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COAST SURVEY.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

The report of the superintendent of the Coast survey, showing the progress of that work.

December 27, 1844.
Read, and laid upon the table.

Treasury Department,
December 23, 1844.

Sir: I have the honor to submit, for the information of the House of Representatives, the accompanying report made to the department by Professor A. D. Bache, superintendent of coast survey, showing the progress of said work during the year ending November, 1844.

All of which is respectfully submitted:

GEO. M. BIBB,
Secretary of the Treasury.

Hon. John W. Jones,
Speaker of the House of Representatives.

Report of the superintendent of the Survey of the Coast, showing the progress of the work during the year ending November, 1844.

Survey of the Coast,
Station near Cumberland hill, R. I., November, 1844.

Sir: In compliance with the regulations for the survey of the coast, I have the honor to submit to you a report of the "progress and state of the work," to be "laid before the President and Congress."

The coast survey owes its present form, and perhaps its existence, to the zeal and scientific ability of the late superintendent, F. R. Hassler, who devoted the energies of a life to it, and who, but for its interruption at a period when he was in the prime of manhood, and its suspension for nearly fifteen years, might have seen its completion. The difficult task of creating

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resources of practical science for carrying on such a work upon a suitable scale, required no common zeal and perseverance for its accomplishment, especially at a time (1807) when our country was far from having attained her present position in scientific acquirement, and when public opinion was hardly sufficiently enlightened to see the full advantages of thoroughness in executing the work. For his successful struggle against great difficulties, his adopted country will, no doubt, honor his memory as the pioneer in a useful national undertaking. In succeeding to the duties of one who had made the work so peculiarly his own, I have felt that entire devotion and unwearied industry alone could enable me to maintain the position. If I have not succeeded, during the past year, in accomplishing all that might have been done, I may promise, for the next, renewed effort, with the advantage of a careful study of the work under its new circumstances.

In making this first report, I hope to be excused if I fail to convey all the information necessary in regard to the survey. Scientific details would, of course, be out of place in it; and these are the peculiar characteristics of the work. I shall strive, however, to present such a view of the progress and state of the survey, as may satisfy the Executive and Congress that the means appropriated have been duly applied, and have yielded results in due proportion to them. It is, no doubt, desirable that all the results of the work should be spread before the public without delay; and I would gladly avail myself of resources granted for that purpose, to publish annually every observation made, and every finished portion of the year's work. The appropriation of the present fiscal year does not permit such a course. It is less by one-fifth than that of years immediately preceding; and with these diminished means it has been necessary to provide for operations of the more expensive class growing out of the new circumstances of the survey; to furnish additional parties, so that the regular operations might go on; and to give additional force to the publishing department. How far this has been satisfactorily accomplished by the arrangements of the work, and the conjoined efforts of all engaged, will appear in the course of this report.

I propose to give, first, a brief sketch of the different classes of work combined in the survey; second, an account of their progress; and, third, a general outline of the work proposed for the next year, with an estimate of the expenditure necessary for its execution.

The operations of the survey may be classed under the following heads:

1. The primary triangulations, and astronomical and other observations connected with them. These are intended chiefly to fix with minute accuracy the positions of important points, with reference to each other and to the earth's surface. They rest upon carefully measured bases, and check the secondary triangulations.

2. The secondary triangulations, which determine the relative positions of all important points upon and near the coast. These form a groundwork for

3. The determination of the minute topography of the coast by plane-table, or other equivalent, surveys. The points thus carefully determined upon the shores and the shore-lines, are used in the fourth class of operations.

4. The hydrography, which includes the determination of the depth of water off the coast, and in the bays, harbors, and other navigable waters connected with the ocean; the existence of shoals, rocks, &c.; and the direction and velocity of currents.

The results of these operations, when requiring calculation, are reduced by the parties making the observations, and checked by others. They go to form the maps and charts which are the ultimate objects of the work; to give a minute knowledge of our coast, in a high degree important to our commercial and naval marine, and in connexion with defence.

