Good Horses and Agreeable Companions

The Search for the Observatory in Ye Forks of the Brandiwine

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On a gentle south-facing slope in the farmlands of Newlin Township, Chester County, Pennsylvania, a small stone stands sentinel over the valley of the Brandywine Creek. The Stargazer's Stone as it has come to be known, stands as a lasting monument to the surveying and scientific exploits of Charles Mason and Jeremiah Dixon. Protected by a small stone enclosure constructed by the Chester County Historical Society in 1908, this stone continues to tell the story of Mason and Dixon's survey to establish the boundary between Pennsylvania and Maryland.

The "Stargazers Stone" is commonly thought to be the very location where Mason and Dixon established their observatory in the garden of property owned by Joel Harlan (John Harland in Mason's Journal) *"in the Forks of the Brandiwine"* to make Astronomical observations in determining the latitude relative to the southernmost point of Philadelphia. The boundary between Pennsylvania and Maryland had been settled upon as a line of latitude lying 15 miles south of the southernmost point in Philadelphia. Having spent several weeks determining the latitude in Philadelphia, Mason and Dixon traveled approximately 30 miles to the west into the Brandywine Valley arriving at the Harlan farm. From this location, Mason and Dixon would have spent many nights taking astronomical observations, which prompted the locals to dub the point as "The Stargazer's Stone".

There is little doubt that the Stargazer's Stone has some significance to the Mason and Dixon survey, however there is some question as to what its purpose was. Two 19th century Chester County Atlases depict Mason and Dixon's observatory several hundred feet north of the Harlan house in the vicinity of the Stargazer's Stone. In 1908, Mr. Henry K. Harlan, who was at the time 71 years old, recounted how his father and grandfather took great care to protect the stone. At one time, the stone had become covered with earth due to years of erosion from the land above. He and his father Joel located the stone using a pitchfork and using great care to mark the location, raised it to the surface. Based on the information contained on the atlases and the first person accounts of the Harlan family, it seems certain that the Stargazers Stone we see today has some significant connection with Mason and Dixon, but does the stone mark the physical location where the astronomical observations were made?

In an effort to calculate the distance between the Stargazer's Stone and another position established by Mason and Dixon, which they referred to as "The Post Marked West", troubling disparities arose between the theoretical distance derived from Mason's Journal and the distance found by actual measurement using the Global Positioning System. Simply put, the two points were too far apart, thus bringing into question the belief that one or the other were the actual locations where Mason and Dixon performed the astronomical observations.

In an address given by J. Carroll Hayes on July 14, 1908, and subsequently published in the Bulletins of the Chester County Historical Society in 1929, Mr. Hayes suggests that *"Finding they were about 357 yards south of the latitude of the starting point, they planted a stone, presumably at the correct location, viz.: 357 yards north of their observatory in the garden."* In a footnote of the published account the writer notes: *"A measurement of 357 yards from the stone brings us south of the Harlans house and the Embreeville and West Chester Road. It seems probable, therefore, that the garden at that time was not north of the house, as now, but was on the sunny slope running south from the road leading towards the Brandywine. This would provide a much pleasanter point for observations during the wintry months of January and February than north of the house".*

Figure 2- Map of southeastern Pennsylvania showing the locations of the Southernmost Point of Philadelphia, the Stargazers Stone and the Post marked West.

Figure 1 - Detail of the location of a Meridian line drawn south from the Stargazers Stone

To test Mr. Hayes' theory, measurements were undertaken in December of 2005 from the Stargazers Stone along the meridian line for a distance of 356.8 yards to determine where the observatory would have been located. This measurement would place the observatory approximately 310 feet south of the Harlan house and 60 feet north of the north bank of the Brandywine Creek. Based upon measurements from the observatory to the stream taken by Mason and Dixon and recorded in their journal, it is not possible that the observatory could have been located this far south.

The monument marking the Post Marked West is not original to the Mason and Dixon survey, having been placed in the 1950's to represent that location based upon measurements contained in Mason's Journal. Modern measurements have confirmed that it is close to the original location; being located approximately 5' west of and 21 feet north of the original position marked by Mason and Dixon.

Figure 1 - 1873 A. R. Witmer Atlas of Newlin Township, Chester County, PA showing the location of the Mason and Dixon Observatory at a point north of the Harlan House opposite the bend in the road. This point is most likely a reference to the Stargazer Stone. ***From the map collection of the Chester County Historical Society.***

In order to determine the original location of the observatory used by Mason and Dixon, it would be necessary to follow in their footsteps. Mason and Dixon measured the line between the observatory at the Harlan house and the Post Marked West on two different occasions and their observations were recorded in their journal. The Journal also includes a record of the distances between the observatory and the roads and streams that were crossed while measuring along the meridian. The West Branch of the Brandywine Creek was crossed three times within the first mile of the survey and the distances from the observatory to each of these crossings was recorded. Using the information contained in the Journal kept by Charles Mason during the survey of the 15-mile line from the Stargazer's Stone to the Post Marked West, it would be possible to retrace the work of the surveyors and calculate the location of the observatory. By locating the present day location of the stream along the course of the original survey, one could use the recorded distance to each crossing and measure in a reverse direction to calculate the location of the Observatory.

The Mason and Dixon Measurements

In 1764 and 1768, Charles Mason and Jeremiah Dixon performed surveys between an astronomical observatory established near the Harlan homestead and the "Post Marked West" in the field of Alexander Bryan. The measurement of this line was undertaken in 1764 to measure the 15-mile line from the latitude of the "Southernmost Point in Philadelphia" to the line that would divide Pennsylvania from Maryland.

In 1768, the Surveyors returned to the Harlan farm to undertake a project for the Royal Society to determine the length of a degree of Latitude. Recognizing the opportunity offered by the many miles of lines cleared during the course of the survey to establish the boundary, Mason and Dixon proposed to the Society that the lines be accurately re-measured and that additional astronomical observations be taken to determine the Latitudes of locations along the surveyed line. Through weeks of astronomical observations to determine the latitude of positions at the north and south ends of an accurately measured line, a determination could be made of the length of one degree of latitude. This would allow the scientists to better understand the size and shape of the Earth.

Before leaving Philadelphia prior to the commencement of the survey to establish the boundary, Mason and Dixon received a letter from Richard Peters acquainting them with the work that had been performed in 1738 and 1739 to survey the "Temporary Line" to quell the dispute between Pennsylvania and Maryland. The Temporary Line was a means to calm the growing conflicts along the border until a permanent boundary could be drawn. By agreement, the Temporary Line was to be 15 and one-quarter miles south of Philadelphia on the East side of the Susquehanna River and 14 and three-quarter miles south on the west side of the river.

