

HISTORY OF WEATHER OBSERVATIONS
Fort Randall, South Dakota
1856 - 1892

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U.S. Corps of Engineers staff (Omaha District) at the Fort Randall Dam was helpful in providing general background material for the area. Their time and effort are appreciated. Staff at the South Dakota State Historical Society located relevant material and made photographic copies of archives on Fort Randall. Their expertise and effort were essential in identifying specific areas of this research.

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INTRODUCTION

Historical Overview

Fort Randall was located on the Missouri River in southeast South Dakota, approximately 98 miles southwest of Sioux Falls, SD, 120 miles northwest of Sioux City, IA, and a little over 3 miles north of the Nebraska state line (Figure 1). In the 1950s, the Fort Randall Dam was built on the Missouri River by the U.S. Corps of Engineers just north of the ruins of the old fort.

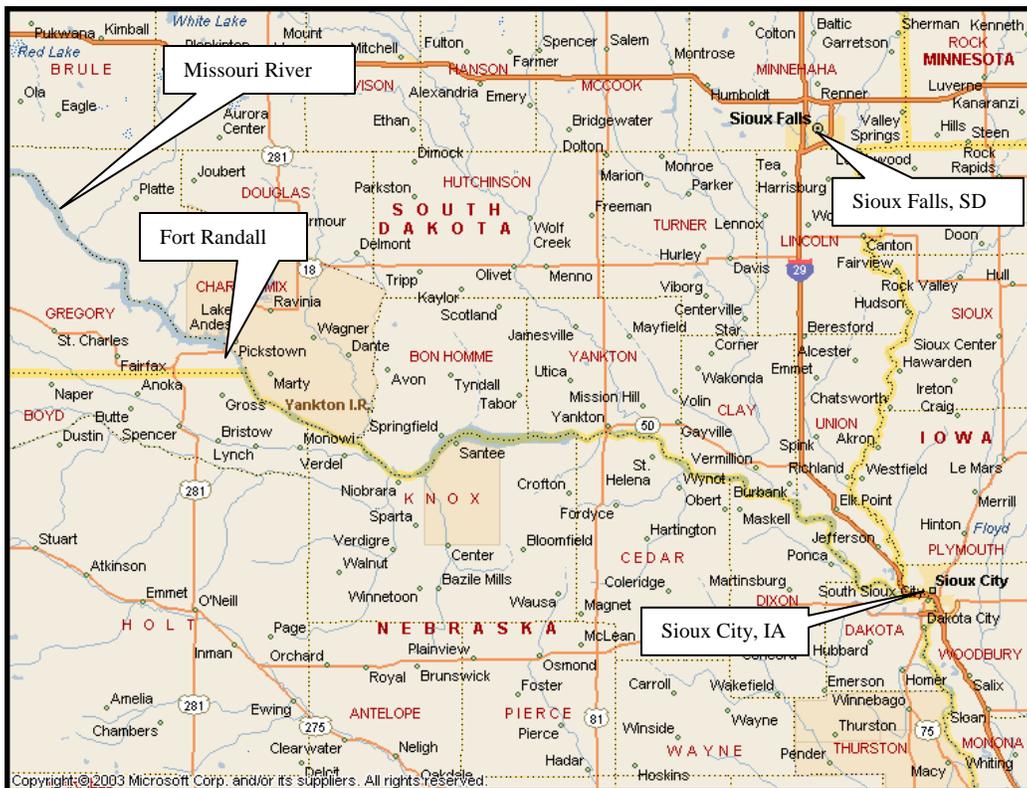


Figure 1. Location of Fort Randall, SD plotted on a current map of South Dakota and neighboring states. East-west distance across the map is approximately 155 miles.

Fort Randall was established on 26 June 1856 to provide protection to settlers and explorers along the Missouri River in southern South Dakota, and northern Nebraska. The post also prevented the trespassing of Indian reservations by white explorers and was

an Army supply depot for the entire Upper Missouri River. Figure 2 is an 1879 map of southeast South Dakota and northeast Nebraska showing the location of Fort Randall.

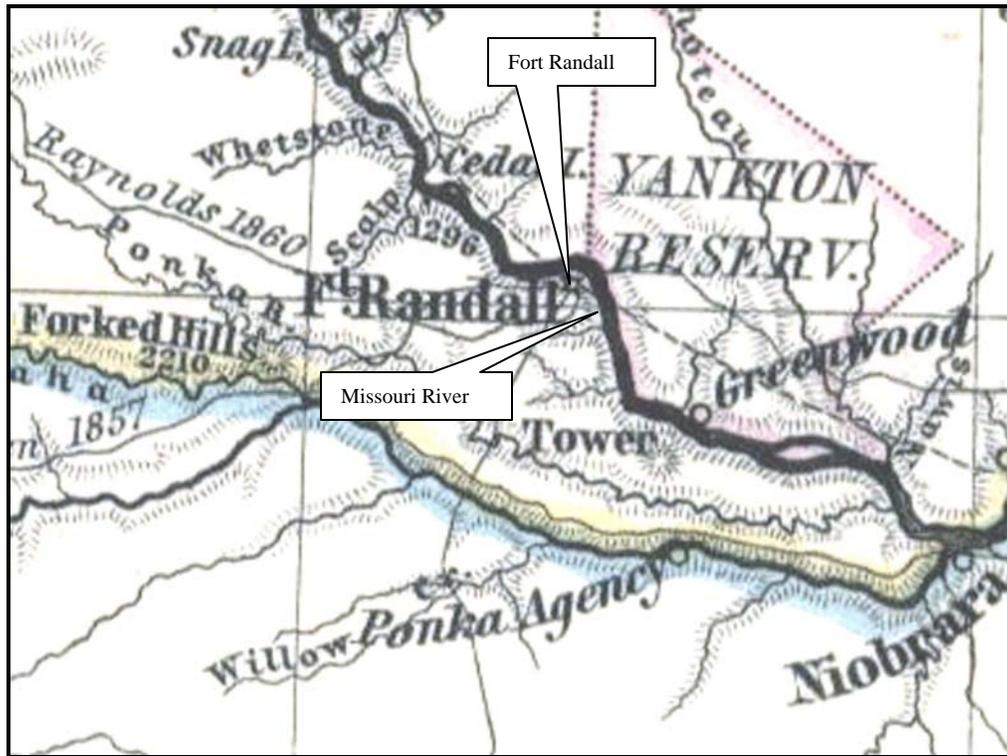


Figure 2. Location of Fort Randall depicted on an 1879 map. Photo courtesy of the South Dakota State Historical Society—State Archives.

The site for Fort Randall was selected by General William S. Harney and named for Colonel Daniel Randall, a career Army officer who was Deputy Paymaster General of the Army. Construction commenced in August 1856, with the completed fort comprised of 24 buildings that housed up to 500 soldiers.

