REPORTS OF THE

DEPARTMENT OF
CONSERVATION AND DEVELOPMENT
STATE OF NEW JERSEY

C. P. WILBER, Director

BULLETIN 46

Geologic Series

WORK
OF THE NEW JERSEY
GEODETIC CONTROL SURVEY

Published 1938
Division of Geology and Topography

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LETTER OF TRANSMITTAL

June 1, 1938

To the Director
N. J. State Board of
Conservation and Development
Trenton, New Jersey

Sir:

Attached hereto is a report which gives a brief statement concerning the New Jersey Geodetic Control Survey which your Department has sponsored since the Survey was operated as a Works Progress Administration project.

I have tried to give herein a short story of the purpose of the Survey, its organization and its accomplishments.

Small scale maps, copies of parts of the Atlas Sheets of your New Jersey Geological Survey are attached, giving location of triangulation stations used and traverses run between them.

There are further given recommendations and samples for connecting any survey work with the Plane Coordinate System.

A publication of all results obtained is not desirable as it would be too expensive and there would be no need for having information covering the State available in one book at this time, as much of the work is still incomplete.

The attached maps form a proper guide in the search for the information needed by public agencies, engineers and surveyors in any particular location in the State.

Respectfully submitted,

ARTHUR NOACK, State Supervisor
N. J. Geodetic Control Survey.

PURPOSE OF THE SURVEY

Accurate maps of large areas require a basic frame work into which the details can be fitted so that the whole gives a correct picture of the relative position of all details shown on any map.

In the young days of our republic, there were no charts available showing harbor entrances and coast lines. To alleviate this need the "National Coast Survey" was established by Act of Congress in 1807. A Swiss mathematician, Ferdinand Hassler was employed to lay out the plans under which this coast survey was later executed. He covered our coastal areas with chains of triangles with side length of about 25 to 50 miles and computed the geographic positions, latitude and longitude for each corner of these triangles. By topographic survey between these triangulation stations, the location of coastal lines were ascertained and plotted.

Later on this same method of triangulation was used in the interior for the location of State boundary lines. The "National Coast Survey" was authorized to enlarge its field of activities and in 1878 the "U. S. Coast and Geodetic Survey" was established. This survey began to run triangulation chains or arcs with first order accuracy in both east-west and north-south directions about 100 miles apart. To-day, although the whole country is not quite covered with a triangulation net, some sections of the country have first order arcs much closer. New Jersey has been especially fortunate in that it has several first order arcs with 150 triangulation stations, the latitude and longitude of which were known and available to anyone who wanted to use them.

Unfortunately geographic positions cannot be readily used for a local mapping project or for any local survey work. Their use involves too much costly field work and computation work which counties, municipalities and private engineering concerns could not afford.

The U. S. Coast and Geodetic Survey had never sufficient funds at its disposal to do any more than first or second order triangulation work with all its other activities, such as astronomic work, first and second order level work, observing and reporting tides and currents, investigating terrestrial magnetism and gravity, seismological work and preparing hydrographic and topographic maps and nautical charts.

For smaller areas a plane coordinate system was recognized as the ideal basis for any survey work. But since neither the U. S. Coast and Geodetic Survey nor any other public or private agency were able to undertake the establishing of such system, there was nothing done anywhere in this respect.

When it was found that due to the depression thousands of engineers throughout the country were without work, the Federal Government decided to use these engineers through C. W. A. and later on E. R. A. in the establishing of Local Control Surveys for areas covering a whole state, if possible, and thereby prepare a common permanent basis for any future detailed mapping.

In 1934, the mathematicians in the U. S. Coast and Geodetic Survey proceeded to establish plane coordinate systems for the various smaller states or parts of the larger states. Such systems eliminate the involved computations dealing with geographic positions for every day use and permit instead the use of plane trigonometry in connecting with them.

TYPE OF MAP PROJECTIONS USED

Due to the difference in area and shape, the map projection used for each state had to fit conditions. Thus, where a state extends mainly from east to west and is quite narrow in the north and south direction, the Lambert conformal conic projection with two standard parallels held true to scale was used. For some of these states two and three overlapping zones were established; Texas has even five. Where a state extends mainly in a north and south direction and is narrow in the east and west direction, like New Jersey, the plane coordinate system is based upon a Transverse Mercator Grid.

NEW JERSEY PLANE COORDINATE SYSTEM

In New Jersey, the plane coordinate system was legalized by an act of the Legislature known as Chapter 116 of P. L. 1935, mainly due to the efforts of Professor Philip Kissam of Princeton, who was then in charge of the Local Control Survey. This Act, the first one of its type in the United States provides that the official survey base for the State of New Jersey shall be a system of plane coordinates on a transverse Mercator projection of Clark's spheroid of 1866 having a central meridian 74°-40′ west from Greenwich. For this meridian, the scale is set one part in 40,000 too small. This gives a correct scale on the small circles parallel with and about 28 miles distant easterly and westerly from the central meridian. Beyond these small circles, the scale grows somewhat too large so that the east shore of the State at 74°-west of Greenwich shows the scale 1 part in 70,000 too large and for the most western point of the State, Pennsville in Salem County, which is 75°-35′ west of Greenwich, the scale is one part in 20,000 too large. The act provides further that all coordinates are expressed in feet, the X-coordinates being measured easterly along the grid and the Y-coordinates being measured northerly along the grid, the origin of the coordinates being the intersection of meridian 74°-40′ west from Greenwich and the parallel 38°-50′ latitude. This origin, however, is not zero for both X and Y but has been given the coordinates for X=2,000,000 and for Y=0 feet. This latter feature and the location of the origin was used in order to avoid a change in sign in calculations as this arrangement brings the whole State in one quadrant so that all signs are positive.

The U. S. Coast and Geodetic Survey has worked out a system and forms for the computations so that the work of converting geographic positions into plane coordinates or the reverse has been simplified considerably. Special Publication No. 195 of the U. S. Coast and Geodetic Survey gives a full account of all steps involved and also gives examples.

The N. J. Act further provides that in any description of land, metes and bounds as well as plane coordinates may be used.

ORGANIZATION

The Survey was organized in the latter part of 1933 as a part of the N. J. Civil Works Administration and was continued in May 1934 under the Emergency Relief Administration until October 1935 with Professor Kissam in charge. During the following month, the Survey was reorganized under the Works Progress Administration with the New Jersey State Department of Conservation and Development as sponsor and under the direction of the writer.

There were field parties maintained in all counties of the State except Salem County where qualified engineers were not available to take charge of the work. Under E.R.A. there were employed double field parties of 9 men each under one party chief and in the larger counties two such field parties were maintained. The average number of persons employed under E.R.A. was 300, while under W.P.A. the average number of persons employed was about 190. There are now maintained twenty field parties for traverse and level work having from six to ten men and one field party for triangulation work. The computation work is done in the main office with a staff of 12 geodetic computers and 8 computers. The administrative personnel consists of a chief clerk, a timekeeper, an engineer in charge of progress reports and maps, a stock-room clerk and four stenographers. The work was done first under the project known as State-1, then continued under State-172 and is now operating under the designation of 1916-O.

EQUIPMENT

For triangulation work the Survey had the loan of one 1″ Parkhurst theodolite, one 5″ and one 10″ theodolite, heliotropes, signal lights with dry batteries for night work, several 90 foot steel towers and three collimators for centering instruments. All this equipment is owned by U. S. Coast and Geodetic Survey. For traverse angle work there were available only instruments loaned by the State Highway Department, Rutgers University, the Central Railroad of New Jersey and private sources. Most of these instruments had only 1′ or 30″ graduations. The lack in quality and refinement of this equipment had to be overcome by proper methods and an increased number of observations.

For chaining, the tapes used are 100 foot steel tapes with spring balances which were loaned in the beginning by the U. S. Coast and Geodetic Survey. Each field party has two tapes which are tested once a month by comparison with two 100 foot Standard Invar tapes, also loaned by the U. S. Coast and Geodetic Survey.

The testing of tapes is done on the Princeton University campus where the apparatus necessary for standardizing tapes had been constructed in the beginning of the Survey.

All chaining is done over three-legged wooden stools. For marking, fine pointed pins are used. For sighting, field parties have built their own tripods to hold sight rods or targets in place.

For level work on first and second order runs, eight Fischer precise levels owned by the U. S. Coast and Geodetic Survey are available. For leveling of the heads of chaining stools, hand-levels were used in the beginning which have gradually been replaced by the older Wye and Dumpy levels available.

For the marking of intermediate traverse points in rural sections where pairs of monuments are set about two miles apart, ¾" pointed steel rods 18 inches long were used. In urban and suburban areas, all traverse points were monumented. All monuments set under C.W.A. and E.R.A. carry the inscription "U. S. Coast and Geodetic Survey and State Survey". Under W.P.A. the monument inscription was changed to "Department of Conservation and Development, N. J. Geodetic Control Survey". Each disk gives the number of the monument and its elevation in feet above mean sea level.

MATERIALS

Sand, stone and cement for setting monuments were in most cases obtained from county or municipal yards free of charge. Originally precast monuments, three feet long and six inches square on top and 8 inches square on the bottom were used. Now all monuments are field cast.

TRANSPORTATION

Transportation of men, materials and equipment to and from work was furnished by using two cars for each field party at current rates for mileage, verified by party chiefs. This transportation item represents about 7.9 percent of the payroll. While this seems to be rather high, it must be remembered that without sufficient means of transportation, the Survey would cease to function. In many cases, county engineers, road supervisors and municipal officials assisted by furnishing trucks for the transportation of materials and triangulation towers.

FEDERAL FUNDS EXPENDED FOR THIS SURVEY:

Under C.W.A.		$113,266.00
Under E.R.A.		351,512.00
Under W.P.A.	State-1	$191,166.00
	State-172	247,677.00
	1916-O	133,302.00
Total W.P.A.		$572,145.00
Total to June 1st, 1938		$1,036,923.00

There were no contributions by a sponsor required under C.W.A. and E.R.A. All loans of equipment and donations of materials from any source whatever were considered as contributions made by the sponsor. Actually the State Department of Conservation and Development has not made any cash contribution except that of the cost of printing results obtained by this Survey.

The distribution of Federal expenditures at present is approximately as follows:

Payroll	86.9%	Survey equipment	3.0%
Travel expenses	7.9%	Office rent	1.3%
Office supplies	.5%	Telephone and other costs	.4%

In each county there is a field office, usually in a county or municipal owned building which is given to the Survey free of charge.

WORK ACCOMPLISHED

The tabulation given on Schedule I shows the amount of work performed under C.W.A., E.R.A. and under W.P.A. From this it will be seen that to-date there have been set throughout the State 8,374 monuments and benchmarks along 2,522.9 miles of traverses. Coordinates for approximately 4,400 monuments for horizontal control and elevations for about 4,000 monuments and 1,500 benchmarks for vertical control have been computed and wherever possible adjusted and are available for use on public or private engineering and survey work.

USE OF RESULTS

Control Surveys are performed to supplement the primary triangulation system. They consist of either additional triangulation or of traverse work for the purpose of determining the relative positions of permanently marked points on the surface of the earth. These positions are known in terms of geographic position, latitude and longitude and are available in that form from records of the U. S. Coast and Geodetic Survey. Since 1935 triangulation stations can be given in both geographic positions and plane coordinates. The positions of monuments set on traverses between these stations are given in plane coordinates. The elevations of all stations and monuments and benchmarks above sea level as well as all coordinates are available to the public in the office of this Survey, 17 William Street, Newark, New Jersey so that inquiries in Washington for such information are no longer necessary.

If the Survey is permitted to continue there will be bulletins available published by the State Department of Conservation and Development which will give descriptions, coordinates and elevations of all stations, monuments and benchmarks now set. The work so far completed forms a skeleton which can be extended as needs develop from time to time.

The use of this information obtained by this Survey is manifold. Requests for information regarding horizontal control came in to the office since the start of the Survey in 1933 and have increased continuously. Parallel with the Control Survey runs another W.P.A. project, the Riparian and Stream Survey which is to map all brooks, streams and waterways throughout the State. Without a Geodetic Control Survey as a basis, this mapping project would be impossible. Regional and County Planning Boards, County Engineers' offices and County Park Commissions, most of the State Departments, the U. S. Resettlement Administration, the Department of Agriculture, Soil Erosion Service, the U. S. Army and Navy and numerous municipal engineers have requested and received such information. In one case, this Survey has assisted in settling a dispute regarding County boundary lines between Atlantic, Camden and Gloucester Counties by establishing a new line agreeable to the parties concerned and running traverses along and across the county line so that the new line could be permanently fixed and monumented in the field by using N. J. Geodetic traverse points in the lay-out of the new line. In another instance, this Survey furnished triangulation points and coordinates for end points of a long county boundary line between Bergen and Passaic Counties and an azimuth so that it is now possible to determine the location of this line in the field.

The most important use of the Control Survey data is made for property surveys. If the starting point given in any deed description is lost, if magnetic bearings are copied from old descriptions without giving in the deed the year when these bearings were observed, if corner markers are destroyed, willfully or by the elements, they always can be restored because their position has been permanently fixed if the survey and the description gives plane coordinates for property corners. With such connection, the advice of the "oldest men" in town is not needed nor can there be ever a dispute over boundary lines once this method of controlled surveys has been adapted.

Observations of magnetic declination have also been made throughout the State.

READJUSTMENT OF 1937 BY U. S. COAST AND GEODETIC SURVEY

During the progress of this Survey, it was found that discrepancies existed between two parallel arcs of the U. S. Coast and Geodetic Survey. In order to clear up these discrepancies, the U. S. Coast

and Geodetic Survey requested that a first order base line about five miles in length be measured from Elizabeth to Port Reading along a tangent of the Central Railroad of New Jersey. In addition to this some first order triangulation check-up work was done between Princeton and Netcong. All observations were made under the supervision of Lt. Lushene of the Coast and Geodetic Survey. As a result of this work, all geographic positions of triangulation stations in northern Jersey above a line from Seaside Park to Mt. Holly to Newtown to Phillipsburg are now being readjusted. In most cases the change is negligible so that coordinates could readily be used for mapping. However, since most of the positions of the stations north of the line above described were changed, traverses connecting these stations have to be recomputed. Part of this work has been done and the result is that in all cases the closure has been materially improved.

So, for instance, was the result for the first traverse in Bergen from "Palisade" to "Eastman", an accuracy of 1:21926 before and 1:30926 after the recent adjustment; "Eastman" to "Teaneck" was 1:11687 and is now 1:20871, while a traverse from "Elizabeth" to "Hale" was 1:15810 and is now 1:26394. While the minimum for closure on second order traverse work is 1:10000, most of the work in South Jersey was far above that limit, on an average of about 1:25000.

In some instances the work done by this Survey, especially in Union and Mercer Counties did not fit in the U. S. triangulation within the required limit of 1:10000. The readjustment of the triangulation of the U. S. Coast and Geodetic Survey in North Jersey eliminates this difficulty now.

METHODS USED IN FIELD AND OFFICE

(A) Triangulation

All triangulation work of both first and second order was done in accordance with the rigid specifications laid down in the manuals of the U. S. Coast and Geodetic Survey, Special Publications Nos. 120 and 145. The northwestern section of the State heretofore had only second order triangulation which had to be brought up to first order and then broken down into smaller triangles. Other triangulation had to be added to obtain stations along the Delaware River north of Phillipsburg, a section of the State which had not heretofore been taken in by any triangulation scheme.

In all this work and also in traverse work, a thorough reconnaissance is of utmost importance. In some instances, existing topographic maps proved to lead to wrong conclusions when intervisibility of proposed stations was tested. Wherever it was possible, ground stations were selected to avoid costly transport of steel towers or the erection of wooden towers made by the triangulation crew.

As soon as the reconnaissance is completed and the monument set, a detailed description of the location of the new station is made giving the ties and directions to other stations and prominent objects visible from the new station. A station is only of value if its description is so clear that it can be recovered without any difficulty. The descriptions of all existing stations used in any triangulation scheme were checked and a report made of its recovery giving all details.

In the beginning of triangulation work in the latter part of 1935, observations were attempted in daylight but during the past year most of the observation work was done at night time. For this work the 1" Parkhurst theodolite and the 5" and 10" theodolites were used. In most cases the direction method was used, 16 positions taken for first order work and 8 for second order work. A sample of a field book page for direction observations will be found attached hereto. (See Schedule II).

If the repetition method is used, four sets of six direct and six reverse angles are required for an instrument with a 10" vernier although there can be no rule set for the number of sets required for first order work because of the variation in quality of the different types of repeating theodolites. This method, however, is the better one from the viewpoint of the computer because no local adjustment is necessary. The error in horizon closure is simply distributed uniformly among the angles measured.

(B) Base Lines

A base line, Elizabeth-Port Reading, was measured with three 50 meter invar tapes which were held with a tension of 15 kg. Another base line along the Belleville Turnpike in Hudson County was measured with 100 foot invar tapes over 4" x 4" stake supports at both ends and center. In both cases thermometers were read at both ends of the tapes and levels taken to obtain the difference in elevation of supports.

(C) Traverses

Reconnaissance and the proper description of all points again is of utmost importance. A traverse point or a monument is only of service to anyone if it can be easily recovered. The location description, therefore, should be clear, accurate and contain sufficient ties to permanent objects. This was not always possible, especially in sparsely settled rural districts.

All angles on traverse work were measured by the repetition method. Sufficient accuracy is obtained with various types of instruments by measuring angles as follows:

Instrument Graduation	*Plate Closure*	*Horizon Closure*	*Limit between 2 sets*	*Repetitions*
10″	30″ for 12 T	5″	4″	24
20″	40″ for 12 T	7″	5″	36
30″ or 1′-0″	1′-0″ for 24 T	10″	8″	48

When observing 24 turns 0°-00′-00″ was used for the first set and 90°-15′-05″ for the second set. When observing 36 turns, the initial setting for each set was 0°-00′-00″; 60°-05′-10″ and 120°10′20″. A set always consisted of measuring the angle six times with the telescope direct and six times with the telescope reversed.

Schedule III gives sample of a field book page recording a traverse angle measured with an instrument having a 1′-0″ graduation and Schedule IV shows the record of an angle measured with a 20″ graduation instrument. The sketches appearing on the field book pages illustrate the order in which the different sets are observed.

Distances between traverse points should be long enough to permit proper sights for angle work. As a general rule, no distance is to be less than 1000 nor more than 2500 feet. In mountainous country in the northern part of the State or in heavily built up urban areas, it is often not possible to get sights at least one thousand feet long. In any such case, the traverse had to be laid out so that an angle control was possible between points more than one thousand feet apart. A traverse loop between these points was then run in which the distance could be less than one thousand feet and the angles would be measured only half the number of times, i.e. 24 times on loop points for a 30″ and 1′-0″ instrument. Quite often the angle control in built up areas was done over high buildings from which both ends of such loop could be seen.

All angles were computed in the field and turned into the office after completion of each traverse.

(D) Chaining

Chaining was done with 100 foot steel tapes over wooden three-legged stools about 24″ high. Each distance was chained foreward and backward with the stools at end supports for the tapes which were kept at tension with a 22 lb. pull registered by a spring balance at the 100 foot end. Thermometers were attached to both ends of the tape and read simultaneously for each tape length. Levels were taken to determine the inclination of each tape length.

A sample of field notes for chaining is given in Schedule V.

Generally chaining notes were reduced in the field applying temperature and catenary corrections and the reduction from the inclined tape length to the horizontal.

Upon completion of all angles and all chaining, a strip map of the traverse was prepared showing angles and distances for all parts of the traverse and giving field book and page number where angles, distances and ties for each traverse point can be found. This facilitated office computation work considerably.

(E) Leveling

While angle work was being done, part of the field party, not needed for this work, went along the traverse and set monel rivets for benchmarks at points where permanency of the mark was assured. Levels were then run over all monuments and benchmarks along the traverse.

When a Fischer precise level (U. S. Coast and Geodetic Survey owned) was used, the run would be made in one direction only and three readings by stadia hairs in meters were taken on the front of the rod and one check reading was taken in feet on the back of the rod. Sights in this case were not more than 300 feet both ways. Where Wye levels were used a forward run would be made in the forenoon and a backward run over the same points in the afternoon. Sights in this case were never over 150 feet both ways. All foreward and backward sights for one set up were made equal in all cases. The permissible closing error between a forward and a backward run could not exceed three one-hundredths of a foot times the square root of the mileage run ($0.03 \times \sqrt{Mi}$). A sample of level notes is given in Schedule VI.

(F) Magnetic Observations

Schedule VII gives a list of points upon which magnetic observations were made in order to determine the magnetic declination in various parts of the State. Since these observations were made at different times over a period of three years, the results have been adjusted to give the declination for all stations listed for the year 1935.

(G) Computation Work

All field computations sent into the office were checked. The computations for all triangulation work were made in accordance with the U. S. Coast and Geodetic Survey Manual and on forms provided therein.

The computations required for the establishing of new triangulation stations are quite involved and it would be beyond the purpose of this report to give examples of work done. Each set of such computations must contain a record of recovery of old triangulation stations, a detailed location description of the new stations, an abstract of directions of all stations occupied, a list of directions, computations of reduction to center where eccentric observations were made, a set-up of equations used in the least square adjustment for each scheme, position computations giving the geographic positions of new stations after all triangles in the scheme have been solved, inverse position computation, a transformation of geographic positions to plane coordinates on the Transverse Mercator Projection and finally a list of geographic positions and of plane coordinates for all new stations.

All field computations for traverse work are likewise checked in the office. The records required for traverse computations comprise an index file card, recovery notes for triangulation stations which the traverse connects, descriptions of all monuments along the traverse, a description of the traverse giving length, number of angles, angle corrections and length correction, the closure on final fixed point, the method of adjustment and the lengths for the various tapes used on the traverse. A sample of such traverse computations, Cumberland-8 and the records required are given in Schedule VIII-A through VIII-J. In this sample there is shown a chaining computation of one distance, a list of preliminary grid azimuths, the computation of plane coordinates for all points and a sample of a computation of azimuth and distance between pairs of monuments. With each traverse goes a copy of the Atlas Section Sheet—in the case at hand, Section 35-5—which will be found among the maps hereto attached.

All level reductions are likewise checked in the office. The various runs are then grouped together and exequated within the net and the connecting points on U. S. first order runs.

Along with this computation work, all maps are kept up to-date. When a traverse is completed in the field, it is given a designation consisting of the first three initials of the County in which it originates and a number conforming to the numerical order in which the traverses are completed; to wit: CUM-8, BER-1, BER-10.

Besides the computations mentioned above, plane coordinates were computed for the intersection of each minute of longitude with each minute of latitude. These computations are about 65% completed for the whole State. They serve to facilitate plotting of plane coordinates on U. S. or N. J. Geological Atlas Sheets.

U. S. COAST AND GEODETIC SURVEY CONTROL

Copies of all completed work are filed with the U. S. Coast and Geodetic Survey in Washington where computations and descriptions are checked. The original of all computation work and all field notes are retained in the Newark office and will eventually be turned over to the sponsor, the State Department of Conservation and Development for maintaining results and extending the Survey as may be required from time to time. Chapter 225 of P. L. of 1938 provides that this be done. However, there is no appropriation available at present with which to do this. The accuracy of all work must meet the specifications set up by the Coast and Geodetic Survey.

RECORDS ON FILE IN NEWARK

There are now in file in the Newark office, the following records:

1. 1255 Field books of all triangulation, traverse and level work.
2. Complete triangulation computations for 14 new stations giving plane coordinate positions.
3. Complete traverse computations for 221 traverses covering 1,858 miles of traverse.
4. Complete level computations for 1,857 miles of levels.
5. Maps of each county showing traverses, monument numbers and benchmark numbers.
6. An Index Map of the State showing the numbering of Atlas Sheets.
7. 88 Atlas Sheets on which political subdivisions, general topography and all completed traverses will be given.
8. Two sets of N. J. Geological original Atlas Sheets showing location of triangulation stations and traverses.
9. Card Index Files (photostatic) giving the positions of all triangulation stations in the State.
10. Card Index File giving location description of magnetic stations in the State.
11. 2,100 tracings giving location descriptions of all monuments, their coordinates and elevations.
12. 1,000 tracings giving location descriptions of all benchmarks and their elevations.
13. An original map of the State showing all triangulation work by U. S. Coast and Geodetic Survey and by New Jersey Geodetic Control Survey.
14. An original map of the State showing U. S. Coast and Geodetic 1st and 2nd order level runs and level nets completed by New Jersey Geodetic Control Survey.
15. Descriptions of all triangulation stations of 1st and 2nd order on tracing paper giving ties and reference marks.

CONNECTING SURVEYS WITH PLANE COORDINATE SYSTEM

For the benefit of engineers employed in public or private work, two samples of connections are given herewith. The first one is a traverse used in the preparation of part of the Tax Assessment Map in the Borough of Chatham, Morris County. It is shown on Schedule IX-A through IX-G.

It begins with a loop formed by the monument line 2351 to 2350 to Pt. 6 to Pt. 12. It will be noted, however, that the short distance in the loop between monument 2350 and Pt. 6 and Pt. 12 are controlled by the angle formed by the monument line 2350 to 2351 and the sight from monument 2351 to Pt. 12 over which the azimuth is carried further to Pt. 13. The town traverse takes in a number of blocks north of the N. J. Geodetic Control Survey traverse and ends in the line between monument 727 and 728.

A sample of field notes for chaining and angles and the rest of the computations are given. Angles were in this case measured 6 times direct and 6 times reversed with a 10″ graduation instrument, which was considered of sufficient accuracy.

The other example is a property survey in Harrington Park, Bergen County, shown on Schedule X-A through X-E. In this case only a computation of azimuths and of plane coordinates is given. A deed description is also attached giving coordinates for each corner and metes and bounds.

It should be noted that in the first case, the town traverse starts from one fixed monument line and runs into another fixed monument line. In the second case, the property line traverse starts at one point in the monument line and ends in another point in the same line. This practice is considered more safe than, as sometimes is done, running from one monument or one particular point on a monument line back to the same point. For facilitating precise chaining computations, there are hereto attached Schedule XI giving temperature corrections and Schedule XII-A, XII-B and XII-C giving grade corrections for a 100 foot tape length. There is further attached, as Schedule XIII, a Bibliography giving the manuals and publications of the U. S. Coast and Geodetic Survey which will prove helpful to the engineering profession in triangulation and traverse work.

MAPS ATTACHED

After Schedule XIII, there will be found attached hereto, 67 Atlas Section Sheets showing traverses so far completed and filed with the U. S. Coast Geodetic Survey. Following these sheets, there is one Index Map of the State giving the numbers and showing the area covered by the Atlas Section Sheets.

ACKNOWLEDGMENT

In conclusion, the writer may be permitted to give praise to the officials in charge of the Works Progress Administration for their always ready helpful assistance and cooperation, without which this project could not have been continued to-date. A word of appreciation should also be given to the personnel employed in this work. Their zeal and loyalty and their readiness at all times to do their best, even under trying conditions, deserves commendation.

In the preparation of the foregoing report, the writer was ably assisted by Richard T. Noble, Supervisor in charge of all field work and Joseph A. McInnis in charge of computations.

June 1, 1938

SCHEDULE #I

SHOWING WORK PERFORMED BY THE

NEW JERSEY GEODETIC CONTROL SURVEY

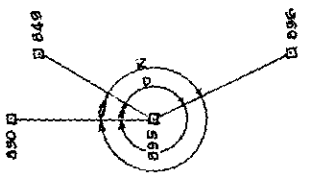
ITEM	C.W.A. & E.R.A.	W.P.A.	TOTAL
Reconnaissance	1500 miles	2800 miles	4300 miles
Monuments set	2448	2920	5368
Traverse completed in field	954.78 miles	1568.12 mi.	2522.90 mi.
Traverse completed in office	664.38 miles	1188.95 mi.	1853.33 mi.
Bench marks set in field	2140	866	3006
Level runs completed in field	1072.75 miles	2590.45 mi.	3663.20 mi.
Level runs computed in office	---	1330.60 mi.	1330.60 mi.
Time used	24 months	30 months	4 yrs. 6 mos.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 251a

SCHEDULE II
Sample of Observations by Direction Method
Horizontal Directions

Station: Mon. 895 Observer: W. Aurnhammer Instrument: U.S.C&G. 360 Date: 12.10.35

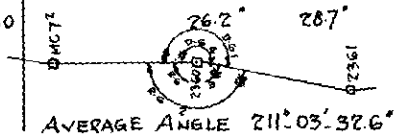
Position	Objects Observed	Time h. m.	Tel. D or R	Mic.	°	′	Do not write in this margin	Do not write in this margin	Back'd "	Forward "	Mean	Mean D and R.	Directions "	Remarks	
1	Mon 850	1:30 P	D	A	0	00			29	28				Rod	clear. cold
				B					19	21	24.2				viz. good
	" "														
			R	A	180	00			28	28					
				B					25	27	27.0	25.6 − 0.0 = 25.6	0.00		
	Mon. 849		D	A	27	15			33	33				Rod.	
				B					19	19	26.0				
	" "		R	A	207	15			31	32					
				B					31	31	31.3	28.6	03.0		27° 15′ 03.0″
	Mon. 896		D	A	133	56			48	51				Rod	
				B					45	45	47.3				
	" "		R	A	213	56			55	59					
				B					48	46	52.0	49.6	24.0		133° 56′ 24.0″
	Mon. 850		D	A	0	00			31	29					
				B					21	18	24.8				
	" "		R	A	180	00			27	29					
				B					26	23	26.3	25.5 + 0.1 = 25.6			
				A											
				B											
				A											
				B											



SCHEDULE III
Sample of Traverse Angle Recording

STATION ~ : Mon. 2360 INST.- B&L "20284 (60") TOWN : Mendham DATE ~ 6.15.36
OBSERVER : F. Voght REC.~ H. Stevens COUNTY: Morris WEATHER ~ cloudy

OBJECTS OBS.	TIME	TEL	REPS	ANGLE °	′	A °	B ″	MEAN	MEAN ANGLE	
MC 7[2] to	2:30	D	0	00	00	00	00	00.0		
Mon. 2361			1	211	03	45				
			6	186	21	00	00	00.0	211° 03′ 30.0″	
		R	6	00	00	45	00	52.5	31.2″	30.6″
Mon 2361 to		R	0	00	00	45	00	52.5		
MC 7[2]			1	148	56	00				
			6	173	38	15	00	07.5	148° 56′ 22.5″	
		D	6	00	00	45	00	52.5	22.5″	22.5″
MC 7[2] to		D	0	90	15	00	00	00.0		
Mon 2361			1	301	18	15				
			6	276	36	15	00	07.5	211° 03′ 31.2″	
		R	6	90	15	00	00	00.0	31.2″	31.2″
Mon 2361 to		R	0	90	15	00	00	00.0		
MC 7[2]			1	239	11	45				
			6	263	54	15	00	07.5	148° 56′ 31.2″	
		D	6	90	15	30	30	30.0	26.2″	28.7″

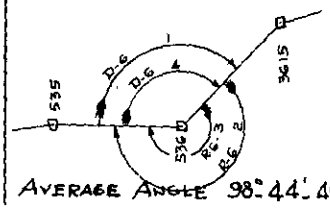


AVERAGE ANGLE 211° 03′ 32.6″

SCHEDULE IV
Sample of Traverse Angle Recording

STATION : Mon 536 INST. Gurley #242271 (20") COUNTY : Essex DATE: 6-18-37
OBSERVER : J. Redfern REC. Vanderbeek TOWN : Livingstone WEATHER clear

OBJECT OBS.	TIME	TEL.	REPS	ANGLE		A	B	MEAN	MEAN ANGLE
Mon 535 to	7:30	D	0	00	00	00	50	55.0	
Mon 3615			1	98	44	50			
			6	232	28	10	00	05.0	98° 44' 41.7"
		R	6	00	00	40	30	35.0	35.0" 38.3"
Mon 535 to		D	0	60	05	20	10	15.0	
Mon 3615			1	158	50	00			
			6	292	33	20	10	15.0	98° 44' 40.0
		R	6	60	05	10	00	05.5	41.7 40.8"
Mon 535 to		D	0	120	10	40	40	40.0	
Mon 3615			1	218	55	20			
			6	352	38	50	30	40.0	98° 44' 40.0
		R	6	120	10	20	20	20.0	43.3 41.6"



AVERAGE ANGLE 98° 44' 40.2"

SCHEDULE V
Sample of Traverse Chaining Notes

FORWARD RUN
15-73 to 15-72 Pat. & Hamb. Tpke Franklin Sussex Co.

H.C. J. Caine LEVEL K&E #3652 - F. Bottema TAPE #75
R.C. E. Askew TRAN. Berger 24572 - A. Young BAL. #13
REC. J. Werner, C.P. Rod. E. Grossi WEATHER: clear. cold.
DATE: 12-9-36

STA.	TEMP.	DIST.	TENS.	SUPP.	INCL.	Corr.	STA.	B.S.	F.S.	H.I.	EL.
15-73 to 15-72 (96S to 95S)							0	0.63		100.63	100.0 Tripod
1	24	100.00	22	2	.01	.000	1		0.64		99.99 "
2	22	100	"	"	.94	.004	2		1.58		99.05 "
3	22	100	"	"	.90	.004	3		2.48		98.15
4	22	100	"	"	1.33	.009	4		3.81		96.82
5	22	100	"	"	.25	.000	5		3.56		97.07
6	22	100	"	"	1.35	.005	6		2.21		98.42
7	22	100	"	"	1.20	.007	7		1.01		99.62 T.P. Tripod
8	22	75.00	"	"	2.47	.040		3.47			
9	24	64.00	"	"	0.16	.001	8		1.00		102.09 "
10	24	87.727	22	2	3.06	.053	9		0.84		102.25 On fence
		926.727				.127	10		3.90		99.19 Mon.
RETURN RUN											
15-72 to	15-73	(95S to 96S)						3.90		103.09	99.19
1	22	87.723	22	2	3.06	.055	1		0.84		102.25 On fence
2	23	100.	"	"	2.26	.026	2		3.10		99.99
3	22	100.	"	"	1.02	.005	3		4.12		98.97
4	22	100.	"	"	1.44	.010	4		5.56		97.53
5	22	100.	"	"	1.24	.008	5	4.37	6.80	100.66	96.29 T.P. Tripod
6	22	100.	"	"	0.46	.001	6		3.91		96.75
7	23	100.	"	"	1.49	.011	7		2.42		98.24
8	22	100.	"	"	1.62	.013	8		0.80		99.86
9	22	65.000	"	"	.10	.000	9		0.70		99.96
10	23	73.995	22	2	.08	.000	10		0.62		100.04
		926.718				.127					

SCHEDULE VI
Sample copy Level Notes
FORWARD RUN

FROM MON. 1008 to MON. # 4050 & RETURN

INST # 21573 B&B
LEVEL ROD # 9-2
RODMAN - H. Stinsman
9:30 A.M.

OBSERVER: A.W. Ernst
RECORDER: F.C. Joep
WEATHER: Partly cloudy, wind (Sun)
DATE Sept. 8. 1937

STA	B.S FT.	H.I. FT.	F.S. FT.	ELEV		
Mon 1008	2.817	22.436		19.619		Mon.# 1008 Bellmawr. Approx. 9.08 Mi S.W. of Mon. 957
T.P. 1	1.577	17.847	6.166	16.270		Pt. on pin on Sly. Side of Rt. 45
T.P. 2	4.728	17.519	5.056	12.791		" " " " " " " " "
T.P. 3	3.020	17.722	2.817	14.702		" " " " " " " " "
T.P. 4	3.568	15.902	5.388	12.334		" " " " " " " " "
MON 4050			5.227	10.675		MON 4050 - Brooklawn. Approx. 9.43 Mi. S.W. of Mon. 957
+	15.710	-	24.654			
Σ F-	24.654			19.619	MON. 1008	
Σ B+	15.710			10.675	MON 4050	
-	8.944			8.944		
		RETURN RUN				
MON. 4050	5.225	15.900		10.675		MON 4050 - Brooklawn, Approx. 9.43 Mi S.W of MON. 957
T.P. 1	5.298	17.631	3.567	12.333		Pt. on pin on Sly side of Rt. 45
T.P. 2	2.332	17.247	2.716	14.915		" " " " " " " " "
T.P. 3	4.828	17.638	4.437	12.810		" " " " " " " " "
T.P. 4	6.358	22.489	1.507	16.131		" " " " " " " " "
MON. 1008			2.860	19.629		MON 1008 - Bellmawr. Approx. 9.08 Mi S.W. of MON 957
+	24.041		-15.087			
Σ B+	24.041			19.629	MON. 1008	
Σ F-	15.087			10.675	MON. 4050	
+	8.954			8.954		

DIVERGENCE FROM MON 1008 to MON 4050

Allowable divergence = $.03\sqrt{.35} = .018$

Return Run + 8.954
Forward " $\frac{-\ 8.944}{+\ 0.010}$

$-8.944 + \frac{.010}{2} = -8.949$

19.619 El. Mon. 1008
- 8.949 Mean diff of Elev.
10.670 El. Mon. 4050

A.W.

SCHEDULE V11

SHOWING

MAGNETIC DECLINATION
AT VARIOUS POINTS IN THE STATE
OF NEW JERSEY
1935

Station	County	Town	Location	West Declinatio
BLAIRSTOWN	Warren	Blairstown	Tri.Sta."Blairs-town"	10°25'
BRIELLE	Monmouth	Wall Twp.	"Zeigler"	10°31'
BROWNS MILLS	Burlington	Camp Dix	"Furnace"	10°14'
COLTS NECK	Monmouth	Atlantic Twp.	NJGS Mon.6233	11°02'
CULLEN	Ocean	Tuckerton	Ref. #3 "Cullen"	10°26'
CULVERS GAP	Sussex	Sandyston Twp.	"Culvers Gap"	10°44'
HIGH POINT	Sussex	Montague Twp.	Ref. #3 "High Pt."	11°03'
JAMESBURG	Middlesex	Monroe Twp.	NJGS Mon. 3181	11°09'
LAKEHURST	Ocean	Naval Air Sta.	Center of Rose	10°18'
MCKINLAY	Ocean	Manahawken	"McKinlay"	10°22'
MONTVALE	Bergen	Rivervale Twp.	NJGS Mon. 850	11°09'
MT. MITCHELL	Monmouth	Middletown Twp.	Ref. #1 "Mt.Mitchell"	11°22'
NEW JERSEY	Ocean	Island Beach	Ref. #2 "N.Jersey"	10°16'
PRINCETON	Mercer	Princeton Twp.	Carnegie Lake	10°39'
ROOSEVELT	Ocean	Roosevelt City	"Balcony-2"	10°15'
SPENCE	Monmouth	Clarksburg	Az.Mk."Spence"	10°27'
STANTON	Hunterdon	Clinton Twp.	Ref. #1 "Pickle"	10°38'
TETERBORO	Bergen	Bendix Boro.	Mag.Sta.Airfield	11°10'
TRENTON	Mercer	Trenton	Mag.Sta. State Hospital	10°21'
VIGNE	Monmouth	Middletown Twp.	"Vigne"	11°05'

SCHEDULE VIII

Traverse CUM-8

From Mon. 9026, about ¼ mile north of Monumuskin River on S.H. Rte. #49, southeast to Co. Rte. #36; then east 1½ miles along Co. Rte. 36; south on woods road to "Scrubby", which lies about 0.2 mile south of Co. Rte. #36 and about 0.5 mile east of Muskee Creek

Monuments
9027
9028
9029
9030
9034
9035

Length: 2.27$
Ratio : 1:39,964

To Washington:

Schedule VIII-A

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 526

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: Scrubby STATE: New Jersey COUNTY: Cumberland
ESTABLISHED BY: John Bowie Jr. YEAR: 1935 LOCALITY: 1½ mi. east (airline) of Port Elizabeth.
RECOVERED BY:* Arthur Noack YEAR: 1937

Detailed statement as to the fitness of the original description:

Recovered in good condition as described.

L. Albertson Huber

Schedule VIII-B

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

U. S. GOVERNMENT PRINTING OFFICE

NOTE.—One of these forms must be used for every station recovered.

11—7002

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 525
Rev. Oct., 1932

TRAVERSE
DESCRIPTION OF ~~RECOVERY~~ STATION

NAME OF STATION: Mon. 9027
CHIEF OF PARTY: Arthur Noack
STATE: New Jersey COUNTY: Cumberland
YEAR: 1937 LOCALITY: Port Elizabeth, Maurice Rive

Surface-station mark, Note,* 1a
Underground-station mark, Note,*
Reference mark, Note,*
Reference mark, Note,*
Azimuth mark, Note,*
Witness mark, Note,*
Height of light above station mark meters.
Height of telescope above station mark meters.†
Detailed description:

Feet
-coord:(east) 1,910,309.34
-coord:(north) 175,094.46

DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH T CAN BE SEEN FROM THE GROUND

OBJECT	DISTANCE	DIRECTION	AZIMUTH
		° ′ ″	° ′ ″

A standard N.J.G.C.S. disk, set in concrete, flush with the ground, on the northwest corner of intersection of Weatherby Road and S.H Rte. #49 just southeast of Manumuskin River. The monument is 41.70 ft. west of the centerline of Rte. 49; 61.16 ft. northwest of pole #BT-56-711; 93.90 ft. north of two story frame house of Mortimer Henderson; and 24 ft. north of the centerline of Weatherby Road. Companion monument 9028 is 1321.03 ft. southeast.

Schedule VIII-C

Described by .....
Marked by Cont'd second card.

NOTE.—The initial direction must be to main scheme station.

* Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145.
† To nearest meter only, when no trigonometric leveling is being done.

11—5761

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 525
Rev. Oct., 1932

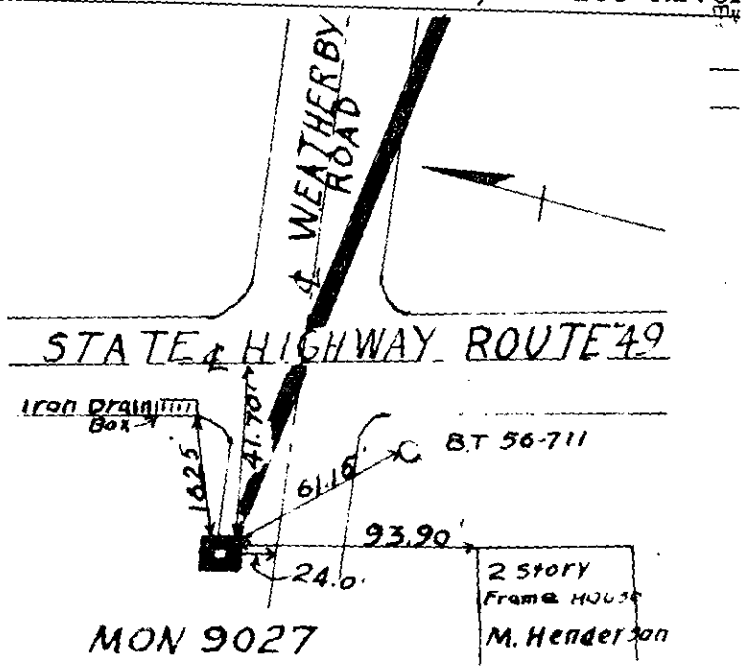
TRAVERSE
DESCRIPTION OF ~~RECOVERY~~ STATION

NAME OF STATION: Mon. 9027
CHIEF OF PARTY: Arthur Noack
STATE: New Jersey COUNTY: Cumberland
YEAR: 1937 LOCALITY: Port Elizabeth, Maurice River

Surface-station mark, Note,* 1a
Underground-station mark, Note,*
Reference mark, Note,*
Reference mark, Note,*
Azimuth mark, Note,*
Witness mark, Note,*
Height of light above station mark meters.
Height of telescope above station mark meters.†
Detailed description:

DISTANCES /

Cont'd from first card.



Schedule VIII-D

Described by L.A. Huber
Marked by L.A. Huber

NOTE.—The initial direction must be to main scheme station.

* Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145.

11—5761

Schedule VIII E

Description of Traverse

NO. OF TRAVERSE: CUM-8
INITIAL POINT: Mon. 9026 (Cum-7), S.H. Rte. 49, Maurice River Twp., Cumberland Co. N.J.
CLOSING POINT: "Scrubby", Maurice River Twp., Cumberland Co. N.J.
GENERAL DIRECTION: Southeast on S.H. Rte. 49, and east on Weatherby Road.