After determining the location of the southernmost point of Philadelphia and discussing the methods to regulate the variation of the compass, a due west line was surveyed from Philadelphia through Philadelphia and Chester Counties. This survey passed through the Harlan property and ended on the property immediately west of the Harlan's on lands of John Newton. From this point, the surveyors measured south fifteen and one-quarter statute miles, which placed them on the Temporary Line. The letter from Mr. Peters to Mason and Dixon reads:

Philadelphia 7th January 1764
Gentlemen:

I hope you have pleased yourselves with good horses and an agreeable companion.
The Temporary Line went through the Township of Darby and the plantation of Thomas Lyeth -through Springfield at Samuel Lewis' -through Providence Township at John Worral's -through Edgmont Township at the widow Yarrels - through Thornburg at Isaac Vernon's - through West Town at Joseph Hunts and through West Bradford at Abraham Marshalls and John Newtons.
At the last place we began to set off the fifteen statute miles and we found it to be about thirty-one mile from Philadelphia.
It is believed that either here or at some place about five or six miles more west there will be found the most level ground. You can go near one Mr. Thomas Woodward's plantation in Marlboro Township. He is a surveyor and well

acquainted with this country and can be of great use to you in showing you the best ground in any part of Chester County contiguous to the County of Newcastle.
I am sure everybody will be glad to oblige you and do you all the service in their power as soon as they are made acquainted with your fullest characters and the business you are employed in. I heartily wish you a good Journey and am Gentlemen

Your most humble servant
Richard Peters

After determining the latitude of the southernmost point of Philadelphia, Mason and Dixon's journal notes; *"Setout from Philadelphia with a Quadrant to find (nearby) a Place in the Forks of Brandiwine having the same Latitude as the South Point of the City of Philadelphia. Jan. & Fixed our Station by the House of Mr. John Harlands (being about 31 miles west of the City of Philadelphia)".* It could perhaps be a generic description of the surroundings, but it should be noted that the surveyors describe the observatory as having been placed "by the house"

On January 13, 1764, Mason and Dixon arrived at the Harlan farm. They *"set up the sector in his Garden (inclosed in a tent), and in the evening brought the instrument into the Meridian, and took the following observations…"* This tent had been made by a Philadelphia sailmaker named Malcolm and served as a temporary home for the Zenith Sector and the Observers while the carpenters constructed a portable wooden observatory. On January 23, Mason notes *"Removed the Sector into the Observatory and in the Evening brought it into the Meridian, N. B. The Sector stands 9-1/2 yards more South in the Observatory than it did in the Tent, therefore 0.3" must be added to all Northern Stars observed in the Tent."* The observations and calculations continued from the newly constructed observatory through February 28.

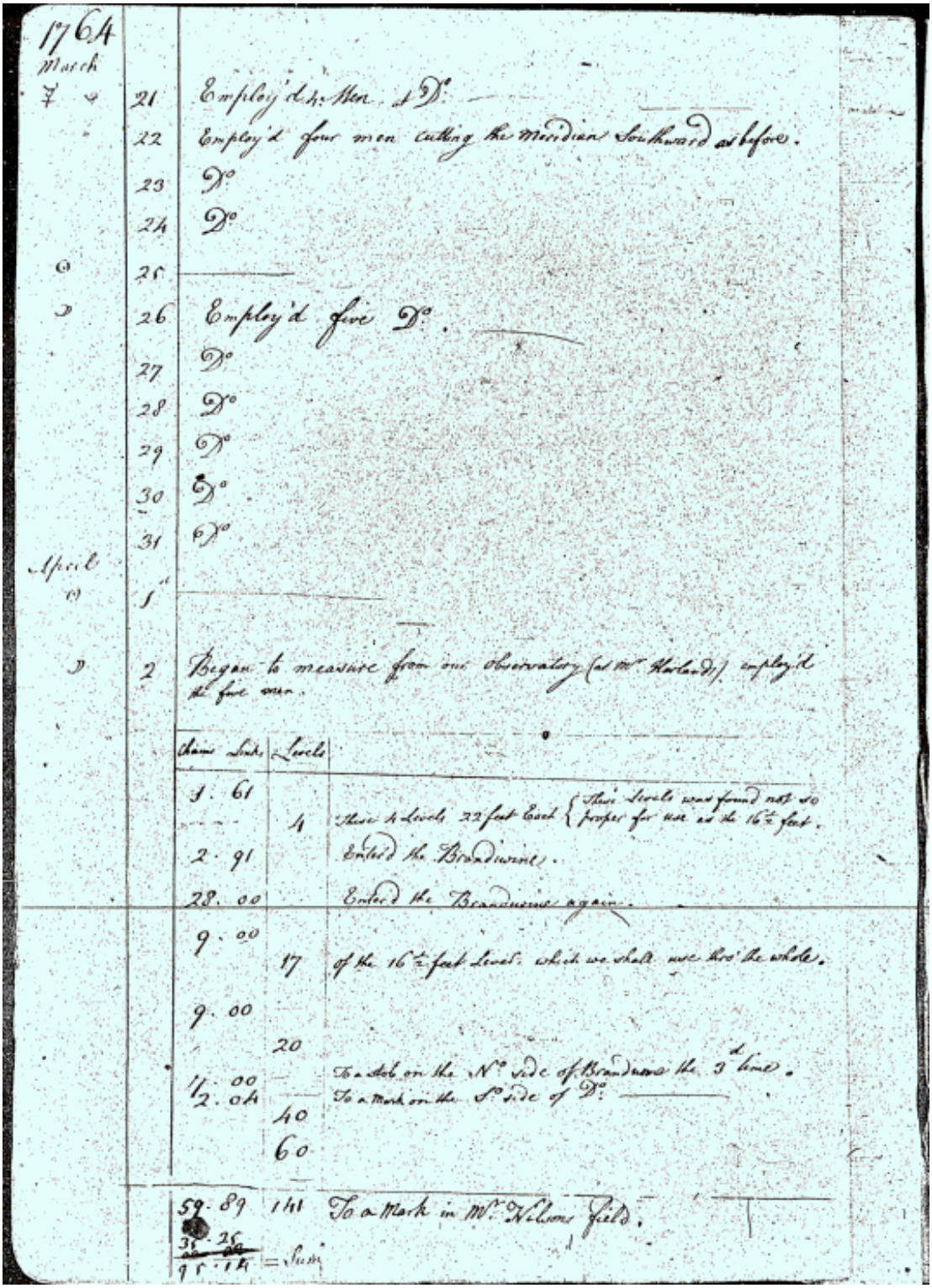
On March 5th, Mason notes *"Cloudy (Sunday) By the Pole Star's transiting the Meridian we placed a mark in the Meridian northward, but it was rendered a little dubious on account of flying clouds."* This is the first reference to a physical mark actually being placed in the Meridian and it is this point that the writer believes is what is now known as the "Stargazers Stone". On March 16th, Mason found the skies clear and noted in the journal that he *"Proved the mark in the Meridian Northward".*

After Several weeks of astronomical observations, they found their observatory to be 356.8 yards south of the Latitude determined at Philadelphia to be the southernmost point of the city. On April 2nd of 1764, Mason, Dixon and five hands began the measurement of the 15-mile line south from the observatory at the Harlan house. The Measurement of the line was undertaken using a 66-foot chain on the flat sections and 22-foot long fir rods or "levels" on the steeper sections of the line. A carpenter by the name of Loxley made these levels and delivered them to the surveyors on February 24. After measuring a section of the line with the chains, the surveyors encountered a relatively steep incline down to the plain adjacent to the Brandywine Creek. The surveyors must have found the 22-foot levels too cumbersome to use and decided instead to use 16.5-foot levels, which were then used throughout the 1764 measurement of the line.

It is interesting to note at this point that the 1969 American Philosophical Society (APS) transcription of the Mason and Dixon Journal contains an error in the first measurement of the 15-mile line that has created a great deal of confusion in the computation of the original observatory location. This mistranslation has made the attempt to locate the position of the original Observatory very difficult. The 1769 American Philosophical Society transcription of Mason's journal records this measurement as 9 Chains and 66 links. The 1887 Pennsylvania Department of Internal Affairs translation records as 1 Chain and 66 links or 386.32'. The 1-Chain measurement appears to be correct in that it conforms more closely with the later 1768 measurements made by Mason and Dixon.