The buildings at the fort were built of cottonwood—a soft wood that shrank and warped quickly. Large cracks developed in the walls, making most buildings uninhabitable. By 1871, a thorough renovation of the post was required. Essentially, each building at the fort was replaced or remodeled. By the end of 1871, Fort Randall was considered the best constructed military fort on the upper Missouri River.

The fort primarily protected the lands between the Platte River, to the south in central Nebraska, and the Missouri River to the north. Soldiers from the post provided protection to settlements along the Missouri River and escorted wagon trains and explorers across the plains. Fort Randall was instrumental in protecting fur traders in South Dakota and Nebraska, and played an important role in the opening of the Black Hills. The fort also was called on to protect the Native American hunting grounds from gold-seeking trespassers headed for the Black Hills.

Many expeditions were mounted from the post to suppress Sioux Indian uprisings. Sitting Bull, legendary chief of the Sioux Nation, was held prisoner at Fort Randall from July 1881 until November 1883.

The post also served as a supply base for Indian agencies and other forts in the area. During the 1860s and 1870s, Fort Randall was a center of steamboat activity along the Missouri River, with steamboats arriving and departing regularly.

By the early 1880s, peace and harmony were becoming established in the Great Plains surrounding Fort Randall. The western frontier had moved farther west as settlers increased along the Missouri River. During the remainder of the 1880s, soldiers at Fort Randall primarily were involved with repairing roads, drilling, target practice, and other maintenance duties. As civilization passed the fort, its military need was over, and on 9 November 1892, Fort Randall was closed.

Based on weather records at the National Climatic Data Center (NCDC), the first weather observation at Fort Randall was on 1 October 1856. U.S. Army surgeons took meticulous and detailed weather observations at, or near the post hospital for over 36 years until the fort closed in November 1892. The last weather observation at Fort Randall was on 17 November 1892.

Goal of the Study

The goal of this study was to document the location and exposure of weather instruments at Fort Randall, SD. The scope of this study covered the mid and late 19th Century, i.e., the life of Fort Randall. Extrinsic observations related to the Army surgeons' weather observing program also were considered.

LOCATION OF OBSERVATIONS

Fort Randall was located in the Missouri River valley with higher terrain east and west of the fort (Figure 3). Terrain in the immediate vicinity of the post was relatively flat (Figure 4). Figure 5 shows the hills to the west of the fort, along with the terrain around the post.

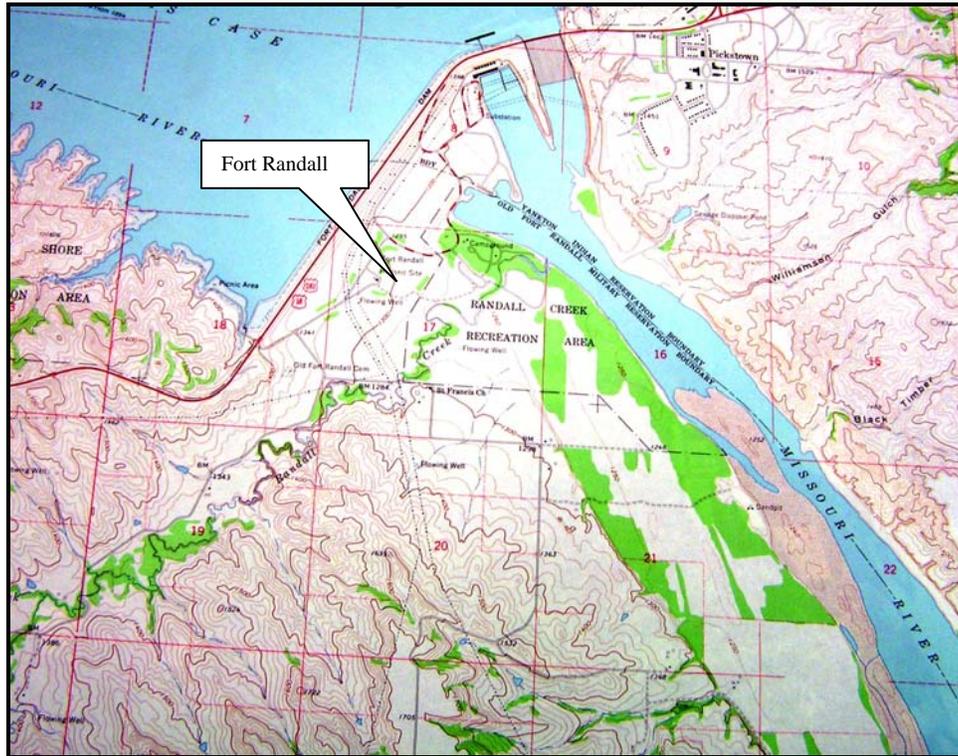


Figure 3. USGS topographical map (1964) showing higher terrain east and west of Fort Randall. North is at the top of the figure. East-west distance across the map is approximately four and one-half miles. Fort Randall Dam is shown just north of the old fort.

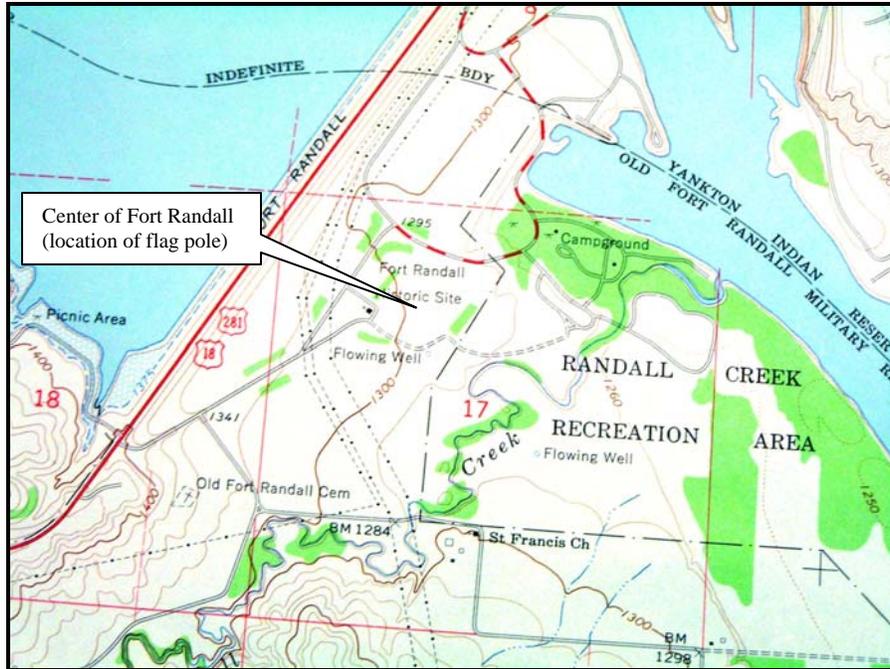


Figure 4. Enlargement of Figure 3 showing relative flatness of terrain around Fort Randall. North is at the top of the figure. East-west distance across the figure is approximately two and one-quarter miles.