LENGTH OF TRAVERSE: 2.278 miles
NO. OF PRINCIPAL ANGLE STATIONS: 8
NO. OF TANGENTS: 10
TOTAL CORRECTION FOR ANGLES: +2.2"
AVERAGE CORRECTION PER ANGLE: 0.28"
AVERAGE CORRECTION TO LENGTH: 1:39,964

CLOSURE CORRECTION ON FINAL FIXED POINT:
x : -0.247 Rate : .0000205336
y : +0.172 Rate : .0000142987

METHOD OF ADJUSTMENT: Control angles adjusted equally between position adjusted azimuth Mon. 9026 to Mon. 9025 (Cum-7), and fixed azimuth "Scrubby" to Az. Mk. Loop angles adjusted equally between adjusted control azimuths. Coordinates adjusted in proportion to length of line.

COMPARISON OF FIELD TAPES WITH STANDARDIZED TAPE:
Length of tape #82 Jan. 1937 t-11 : 99.999; 2-22 : 100.006

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 559
Rev. April 1935

Schedule VIII - F

CUM-8

COMPUTATION OF Mon. 9026 to "Scrubby" BASE LINE

Fold to Here

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Lengths	UNCORRECTED LENGTH: Feet	TEMP.	CORRECTIONS: Temp.	CORRECTIONS: Tape and Catenary	CORRECTIONS: Set-up Set-back	CORRECTIONS: Inclination	CORRECTIONS: Sea level	REDUCED LENGTH	ADOPTED LENGTH	(v)	(vv)
							°C					Meters			mm	mm
							°F	Feet	Feet	Feet	Feet		Feet	Feet		
105+82 to	1/26/37	F	82		10	1000	46	-.142	+.060							
"Scrubby"							43	-.009	+.006	58.000	-2.277					
							45	-.011	+.007	76.000						
30-T8							44	-.015	+.006	98.000	- .061					
45-46							48	-.007	+.006	56.000	- .003					
							46	-.009	+.007	65.700	- .001					
							47	-.013	+.006	97.375	-..075					
	"	B	82		10	1000	45	-.148	+.060		- .008		1448.542			
							46	-.014	+.006	96.000	-2.432					
							46	-.010	+.007	67.000	- .008					
							44	-.012	+.007	75.000	- .016					
							45	-.012	+.007	79.411	- .001			1448.550	.017	1/85200
							44	-.012	+.007	76.000						
							44	-.009	+.006	57.810	- .088		1448.559			

(FOLDING SPACE)

Traverse No. Cum-8

Schedule-VIII-G

COMPUTATION OF AZIMUTH & DISTANCE

	x	Station	y
	1,910,309.34	Mon. 9027	175,094.46
	1,911,609.04	Mon. 9028	174,858.05
△	1299.70		236.41

log △x 3113843l
log △y 23736658
log tan a' 0.7401773
a' 79 41 27.1
a 280 18 32.9

Azimuths

Mon. 9027 to Mon. 9028

	°	'	"
Comp.	280	18	32.9
Obs.	280	18	34.9
Diff.			- 2.0

log △ 3.1138431
log a' 9.9929318
log Dist. 3.1209113
Dist. 1321.026

Distances

Comp. 1321.026
Obs. 1321.058
Diff. -.032

---

	x	Station	y
	1,912,842.42	Mon. 9029	175270.84
	1,914,301.90	Mon. 9030	175461.51
△	1459.48		190.67

log △x 3.1641981
log △y 2.2802824
log tan a' 0.8839157
a' 82 33 24.8
a 262 33 24.8

Azimuths

Mon. 9029 to Mon. 9030

	°	'	"
Comp.	262	33	24.8
Obs.	262	33	29.6
Diff.			-4.8

log △ 3.1641981
log a' 9.9963251
log Dist. 3.1678730
Dist. 1471.882

Distances

Comp. 1471.882
Obs. 1471.913
Diff. -.031

Computed by _____

Checked by _____

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 758

Schedule VIII-H

LIST OF PRELIMINARY GRID AZIMUTHS

State New Jersey Locality Cumberland Co. Line Cum-8

From station—	To station—	Preliminary azimuth	Correction for closure	Corrected azimuth
		° ′ ″	′ ″	° ′ ″
Mon. 9026	Mon. 9025	144 26 34.1	(Cum-7)	
∠		184 42 48.1		
Mon. 9026	Mon. 9027	329 09 22.2	+.3	329 09 22.5
∠		131 09 12.1		
Mon. 9027	Mon. 9028	280 18 34.3	+.6	280 18 34.9
∠		151 11 12.4		
Mon. 9028	Mon. 9029	251 29 46.7	+.8	251 29 47.5
∠		191 03 41.8		
Mon. 9029	Mon. 9030	262 33 28.5	+1.1	262 33 29.6
∠		178 03 28.4		
Mon. 9030	Mon. 9034	260 36 56.9	+1.4	260 36 58.3
∠		205 53 10.5		
Mon. 9034	105+82	286 30 07.4	+1.6	286 30 09.0
∠		219 47 57.3		
105+82	"Scrubby"	326 18 04.7	+1.9	326 18 06.6
∠		220 41 03.5		
		6 59 08.2	+2.2	6 59 10.4
Scrubby	Az. Mk.	6 59 10.4	(fixed)	
∠		Error -2.2 for 8 angles		
		Corr +.275 per angle		
∠				
∠				

Schedule VIII-I

COMPUTATION OF COORDINATES

Traverse line No. Cum-8
State New Jersey
Year 1937
County Cumberland
Month June
Initial Station Mon. 9026
Closing Station "Scrubby"

Station	Azimuth Plane	Grid Distance Feet	Log. Lat. / Log. cos Az / Log. dist. / Log. sin Az / Log. Dep.	Latitude Feet	Departure Feet	Grid Coordinates y Feet	Grid Coordinates x Feet
Mon. 9029				N190.640			
			12951865				
	262 33 29.6	1471.913				175,461.418	1914302.026
			99157699			+.088	-.126
Mon. 9030		1154.309			E1459.515	175,461.506	1914301.900
				N437.559			
			16304710				
	260 36 58.3	2683.635				175,898.977	1916949.749
			98661829			+.126	-.181
Mon. 9034		8837.944			E2647.723	175,899.103	1916949.568
				S425.675			
			28149071				
	286 20 57.1	1512.218				175,423.302	1918400.819
			95956396			+.148	-.213
Mon. 9035		10350.162			E1451.070	175,473.450	1918400.606
				S 69.271			
			30074556				
	287 30 08.6	230.330				175,404.031	
			953.70442				
105482					E 219.567		
				S1205.153			
			831971.87				
	326 18 06.6	1448.550				174198.878	1919424.167
			55481780				
"Scrubby"		12029.042			E 803.681	174199.05	1919423.92
						Errors -0.172	+0.247
						Error of closure .301	

Latitude corr. coeff : +.0000142987
Dep. " " : -.0000205336 Accuracy 1:39964

EPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form No. 708
Rev. Nov. 1936

Traverse CUM-8

PLANE COORDINATES

Schedule VIII-J

'ate New Jersey *Locality* *Datum* North American 1927 *Projection* Transverse Mercator *Zone*

Station	x Coordinate / y Coordinate	Azimuth	Mark	Station	x Coordinate / y Coordinate	Azimuth	Mark
	Feet	° ′ ″			*Feet*	° ′ ″	
Mon. 9027	1,910,309.34	280 18 32.9	Mon. 9028				
	175,094.46	1321.03					
Mon. 9028	1,911,609.04	100 18 32.9	Mon. 9027				
	174,858.05						
Mon. 9029	1,912,842.42	262 33 24.8	Mon. 9030				
	175,270.84	1471.88					
Mon. 9030	1,914,301.90	82 33 24.8	Mon. 9029				
	175,461.51						
Mon. 9034	1,916,949.57	286 20 54.9	Mon. 9035				
	175,899.10	1512.18					
Mon. 9035	1,918,400.61	106 20 54.9	Mon. 9034				
	175,473.45						

U. S. GOVERNMENT PRINTING OFFICE 111180

Schedule IX-A

CHATHAM TAX MAP SURVEY

TRANSCRIPT OF CHAINING NOTES

6-26-37

TAPE No. 71 300 FT.

LENGTH T.20 300.017

PT. 59 to PT. 58

FROM	TO	SET UP	TEMP.	PULL	SUP.	INCLINATION & CORRECTION B.S.	F.S.	DIFF.	CORR.
PT. 59	3		85	20	T	11.20	7.44	3.76	-.024
3	6		85	20	T		3.70	3.74	-.024
6	9		80	20	T		0.00	3.70	-.024
9	12		80	20	T	9.60	6.52	3.08	-.015
12	15		80	20	T		3.40	3.12	-.015
15	15'	210.00	80	20	T	9.26	4.11	5.15	-.063
15'	PT. 58	27.09	80	10	T		3.62	0.49	-.004

1737.09
+.086
CORR. DIST. 1737.176

INCL. CORR. -.169
TEMP. CORR. +.156
CATENARY +.099
+.086

TRANSCRIPT OF ANGLE NOTES

INST. BERGER No. 3224 (10")

STA. PT. #12 OBS. W.A. 5-29-37

OBJ. OBS.	D/R	REP.	°	'	" A	" B	" MEAN	ANGLE
MON. 2351 to PT. 13	D	0	0	00	00	10	05.0	89°-34'-29."6
	D	1	89	34	30			
	D	6	177	27	00	10	05.0	
PT. 13 to MON. 2351	R	6	0	00	10	10	10.0	

1/1

Traverse No. _____

COMPUTATION OF AZIMUTH & DISTANCE Schedule IX-B

x	Station	y
2,078,467.84	Mon. Pt. 14	696,969.86
2,079,339.40	Mon. Pt. 15	696,466.95
Δx 871.56		Δy 502.91

log Δx 2.9402973
log Δy 2.7014903
log tan a' 0.2388070
a' 60°-00'-50".7
a 299-59-09.3

Azimuths
~~Mon.~~ Pt. 14 to ~~Mon.~~ Pt. 15
Comp. 299° - 59' - 09".3
Obs. 299 · 59 - 07.1
Diff. + 2.2

log Δ 2.9402973
log Sin a' 9.9375922
log Dist. 3.0027051
Dist. 1006.248

Distances
Comp. 1006.248
Obs. 1006.305
Diff. -0.057

---

x	Station	y
	Mon. _____	
	Mon. _____	
Δx		Δy

log Δx _____
log Δy _____
log tan a' _____
a' _____
a _____

log Δ _____
log a' _____
log Dist. _____
Dist. _____

Azimuths
Mon. _____ to Mon. _____
Comp. _____ ° ' "
Obs. _____
Diff. _____

Distances
Comp. _____
Obs. _____
Diff. _____

Computed by _____
Checked by _____

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 738
Ed. May 1935

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Schedule IX - C

COMPUTATION OF COORDINATES

TRAVERSE LINE NO. CHATHAM TAX MAP SURVEY
STATE NEW JERSEY COUNTY MORRIS INITIAL STATION MON. 2350
YEAR 1937 MONTH JUNE CLOSING STATION MON. 727

U. S. GOVERNMENT PRINTING OFFICE 31-11507

STATION	[redacted] BEARING	GRID DISTANCE	[redacted] SIN [redacted] COS [redacted]	DEPARTURE	LATITUDE	GRID COORDINATES x	GRID COORDINATES y
	° ' "	Feet		Feet	Feet	Feet	Feet
MON. 2350				E. 311.332	(ADJ. N.J.G.C.S.)	2,076,237.43	696,100.94
			.81020223				
	S. 54-06-56.5 E.	384.264				2,076,548.762	695,875.703
			.58615045			- .020	+ .005
PT. 6					S. 225.237	2,076,548.742	695,875.708
				E. 53.721			
			.79761756				
	S. 52-54-11.5 E.	67.352				2,076,602.483	695,835.079
		451.616	.60316352			- .023	+ .006
PT. 12					S. 40.624	2,076,602.460	695,835.085
				E. 1207.702			
			.59720837				
	N. 36-40-12.8 E	2022.246				2,077,810.185	697.457.094
		2473.862	.80208613			- .127	+ .031
PT. 13					N. 1622.015	2,077,810.058	697.457.125
				E. 657.824			
			.8035.6060				
	S. 53-28-17.3 E.	818.637				2,078,468.009	696,969.822
		3292.499	.59522296			- .169	+ .042
PT. 14					S. 487.272	2,078,467.840	696,969.864

Based on 1935 Geographic Positions

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 738
Ed. May 1935

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Schedule IX-D

COMPUTATION OF COORDINATES

TRAVERSE LINE NO. CHATHAM TAX MAP SURVEY
STATE NEW JERSEY COUNTY MORRIS INITIAL STATION MON. 2350
YEAR 1937 MONTH JUNE CLOSING STATION MON. 727

U. S. GOVERNMENT PRINTING OFFICE 15—11507

STATION	[redacted] BEARING	GRID DISTANCE	[redacted] SIN [redacted] COS [redacted]	DEPARTURE	LATITUDE	GRID COORDINATES x	GRID COORDINATES y
	° ′ ″	Feet		Feet	Feet	Feet	Feet
PT. 14				E. 871.615		2,078,467.840	696,969.864
			.86615361				
	S. 60-00-52.9 E.	1006.305				2,079,339.624	696,466.893
		4298.804	.49977788			−.221	+.055
PT. 15					S. 502.929	2,079,339.403	696,466.948
				E. 878.811			
			.91852672				
	S. 66-42-41.9 E.	956.761				2,080,218.435	696,088.629
		5255.565	.39535892			−.270	+.067
PT. 59					S. 378.264	2,080,218.165	696,088.696
				W. 499.301			
			.28742089				
	S. 16-42-13.0 W.	1737.176				2,079,719.134	694,424.754
		6992.741	.95780438			−.359	+.089
PT. 58					S. 1663.875	2,079,718.775	694,424.843

Based on 1935 Geographic Positions

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 788
Ed. May 1935

Schedule IX-E

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COMPUTATION OF COORDINATES

TRAVERSE LINE NO. CHATHAM TAX MAP SURVEY
STATE NEW JERSEY COUNTY MORRIS INITIAL STATION MON. 2350
YEAR 1937 MONTH JUNE CLOSING STATION MON. 727

U. S. GOVERNMENT PRINTING OFFICE 11—11507

STATION	[redacted] BEARING	GRID DISTANCE	[redacted] SIN [redacted] COS [redacted]	DEPARTURE	LATITUDE	GRID COORDINATES	
						x	y
	° ′ ″	Feet		Feet	Feet	Feet	Feet
PT. 58				W. 213.035		2,079,718.775	694,424.843
			.99557983				
	N. 84-36-39.2 W.	213.981					
		7206.722	.0939191 1				
MON. 727					N. 20.097	2,079,506.099	694,444.851
	TOTAL DISTANCE = 7206.722 FT. = 1.365 MILES				(ADJ. N.J.G.C.S.)	2,079,505.74	694,444.94
						+ 0.359	- 0.089
"Y"	CORR. COEFF. = $\frac{+0.089}{6992.741}$	=	+0.000012 7275			RESULTANT 0.370	
"X"	CORR. COEFF. = $\frac{-0.359}{6992.741}$	=	−0.0000513390		ACCURACY	$\frac{7206.722}{0.370}$	= 1 : 19,478

NOTE: PT. 58 is held in position between MONS. 726 and 727.

Based on 1935 Geographic Positions

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 758

Schedule IX - F 1/1

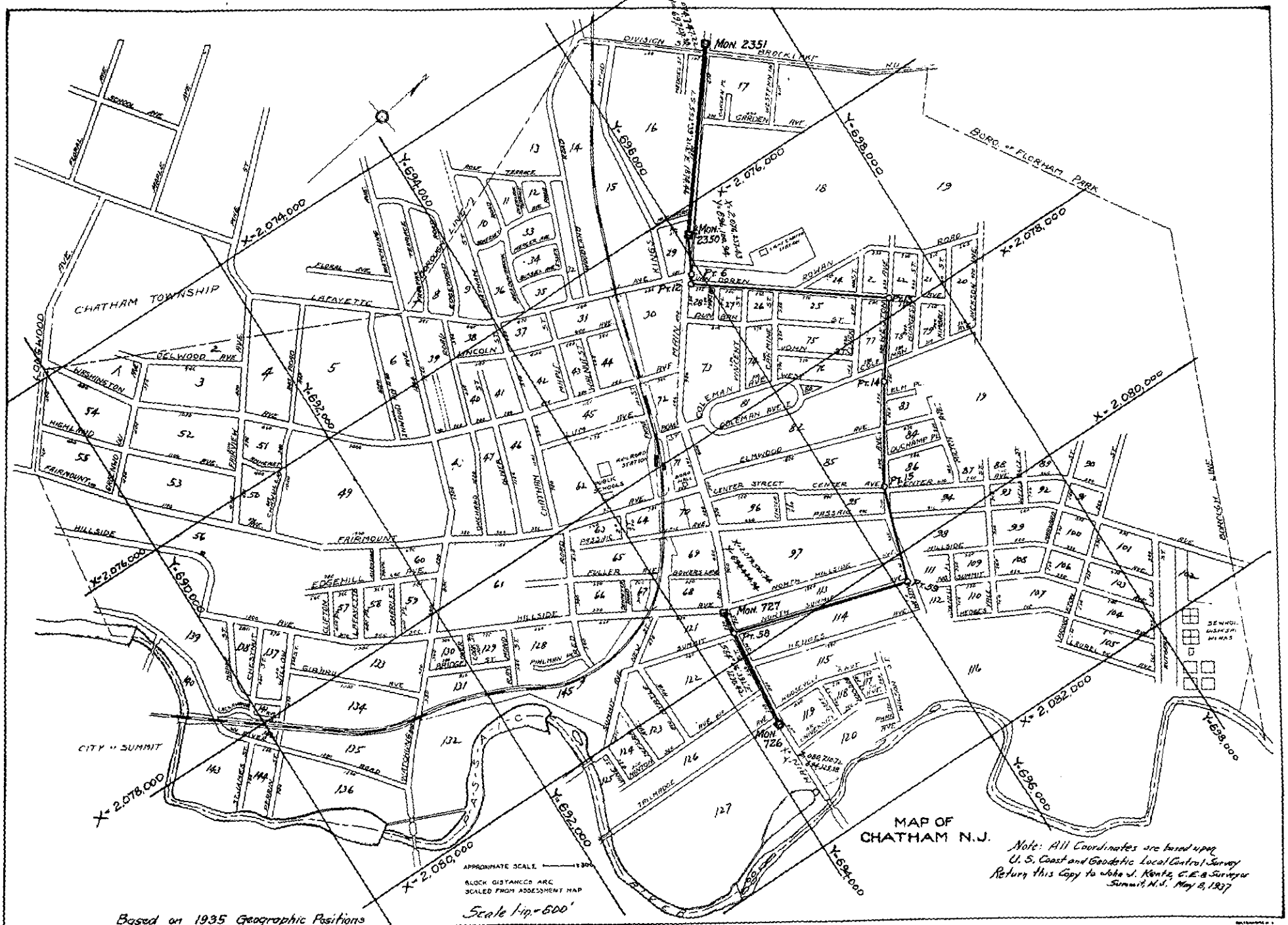
LIST OF PRELIMINARY GRID AZIMUTHS

State NEW JERSEY Locality MORRIS CO. Line CHATHAM TAX MAP SURVEY

U. S. GOVERNMENT PRINTING OFFICE — 11—11719

From station—	To station—	Preliminary azimuth	Correction for closure	Corrected azimuth
		° ′ ″	′ ″	° ′ ″
MON. 2351	MON. 2350	307-20-38.8	(ADJ. N.J.G.C.S.)	
∠ MON. 2350	PT. 12	359-45-09.7		
MON. 2351	PT. 12	307-05-48.5	-2.7	307-05-45.8
PT. 12	MON. 2351	127-05-48.5		
∠ MON. 2351	PT. 13	89-34-29.6		
PT. 12	PT. 13	216-40-18.1	-5.3	216-40-12.8
PT. 13	PT. 12	36-40-18.1		
∠ PT. 12	PT. 14	269-51-32.6		
PT. 13	PT. 14	306-31-50.7	-8.0	306-31-42.7
PT. 14	PT. 13	126-31-50.7		
∠ PT. 13	PT. 15	173-27-27.1		
PT. 14	PT. 15	299-59-17.8	-10.7	299-59-07.1
PT. 15	PT. 14	119-59-17.8		
∠ PT. 14	PT. 59	173-18-13.7		
PT. 15	PT. 59	293-17-31.5	-13.4	293-17-18.1
PT. 59	PT. 15	113-17-31.5		
∠ PT. 15	PT. 58	263-24-57.5		
PT 59	PT. 58	16-42-29.0	-16.0	16-42-13.0
PT. 58	PT. 59	196-42-29.0		
∠ PT. 59	MON. 726	78-41-10.5		
PT. 58	MON. 726	275-23-39.5	-18.7	275-23-20.8
MON. 727	MON. 726	275-23-20.8	(ADJ. N.J.G.C.S.)	
∠	ERROR	+18.7	7 ANGLES CORR. -2.″67 per ∠.	
MON. 2350	MON. 2351	127-20-38.8	(ADJ. N.J.G.C.S.)	
∠ MON. 2351	PT. 6	178-32-26.1		
MON. 2350	PT. 6	305-53-04.9	-1.4	305-53-03.5
PT. 6	MON. 2350	125-53-04.9		
∠ MON. 2350	PT. 12	181-12-43.6	(Concluded)	
PT. 6	PT. 12	307-05-48.5	-2.7	307-05-45.8
PT. 6	PT. 12	307-05-45.8		
∠	ERROR	+2.7	2 ANGLES CORR. -1.″35 per ∠	

NOTE: PT. 58 is on line MON. 726 to MON. 727.
NOTE: PT. 12 is on prolongation of line MON. 2351 to PT. 6



DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 758

SURVEY AT HARRINGTON PARK
BERGEN CO. N.J.

Schedule X-A

LIST OF PRELIMINARY GRID AZIMUTHS

State ..... Locality ..... Line .....

U. S. GOVERNMENT PRINTING OFFICE 11—11719

	From station—	To station—	Preliminary azimuth ° ′ ″	Correction for closure ′ ″	Corrected azimuth ° ′ ″
	A	MON 1459	248 33 28.4	(FIXED)	
∠	MON 1459	B	280 02 31.7		
	A	B	168 36 00.1		
	B	A	348 36 00.1		
∠	A	C	90 00 00.0		
	B	C	78 36 00.1		
	C	B	258 36 00.1		
∠	B	D	90 00 00.0		
	C	D	348 36 00.1		
	D	C	168 36 00.1		
∠	C	MON 1460	259 57 28.3		
	D	MON 1460	68 33 28.4		
	D	MON 1460	68 33 28.4	(FIXED)	
∠					
∠					
∠					
∠					
∠					
∠					
∠					
∠					

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 738
Ed. May 1935

Schedule X-B

COMPUTATION OF COORDINATES

SURVEY AT
HARRINGTON PARK
BERGEN CO N.J.

TRAVERSE LINE NO.

STATE | COUNTY | INITIAL STATION

YEAR | MONTH | CLOSING STATION

STATION	PLANE AZIMUTH	GRID DISTANCE	~~LOG DEPARTURE~~ / ~~LOG~~ SIN AZIMUTH / ~~LOG DISTANCE~~ / ~~LOG~~ COS AZIMUTH / ~~LOG LATITUDE~~	DEPARTURE	LATITUDE	GRID COORDINATES	
						x	y
	° ′ ″	Feet		Feet	Feet	Feet	Feet
C						2188795.88	784766.04
	S		.19765787	+21.47			
	11 23 59.9	108.60					
			.98027127				
					106.46		
F	S			+7.58		2188803.46	784728.43
	11 23 59.9		.19765787				
		38.36					
			.98027127				
					37.60		
D	S			−262.11		2188541.35	784625.49
	68 33 28.4		.93078739				
		281.60					
			.36556100				
					102.94		
MON 1460					(FIXED)	2188541.35	784625.49

Based on 1935 Geographic Positions

Schedule X- C

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 738
Ed. May 1935

COMPUTATION OF COORDINATES

SURVEY AT
HARRINGTON PARK
BERGEN Co N.J.

TRAVERSE LINE NO.

STATE | COUNTY | INITIAL STATION

YEAR | MONTH | CLOSING STATION

U. S. GOVERNMENT PRINTING OFFICE — 16—11407

STATION	PLANE AZIMUTH	GRID DISTANCE	~~Log departure~~ / ~~Log~~ sin azimuth / ~~Log distance~~ / ~~Log~~ cos azimuth / ~~Log latitude~~	DEPARTURE	LATITUDE	GRID COORDINATES x	GRID COORDINATES y
	° ′ ″	Feet		Feet	Feet	Feet	Feet
MON 1459				1091.39	(FIXED)	2189942.11	785175.63
	S W		.93078739				
	68 33 28.4	1172.54					
			.36556100		− 428.64		
A				7.34		2188850.72	784746.99
	N W		.19765787				
	11 23 59.9	37.11					
			.98027127		+ 36.38		
E				19.96		2188843.38	784783.37
	N W		.19765787				
	11 23 59.9	101.00					
			.98027127		+ 99.01		
B				49.01		2188774.41	784872.50
	S W		.98027127				
	78 36 00.1	56.00					
			.19765787				
					9.88		

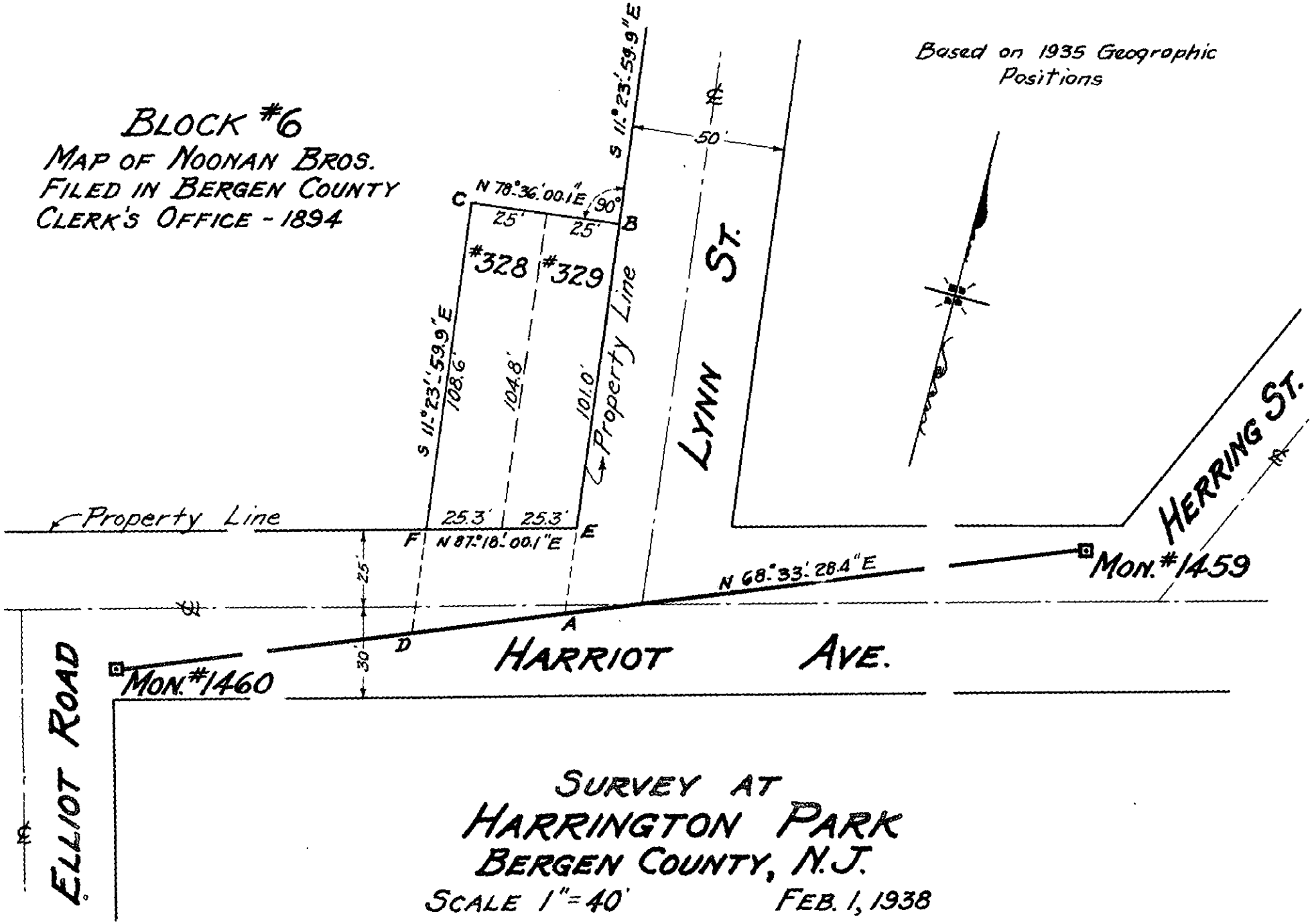
Based on 1935 Geographic Positions

Schedule X-D

Based on 1935 Geographic Positions

BLOCK #6

MAP OF NOONAN BROS.
FILED IN BERGEN COUNTY
CLERK'S OFFICE - 1894



SURVEY AT
HARRINGTON PARK
BERGEN COUNTY, N.J.

SCALE 1"=40' FEB. 1, 1938

SCHEDULE X-E

LOCATED AT THE INTERSECTION OF HARRIOT AVE., IN HARRINGTON PARK, BERGEN CO., N.J.

DESCRIPTION OF PROPERTY, FEBRUARY, 1938

Beginning at a point formed by the intersection of the westerly line of Lynn St. with the northerly line of Harriot Ave., (x : 2,188,843.38)(y : 784,783.37) and running thence: (1) S 87°18'00.1"W along the said northerly line of Harriot Ave. a distance of 50.60 ft. to a point (x : 2,188,795.88) (y : 784,766.04) thence (2) N 11°23'59.9"W a distance of 108.60 ft. to a point (x : 2,188,774.41) (y : 784,872.50) thence (3) N 78°36'00.1"E a distance of 50.00 ft. to a point in the westerly line of Lynn St. (x : 2,188,823.42) (y : 784,882.38) and thence (4) S 11°23'59.9"E along the said westerly line of Lynn St. a distance of 101.00 ft. to the northerly line of Harriot Ave., the point and place of beginning.

SCHEDULE XI.

TEMPERATURE CORRECTION COEFFICIENTS FOR STEEL TAPES

°F −		°F +
68	.00000000	68
67	.00000645	69
66	.00001290	70
65	.00001935	71
64	.00002580	72
63	.00003225	73
62	.00003870	74
61	.00004515	75
60	.00005160	76
59	.00005805	77
58	.00006450	78
57	.00007095	79
56	.00007740	80
55	.00008385	81
54	.00009030	82
53	.00009675	83
52	.00010320	84
51	.00010965	85
50	.00011610	86
49	.00012255	87
48	.00012900	88
47	.00013545	89
46	.00014190	90
45	.00014835	91
44	.00015480	92
43	.00016125	93

°F −		°F +
42	.00016770	94
41	.00017415	95
40	.00018060	96
39	.00018705	97
38	.00019350	98
37	.00019995	99
36	.00020640	100
35	.00021285	
34	.00021930	
33	.00022575	
32	.00023220	
31	.00023865	
30	.00024510	
29	.00025155	
28	.00025800	
27	.00026445	
26	.00027090	
25	.00027735	
24	.00028380	
23	.00029025	
22	.00029670	
21	.00030315	
20	.00030960	
19	.00031605	
18	.00032250	
17	.00032895	

°F −	
16	.00033540
15	.00034185
14	.00034830
13	.00035475
12	.00036120
11	.00036765
10	.00037410
9	.00038055
8	.00038700
7	.00039345
6	.00039990
5	.00040635
4	.00041280
3	.00041925
2	.00042570
1	.00043215
0	.00043860
-1	.00044505
-2	.00045150
-3	.00045795
-4	.00046440
-5	.00047085
-6	.00047730
-7	.00048375
-8	.00049020
-9	.00049665

GRADE CORRECTIONS FOR 100 FOOT TAPE LENGTH

C=Correction in Feet H=Inclination in Feet

H	C	H	C	H	C	H	C
0.00-0.31	0.000	3.12-3.14	0.049	4.42-4.43	0.098	5.42-	0.147
0.32-0.54	0.001	3.15-3.17	0.050	4.44-4.46	0.099	5.43-5.44	0.148
0.55-0.70	0.002	3.18-3.20	0.051	4.47-4.48	0.100	5.45-5.46	0.149
0.71-0.83	0.003	3.21-3.24	0.052	4.49-4.50	0.101	5.47-5.48	0.150
0.84-0.94	0.004	3.25-3.27	0.053	4.51-4.52	0.102	5.49-5.50	0.151
0.95-1.04	0.005	3.28-3.30	0.054	4.53-4.54	0.103	5.51-5.52	0.152
1.05-1.14	0.006	3.31-3.33	0.055	4.55-4.57	0.104	5.53-	0.153
1.15-1.22	0.007	3.34-3.36	0.056	4.58-4.59	0.105	5.54-5.55	0.154
1.23-1.30	0.008	3.37-3.39	0.057	4.60-4.61	0.106	5.56-5.57	0.155
1.31-1.37	0.009	3.40-3.42	0.058	4.62-4.63	0.107	5.58-5.59	0.156
1.38-1.44	0.010	3.43-3.45	0.059	4.64-4.65	0.108	5.60-5.61	0.157
1.45-1.51	0.011	3.46-3.47	0.060	4.66-4.67	0.109	5.62-	0.158
1.52-1.58	0.012	3.48-3.50	0.061	4.68-4.70	0.110	5.63-5.64	0.159
1.59-1.64	0.013	3.51-3.53	0.062	4.71-4.72	0.111	5.65-5.66	0.160
1.65-1.70	0.014	3.54-3.56	0.063	4.73-4.74	0.112	5.67-5.68	0.161
1.71-1.76	0.015	3.57-3.59	0.064	4.75-4.76	0.113	5.69-	0.162
1.77-1.81	0.016	3.60-3.61	0.065	4.77-4.78	0.114	5.70-5.71	0.163
1.82-1.87	0.017	3.62-3.64	0.066	4.79-4.80	0.115	5.72-5.73	0.164
1.88-1.92	0.018	3.65-3.67	0.067	4.81-4.82	0.116	5.74-5.75	0.165
1.93-1.97	0.019	3.68-3.70	0.068	4.83-4.84	0.117	5.76-	0.166
1.98-2.02	0.020	3.71-3.72	0.069	4.85-4.86	0.118	5.77-5.78	0.167
2.03-2.07	0.021	3.73-3.75	0.070	4.87-4.88	0.119	5.79-5.80	0.168
2.08-2.12	0.022	3.76-3.78	0.071	4.89-4.90	0.120	5.81-5.82	0.169
2.13-2.16	0.023	3.79-3.80	0.072	4.91-4.92	0.121	5.83-	0.170
2.17-2.21	0.024	3.81-3.83	0.073	4.93-4.94	0.122	5.84-5.85	0.171
2.22-2.25	0.025	3.84-3.85	0.074	4.95-4.96	0.123	5.86-5.87	0.172
2.26-2.30	0.026	3.86-3.88	0.075	4.97-4.98	0.124	5.88-	0.173
2.31-2.34	0.027	3.89-3.91	0.076	4.99-5.00	0.125	5.89-5.90	0.174
2.35-2.38	0.028	3.92-3.93	0.077	5.01-5.02	0.126	5.91-5.92	0.175
2.39-2.42	0.029	3.94-3.96	0.078	5.03-5.04	0.127	5.93-	0.176
2.43-2.47	0.030	3.97-3.98	0.079	5.05-5.06	0.128	5.94-5.95	0.177
2.48-2.51	0.031	3.99-4.01	0.080	5.07-5.08	0.129	5.96-5.97	0.178
2.52-2.54	0.032	4.02-4.03	0.081	5.09-5.10	0.130	5.98-	0.179
2.55-2.58	0.033	4.04-4.06	0.082	5.11-5.12	0.131	5.99-6.00	0.180
2.59-2.62	0.034	4.07-4.08	0.083	5.13-5.14	0.132	6.01-6.02	0.181
2.63-2.66	0.035	4.09-4.11	0.084	5.15-5.16	0.133	6.03-	0.182
2.67-2.70	0.036	4.12-4.13	0.085	5.17-5.18	0.134	6.04-6.05	0.183
2.71-2.73	0.037	4.14-4.15	0.086	5.19-5.20	0.135	6.06-6.07	0.184
2.74-2.77	0.038	4.16-4.18	0.087	5.21-5.22	0.136	6.08-	0.185
2.78-2.81	0.039	4.19-4.20	0.088	5.23-5.24	0.137	6.09-6.10	0.186
2.82-2.84	0.040	4.21-4.23	0.089	5.25-5.26	0.138	6.11-6.12	0.187
2.85-2.88	0.041	4.24-4.25	0.090	5.27-5.28	0.139	6.13-	0.188
2.89-2.91	0.042	4.26-4.27	0.091	5.29-	0.140	6.14-6.15	0.189
2.92-2.94	0.043	4.28-4.30	0.092	5.30-5.31	0.141	6.16-6.17	0.190
2.95-2.98	0.044	4.31-4.32	0.093	5.32-5.33	0.142	6.18-	0.191
2.99-3.01	0.045	4.33-4.34	0.094	5.34-5.35	0.143	6.19-6.20	0.192
3.02-3.04	0.046	4.35-4.36	0.095	5.36-5.37	0.144	6.21-	0.193
3.05-3.08	0.047	4.37-4.39	0.096	5.38-5.39	0.145	6.22-6.23	0.194
3.09-3.11	0.048	4.40-4.41	0.097	5.40-5.41	0.146	6.24-6.25	0.195

Schedule XII-A

GRADE CORRECTIONS FOR 100 FOOT TAPE LENGTH

C=Correction in Feet

H=Inclination in Feet

H	C	H	C
6.26-	0.196	7.04-	0.248
6.27-6.28	0.197	7.05-	0.249
6.29-	0.198	7.06-7.07	0.250
		7.08-	0.251
6.30-6.31	0.199	7.09-7.10	0.252
6.32-	0.200		
6.33-6.34	0.201	7.11-	0.253
6.35-6.36	0.202	7.12-	0.254
6.37-	0.203	7.13-7.14	0.255
6.38-6.39	0.204	7.15-	0.256
6.40-	0.205	7.16-7.17	0.257
		7.18-	0.258
6.41-6.42	0.206	7.19-	0.259
6.43-	0.207		
6.44-6.45	0.208	7.20-7.21	0.260
6.46-6.47	0.209	7.22-	0.261
6.48-	0.210	7.23-7.24	0.262
6.49-6.50	0.211	7.25-	0.263
		7.26-	0.264
6.51-	0.212	7.27-7.28	0.265
6.52-6.53	0.213	7.29-	0.266
6.54-	0.214	7.30-	0.267
6.55-6.56	0.215		
6.57-	0.216	7.31-7.32	0.268
6.58-6.59	0.217	7.33-	0.269
6.60-	0.218	7.34-7.35	0.270
		7.36-	0.271
6.61-6.62	0.219	7.37-	0.272
6.63-	0.220	7.38-7.39	0.273
6.64-6.65	0.221	7.40-	0.274
6.66-	0.222		
6.67-6.68	0.223	7.41-	0.275
6.69-	0.224	7.42-7.43	0.276
		7.44-	0.277
6.70-6.71	0.225	7.45-	0.278
6.72-	0.226	7.46-7.47	0.279
6.73-6.74	0.227	7.48-	0.280
6.75-	0.228	7.49-	0.281
6.76-6.77	0.229		
6.78	0.230	7.50-5.51	0.282
6.79	0.231	7.52-	0.283
		7.53-	0.284
6.80-6.81	0.232	7.54-7.55	0.285
6.82-	0.233	7.56-	0.286
6.83-6.84	0.234	7.57-	0.287
6.85-	0.235	7.58-	0.288
6.86-6.87	0.236	7.59-7.60	0.289
6.88-	0.237		
6.89-6.90	0.238	7.61-	0.290
		7.62-	0.291
6.91-	0.239	7.63-7.64	0.292
6.92-6.93	0.240	7.65-	0.293
6.94-	0.241	7.66-	0.294
6.95-6.96	0.242	7.67-7.68	0.295
6.97-	0.243	7.69-	0.296
6.98-	0.244	7.70-	0.297
6.99-7.00	0.245		
7.01	0.246	7.71-7.72	0.298
7.02-7.03	0.247	7.73-	0.299
7.74-	0.300	8.39-8.40	0.353
7.75-7.76	0.301	8.41-	0.354
7.77-	0.302	8.42	0.355
7.78-	0.303	8.43-	0.356
7.79-	0.304	8.44-	0.357
		8.45-8.46	0.358
7.80-7.81	0.305	8.47-	0.359
7.82-	0.306	8.48-	0.360
7.83-	0.307	8.49-	0.361
7.84-	0.308	8.50-	0.362
7.85-7.86	0.309		
7.87-	0.310	8.51-	0.363
7.88-	0.311	8.52-8.53	0.364
7.89-	0.312	8.54-	0.365
		8.55-	0.366
7.90-7.91	0.313	8.56-	0.367
7.92-	0.314	8.57-	0.368
7.93-	0.315	8.58-	0.369
7.94-	0.316	8.59-8.60	0.370
7.95-7.96	0.317		
7.97-	0.318	8.61-	0.371
7.98-	0.319	8.62-	0.372
7.99-	0.320	8.63-	0.373
		8.64-	0.374
8.00-8.01	0.321	8.65-	0.375
8.02-	0.322	8.66-	0.376
8.03-	0.323	8.67-8.68	0.377
8.04-	0.324	8.69-	0.378
8.05-8.06	0.325	8.70-	0.379
8.07-	0.326		
8.08-	0.327	8.71-	0.380
8.09-	0.328	8.72-	0.381
		8.73-	0.382
8.10-8.11	0.329	8.74-	0.383
8.12-	0.330	8.75-8.76	0.384
8.13-	0.331	8.77-	0.385
8.14-	0.332	8.78-	0.386
8.15-8.16	0.333	8.79-	0.387
8.17-	0.334	8.80-	0.388
8.18-	0.335		
8.19-	0.336	8.81-	0.389
8.20-	0.337	8.82-	0.390
		8.83-	0.391
8.21-8.22	0.338	8.84-8.85	0.392
8.23-	0.339	8.86-	0.393
8.24-	0.340	8.87-	0.394
8.25-	0.341	8.88-	0.395
8.26-	0.342	8.89-	0.396
8.27-8.28	0.343	8.90-	0.397
8.29-	0.344		
8.30-	0.345	8.91-	0.398
		8.92-	0.399
8.31-	0.345	8.93-8.94	0.400
8.32-	0.347	8.95-	0.401
8.33-8.34	0.348	8.96-	0.402
8.35-	0.349	8.97-	0.403
8.36-	0.350	8.98-	0.404
8.37-	0.351	8.99-	0.405
8.38-	0.352	9.00-	0.406

