





FORT STEELE BENCH MARK Рното ву Todd Cedarholm, P.L.S.

CONTENTS



Troy Langston - Monsen Engineering

Advertising Information

Digital-ready, full-color advertising with payment should be mailed to Lines & Points, P.O. Box 8, Cheyenne, WY 82003.

Advertising rates are as follows:	Year	Issue	
Full Page	\$810	\$210	
Half Page	\$540	\$140	
Quarter Page	\$310	\$80	
Business Card	\$40	\$10	
Employment	Free	Free	
Special Rates apply for PLSW Chapters and cover placements.			
For more information please contact Jack Studley.			

Committee Chair-Chief Editor	Steven "Dennis" Dawson, PLS dennieandbarb@gmail.com
Designer	Michael Flaim, PELS mike.flaim@bresnan.net
Treasurer & Advertising	John "Jack" Studley, PLS jklz0318@gmail.com
Circulation	Joel Ebner, PLS jvebner@bresnan.net
Copy Editor	Herbert W. Stoughton, PhD, PELS, CI hws.geod.engr@gmail.com
Website	Sonja "Suzie" Sparks, PLS sasparks7@gmail.com
Emeritus Member	Pete Hutchison, PELS petehpels@gmail.com

PLSW (Professional Land Surveyors of Wyoming; PO Box 8, Cheyenne, WY 82003) is a statewide organization of Land Surveyors registered to practice in the Equality State of Wyoming. PLSW is dedicated to improving the technical, legal, and business aspects of surveying in the State of Wyoming. PLSW is affiliated with the National Society of Professional Surveyors (NSPS) and the Western Federation of Professional Land Surveyors (WestFed).

Lines and Points is published by the Professional Land Surveyors of Wyoming. Lines and Points is not copyrighted and permission is hereby granted to reprint articles with appropriate credit. The Professional Land Surveyors of Wyoming assume no responsibility for statements made or opinions expressed in this publication. The articles and opinions as put forth in this journal are not necessarily those of PLSW or the Editorial staff of this journal.

PRESIDENT'S MESSAGE



Fall is in the air! I must say this is my favorite season in Wyoming. Up in the Searra Madres this week the leaves were turning and every morning we could hear bulls bugling. It makes everything better, even

on projects where construction superintendents have realized the summers work is not done and snow is on its way!

As most of you know, Fall Tech will be held in Casper in early November. This is a longstanding tradition in PLSW. I would like to give a big thank you to the education committee for the hard work and effort expended in organizing this event. I always look forward to the speaker, and the chance to see old friends and see new faces. When the new faces include students, it is really encouraging to me for the future of our profession. Speaking of students, this year the scholarship committee has received the highest number of quality applicants seen in recent history. The scholarship fund was established to support and encourage the next generation of surveyors in Wyoming. One of the funds primary funding sources are the silent auction and the raffle which takes place at Fall Tech. I will shamelessly throw out a plug for that endeavor here. If you have an item you are interested in donating to the auction or the raffle, please reach out to Chris Hamilton or myself. Your donations will help students with their education so please bid high and often!

In conclusion, I would like to thank the membership for the opportunity to serve with you all this past year. I have had the privilege of working with the dedicated and professional volunteers that keep this organization viable and functioning and am very thankful for this opportunity.

Best Wishes to all, Doug Boyd, PLS President, Professional Land Surveyors of Wyoming

SURV-KAP®

THE LANDMARK NAME IN SURVEY PRODUCTS Exceptional Customer Service

- REBAR & PIPE CAPS
- CONCRETE MARKERS
- SURVEY MONUMENTS
- SECTIONAL ROD MONUMENTS
- ACCESS COVERS
- WASHERS & NAILS
- SUBSURFACE MAGNETICS
- STAMPING TOOLS
- SURVEY TOOLS & ACCESSORIES

520-622-6011 • 800-445-5320 • FAX 520-792-2030 • SURV-KAP.COM

CALL OR ORDER ONLINE!