The first measurement in the APS transcription lists a measurement of "9 Chains 61 Links". When taken together with the two subsequent measurements, there is a noticeable disparity between the 1764 and 1768 measurements between the observatory and the first crossing of the Brandywine Creek. Upon further investigation, it was discovered that an 1877 transcription of the Mason journal compiled by the Pennsylvania Department of Internal Affairs notes the first course as being "1 Chain and 61 Links", a difference of 8 chains or 528 feet. To be certain of this distance, it was necessary to return to the original source in Mason's journal to confirm the correct interpretation. For the purpose of this paper, it will be assumed that the correct measurement of the first course is 1 Chain and 66 Links.

The purpose of the writer's 2005 survey was to locate the Brandywine Creek in the vicinity of the crossings made by Charles Mason and Jeremiah Dixon in 1764 and 1768 in an effort to determine if in fact the Stargazer's Stone is the location where Mason and Dixon established their observatory. To accomplish this task, a different sort of "Stargazing" was used. With the advent of The Global Positioning System (GPS), it has become possible to easily and accurately determine the position of points on the Earth using satellites orbiting the globe. This also allows the calculation of the distance between two points lying many miles apart without physically measuring on the ground.



1764 March 7 ☿ 21 Employ'd 4 Men as Do.

22 Employ'd four men cutting the Meridian Southward as before.

23 Do.

24 Do.

25

26 Employ'd five Do.

27 Do.

28 Do.

29 Do.

30 Do.

31 Do.

April ☉ 1st

☽ 2 Began to measure from our Observatory (at Mr. Harland's) employ'd the five men.

Chains	Links	Levels	
1.	61		
		4	These 4 Levels 22 feet Each { These levels were found not so proper for use as the 16½ feet.
2.	91		Entered the Brandywine.
28.	00		Entered the Brandywine again.
9.	00		
		17	of the 16½ feet Level: which we shall use tho' the whole.
9.	00		
		20	
1/2.	00		To a stake on the N° side of Brandywine the 3d time.
2.	04		To a Mark on the S° side of Do.
		40	
		60	
59.	89	141	To a Mark in Mr. Wilsons field.
35.	25		
95.	14	= Sum	

Figure 2 – Excerpt from Mason's Journal for April 2nd 1764 for the measurement of the 15-mile line from the Observatory to the Post Marked West in Mr. Bryan's field. The American Philosophical Society transcribed the first course of 1 chain and 61 links as 9 chains and 61 links in the 1969 transcription.

Figure 3 - Plaque installed on the stone wall erected in 1908 at the Stargazers Stone.

Figure 4 - Global Positioning System (GPS) receiver collecting data from orbiting satellites to establish the Latitude and Longitude of the "Stargazers Stone".

Observations and Assumptions

The water elevation in the Brandywine Creek appeared at the time of my survey to be at what would be considered the normal pool elevation. That is to say, the stream is not in a flood condition from heavy rainfall or snowmelt, nor is there a drought condition. The stream was located on December 20, 2005 and there was evidence that the stream depth had recently receded approximately 3 feet by evidence of the snow line on the southern shoreline at south shore at the third crossing. There had been about 1” of rainfall on the 15-16th of December, but the stream had receded to a stable elevation.

Meridian lines:
The first and northernmost crossing location is nearly perpendicular to the Meridian line. The banks of the stream are nearly vertical with a drop of approximately 5 feet from the top of bank to the water surface elevation on both the north and south banks. Both sides of the stream are wooded and the banks are lined with trees of varying diameter. Some trees have a diameter in excess of 36", which indicated they have been in place for at least 100 years by estimation. There is no evidence of meander of the stream in this area. All indications are that the stream has followed this course for many years. If there has been any change, it may be that the stream has grown wider, although the large trees that line the banks seem to indicate this is not the case. The stream pool appears to be 2' –4' deep in this section of slow moving water.

The second, or middle crossing is at a skew with the Meridian line creating an angle of approximately 36 degrees. The banks in this area are similar to the first crossing. On the West bank, there is evidence of accretion with an area of sediment and stone that creates a shore area that extends toward the center of the stream approximately 15 feet. The East bank is nearly vertical with a number of small trees with the root systems undercut by erosion. The stream is deepest along the eastern shore where there is some evidence of bank erosion. Both banks are lined with trees. The meridian crosses the west shore approximately 60 feet north of the western abutment of a bridge for a railroad crossing. The bridge was constructed in the 1920's and appears to have had a stabilizing affect on the west bank of the stream.

The third and southernmost crossing also crosses the stream at nearly a right angle. The north shore shows evidence of some accretion. The distance between the top of bank and water edge varies between 2 to 4 feet. To the east of the crossing, the bank is nearly vertical and to the west there is an area of sediment and stone that places the waters edge approximately 10 feet south of the top of bank. The fact that the northern shoreline is on the inside edge of a sweeping curve in the stream, would indicate that little erosion has occurred at this location. There is some evidence of erosion on the northern shore to the east where the stream flow carries around the bend of the stream. The south bank is a steep rock incline that rises from 15 to 25 feet to the Embreeville Road (Route 162). The southern shoreline is probably very much like it existed during the crossing made by Mason and Dixon. It is very unlikely that erosion has occurred on this rocky shoreline. The water in this area is rather fast moving compared to the crossings to the north. It is also shallower, ranging from 1-4 feet deep with the deeper water along the outside or southern shore.

