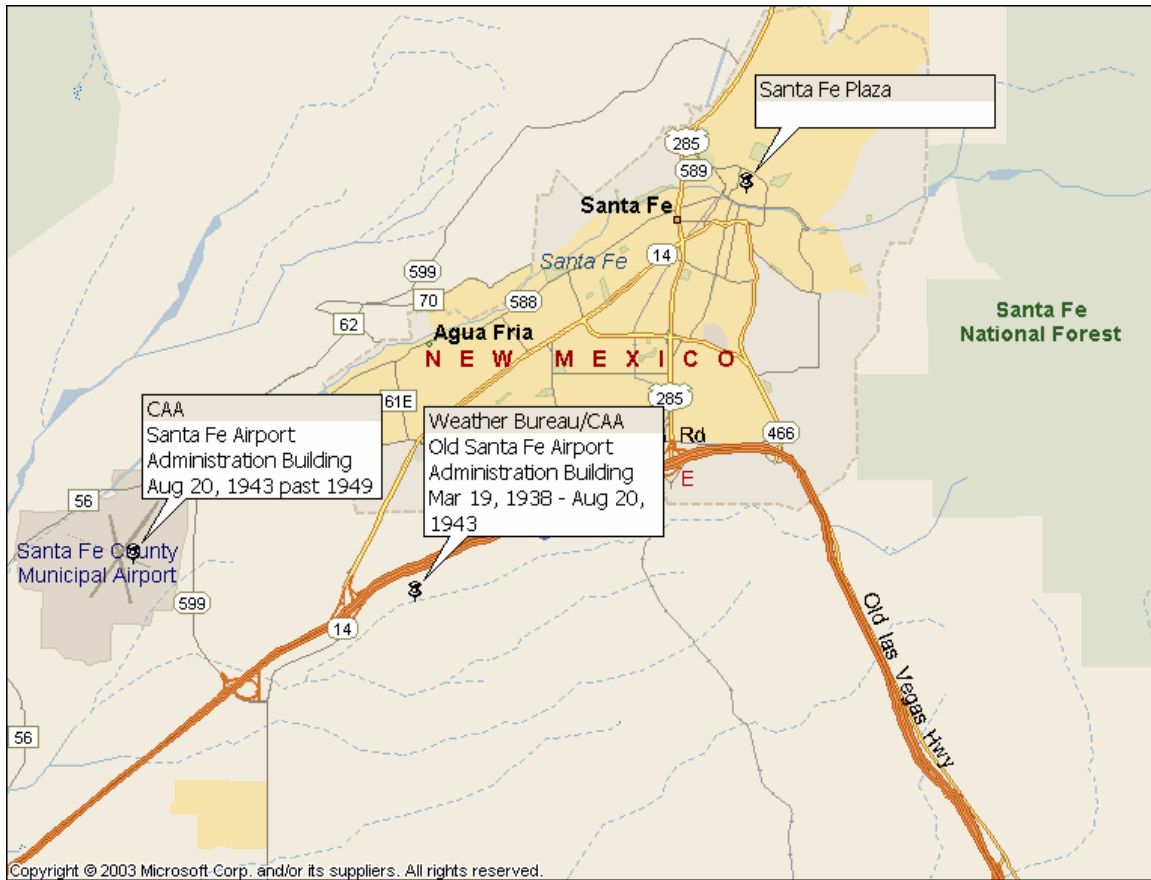


Figure 3. Weather Bureau and Civil stations located at the old and new Santa Fe airports.

The following lists the chronology of weather station locations for the Signal Service, Weather Bureau and Civil Aeronautical Administration (CAA) in Santa Fe for the period 1871 through 1949:

NOTE – All elevations refer to barometer height.

Nov 18, 1871 – Jun 28, 1873 Signal Service - Elevation – 6,850 feet

- Johnson Building; northeast corner of Plaza near intersection of Washington Avenue and East Palace Avenue. Located approximately 325 yards southeast of Fort Marcy hospital where Army surgeons took weather observations. NOTE – Signal Service records indicate that the office was opened Nov 18, 1871 with the first observations taken Nov 20th. First observation in the NCDC database is on Jan 1, 1872.

Jun 28, 1873 – Mar 26, 1878 – Elevation – 6,863 feet

- Sena Building (or Plaza), 2nd floor; East Palace Avenue near the intersection withf Cathedral. Located approximately 85 yards east of Johnson Building

Mar 26, 1878 – Mar 1, 1882 – Elevation – 6,851 feet

- Johnson Building; northeast corner of Plaza near intersection of Washington Avenue and East Palace Avenue. Located approximately 85 yards west of the Sena Building. *

Mar 1, 1882 – Jun 15, 1883 – Elevation – 7,106 feet

- In the Tower of Palace Hotel; Northeast corner of Washington Avenue and East Marcy. Located approximately 100 yards northeast of Johnson Building.

Jun 15, 1883 – Dec 1, 1884 – Records indicate the Signal Service office in Santa Fe was not in service for this period due to agency budget restrictions.+

Dec 1, 1884 - Jan 1, 1892 (Weather Bureau began taking observations Jul 1, 1891) – Elevation – 7,026 feet

- Franz Building; 48 San Francisco Street, Room 1. Located approximately 160 yards southwest of the Palace Hotel.

Jan 1, 1892 - Mar 1, 1893 Weather Bureau – Elevation – Not available

- Webber Building; southwest Plaza on the corner of Lincoln Ave and West San Francisco 3rd floor, Rooms 18 and 20. Located approximately 15 yards north of the Franz Building.

Mar 1, 1893 - Aug 27, 1904 – Elevation 7013 feet

- Catron Building; northeast corner of Plaza near intersection of Washington Avenue and East Palace Avenue, 2nd floor. Located approximately 55 yards east of the Webber Building.

Aug 27, 1904 - Jul 25, 1907 – Elevation 6991 feet

- General Smith House; 216 Grant Avenue. Located approximately 450 yards northwest of Catron Building.

Jul 25, 1907 - Sep 24, 1908 – Elevation 7022 feet

- Federal Building; Federal and Lincoln Avenues, 2nd floor courtroom (rooms 7 and 8), located in western half of the Federal Building. Located approximately 225 yards east of the General Smith House.

Sep 24, 1908 – Apr 12, 1912 – Elevation 7005 feet

- Federal Building; Federal and Lincoln Avenues, 1st floor, southwest corner of building, Rooms 4, 5, and 6. Located in same building.

Apr 12, 1912 - Mar 29, 1922 – Elevation 7018 feet

- Capital City Bank Building; southwest Plaza at corner of San Francisco and Lincoln Streets, rooms 17, 18, 19, and 20, 3rd floor. Located approximately 350 yards south of the Federal Building.

Mar 29, 1922 - Mar 19, 1938 – Elevation 7013 feet

- Federal (or new Post Office) Building; on Cathedral Place between Palace Avenue and San Francisco Streets, Room 210 (east side of building facing Cathedral Place), 2nd floor. This office continued at the Federal Building until officially closed on Jun 15, 1941.

Mar 19, 1938 - Aug 20, 1943 – Elevation 6522 feet

- Administration Building at old Municipal Airport; , on U.S. Highway 85, 1st floor, northwest corner of building. Changed to Civil Aeronautical Administration station May 27, 1941. Located approximately seven miles southwest of Federal Building.