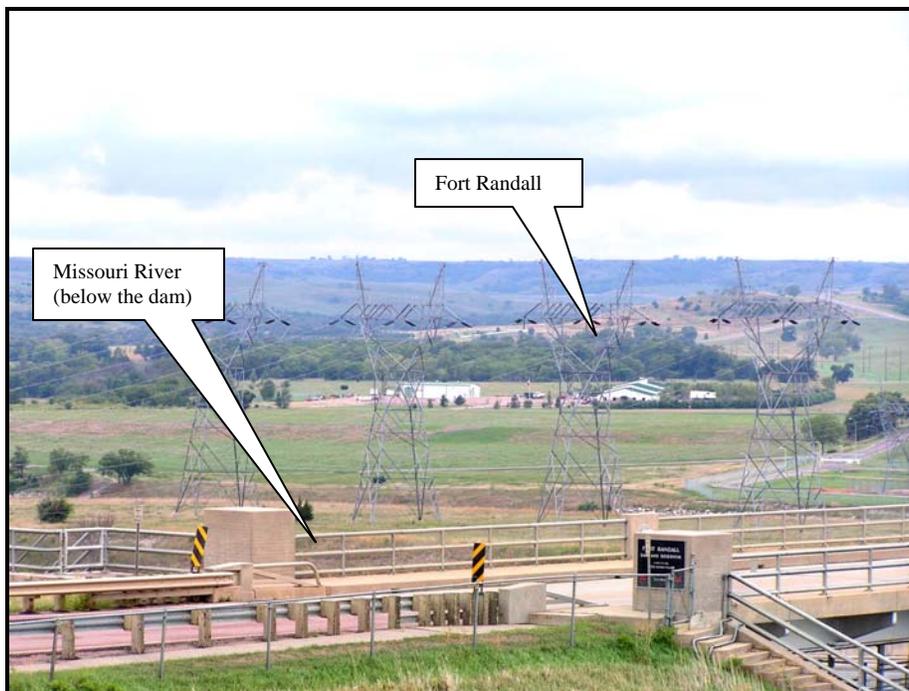


Figure 5. Terrain surrounding Fort Randall taken from the east end of the Fort Randall Dam. View is southwest. The fort was located behind (west) the trees indicated by the arrow. Photograph taken by the author.

Based on available information on Fort Randall, as well as histories from other posts, weather observations were taken at, or near the fort hospital, and the hospital was at two separate locations during the life of the fort, i.e., the hospital moved in 1872 (exact date unknown). The fort was almost one-half mile south of the Missouri River and 56 feet above the river. Figure 6 is an 1873 map that shows the location of Fort Randall with respect to the Missouri River, as well as the surrounding area. Figure 7 shows the two locations of the hospital with respect to the remainder of the fort. Fort Randall was oriented north northeast to south southwest (Figure 6) with the hospital on the eastern side of the post. The first hospital (hospital prior to 1872) was located approximately 600 feet southeast of the last hospital.

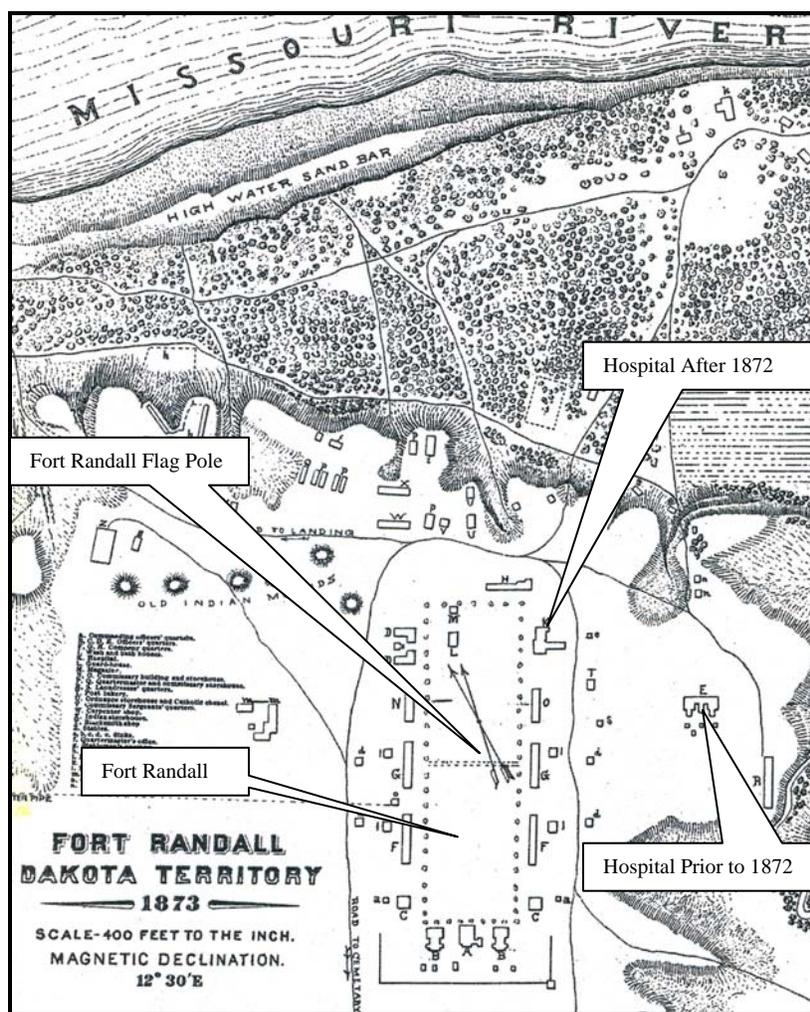


Figure 6. Fort Randall (1873) with respect to the Missouri River and surrounding area. North is toward the upper left of the map. East-west distance across the map approximately one-half mile Randall Creek was located approximately 400 feet southeast of the first hospital at closest approach. From the U.S. Army Surgeon General's Office.