ANNOUNCEMENTS P.L.S.W. TECHNICAL SESSION NOVEMBER 7 & 8, 2024 • CASPER, WYOMING

GENERAL INFORMATION

PRE-REGISTRATION:

FEE: \$150 PLSW Members \$100 PLSW Affiliate Members \$225 Non-Members

A \$20 late registration fee will be added to all registrations received after October 20, 2024. AGENDA

November 7th

November 8th 7^{am} - 7:45^{am} Breakfast Buffet

7 ^{am} - 8 ^{am}	Registration	7 ^{am} - 7:45 ^{am}	Breakfas
8 ^{am} - 12 ^{pm}	Seminar	8 ^{am} - 12 ^{pm}	Seminar
12 ^{pm} - 1 ^{pm}	Luncheon &		
	Annual PLSW Meeting		
1 ^{pm} - 5 ^{pm}	Seminar		
5 ^{pm} - 9 ^{pm}	Social Hour		

Finding And Prioritizing Boundary Retracement Evidence

The majority of land surveyors retrace the boundaries of existing, already created parcels. But many things including poorly-written documents, less-than-detail-oriented original surveyors, and conflicting resurveys can make the task of retracing a parcel so difficult. Learn the five most important principles of boundary retracement in just four hours!

Limiting The Liability Of Your Survey Business This seminar will examine the actions that business owners, officers, and employees can take to reduce and limit the liability of work performed

by their surveying firms. Topics will include best practices, contractual terms, and upfront decisions that every surveyor can learn from.

Wyoming Water Rights Overview

Overview of Wyoming water rights, followed by a discussion on how to change water rights. The focus will be on the types of petitions, content and map requirements. I will also go over what we call the "consent burden" associated with different types of petitions and when consents are mandatory. Lastly, we will cover recent statutory changes regarding land developments and what is required for compliance. I will also delve into Water Development Plans (WDP) and Authorizations to Detach Water Rights (ADWR), instruments commonly used to this end.

LOCATION AND LODING

A block of rooms has been reserved at the Best Western Downtown Hotel, 123 West E Street, Casper, Wyoming until October 25th.

Rate: \$95/night. Telephone: 307-439-2074.

PROFESSIONAL DEVELOPMENT HOURS

12 Professional Development Hours will be awarded for the entire seminar.

FOR MORE INFORMATION, CONTACT:

Paul Svenson	
Bill Fehringer	

307-266-2524 307-995-2620

Karyl Tully

Karyl Tully is currently the Assistant Administrator of the Board of Control, which is a division of the Wyoming State Engineer's Office. The State Engineer's Office deals solely with the administration and regulation of water rights, and within that framework, the Board of Control (BOC) handles adjudication of permitted rights as well as changes to adjudicated water rights. She started as a petition tech with the BOC in 2013.

Tony Nettleman

Tony Nettleman is a Land Surveying Engineer and Attorney who holds the distinguished position of professional assistant professor at Texas A&M Corpus Christi, teaches continuing education courses for attorneys and land surveyors, provides online test preparation modules to help land surveyors become licensed in all 50 states, and serves as an expert witness in boundary, easement, title and riparian disputes. He is licensed as a Florida attorney and a Florida and Texas professional surveyor.

LINES AND POINTS ARTICLE ROTATION SUBMISSION SCHEDULE BY CHAPTER

Responsible Chapter	First Call Date	Last Call Date	Publication Date
West Chapter	THANK YOU! (SEE "FORT	STEELE ASTRONOMICAL STA	ATION OF 1872" IN THIS ISSUE)
Central Chapter	December 1	December 15, 2024	January 1, 2025
South Central Chapter	March 1	March 15	April 1, 2025
Southeast Chapter	June 1	June 15	July 1, 2025
Southwest Chapter	September 1	September 15	October 1, 2025
Northeast Chapter	December 1	December 15, 2025	January 1, 2026
Northwest Chapter	March 1	March 15	April 1, 2026

As the Board of Directors discussed, any four page article (with pictures) may be from within the particular chapter membership (survey stories, or technical experiences) or after acquiring permission to use an article from another professional society publication or which provides information of interest to the PLSW members. The Board also approved assigning the responsibility for the article development and submission to each chapter's vice president. If a Chapter does not provide an article that same Chapter shall be obligated to provide an article for the next publish date.

Lines & Points (Vol. 35: No. 4)

GIS DAY

It's coming up on Wednesday, November 20. The Cheyenne community will be celebrating at the Clay Pathfinder ANB Leadership Center at LCCC, Cheyenne Campus that day from 10 am - 3 pm. We will have a Keynote speaker, lots of activities, lightning talks, lunch, trade show, booths, STEM lab with self-driving tractor, LCCC STEM Mobile Science lab.

WFPS CONFERENCE REPORT

The Western Regional Survey Conference was held March 23-26 at the Horseshoe in Las Vegas, Nevada. Participating associations included Arizona Professional Land Surveyors (APLS), California Land Surveyors Association (CLSA), Nevada Association of Land Surveyors (NALS), New Mexico Professional Surveyors (NMPS), Professional Land Surveyors of Wyoming (PLSW), and Western Federation of Professional Surveyors (WFPS).