Aug 20, 1943 – Through 1949 – Elevation – 6318 feet

- Administration Building at the new Municipal Airport; Address: Civil Aeronautical Administration, Box 1107, Santa Fe. Located 10 miles southwest of Post Office (Federal Building) and 2.5 miles west of U.S. Highway 85.

* Records at NCDC suggest the office may have moved to another room in the Johnson Building on Jun 30, 1881.

+ Records at NCDC indicate no observations were taken by the Signal Service from Jun 15, 1883 to Dec 1, 1884. The June 1883 monthly records by the Signal Service contain several notes, “Station Discontinued.” A note in the 1885 Report of the Secretary of War (page 545) states: “Closed June 15, 1883; re-established September 24, 1884.” A second note on page 576 states the Santa Fe office was, “Re-established Dec. 1, 1884.” It was suggested by the 1885 Report of the Secretary of War and a newspaper article on Dec 2, 1884 that the closure was related to budget restrictions.

Instrumentation Descriptions

Information regarding available instrument data for the Santa Fe area from 1849 through 1871 is contained in the Fort Marcy Report. This report begins with 1871, the year the Signal Service began taking weather observations in Santa Fe.

Descriptive information was lacking with regard to instrument locations and exposures for Signal Service offices at Santa Fe, i.e., from 1871 through 1891. This was especially true for barometers. Although weather observing forms indicated routine barometric observations, specific information regarding the barometers was almost non-existent.

The following provides general information regarding the installation, exposure and reading of weather instruments at Signal Service offices. The instructions were printed in the 1871 Annual Report of the Chief Signal Officer. Considering the discipline inherited in the Signal Service and Department of War in the 1870s and 1880s, it is safe to assume these instructions were followed fairly closely.

Report of the Chief Signal Officer, 1871

“Instruments – Each station will be supplied with one of Green’s standard barometers, one thermometer, one hygrometer, one wind vane, one rain gauge, one Robinson anemometer, and one clock.”

“Barometer – The barometer will in all cases be carefully compared with the standard at this office (Editor’s note – Since instruments were sent from the Signal Service Headquarters in Washington D.C., it seems that is the office of reference) before issue, and the amount of instrumental error will be sent with each.”

“The barometer should be placed in a room of a temperature as uniform as possible, not heated nor too much exposed to the sun. It should be suspended at the height of the eye near a window, in such a manner as to be lighted perfectly without exposure either to the direct rays of the sun or to the currents of air which are always found at the window-casings and doors. To protect the instrument: from external injuries, from dust, and from the direct radiation of warm bodies or the currents of air from the window, observers will fasten the wooden case in which it is carried firmly against the wall in a vertical position near the window, in such a manner that the cover will open in a direction parallel to the panes. An opening large enough to admit the tube of the barometer will be cut in the upper end of the box: and directly above this, at the distance of one inch, a strong hook will be driven into the wall. This hook should extend two or three inches beyond the box, and upon it the instrument will be suspended. When not in use the cover will be closed; but when an observation is to be taken it will be opened, and the instrument drawn out on the hook, clear of the box, and in the full light of the window. After the observation is made the barometer will be slipped back into the box.”

“Thermometer – The thermometer should be hung in the open air facing the north in such a manner that it will always be in the shade, and at least one foot from the wall of the building to which the shelter is attached, where the Smithsonian form of shelter is used. It must be protected against the light reflected from surrounding objects, and from rain, snow, and hail. The instrument must be placed exactly perpendicular, the middle of the scale being at the height of the eye in order to prevent error in reading. The readings should be made at all times, and, especially in the winter, *through the panes*, without opening the window, when the shelter is built out from a window. When the shelter is built upon a roof, great care must be exercised in making the readings in order to prevent the instrument from being affected by the heat of the body or of the lantern at night. The observation must be made as rapidly as is consistent with accuracy.”

“Hygrometer – The hygrometer will be placed in the same shelter as the thermometer, and at a distance of one foot from it. The cistern will be kept supplied with pure water at all times when the temperature of the air is above the

freezing point, and the muslin cover of the wet-bulb will be changed every two months, and the bulb carefully cleaned. The muslin may be washed as often as necessary, without removal, by means of a jet of clean water from a small syringe.”

“When the temperature of the air is below the freezing-point, the water will be emptied from the cistern, and the wet-bulb will be moistened with cold water by means of a camel’s-hair brush fifteen minutes before the observation is made, or long enough to permit the ice to form and dry on the bulb. The coating of ice allowed to form should be very thin, otherwise the reading will be inaccurate. Alcohol must not be used to prevent the water from freezing. The reading must be made rapidly, and without opening the window.”

“Anemometer – The anemometer will be fixed in a vertical position upon a post of sufficient height to bring the dial on a level with the eye of the observer, and will be in an exposed situation, so as to receive the full force of the wind. When possible, this post should be framed into the roof, to steady it and prevent the instrument from vibrating; but when this cannot be done, it should be framed at the bottom into two pieces of scantling, not less than three feet in length, which cross each other at right angles, and which can be nailed fast to the roof or platform upon which the instrument is placed. The outer dial of the anemometer is graduated in miles and tenths of miles, indicating miles, and the subdivisions tenths. One complete revolution of this dial is equivalent to ten miles of wind, and carries the inner dial forward one subdivision.”

“Wind-Vane – The wind-vane should be set in a place as free and open as possible, in order that the wind may act freely upon it, and must never be sheltered by surrounding buildings or other objects. Observers will mark with the aid of a compass, at the base of the upright which supports the vane, the true meridian of their respective stations.”

“Rain-Gauge – The rain-gauge will be placed, whenever practicable, with the top of the funnel-shaped collector twelve inches above the surface of the ground, firmly fixed in a vertical position, and protected from the interference of unauthorized persons. When a position at the level of the ground cannot be found with a sufficiently clear exposure the gauge will be placed on the top of the instrument-room, or roof of the building occupied by the observer, who will measure the height above the ground and report it to this office. The measuring rod is graduated in inches and tenths of inches, and the proportion between the cylinder and funnel is as ten to one.

Instrument Descriptions at Santa Fe Weather Observing Stations

Nov 18, 1871 – Jun 28, 1873; Signal Service office located in the Johnson Building on the northeast corner of the Plaza (near intersection of Washington Avenue and East Palace Avenue).

- According to the 1872 Annual Report of the Chief Signal Officer to the Secretary of War, the Johnson building consisted of two floors with the Signal Service office on the second floor (see Figure 4).



Figure 4. The Johnson Building (circa 1872) at the northeast corner of the Plaza that housed the Signal Service office Nov 18, 1871 – Jun 28, 1873 and Mar 26, 1878 – Mar 1, 1882. View is looking southeast with Washington Avenue to the left and the Plaza to the right. From the Palace of the Governors Angelico Chavez History Library in Santa Fe.

Barometer – Barometric observations made, but no information available on the instrument, except the elevation was 6,850 feet above sea level.

Instrument Shelter – Located on roof of Johnson Building. The instrument shelter was 4 feet long, 2 feet wide, and 2 feet high. The sides were of lattice work, the bottom was open, and the sides covered half way up with green cloth. Bulbs of the thermometers were nearly on a plane with the bottom of the shelter. Height of the thermometer was 5 feet above the roof and about 31 feet above the ground. The Climatological Record states that readings were not affected by nearby ventilators' exhaust pipes.

Rain gage – On roof of Johnson Building , four feet from base of wind vane. Top of gage 26 feet above ground.