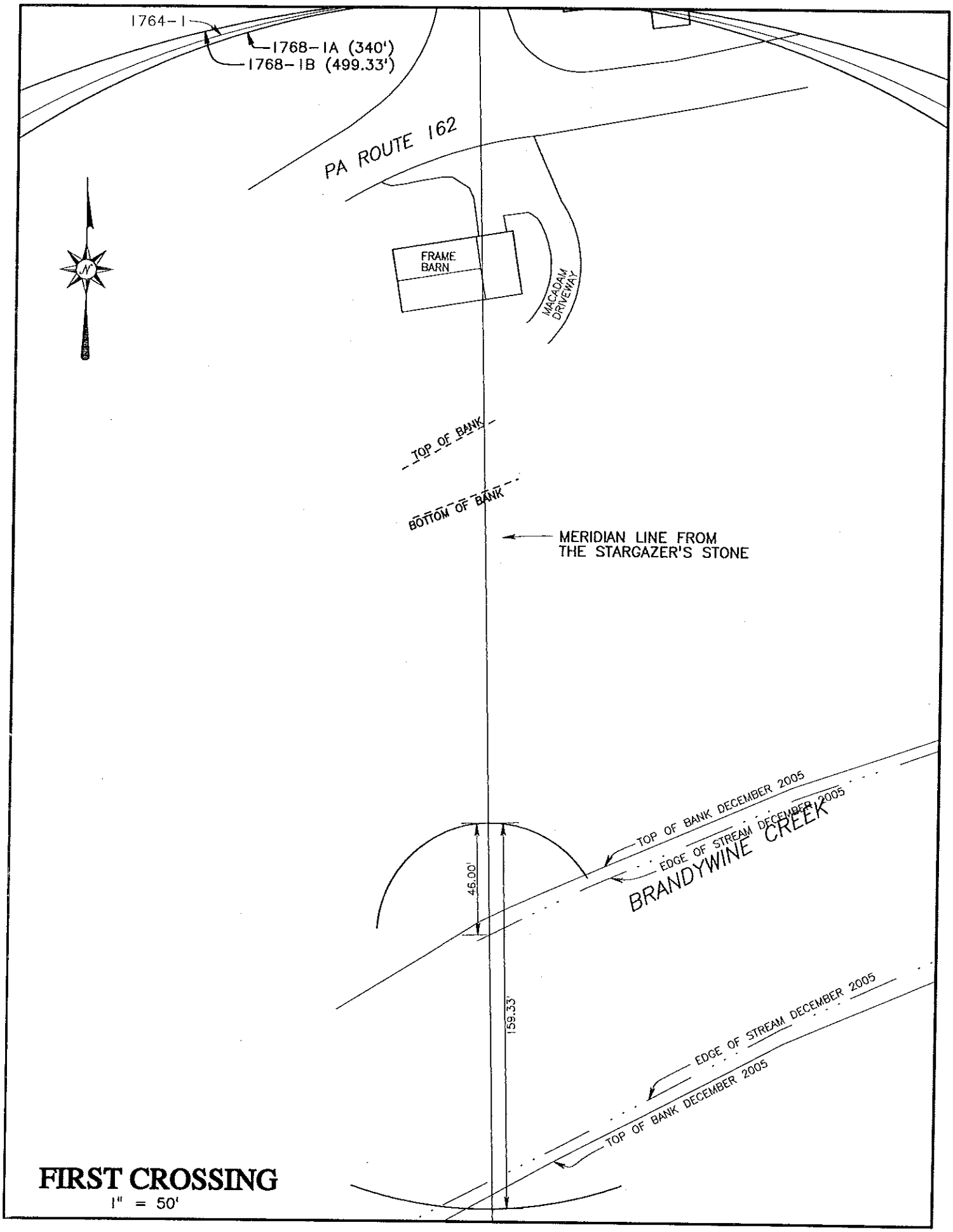
It is interesting to note that the measurements of Mason and Dixon to the stream crossing locations do not fit well if a Meridian line from the stone marking the Post Marked West is used. This is likely attributed to the fact that the Meridian, being 28 feet farther east, intersects the stream banks 36 feet further south at Crossing # 2. Because the stream at Crossing # 2 is flowing at a skewed angle to the Meridian line, any shift in the Meridian line in an East-West direction makes a significant difference in the location of the stream intersection points in the North-South direction. It was therefore decided to use a meridian line through the Stargazer's Stone for the purpose of this survey.

American Philosophical Society Translation of the Journal of Charles Mason - Measurement of the 15 mile line south from the Stargazer Stone to Post Marked West			
APS information found on Page 46			
1 Level = 22 feet for 1st course; 16.5feet thereafter			
1 Chain = 66 feet			
1 Link = 0.66 feet			
Journal entry	**Distance in feet**	**Cumulative distance to River crossing points**	**Comments**
*9 Chains & 61 Links	634.26		NOTE: This entry appears to be an error in the APS translation in that it should be 1 Chain and 61 links. The 1887 translation contained in the "Report of the Secretary of Internal Affairs of Pennsylvania" on Page 94 list this course as 1 chain 61 Links.
4 Levels	+ 88		
2 Chains 91 Links	+ 192.06		
	=	**914.32***	Entered the Brandywine
28 Chains	+ 1848		
	=	**2762.32***	Entered the Brandywine
9 Chains	+ 594		
17 Levels	+ 280.5		
9 Chains	+ 594		
20 Levels	+ 330		
7Chains	+ 462		
	=	**5022.82***	Stob on the North side of the Brandywine
2 Chains & 4 links	+ 134.64		
	=	**5157.46***	Stob on the South side of the Brandywine
* -Assuming that the first course is incorrect and the that the correct measured distance was 1 Chain and 61 Links, 528 feet should be subtracted from the cumulative distances giving the following results:			
	*	**386.32**	Entered the Brandywine
	*	**2234.32**	Entered the Brandywine
	*	**4494.82**	Stob on the North side of the Brandywine
	*	**4629.46**	Stob on the South side of the Brandywine

The distance represented on the plan is based upon the location of the northern edge of the Brandywine Creek, as it existed on December 20, 2005. The shoreline of the stream in 1764 may have been located farther south if the stream has widened in 241years. This location also assumes that the reference “Entered the Brandywine” is to mean that this was the measurement to the northern shoreline and not to the thread of the creek.

1764-1 - “Entered the Brandywine” Distance = 386.32’ from the Observatory

Figure 5 - North shore of the Brandywine Creek at Crossing # 1. The author is pointing to the 10-foot mark on the rod.



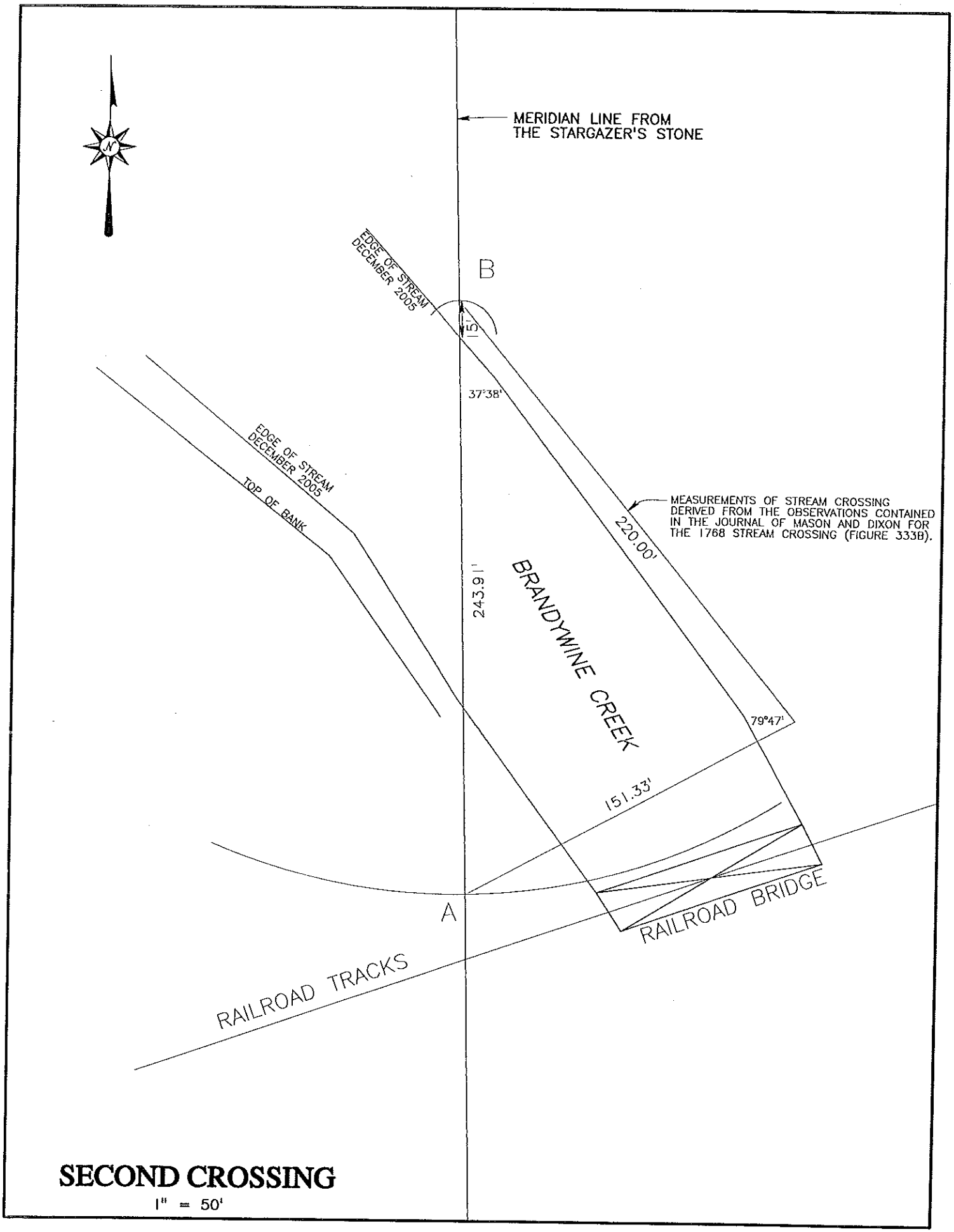
FIRST CROSSING

1" = 50'