Attendance was beyond expectation at over 850 registrants from 24 different states. Below are preliminary numbers from the conference.

TOTAL REGISTRATION: 855

TOTAL FULL PAID REGISTRATION TOTAL: 640 FULL PAID FROM SPONSORING ASSNS: 599 NET PROCEEDS \$151,609.90

Percent Proceed Split				
APLS	86	14.5%	\$	21,983.44
CLSA	275	46%	\$	69,740.55
NALS	134	22.5%	\$	34,112.23
NMPS	36	6%	\$	9,096.59
PLSW	13	2%	\$	3,032.20
WFPS	55	9%	\$	13,644.89
	599	100%	\$1	151,609.90

CUMULATIVE INDEX FOR LINES AND POINTS

The Cumulative index has been prepared by Herbert W. Stoughton, PEPLS for Lines and Points and is complete as an index of all the Lines and Points issues and very professional. However, the actual assembly of all the available Lines and Points issues is incomplete and is planned to be available by the end of the coming summer to be included in the PLSW Website under the Lines and Points heading.



"Journeys: One Individual's Excursions into the Surveying and Mapping Professions: Volume I"

by Herbert W. Stoughton

Price: \$30.00 (includes S&H) Proceeds from the sale will be invested in the PLSW Scholarship fund.

Send orders to: 2821 Carey Avenue, Cheyenne, WY 82001

APPLY NOW FOR A PLSW SCHOLARSHIP

If you are attending college with the intent of pursuing a career in Land Surveying in Wyoming, we want to give you money!

A Scholarship Application is available on our website http://www.plsw.org





HINTS TO AUTHORS

Dear Readers:

The editors of Lines & Points wish to convey our gratitude to the numerous authors who have contributed photographs, technical and professional articles, and other information to be incorporated into the quarterly journal. In recent years, the assembly and redaction of the submitted materials has taken on considerable technical application of the various English language compilers, office suites, and "publishing suites". This means that the communication and transfer of information and materials arrive at the editors' desktops in a multitude of formats and styles, which sometimes are not compatible with the PLSW personal computers.

We, the editors, are setting forth some simple rules for submitting materials which, hopefully will simplify your efforts and make the transition to the published version simpler and less time consuming.

1. If you have any questions or comments, please contact S. Dennis Dawson, Publications Comm. Chm., (dennieandbarb@gmail.com) or Michael A. Flaim, Editor-in-Chief (mike.flaim@bresnan.net).

2. If an article contains any illustrations, photographs, graphs, or other graphics, please transmit them as separate individual files. You may also include the illustrations within your manuscript, but the image integrity/quality is degraded seriously when attempting to extract them from the manuscript to create a published digital image. The Editor-in-Chief states that a much better digital resolution is obtained from the separate, individual illustrations submitted.

3. All submissions (electronic and snail mail) should be sent to S. Dennis Dawson (4005 Snyder Avenue; Chevenne 82001). It is recommended a second copy be sent to Michael A Flaim (1212 Southwest Drive; Cheyenne 82007). It is further recommended a third copy be sent to Dr. Herbert W. Stoughton (2829 Carey Avenue: Cheyenne 2001. Dr. Stoughton has spent over two decades as a technical review editor of two national surveying journals, and will provide editorial/redactory review for grammatical presentation and punctuation format. The criteria for acceptable conformity to grammatical usage and punctuation shall be governed by the U.S. Government Printing Office Style Manual (any edition is acceptable).

4. It is strongly recommended that all submissions be transmitted six weeks prior to the publication deadline. The publication deadlines are: 1 January; 1 April; 1 July; and 1 October, annually.

5. Lines & Points is the official publication for Professional Land Surveyors of Wyoming. the Therefore, hence forth there will be incorporated in the publication all formal announcements pertaining to official business of the organization and other announcements. This includes announcements for the Annual Meeting; state-wide membership meetings; seminars; and the Fall Technical Session. These announcements are to be submitted to the PLSW Secretary/Treasurer John J. Studley (PLSW; Attn.: Mr. Jack Studley; P.O. Box No. 8; Cheyenne 82003) (jklz0318@gmail.com), at least four weeks prior to the publication deadline in which the announcement will appear. The PLSW Secretary/Treasurer will circulate the announcements to the Publication Comm. Chm.: the Editor-in-Chief; and the PLSW Board of Directors.