5. The results obtained in the field and by calculation are projected in the office, according to a uniform system, by the draughtsmen engaged there, who also trace carefully upon copper the projections for the maps. Within these projections the engravers enter the work from the reduced drawings. The maps are printed at the office for sale and distribution.

Directions for conducting these operations during the year beginning with the spring of 1844 were submitted by me to the Treasury Department, and, after undergoing examination by the head of the department, the Hon. John C. Spencer, were approved on the 30th of March. These directions have been closely adhered to; and my instructions to the assistants, directing more or less minutely the execution of their work, have been in strict conformity with them.

The year for which this report is made extends from November to November, while the year for which the directions were issued extends from one spring to the next. In consequence of this, I shall include in the report an account of certain portions of the work directed by my predecessor, and shall also refer to operations yet to be executed in the spring, which are included in the connected scheme for the year.

The operations of the survey have, during the past year, been carried on in nine States of the Union, and will be extended soon to three others, making twelve, and probably into a thirteenth in the spring. Enumerating these in geographical order, they are Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, North Carolina, Alabama, Mississippi, and Louisiana. The greatest force has been on and near the Chesapeake and Delaware bays.

In describing the progress of the survey, I begin with the eastern section, and proceed southward.

I.—*From Narragansett bay northward and eastward.*

1. The *primary triangulation* has been extended northward and eastward across the State of Rhode Island and part of Massachusetts, joining the main triangulation previously made in that quarter, and resting on the base now measuring. The scheme of the triangulation is shown in the annexed diagram A. The darker lines show the scheme of the primary triangulation, the lighter its connexion with the main triangulation; the lighter dotted lines show the connexion with the base, which is indicated by a full line; the stronger dotted lines represent lines for the completion of the scheme. Subsidiary lines of verification are omitted in the sketch. The sides of the triangles generally increase from the line McSparran—Pocasset of the main triangulation, which is seventeen miles in length, through the primary series, the longest line of which is forty-four and a half miles. The stations marked (o,) five in number, have been occupied. The number of points observed upon from the different stations was from the first 13, second 9, third 8, fourth 10, fifth 13. The number of angles measured was 2,753. The stations observed upon, fifteen in number, extend from Narragansett and Buzzard's bays, and Martha's Vineyard sound,

on the south, to near Boston harbor on the north, and to Massachusetts bay on the east. The area included in the triangulation is about 1,100 square miles, reckoning at one-third and at two-thirds respectively the areas where one and two angles of the triangles have been measured; but the sums of the areas of the different triangles measured in the observations is more than 4,000 square miles.

At three of the stations, astronomical observations were made; and at four, magnetic and meteorological observations. The number of observations for the measurement of the angles in the triangles is about 2,100; for time, 359; for latitude, about 3,800; for azimuth, 340. Vertical angles for the relative heights of the stations were measured at two of the stations.

The horizontal angles for the triangulation were measured, and observations for azimuth were made by myself personally. The observations for time and latitude, and for elevation, were made by the assistants of my immediate party, Lieutenant T. J. Lee, of the United States topographical engineers, and C. O. Boutelle, Esq.; and the magnetic observations generally by Lieutenant Lee.

A reconnoissance for this triangulation was commenced in April last by Assistant C. O. Boutelle, under my immediate direction; and the party took the field in June, remaining until the 25th of November. Material aid was derived in the reconnoissance from the results of the survey of Massachusetts by Simeon Borden, esq., whose local knowledge and general resources in practical science were always freely put at our disposal.

The horizontal angles for the triangulation were measured, and the observations for azimuth made with the 3-feet theodolite of Troughton and Simms (1835) belonging to the survey, and the results in both cases were highly satisfactory. The instruments belonging to the survey available for astronomical observations proving, on patient trial, very defective, we were indebted to Professor Hackley, of Columbia college, New York, for the use for a short time of an altitude and azimuth instrument by Simms of London; and subsequently to the Engineer Department, on the recommendation of Professor Bartlett of West Point, for the loan of a Troughton repeating circle, and to Assistant Edmund Blunt for the use of a 6-inch Gambey theodolite belonging to him. The greater number of the observations were made with the last named instrument.