Schedule XII-B

GRADE CORRECTIONS FOR 100 FOOT TAPE LENGTH

C-Correction in Feet H C			H-Inclination in Feet H C	
9.01-0.407	9.51-0.453	10.01-0.502	10.51-0.554	11.01-0.608
9.02-0.408	9.52-0.454	10.02-0.503	10.52-0.555	11.02-0.609
9.03-0.409	9.53-0.455	10.03-0.504	10.53-0.556	11.03-0.610
9.04-0.409	9.54-0.456	10.04-0.505	10.54-0.557	11.04-0.611
9.05-0.410	9.55-0.457	10.05-0.506	10.55-0.558	11.05-0.612
9.06-0.411	9.56-0.458	10.06-0.507	10.56-0.559	11.06-0.613
9.07-0.412	9.57-0.459	10.07-0.508	10.57-0.560	11.07-0.615
9.08-0.413	9.58-0.460	10.08-0.509	10.58-0.561	11.08-0.616
9.09-0.414	9.59-0.461	10.09-0.510	10.59-0.562	11.09-0.617
9.10-0.415	9.60-0.462	10.10-0.511	10.60-0.563	11.10-0.618
9.11-0.416	9.61-0.463	10.11-0.512	10.61-0.564	11.11-0.619
9.12-0.417	9.62-0.464	10.12-0.513	10.62-0.566	11.12-0.620
9.13-0.418	9.63-0.465	10.13-0.514	10.63-0.567	11.13-0.621
9.14-0.418	9.64-0.466	10.14-0.515	10.64-0.568	11.14-0.622
9.15-0.419	9.65-0.467	10.15-0.516	10.65-0.569	11.15-0.624
9.16-0.420	9.66-0.468	10.16-0.517	10.66-0.570	11.16-0.625
9.17-0.421	9.67-0.469	10.17-0.518	10.67-0.571	11.17-0.626
9.18-0.422	9.68-0.470	10.18-0.519	10.68-0.572	11.18-0.627
9.19-0.423	9.69-0.471	10.19-0.520	10.69-0.573	11.19-0.628
9.20-0.424	9.70-0.472	10.20-0.522	10.70-0.574	11.20-0.629
9.21-0.425	9.71-0.473	10.21-0.523	10.71-0.575	11.21-0.630
9.22-0.426	9.72-0.474	10.22-0.524	10.72-0.576	11.22-0.631
9.23-0.427	9.73-0.475	10.23-0.525	10.73-0.577	11.23-0.633
9.24-0.428	9.74-0.475	10.24-0.526	10.74-0.578	11.24-0.634
9.25-0.429	9.75-0.476	10.25-0.527	10.75-0.580	11.25-0.635
9.26-0.430	9.76-0.477	10.26-0.528	10.76-0.581	11.26-0.636
9.27-0.431	9.77-0.478	10.27-0.529	10.77-0.582	11.27-0.637
9.28-0.431	9.78-0.479	10.28-0.530	10.78-0.583	11.28-0.638
9.29-0.432	9.79-0.480	10.29-0.531	10.79-0.584	11.29-0.639
9.30-0.433	9.80-0.481	10.30-0.532	10.80-0.585	11.30-0.640
9.31-0.434	9.81-0.482	10.31-0.533	10.81-0.586	11.31-0.642
9.32-0.435	9.82-0.483	10.32-0.534	10.82-0.587	11.32-0.643
9.33-0.436	9.83-0.484	10.33-0.535	10.83-0.588	11.33-0.644
9.34-0.437	9.84-0.485	10.34-0.536	10.84-0.589	11.34-0.645
9.35-0.438	9.85-0.486	10.35-0.537	10.85-0.590	11.35-0.646
9.36-0.439	9.86-0.487	10.36-0.538	10.86-0.591	11.36-0.647
9.37-0.440	9.87-0.488	10.37-0.539	10.87-0.593	11.37-0.648
9.38-0.441	9.88-0.489	10.38-0.540	10.88-0.594	11.38-0.650
9.39-0.442	9.89-0.490	10.39-0.541	10.89-0.595	11.39-0.651
9.40-0.443	9.90-0.491	10.40-0.542	10.90-0.596	11.40-0.652
9.41-0.444	9.91-0.492	10.41-0.543	10.91-0.597	11.41-0.653
9.42-0.445	9.92-0.493	10.42-0.544	10.92-0.598	11.42-0.654
9.43-0.446	9.93-0.494	10.43-0.545	10.93-0.599	11.43-0.655
9.44-0.447	9.94-0.495	10.44-0.546	10.94-0.600	11.44-0.656
9.45-0.448	9.95-0.496	10.45-0.547	10.95-0.601	11.45-0.658
9.46-0.448	9.96-0.497	10.46-0.549	10.96-0.602	11.46-0.659
9.47-0.449	9.97-0.498	10.47-0.550	10.97-0.603	11.47-0.660
9.48-0.450	9.98-0.499	10.48-0.551	10.98-0.604	11.48-0.661
9.49-0.451	9.99-0.500	10.49-0.552	10.99-0.606	11.49-0.662
9.50-0.452	10.00-0.501	10.50-0.553	11.00-0.607	11.50-0.663

Schedule XII-C

S C H E D U L E XIII

BIBLIOGRAPHY:

Publication of U. S. Coast and Geodetic Survey

Serial No. 250 Oscar S. Adams, Elementary Examples of Least Squares

Serial No. 583 J. H. Brittain, Control Surveys and their Uses

Serial No. 529 Triangulation

Serial No. 562 Oscar S. Adams, Plane Coordinate Systems

Serial No. 502 First Order Leveling

Serial No. 584 Azimuths from Plane Coordinates

SPECIAL PUBLICATIONS:

No. 23 The U.S. Coast and Geodetic Survey

No. 57 General Theory of Ploy conic Projections

No. 68 Elements of Map Projection

No. 71 Relation between Plane Rectangular Coordinates and Geographic Positions

No. 91 Use of Geodetic Control for City Surveys

No.120 Manual of First Order Triangulation

No.137 Manual of First Order Traverse

No.138 Manual of Triangulation Computation and Adjustment

No.140 Manual of First Order Leveling

No.145 Manual of Second and Third Order Traverse

No.172 First Order Leveling in New Jersey

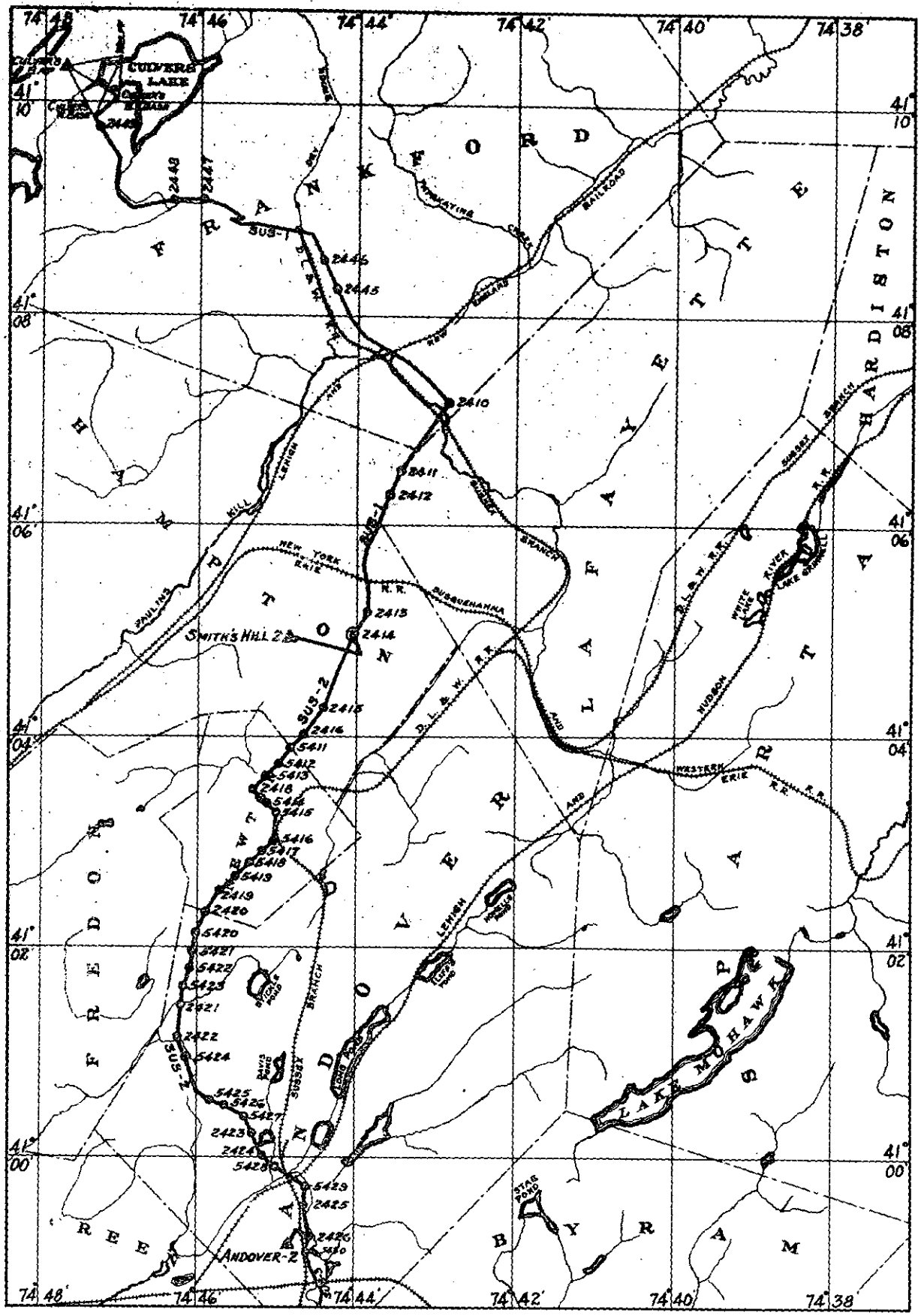
No.195 Manual of Traverse Computation on the Transverse Mercator Grid

MANUALS PUBLISHED BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS:

No. 10 Technical Procedure for City Surveys

No. 15 Definition of Surveying Terms

All of these pamphlets may be obtained for the payment of a few cents. They contain all the information required to be known regarding triangulation and traverse work.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 22-4

TRAVERSES

SUS - 1
SUS - 2

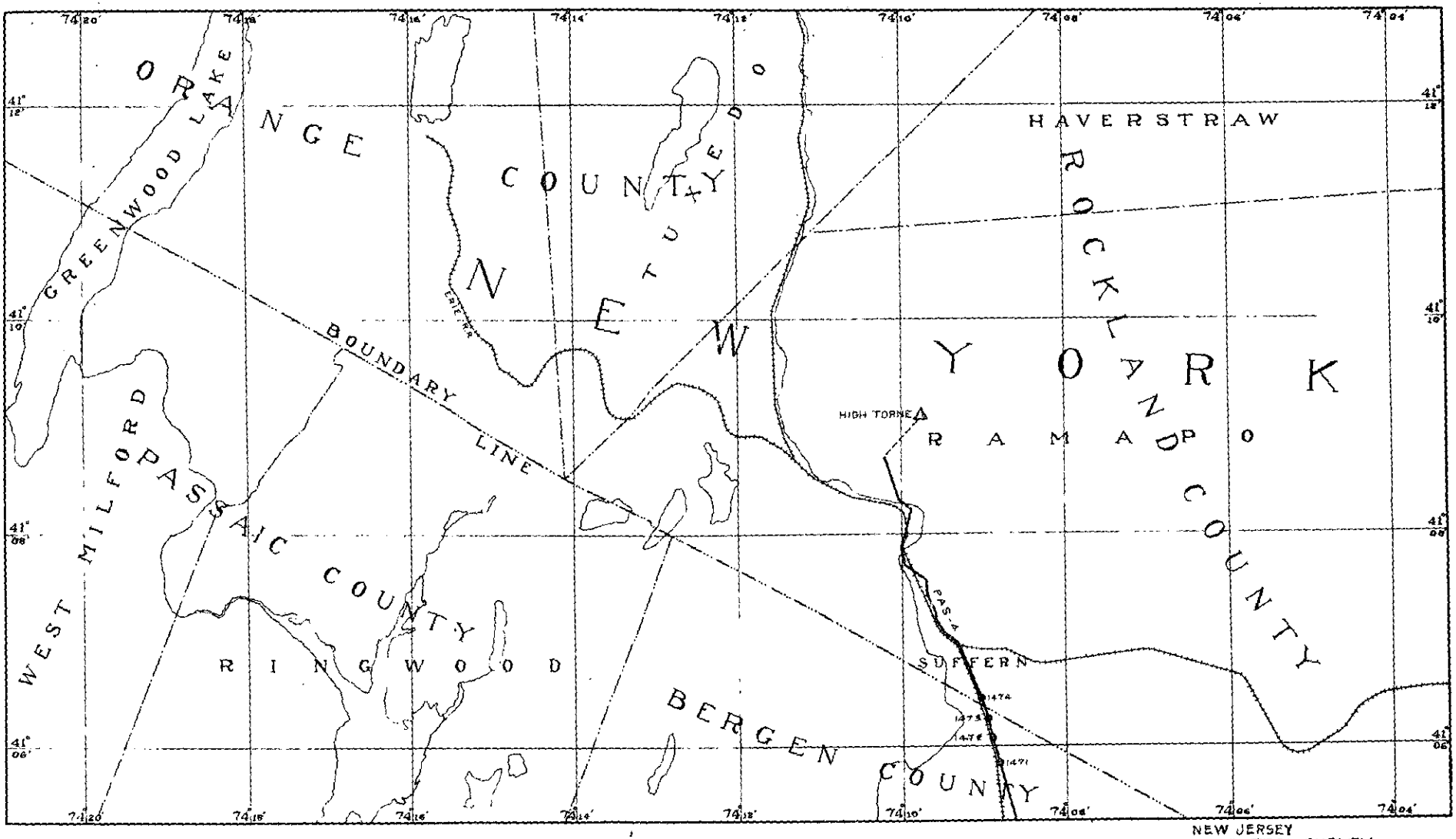
NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.

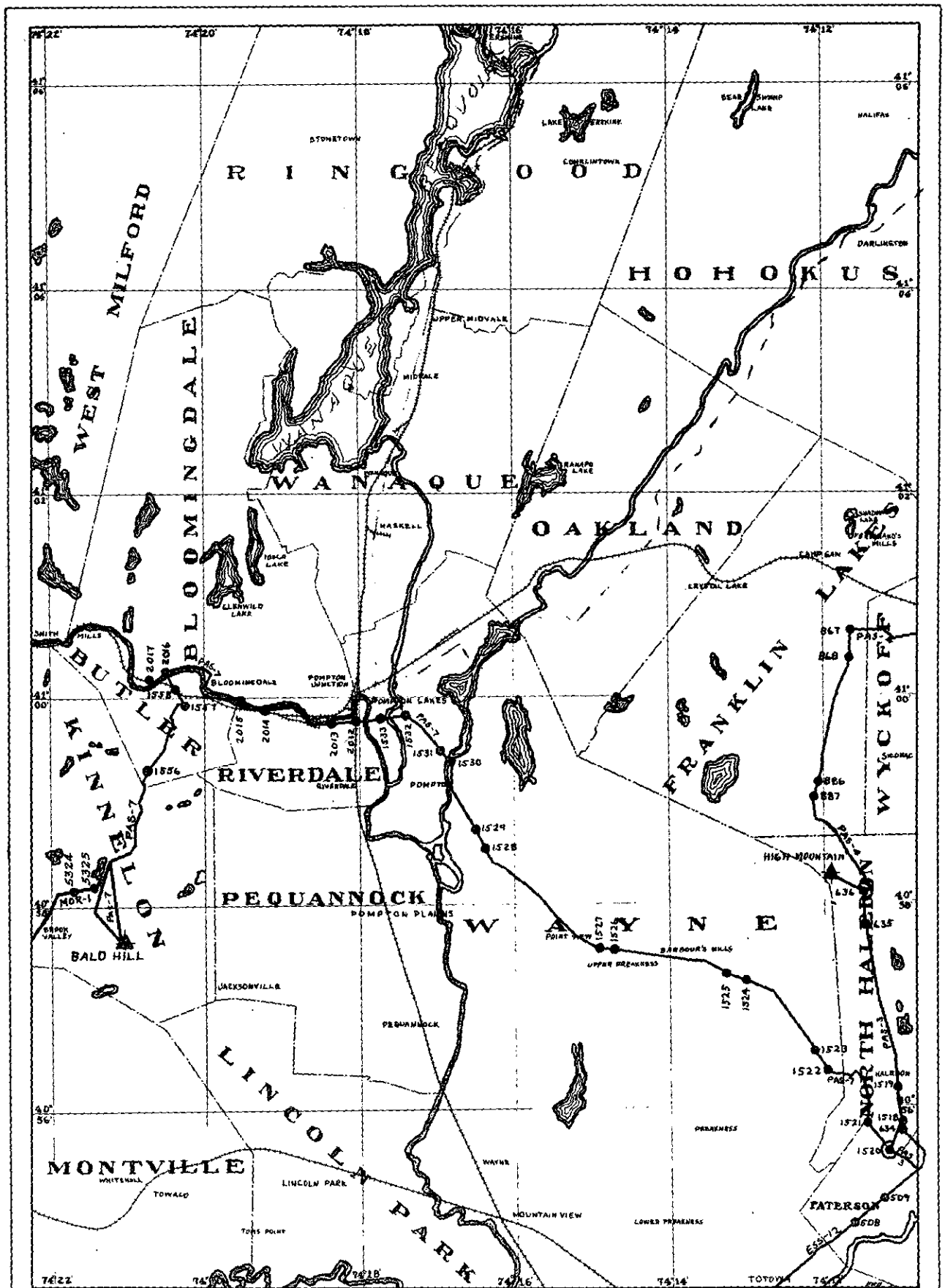


LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 23-1
TRAVERSES
PA5-4

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 AND 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE 1 INCH = 1 MILE



LEGEND

Traverse _____ PAS-7

Monument _____ ○

Traverse Junction _____

Triangulation Station (1st Order) _____ △

Triangulation Station (2nd Order) _____ △

SHEET 23-2

TRAVERSES

PAS-3 ESS-12

PAS-4 MOR-1

PAS-7

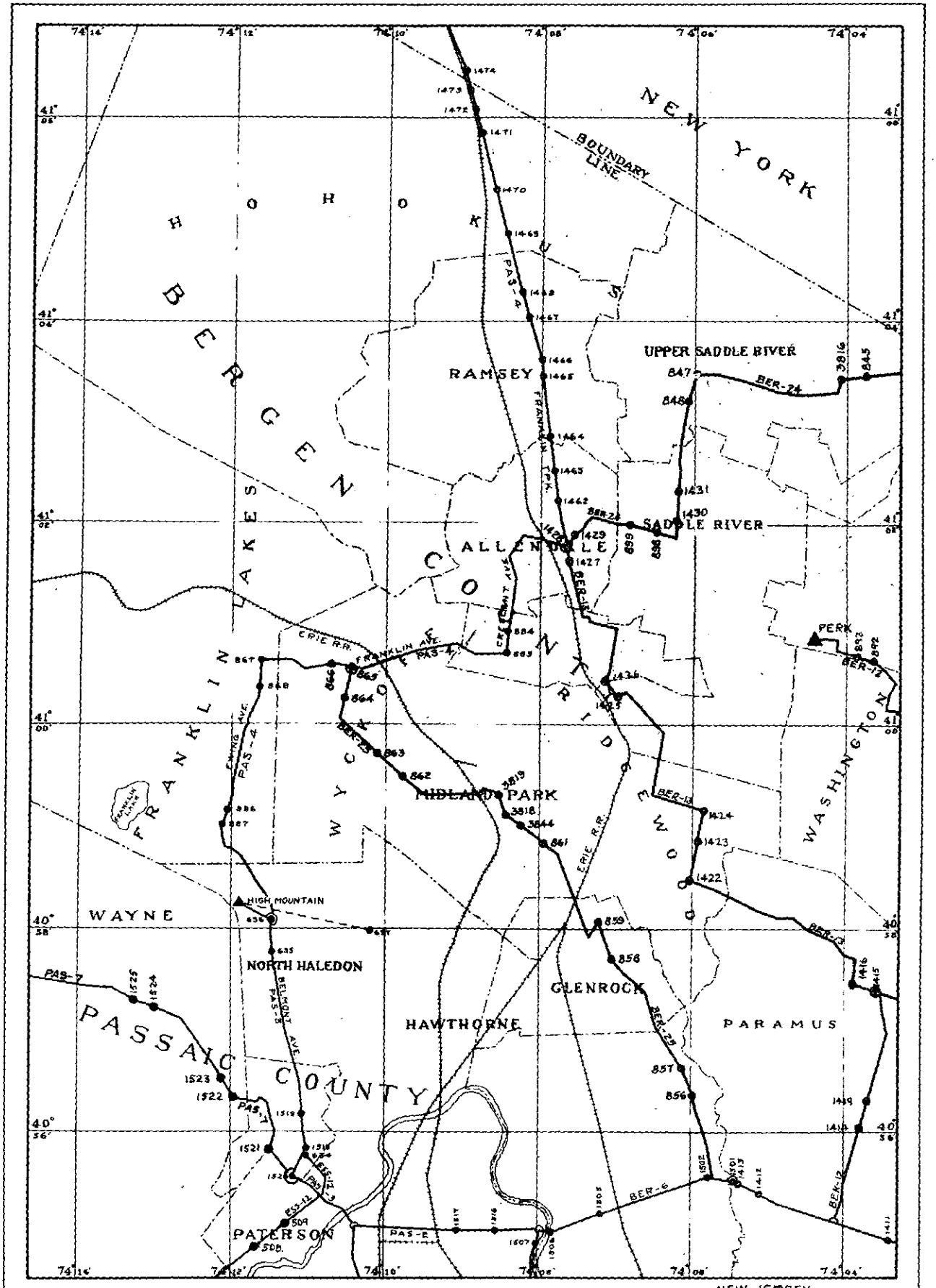
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 23-3

TRAVERSES

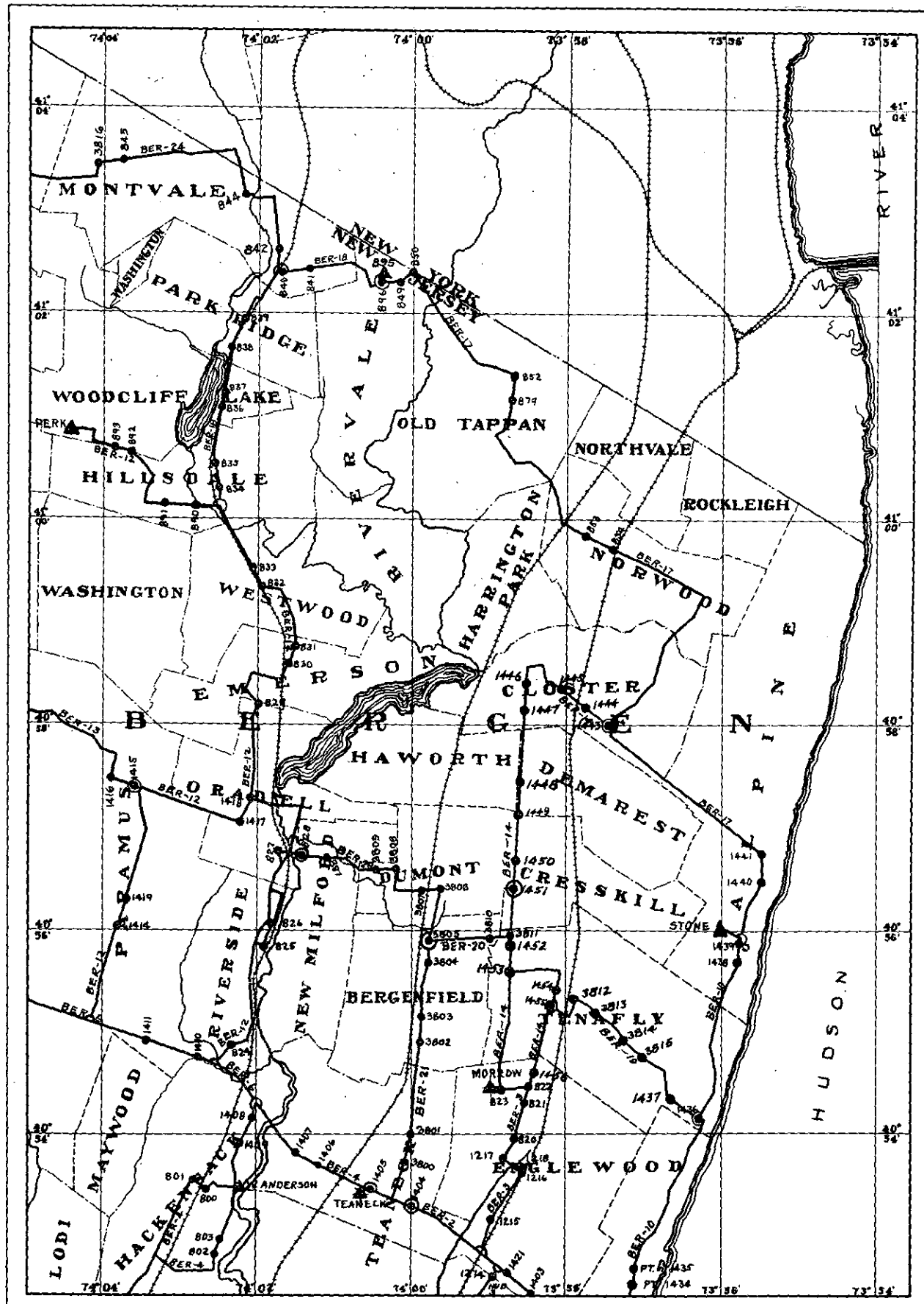
PAS-3	ESS-12	BER-25
PAS-4	BER-6	BER-24
PAS-2	BER-12	
PAS-7	BER-13	

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— BER-4

Monument ●

Traverse Junction

Triangulation Station (1st Order) ▲

Triangulation Station (2nd Order) △

SHEET 23-4

TRAVERSES

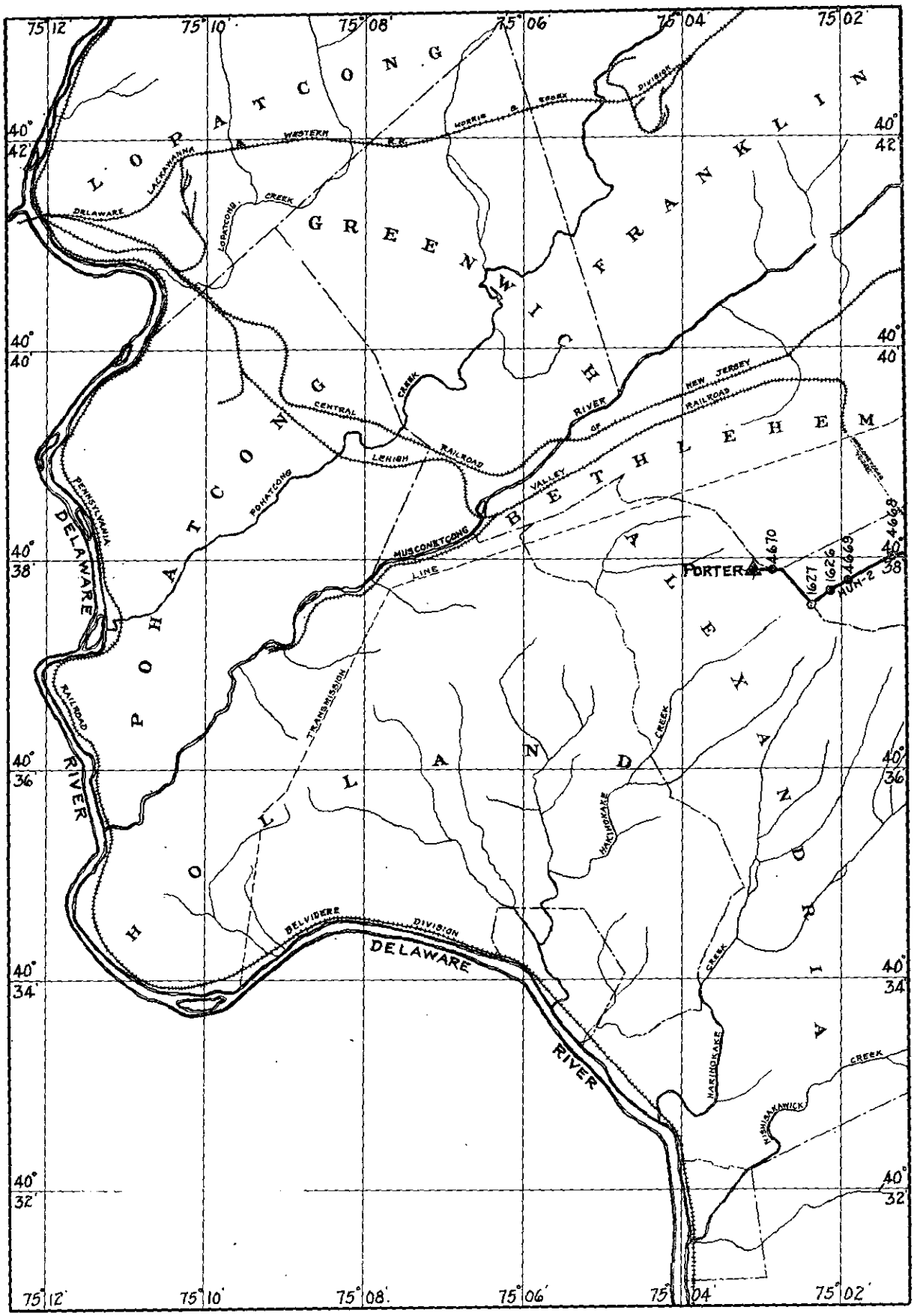
BER-3	BER-12	BER-19	BER-24
BER-4	BER-13	BER-14	
BER-6	BER-17	BER-20	
BER-10	BER-18	BER-21	

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 B 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 24-3
TRAVERSES
HUN-2

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE 1 INCH = 1 MILE
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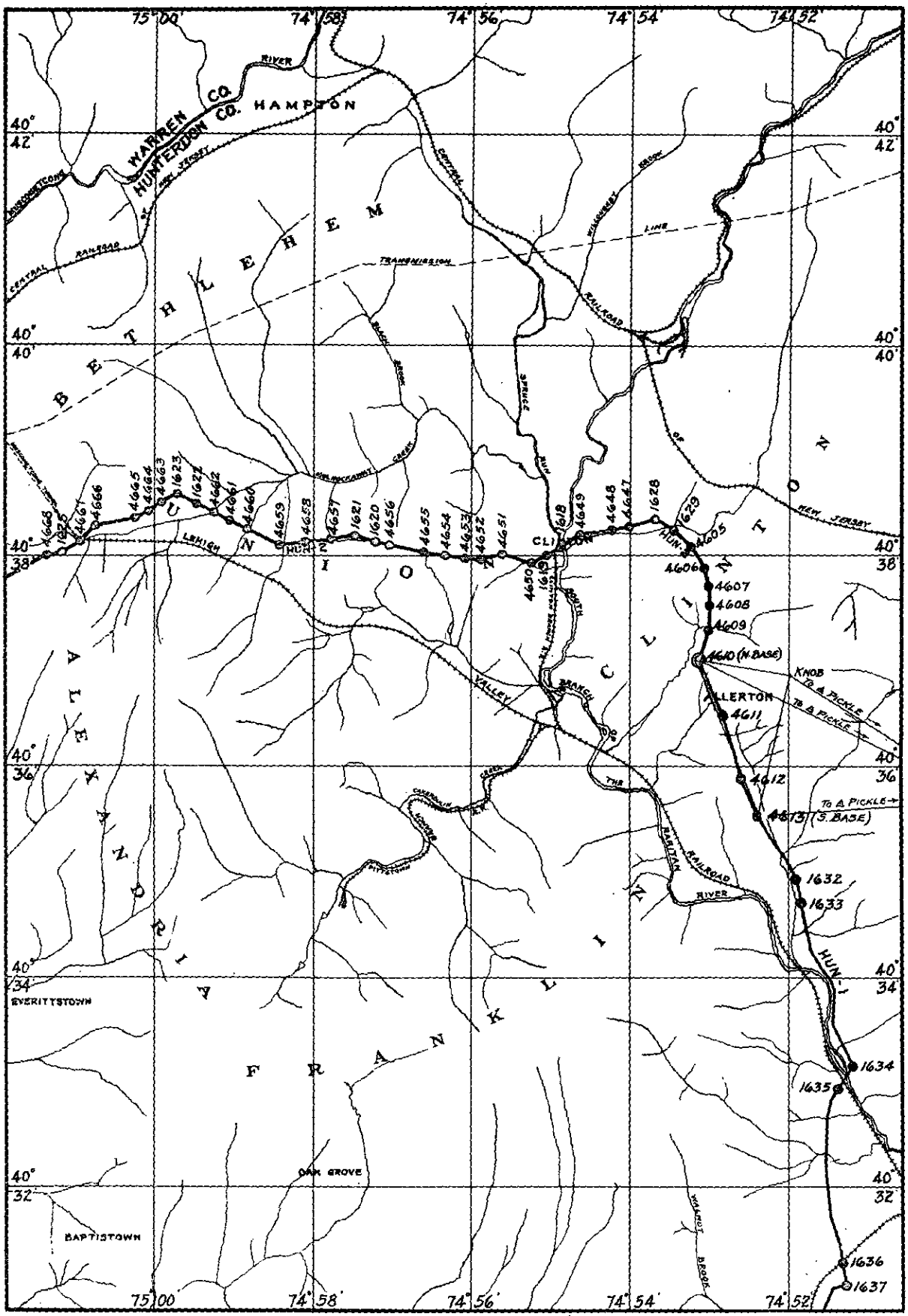

LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 24-4

TRAVERSE

HUN - 1
HUN - 2

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

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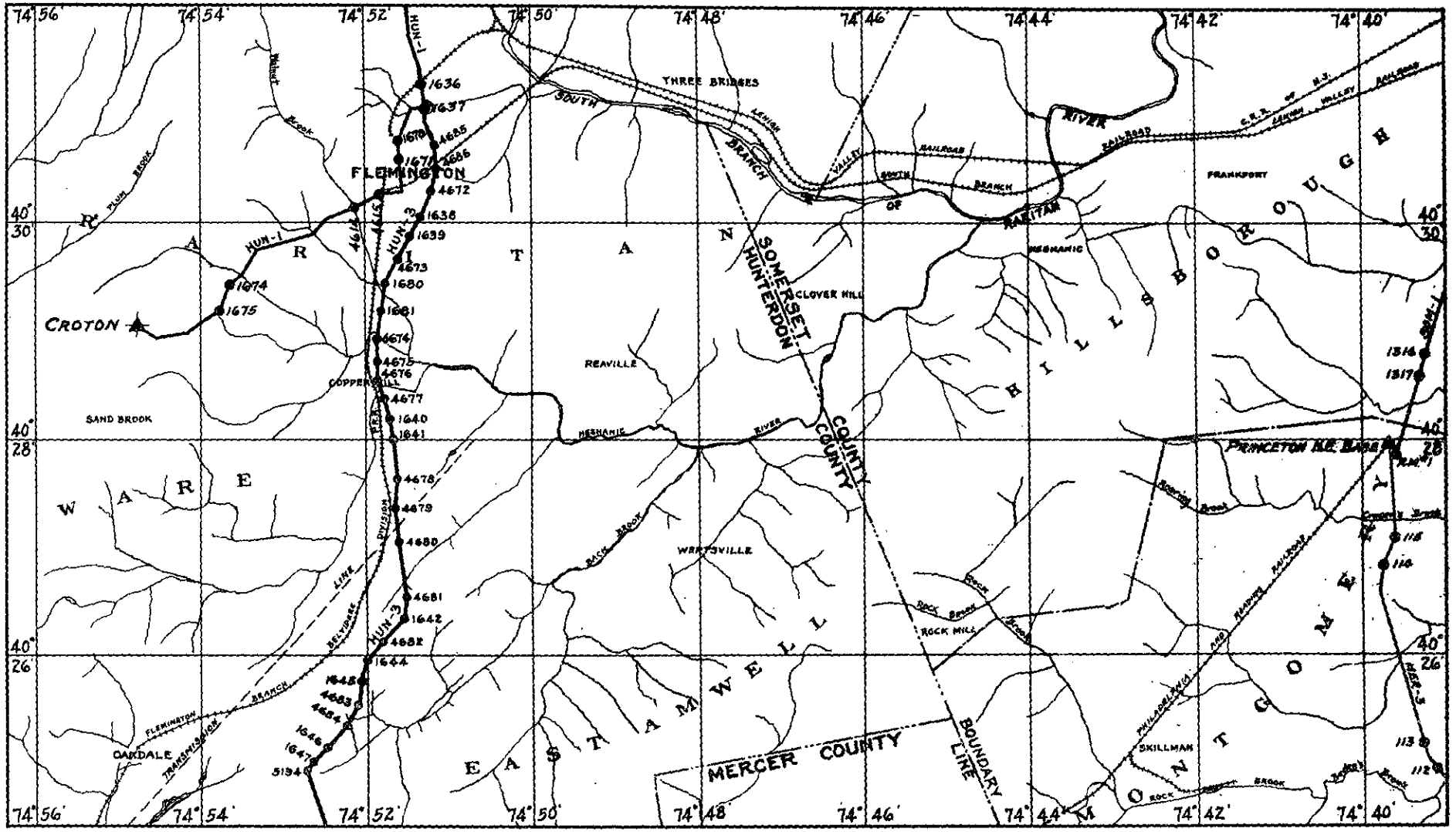


LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 24-5
TRAVERSES

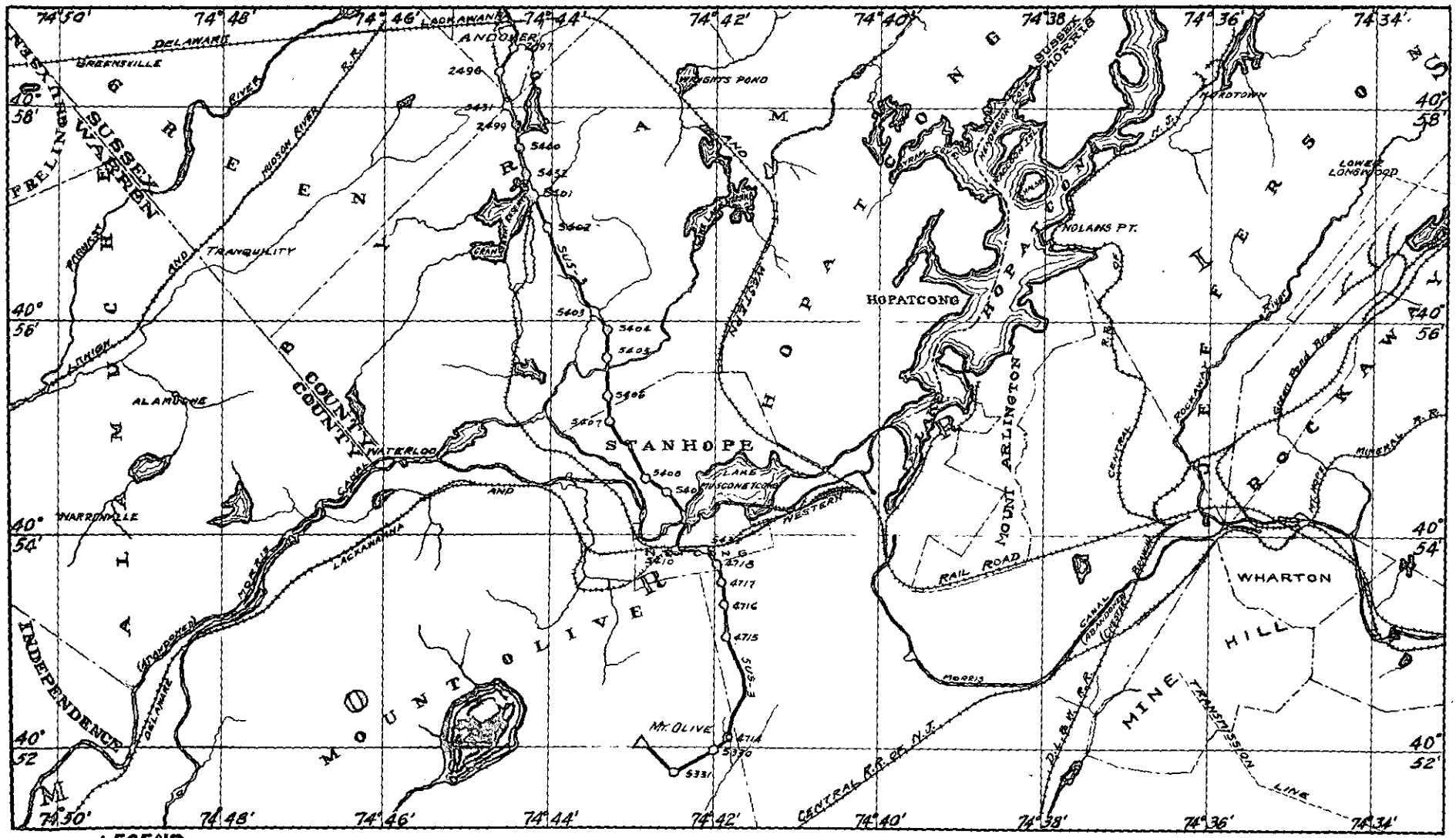
HUN-1 MER-3 SOM-1
HUN-3

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 B 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 25-1

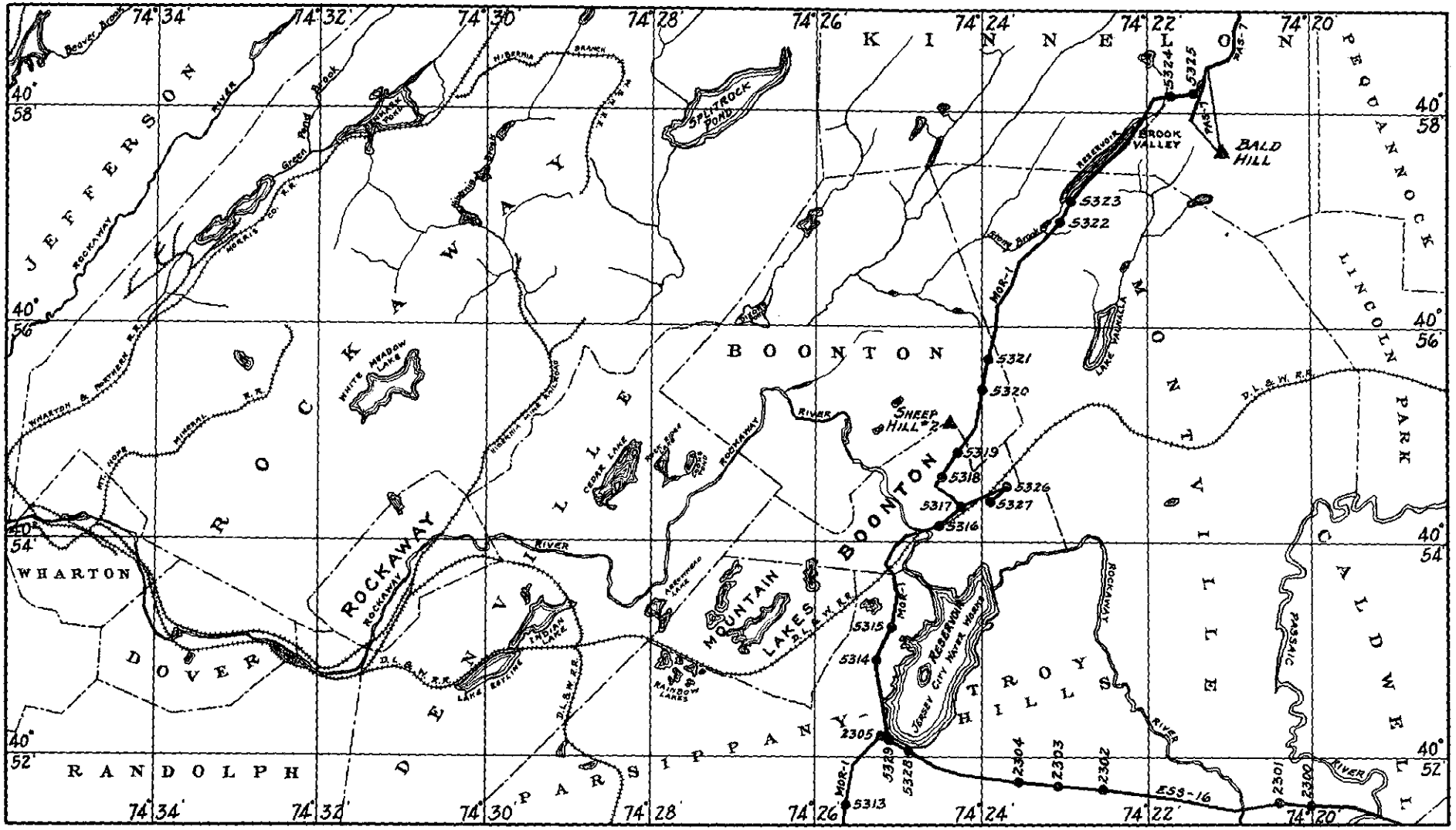
TRAVERSES

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order) ▲
Triangulation Station (2nd Order) △