6. Advertisers and prospective advertisers should communicate directly with PLSW Secretary/Treasurer Studley about any advertisements and modifications.





Thoughts on Professional Practice and Education

Article 6: License Forum Shopping

by: Knud E. Hermansen, P.L.S., P.E., Ph.D., Esq.[†]

This is the seventh article I have prepared in the series offering thoughts on professional practice and education. In this article, I wish to discuss forum shopping for licensing, experience, and testing timing. To better understand forum shopping, some background on testing will help understand the purpose and reasons for forum shopping.

I have been surveying for fifty years and been licensed to practice surveying in six different states. When I tested for many of my licenses, I had to show up within the state on a certain day, at a certain location, to take an exam only offered once or twice a year. Given the pre-application time and time after the exam that was required to grade, review, and receive the results, it was not unusual to wait a year between a desire or need to obtain a license in a state and eventual receipt of the license (assuming the pre-requisite experience and education was already attained, and the required testing was passed). NCEES1 has considerably reduced the cycle time and wait time for the fundamentals of surveying (FS) exam and the professional surveyor's (PS) exam. I would venture the opinion that any delays are now centered upon waiting for the availability of a seat at a testing center rather than NCEES or the state licensing board to perform their actions. NCEES exams may be taken in hundreds of testing sites across the nation. By way of example, a student in Ohio that plans to visit grandparents in Florida, over Christmas break, with enough lead time to reserve an empty seat at a Florida testing center, can take the NCEES exam in Florida during their visit.

The Covid pandemic has forced many states to offer state specific exams through testing centers on an as-need basis. Previously, states only offered state specific exams once or twice a year on a specific date at a specific location. Many states have had to adjust for Covid to avoid large



gatherings or to quell unrest from applicants that expect state specific exams to be conducted with the same ease in scheduling and promptness experienced with NCEES testing.

The ease of professional testing has allowed for those desiring a surveying license to go forum shopping. What is meant by forum shopping? I am referring to the ability of an applicant to choose among all the states to find the easiest route, in their circumstances, to obtain professional licensing.

I wish to make it clear that a person intending to provide surveying services in a particular state, must have a surveying license for that state. The person must deal exclusively with the licensing board in that state. However, not all aspiring licensees need to be licensed in a particular state to fill their employment requirements or their professional objectives. For example, many individuals employed by the United States Government simply need to be licensed as a surveyor in any state to qualify for higher pay or positions. It does not matter what state the federally employed surveyor has their license. The licensed status of faculty members is not necessarily governed by the state where the university is located. The status of employees in large firms where they do not stamp and seal documents is assured by licensing in any state, not necessarily the state they reside or work in.

In some cases, an individual working in a firm may desire 'professional status' yet they cannot meet the requirements for a survey license in their state of residency. Perhaps they don't have a surveying degree, or the correct degree, or experience required in that state. Nevertheless, these individuals can seek to obtain licensing in another state where they do meet the requirements. For example, a GIS specialist working in a state not requiring a license for GIS services can nevertheless enhance their credibility and reputation by becoming a licensed surveyor in a state that does require a surveyor license for GIS services and will count experience performing GIS services.

Perhaps the most common forum shopping is conducted by the unlicensed person that is embarking on their professional career and desires to take the fundamentals of surveying (FS) exam. In terms of taking their fundamentals of surveying exam, this individual can begin the process in any state regardless of their state of residency. A person can start their professional licensing by choosing a state that charges the least for an application or has the least restrictions on the initial or subsequent process for renewal. One state may allow both NCEES' exams be taken without any restrictions versus the state of residence that may require numerous pre-conditions before an exam can be taken. I am unaware of any state that will not accept the NCEES fundamental of surveying exam results obtained by a person through another state.

(Continued on Page 17)

FUNDAMENTALS OF SURVEYING: EXAM STUDY COURSE

ORDER TODAY WFPS.ORG

Over 16 hours of videos and manual Member Price - \$199

Topics included are based on the current NCEES Fundaments of Surveying (FS) exam specifications and recommended knowledge.

Presenters: Dane Courville, PLS and Knud Hermansen, PLS, PE, Ph.D.



FORT STEELE ASTRONOMICAL STATION OF 1872

U.S. Geographical Surveys West of the 100th Meridian 1st Lieut. George M. Wheeler, U.S. Army Corps of Engineers



George M. Wheeler portrait by Alice Pike Barney "Captain Wheeler" 1892

"The Four Great Surveys of the American West", U.S. Government sponsored exploration and mapping expeditions whose purpose was to document the geology and natural resources of the American West, were carried out from the late 1860's to the late 1870's. Civilians led three of the surveys: Ferdinand V. Hayden, John Wesley Powell and Clarence King, the lone Military survey was led by 1st Lieutenant George Montague Wheeler.