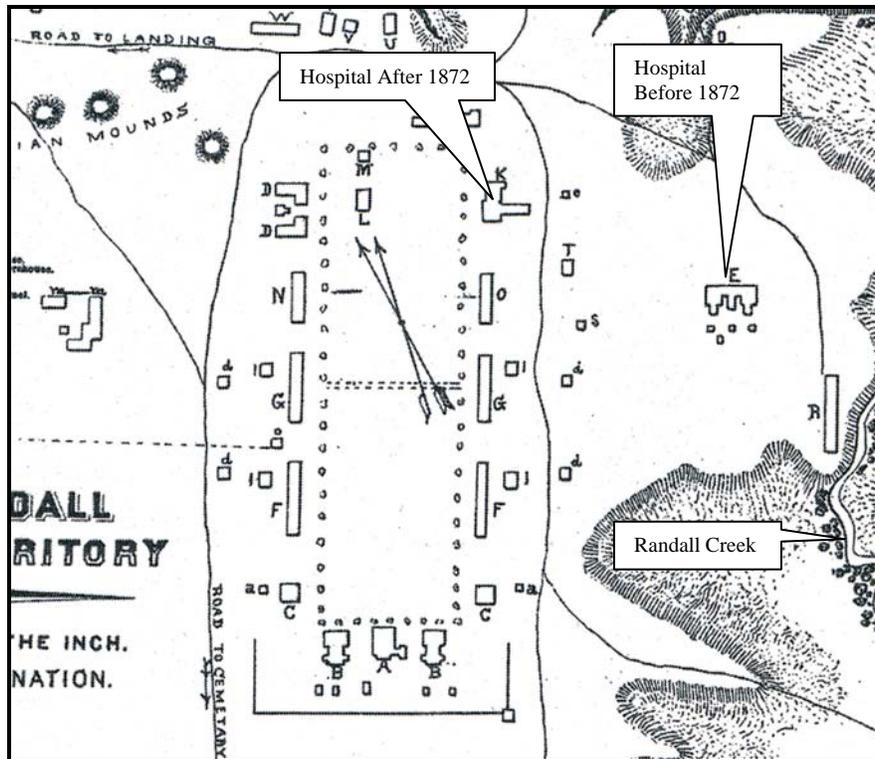


Figure 7. Main section of Fort Randall (1873). North is toward the upper left part of the figure. East-west distance across the map approximately 1,000 feet. From the U.S. Army Surgeon General's Office.

According to the NCDC database, the first weather observation at Fort Randall was taken on 1 October 1856. This likely was the actual beginning date (or very close) since construction on the fort began the previous August. The last weather observation at Fort Randall was taken on 17 November 1892. Observations likely were taken at, or near the hospital.

According to U.S. Army Surgeon General's Office publications, the hospital initially was located approximately 600 feet east of the main fort complex (see Figures 5 and 6). The first hospital was completed in 1857, although some form of the hospital was in place at that location as early as October 1856 (when weather observations began). A map drawn by an Army office in October 1856 showed the hospital in place at its original location approximately 600 feet east of the fort complex (from book entitled *Fort Randall on the Missouri, 1856-1892*). In 1872 (exact date unknown), another hospital was built approximately 600 feet northwest of the first hospital.

Coordinates first listed for the fort on the observation forms were 43°1'N 98°12'W (beginning October 1856). Essentially, these coordinates did not change on the observation forms although obvious errors were made on some of the forms during the years. Elevation of the fort was first listed as 1,245 feet above sea level which did not change on the forms. GPS coordinates for the second hospital were 43°3'2"N 98°33'32"W and elevation 1,286 feet. Beginning in June 1861, the name of the station

on the observation form was changed from “Fort Randall NT” to “Fort Randall DT.” The abbreviation “NT” referred to Nebraska Territory and “DT” to Dakota Territory.

INSTRUMENTATION

Weather observations at Fort Randall were consistent for the 36 year period from October 1856 through November 1892. The main exceptions are indicated below:

- 1864 – May and October missing
- 1865 – June through August, November, and December missing
- 1866 – January through August missing
- 1867 – September through November missing
- 1869 – August missing

The reasons for the missing observations were not apparent, i.e., whether observations were not taken or the data have been lost over the years.

The first observation available in the National Climate Data Center (NCDC) database for Fort Randall was 1 October 1856 (Figure 8).

1856		METEOROLOGICAL REGISTER.															48 163			
Station <i>Fort Randall N.C.</i>		Lat. <i>43° 11' North</i> Long. <i>98° 12' West</i>															Alt. of Bar. above <i>the Sea</i> <i>1245</i> feet			
Month	THERMOMETER.				HYGROMETER.				WINDS.						WEATHER.			RAIN.		REMARKS.
	7 A.M.	2 P.M.	9 P.M.	Daily Mean.	7 A.M.	2 P.M.	9 P.M.	Daily Mean.	7 A.M.		2 P.M.		9 P.M.		7 A.M.	2 P.M.	9 P.M.	BEGAN.	ENDED.	
1	55	72	41	56.	48	67	39	49	7.2	2	7.6	5	7	3	Fair	Fair	Fair			
2	48	65	52	59.	40	61	47	53.33	6	1	5.6	5	6	1	Fair	Fair	Fair			
3	49	94	77	73.33	46	70	67	61.	6	2	5.2	6	5.2	7	Fair	Fair	Fair			
4	65	77	50	64.	54	61	45	53.33	7.2	6	7	3	7.2	2	Cloudy	Fair	Fair			
5	36	70	58	57.	35	60	45	46.66	7.2	2	5.2	2	5.2	1	Cloudy	Fair	Fair			
6	53	70	77	74.	58	70	69	63	5.2	2	5.2	7	5.2	7	Cloudy	Fair	Fair			
7	71	88	63	72.	67	70	60	65.66	5	3	5.2	2	7	1	Fair	Fair	Fair			
8	66	87	78	75.	58	71	68	65.66	1.6	1	5.2	3	5.2	5	Fair	Fair	Fair			
9	67	64	58	63.	60	58	53	57.	7.2	5	7	4	7.6	3	Cloudy	Cloudy	Cloudy			
10	53	64	48	52.33	45	52	36	45.33	7.6	2	7.6	4	2	2	Cloudy	Cloudy	Fair			
11	38	65	36	44.33	30	53	35	39.33	7.2	1	7.6	2	7	1	Fair	Fair	Fair			

Figure 8. First observations for Fort Randall in the NCDC database (October 1856). Only the top of the form is shown. From the official station history files at the National Climatic Data Center.

Initial weather measurements/observations at Fort Randall consisted of the following parameters:

1. Temperature (Fahrenheit) – Measured three times daily (7:00 a.m., 2:00 p.m., and 9:00 p.m.).
2. Hygrometer (wet bulb temperature) – Measured three times daily coincident with temperature readings
3. Wind direction and force – Three times daily coincident with temperature readings (direction expressed on an eight-point compass and wind force expressed on a scale from “0” for calm conditions, to “10” for a “violent hurricane”; e.g., SW4)
4. Weather (fair or cloudy) – Observed three times daily coincident with temperature readings
5. Rainfall – Beginning, ending, and daily amount
6. Significant weather in Remarks section

Based on available data, it appears Fort Randall surgeons used the following weather instruments in 1856:

1. Thermometer
2. Hygrometer
3. Rain gage
4. Wind vane (wind force was estimated subjectively)

Although specific information was lacking regarding weather instruments used by Fort Randall Army surgeons, the Army Surgeon General's Office issued descriptions and instructions to field surgeons in 1856 and 1868 regarding instrument exposure and how the observations were to be taken. Those instructions are contained in the reports (under this general contract) for Fort Union, NM; Fort Snelling, MN; and Fort Gibson, OK. The general instructions listed in those reports also applied to Fort Randall.

A note on the January 1857 observation form stated: "Thermometer broken after 2 PM (on the 12th). The observations have since been taken from a private thermometer distant about 200 yards from the hygrometer."