SHEET 25-2

TRAVERSES

ESS-16 MOR-1 PAS-7

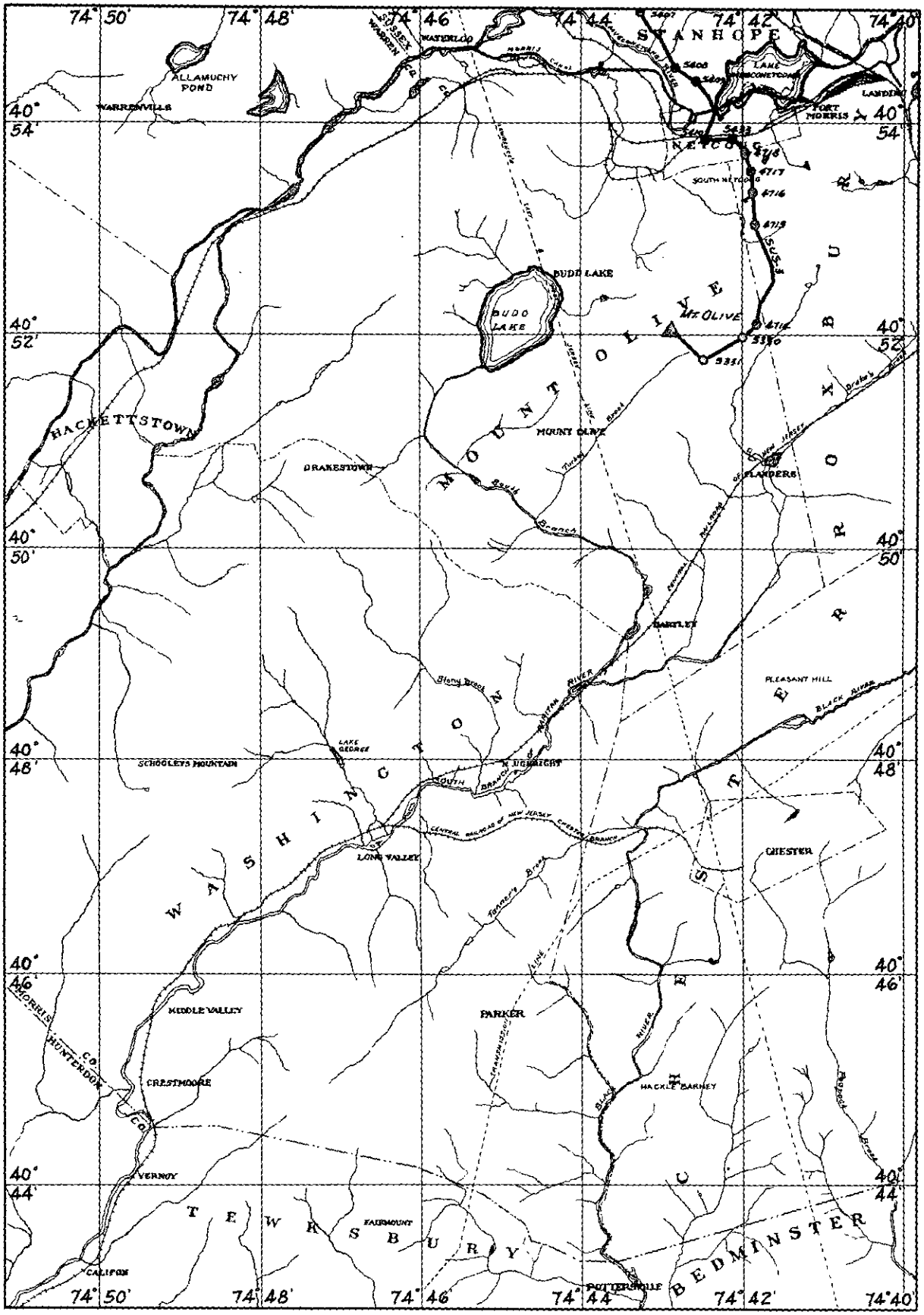
NEW JERSEY GEODETIC CONTROL SURVEY

WPA. PROJECT STATE-1; STATE-172 & 1916-D

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

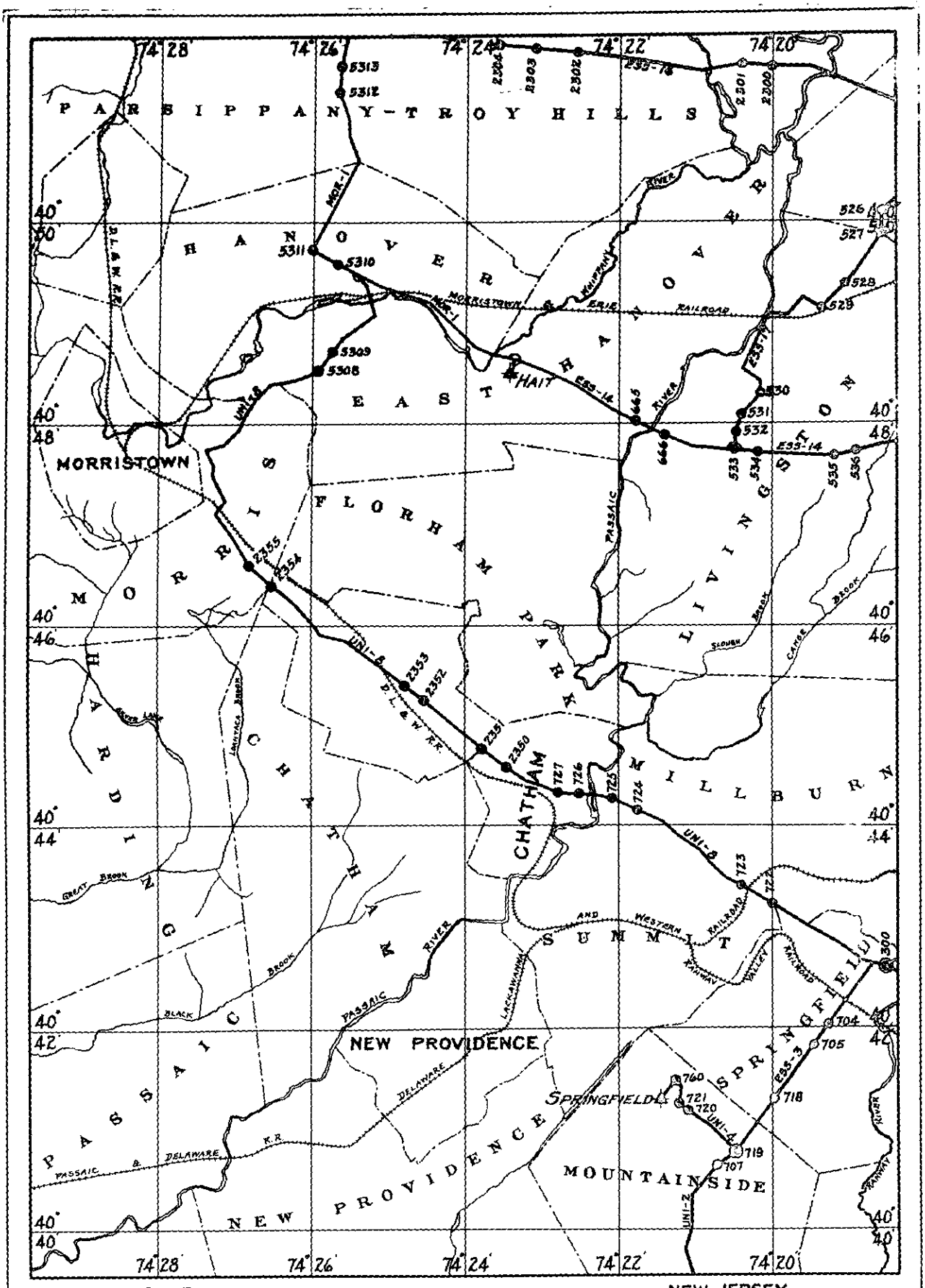
SHEET 25-3
TRAVERSES

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1915-0

TRAVERSE & MONUMENT LOCATION

Scale 1 inch = 1 mile



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 25-5

TRAVERSES

ESS-14	UNI-2	MOR-1
ESS-17	UNI-4	ESS-16
ESS-3	UNI-8	

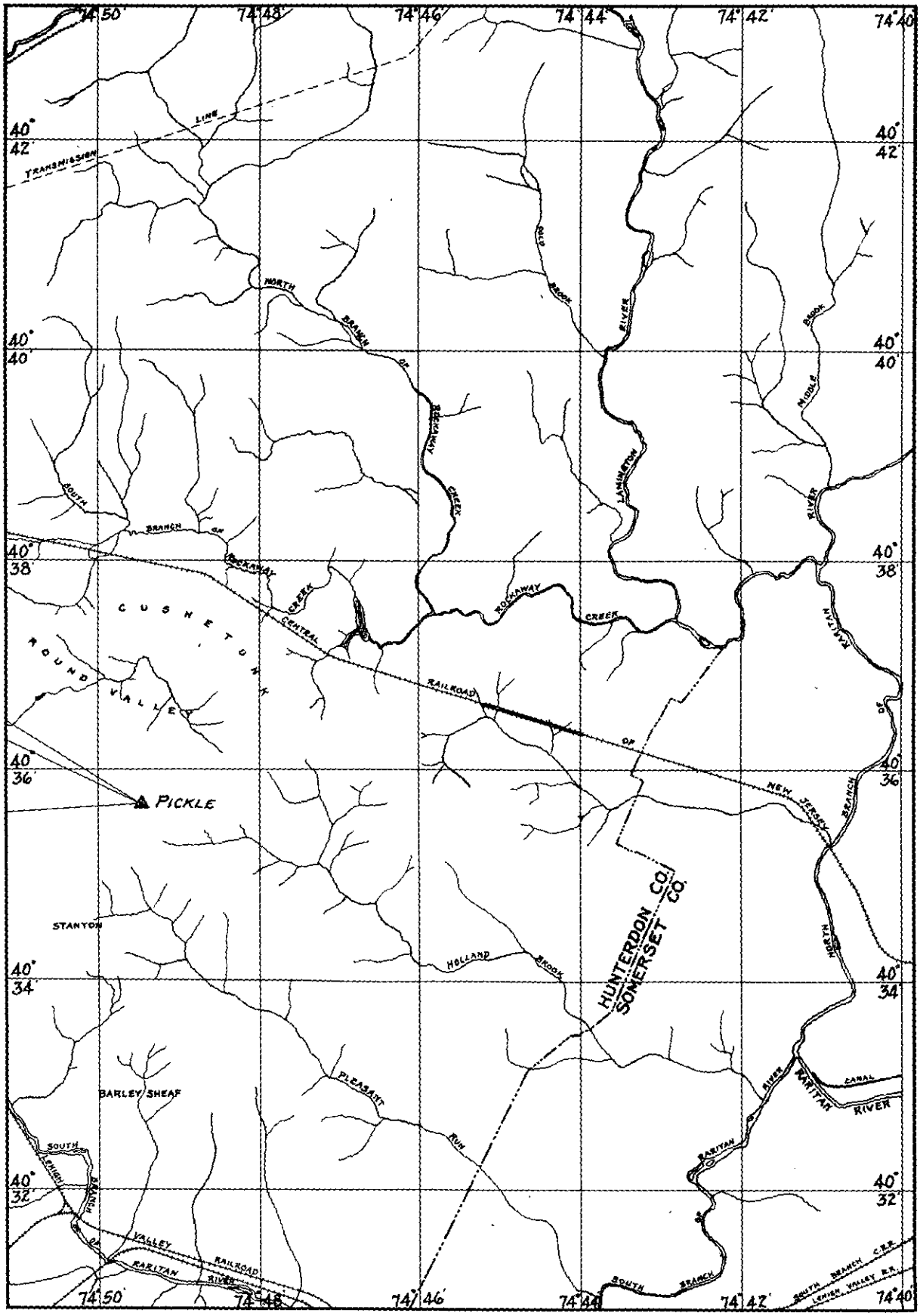
NEW JERSEY GEODETIC CONTROL SURVEY

WPA PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 25-6
TRAVERSES

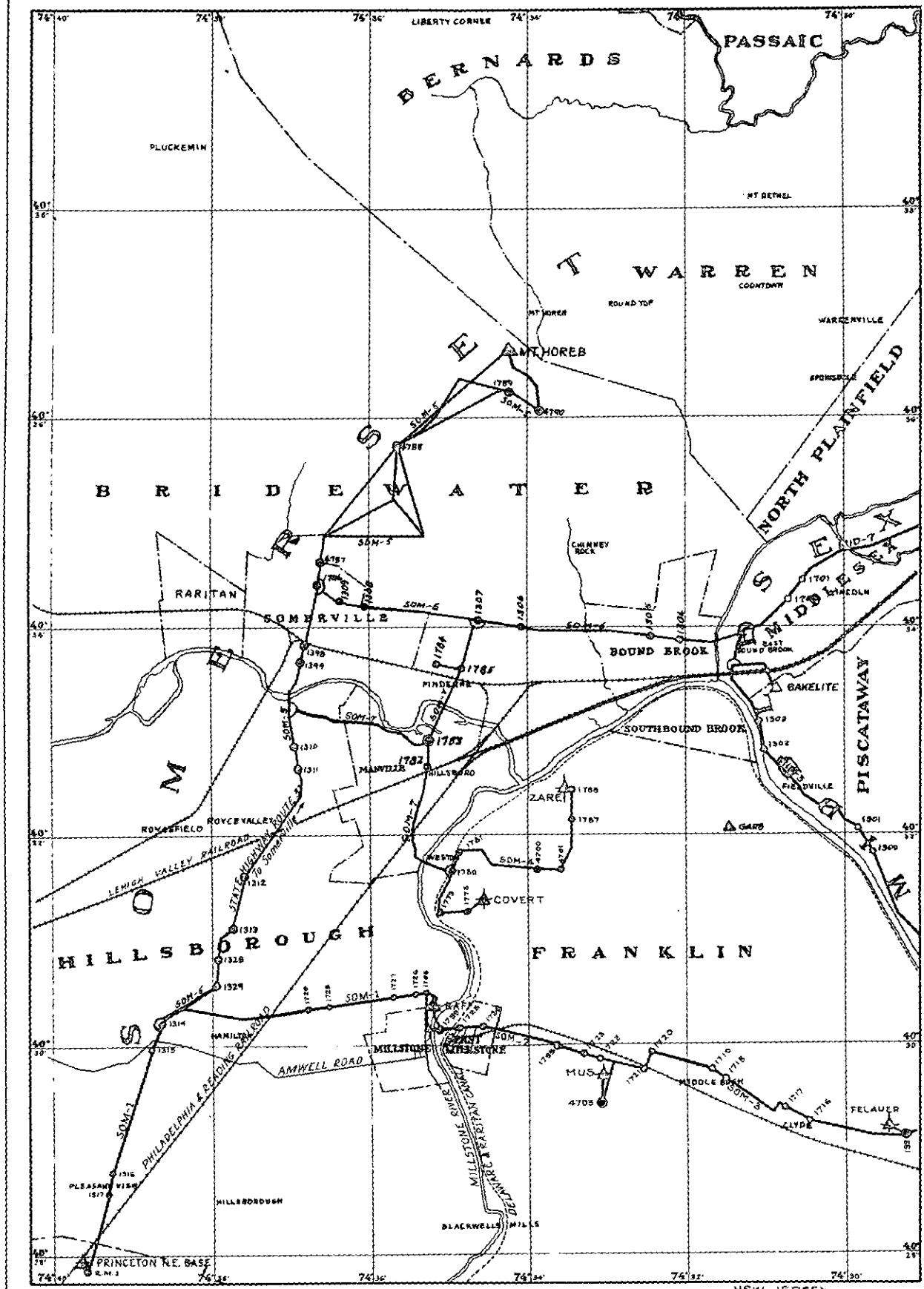
NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.



LEGEND

Traverse ——— SOM-1

Monument

Traverse Junction 1300

Triangulation Station

SHEET 25-7

TRAVERSES

SOM-1	SOM-5
SOM-2	SOM-6
SOM-3	SOM-7
SOM-4	

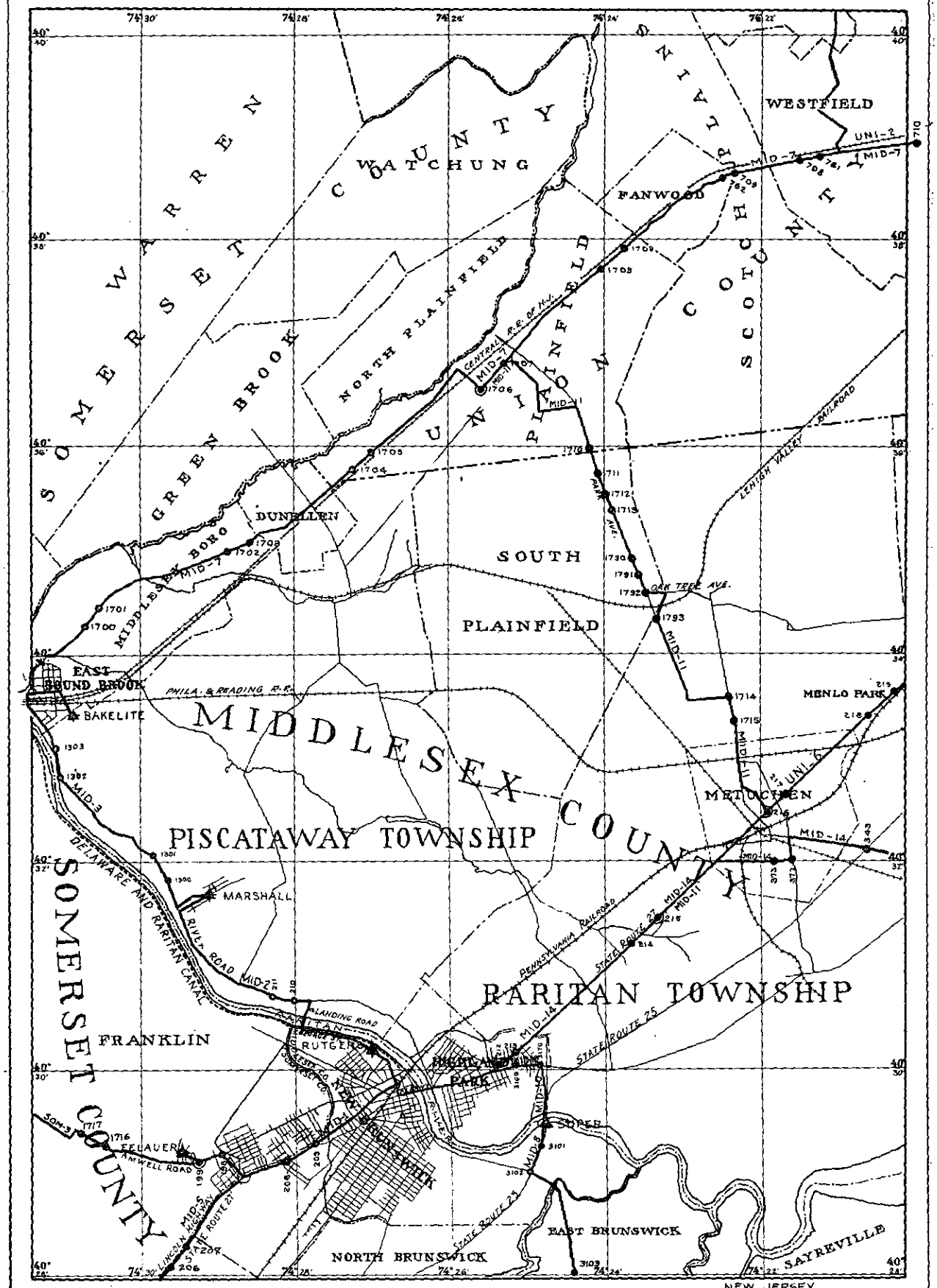
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse MID-1

Monuments 200

Triangulation Stations.

First Order .....

Second Order .....

Traverse Junction .....

SHEET 25-8

TRAVERSES

MID-1	MID-10	UNI-6
MID-2	MID-7	MID-11
MID-3	MID-14	

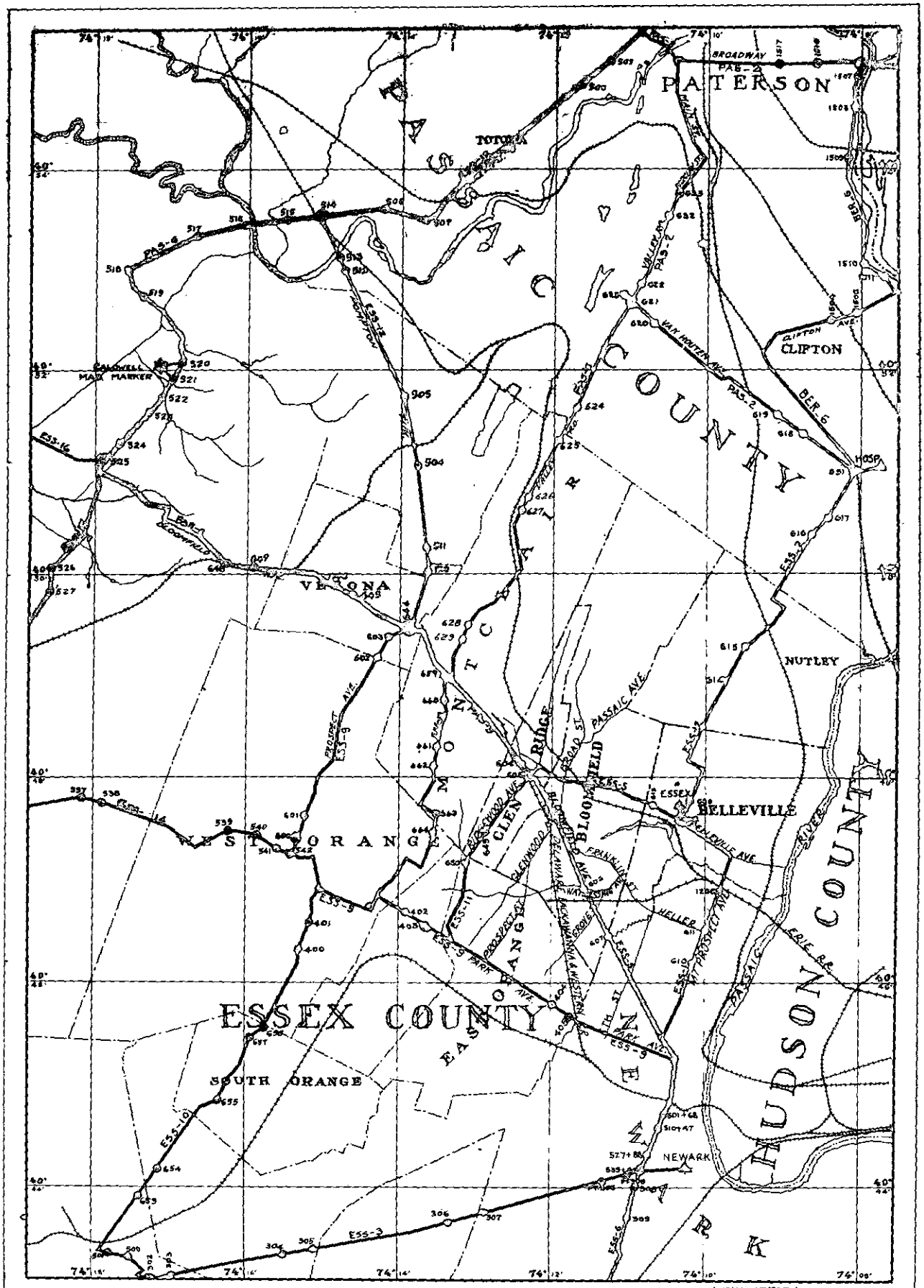
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE, 1 INCH = 1 MILE



LEGEND

Traverse ESS-5

Monument 605

Traverse Junction

Triangulation Station △

SHEET 26-1

TRAVERSES

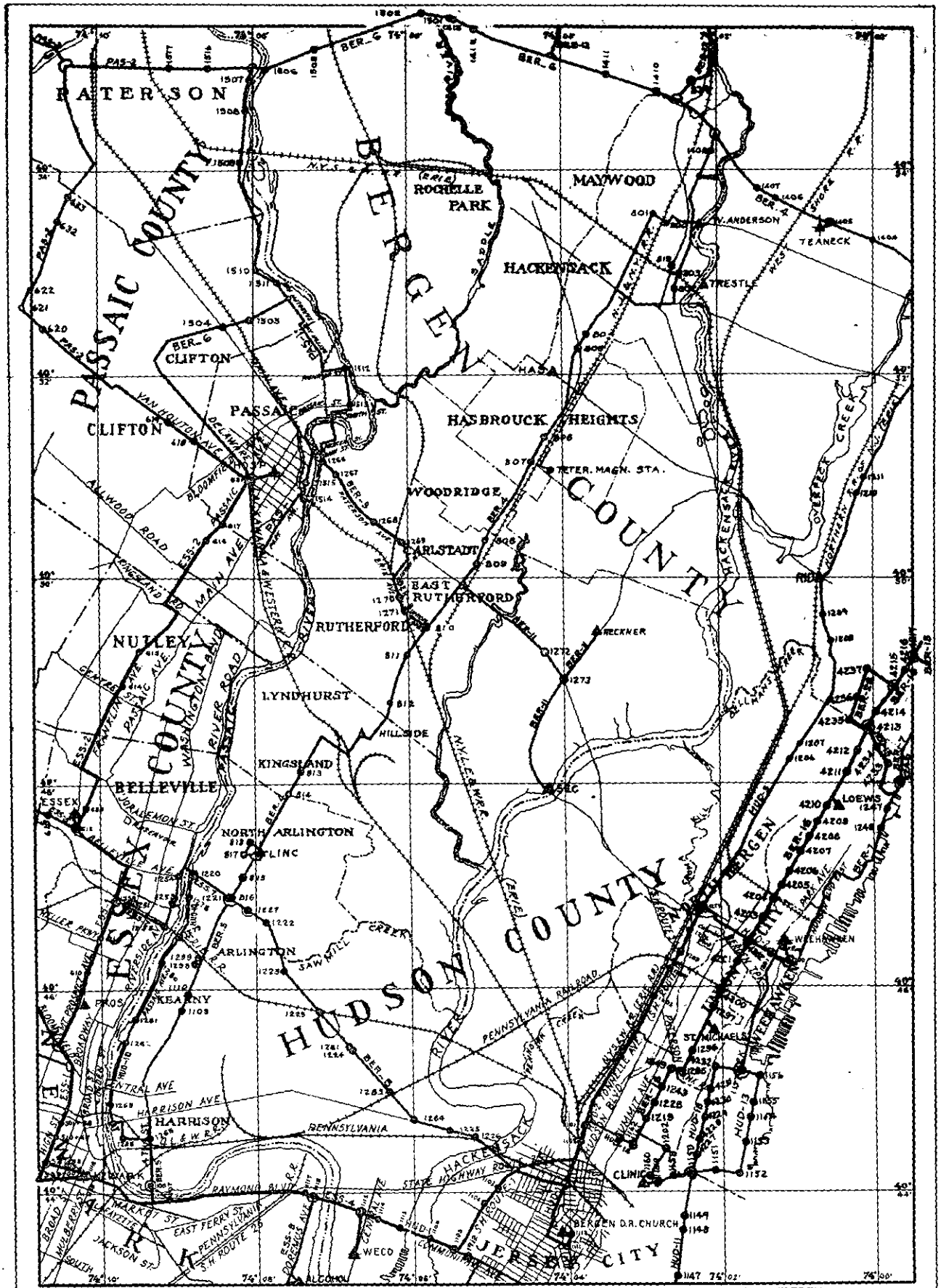
ESS-5	BER-6	PAS-2	ESS-12
ESS-1	ESS-9	PAS-5	ESS-13
ESS-2	ESS-11	PAS-6	ESS-14
ESS-3	ESS-10	PAS-9	ESS-17

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ESS-1

Monument 600

Traverse Junction

Triangulation Station

SHEET 26-2

TRAVERSES

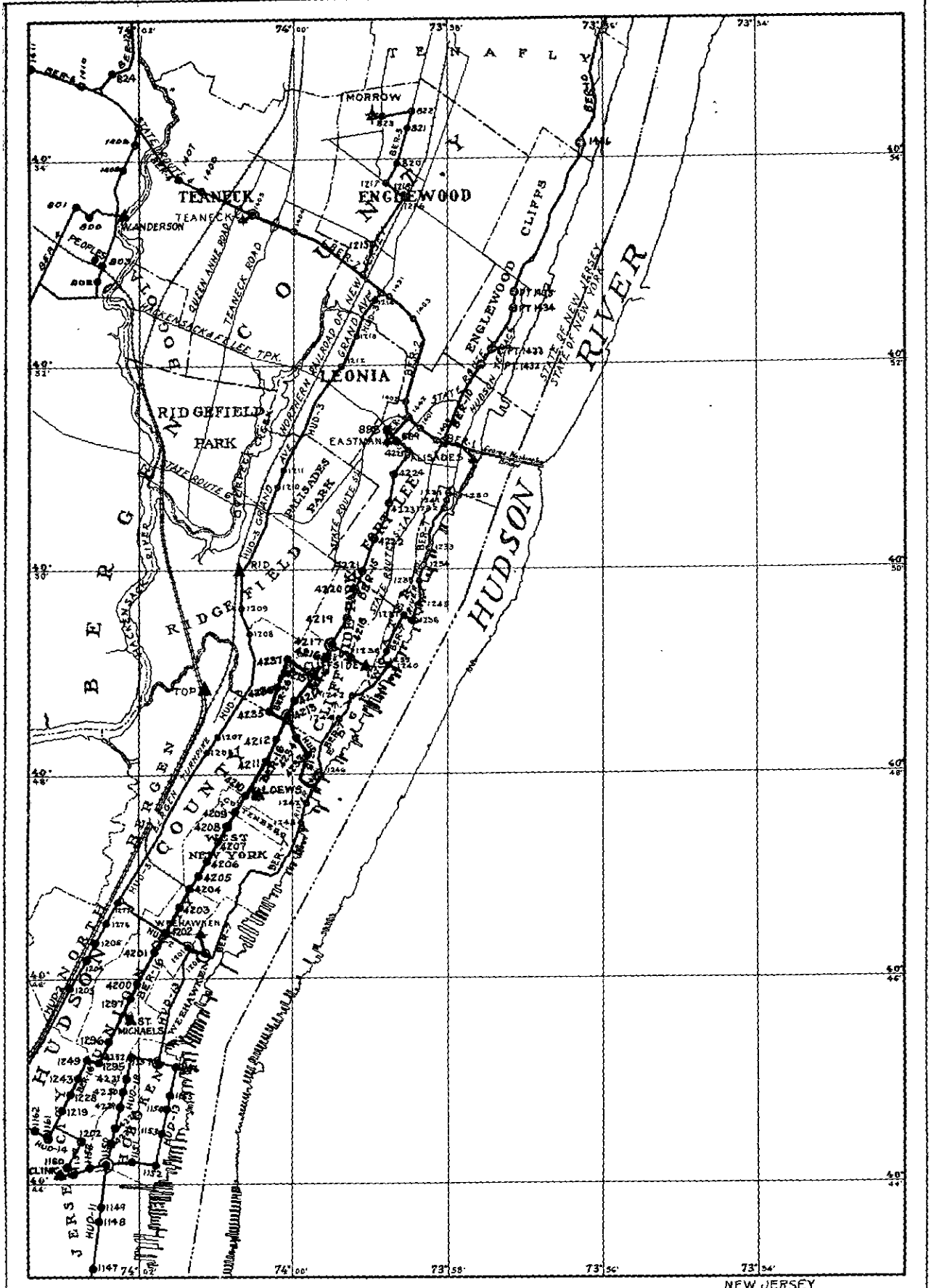
BER-16				HUD-15	BER-12
BER-26				HUD-14	BER-11
ESS-1	HUD-1	BER-4		BER-8	HUD-3
ESS-2	HUD-2	BER-5		PAS-1	BER-7
HUD-18	HUD-10	BER-6		PAS-2	HUD-11
ESS-4	ESS-7	BER-9		ESS-8	HUD-13

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-1728 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ——— BER-1

Monument ——— 1400

Traverse Junction ———

Triangulation Station ———

SHEET 26-3

TRAVERSES

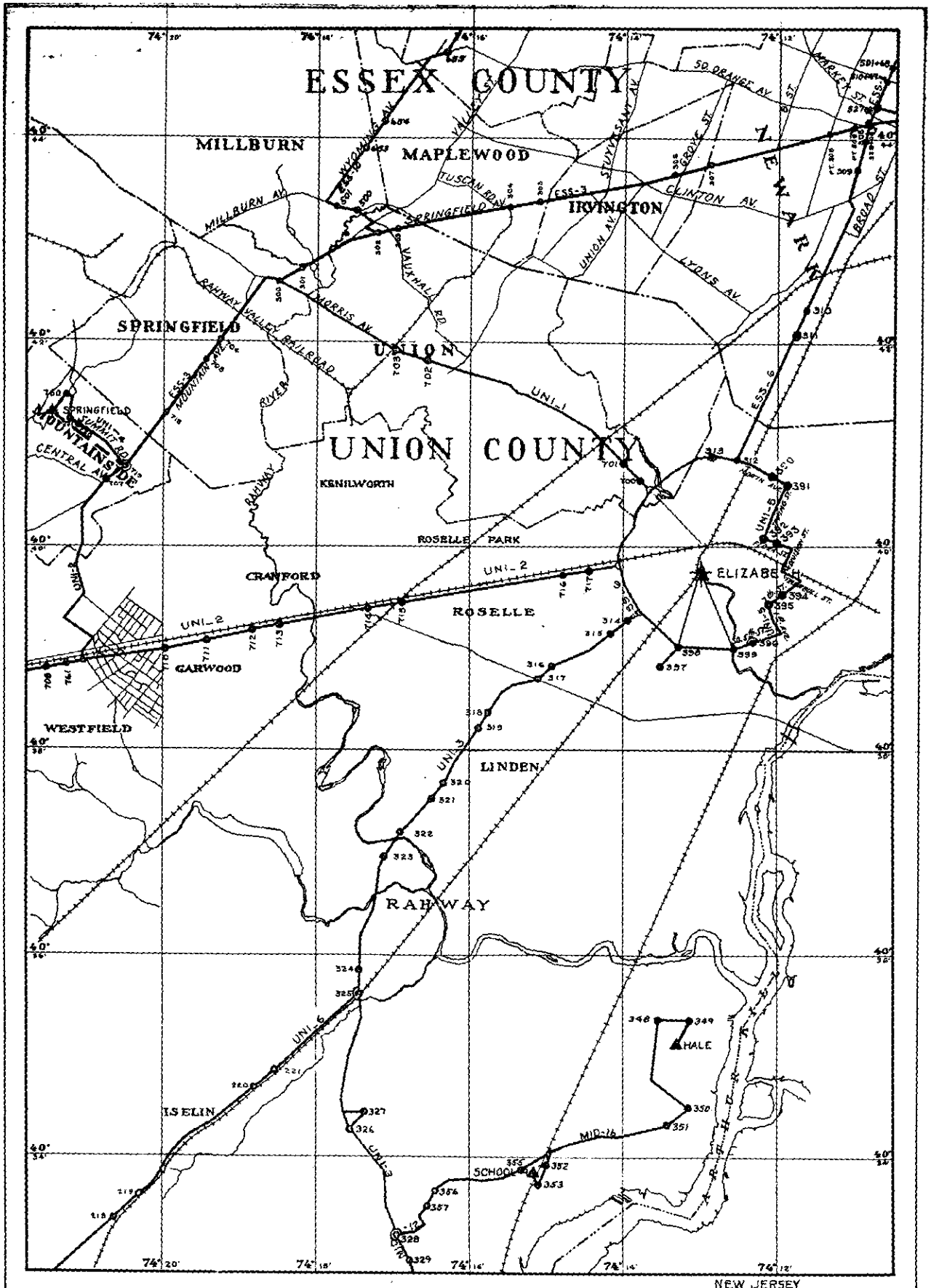
BER-1	BER-7	HUD-3	HUD-15
BER-2	HUD-11	HUD-2	BER-12
BER-3	HUD-13	BER-10	BER-18
BER-4	HUD-14	BER-15	BER-26

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ESS-3

Monument 308

Traverse Junction

Triangulation Station

SHEET 26-4

TRAVERSES

ESS-3	UNI-1	UNI-4	MID-16
ESS-6	UNI-2	UNI-5	MID-12
ESS-1	UNI-3		
ESS-10	UNI-6		

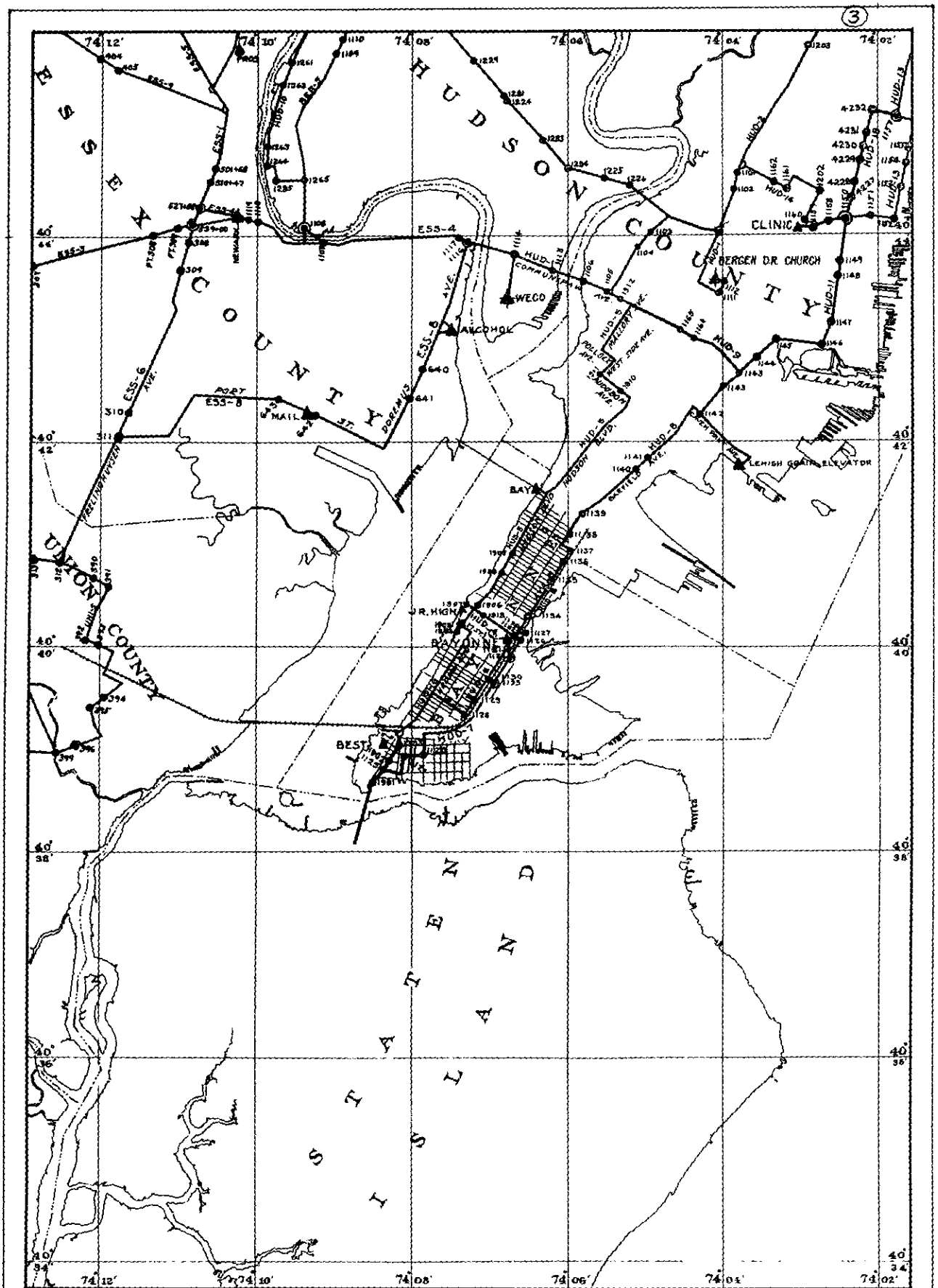
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ——— HUD-5

Monument ——— 1913

Traverse Junction

Triangulation Station

SHEET 26-5

TRAVERSES

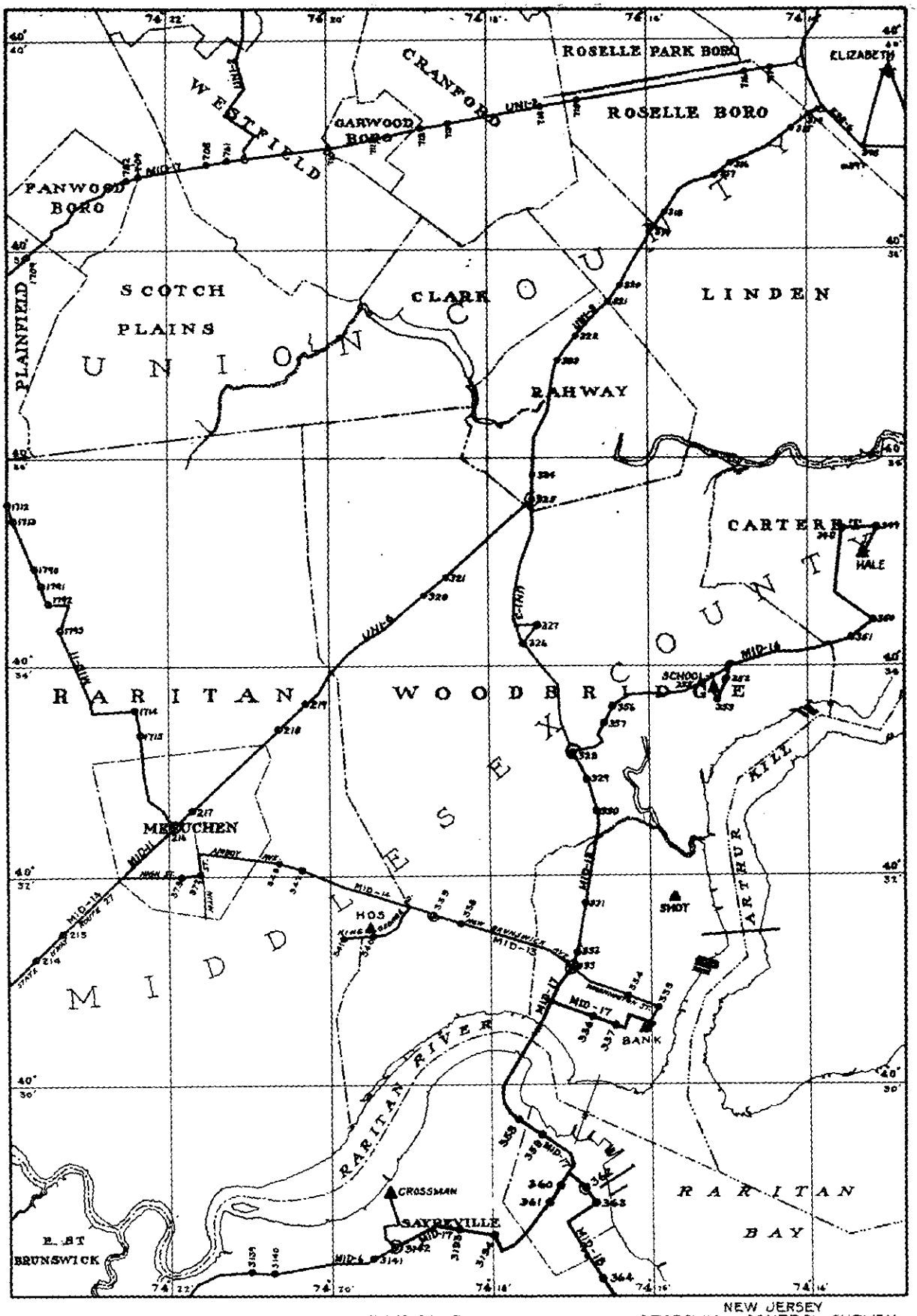
HUD-4	ESS-8	HUD-7
HUD-5	HUD-11	HUD-8
HUD-6	HUD-13	HUD-9