To supply the deficiency in instruments for this important part of our work, and in others made known to me by the reports of the assistants, I have included in the estimate, at the close of this report, an item for the purchase of astronomical and other instruments.

2. The *secondary triangulation* in this section has been extended to include Buzzard's bay and the greater part of the Vineyard sound, from East rock to the east chop of Holmes's hole, Martha's Vineyard. Preliminary operations were commenced in May; and between the 12th of June and the middle of October, twenty four stations were occupied, and more than 6,600 angles measured upon sixty-eight objects, viz: forty-four signals, thirteen spires, nine lights, one beacon, and one telegraph. The area covered by the triangulation, estimating as already explained in the foregoing, is 379 square miles. It has fully prepared work for three plane-table parties next season, should so many be provided. The triangulation was planned and executed by Assistant C. M. Eakin, assisted by Mr. Shiras. A sketch of it is shown upon diagram A, beginning at a base furnished by the main triangulation, and occupying the limits before stated.

3. The *topographical work* in this section has employed two parties. The first, under charge of Assistant W. M. Boyce, was in the field from the 15th of May to the 9th of November. The plane-table survey made by him extends from Beavertail light-house, on Connanicut island, (Rhode Island,) to Mishaum point, (Massachusetts,) on the western side of Buzzard's bay, including the southern shores of Connanicut and Rhode Islands, and of the main in the States of Rhode Island and Massachusetts, and the harbor and town of Newport. It comprehends an area of eighty square miles, ninety miles in length of shore-line, fifty-eight miles of roads, and forty-four of the shore-line of ponds. The limits of the plane-table sheets are shown upon sketch A, where the sheets are numbered 1 and 2. A small vessel was hired for the use of the party—an arrangement recommended by Mr. Boyce, on the ground of economy and of facility in moving from point to point.

Assistant H. L. Whiting, in charge of the second topographical party in this section, has nearly completed the three plane-table sheets numbered 3, 4, and 5, in sketch A. The first sheet takes in both sides of the eastern arm of Narragansett bay—sometimes called Saughkonnet river—extending from its entrance on the south, to the stone bridge connecting Rhode Island and the main, near the north end of the island. The second and third extend from Mishaum point, to include the harbor and towns of New Bedford and Fairhaven. The area of the work done is about sixty square miles, the extent of shore-line surveyed about sixty miles, and the length of roads about one hundred miles. The party was in the field from the 6th of May to the 25th of November.

The results obtained by these parties were furnished to the hydrographical party acting in the vicinity. The total area surveyed by them was one hundred and forty square miles, and the length of shore line determined one hundred and fifty miles.

4. The *soundings* of this part of the coast have been nearly completed from Point Judith to New Bedford harbor, inclusive. They extend, as shown in sketch A, where the sheets containing them are marked Nos. 6, 7, and 8, off the shores of Rhode Island and Massachusetts to a line drawn from Point Judith to Gay Head, as far east as the meridian of East rock; and east of this to the line Point Judith-Cuttyhunk. Observations of the currents have also been made at the entrances of Narragansett bay and in Buzzard's bay. On the completion of the soundings in the harbor of New Bedford, the vessels used in this work were laid up, the season having become too precarious for economical work. The party by which this work has been executed, was under the charge of Lieutenant Commanding George S. Blake, United States navy, having immediate command of the surveying vessel Gallatin. The observations for the set and velocity of currents in Buzzard's bay were made by Lieutenant Commanding S. P. Lee, United States navy, attached to this party, and commanding the Vanderbilt. Similar observations off Narragansett bay were commenced by Lieutenant Lee; and, on his being relieved by the Navy Department, at his own request, from duty on the survey, were completed by Lieutenant W. P. McArthur, United States navy, who is now engaged in the office at Washington in their reduction. At the close of the season, the surveying vessel Vanderbilt was under the command of Lieutenant Commanding Goldsborough, United States navy.