The Wheeler survey, by far the most ambitious of the surveys, was officially known as "The United States Geographical Surveys West of the One Hundredth Meridian". This effort intended to map all of the U.S. territory west of the 100th meridian and was the culmination of sixty years of Army surveying. The Powell survey was focused on the western mountains of Colorado and the canyon country of Utah but is most well-known for the by Todd Cedarholm, PLS

exploration of the Colorado River and the Grand Canyon. The King, Hayden, and Wheeler surveys each included parts of Colorado and Wyoming. This overlap and duplication of effort ultimately led to conflict that would lead Congress in 1879 to terminate the four surveys and create a single agency the United States Geological Survey.

The reports published by the Wheeler Survey include multiple editions of a map titled "Progress Map of the U.S. Geographical Surveys West of the 100th Meridian". This map divided the survey area into 95 sheets which are shaded to show published sheets, areas of work in progress, areas proposed for immediate future mapping, and areas mapped by the King 40th Parallel Survey. Of particular interest is the area in southern Wyoming along the Union Pacific Railroad corridor where symbols were drawn to mark Primary Astronomic Stations Completed. The Wheeler Astro Stations were established in locations that provided access to the telegraphic lines necessary for longitude measurements in Green River, Fort Fred Steele,



CLOSE UP IMAGE OF FORT STEEL BM

October 2024



IMMEDIATE SITE VIEW OF FORT STEELE BM

Laramie, and Chevenne. The USC&GS had previously established an Astro Station near Sherman WY at the high point of the Union Pacific Railroad. Appendix FF attached to the Wheeler 1874 Annual Report provides sketches and detailed descriptions of the location and construction of the astro stations in Fort Steele, Chevenne, Laramie, and Green River. Astro stations had been established near the rail stations in each of these towns, however, downtown development and reconstruction of the rail lines made it highly unlikely that any of the original downtown monuments could be recovered. The Fort Steele location, however, gave me cause for optimism. The search for and possible recovery of original Astronomic Stations was the impetus behind this research 150 years later.

Fort Fred Steele was built in 1868 and occupied until 1886. The purpose of the Fort was to provide regional law enforcement and protection for the Union Pacific Railroad. A small town had grown up nearby and after the de-commissioning of the Fort the town prospered as a logging center and



VIEW LOOKING NORTH FROM FORT STEELE BM TOWARD THE UP RAILROAD



1880 Progress Map, US Geographical Surveys of the West of the 100th Meridian, Detail of southern Wyoming showing Wheeler Astronomic Station locations

sheep operation. The Lincoln Highway passed through town until 1939 when Route 30 was moved to the current location of I-80, this proved to be the end of the community of Fort Steele. Fort Steele was listed on the National Register of Historic Places in 1969 and designated a Wyoming State Historic Site in 1973. Today, the Park includes several reconstructed buildings, a cemetery, and the original Fort foundations. The site appears today very much as it was described by Wheeler in 1872, "Taken altogether, its surroundings are not inviting, and, if we except the country about the Green River, no region which the Union Pacific Railroad traverses is more destitute of animal and vegetable life"

Survey and Establishment of the Fort Steele Astro Station

In November of 1872 members of the United States Geographical Surveys West of the One Hundredth Meridian, led by 1st Lieutenant Georg Montague Wheeler, established a camp at Fort Fred Steele, Wyoming, a military post on the bank of the North Platte where the Union Pacific Railroad crosses the river. Their task for the next 30 days was to establish a survey station and to determine the precise latitude and longitude by astronomic methods, astronomic stations were essential as initial points for triangulation networks that formed the control framework for the topographic surveys. The site was selected in large part due to access to a telegraphic connection necessary for the time difference observations required for the determination of longitude. For both latitude and longitude observations a combined transit Wurdeman No. 26 meridian instrument was used. The instrument was mounted on a 7 foot long pine post planted firmly in the ground and the entire observatory enclosed in a canvas tent to protect the instruments and observers. Latitude was determined by the Horrebrow-Talcott method in which a measurement is made of the zenith distances of two stars located close to the meridian with similar declinations but located on opposite sides of the zenith. The latitude is computed from one-half the difference in zenith distance and the mean of the star declinations.