A barometer (made by Green) was received from the Surgeon General's office in early June 1857 with barometric and attached thermometer readings started at Fort Randall on 5 June 1857. A note on the July 1860 form stated the mercury in the barometer had "read incorrectly" since 8 April 1860. The note stated the incorrect barometer was due to an "unassignable (sic) cause," but had been repaired "by an astronomer."

The observation form for June 1860 contained the following:

"As noted on the form, the station name has changed from 'Fort Randall N.T.' to 'Fort Randall D.T.' Fort Randall was originally part of Nebraska Territory, but on March 2, 1861, Dakota Territory was formed. As of this date, the location of Fort Randall became included within the newly formed Dakota Territory, hence the name change."

Barometric observations ceased between May 1865 and September 1865 (weather observations from June through August were missing in the NCDC database) but attached thermometer readings continued. A note on the September 1865 form stated the barometer was still out of order. No observations for either the barometer or attached thermometer were recorded through June 1871. Barometric observations and attached thermometer observations were recorded beginning 1 July 1871. The July 1871 observation form also stated: "The barometer used is an 'Aneroid' with thermometer attached. No reduction to 32 degrees to Aneroid." The September 1871 observation form stated: "The barometer used being an 'Aneroid' is so graduated, that the fractional parts of the inch can only be expressed by two decimal points."

Barometric readings ceased 7 May 1872. A note was attached to the May 1872 form that stated: "The barometer has not been kept since the 6th on account of Act. Asst. Surgeon J.F. Boughton U.S.A. being relieved from duty at this post and taking the barometer with him as it was Private Property." Barometric measurements were not recorded at Fort Randall through November 1892 when all weather observations ceased because of the fort closing.

In December 1868, the U.S. Surgeon General changed the observing form, requiring readings from maximum and minimum thermometers. However, Fort Randall did not have maximum/minimum thermometers. Maximum/minimum observations began at the post on 1 September 1869.

The new forms also required field surgeons to record motion of clouds at 7 a.m., 2 p.m., and 9 p.m., as well as amount of cloudiness. This was performed by the Fort Randall surgeons. Fort Randall surgeons continued to record temperature and hygrometric observations at 7 a.m., 2 p.m., and 9 p.m., as well as wind direction/force.

A note on the February 1869 form stated: "The snow and rain was received by the old conical receiver and measured by L. DeWitt's Rain Gage."

A note on the June 1873 form stated: "Meteorological instruments removed from veranda to thermometer box constructed, as per Instruction S.G.O (Surgeon General's Office) August 10th 1868. Maximum thermometer sent to S.G.O. to be repaired or exchanged." According to documents from the Surgeon General's Office, the veranda was in the front of hospital, i.e., the side facing the parade ground (west of the hospital). Maximum temperatures continued to be recorded after June 1873. A note on the December 1873 form stated: "No maximum thermometer at post belonging to Hospital, that in use being private property liable at any time to removal."

The January 1876 form contained the following note: "Thermometers tested this a.m. Minimum (thermometer) registers 3 degrees too low. Others correct or varying but a small fraction of a degree." No information was included as to how the thermometers were tested or who conducted the test.

Hygrometric recordings stopped 31 January 1888, and beginning 1 September 1888, Fort Randall surgeons recorded weather observations only once daily. Each day, maximum/minimum temperatures, beginning/ending of precipitation, total daily precipitation, depth of snow, and general direction of the wind were recorded at the post. This resulted from instructions from the Army Surgeon General's Office.

The last weather observation at Fort Randall was 17 November 1892. A note was attached to the November 1892 form indicating the station would close, beginning 18 November 1892.

Figure 9 shows Fort Randall around the mid 1870s, including locations of the first and second hospitals. Figures 10 and 11 are close-up photographs of the first and second hospital buildings and areas respectively. The exact date in 1872 the surgeons moved to the new hospital could not be determined.

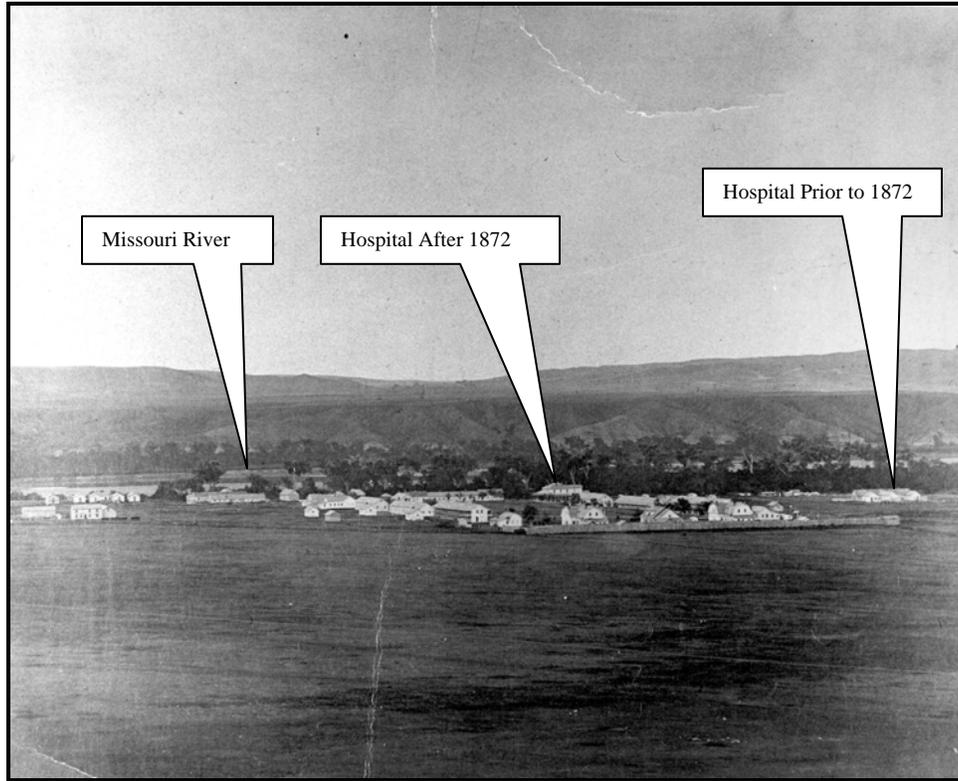


Figure 9. Fort Randall (circa mid 1870s) looking northeast. Photo courtesy of the South Dakota State Historical Society—State Archives.