In his report at the close of the season, Lieut. Com. Blake remarks:—"In conclusion, I cannot forbear calling your attention to the great defi-

ciencies in all the existing charts of the dangerous sections of the coast upon which I have been employed this season. They all appear to have been founded upon the survey of Des Barres, made before the Revolution, with some occasional amendments and additions; but even immediately off the important port of New Bedford and Fairhaven, where nearly 300 whale ships are owned, I found dangerous single rocks near one of the main ship channels, with but five feet water on them, entirely omitted in the latest publications. These rocks are not marked by buoys, and certainly are not generally known. I propose hereafter to name to you certain localities where I think buoys very necessary indeed."

II.—*From Narragansett bay to New York bay, and thence to the capes of the Delaware.*

1. A *main triangulation* connected with the primary triangulation of Mr. Hassler, near the Fire island base, had been carried by Assistant Edmund Blunt over Long Island sound, northward and eastward to Narragansett bay, the sides of the triangles varying from 7 to 32 miles in length. The angles were measured with a 12 inch repeating theodolite, by Simms of London. This work was not originally intended to take the place of a primary triangulation; but the care bestowed upon it, and the character of the work, appeared to me to justify its provisional adoption as such, measuring, at once, a base near its northern end as a means of verification. The verification proving satisfactory, the survey might be considered safely as having advanced to this point, without the necessity of going over the same area with a new triangulation, which, after all, would not differ greatly in the length of the sides and the figures of the triangles from that of Mr. Blunt. The nearest position suitable for a base was the one selected by Mr. Borden for the intended verification of the Massachusetts survey—namely, Seekonk plain; and the "directions" required its examination for that object. The site was certainly practicable for a base of about five miles long, requiring, however, considerable cutting through woodland, and presenting obstacles in the irregularities of surface, and in the necessity for crossing the Providence and Boston railroad, which was not laid out at the time the site was selected by Mr. Borden. The possible use of a long straight line of the railroad just referred to, as the site for a base, was suggested to me by Assistant Boutelle. The road was originally intended for two tracks, and only one has been laid; so that there is a wide space on the side, ready graded, and available for such a purpose. A cursory examination of the location made when on a visit to the site of the Seekonk base, satisfied me that if a suitable connexion with the triangulation could be made from two points upon the road sufficiently far asunder, the site would be excellent for the measurement in question. Assistant Blunt was accordingly requested to make the necessary examinations, and to compare this location with that on Seekonk plain. He gave the preference to the railroad site, and ascertained that a base of about 11 miles in length could be had, which might be easily connected with the triangulation. The Hon. Joseph Grinnell, president of the Providence and Boston Railroad Company, liberally granted the use of the road.

Mr. Blunt having made all the preliminary arrangements necessary, including the cutting of an avenue upon the line from a primary triangulation point to the north end of the base, began the measurement on the 11th

of September. Every facility required in reference to the unobstructed use of the road has been furnished by the superintendent, W. R. Lee, esq.

The measuring apparatus was the same employed by Mr. Hassler at the Fire island base, with some improvements made under Mr. Blunt's direction, rendering its use more easy and accurate. The position of the base is shown by the line N S in diagram A, its location being in the section of the survey there represented; though, as its immediate object is the verification of the main triangulation in the section now under consideration, I have described the operation under this head. The ground at the south end is visible from one of the primary stations (Beaconpole) near Cumberland hill. A considerable elevation is necessary to render a signal at the north end visible from two stations, (Beaconpole and Great Meadow of the diagram,) to be connected with it; and a structure has been raised there 42 feet high, for observing upon the same stations. The use of the ground for its erection has been liberally given by the owner, Captain Kingsbury. The south end of the base is marked by a stone monument at the side of the railroad track, and the north end by a stone covered by the structure just referred to. It is easily seen that the cost of measuring this base must be less than that of a shorter line not presenting such peculiar facilities, and that the expense of the station structure at the north end will not turn the scale in favor of an ordinary site. The base is of course perfectly secure, and can, if required, easily be remeasured. It will serve not only as a base of verification, but as a new base of departure for the eastern primary triangulation.