Wind Instruments – Anemometer on roof of Johnson Building 37 feet above the ground. The Climatological Record stated that the elevation of the anemometer was well above surrounding buildings with fine exposure. Wind vane 10 feet south of anemometer at same elevation.

Jun 28, 1873 – Mar 26, 1878; Signal Service office located in Sena Building, 2nd floor, East Palace Avenue near the intersection with Cathedral (Figure 5).



Figure 5. The Sena Building (also called the Sena Plaza) located on East Palace Avenue near the intersection of Cathedral (circa 1920). Signal Service office likely was in the second story located in the center of the building Jun 28, 1873 – Mar 26, 1878. Weather instruments likely were on the flat part of the lower part of the building to be consistent with height of the instrument shelter at 25 feet. View is looking northwest along Palace Avenue near the intersection with Cathedral. From the Palace of the Governors Angelico Chavez History Library in Santa Fe.

The 1874 Annual Report of the Chief Signal Officer listed the following instruments on station in the Sena Building: A) Two standard barometers; B) Three standard thermometers; C) Three standard minimum thermometers; D) Two standard maximum thermometers; E) One standard hygrometer; F) One standard anemometer, G) One self-register for anemometer; H) One standard rain-gauge; and I) One standard wind-vane.

Barometer – Barometric observations made, but no information available on the instrument, except the elevation was 6,893 feet above sea level.

Instrument Shelter – Same instrument shelter as located on Johnson Building. Located on flat roof of the Sena Building about 25 feet above ground. The Climatological Record stated that readings not affected from ventilators or other equipment.

Rain gage – On roof of Sena Building about 25 feet above ground.

Wind Instruments – On roof of Sena Building about 25 feet above ground.

Mar 26, 1878 – Mar 1, 1882; ; Signal Service office located in the Johnson Building on the northeast corner of the Plaza (near intersection of Washington Avenue and East Palace Avenue).

Barometer – Barometric observations made, but no information available on the instrument, except the elevation was 6,851 feet above sea level.

Instrument Shelter – Over sod back of Johnson Building. Located 4 feet 7 inches above ground. The Climatological Record stated that temperatures taken at this location “seem to be high.”

Rain gage – On ground over sod in back of the Johnson Building. Height of gage 2 feet 4 inches above ground.

Wind Instruments – On the roof of Johnson Building 34 feet above ground.

Mar 1, 1882 – Jun 15, 1883; Signal Service office located in the Tower of Palace Hotel; Northeast corner of Washington Avenue and East Marcy (Figure 6).



Figure 6. The Palace Hotel located on the northeast corner of Washington Avenue and East Marcy (circa 1885). Signal Service office was located in one of the towers of the building (exact tower unknown). Configuration of closest tower suggests the best candidate for the office, considering thermometers and instrument shelter were exposed from the window in the tower. View is looking northeast from intersection of Washington and East Marcy. From the Palace of the Governors Angelico Chavez History Library in Santa Fe.

Barometer – Barometric observations made, but no information available on the instrument, except the elevation was 7,106 feet above sea level.

Instrument Shelter – Exposed from window in Tower of Palace Hotel. Thermometers 54 feet above ground.

Rain gage – On roof of tower of Palace Hotel. Top of gage 68 feet above ground.

Wind Instruments – On tower of Palace Hotel. Anemometer and wind vane 69 feet above ground. The Climatological Record indicates the instrument is above all obstacles.

Jun 15, 1883 – Dec 1, 1884; Records at NCDC indicate no weather observations from the Signal Service for the almost 18 month period Jun 15, 1883 – Dec 1, 1884. The same gap is indicated in the Santa Fe Climatological Record. Government report and newspaper clipping indicate Signal Service office was closed during this period due to budget restrictions.

Dec 1, 1884 - Jan 1, 1892; Franz Building, 48 San Francisco Street, Room 1 (Signal Service office until Weather Bureau began taking observations Jul 1, 1891)

Barometer – Barometric observations made, but no information available on the instrument, except elevation 7,026 feet above sea level.

Instrument Shelter – Standard instrument on roof of Franz Building. Thermometers 35 feet above ground and 8 feet 9 inches above the roof.

Rain gage – On flat roof of Franz Building. Top of gage 29 feet above ground. The Climatological Record indicates the gage has very good exposure.

Wind Instruments – On flat roof of Franz Building. Anemometer and wind vane 42 feet above ground.

Jan 1, 1892 - Mar 1, 1893; Weather Bureau office located on the southwest Plaza in the Webber Building, corner of Lincoln Avenue and West San Francisco, 3rd floor, Rooms 18 and 20 (Figure 7).

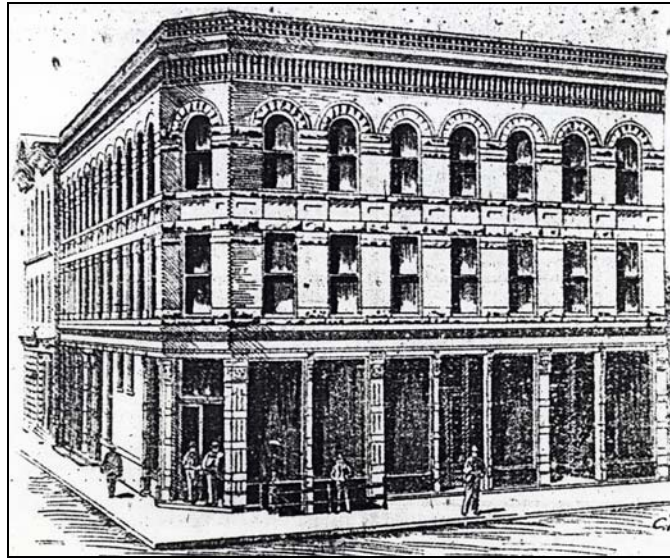


Figure 7. The Webber Building located on southwest Plaza at the corner of Lincoln Avenue and West San Francisco. View is looking northwest with Lincoln Avenue and the Plaza to the right and West San Francisco to the left. From the Palace of the Governors Angelico Chavez History Library in Santa Fe.

Barometer – Barometric observations made, but no information available on the instrument.

Instrument Shelter – On roof of Webber Building in standard instrument shelter. Thermometers 10 feet 5 inches above the roof and 58 feet 1 inch above ground.

Rain gage – On flat roof of Webber Building. Top of gage 51 feet 6 inches above ground and 3 feet above the roof.

Wind Instruments – On roof of Webber Building. Wind vane 64 feet above ground and 15 feet from roof anemometer. Anemometer 60 feet 6 inches above ground and 12 feet above the roof. Climatological Record indicated no obstacles present.

Mar 1, 1893 - Aug 27, 1904; Weather Bureau office located in the Catron Building (Figure 8), northeast corner of the Plaza near intersection of Washington Avenue and East Palace Avenue, 2nd floor.



Figure 8. The Catron Building located in the northeast Plaza at the corner of Washington and East Palace Avenues. View is looking southeast with East Palace Avenue on the left and the Plaza on the right. From the Palace of the Governors Angelico Chavez History Library in Santa Fe.

Barometer – Barometric observations made, but no information available on the instrument.

Instrument Shelter – Standard shelter on the roof of the Catron Building. Height of instruments 47 feet above ground and 10 feet above the roof.

Rain/snow gages – On roof of Catron Building. Top of gages 3 feet above the roof and 39 feet above ground. The Climatological Record indicated good exposure.