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ———— MID-13

Monument ———— 341

Traverse Junction

Triangulation Station (1st. Order)

Triangulation Station (2nd Order)

SHEET 26-7

TRAVERSES

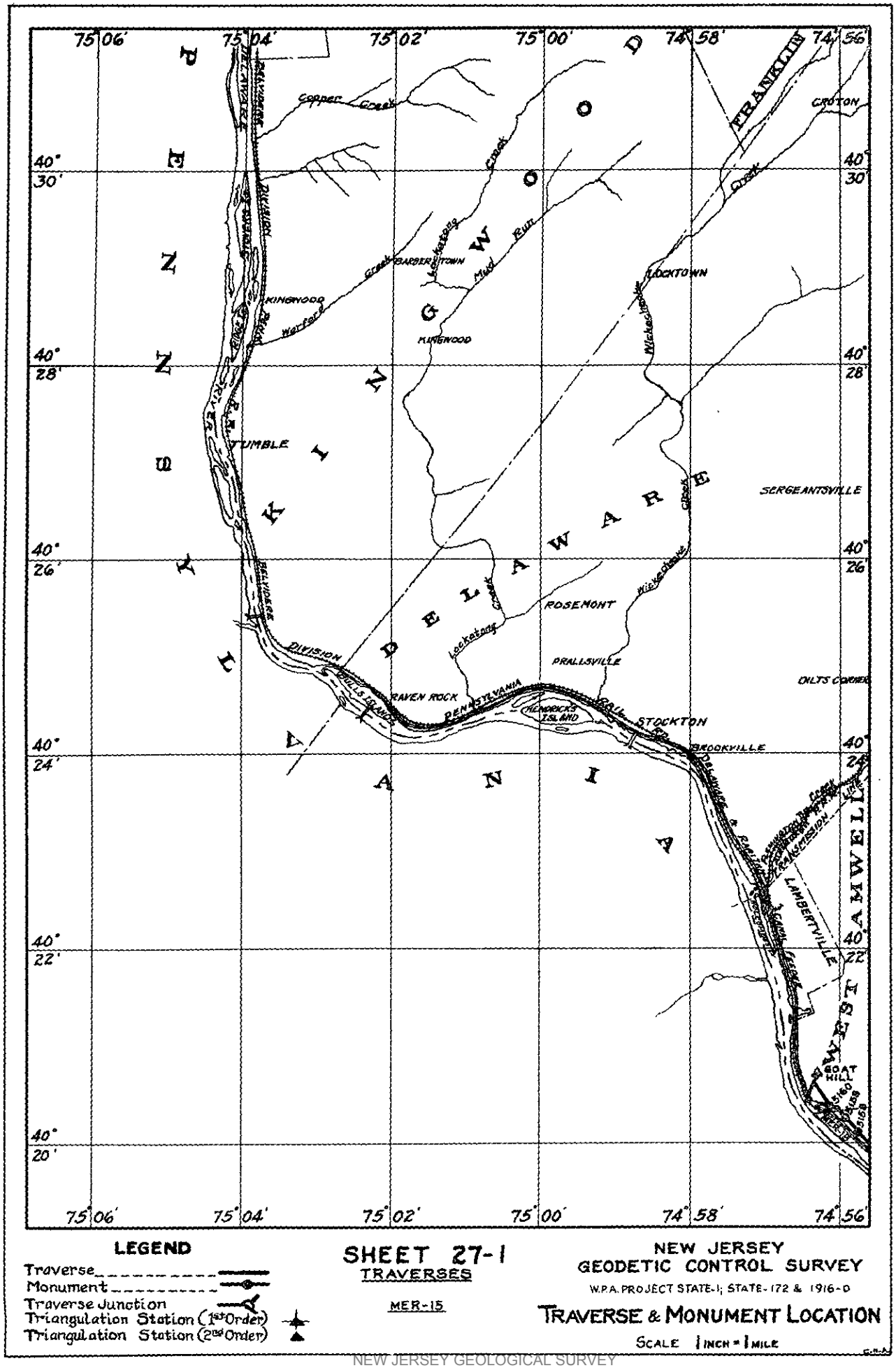
MID-13 MID-11 MID-16 MID-18
MID-14 UNI-2 MID-12
MID-17 UNI-3 UNI-6
MID-6 ESS-6 MID-7

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-D

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

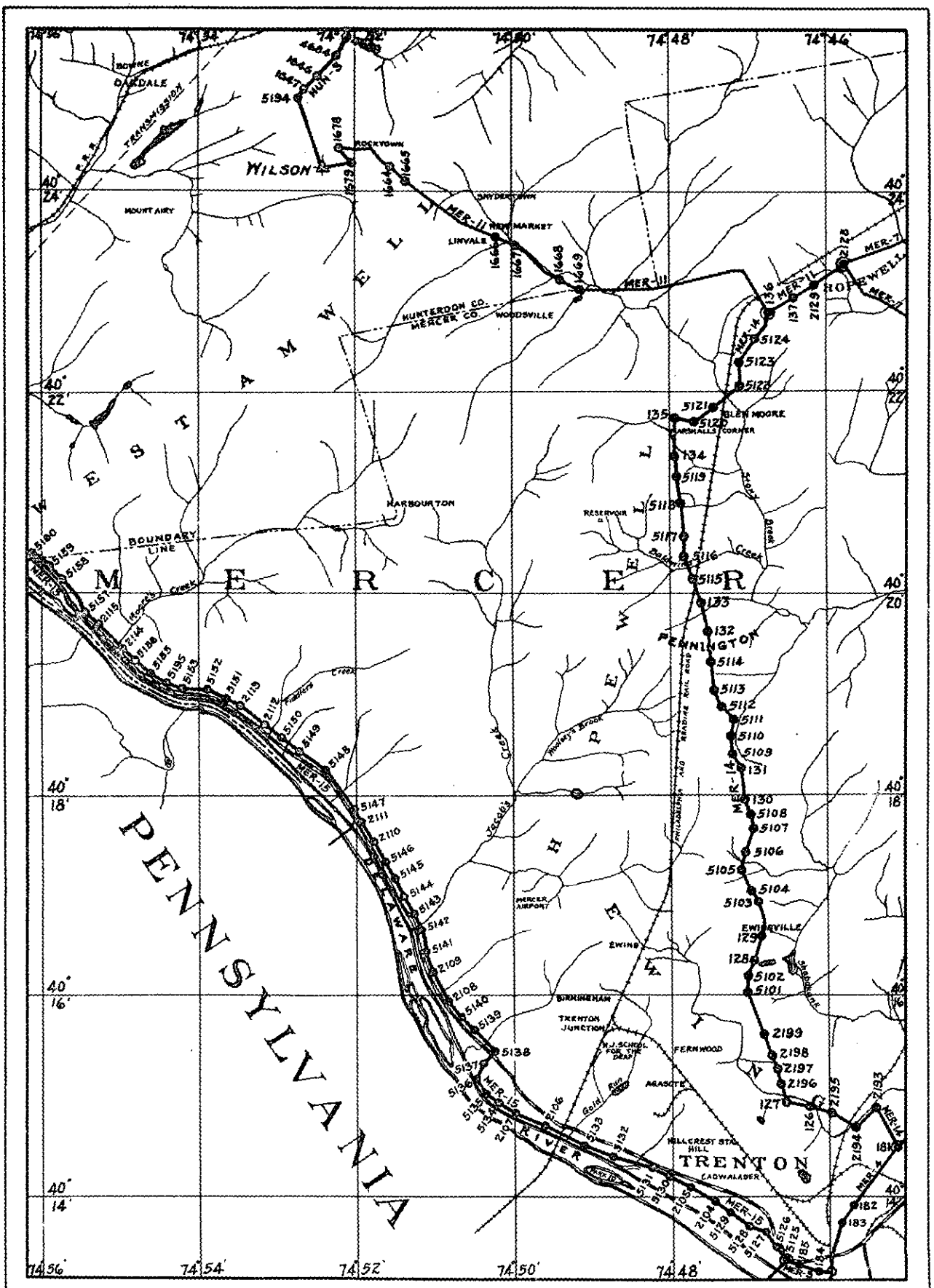
SHEET 27-1
TRAVERSES

MER-15

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-D

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 27-2

TRAVERSES

MER-4 HUN-3
MER-11 MER-5
MER-14 MER-15

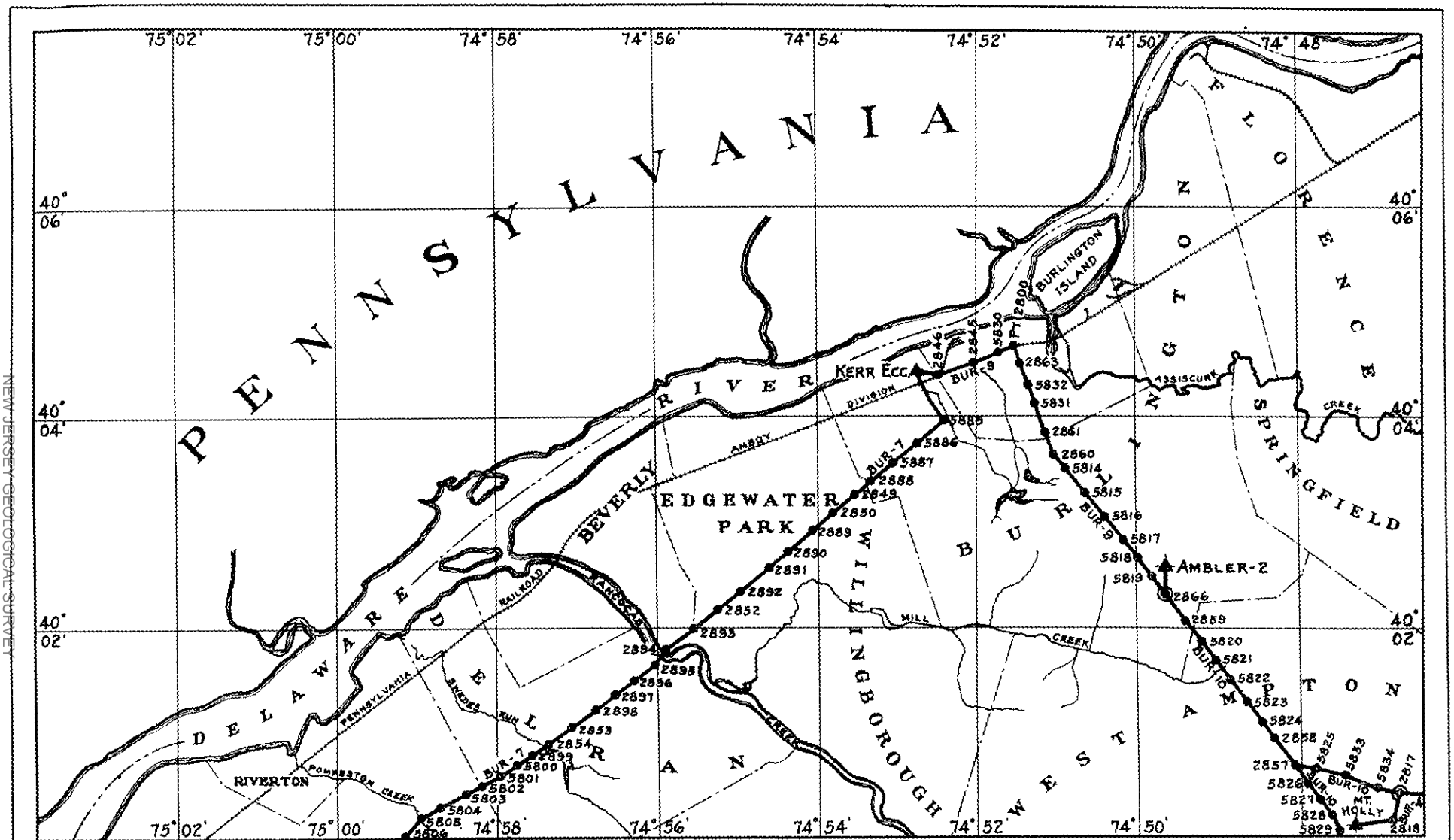
NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 27-3

TRAVERSES

BUR-10 BUR-4 BUR-9
BUR-7

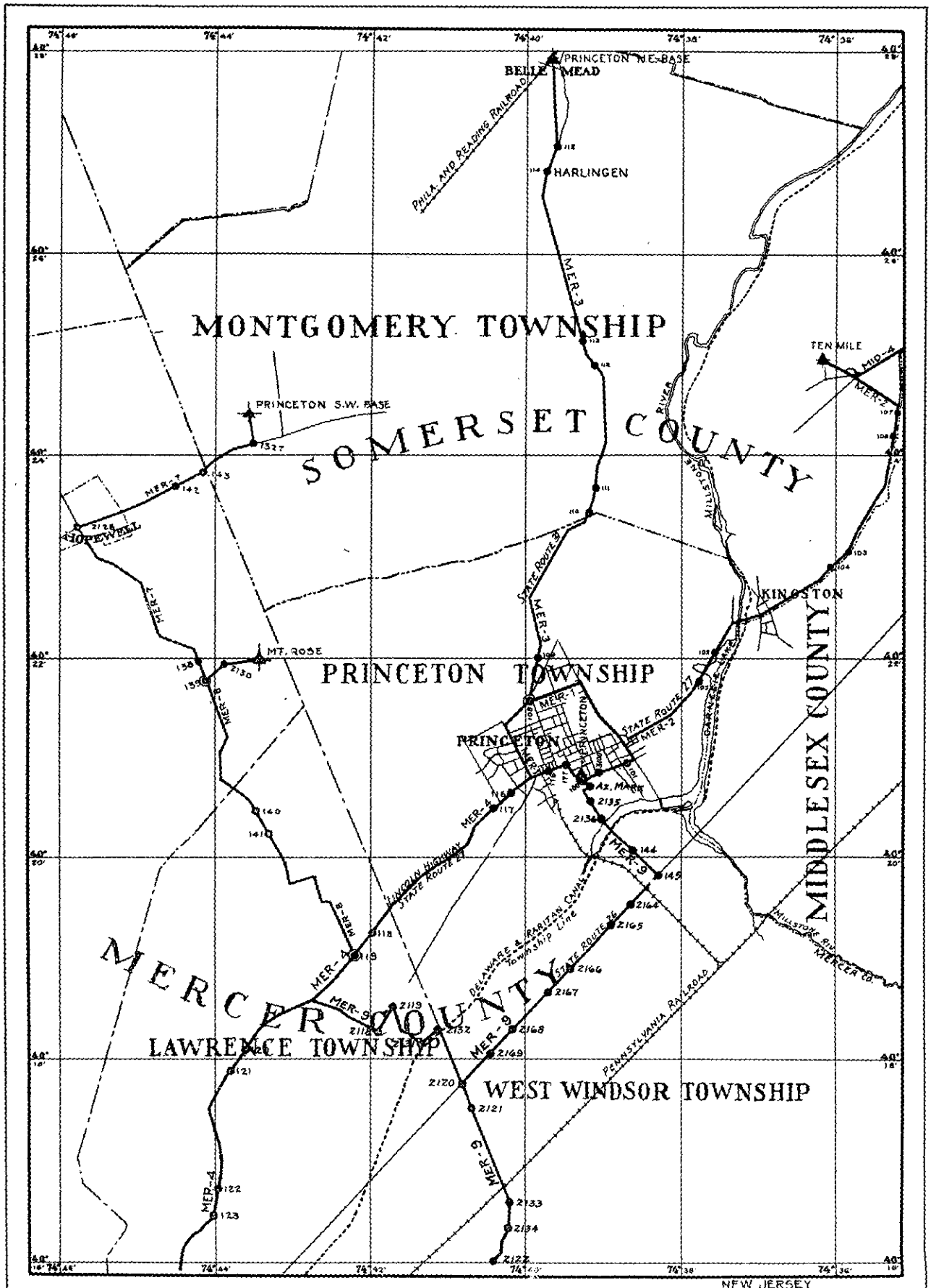
NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

B.C.



LEGEND

Traverse ——— MER-1

Monument ○ 100

Triangulation Stations.

First Order ▲

Second Order △

Traverse Junction

SHEET 28-1

TRAVERSES

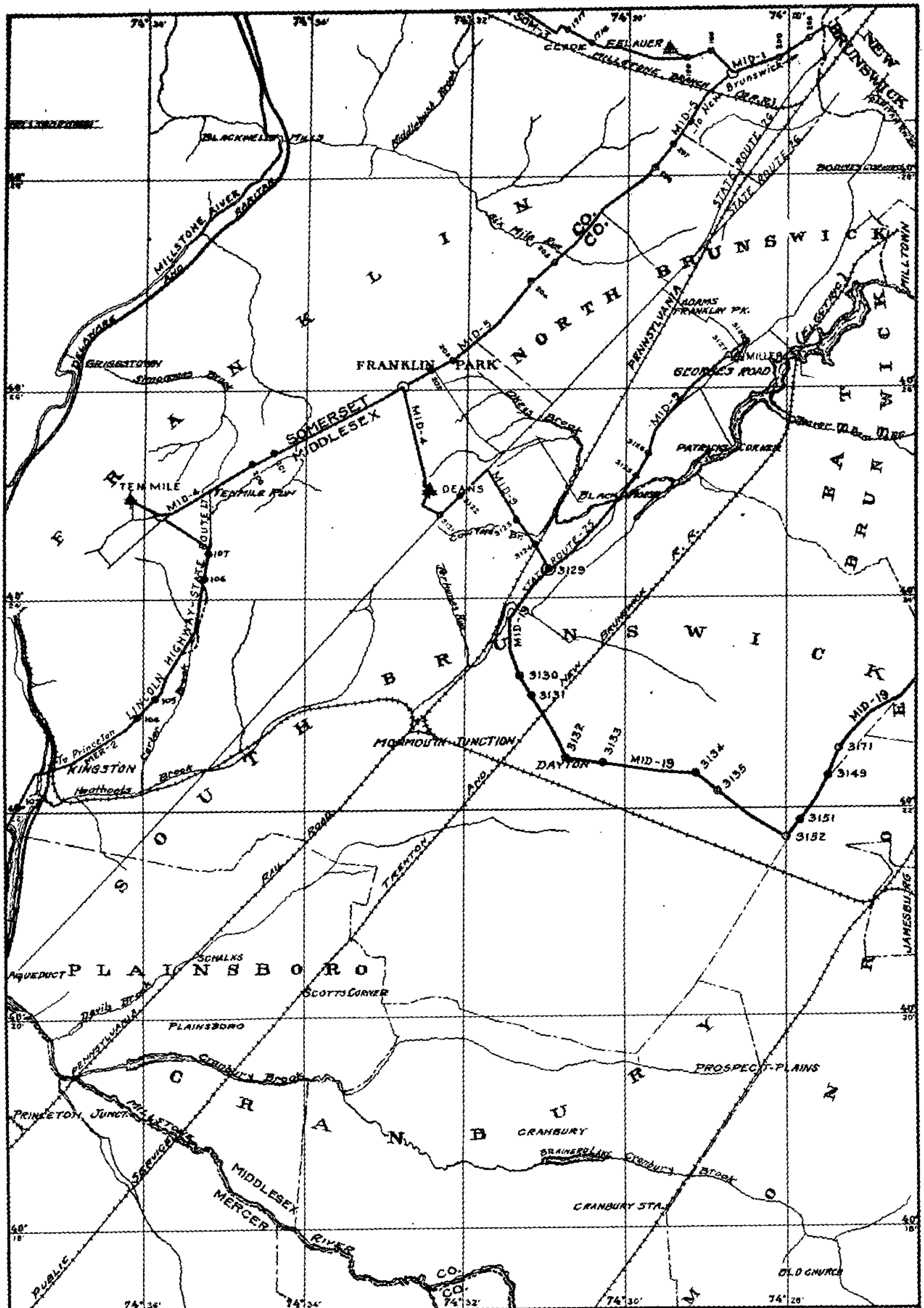
MER-1, MER-2, MER-3, MER-4, MER-7, MER-8, MER-9

NEW JERSEY GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-I; STATE-1728 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ---------- MID-4

Monument ---------- 200

Traverse Junction ----------

Triangulation Station ----------

SHEET 28-2

TRAVERSES

MID-4
MID-5
MID-3
MID-19

MER-2

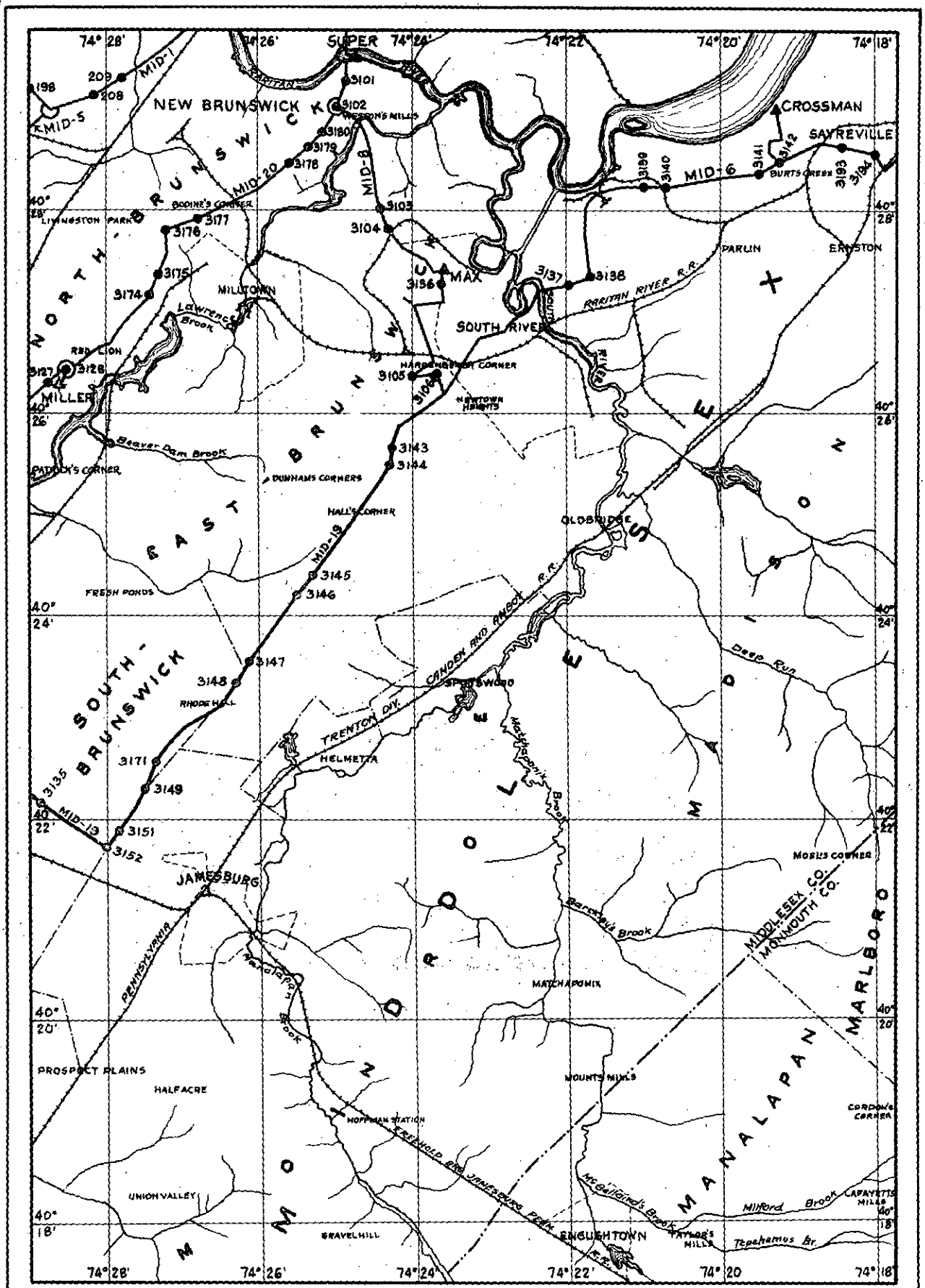
NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE

C.R.A.



LEGEND

Traverse — MID-1
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 28-3

TRAVERSES

MID-1 MID-6 MID-8
MID-20 MID-19

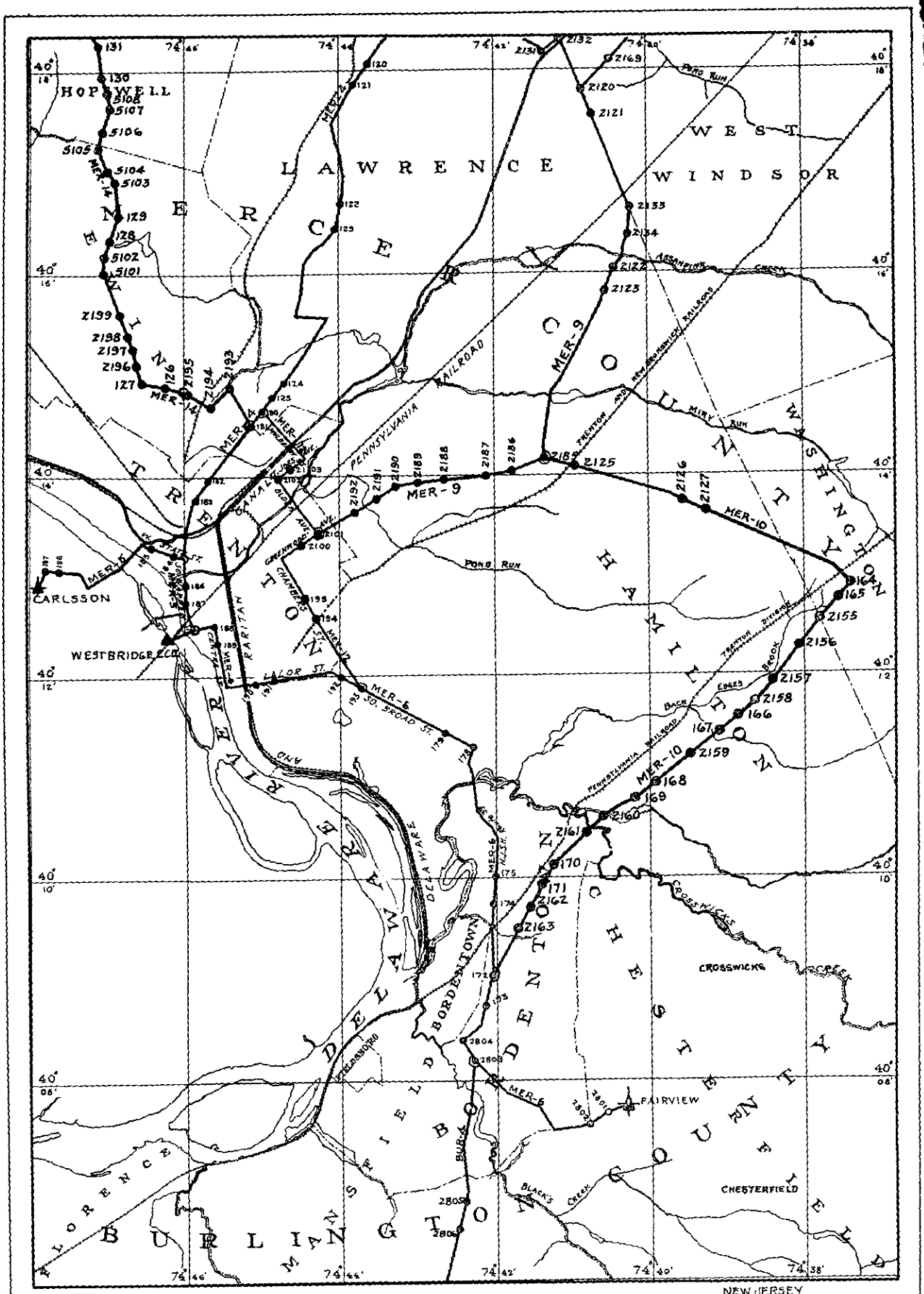
NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

R.H.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 28-4

TRAVERSES

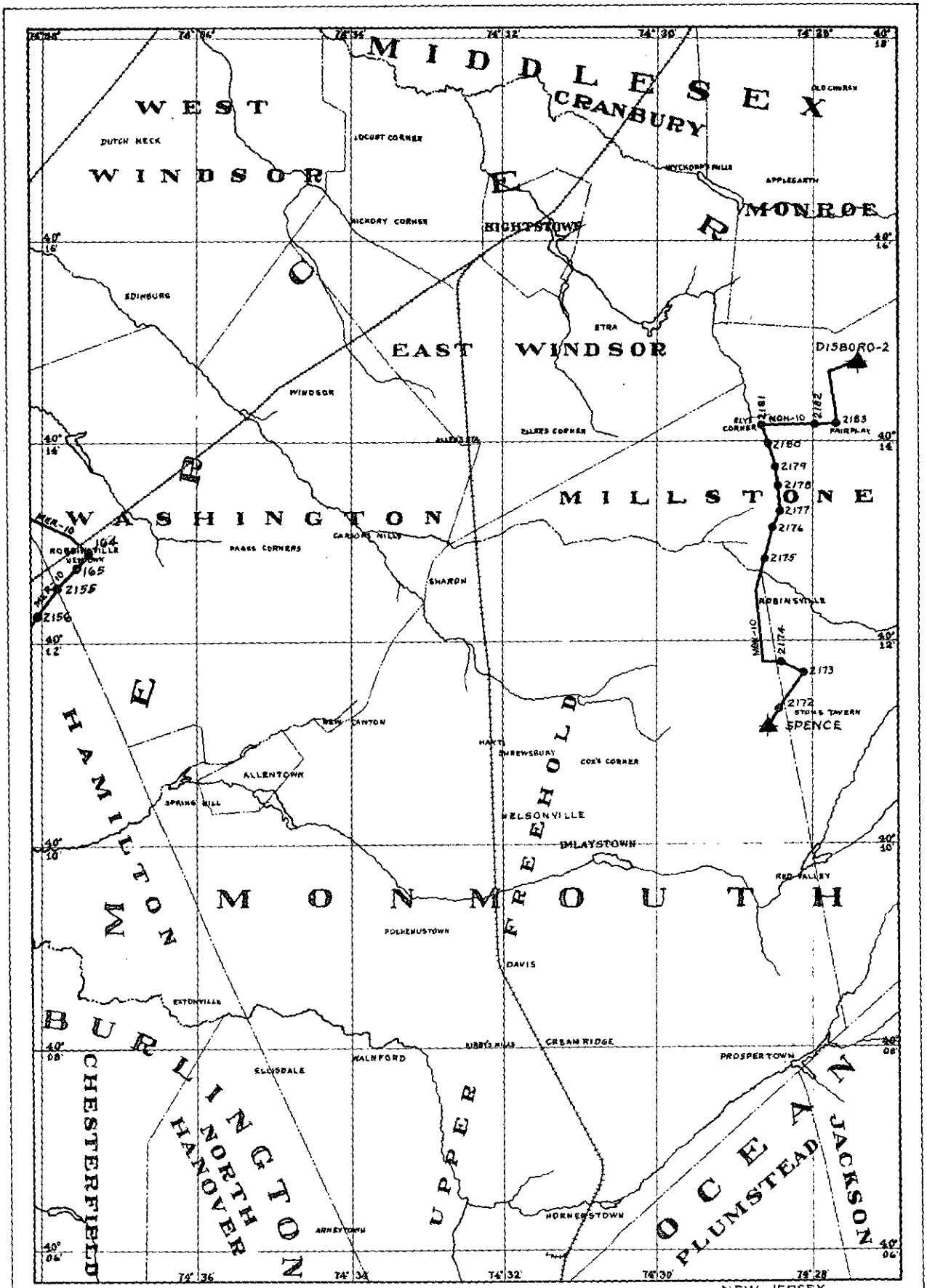
MER-5	MER-12	MER-14
MER-4	BUR-4	MER-10
MER-6	MER-9	

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ——— MON-10

Monument ● ◎

Traverse Junction

Triangulation Station (1st Order) ▲

Triangulation Station (2nd Order) △

SHEET 28-5

TRAVERSES

MON-10

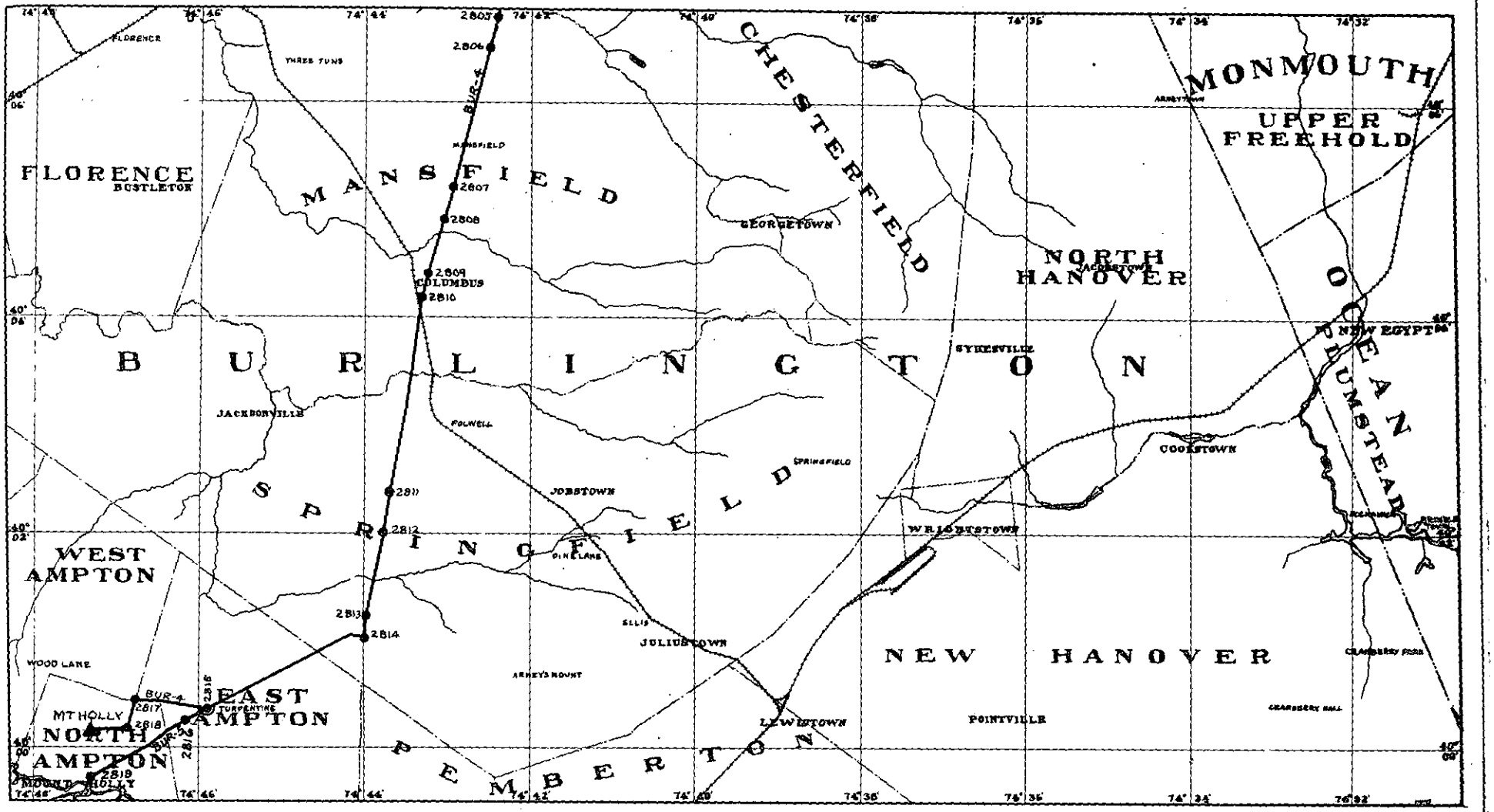
MER-10

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— BUR-4

Monument ———

Traverse Junction ———

Triangulation Station (1st Order) ———

Triangulation Station (2nd Order) ———

SHEET 28-7

TRAVERSES

BUR-4

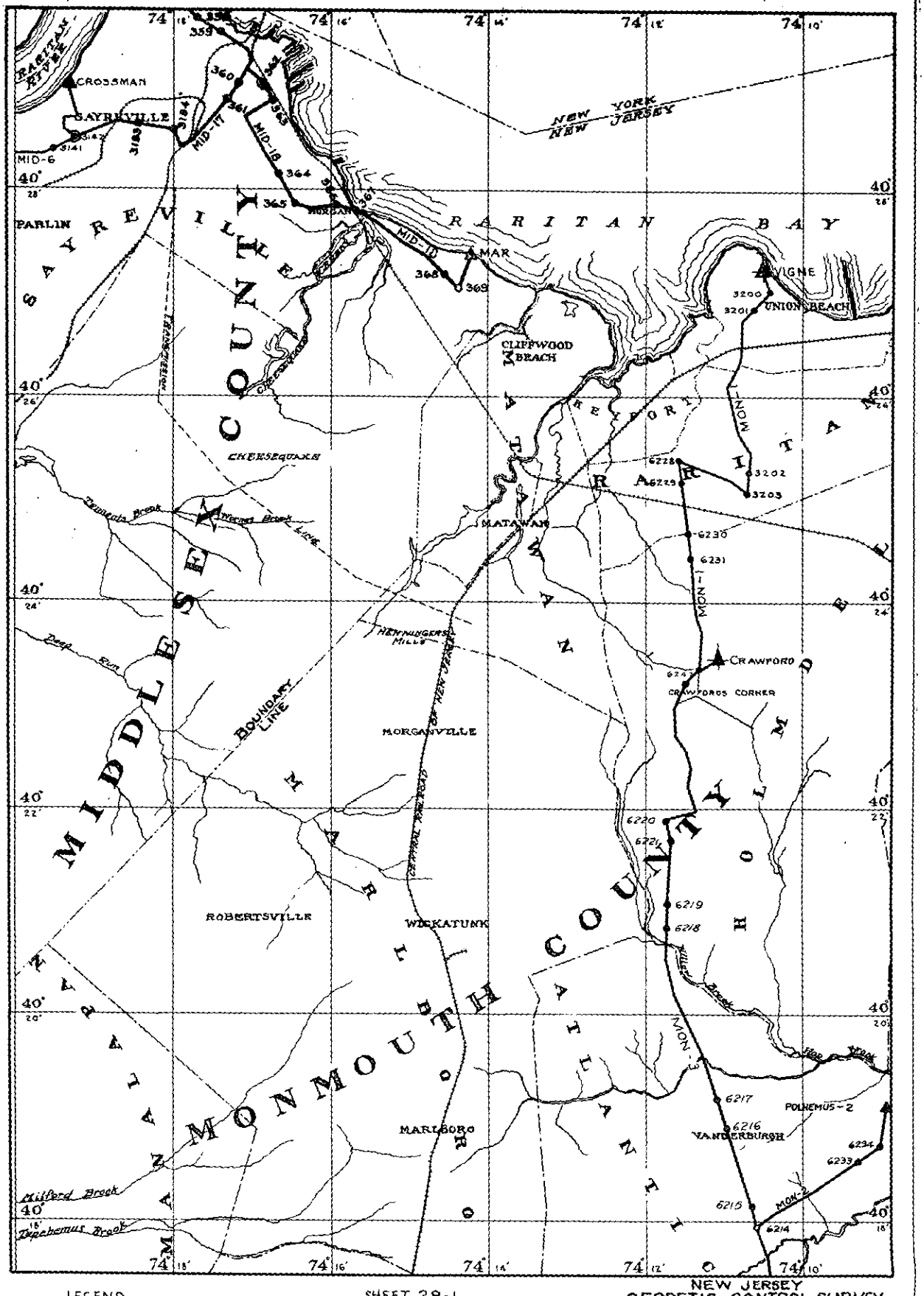
BUR-5

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument 3201
Traverse Junction
Triangulation Station

SHEET 29-1

TRAVERSES

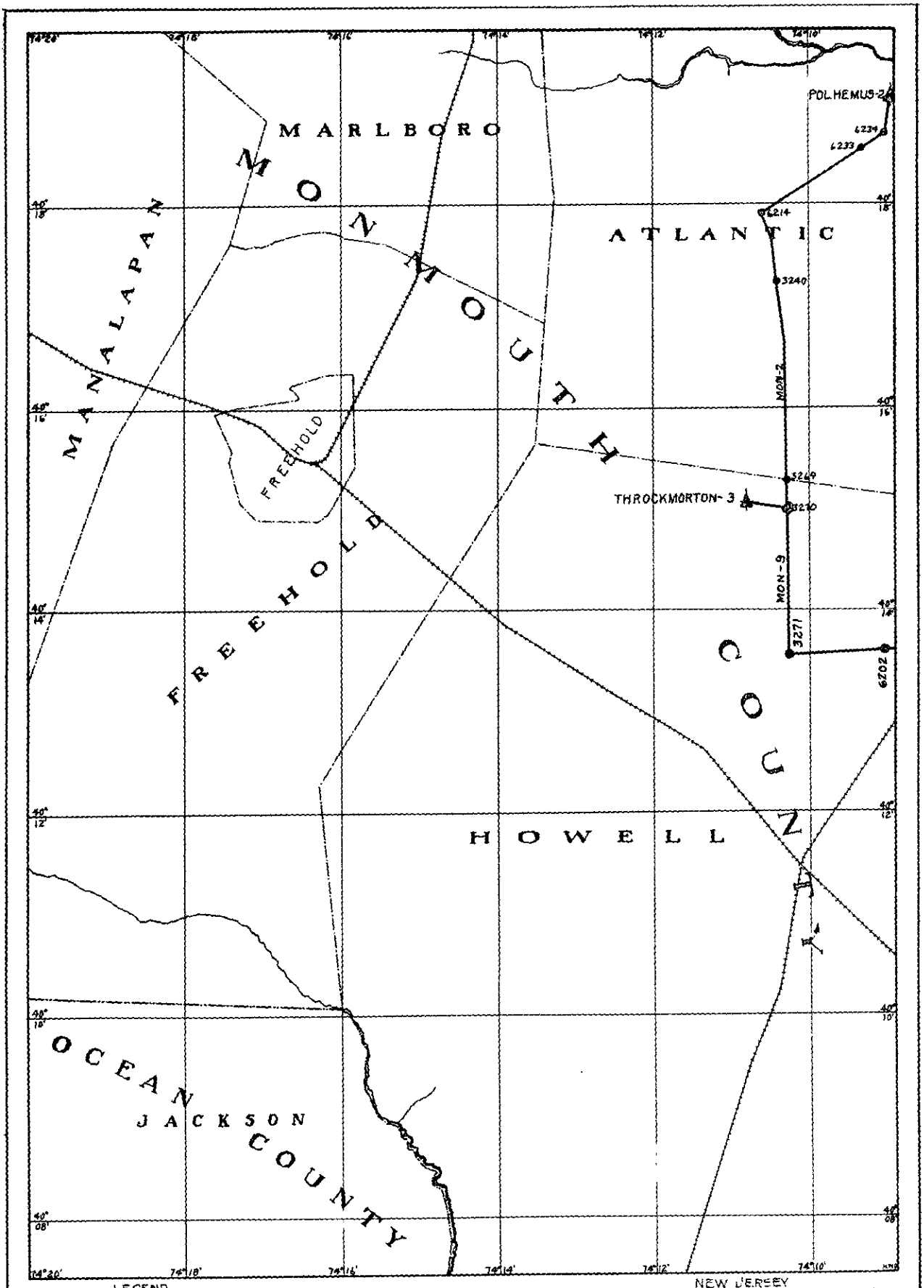
MON-1	MID-18
MID-6	MID-17
MON-3	MON-2

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1918-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse MON-2

Monument 6233

Traverse Junction .....

Triangulation Station (1st Order) .....

Triangulation Station (2nd Order) .....