The weather in November was miserably cold, windy and snowy with temperatures often reaching minus 40 degrees F. The extreme winter conditions made observations difficult and sometimes impossible, freezing the chronometer batteries and ink and forcing the surveyors to abandon the observatory tent for warmer quarters.



US GEOGRAPHICAL SURVEYS OF THE WEST, PROGRESS REPORT, ASTRONOMY, PLATE NO.4, DETAIL OF FORT STEELE SITE IN 1872, SURVEYED POSITION INDICATED AT TOP OF MAP, ELEVATION DETERMINED FROM BAROMETRIC MEASUREMENTS.



"WORD" AND ADOBE ".pdf" FORMATS THAT CAN BE EDITED AND ADAPTED FOR YOUR PARTICULAR USE

Contact Secretary/Treasurer: Olian T. Shockley Olian_Shockley@msn.com or phone 307-875-0146

From Wyoming's own W. A. Richards

★★★★★ "must-read"—Goodreads & Amazon

Join our future governor as he surveys for settlement of the West. Writing in camp, he vividly and often humorously records his hardships and challenges—

- As a fledgling surveyor laying out townships west of Omaha, 1869
- Surveying the rugged southern and western boundaries of Wyoming Territory, 1873 and 1874
- Exploring and homesteading in the Bighorn Basin, 1884 and 1885

Plus technical explanations and essays by Dr. Herbert W. Stoughton and others



- An essay with maps of Richards's Nebraska surveys by Gene A. Thomsen, a Nebraska deputy state surveyor and historian
 Paul Scherbel's boundary corner remonumentation campaign
 Biographical articles including Dennis Bland's "W. A. Richards: Surveyor to Statesman"
- · Richards's dramatic published hunting stories and his revealing letters

By Lucia McCreery #B Red Bank Press®

Paperback 6" x 9" 296 pages 55 illustrations and photos, 22 in full color 30 maps and diagrams Available at bookstores, libraries, and at a discount on WilliamARichards.com

Reviewed in the October 2023 issue of Lines & Points



Monument Search and Recovery

On the day of our visit to Fort Steele we exited I-80 at the Fort Steele Rest Area and followed the paved park road north from I-80 through the park entrance gate toward the restored Post Traders House. As we approached the house, we immediately recognized the familiar orange Carsonite post marking a low iron pipe and brass cap, not what we expected to find but a good start. The monument proved to be an old style USGS iron post with a B.M. brass cap inscribed "6512 ADJ-03". A further search failed to produce evidence of a pine post or possible accessories to the astro station.

History of the Fort Steele Astro Station

Back at the office I quickly located the NGS Data Sheet for the monument, the history portion of the data sheet described the monument as being set in 1904 by the USGS. Looking for an explanation as to the origins of the iron post and cap I began to review the USGS Annual reports looking for triangulation and level work in Wyoming beginning in 1904 and working backwards. Eventually I found what I was looking for in the "USGS Results of Primary Triangulation and Primary Traverse Fiscal Year 1901-1902", page 85:

Fort Steele, Astronomic Station, Carbon County, "Situated about 700 feet southeast of railroad station at Fort Steele, across a small gulch 6 feet deep and about 500 feet southwest of the Fort Steele Hotel. Station mark: An iron bench-mark post projecting 6 inches above ground. The station is described in Wheeler's 1872 report and was originally marked by a pine post 3 feet in diameter and 2 ½ feet high above ground, but was sawed off and sides chopped away until in 1901 it stood but 1 foot above ground and was dug up and replaced by the iron post noted above."



DETAIL FROM USGS FORT STEELE QUAD SURVEYED IN 1891, POB was Fort Steele BM using adjusted Wheeler 1872 latitude and longitude



US GEOLOGICAL SURVEY OF THE TERRITORIES, DETAIL IN THE VICINITY OF FORT STEELE FROM "MAP SHOWING THE PRIMARY TRIANGULATION OF 1877-1888, BY A.D. WILSON CHIEF TOPOGRAPHER

The elevation inscription "6512 ADJ-03" and the fact that the NGS was maintaining a Data Sheet at all led me to believe that the elevation associated with the monument had its source in USC&GS precise leveling work and not entirely from USGS spirit levels. The 1903 USC&GS Report showing The Progress of the Work, page 86, describes leveling work from the Union Pacific station at Rock Creek passing through Fort Steele and on to Red Desert following the Union Pacific line. Permanent benchmarks were established at comparatively short intervals along the line including a benchmark at the Fort Steele bridge. The 1905 Twenty-Sixth Annual Report of the USGS, for the work of 1904-1905, page 136, describes leveling work in Wyoming, "Mr. M.S. Bright, levelman, completed a circuit of levels begun the season previous and continued the line down the Platte River via Casper and Orin Junction, at which place it was connected with

the precise-level line of the Coast and Geodetic Survey..."