Wind Instruments – On roof of Catron Building. Wind vane and anemometer 5 feet 6 inches above the top of the roof and 52 feet 6 inches above ground. No obstacles.

Sunshine Recorder – Located on the top of the instrument shelter.

Figure 9 shows the locations of the instruments on the roof of the Catron Building.

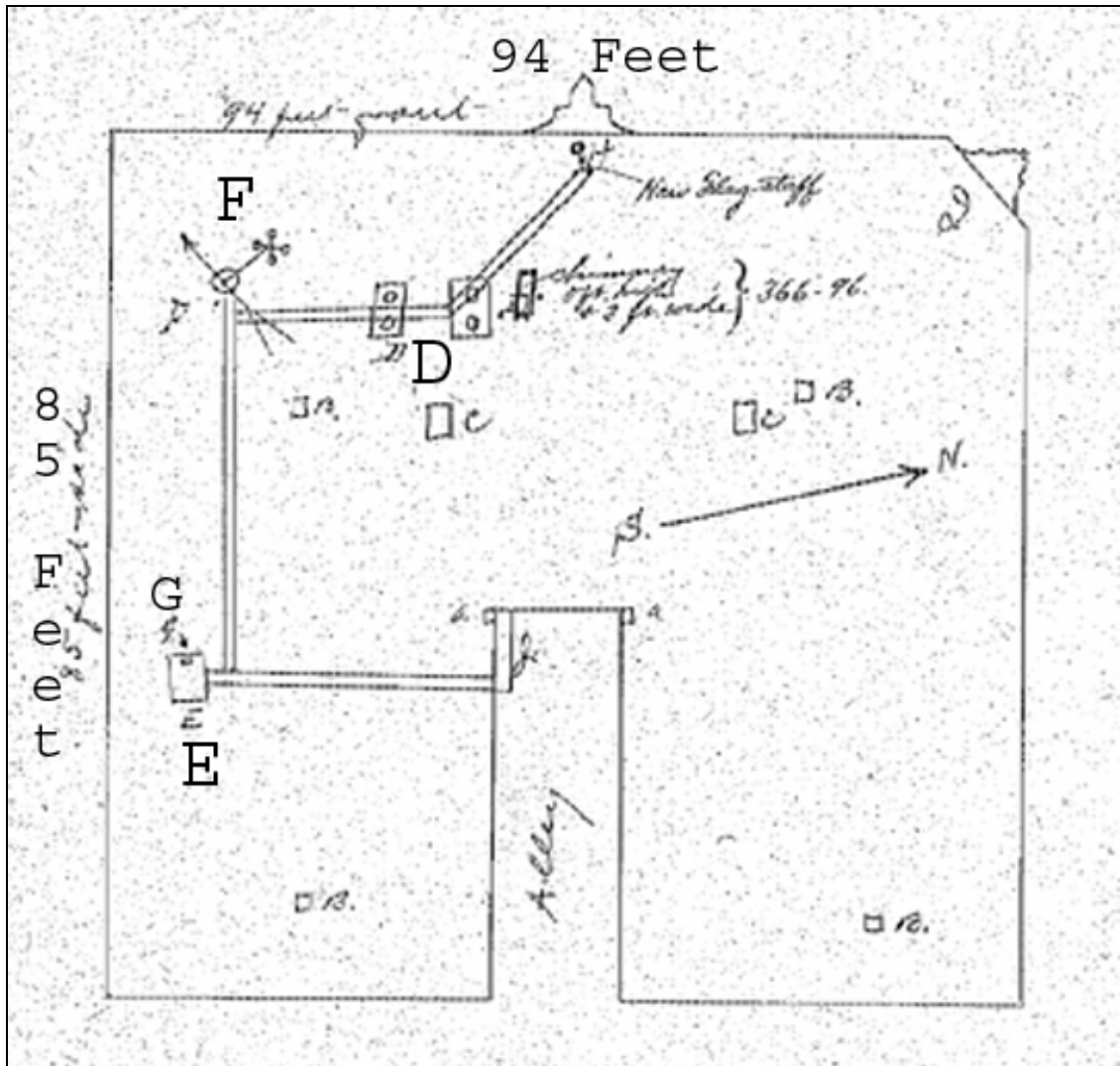


Figure 9. Schematic drawing from March 20, 1893, showing the location of weather instruments on the roof of the Catron Building. Plaza is located at the top of the page and Palace Avenue located on the right. Legend for the drawing includes (Bold letters in figure are underlined): A) Furnace chimneys for heating the building; B) Small chimneys (not in use); C) Skylights with slanting roofs, three feet high; D) Rain/snow gages (the rain/snow gages were moved three feet southward in February 1896); E) Instrument shelter; F) Anemometer/wind vane; G) Sunshine recorder located on top of the instrument shelter; H) Ornamental porch approximately seven feet above the roof; I) Ornamental cover approximately five feet above the roof (upper-right corner of schematic); and J) Stairway to the roof. From the official station history files at the National Climatic Data Center.

Aug 27, 1904 - Jul 25, 1907; Weather Bureau office located in the General Smith House, 216 Grant Avenue

Barometer – Located at southeast side of south bay window. On Mar 1, 1907, the elevation of the barometer was adjusted from 6986 feet to 6991 feet

Instrument shelter – Standard shelter on the roof of General Smith Home with the floor of the shelter 7 feet 10 inches above the roof. Maximum and minimum thermometers 9 feet 8 inches above the roof and 34 feet 5 inches above ground. Dry bulb thermometer 8 feet 1 inch above the roof and 32 feet 8 inches above ground. The Climatological Record indicated the shelter had good exposure.

Rain/snow gages – On roof of General Smith home. Top of gages 3 feet above the roof and 27 feet 7 inches above ground. The rain/snow gages were moved around Mar 1, 1907 (see explanation under Schematic Description).

Wind instruments – Anemometer 39 feet 2 inches above ground and 13 feet 10 inches above the roof. Wind vane 41 feet 4 inches above ground and 16 feet above the roof.

Sunshine recorder – Weather Bureau form entitled, “Report of Elevation and Position of Instruments,” (dated Jan 1, 1905) indicated a sunshine recorder was located 11 feet 8 inches above the roof of the building and 36 feet 5 inches above ground.

Schematic Description - A 1904 schematic in the NCDC database (not shown due to lack of clarity) showed the roof of the General Smith House to be a rectangle of almost 38 feet long in an east to west direction and 35 feet wide north to south. A cutout, or indentation, of the roof was located on the southeast corner, measuring 16 feet (east to west) by 3 feet 6 inches (north to south). One chimney was located on the northeast side of the building with a second chimney on the southwest side. The roof had a slight pitch, being 2 feet 2 inches higher in the center than on the north and south sides.

The anemometer and wind vane were located approximately 10 feet from the west side of the building and about 15 feet from the north side. The rain/snow gages were located seven feet north of the wind instruments, but the rain gage was moved to a position 10 feet 3 inches south of the wind instruments around Mar 1, 1907 (no reason given for the move) and the snow gage moved to a location 13 feet 8 inches south of the wind instruments. This move raised the tops of the rain/snow gages to 28 feet 6 inches above ground. The instrument shelter was located approximately 15 feet from the east side of the building and about 20 feet from the north side.