The measurement was finished on the 28th of November. Mr. Blunt's party consisted of Assistant S. V. Talcott, and of Messrs. T. C. Meyer and F. P. Proctor. The connexion of the triangulation with the base will be completed next spring.

2. Observations for *latitude* have been made near the two extremities of the main triangulation, and for *azimuth* near the northern end, by Assistant Edmund Blunt. The southern point selected was Brooklyn, which is connected by the survey with the city hall of New York; and the northern point was Champlin's hill, near Hopkinton, R. I. These operations were commenced in the spring; and, owing to the unfavorable state of the weather, were not completed until July. Mr. Blunt was assisted in them by Assistant S. V. Talcott and Mr. Meyer.

3. *Magnetic observations* have been made in some of the principal harbors of Long Island sound, by Professor Renwick, of Columbia college, New York. The important element to the mariner—the variation of the compass—formed the chief object of these observations; the results of which were required to accompany a series of charts of the harbors of the sound, now preparing for publication. Observations of the magnetic dip and intensity were made, at the same time, by the modern instruments invented by the German and English magneticians; furnishing useful data to science, without additional cost to the survey. The survey is indebted to Lieutenant C. B. Riddell, of the British artillery, for the speedy forwarding of the instruments. The magnetic variation has thus been accurately determined in nine places in New York and Connecticut, upon the sound, viz: New Rochelle, Stamford, Oyster bay, Sawpits, Norwalk, Lloyd's harbor, New Haven, and at Martinicock and Shepan points. The dip has been determined at nine stations, and the magnetic intensity at eight. A report of these observations, with their details, will be prepared for early

publication. Professor Renwick was assisted by Midshipman Charles Wilkes, jr., U. S. N., who was temporarily attached to the survey by the Navy Department, for this purpose.

4. The *deep-sea soundings* off the coasts of Connecticut, New York, and New Jersey, had been nearly completed before the beginning of this year. A careful examination of the work done, and the tracing by it of the horizontal curves of the bottom of the sea, showed where it required to be carried to a greater depth, and where the soundings must be multiplied; and the operations were directed accordingly. Commander Thomas R. Gedney, U. S. N., under whose immediate charge this part of the work has been, reports that "the deep-sea soundings (sketch B) are comprised between a line running SE½E. from Block island, and a line SE½E. from Cape Henlopen, extending from Block island one hundred and nine miles, to the depth of one hundred and seven fathoms; and from Cape Henlopen seventy-two miles, to the depth of one hundred and forty-five fathoms; the lines of soundings extending generally to two hundred fathoms in depth." This work forms the necessary supplement to that required for a series of charts extending seaward from the coast, the materials for which, from Massachusetts to Maryland, are so nearly completed that the charts might at once be put in the course of reduction and engraving, if pecuniary means were at hand for the purpose. The annexed sketch (B) will serve to give an idea of the present limits of the work, the completion of which has just been referred to. The party of Commander Gedney has also been engaged in some work in New York bay and harbor, and the vicinity.