The connection from the USC&GS precise levels to the Wheeler astro station is found in USGS Bulletin 558, "Results of Spirit Leveling in Wyoming 1896-1912, Inclusive" published in 1914.

Page 37,

Fort Steele, on southeast corner of stone foundation under more eastern one of two southern iron columns supporting the railroad water tank west of station, letters "U.S.B.M." are cut in east face of foundation just under bench mark; bottom of square cut (C.&G.S.b.m.N 2) ---- 6514.547 feet

Fort Steele, in front of Union Pacific R.R. Station; top of rail ---- 6512.2 feet

Fort Steele, triangulation station, 600 feet south of station; iron post stamped "6512, Adj,. 1903" ---- 6513.270 feet

Hayden survey plans go awry

A.D.Wilson, Chief Topographer for the 1877-78 Hayden Survey, was very familiar with the work of Wheeler and King and decided to take advantage of their earlier astronomic work in Salt Lake City and Ogden, Utah by connecting the Hayden triangulation to both of the Utah observatories. Wilson had made plans to incorporate the Wheeler astro station at Fort Steele into his work, however, in his Report of 1877 and 1878 he describes the events of the last weeks of the 1878 field season that cut short the work of the triangulation party and prevented the connection at Fort Steele;

August 24 – Indians attacked the camp at Henry's Lake making off with most of the stock and all their supplies except what they could carry on their backs. The party managed to save the guns and ammunition and cache the survey instruments. The party retreated to Upper Geyser Basin and rendezvoused with the main Hayden

October 2024

party. Wilson and guide Harry Younts later returned to the Henry's Lake camp on borrowed mules to find the camp destroyed but the hidden instruments undisturbed.

September 7 – Headed north to Mammoth Hot Springs and rendezvoused with General Miles who had recently engaged the Indian party that had raided the Henry's Lake camp. General Miles' party had killed 11 Indians, captured 35, and retrieved all of the stolen stock.

September 24 – Occupied Electric Peak and Mt Washburn despite heavy snow that was now covering the Park up to a foot deep. The party headed south along the east shore of Yellowstone Lake hoping to make a station on Younts Peak. Another heavy storm hit and the party decided to head south toward the Wind River before it was too late to cross the range. Marching by way of To-gwotee Pass they made the valley of the Wind River after five days of hard struggle, thence by forced marches to Rawlins on the Union Pacific Railroad.

"This was one of the worst snow-storms I had ever encountered...I was in hopes of visiting Fort Steele and making another connection with the astronomical station made there by Lieutenant Wheeler's survey; but the storm had been so severe and the weather continued cold and windy, I determined to close up for the season. Loading everything on the cars we arrived in Cheyenne on October 17 and soon after we were on our way to Washington"

Hayden had been critical of Wheelers topographic work for inaccuracies and for the fact that the use of hachures in lieu of contour lines made the maps relatively useless for geologic mapping. However, at an 1874 Congressional Hearing to ascertain whether inefficiencies due to overlaps and conflicts between the Four Surveys could be eliminated by a consolidation, Powell praised Wheelers astronomic work stating that it "…ranks with the best that has ever been done in this country…".¹

Conclusion

The Fort Steele monument presents a unique and historic geodetic pedigree not only in Wyoming but across all the western states. A debt of gratitude is owed to the USGS surveyors who understood the significance of the rotten pine



stump they discovered at Fort Steele, not only did they preserve the surveyed position of the astro station but more importantly they documented their work clearly and precisely for the future. As barren and desolate as the site may be, a visit to Fort Steele to stand in the footsteps of Wheeler, Hayden, A.D. Wilson and probably Gannett and King is definitely worth the short detour.