Jul 25, 1907 - Sep 24, 1908; Weather Bureau office located in the Federal Building, Federal and Lincoln Avenues, 2nd floor courtroom (rooms 7 and 8), located in western half of the building (Figure 10)



Figure 10. Federal Building located at Federal and Lincoln Avenues (circa 1908). View is looking north. Weather Bureau office was located on the 2nd floor (top floor). On Sep 24, 1908, the Weather Bureau office moved to the middle, or 1st floor (building comprised of three floors-basement, first floor, and second floor, i.e., outside stairs empty onto the middle, or first floor). Weather instruments were located west northwest of the building (to the left and out of the photo; see Figure 11). From the official station history files at the National Climatic Data Center.

Barometer – Located near northwest window of court room.

Instrument Shelter – Standard shelter over sod about 150 feet west northwest from the Federal Building. Floor of shelter 7 feet above ground. Dry bulb thermometer located 8 feet above ground.

Rain/snow gages – Exposed on cement block with sod all around. Top of gages 3 feet above ground. Tipping bucket rain gage installed May 1, 1908 (based on Weather Bureau correspondence indicating beginning of tipping bucket records).

Wind Instruments – Anemometer and wind vane on a tower in yard 150 feet west northwest from the Federal Building. Anemometer 56 feet above ground and wind vane 54 feet above ground.

Figures 11 and 12 show different perspectives of the weather instruments located approximately 150 feet west northwest of the Federal Building (from Jul 25, 1907 through Apr 12, 1912) with views looking east (Figure 11) and northwest (Figure 12).

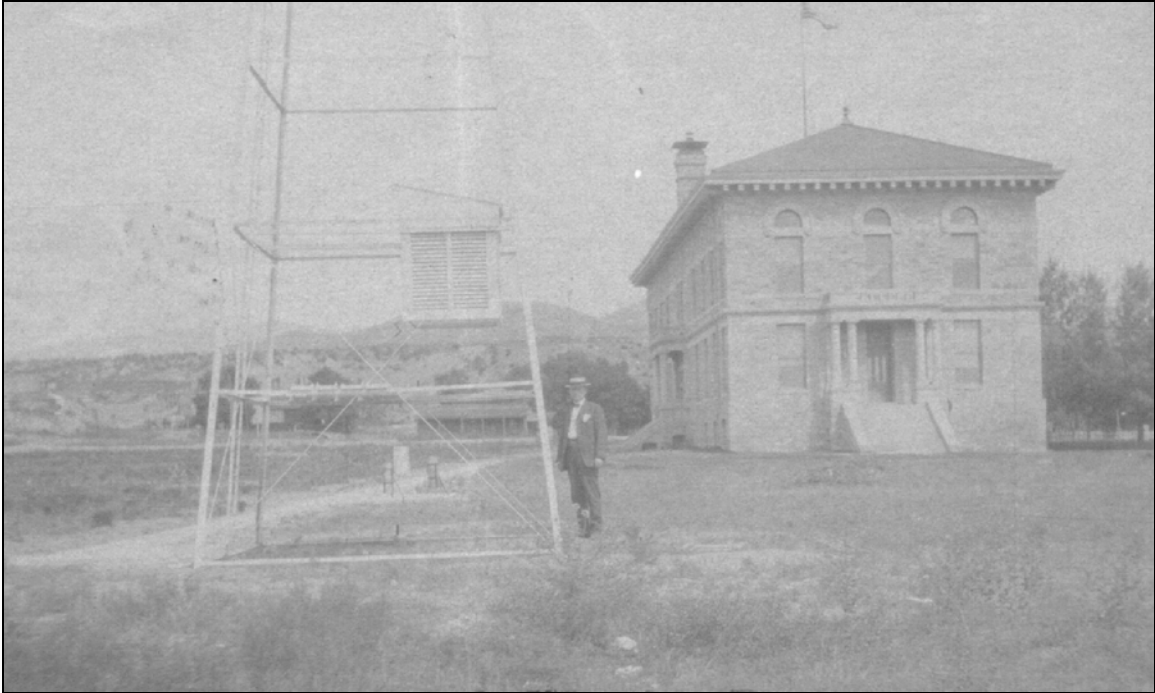


Figure 11. View of weather instruments (circa 1908) looking east with Federal Building in the background. Base of wind instrument tower and rain/snow gages are shown. Instrument shelter (center of picture) appears to be attached to the wind tower. From the official station history files at the National Climatic Data Center.

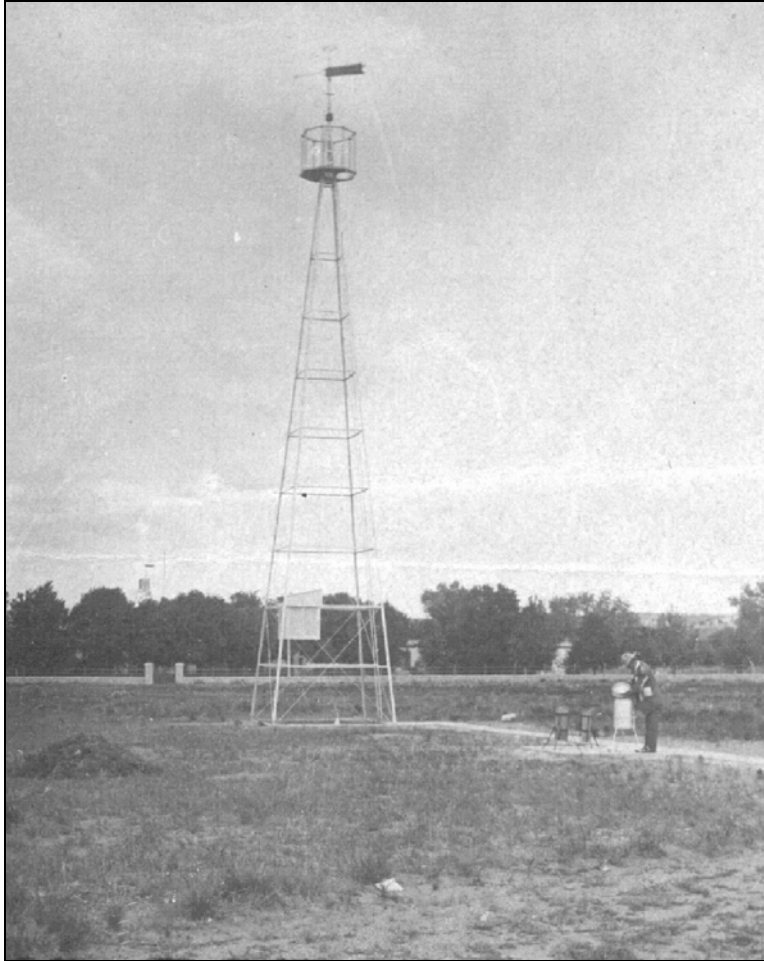


Figure 12. View of the weather instruments (circa 1908) looking northwest from the Federal Building. From the official station history files at the National Climatic Data Center.

Sep 24, 1908 – Apr 12, 1912; Weather Bureau office located in the Federal Building, Federal and Lincoln Avenues, 1st floor, southwest corner of building, Rooms 4, 5, and 6

Barometer – Fixed point is a brass screw set in lead in top surface of stone of water table on north side of building. Located 18 feet 6 inches from northwest corner of building.

Instrument Shelter - Standard shelter over sod about 150 feet west northwest from the Federal Building. Floor of shelter 7 feet above ground. Dry bulb thermometer located 8 feet above ground.