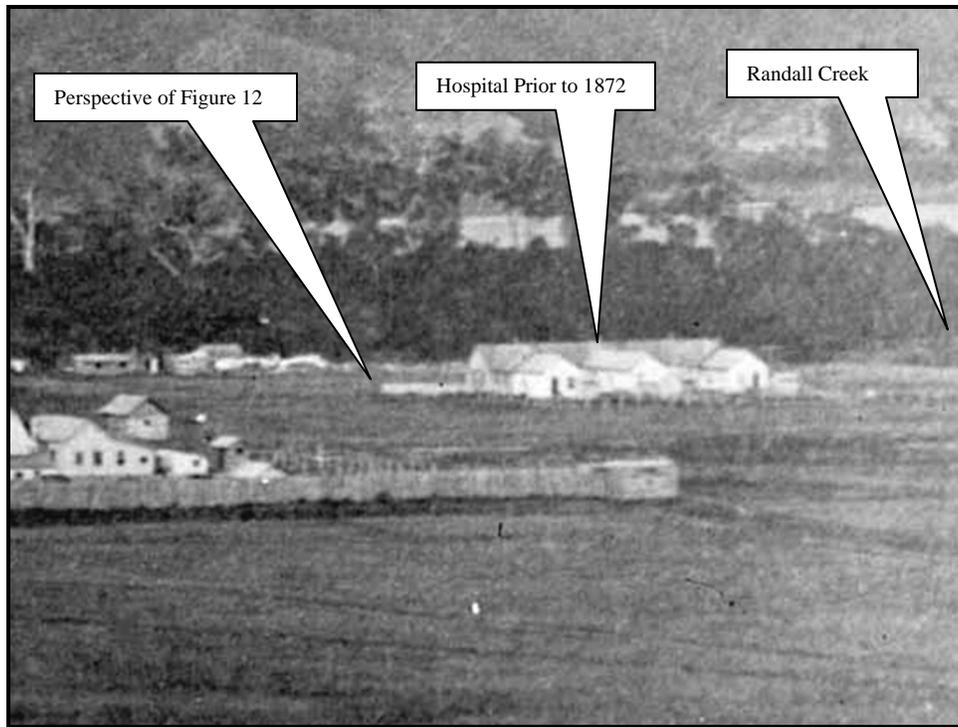


Figure 10. Enlargement of Figure 9 showing first hospital building and area (prior to 1872). View is northeast. Photo courtesy of the South Dakota State Historical Society—State Archives.

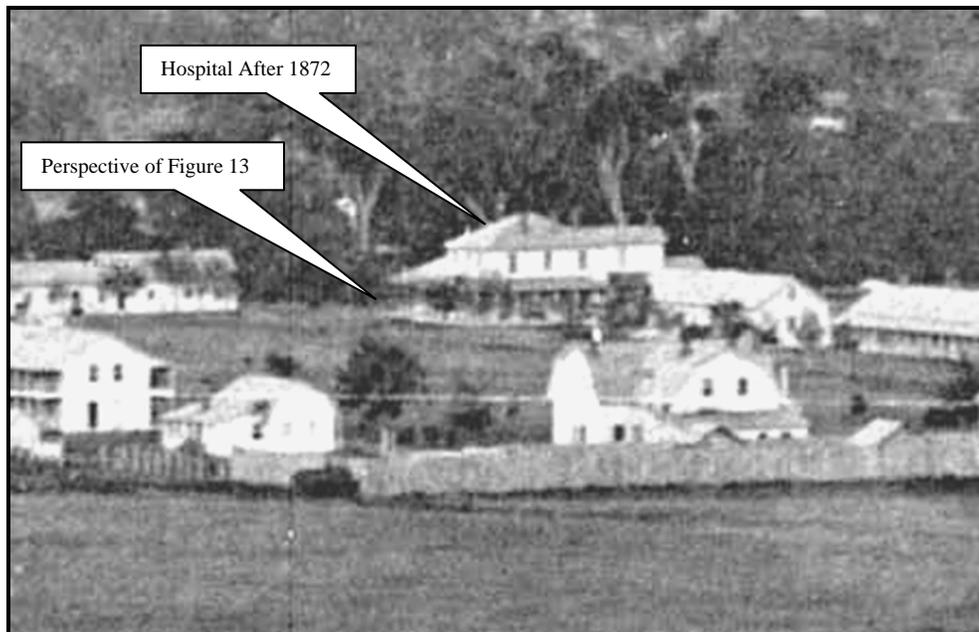


Figure 11. Enlargement of Figure 9 showing second hospital building and area (after 1872). View is northeast. Photo courtesy of the South Dakota State Historical Society—State Archives.

Figure 12 shows the first hospital building and Figure 13 shows the second hospital

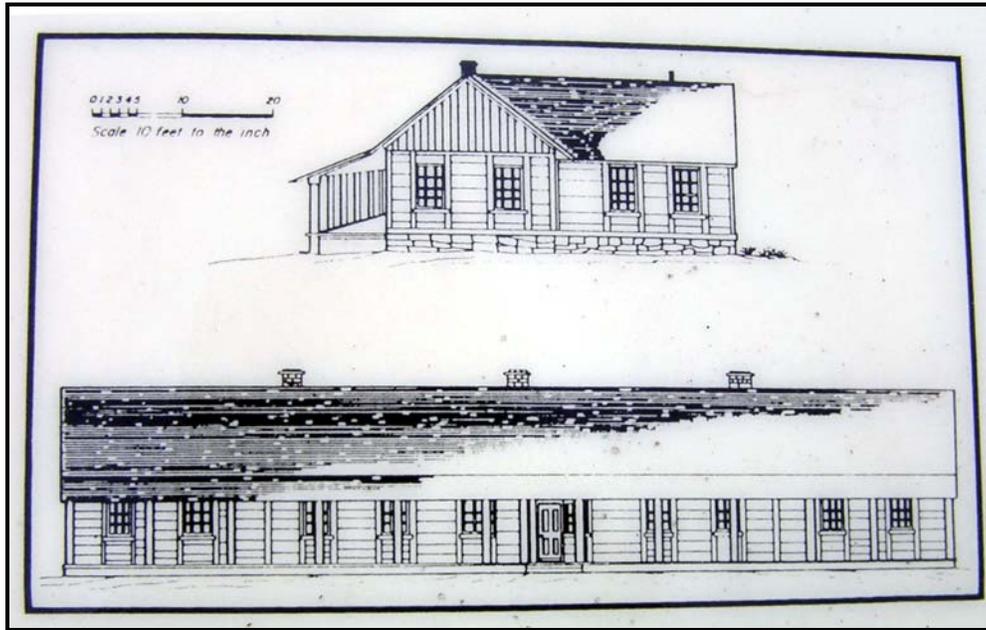


Figure 12. Side and front views of first hospital at Fort Randall (prior to 1872). Drawing was made in the mid 1860s. Side view is to the southeast (see Figure 10 for perspective of side view) and front view is southwest. The old hospital was altered and enlarged in 1872 (when the new hospital was built) to serve as officers' quarters. From the U.S. Army Corps of Engineers, Omaha District.

Although the first hospital was started by late 1856 and basically completed by mid 1857, work likely continued on the building and grounds during later years. A physician visiting the fort in June 1859 filed the following report:

“We looked about the Fort, which is no fort at all (meaning no stockade), only barracks, log cabins occupied by the soldiers, and better ones by the officers, all facing an open square, in the center of which is a (sun) dial and flagstaff, with a stand for the musicians. I afterwards saw a new hospital that is not quite completed. It is built of cedar boards and divided into seven rooms, each about 18 feet by 10, and 8 feet high, with about three windows and a door in each, and other rooms for a surgery and storehouse, which form wings.”