Figure 6 - North shore of the Brandywine Creek at Crossing # 1 looking west. The Author's son is standing at the approximate location of the Meridian line crossing.

1764-2 - "Entered the Brandywine" Distance = 2234.32' from the Observatory

The distance represented on the plan is based upon the location of the northern edge of the Brandywine Creek, as it existed on December 20, 2005. The shoreline of the stream in 1764 may have been located farther south if the stream has widened in 241 years. This location also assumes that the reference "Entered the Brandywine" is to mean that this was the measurement to the northern shoreline and not to the thread or center of the creek.



SECOND CROSSING

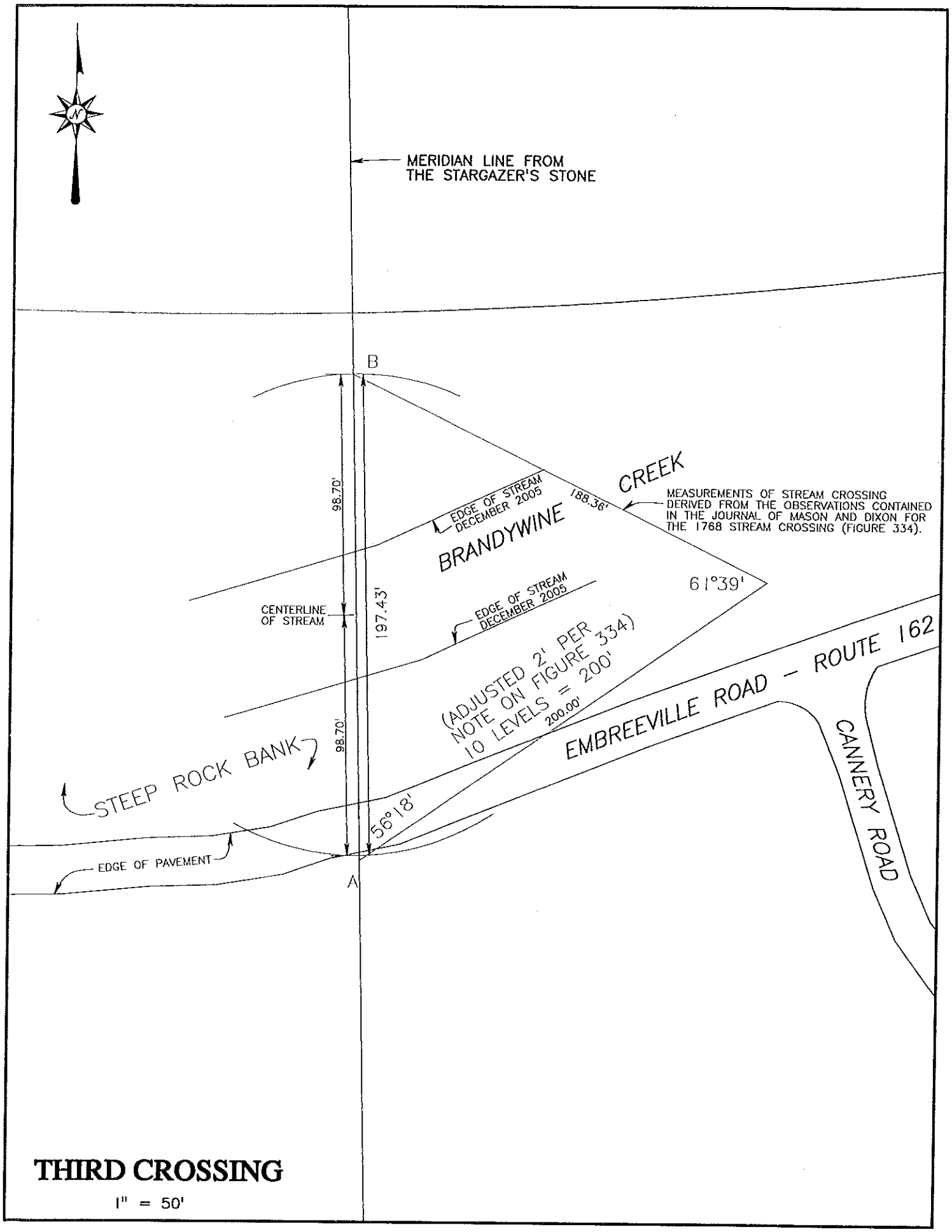
1" = 50'

1764-3A - “Stob on the North side of the Brandywine” Distance = 4494.82 from the Observatory

1764-3B - “Stob on the South side of the Brandywine” Distance = 4629.46 from the Observatory

The distance between the “Stob” (a short straight piece of wood, such as a stake) on the north side of the stream and the “Stob” on the south side was recorded as 131.64 feet. It is unlikely that both stobs were set equidistant from the north and south shorelines. The distance shown on the plan assumes however that both are equal distance from the shoreline. This would place the stob on the north side approximately 40 feet from the waters edge. The stob on the south side would be located somewhere at the top of the steep bank near the road (PA Rte 162).

The location of both measurements 1764-3 & 1764-4 could be farther north or south depending on how far the stobs were actually located from the creek. For instance, if the stob on the north side of the stream were located farther south and closer to the stream, the stob on the south side would also be located farther south. The position of the stobs could have been as much as 40 feet north or south of the position represented on the plan



THIRD CROSSING

1" = 50'