Rain/snow gages – Exposed on cement block with sod all around. Top of gages 3 feet above ground. Tipping bucket gage in place.

Wind Instruments – Anemometer and wind vane on a tower in yard 150 feet from the Federal Building. Anemometer 56 feet above ground and wind vane 54 feet above ground.

Apr 12, 1912 - Mar 29, 1922; Capital City Bank Building, southwest Plaza at corner of San Francisco and Lincoln, rooms 17, 18, 19 and 20, northeast part of 3rd floor (Figures 13 and 14)



Figure 13. Capital City Bank Building located on the southwest Plaza at the corner of San Francisco and Lincoln (circa 1923). View is looking northwest with San Francisco street to the left and Lincoln Avenue in front of the building. Santa Fe Plaza is located to the right. Weather Bureau offices occupied part of the top floor on the right side of the building in the photograph (top four windows from the right). From the official station history files at the National Climatic Data Center.

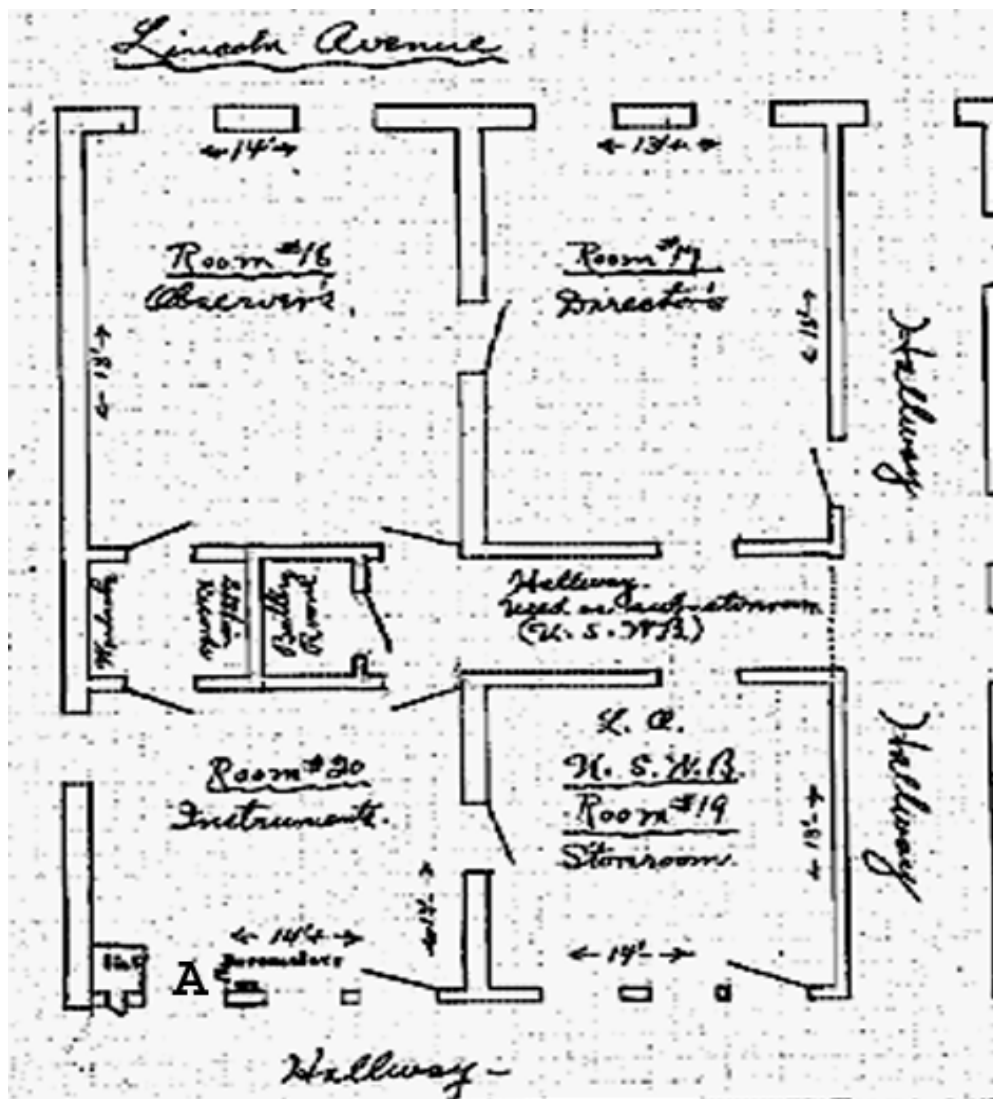


Figure 14. Schematic of Weather Bureau offices in Capital City Bank Building (circa 1912) showing location of barometers (point A). North is to the left of the page. Point A (lower left corner of the page) denotes location of barometers. From the official station history files at the National Climatic Data Center.

Barometer – Located on a western interior wall toward the north side of the building (see Figure 14).

Instrument Shelter – Standard tower shelter located on the roof of the Capital City Bank Building with the floor of the shelter located 9 feet 5 inches above the roof of the building. Dry bulb thermometer 9 feet 8 inches above the roof and 57 feet 5 inches above ground.

Rain/snow gages – On roof of Capital City Bank Building. Good exposure with top of gages 3 feet above the roof and 49 feet 4 inches above ground. Tipping bucket gage in place.

Wind Instruments – Anemometer on roof of the Capital City Bank Building. Anemometer 14 feet 5 inches above the roof and 62 feet above ground. Wind vane 15 feet 7 inches above the roof and 63 feet 2 inches above ground. On Nov 29, 1915, a new tower for the wind instruments was installed. Anemometer height was changed to 18 feet 8 inches above the roof and 66 feet 4 inches above ground and the wind vane changed to 20 feet 6 inches above the roof and 68 feet one inch above ground.

Sunshine Recorder – Located on top of the instrument shelter.

Figure 15 shows the location of the weather instruments on top of the Capital City Bank Building and Figure 16 is a photograph of the instruments.

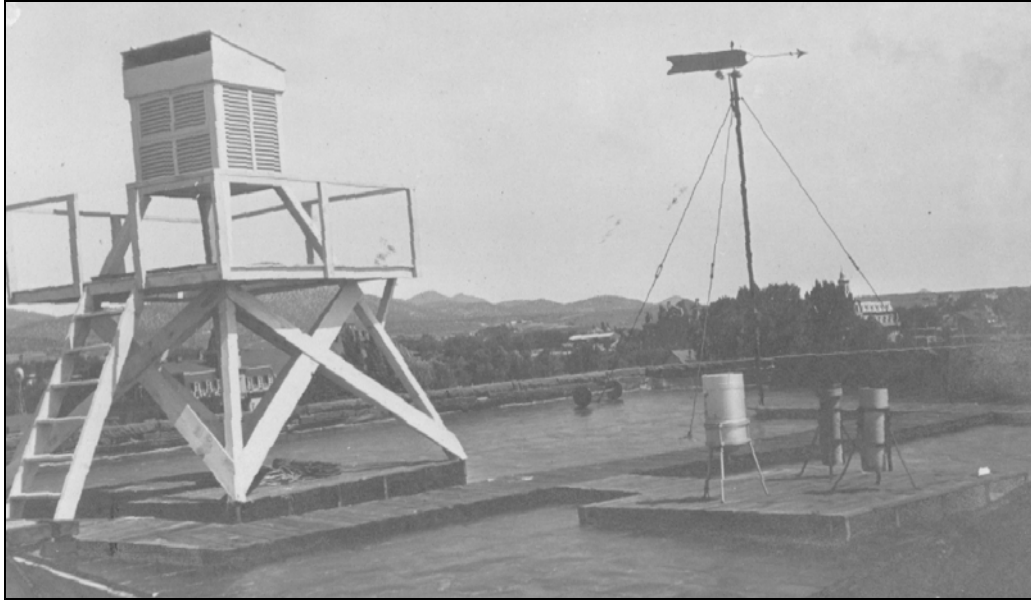


Figure 16. Photograph of weather instruments on the roof of the Capital City Bank Building (1912). View is looking southeast. From the official station history files at the National Climatic Data Center.