The “new” hospital indicated the first hospital was being remodel, which was frequently necessary due to the soft wood use in constructing the post’s buildings. The remodeling of the hospital may have resulted in some/all of the weather instruments being moved.



Figure 13. Front view of the second Fort Randall hospital (after 1872). Photograph made in the mid 1870s. View is southeast (see Figure 11 for perspective). From the U.S. Army Corps of Engineers, Omaha District.

Figures 14 through 18 show the terrain around Fort Randall. An engineer at the Corps of Engineers stated the area around the fort was not disturbed during the building of the dam. The engineer stated the dam actually was moved during the planning stages to ensure the integrity of the old fort site and surrounding terrain.

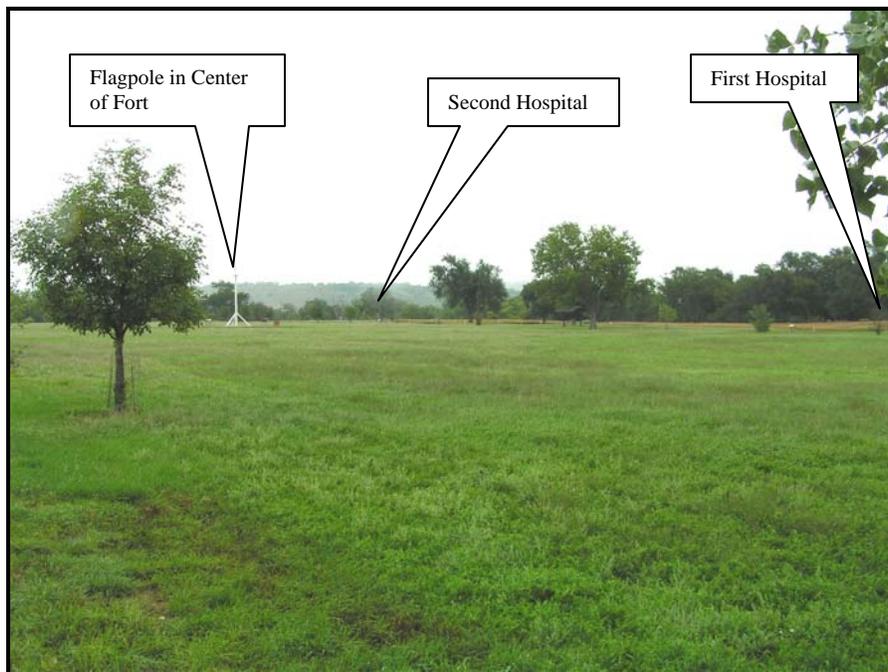


Figure 14. Fort Randall site looking northeast from the southwest corner of the post. The Missouri River is located in front of the distant hill. Photograph taken by the author.

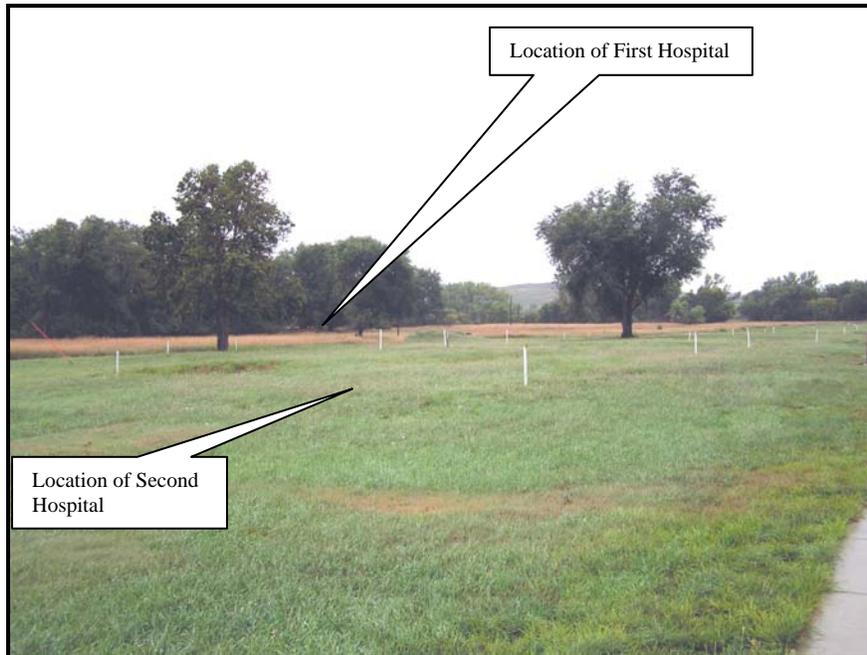


Figure 15. Locations of the first and second hospitals looking south. The first hospital was located approximately 600 feet south southeast of the second hospital. Photograph taken by the author.



Figure 16. Terrain north northeast from the second hospital. Photograph taken by the author.

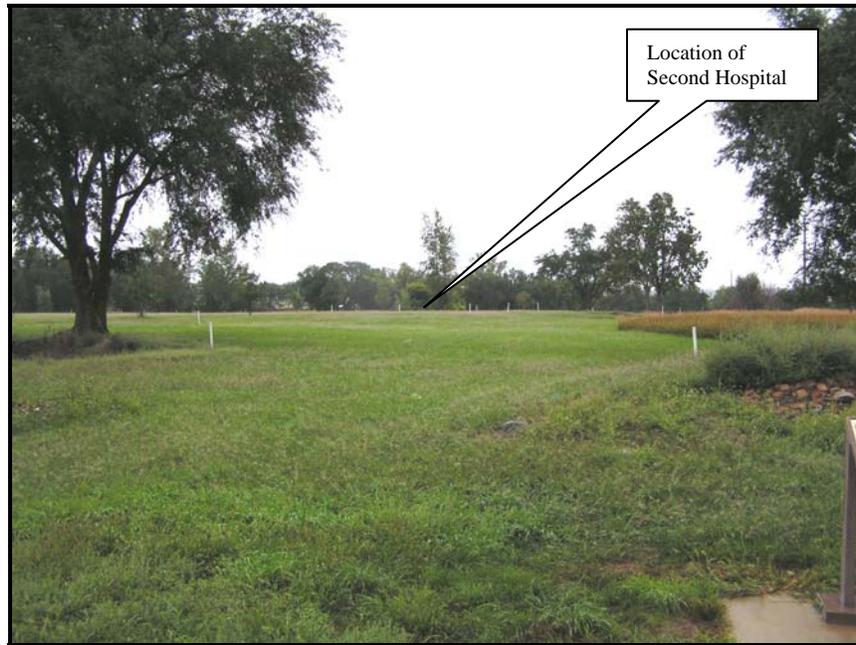


Figure 17. Location of second hospital viewed from a spot approximately half way between the first and second hospitals. View is north northwest. Photograph taken by the author.