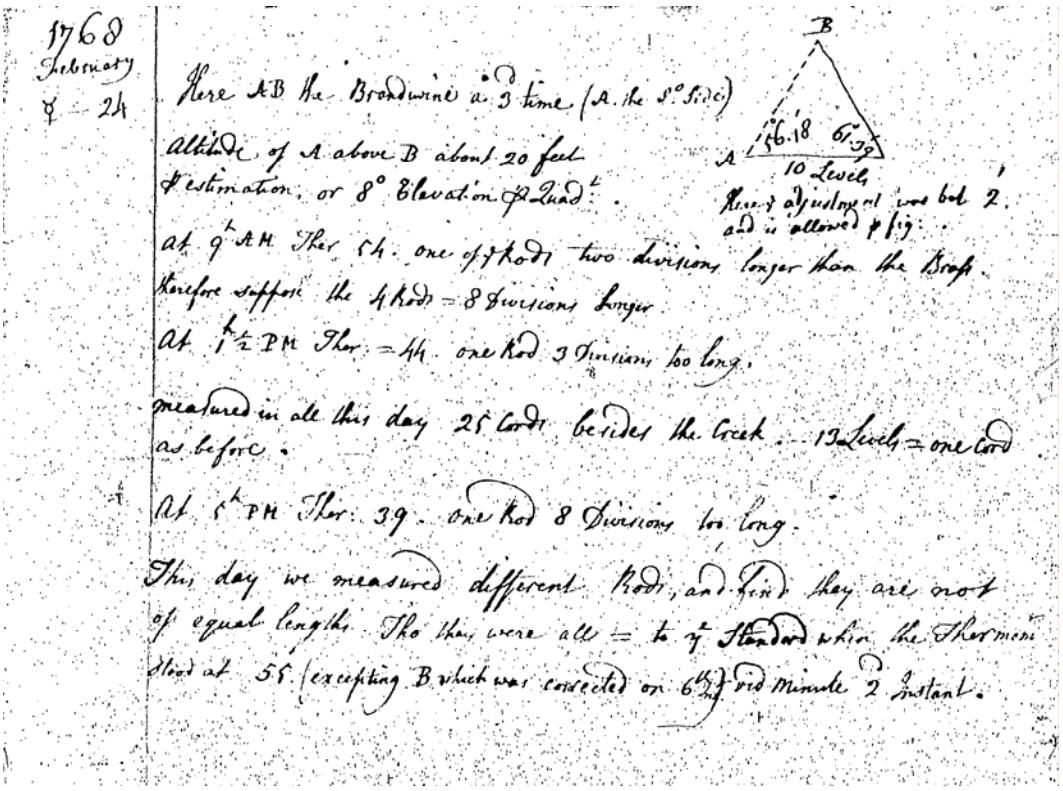
Figure 7 – Looking east along the south shore of the Brandywine Creek at Crossing # 3. Note the steep bank on the right side on the southern shore.

Figure 8 - From the southern shore of the Brandywine Creek at Crossing # 3 looking west.

Figure 9 - View from the shoulder of PA Rte 162 on the southern shore of the Brandywine Creek looking north along the Meridian Line. The Meridian crosses the stream near the two large trees.

Figure 10 - Craig Babcock sits on the guide rail on the north side of PA Rte. 162. The stream is approximately 15-25 feet lower than the road elevation.

1768 measurement for a Degree of Latitude



1768 February 24

Here AB the Brandywine at 3 time (A. the S.° Side)

altitude of A above B about 20 feet

& estimation, or 8° Elevation of Quad.t.

B

A 56.18 61.39

10 Levels

Here adjustment was but 2'. and is allowed of by

at 9.t AM Ther 54. one of 7 Rods two divisions longer than the Brass.

Therefore suppose the 4 Rods = 8 divisions longer

At 1½ PM Ther. = 44. one Rod 3 Divisions too long.

measured in all this day 25 Cords besides the Creek ... 13 Levels = one Cord as before.

At 5.h PM Ther: 39. one Rod 8 Divisions too long.

This day we measured different Rods, and find they are not of equal lengths. Tho they were all = to 7.d Standard when the Thermom. stood at 55. (excepting B which was corrected on 6.th 7.th 8.th Minute 2 Instant.

Figure 11 -Excerpt from the Journal of Charles Mason and Jeremiah Dixon dated February 24, 1768 recording the measurement of the Brandywine River 3rd crossing.

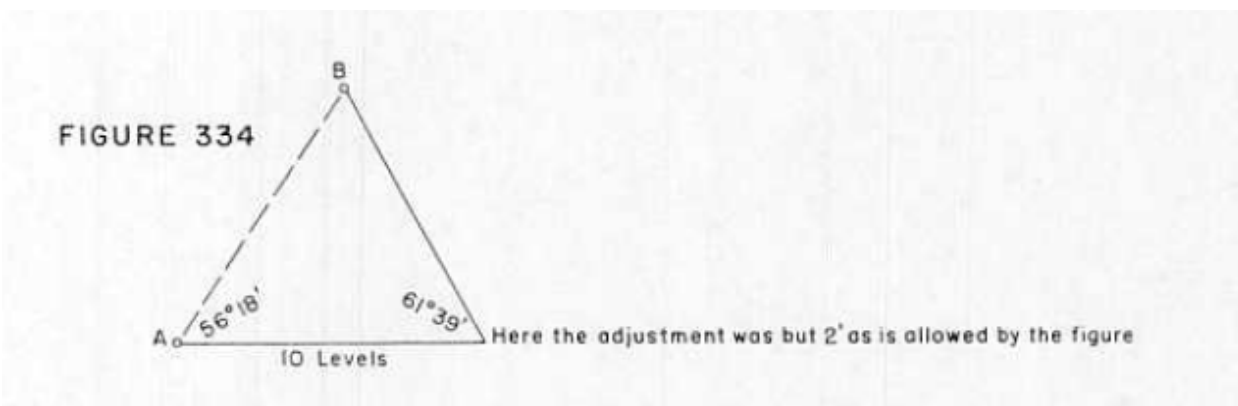


Figure 12 - Transcription of Mason's sketch as depicted on page 227 of the American Philosophical Society Journal transcription.

The width of the Brandywine Creek was determined by measuring a baseline on one side of the stream. Angles were then measured using the Hadley Quadrant between the baseline and a point on the opposite side of the stream. Using these measurements, the distances across the stream could be calculated.

American Philosophical Society Translation of the Journal of Charles Mason combined with widths of the River Brandywine as provided in the report of the Royal Society on the measure of a Degree of Latitude			
APS information found on Page 196; Royal Society information found on Pages 313-314			
1 Level = 20 feet			
1 Cord = 13 Levels			
Journal entry	**Distance in feet**	**Cumulative distance to River crossing points**	**Comments**
17 levels	340	**340**	To the north side of the Brandywine River (about 46' from river)
8 Level less 8"	+ 159.33		Width of the river (163.6' in 1768 during the survey of a Degree of Latitude
	=	**499.33**	To the south side of the Brandywine River
6 Cords & 8 Levels	+ 1720		Each Cord = 13 Levels
	=	**2219.3**	To a mark on the North side of the River (about 15' from the river)
12.2 levels	+ 244		Width of river in the Royal Society report on the Measure of a Degree of Latitude
	=	**2463.3**	South side of river
7 Cords & 9 Levels	+ 2000		(100 levels)
	=	**4463.3**	To a mark on the North side a 3rd time
9.87 levels	+ 197.4		Width of river in the Royal Society report on the Measure of a Degree of Latitude
	=	**4660.7**	To the South side of the river

1768-1A - "To the north side of the Brandywine River" (Distance =340 feet from the Observatory.

The first course was measured as 17 Levels (20 feet each) or 340 feet from the observatory to "The north side of the Brandywine River". This is a difference of 46 feet from the 1764 measure of 386.32', which they had described as the point where they "entered the Brandywine". Therefore the assumption for the 1768 measurement is that the distance from the observatory placed them 46.32 feet north of the Brandywine Creek. The measurement used for the 2005 survey is taken from the actual location of the stream at the waterline, as it existed in December 2005.

1768-1B - "AB the Creek or River. --measured by the Cord, 8 Levels wanting 8 Inches." Distance = 499.33 feet from the Observatory.