Mar 29, 1922 - Mar 19, 1938; Federal (or new Post Office) Building, on Cathedral Place between Palace Avenue and San Francisco Street, Room 210 (east side of building facing Cathedral place), 2nd floor

Figure 17 shows the weather instruments on the roof of the Post Office Building and Figure 18 of the instruments' platform.



Figure 17. Post Office Building (circa 1932) showing location of weather instruments. Picture taken from Cathedral Place with view looking southwest. From the official station history files at the National Climatic Data Center.



Figure 18. Close-up photograph of weather instruments on roof of the Post Office (circa 1932). View is looking northwest. Station records indicate the size of the instrument platform was 20 feet by 20 feet. From the official station history files at the National Climatic Data Center.

Barometer – Detailed information regarding the barometers was not available until Feb 28, 1932 on the Weather Bureau form entitled, “Description of Meteorological Features and Instrumental Equipment and Exposures at Airport and Airways Stations.” However, comparing information in this document with material on the Mar 31, 1922 form, “Report of Elevation and Position of Instruments,” it appears the barometers were located at the same location. The barometers were suspended against the north wall of the main office. Both were made by Green Co. An aneroid barometer was added around Sep 1932, and a barograph added around early 1932.

Instrument Shelter – Standard instrument shelter located on a platform on the roof of the Federal (or new Post Office) building. Base of the shelter 10 feet above the platform and 38 feet above ground. Dry bulb 10 feet 5 inches above the roof and 38 feet 6 inches above ground. Shelter also contained maximum/minimum thermometers and thermograph. According to Weather Bureau evaluation forms on instrument exposure, a large chimney 40 feet northwest of the shelter could have raised temperatures as much as six degrees in winter, especially during the night.

Rain/snow gages – On roof of new Federal Building. Top of gages 3 feet 1 inch above the roof and 31 feet 2 inches above ground. A tipping bucket gage was in place. A brick firewall extended about 1 foot 6 inches above the top of the gages and was located about 8 feet due west of the gages. According to the exposure reports, this firewall apparently did not affect the catch of the rain gages.

Wind Instruments – Anemometer 24 feet 7 inches above the roof and 52 feet 8 inches above ground. Wind vane 26 feet 6 inches above the roof and 54 feet 7 inches above ground. According to the exposure reports, wind readings were affected by surrounding trees and nearby Cathedral (located approximately 50 yards southeast of the weather instruments).

Sunshine Recorder – Exposed on the northwest corner of the instrument shelter roof. Instrument reports indicated exposure generally good, except for a short period in autumn and early spring when the Cathedral tower shaded the instrument for 30 to 45 minutes in early morning.

Additional Equipment – A triple register was located in the main office. A nephoscope was available was not used due to interference from other instruments. By 1932 the office also contained a barograph and a triple register. A whirling psychrometer was added to the office around Sep 1932 and a sling psychrometer added in early 1938.

At this location, trees to the east about 100 feet, roof and towers of the Cathedral 200 feet southeast, school building and hotel 250 feet south and trees 300 feet west slightly overtopped the roof of the Federal Building and the instruments.

Mar 19, 1938 - Aug 20, 1943; Administration Building at old Municipal Airport on U.S. Highway 85, seven miles south of Post Office (Federal Building), 1st floor, northwest corner of building. Changed to Civil Aeronautical Administration station May 27, 1941. City office continued at the Federal Building until closed on Jun 15, 1941.

NOTE – From Mar 19, 1938 to May 27, 1941, two Weather Bureau offices were located in Santa Fe-the office at the airport and the office that remained at the downtown Federal Building. On May 27, 1941, the airport office was transferred to the CAA and on Jun 15, 1941, the Weather Bureau office at the Federal Building was closed.

When the airport office first opened on Mar 19, 1938 the following instruments were located at that site: 1) Wind instruments; 2) Psychrometers (sling and fan); 3) Thermometer and thermometer shelter; and 4) Ceiling balloons. The city office remained fully instrumented to take synoptic and climatological observations. Over the following three years, observational responsibility shifted from the Weather Bureau downtown office to the CAA airport office.

Barometer – Aneroid barometer installed around Jan 1939. Mercurial barometer moved from Federal Building to airport station Jul 13, 1940. Mercurial barometer hung on inside east wall of CAA office (Figure 19). Station records indicated the barometer was not exposed to sun's rays and was located 12 feet from nearest door or window. Four-day barograph (for use at stations above 2,000 feet elevation) installed around Jul 1940.

Instrument Shelter – Station records indicate an instrument shelter was not located at the airport until around Aug 1939 when a cotton region type was installed. Records indicate the instrument shelter remained at the Santa Fe City Office (i.e., on the Post Office Building) with the airport having a “thermometer shelter” located four feet above ground. When installed, the cotton region shelter was located four feet above ground approximately 30 feet northeast of the north corner of the combined Administration and Hanger Building, and moved to 96 feet northeast of the building around Jul 1940 (Figure 20). According to Weather Bureau records the shelter was over bare ground with no troublesome local features. Exposed thermometer was transferred to the cotton region shelter. Maximum/minimum thermometers were installed in the shelter around Jul 1940.

Rain gage/snow gages – Standard 8 inch rain gage and snow gage installed near instrument shelter May 1941. Weighing rain gage with snow shield installed near instrument shelter around Apr 1942.

Wind Instruments – Anemometer was located 12 feet above the roof on the west end of the Administration/Hanger Building and 57 feet above ground. The wind vane was located 13 feet above the roof and 58 feet above ground. According to station records (Airport, Airway, or Six-Hourly Station Record) no nearby high objects to obstruct wind flow.

Additional Equipment – Sling and fan psychrometers. The sling psychrometer was discontinued around May 1941.



Figure 19. CAA Observatory and communications room in the Administration and Hanger Building (picture taken Oct 1942). Mercurial barometer and barograph on the wall at the far right of the picture. From the official station history files at the National Climate Data Center.



Figure 20. Instrument shelter and rain/snow gages. View toward north northeast from the Administration and Hanger Building at the old Santa Fe Airport. Picture taken Oct 1942. From the official station history files at the National Climate Data Center.

Aug 20, 1943 – Through 1949; Administration Building at the new Municipal Airport, 10 miles southwest of Post Office (Federal Building) and 2.5 miles west of U.S. Highway 85. Address: Civil Aeronautical Administration, Box 1107, Santa Fe.

Barometer – Mercurial barometer and barograph both were mounted to an instrument panel located on the west wall of the office with good exposure. Weather Bureau inspections indicated neither instrument was subject to direct rays from the sun or sudden temperature changes. The instruments also were secured from vibration. The station also had a four-day barograph.