Figure 18. View west northwest from the location of the second hospital. Photograph taken by the author.

OTHER OBSERVATIONS

Figure 19 shows the locations of significant observations in the vicinity of Fort Randall during the 19th and early 20th centuries. Weather Bureau voluntary/cooperative weather observations were taken at Armour, SD (21 miles northeast of Fort Randall) from 1 April 1896 through 20 July 1953. This station had a standard instrument shelter, maximum/minimum thermometers, and a standard rain gage. Latitude/longitude for this site was listed as 43°19'N 98°64'W and the elevation was listed as 1,514 feet above sea level.

Voluntary/cooperative weather observations were taken in the vicinity of Fairfax, SD (17 miles west of Fort Randall) from September 1902 through 1954. Listed latitude/longitude varied among the stations and elevation was listed as approximately 1,942 feet. These stations had a cotton region instrument shelter, maximum/minimum thermometers, and a standard rain gage.

Cooperative weather observations were taken in the vicinity of Butte, NE (18 miles southwest of Fort Randall) from 12 May 1906 through 1955. Listed latitude/longitude varied among the stations and elevation was listed as approximately 1,900 feet. These stations had a cotton region instrument shelter, maximum/minimum thermometers, and a standard rain gage.

Voluntary/cooperative weather observations were taken in the vicinity of Lynch, NE (15 miles south southeast of Fort Randall) from 1 April 1893 to 18 November 1941. Observing periods were intermittent with gaps existing from 1909 to 1913 and 1915 to 1923. Instruments at these stations varied. Initially, a dry bulb thermometer and standard rain gage were at this site. From April 1899 through November 1909 a cotton region instrument shelter, maximum/minimum thermometers, and standard rain gage were used. Beginning in 1913, this station had only a standard rain gage, with a recording rain gage added in 1940. Listed latitude/longitude varied among the stations and elevation was listed as approximately 1,411 feet.

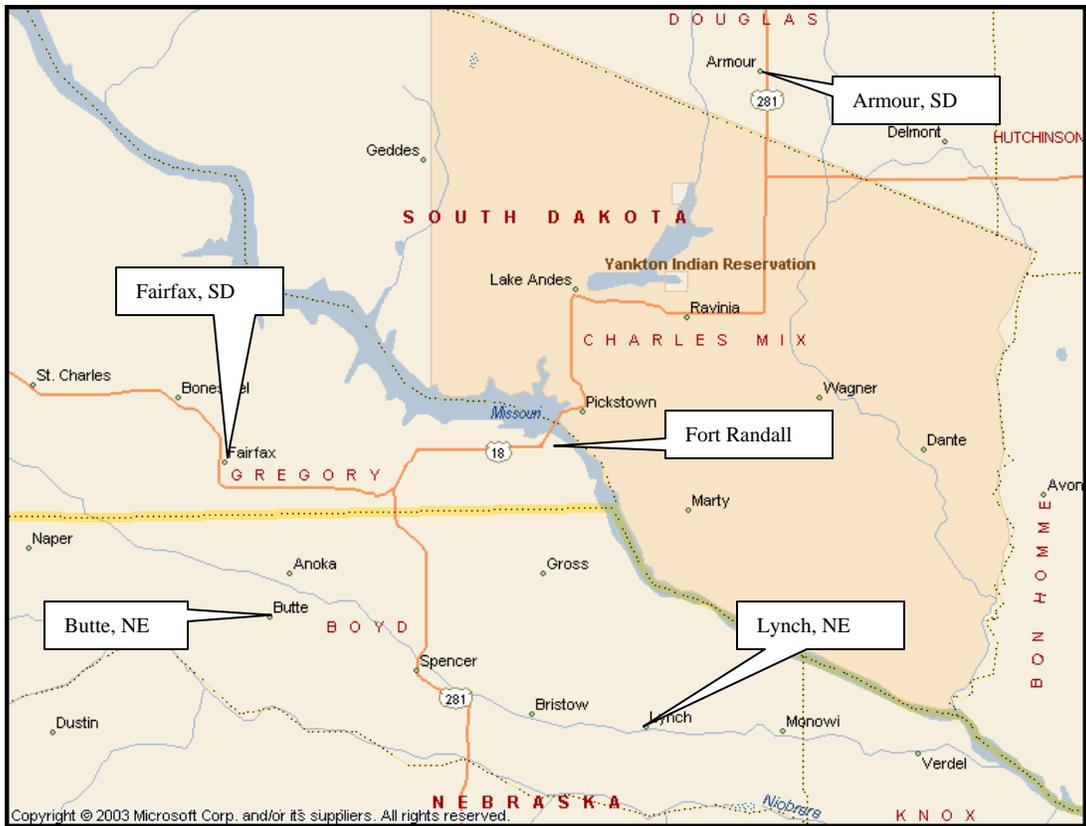


Figure 19. Locations of significant voluntary/cooperative observers nearby to Fort Randall. North is at the top of the page. Distance across the figure (horizontal) is approximately 53 miles. Information is plotted on a current map of South Dakota/Nebraska.

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Appendix

Methodology

Specific information regarding weather instrument location and exposure at Fort Randall during observations by Army surgeons was sparse. The NCDC database was the primary source of weather observations for this report.

General information regarding weather instruments used by the Army surgeons, and procedures used to take the observations, came from publications by the Army Surgeon General's Office (1844, 1850, 1851, 1856, and 1868). This general information was included with the assumption that the military surgeons followed those instructions closely.

Annual reports by the U.S. Army Surgeon General were reviewed for the years 1850 through 1875 with only bits and pieces of revealed information. The primary exception was the annual report for 1844, which contained a summary of instructions for taking weather observations; however, a more detailed document was obtained from the National Library of Medicine in Bethesda, MD. Several publications by the Army Surgeon General were obtained from the extensive government library microfiche collection at Oklahoma State University.

The South Dakota State Historical Society contains numerous archives on Fort Randall. A number of relevant photographs, maps, and documents were found at the library. The U.S. Corps of Engineers office at the Fort Randall Dam provided a few photographs and documents on the fort, and in particular, on the hospital. Staff at the office also provided general historical insight. Documents on Fort Randall (published and unpublished) were obtained from the I.D. Weeks Library at the University of South Dakota (Vermillion).

Other research sources checked in person, by telephone, or via the Internet included Central Plains Region Branch of the National Archives and Records Administration (Kansas City), Rocky Mountain Region Branch of the National Archives and Records Administration (Denver), Sioux City Public Museum, Sioux City Public Library, Old Courthouse Museum in Sioux Falls, Sioux Falls Municipal Library, South Dakota State Library, Pierre Municipal Library, Rapid City Public Library, South Dakota School of Mines and Technology Library, South Dakota State University Hilton M. Briggs Library, U.S. Army Military History Institute (Carlisle, PA), and the Nebraska State Historical Society.