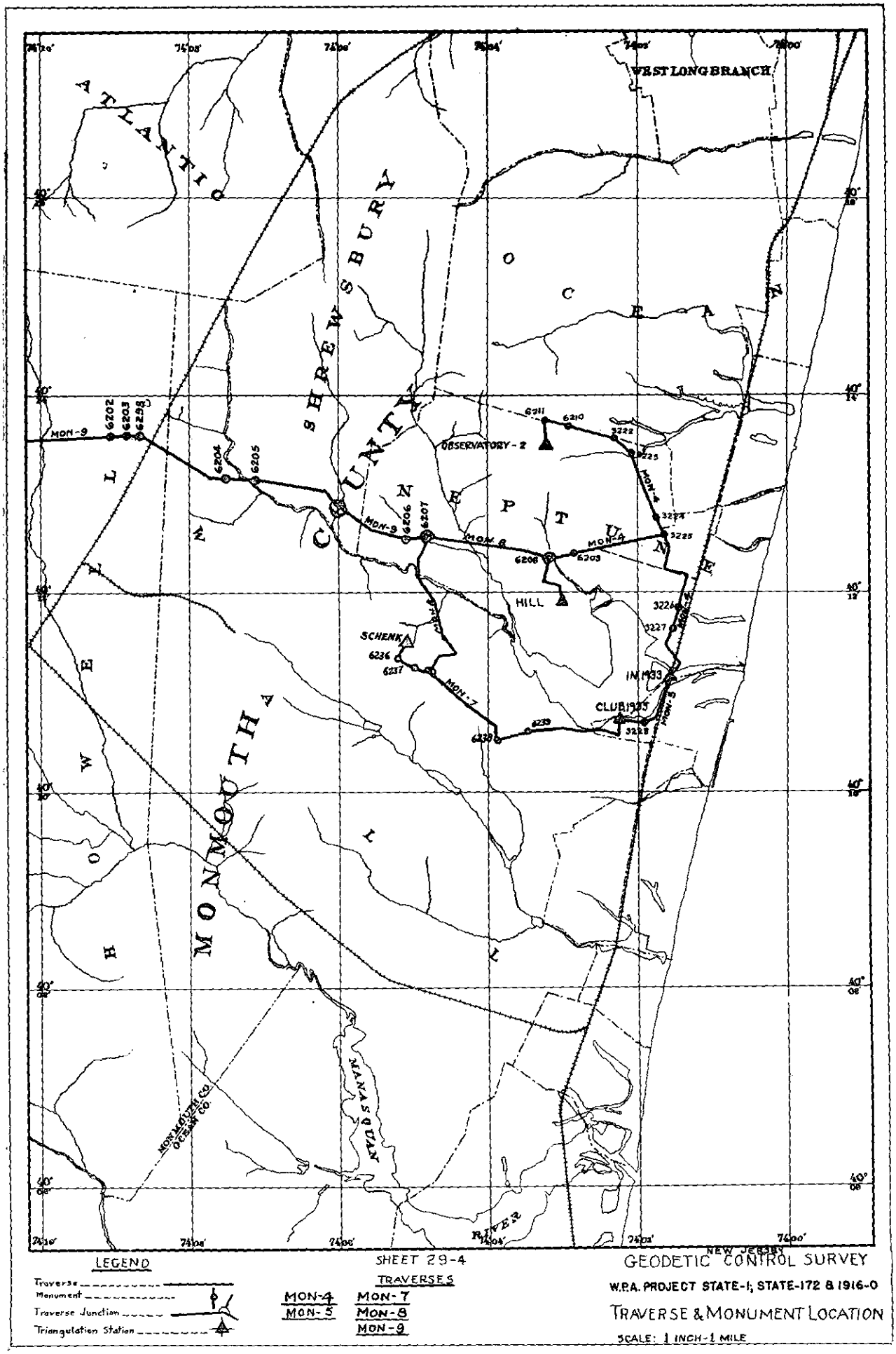
SHEET 29-3
TRAVERSES
MON-2
MON-9

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station

SHEET 29-4

TRAVERSES

MON-4 MON-7
MON-5 MON-8
MON-9

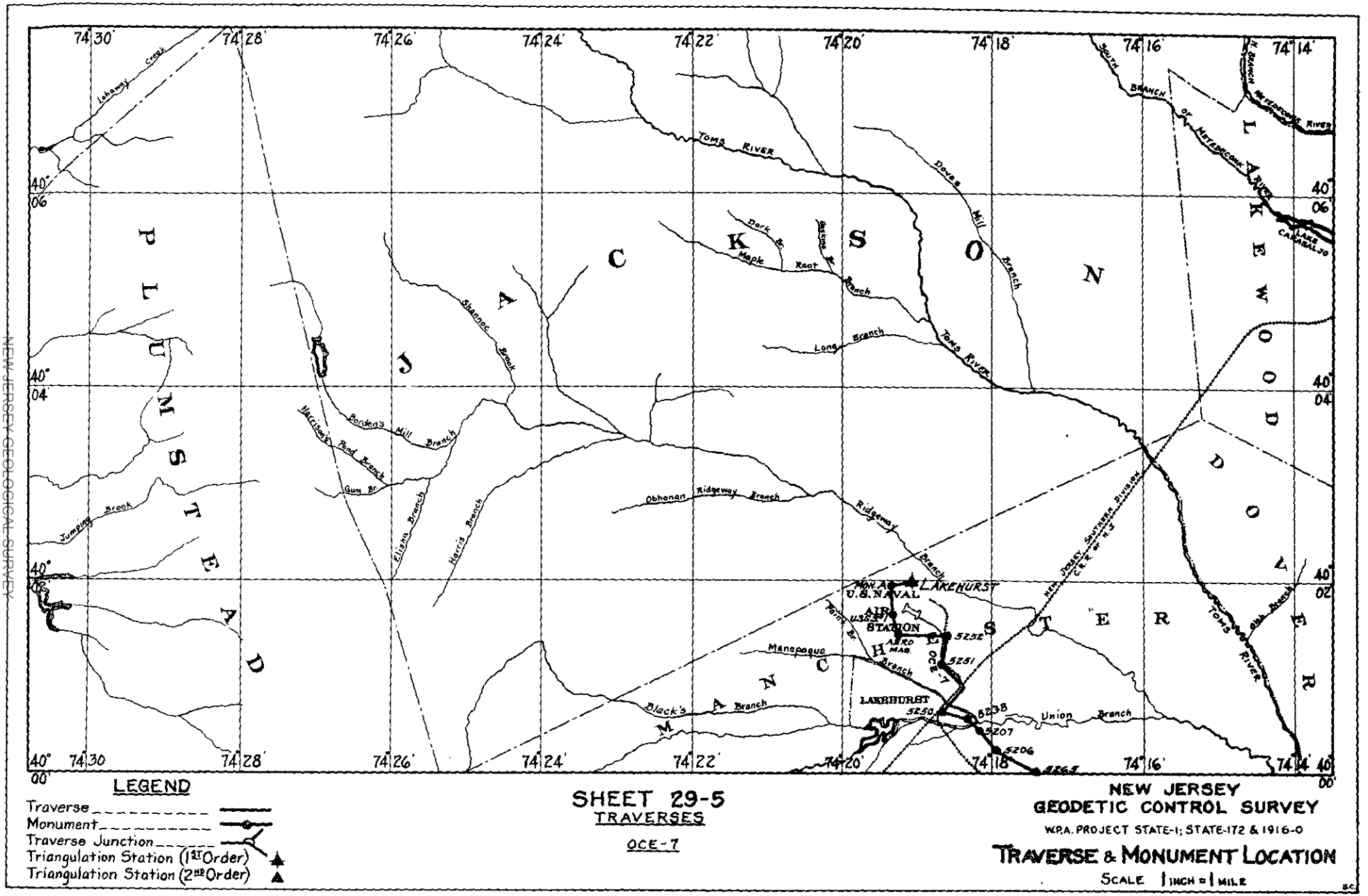
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH-1 MILE

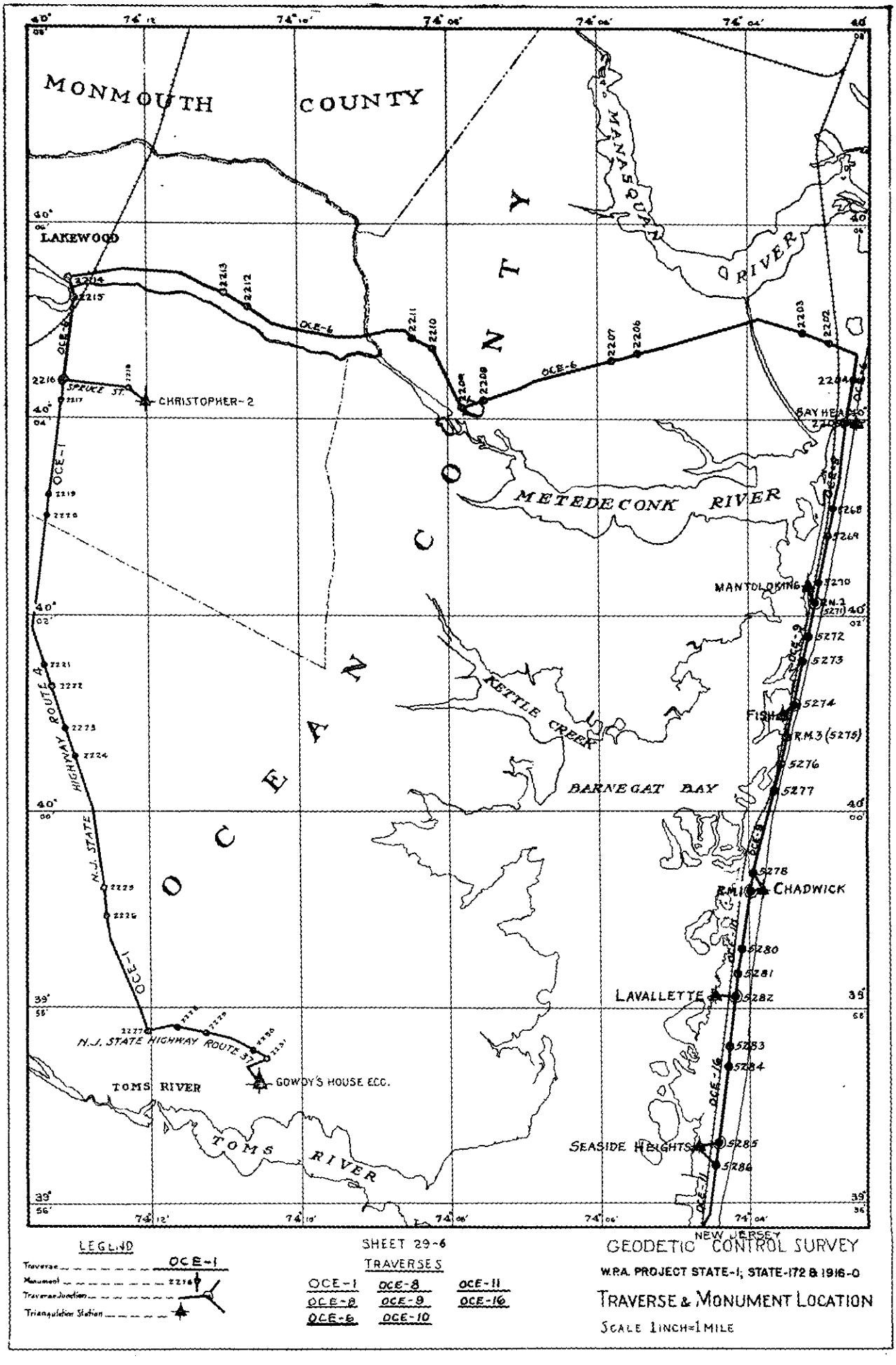


LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 29-5
TRAVERSES
OCE-7

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE 1 INCH = 1 MILE



LEGEND

Traverse — OCE-1

Monument — 2216

Traverse Junction

Triangulation Station

SHEET 29-6

TRAVERSES

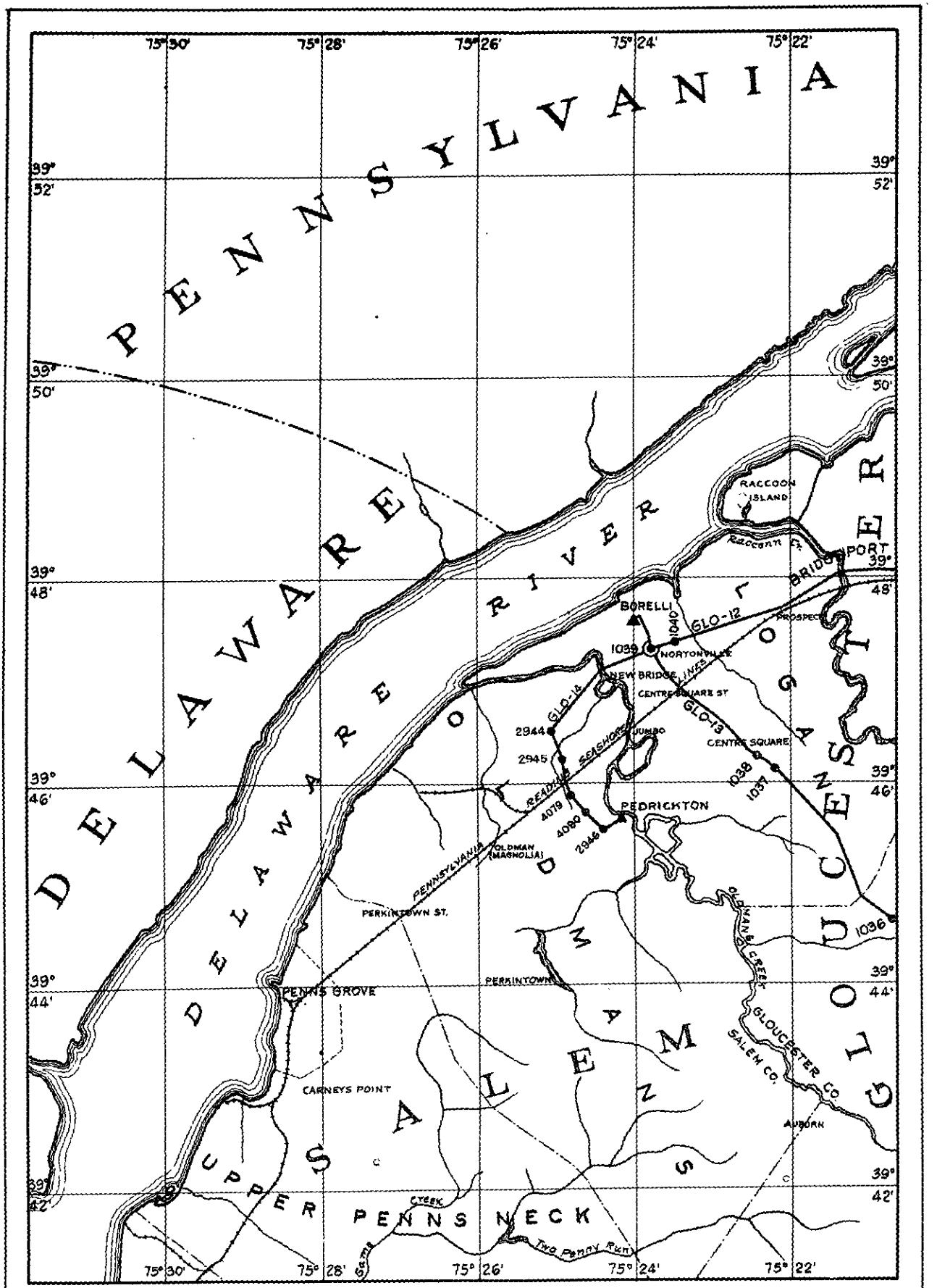
OCE-1	OCE-8	OCE-11
OCE-2	OCE-9	OCE-16
OCE-6	OCE-10	

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH=1 MILE



LEGEND

Traverse GLO-12
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

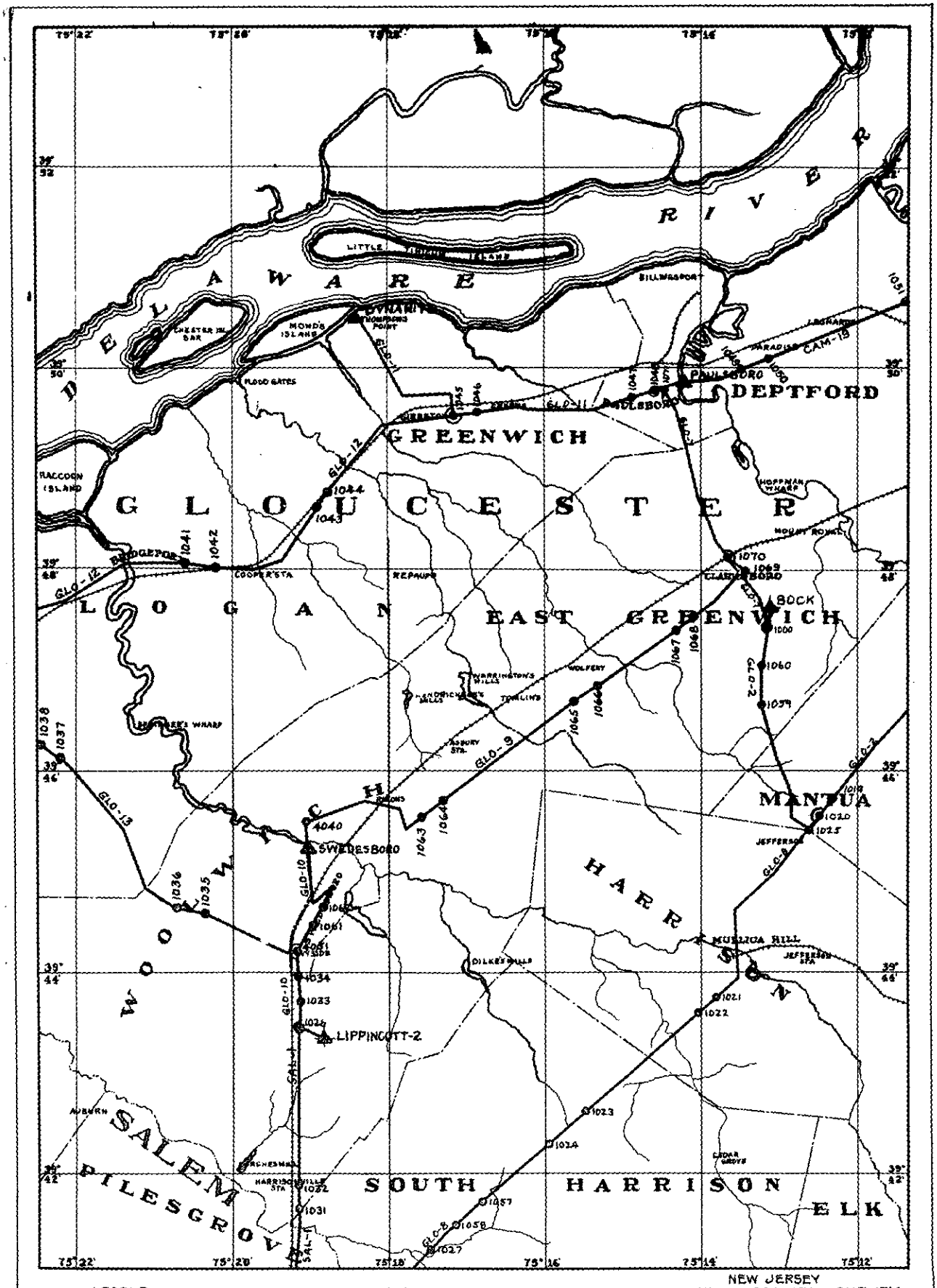
SHEET 30-1
TRAVERSES
GLO-12 GLO-13
GLO-14

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

R.N.



LEGEND

Traverse _____ GLO-10

Monument ○

Traverse Junction

Triangulation Sta. (1st Order) ▲

Triangulation Sta. (2nd Order) △

SHEET 30-2

TRAVERSES

GLO-10	GLO-8	GLO-13
GLO-2	GLO-7	CAM-19
GLO-11	GLO-9	
SAL-1	GLO-12	

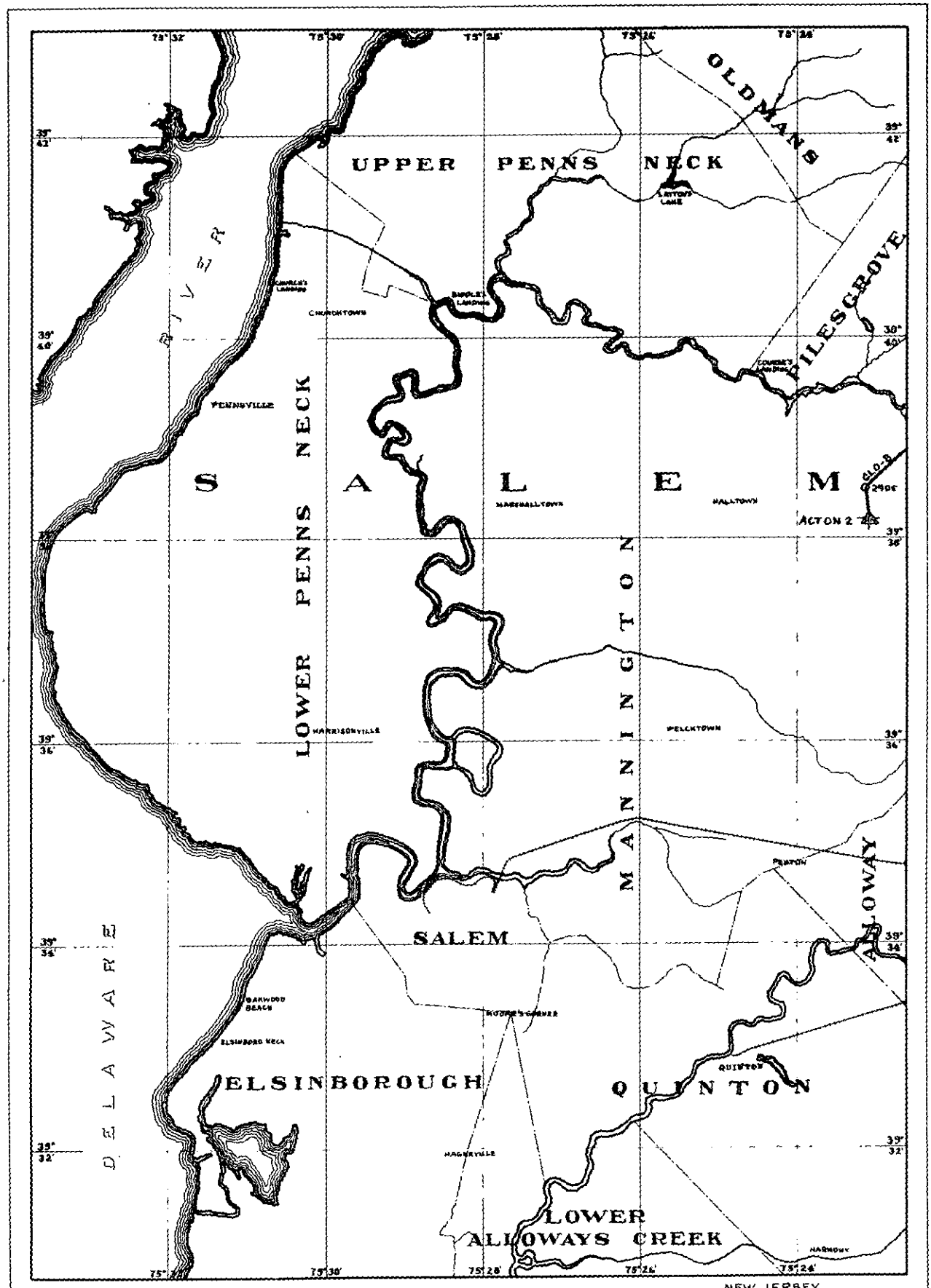
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



Traverse ——— GL

Monument ——— ●

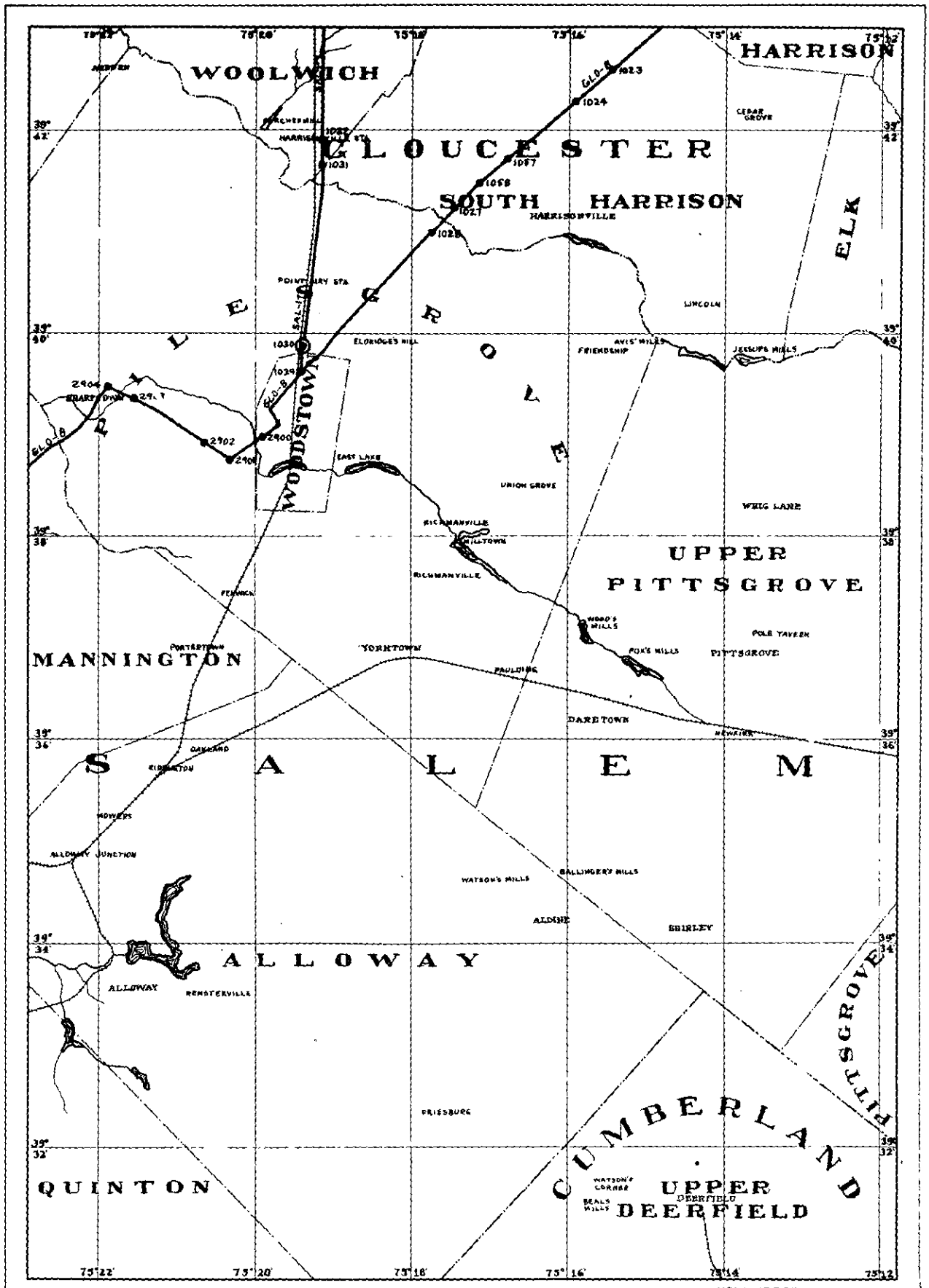
Traverse Junction ——— ———

Triangulation Station (1st Order) ——— ▲

Triangulation Station (2nd Order) ——— ▲

SHEET 30-3
TRAVERSES
GLO-8

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE 1 Inch = 1 Mile



LEGEND

Traverse ——— SAL-1

Monument ●

Traverse Junction

Triangulation Sta. (1st Order) ▲

Triangulation Sta. (2nd Order) ▲

SHEET 30-4

TRAVERSES

GLO-8 SAL-1

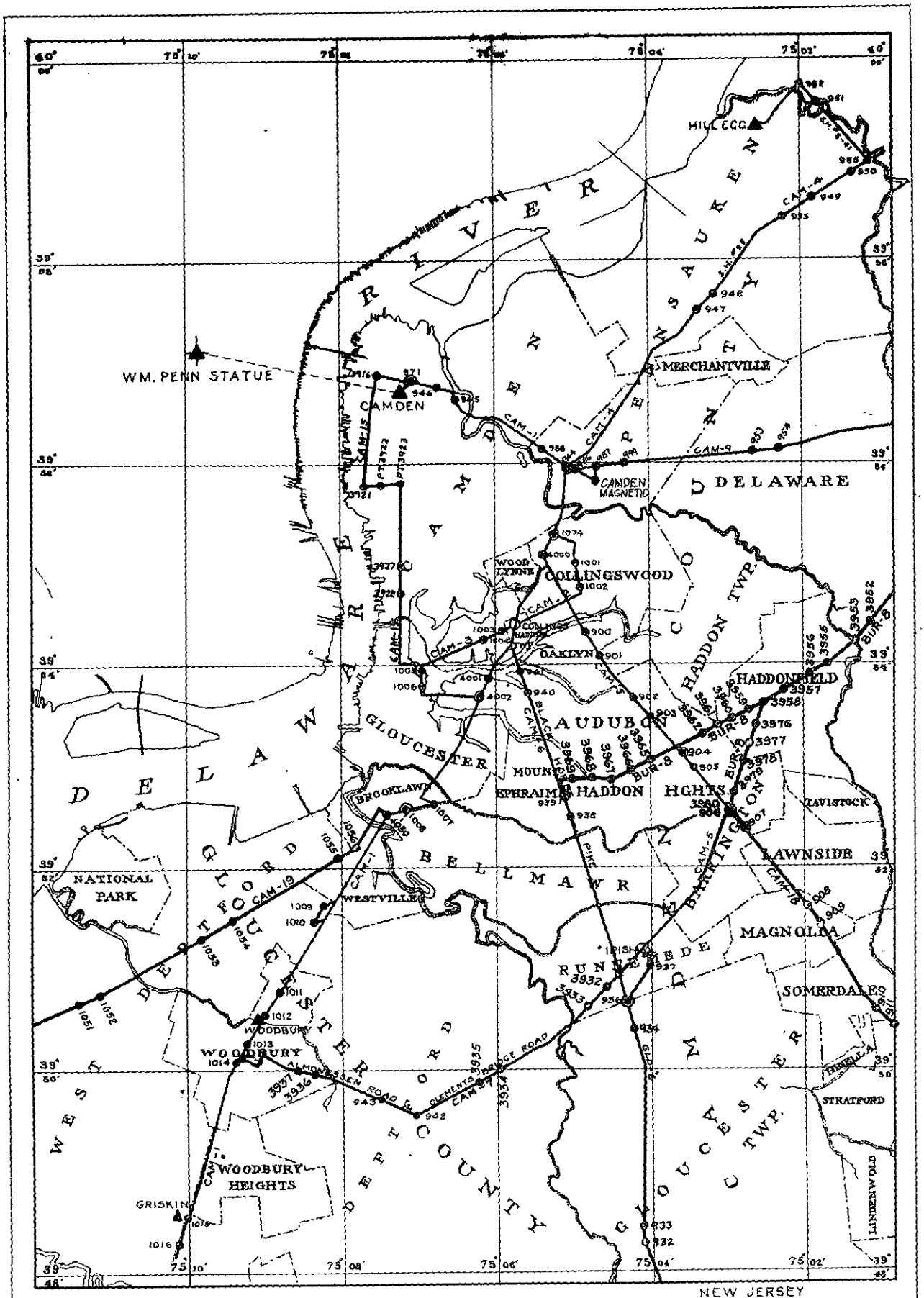
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 Inch = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

BUR-8

CAM-1 CAM-4 CAM-7
CAM-2 CAM-5 CAM-9
CAM-3 CAM-6 GLO-6
CAM-19 CAM-18

SHEET 31-1

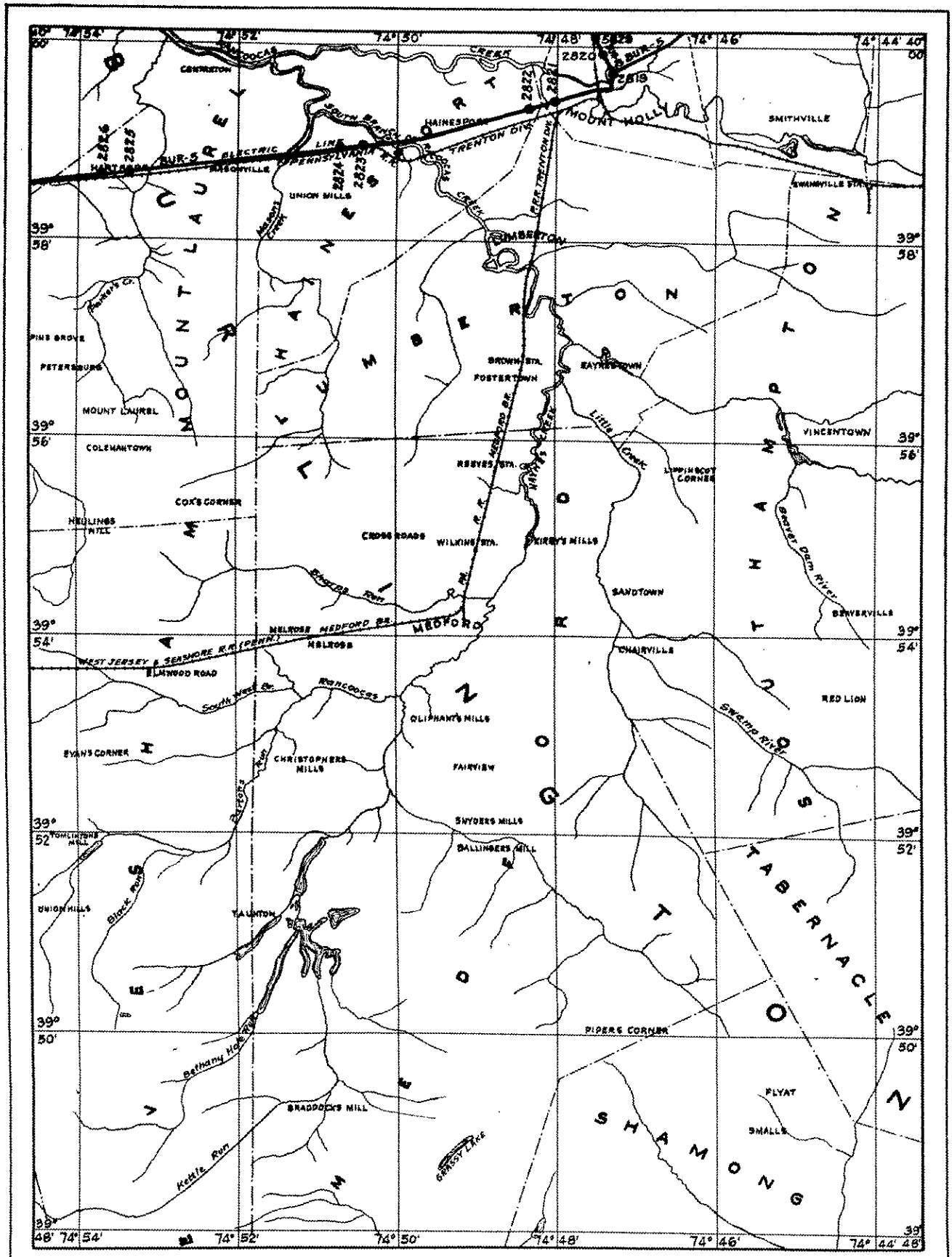
TRAVERSES

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

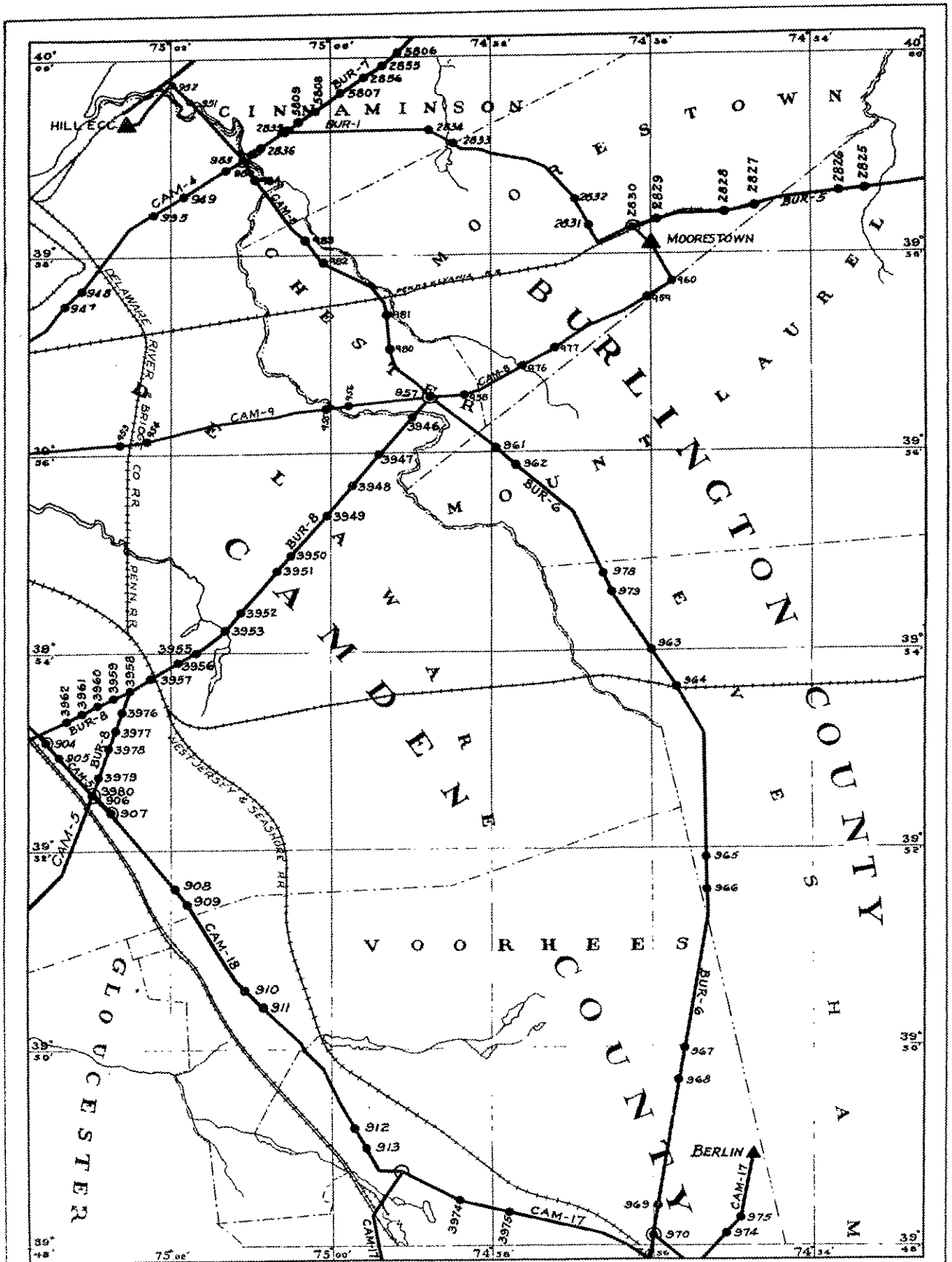
SHEET 31-3
TRAVERSES
BUR-5
BUR-10

NEW JERSEY
GEODETIC CONTROL SURVEY
WRA PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

R.H.