5. Observations on *the direction and velocity of currents*, and of the tides in connexion with them, have been made in New York bay and harbor, by the hydrographic party under the charge of Lieutenant Commanding Charles H. Davis, U. S. N. Tide gauges at Governor's island and Sandy Hook have been regularly observed; and a self-registering gauge has more recently been established at Governor's island. Should this instrument prove as successful as is anticipated, not only the ordinary observations may be rendered less expensive and more elaborate, but a complete knowledge of the tides along our coast may be obtained with very little expense. Meteorological observations have accompanied those upon the tides. A transit instrument has also been kept in position at Sandy Hook, for rating the chronometers of the hydrographical party acting in this section, the nature of whose operations required the accurate determination of time. In his report containing a general summary of the season's work, Lieutenant Davis remarks: "The most important part of my duty this season has been that relating to the currents of New York bay and harbor. This duty was performed under your instruction of May 18th, and had for its object to ascertain the force and direction of the currents of New York bay and vicinity. The late period at which it was begun, and other circumstances, rendered it necessary, this season, to give almost exclusive attention to the normal condition of the tides and currents in favorable weather, and when the influence of the wind was small. For this purpose, twenty-one of the twenty-eight stations named in your letter of the 18th of May have been successively occupied, chiefly when the sea was smooth and the wind calm or light. The results have been laid down in both forms prescribed by the instructions." This work has been executed with zeal and ability by Lieutenant Davis; and the results have been already recorded on the map of New

York bay and harbor, the publication of which, as prepared by my predecessor, I ventured to delay, in order to add this valuable information.

6. The surveys of Sandy Hook, made at different periods, indicate a change in that important part of our coast. My attention was drawn to this, especially, by the map prepared in 1841, for military purposes, by Major Hartman Bache, of the U. S. topographical engineers, on which the results of the surveys in 1819, 1836, and 1841 were represented, showing a decided increase of the Hook northward. To ascertain if this change had continued, I requested Lieutenant Davis, in July last, to re-examine the ground. He has fully confirmed the fact, to which the attention of those specially interested in this part of our coast should be called. I propose to have these changes properly represented on paper, and laid before the Treasury Department, for such reference as it may direct.

III.—*Delaware bay and river, and south of Cape Henlopen.*

1. The *triangulation* to connect the primary work with the main triangulation of the bay, will be made in the spring. The other operations assigned to Assistant Blunt have, up to this time, taken the precedence of this work.

2. The *secondary triangulation*, which had previously reached Cape Henlopen, has been extended south to Indian river, as shown in sketch C, No. 1. In consequence of the illness of Captain Johnstone, of the U. S. topographical engineers, to whom this work was to have been assigned, the preliminary reconnoissance was made, and a triangulation commenced by Assistant Theodore W. Werner. The greater part of the work has, however, been done under the direction of Captain Johnstone. The party was occupied during August, September, and part of October, and have surveyed seventy-four square miles, occupying twenty-seven stations, and observing upon twenty-seven points. The ground is prepared for a plane-table party next season. A reconnoissance for extending this part of the work southward, and for determining the nature of the operations required, will be made this winter or early in the spring. It is intended to leave the outside of the peninsula to the work of the secondary parties, duly connecting it from the north, and near the southern termination, with the primary and main triangulations.

3. The *topographical survey* of the shores of Delaware bay and river, which was nearly completed last year, has been entirely finished. The work of Assistant J. J. S. Hassler, in the neighborhood of Bristol, Pennsylvania, was continued, under the instructions of my predecessor, during the winter, when the weather permitted, and was completed early in August. It extended (as shown in the annexed sketch C, No. 2) from near Bristol to Morrisville, Pennsylvania, including the country through which the Delaware division of the Pennsylvania canal passes, and from the neighborhood of Burlington to that of Bordentown, New Jersey. The points for directing the soundings of the river were thus furnished to the hydrographic party, under Lieutenant Commanding Blake, United States navy, which was employed in this section. To expedite the completion of the soundings, by furnishing the necessary data on land as fast as required by the hydrographic party, Assistant George D. Wise was sent to the same section on the 15th of April. Between that time and the 31st of May, he completed sheet C of sketch C No. 2, taking in both sides of the river, ex-

tending back to the nearest roads on each side, and including the towns of Bordentown, Lambertville, and Trenton, in New Jersey, and Morrisville, in Pennsylvania. The drawings will be completed during the winter in the office.