Instrument Shelter – Cotton region type instrument shelter located 55 feet south southeast of the Administration Building and 75 feet east of the parking lot. Neither was judged to have an impact on instrument readings. Shelter contained maximum/minimum and dry bulb thermometers.

Rain/snow gages – A standard eight inch rain gage, a snow gage, and a weighing rain gage were located at the site. The weighing rain gage was equipped with a wind shield. All gages were located on the ground near the instrument shelter with top of gages 3 feet 3 inches above ground. Weather Bureau inspections indicated the rain and snow gages had good exposure with the nearest taller object being 50 feet away and approximately 12 feet tall in 1943. In 1948, an 18 foot

tree was reported 12 feet from the weighing gage and 16 feet from the rain gage with a 12 foot tree 16 feet from the weighing gage and 14 feet from the standard gage. The inspection report had the following comment: "Exposure will become poorer as these trees grow."

Wind Instruments – The 12 foot high instrument support was mounted on a roof which was 12 feet high. Anemometer was 12 feet above the roof (24 feet above ground) and wind vane 13 feet above the roof (25 feet above ground).

Additional Equipment – Station had both fan and sling psychrometers.

Figure 21 depicts the location of weather instruments at the Santa Fe Airport with respect to the CAA Administration building.

John Clum was born September 1, 1851, in the Hudson Valley of New York. At age 16 he entered Rutgers College. After a year in college, and broke, he decided to go west. One day, reading in a newspaper that the War Department in Washington was about to organize a nationwide Meteorological Service (under the Signal Service), he applied for a job. Successfully passing an examination he was appointed as an Observer-Sergeant in the U.S. Signal Corps, and was directed to proceed to Santa Fe, New Mexico. He rode the railroad to the end of the rails at Kit Carson, Colorado, then made the remainder of the trip to Santa Fe by stagecoach.

He began work in the Santa Fe Signal Service weather station in a building close to the Palace of the Governors (Johnson Building). The office was described in the 1872 Annual Report of the Chief Signal-Officer to the Secretary of War: "The office is on the upper floor of a two story building known as Johnson's Building on a street without name or number. The roof is flat and affords a good exposure for the Wind vane, Anemometer and Rain Gauge and also the Instrument Shelter . . ." On Nov 18, 1871, the first official Signal Service weather observation at Santa Fe was made.

Recording atmospheric conditions did not require all of Mr. Clum's time, so he started a private school. In a short time he had enrolled 15 students in one of the first English speaking schools in Santa Fe. He continued in his dual position as weather observer and school master until late in 1873 when he was offered the job of Indian Agent at the large San Carlos Reservation in central Arizona. Mr. Clum left the Signal Service, but with the legacy of being the first Signal Service observer in Santa Fe.

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Mike Asmus, Regional Coop/Surface Observation Program Manager at the NWS Southern Region Headquarters, provided invaluable advice and reference material, including loan of the NWS publication on the substation history for New Mexico. Victor Murphy and Al Abernathy at NWS Southern Region Headquarters also provided valuable suggestions regarding the project in general, and their help and interest are appreciated.

Steve Doty developed the procedures and methodologies used in developing this report. Without the extensive work of Steve in developing the appropriate process, this research would not have been possible. Steve also provided appropriate documentation from the 1871 Report of the Chief Signal Officer detailing exposure instructions for Signal Service weather instruments.

The staffs at the Angelico Chavez History Library and the New Mexico State Records Center and Archives were very helpful in locating old maps, photographs, and textual information on the Fort Marcy area. Their help is greatly appreciated.

Charlie Liles, Meteorologist in Charge of the NWS Forecast Office in Albuquerque checked the office files and provided individual contacts that were helpful.

References and Data Sources

References

Reports of the Chief Signal Officer 1871 through 1891; Government Printing Office, Washington D.C.; 1872.

Reports of the Chief of the Weather Bureau for the years 1892 through 1934; Government Printing Office, Washington DC.

Santa Fe: Historic Neighborhood Study. Corinne P. Sze and Beverly Spears (with assistance by Boyd Pratt and Linda Tigges); Informal publication prepared for the City of Santa Fe; 1988.

Substation History (New Mexico); National Weather Service, Washington D.C; 1982.

United States Meteorological Yearbook for the years 1935 through 1942; Government Printing Office, Washington DC.

Data Sources

Station history files at NCDC provided descriptions of weather station locations beginning with the Signal Service years, i.e., Nov 18, 1871 with improving detail and resolution in the 1890s and 20th Century. In particular, information regarding instrument (and instrument shelter) location and exposure for the period 1871 – 1893 was documented from a detailed study in 1941 at the Weather Bureau office in Albuquerque, NM. This information was contained in the remarks section of the Climatological Record for Santa Fe located at NCDC. Also during the latter time period of this study, Weather Bureau officials routinely documented station history and instrument status through forms entitled, Description of Topography and Exposure of Instruments, Report of Elevation and Position of Instruments, and Surface Weather Observations. Information on these forms provided significant detail regarding Santa Fe Weather Bureau offices.

Entries from Climate Record Books at NCDC provided the backbone for locations and general exposures for instrument shelters (especially thermometers), rain gages, and anemometers/wind vanes for the Santa Fe station (city office) from Nov 18, 1871 through June 15, 1941. This foundation was instrumental in relating other, more specific information, especially forms describing elevations and positions of instruments, to station locations.

Routine status information regarding location and exposure of weather instruments in Santa Fe was not contained in the NCDC data files for observations by Army surgeons, Signal Service, or Weather Bureau, i.e., up until 1904. Beginning in 1904, routine

information was sketchy, but timely, with reports available for Weather Bureau station moves. This information primarily was available through local Weather Bureau Reports of Elevation and Position of Instruments which provided location and exposure information for the barometer, rain/snow gages, wind instruments, and instrument shelter. Beginning in 1932, more extensive and descriptive information was contained in Weather Bureau forms entitled, "Description of Installation and Exposure of Instrumental Equipment and Surroundings." In addition, information on forms labeled, "Airway, Airport, or Off-Airway Station Record" provided supplemental information regarding instrument availability. Also containing important information were the Airport, Airway, or Six-Hourly Station Records, and the Inspection of Airport and Airways Stations Instrumental Equipment.

Tracking office location and instrument exposure on a yearly basis was important to ensure no information gaps existed. This yearly information was obtained from the Annual Reports of the Chief Signal Officer for the 1870s and 1880s, and from the Annual Reports of the Weather Bureau from 1892 through 1943. Information consistency for the mid to late 1940s was maintained from the wealth of historical records from the 1950s. Weather Bureau Annual Reports were more complete for this project than Signal Service versions. Annual Reports of the U.S. Army Signal Service contained elevations of the stations' barometers, as well as intermittent data on the height of the stations' rain gages and thermometers, especially after 1882. Weather Bureau Annual Reports listed parameters observed, instrument elevations, and dates of any changes.

The Angelico Chavez History Library contained photographs of buildings used to house Signal Service and Weather Bureau offices. In addition, the library had an extensive old map and newspaper archive that was helpful in identifying specific locations and finding pictures for a few hard-to-find buildings that contained Signal Service or Weather Bureau offices.

Other possible sources of information checked included the Santa Fe Public Library, National Park Service Archives at Fort Union, NM, National Park Service Library at Santa Fe, New Mexico Highlands University Library/Archives (Las Vegas, NM), New Mexico State Library, State Engineer's Library, and the State of New Mexico Historical Preservation Division.