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

BUR-1

SHEET 31-2

TRAVERSES

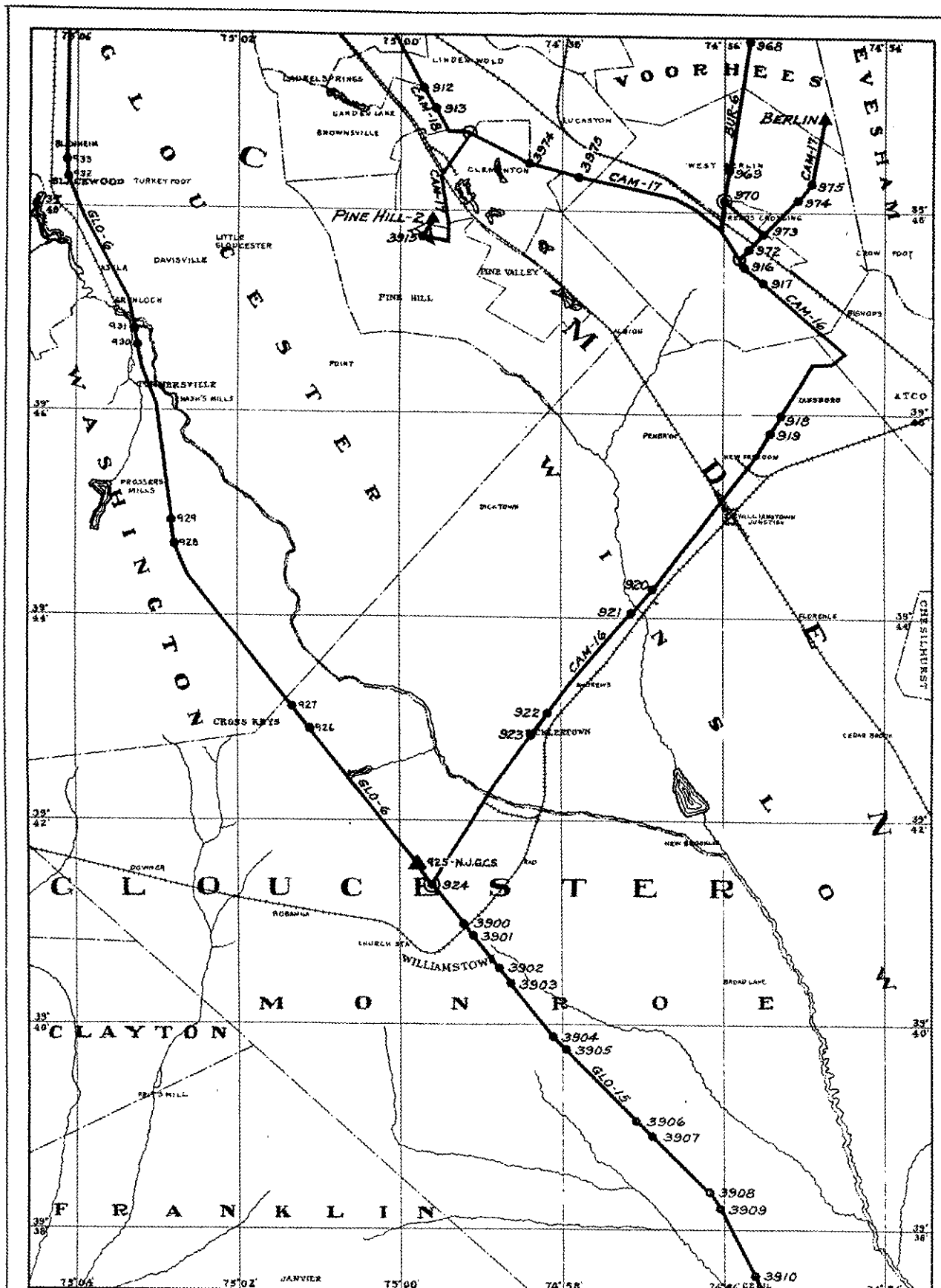
BUR-1	CAM-4
BUR-5	CAM-8
BUR-6	CAM-9
BUR-7	CAM-18
BUR-8	CAM-17

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— GLO-6

Monument

Traverse Junction

Triangulation Station (1st Order) ▲

Triangulation Station (2nd Order) ▲

SHEET-31, 5

GLO-6 BUR-6

GLO-15

CAM-16

CAM-17

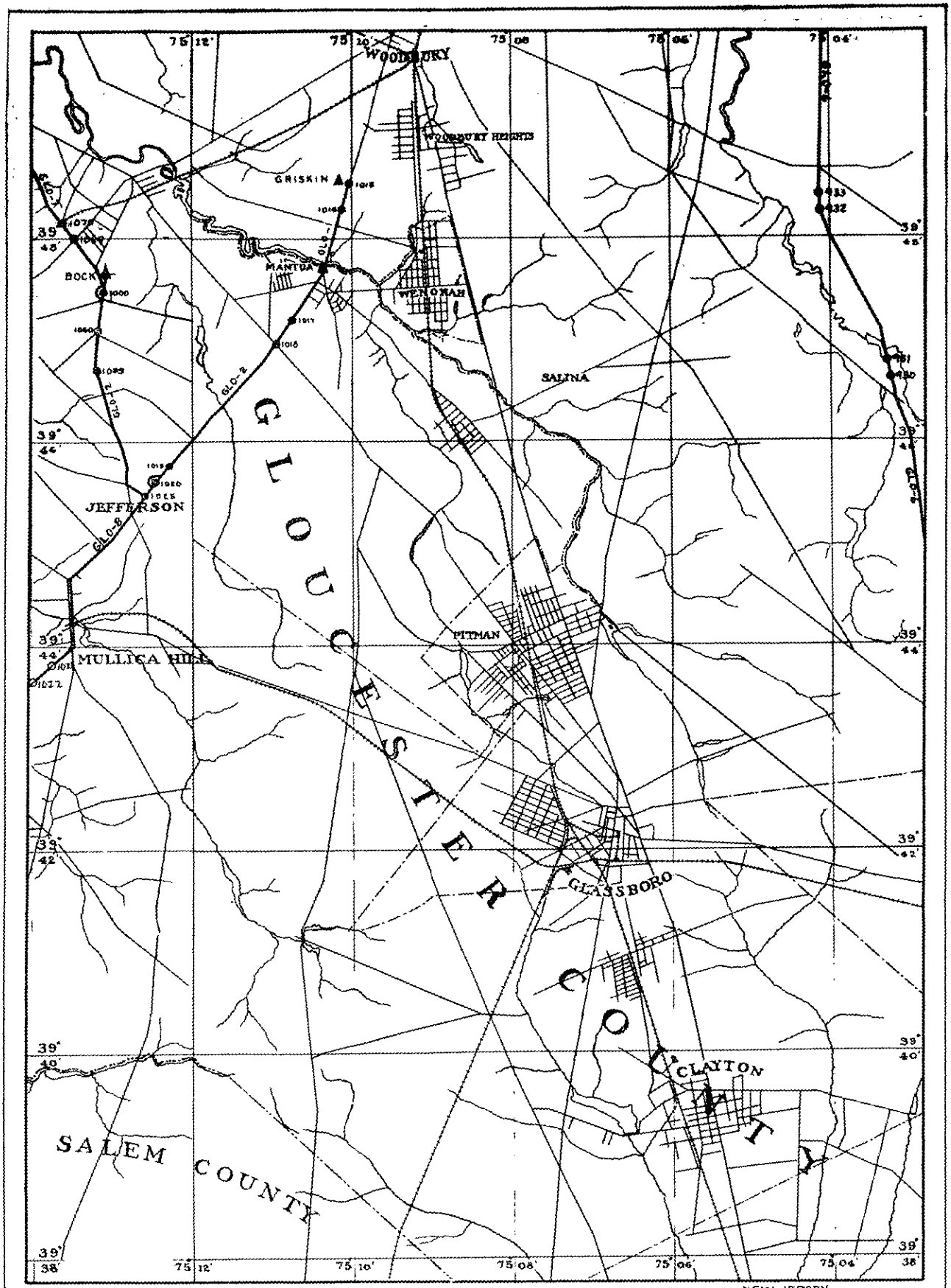
CAM-18

NEW JERSEY
GEODETIC CONTROL SURVEY

WRA PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— GLO-1

Monument ——— 1025

Traverse Junction

Triangulation Station

SHEET 31-4

TRAVERSES

GLO-1 GLO-7

GLO-2

GLO-6

GLO-8

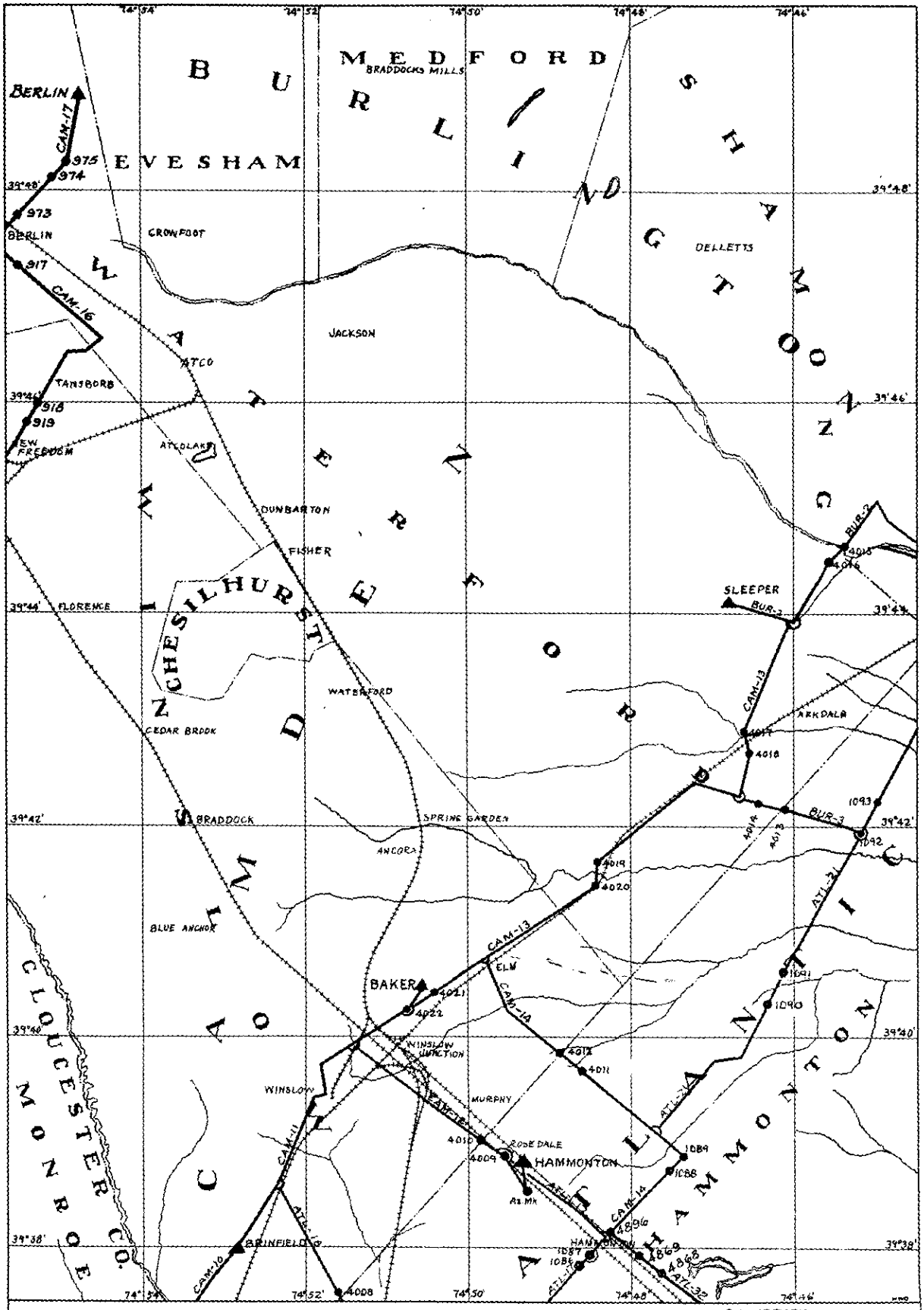
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

CAM-13

SHEET-31,6

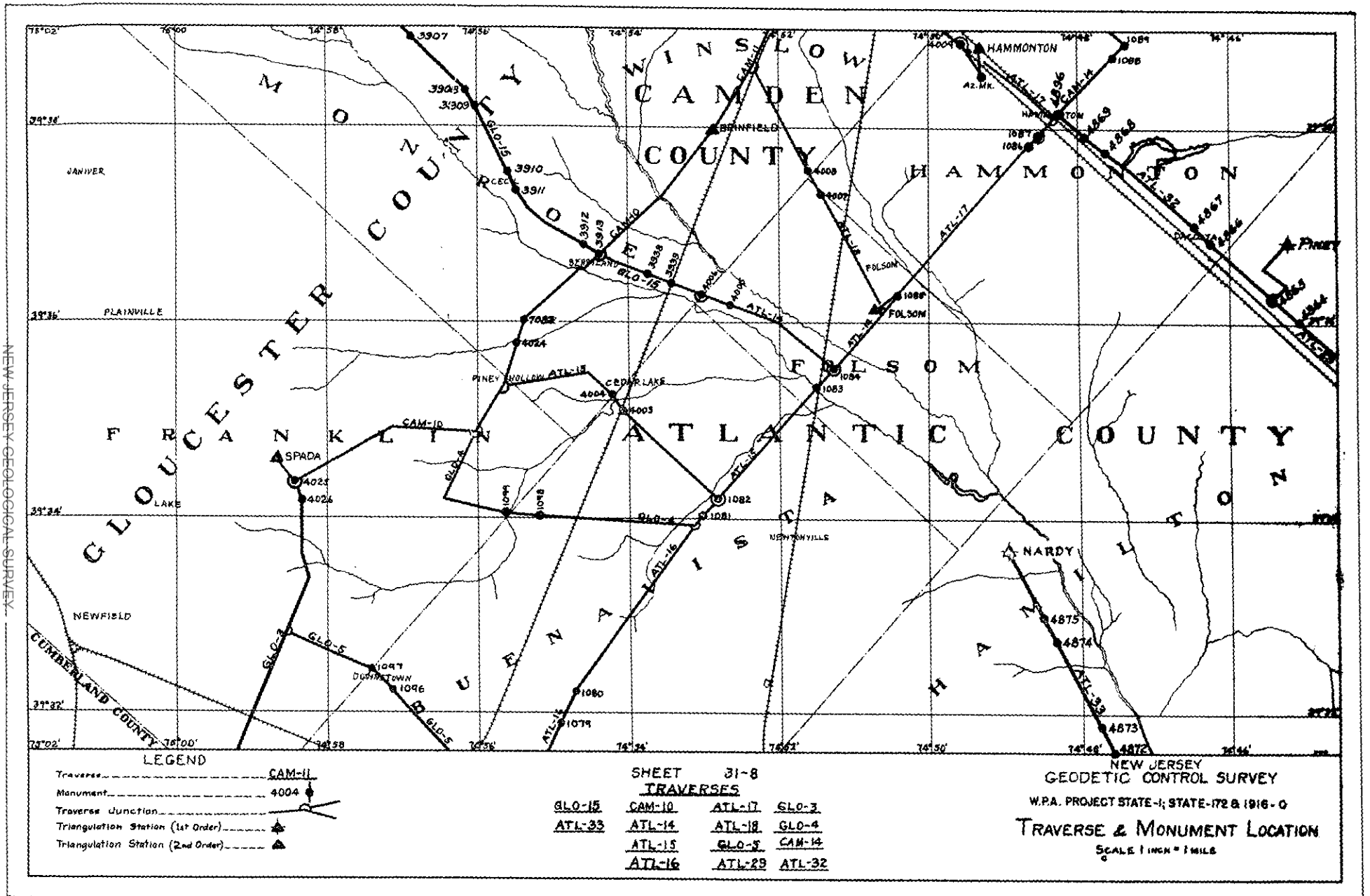
CAM-10	ATL-18	CAM-17
CAM-11	BUR-3	
CAM-12	BUR-2	
CAM-13	ATL-17	
CAM-14	ATL-21	
CAM-16	ATL-32	

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— CAM-11

Monument ——— 4004

Traverse Junction

Triangulation Station (1st Order)

Triangulation Station (2nd Order)

SHEET 31-8

TRAVERSES

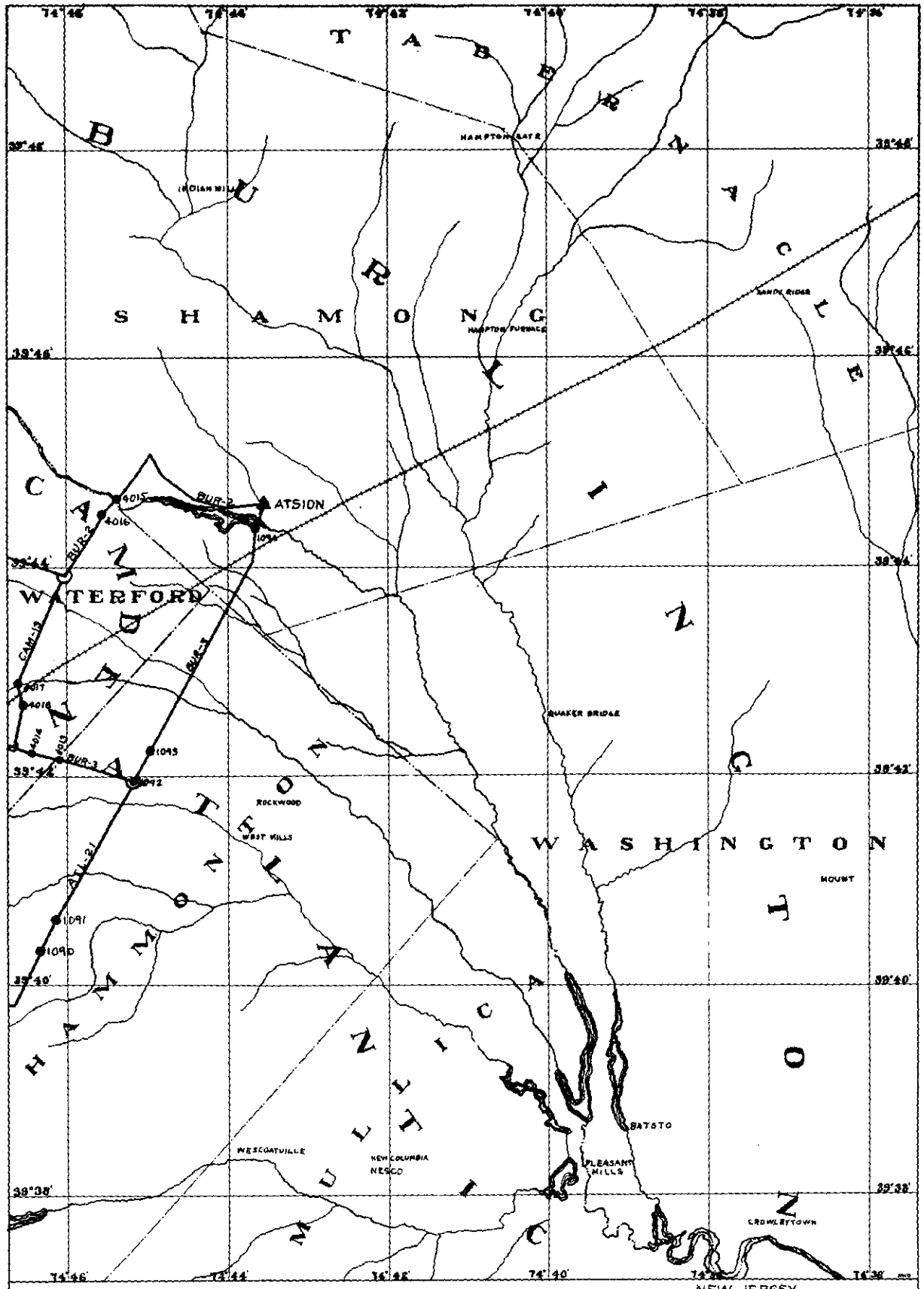
GLO-15	CAM-10	ATL-17	GLO-3
ATL-33	ATL-14	ATL-18	GLO-4
	ATL-15	GLO-5	CAM-14
	ATL-16	ATL-29	ATL-32

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— BUR-3

Monument ———●———

Traverse Junction ———Y———

Triangulation Station (1st Order) ---★---

Triangulation Station (2nd Order) ---▲---

SHEET 32-4

TRAVERSES

CAM-13 BUR-3 BUR-2

ATL-21

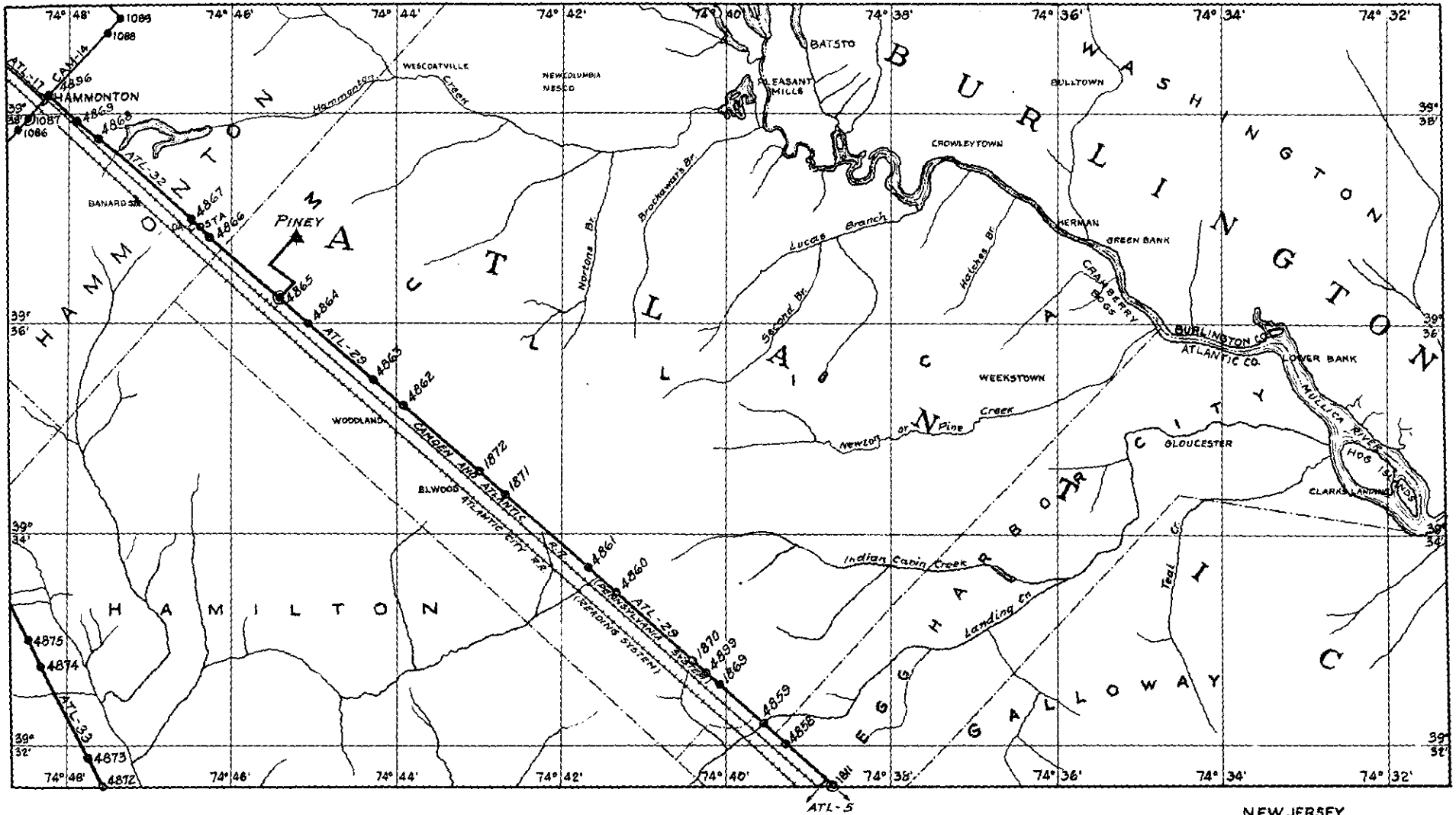
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ATL-5
Monument .....
Traverse Junction .....
Triangulation Station (1ST Order)
Triangulation Station (2ND Order)

SHEET 32-7

TRAVERSES

ATL-5 , ATL-17 , CAM-14
ATL-33 ATL-29
ATL-32

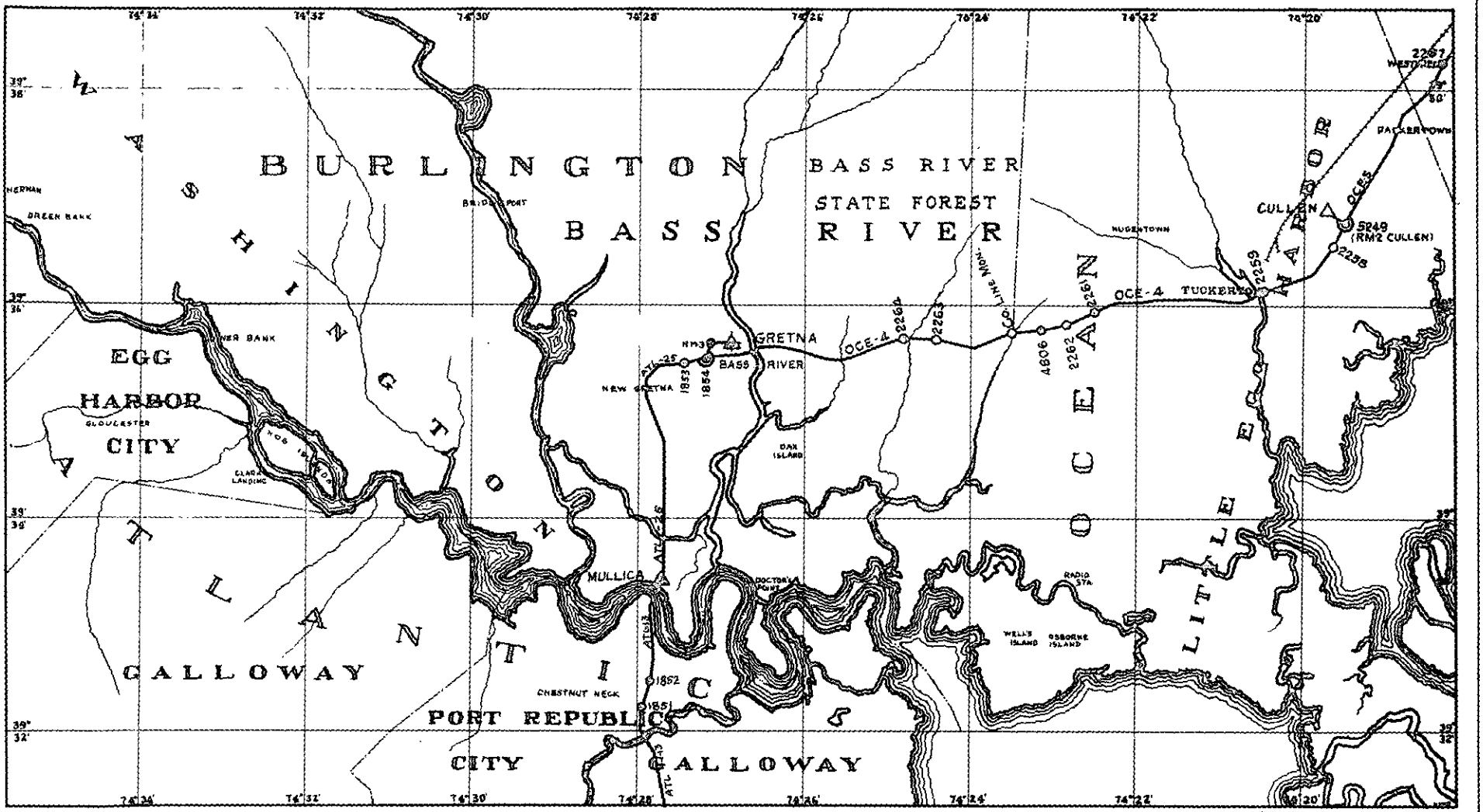
NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

T.H.



LEGEND

Traverse ATL-13

Monument

Traverse Junction

Triangulation Station (1st Order)

Triangulation Station (2nd Order)

SHEET 32-8

TRAVERSES

ATL-13 OCE-5

ATL-25 OCE-4

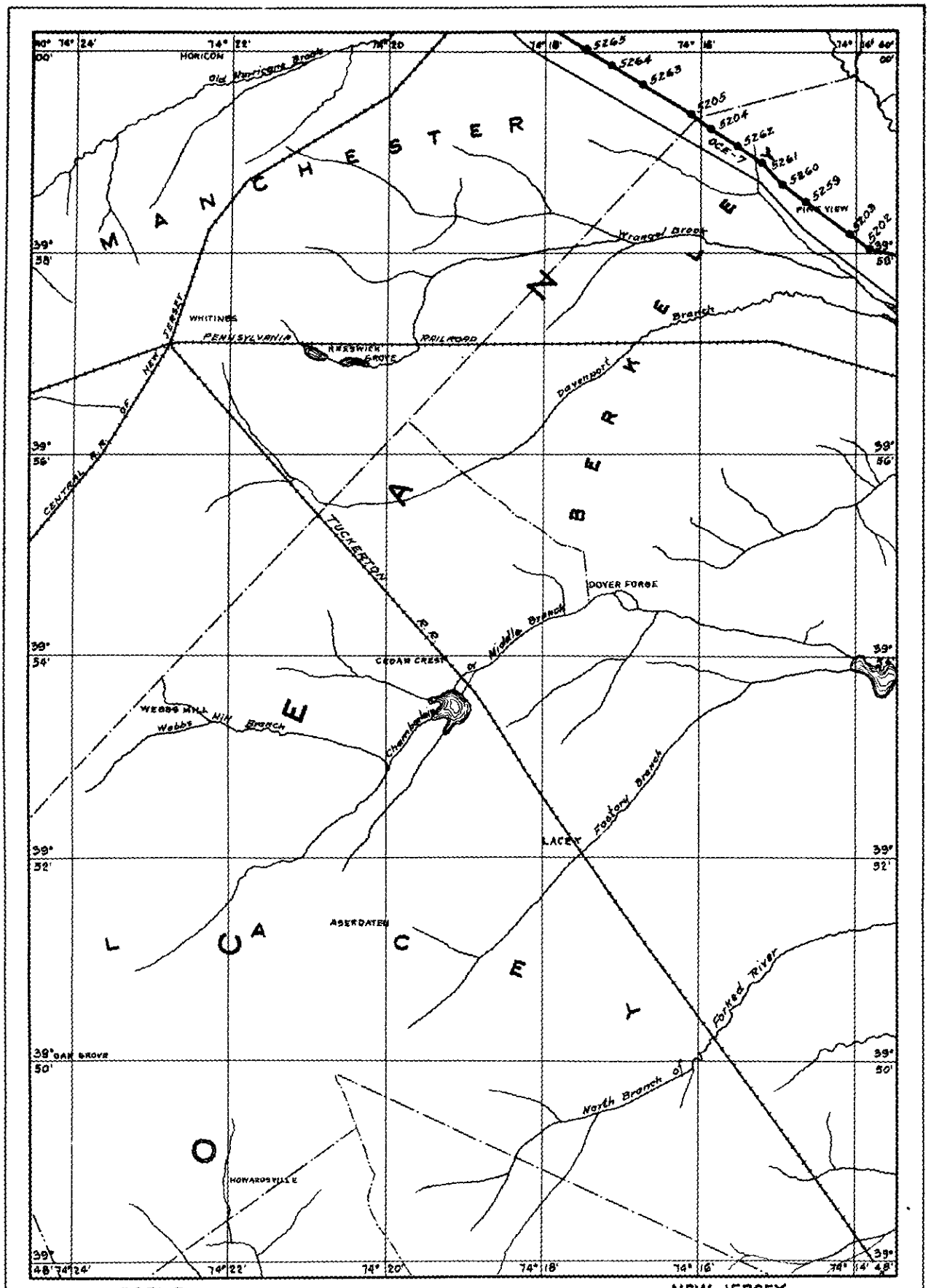
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

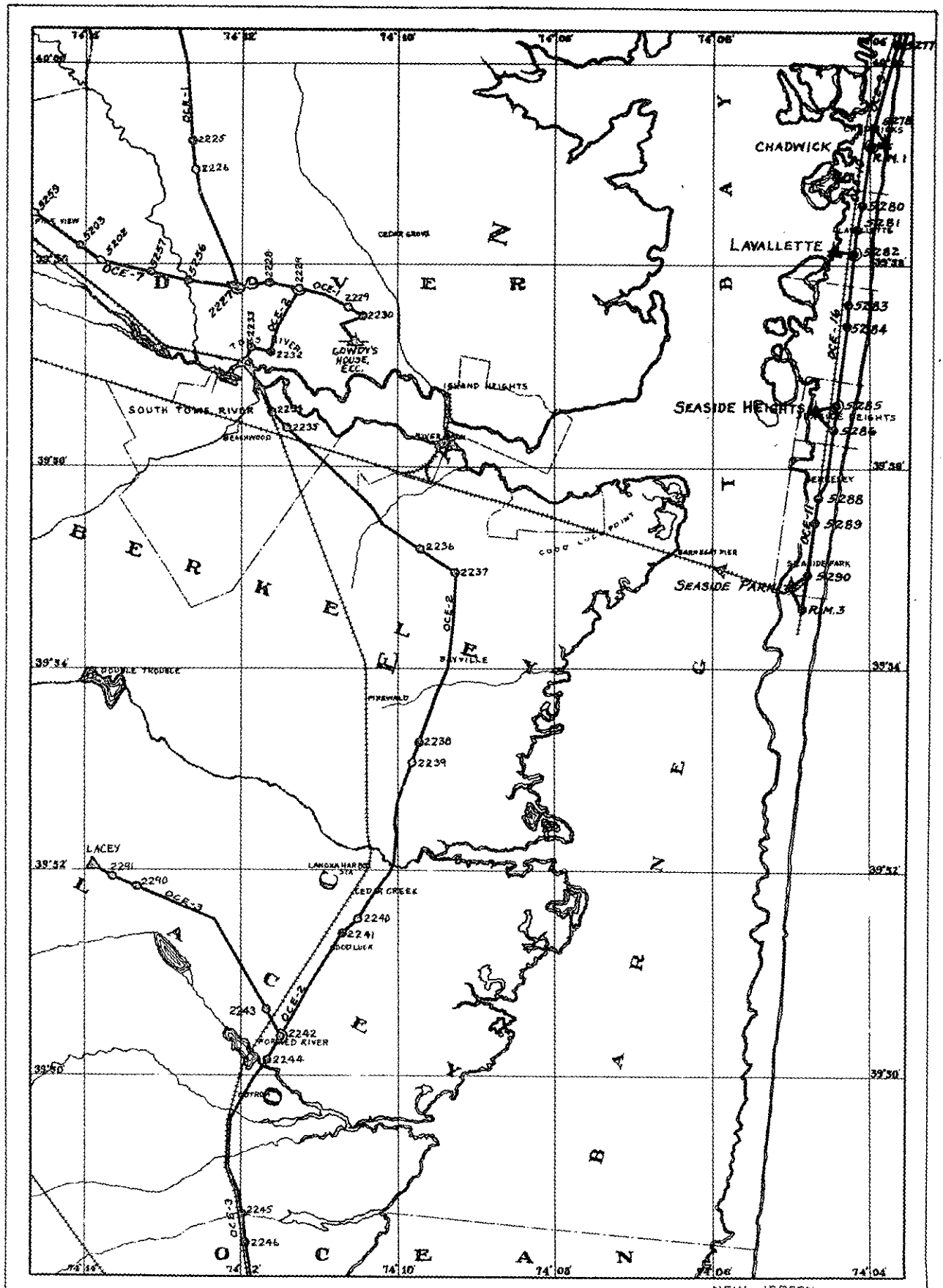
Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 33-1
TRAVERSES
OCE-7

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse ——— OCE-1

Monument

Traverse Junction

Triangulation Station (1st Order)

Triangulation Station (2nd Order)

SHEET 33-2

TRAVERSES

OCE-1	OCE-9	OCE-16
OCE-2	OCE-10	OCE-7
OCE-3	OCE-11	

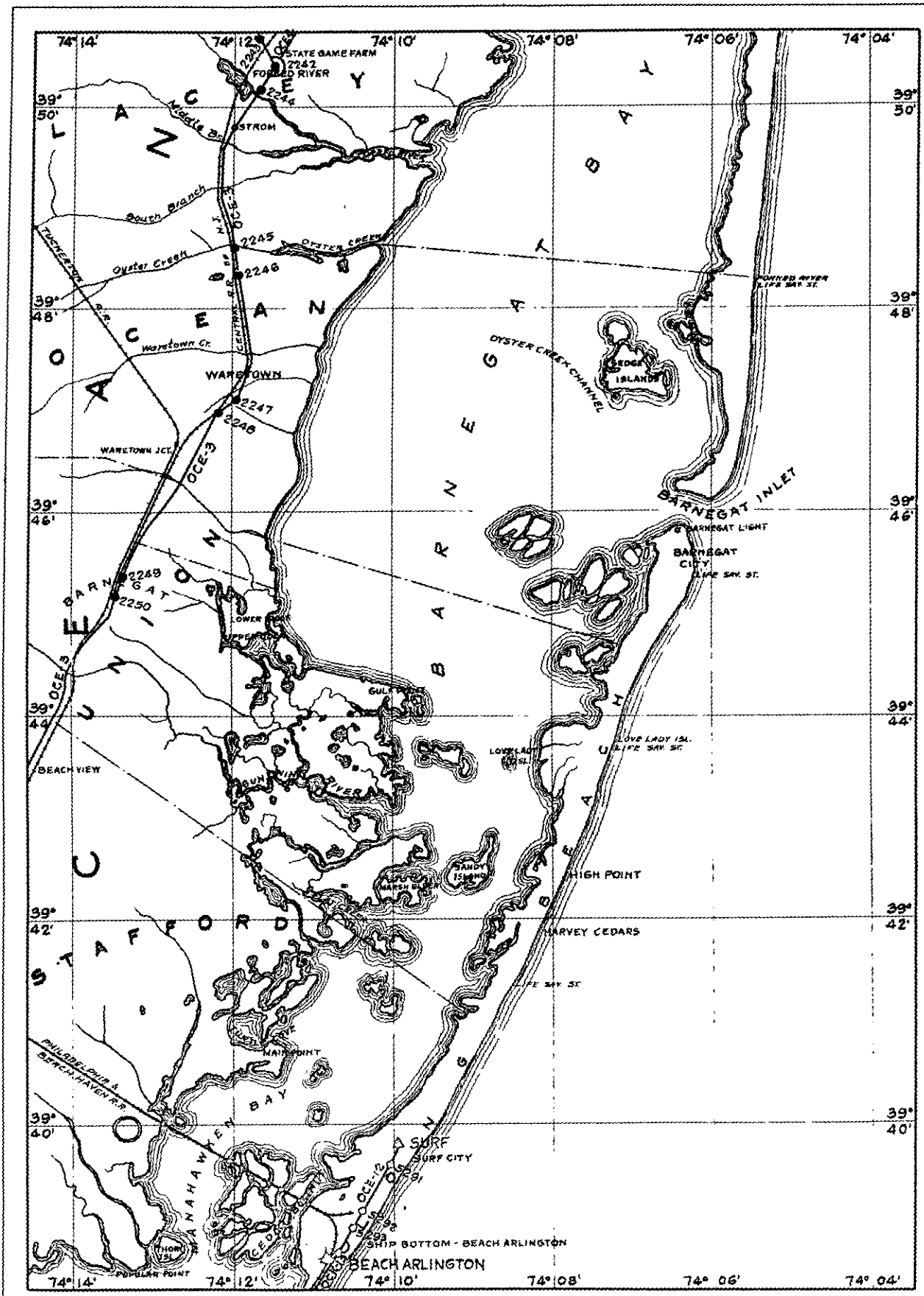
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

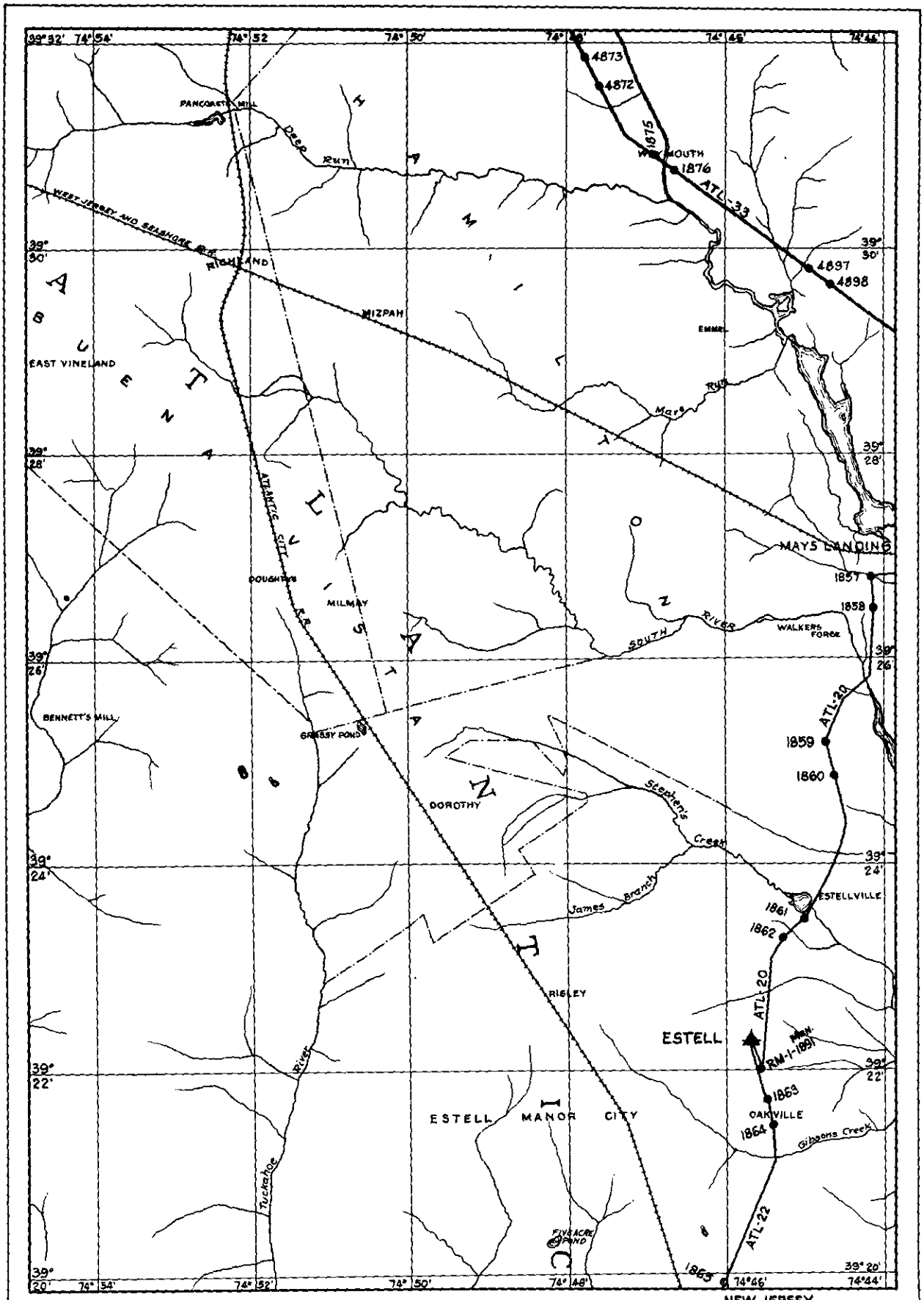
Traverse OCE-3
Monument ..... ○
Traverse Junction ..... ⊙
Triangulation Station (1ST Order) ☆
Triangulation Station (2ND Order) △

SHEET 33-3
TRAVERSES
OCE-3, OCE-4, OCE-12
OCE-13,

NEW JERSEY
GEODETIC CONTROL SURVEY
WPA PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION
SCALE 1 INCH = 1 MILE

R.H.

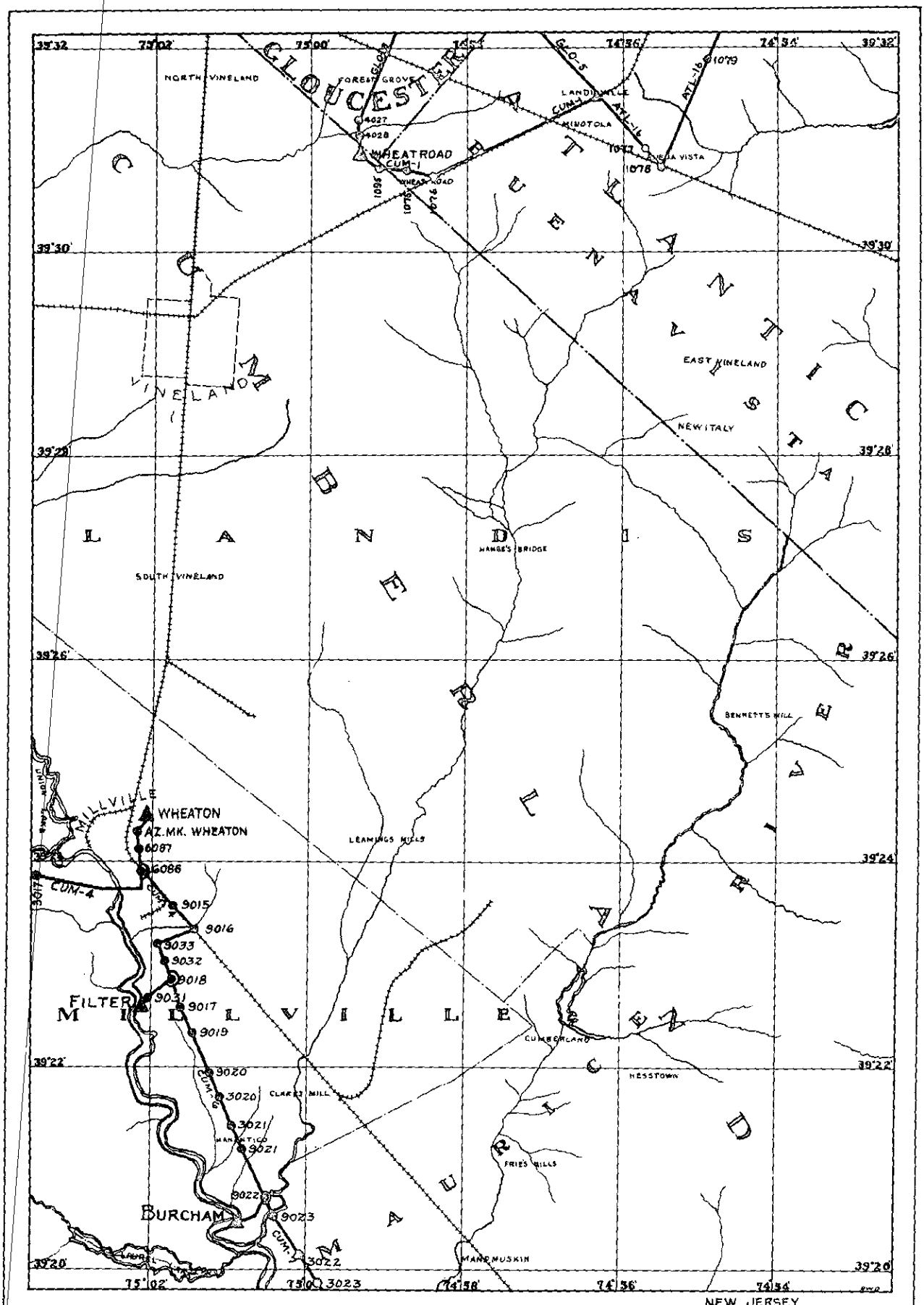


LEGEND

Traverse ATL-20
Monument .....
Traverse Junction .....
Triangulation Station (1st Order) ..
Triangulation Station (2nd Order) ..