Bibliography

1. USGS Circular 1362, "Star Crossings and Stone Monuments, Field Astronomy by the Wheeler Survey..." William E. Wilson 2010

2. "Finding North America – Longitude By Wire", Richard Stachurski, Univ of South Carolina Press, 2009

3. "Geodetic Surveys in the United States, The Beginning and the Next 100 Years 1807-1940", Joseph F. Dracup, US Coast and Geodetic Survey

4. "Great Surveys of the American West", Richard A. Bartlett, University of Oklahoma Press, 1962

5. "Progress Report upon the Geographical and Geological Explorations and Surveys West of the One Hundredth Meridian 1872" First Lieutenant Georg M. Wheeler, Government Printing Office, 1874

6. "Eleventh Annual Report of the United States Geological and Geological Survey of the Territories Embracing Idaho and Wyoming 1877" F.V.Hayden, 1979

7. Appendix FF "Progress Report upon the Geographical and Geological Explorations and Surveys West of the One Hundredth Meridian 1872" First Lieutenant Georg M. Wheeler, Government Printing Office, 1874

8. "Results of Primary Triangulation and Primary Traverse Fiscal Year 1901-1902" United States Geological Survey, Bulletin No. 201, pp 83-90, H.M. Wilson et al, 1902

9. "U.S. Coast and Geodetic Survey, Progress of the Work 1902-1903" pp86-87, Government Printing Office, 1903

10. "Twenty-Sixth Annual Report, US Geological Survey 1904-1905" pp136-137, Government Printing Office, 1905

11. "Results of Spirit Leveling in Wyoming 1896 to 1912 Inclusive" Bulletin 558, pp37-38, R.B. Marshall, Chief Geographer, Government Printing Office 1914

12. NGS Data Sheet, PID MP207, Designation – 6512, USGS Fort Steele quad 13. Wyoming Parks, Fort Fred Steele Historic Site, Web brochure

14. Map - 1880 Progress Map, US Geographical Surveys of the West of the 100th Meridian

15. Map – Appendix FF US Geographical Surveys of the West, Progress Report, Astronomy, Plate No.4,

16. Map – USGS Fort Steele quad 1893

17. Map – US Geological Survey of the Territories – F.V. Hayden - Map Showing the Primary Triangulation of 1877-1888, by A.D. Wilson Chief Topographer



(Continued from Page 8)

There are numerous factors that may impact forum shopping. Licensing requirement is a major factor. States vary according to academic requirements, years of experience, or acceptable experience. Another major factor is timeliness of licensing steps. For example, some states allow both exams (FS and PS) be taken at or near graduation. Some states require four years with an appropriate degree, other states require only two years with an appropriate degree. Cost is another factor. Renewing a survey license in one state is \$50 while another state demands \$300. The last factor worth mentioning is continuing education. Some states don't require continuing education. Other states have minimal or no continuing education requirements.

In summary, given the ease of taking exams, unless an individual must be licensed in a particular state to provide services, many will shop for the best licensing deals among the various states.

1 NCEES stands for the National Council of Examiners for Engineering and Surveying

† Other books and articles by Knud can be found at https://umaine.edu/svt/faculty/hermansenarticles/



Combining innovative technology with intuitive functionality, the Trimble® SX12 scanning total station saves time and maximizes efficiency. The SX12 collects high-quality, high-speed scan data, providing detailed site context in a seamless workflow that enables informed and faster project-based decisions.

Want more information? Contact:

Jason Dysthe, Geospatial Sales Representative jasond@frontierprecision.com 720.214.3500 | 800.652.1522 [Toll Free]

> Frontier Precision 5480 West 60th Avenue, Unit A Arvada, CO 80003



Authorized Distribution Partner

TRIMBLE SX12 SCANNING TOTAL STATION

> THE INDUSTRY'S MOST INNOVATIVE SOLUTION FOR SURVEYING, ENGINEERING, AND SCANNING PROFESSIONALS.

PRODUCTS | TRAINING | REPAIR RENTALS | TECHNICAL SERVICES

LEARN MORE www.frontierprecision.com/product/trimble-sx12-scanning-total-station

LINES AND POINTS

P.O. BOX 8 CHEYENNE, WY 82003



SURVEY | ENGINEERING | PLANNING | NATURAL RESOURCE SERVICES y2consultants.com 307 733 2999 offices in Jackson, Cheyenne, and Pinedale

ONSULTANTS Y2



LAND SURVEYING

Boundary/Property Lines Existing Conditions Surveys ALTA/NSPS Surveys Route Surveying Topographic Mapping FEMA Elevation Certificates Legal Descriptions Certificates of Placement As-Built Surveys/Drawings

GIS & MAPPING

Web/App-based Mapping Topographic Modeling Spatial Analysis

Subdivision/Condominium Plats Improvement Location Surveys Trail, Wetland, Resource Mapping Water Rights Permitting Construction Staking Survey Control for Aerial Photos

Large-scale GeoDatabase Mgmt Aerial Imagery - Current/Historic Slope/Aspect Data Analysis

(Y2 Consultants merged with Western Research & Development in 2020)