The width of the river was measured to be 8 levels (20 feet each) less 8 inches or a total width of 159.33 feet. The width of the river at the waterline in December 2005 was 101' at the Meridian line. The width between the tops of banks was approximately 114'. Assuming the location of the measurement for 1768-1A is 46.32 feet north of the stream as described above, the 159.33 foot measurement by Mason and Dixon across the stream would place the location of 1768-1B at a point 12 feet south of the edge of water as it existed in 2005 or 6 feet south of the top of bank.

1768-2A - "To a mark on the North side of the River" Distance = 2219.3 feet from the Observatory.

In 1764 Mason and Dixon measured a distance of 2234.32 feet to a point where they "entered the Brandywine". In 1768, the measurement to the second crossing placed them at 2219.3 feet from the Observatory, a difference of 15 feet. Assuming the stream in 2005 is in the same location as in 1768 and measuring from a point 15 feet north of the waters edge will establish the location as shown as 1768-2A. (The stream is surely is not in the same location today, but lacking a full knowledge of the changes that have occurred since 1768, it will be assumed that the stream is in the same location for the purpose of these calculations)

1768-2B - "To a mark on the North side of the River" Distance = 2463.3 feet from the Observatory.

Assuming the river to be 244 feet wide at this location based upon the information contained in the Report of the Royal Society (12.20 levels at 20 feet each). Mason's Journal contained sketches (figure 333b) to show how they measured across the stream by measuring a baseline on one side and measuring the angle between the baseline and a point on the opposite side of the stream. The distance across was then calculated. The position of 1768-2B is established from a point 244' south of 1768-2A.

1768-3A - "To a mark on the North side a 3rd time" Distance = 4463.3 feet from the Observatory.

In 1764, Mason and Dixon recorded a distance of 4494.82 feet to a Stob on the North side of the Brandywine. The 1768 measurement falls 31.52 feet short of this point. The distances between the points on the North and South sides of the creek were recorded as being 197.4 feet apart (Figure 333b). The Journal also notes that the altitude of the south side of the river by estimation was about 20 feet higher than the north side, or 8°(elevation by the Quadrant. For the purpose of establishing the location from this measurement, I have assumed that the points on the north and south sides were placed equal distance from the center of the stream. It is unlikely that this was

the case, but barring any evidence to the contrary, the points for 1768-3A and 1768-3B have been placed 98.7 feet from the approximate center of the stream as it existed in December 2005.

The Lay of the Land

Another possible method to determine the location of the Observatory would be to compare the measurements made by Mason and Dixon with the terrain along the Meridian line. For the most part, a 66-foot long Gunther's Chain was used on the flat sections of the surveyed line. When a steep slope was encountered a wood rod or "level" was used to measure up or down the slope in sections. On the first slope encountered, a 22-foot level was used, however, the surveyors soon realized that a 22-foot long rod was too cumbersome and thereafter opted to use a shorter 16 ½ foot level.

Figure 13 - A 66' long Gunther's Chain consisting of 100 "links" each being 0.66' or 7.92" long.

Figure 24 - This sketch shows the sections of the line measured by Mason and Dixon using the 66' Gunthers Chain and the 22' levels for the section of the line located between the Observatory and the north bank of the Brandywine Creek. The dashed line represents the approximate ground elevation at the time of the Mason and Dixon survey.

CONCLUSION

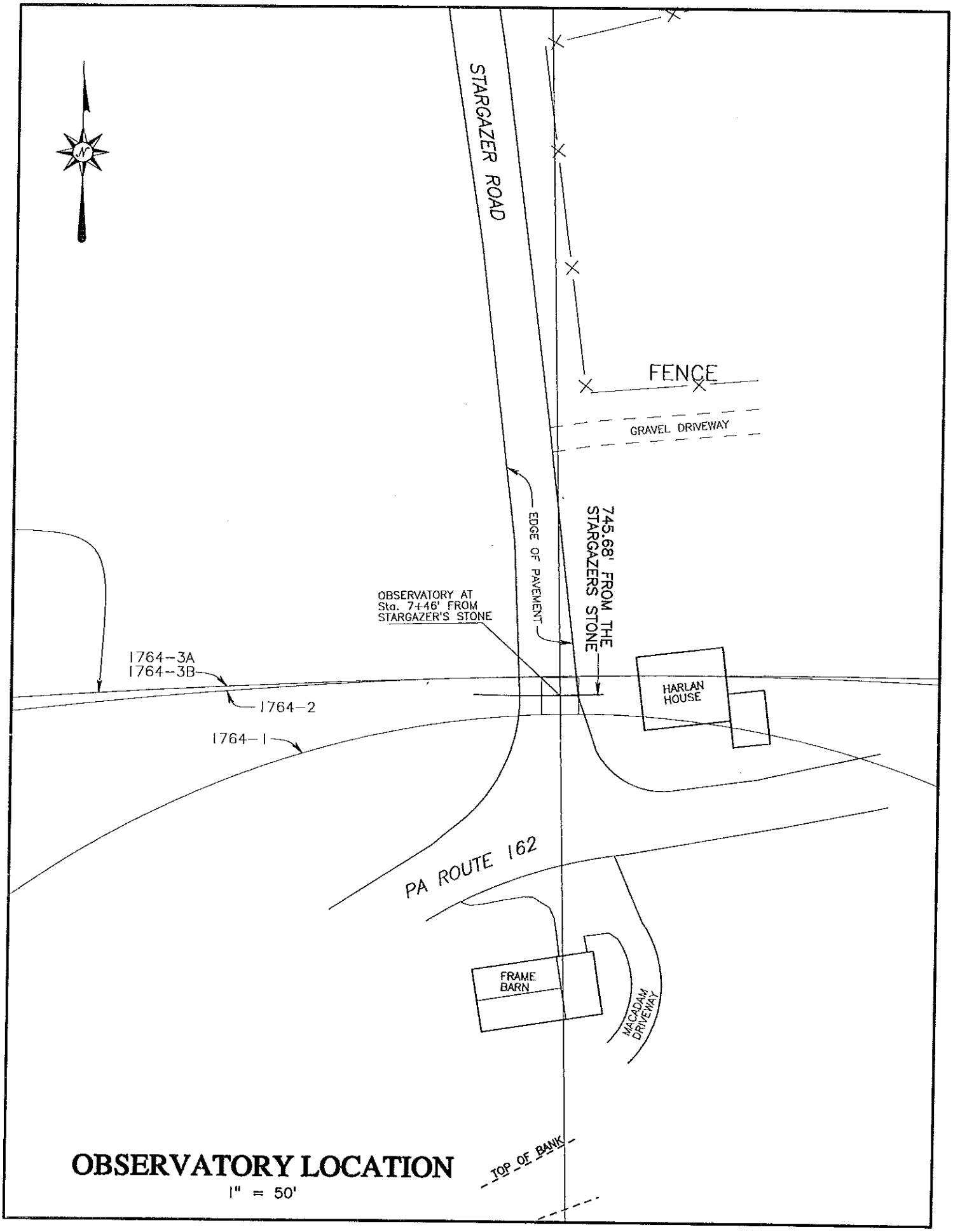
We can be relatively certain that the stone referred to as the "Stargazers' Stone" has some significant connection with the Mason and Dixon survey. Based upon such factors as the Harlan Family accounts, 19th Century atlases and the close proximity of the stone to the Meridian line drawn from the Post Marked West, the stone certainly has some connection with the survey. It is not, however the location where Mason and Dixon erected their observatory to undertake their astronomical observations. This does not reduce the historic significance of the stone, but helps to draw us closer to a better understanding of the methods and procedures used by Mason and Dixon.