SHEET 35-1
TRAVERSES
ATL-20 ATL-22
ATL-33

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ——— GLO-3

Monument ———

Traverse Junction ———

Triangulation Station (1st Order) ———

Triangulation Station (2nd Order) ———

SHEET 35-2

TRAVERSES

GLO-3 ATL-16 CUM-1
GLO-5 CUM-7 CUM-4
CUM-5
CUM-6

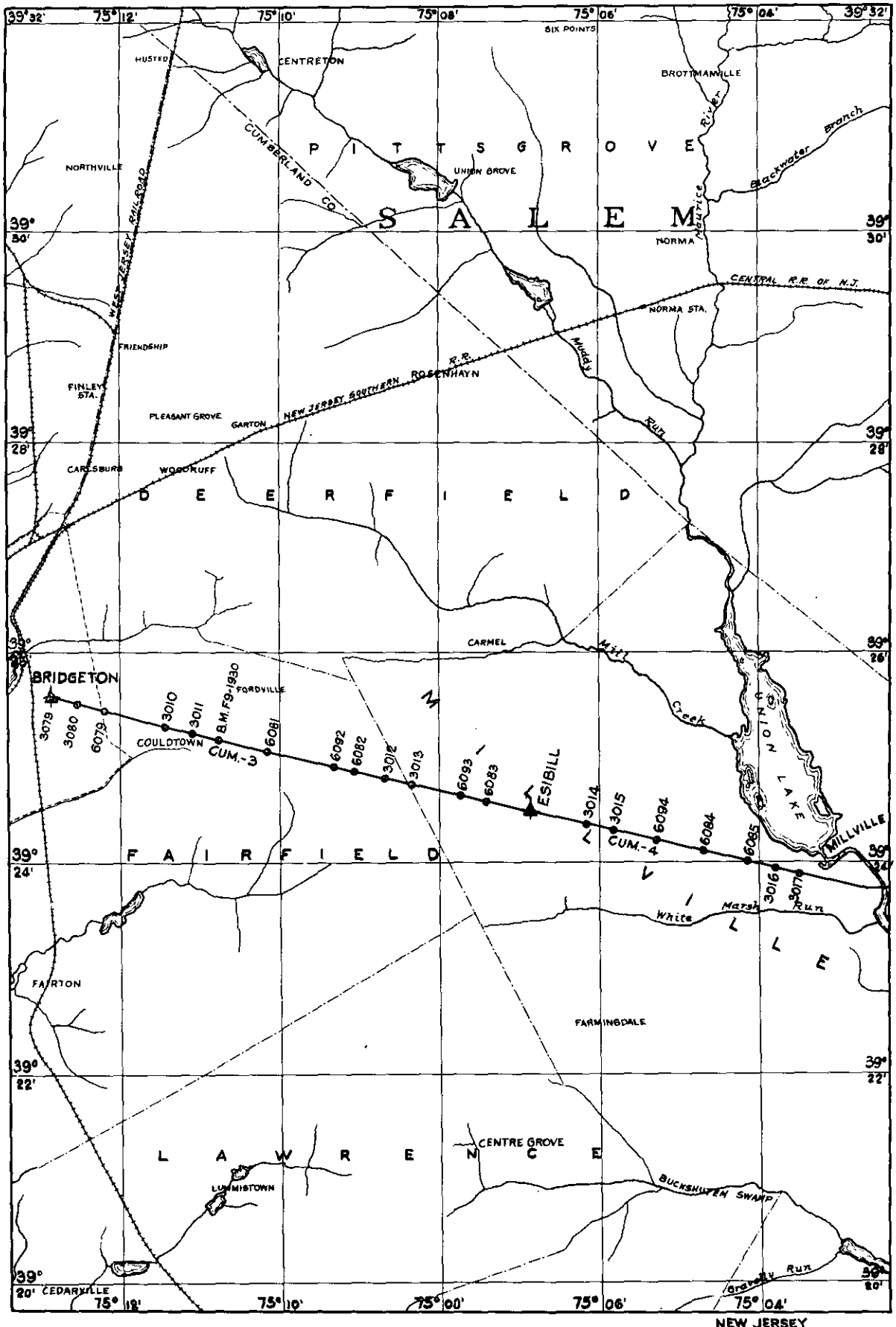
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse CUM-3
Monument .....
Traverse Junction .....
Triangulation Station (1st Order) ..
Triangulation Station (2nd Order) ..

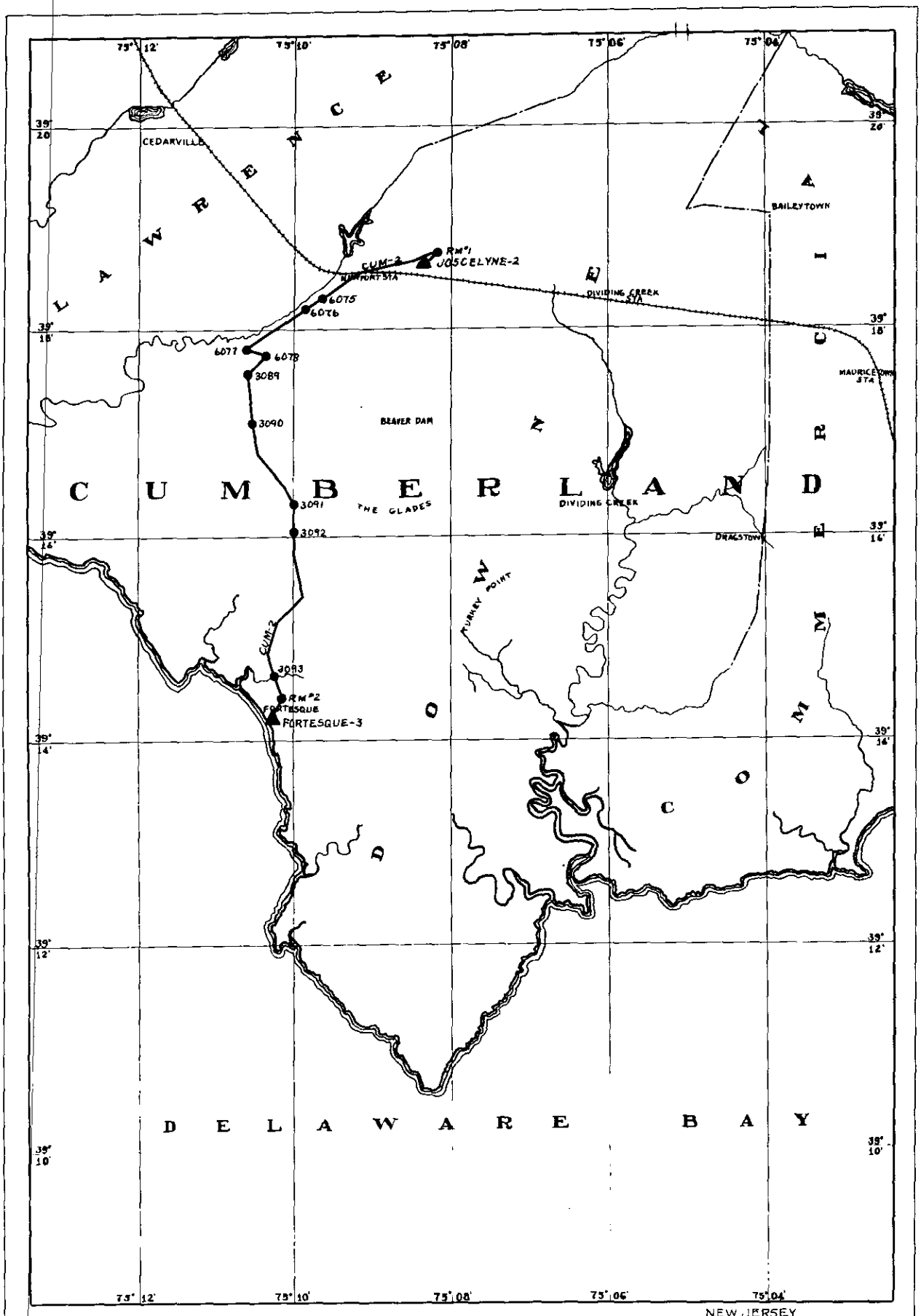
SHEET 35-3
TRAVERSES
CUM.-3 , CUM.-4

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE

R.H.



LEGEND

Traverse _____ CUM-2

Monument _____ ●

Traverse Junction _____

Triangulation Station (1st Order) _____ ▲

Triangulation Station (2nd Order) _____ ▲

SHEET - 35-4

TRAVERSES

CUM-2

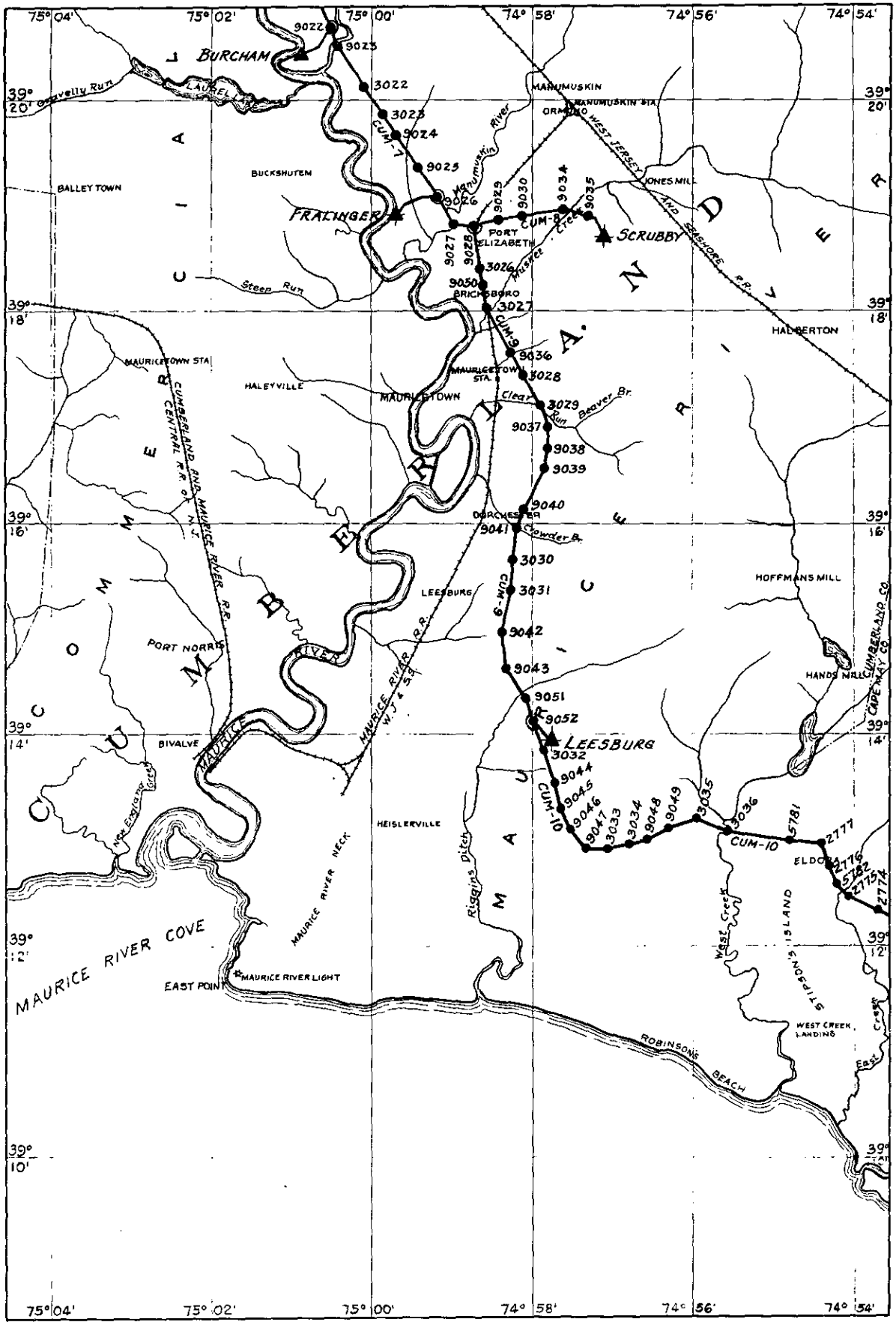
NEW JERSEY

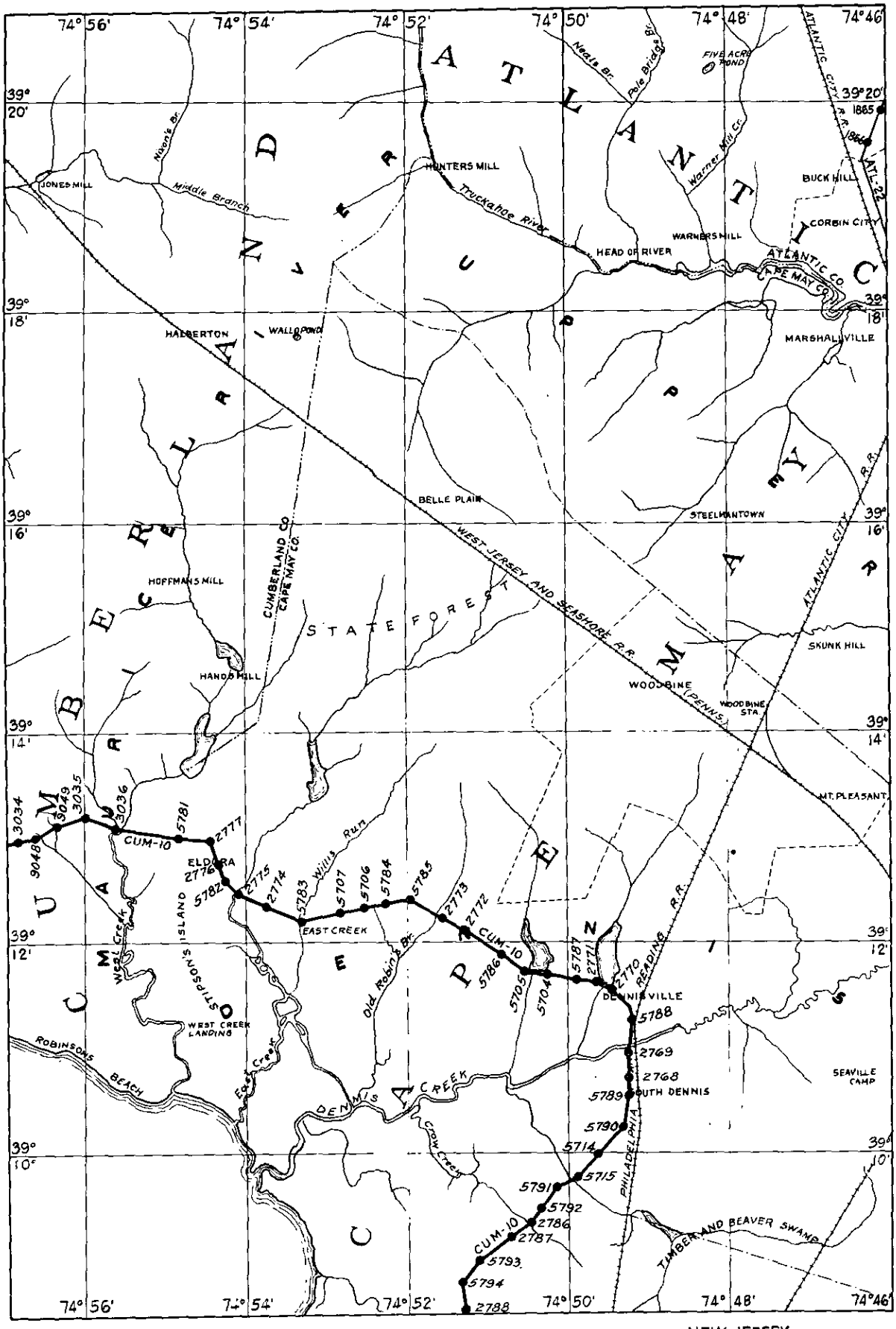
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



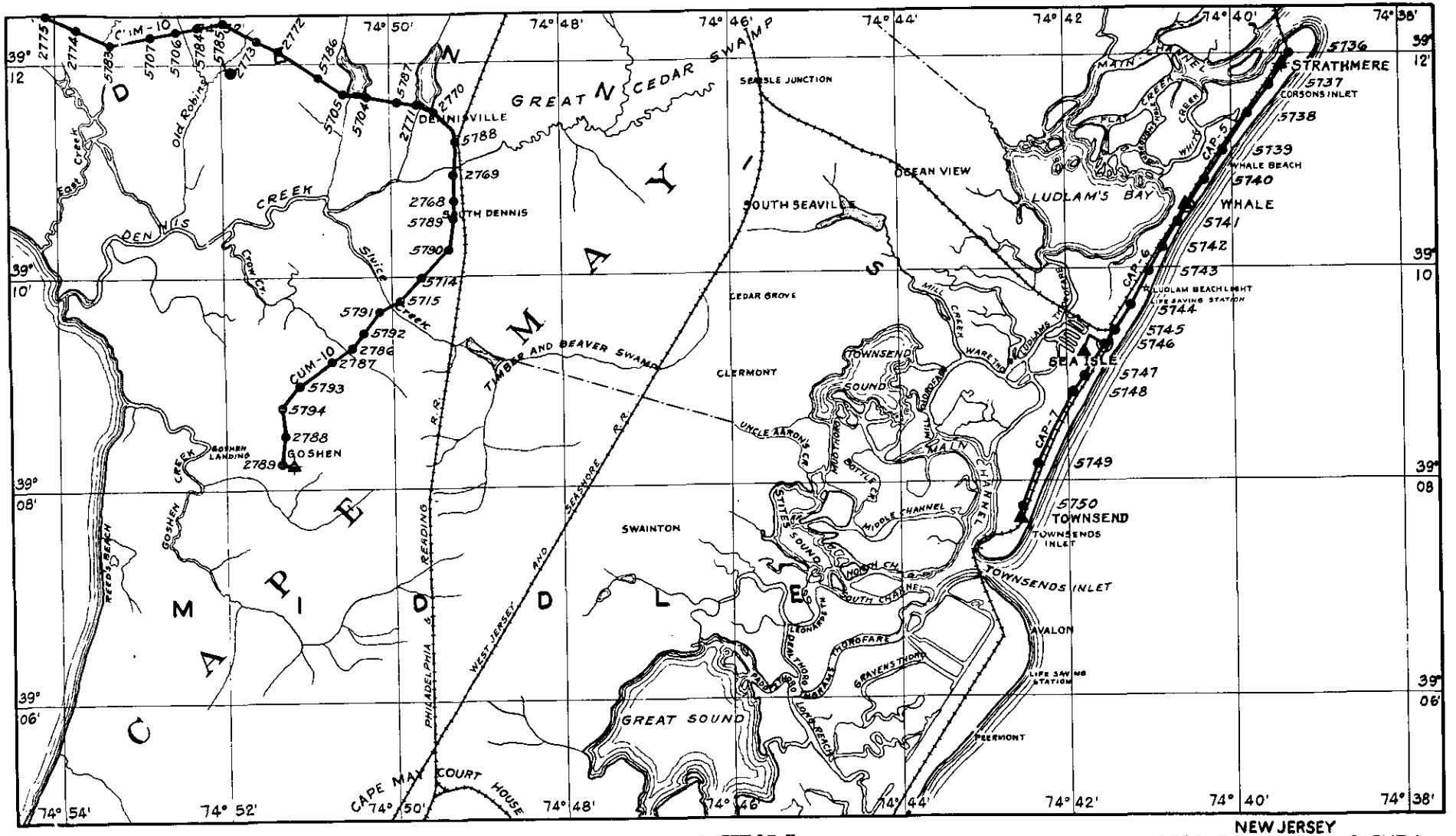


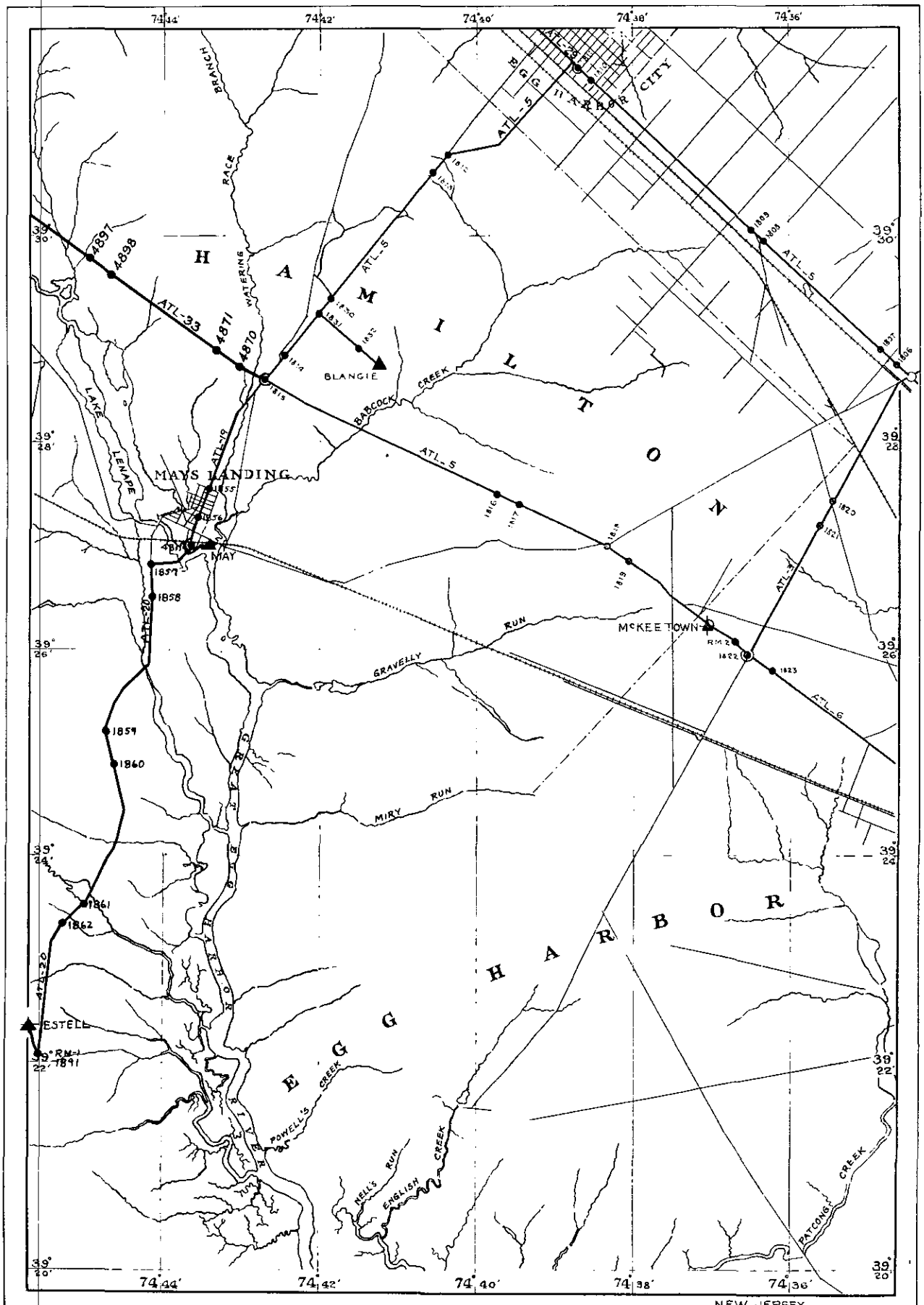
LEGEND

Traverse ATL-22
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 35-6
TRAVERSES
ATL-22 CUM-10

NEW JERSEY
GEODETIC CONTROL SURVEY
WPA PROJECT STATE-1, STATE-172 & 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE 1 INCH = 1 MILE





LEGEND

Traverse — ATL-5

Monument — 1812

Traverse Junction

Triangulation Station

SHEET 36-1

TRAVERSES

ATL-5	ATL-20
ATL-3	ATL-29
ATL-6	ATL-33
ATL-19	

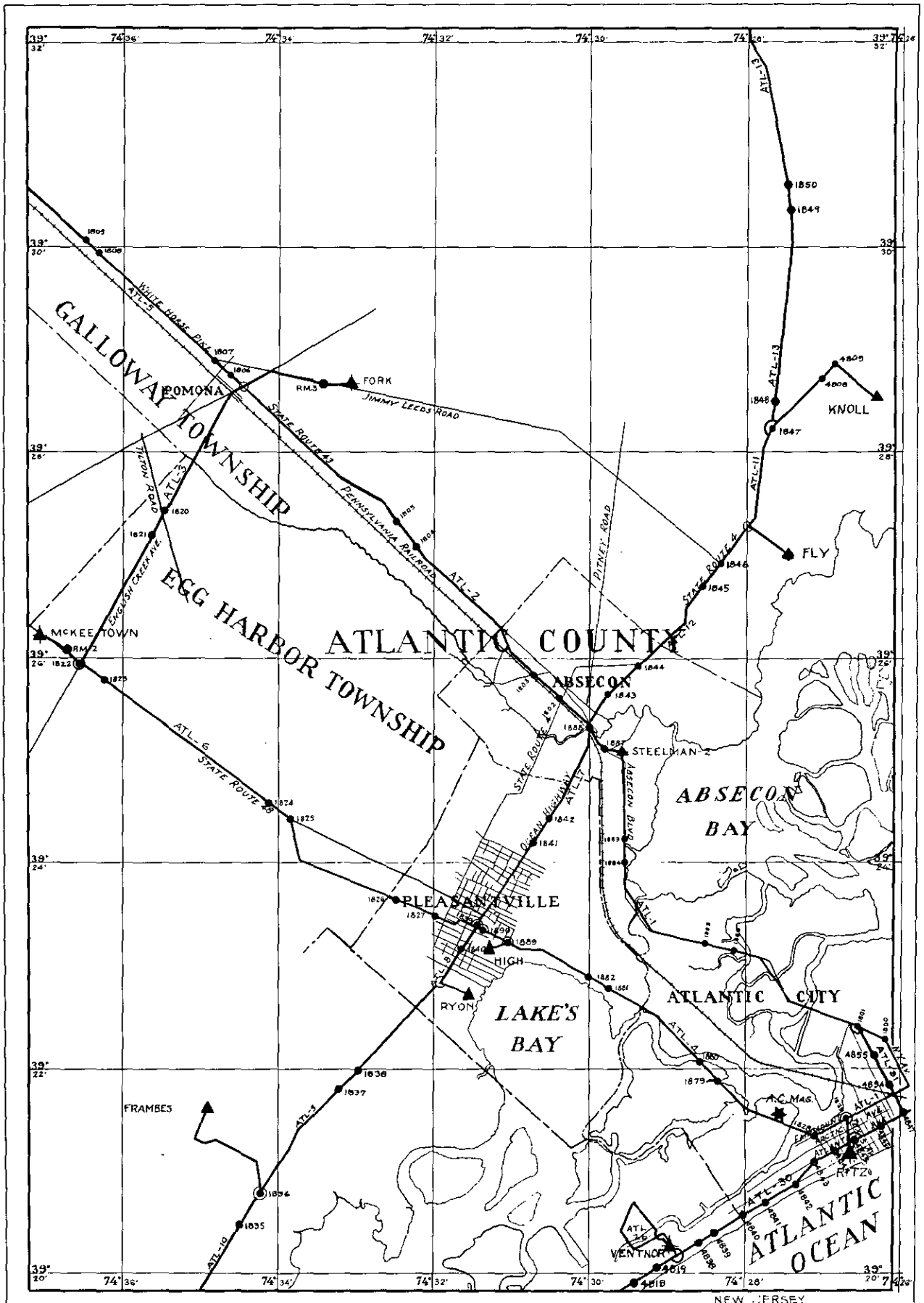
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE: 1 INCH = 1 MILE



LEGEND

Traverse ATL-1

Monument 1800

Triangulation Stations.

First Order

Second Order

Traverse Junction

SHEET 36-2

TRAVERSES

ATL-1	ATL-4	ATL-8	ATL-11
ATL-2	ATL-6	ATL-9	ATL-12
ATL-3	ATL-7	ATL-10	ATL-13
ATL-26	ATL-30	ATL-31	

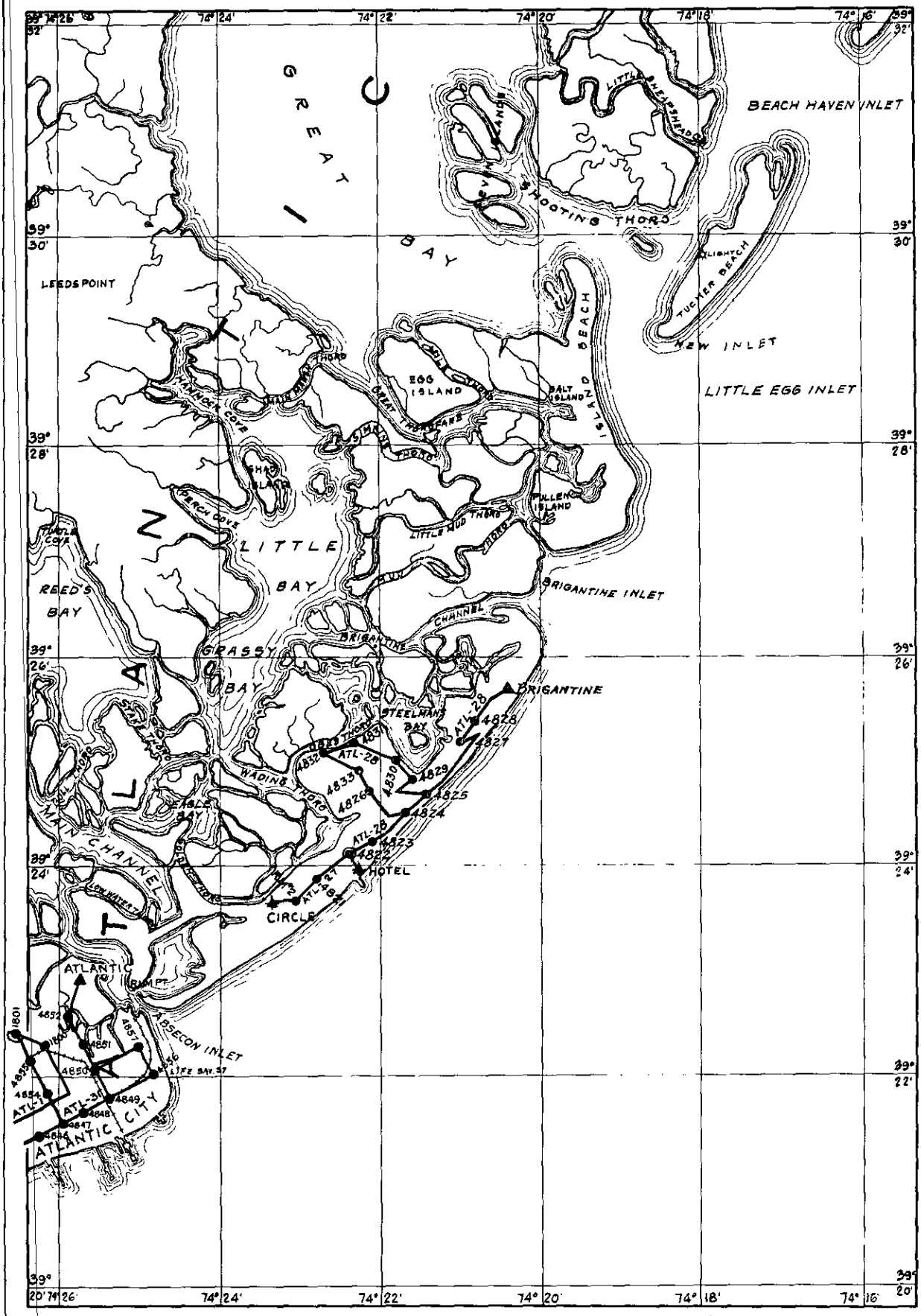
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE. 1 INCH = 1 MILE

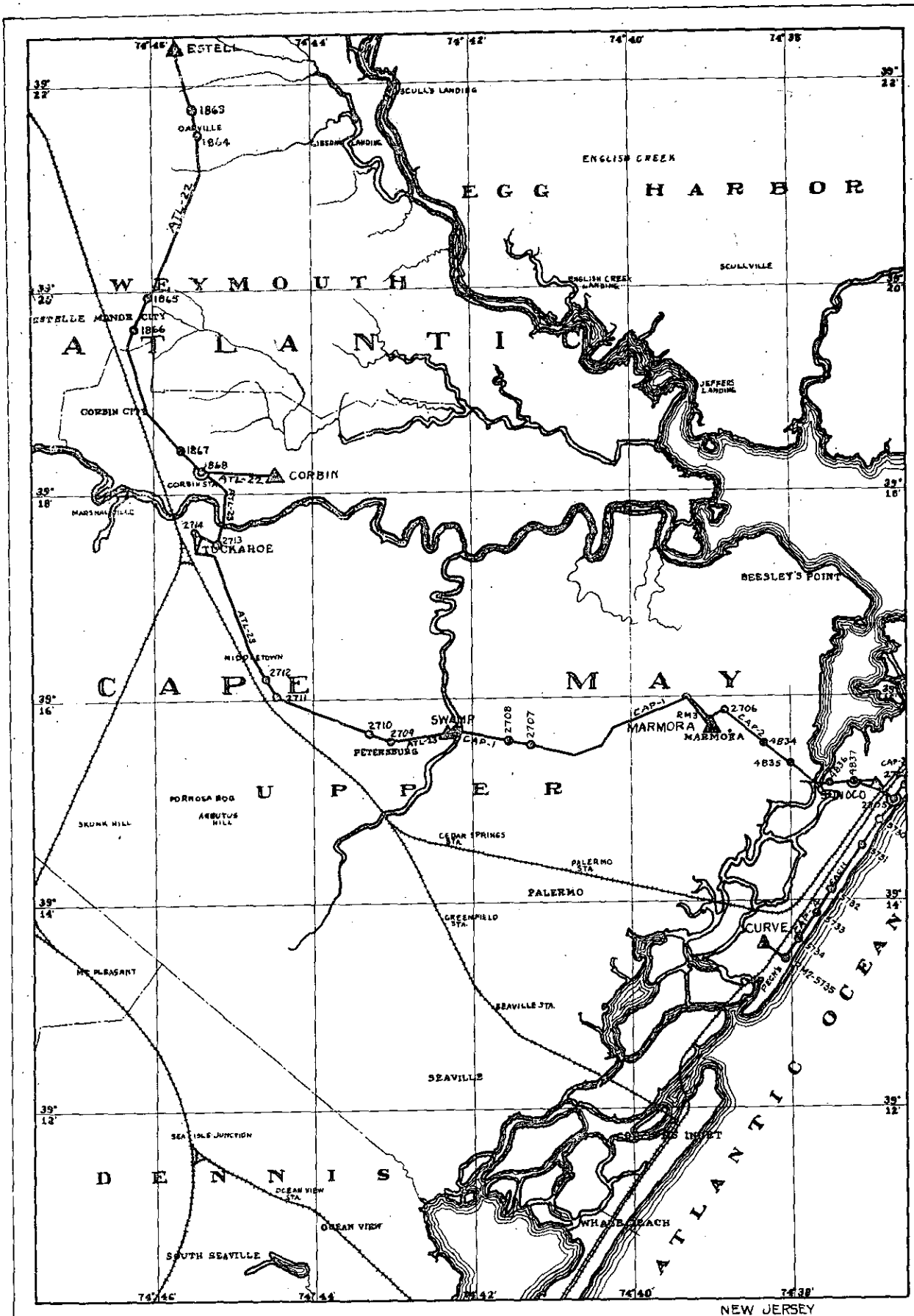


LEGEND

Traverse ATL-27
Monument ..... ●
Traverse Junction ..... ⌒
Triangulation Station (1st Order) ▲
Triangulation Station (2nd Order) △

SHEET 36-3
TRAVERSES
ATL-1 ATL-27 ATL-31
ATL-28

NEW JERSEY
GEODETIC CONTROL SURVEY
W.P.A. PROJECT STATE-1; STATE-172 & 1916-0
TRAVERSE & MONUMENT LOCATION
SCALE 1 INCH = 1 MILE
R.H.



LEGEND

Traverse ATL-22

Monument

Traverse Junction

Triangulation Station (1st Order)

Triangulation Station (2nd Order)

SHEET 36-4

TRAVERSES

ATL-22 CAP-3

ATL-23 CAP-4

CAP-1

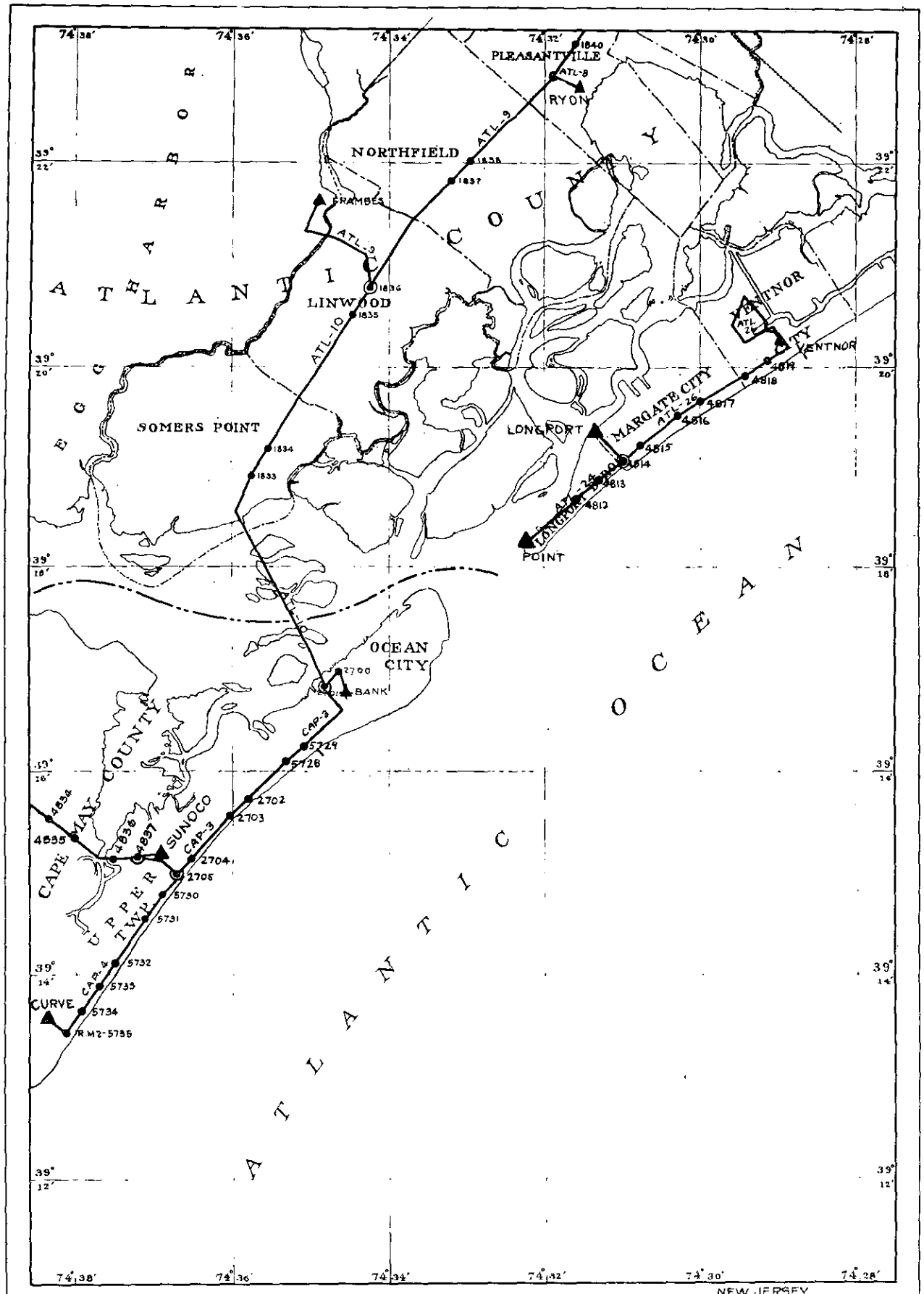
CAP-2

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse — ATL-9

Monument

Traverse Junction

Triangulation Station (1st Order)

Triangulation Station (2nd Order)

SHEET 36-5

TRAVERSES

ATL-8	ATL-9	ATL-10
ATL-24	ATL-26	
CAP-2	CAP-3	CAP-4

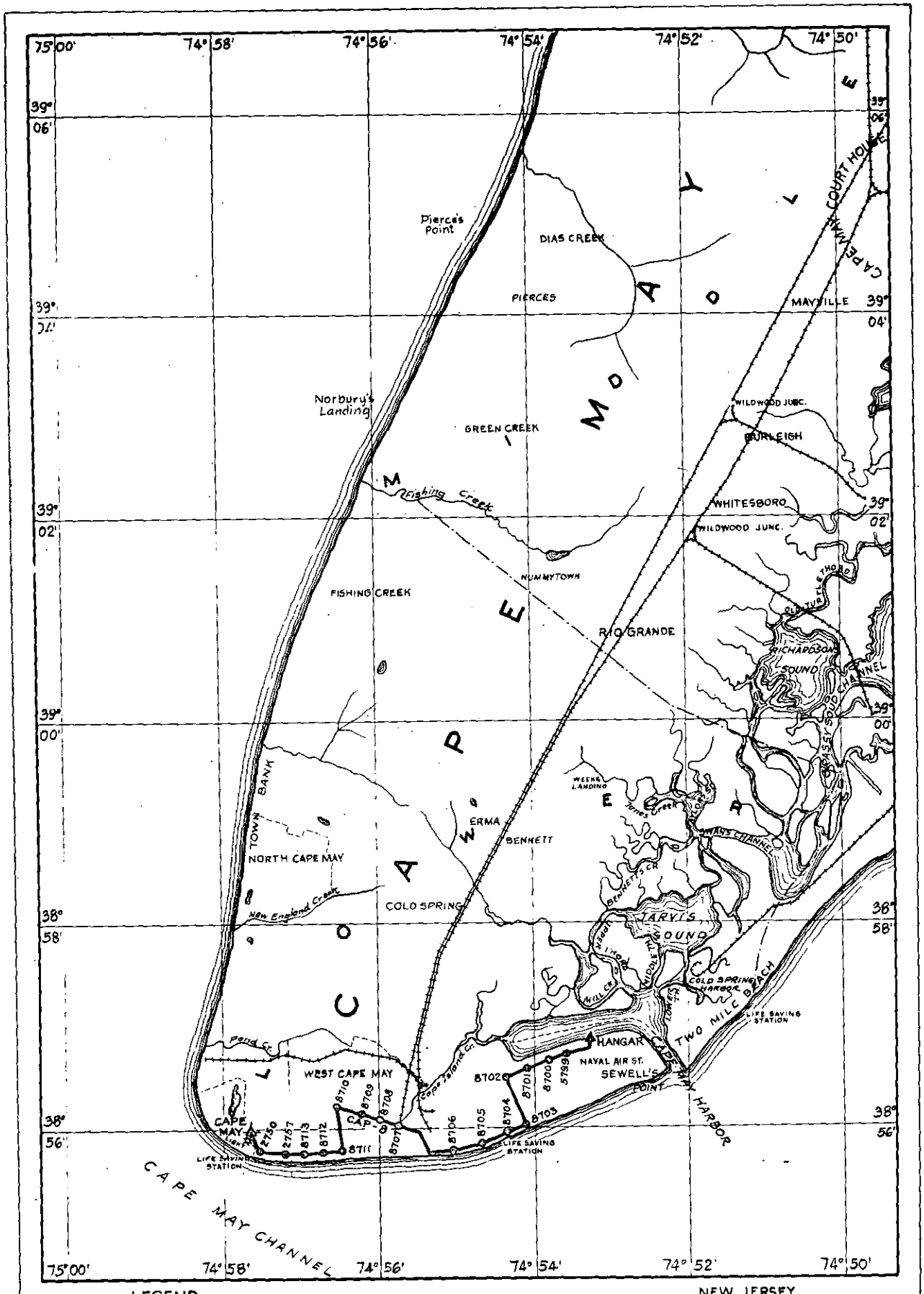
NEW JERSEY

GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1, STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE



LEGEND

Traverse
Monument
Traverse Junction
Triangulation Station (1st Order)
Triangulation Station (2nd Order)

SHEET 37-1

TRAVERSES

CAP-8

NEW JERSEY
GEODETIC CONTROL SURVEY

W.P.A. PROJECT STATE-1; STATE-172 & 1916-0

TRAVERSE & MONUMENT LOCATION

SCALE 1 INCH = 1 MILE

R.H.