The findings of this analysis shows that the actual observatory was located approximately 746 feet south of the Stargazers Stone. This would place the observatory in the bed of Stargazer Road at a point 32 feet west of the west wall of the Harlan house and 12 feet south of the north wall of the house. The observatory could have been as much as 8 feet north or south of this location based upon the measurements from the stream crossings.

From the perspective of a Surveyor, this location makes sense. There is no logical reason to have placed the observatory several hundred feet north of the Harlan house. Mason makes specific reference to the observatory being located in the Harlan garden. It seems highly unlikely that the Harlan's garden would have been located several hundred feet from their dwelling, nor does it seem likely that the garden would have been so expansive as to encompass the area where the Stargazer's stone now resides. Some may argue that the higher elevation at the Stargazer's Stone would have been more conducive to undertaking astronomical observations. This would be true if Mason and Dixon were interested in observing the entire celestial sphere. The observations required to complete their project required only the observance of the stars near the zenith (directly overhead) and to have an open line of sight along the Meridian (due north and south). Mason did note the observation of a solar eclipse from the observatory, which would have been visible from the location adjacent to the house. Another point to consider is that many of the observations would have been made during the heart of the frigid Pennsylvania winters. It seems logical that the observatory would have been placed in close proximity to the house to allow the astronomers to warm themselves in the Harlan house between observations.

It is not possible that the Stargazer's Stone marks the latitude of the Southernmost Point of Philadelphia as suggested by J. Carroll Hayes in his July 14, 1908 address earlier mentioned. This would place the observatory too far south to fit with the measurements Mason and Dixon recorded between the observatory and the three stream crossings.

It is my conclusion, that the Stargazer's Stone is the point Mason refers to in his journal on March 5, 1764 as the point placed northward in the meridian. This would have allowed the surveyors to have an accurate meridian reference mark to sight during the daytime hours.



OBSERVATORY LOCATION

1" = 50'

EPILOUGE

Dr. Thomas D. Cope writes: “If there be favored spots on earth where the Great Dead are wont to hold reunion surely the Stargazers' Stone marks one of them. Here perhaps may gather at times the shades of Isaac Newton, Christian Huyghens, Richer, Picard, the three Cassinis, the academicians of Lapland and those of Peru, the mathematicians whose theory gave meaning to the work, the Fathers Boscovich and La Maire, Charles Mason and Jeremiah Dixon, Nevil Maskelyne, John Bird and a host of others. Here they renew old campaigns and review great issues fought out on the battlefields of science. And perhaps they rejoice together that man still strives even as they strove, with transit and pendulum, in heat and frost, through swamp and forest, over mountain ranges and at peril of the seas better to know and to comprehend the earth on which he lives.”

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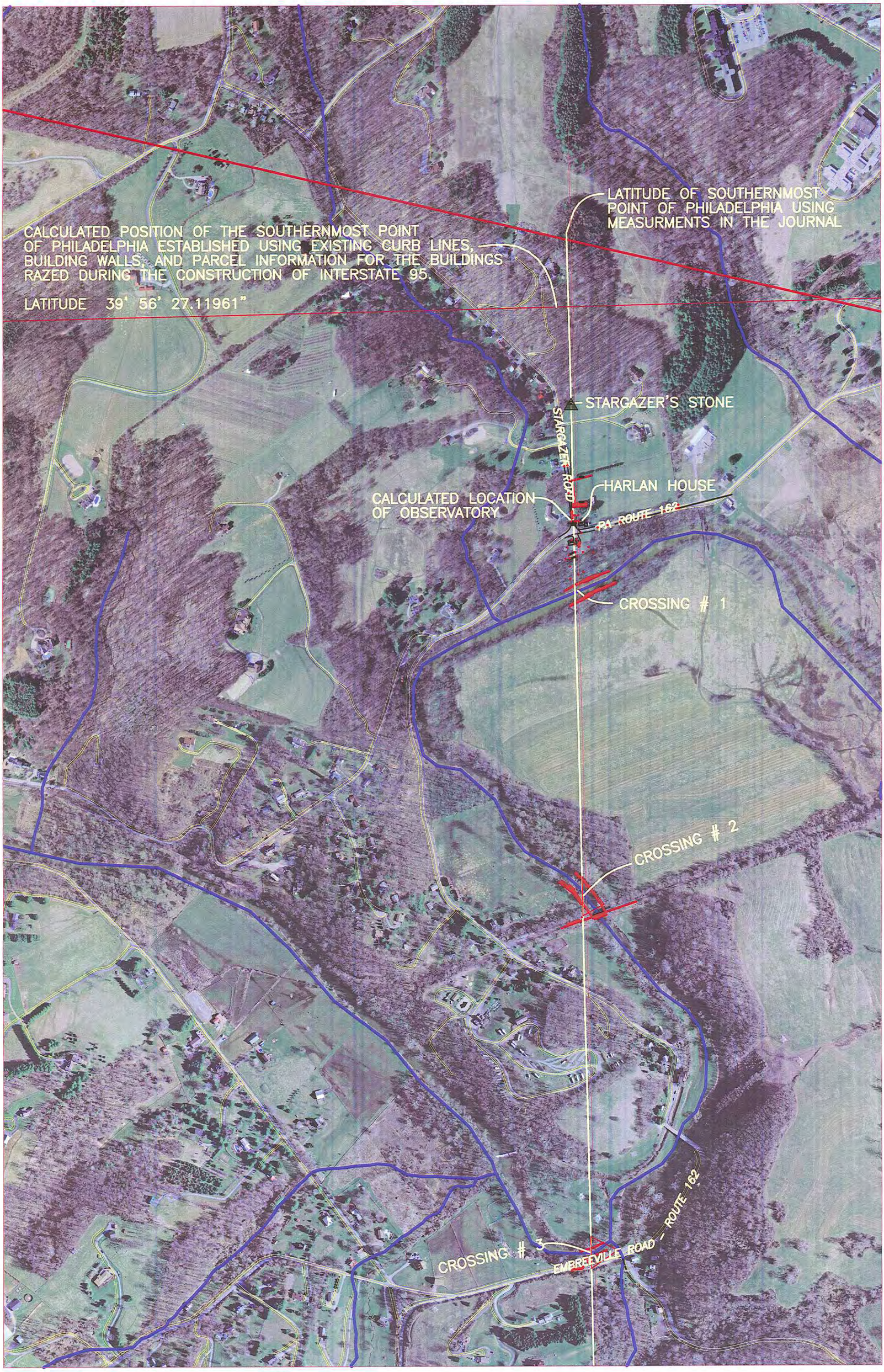
LATITUDE OF SOUTHERNMOST POINT OF PHILADELPHIA USING MEASURMENTS IN THE JOURNAL
CALCULATED POSITION OF THE SOUTHERNMOST POINT OF PHILADELPHIA ESTABLISHED USING EXISTING CURB LINES, BUILDING WALLS, AND PARCEL INFORMATION FOR THE BUILDINGS RAZED DURING THE CONSTRUCTION OF INTERSTATE 95.
LATITUDE 39° 56' 27.11961"
STARGAZER'S STONE
STARGAZER ROAD
HARLAN HOUSE
CALCULATED LOCATION OF OBSERVATORY
PA ROUTE 162
CROSSING # 1
CROSSING # 2
CROSSING # 3
EMBREEVILLE ROAD
ROUTE 162