3. The Vanderbilt, one of the surveying vessels of Lieutenant Commanding Blake's party, was used during the winter, as the season permitted, in *sounding;* and both the Gallatin and Vanderbilt were employed in the same work as soon as the ice had disappeared from the river in March. The soundings from Burlington, New Jersey, to the head of tide at Trenton, were completed by the beginning of May. The vessels were then prepared for commencing the hydrography of the eastern section, which has already been referred to. When this part of the work was closed, and before the party sailed for the eastward, all the journals of the work, and charts recording it, were deposited in the office of the survey at Washington; every part of the work, as far as was required from the hydrographic party, being complete on the termination of the soundings, exhibiting an evidence of labor, care, and system in the officer commanding, worthy of all commendation.

4. I append to this report a letter from Lieutenant Commanding Blake, which has not heretofore been officially published, relating to the determination of a new channel near the entrance of Delaware river, important especially to the commerce of Philadelphia and of places trading with it.

5. The *hydrographic party* from the Chesapeake, under command of Lieutenant Commanding George M. Bache, U. S. N., was occupied about two months during the part of the season most favorable for work in this quarter, and least so in the Chesapeake, in *off-shore soundings* southward and eastward of Cape Henlopen, co operating with the secondary triangulation party already referred to. The limits of the work executed are shown in sketch C, No. 1, extending from the light-boat off the Five-fathom bank to Indian-river inlet, twelve miles south of Cape Henlopen, and off-shore to a distance of ten to fifteen miles—covering an area of about two hundred and fifty square miles. The following extract from Lieutenant Bache's summary of his operations shows the nature of the work done, and will be found of interest to navigators:

"Three important shoals were examined within this limit: 1st. McCreas' shoal, seven miles due south from the Two-mile beach, and seven miles southeast from Cape May light-house. This shoal has less than three fathoms on it at low water, and is near, though somewhat to the northward of, the track of vessels coming into Delaware bay from the northward and eastward. I would recommend that a buoy be placed upon it.

"2d. The shoal of the Hen and Chickens. This is a narrow ridge of sand, commencing within the third of a mile from the northern point of Cape Henlopen, and extending three miles in a SSE. direction. The least water, four and a half feet, is found near its southern extremity, at a distance of a mile and a quarter from the shore. This shoal is dangerous on account of deep water (ten fathoms) being carried close to it from the eastward. There is a good channel for small vessels between it and Cape Henlopen.

"3d. A shoal, least water four and a quarter fathoms, lying fifteen nautical miles ESE. from Cape Henlopen light. This appears to be the southeastern termination of what is called the Cape May flats, on which the soundings are from six to nine fathoms."

IV.—*Chesapeake bay, &c.*

1. The necessity for the measurement of a base to verify the primary triangulation of the survey of the coast, has been set forth by various authorities. It was rendered imperative by the death of Mr. Hassler; and justice to his memory required that as little of the work of others as practicable should be included in the verification of what he had accomplished. It was determined, in consequence, that a *base of verification* should be measured as near as practicable to the southern termination of Mr. Hassler's work, near the Delaware; and this measurement it was deemed most proper to assign to his senior assistant, James Ferguson, Esq.

The portions of country where the required base might be found were—1. On the shores of Delaware bay. 2. On the ocean side of the peninsula, between the ocean and Chesapeake bay. 3. On the shores, or upon one of the islands, of the Chesapeake. The whole of the shores of the Delaware had been minutely surveyed; and, from the data in the office, it was apparent that a base could not be found, of suitable length, readily connected with the primary triangulation, offering the means of verification, and also for a direct continuation of the work southward. In reference to a site on the ocean side of the peninsula of the eastern shore, the difficult character of the country of the peninsula, level and wooded, made it very inexpedient to carry the triangulation outside, which would be necessary if the base were there. My views were, therefore, early directed towards one of the islands of the Chesapeake, as presenting the best site for a base for verifying the past and continuing the future work.

The considerations which led finally to the location of the base on Kent island, opposite Annapolis, may be briefly given. A reconnoissance had been made on the coast of North Carolina, in the autumn of 1843, under the direction of Assistant Ferguson, with the purpose of measuring a base line, and extending the primary triangulation thence southward. This had resulted in determining Bodie's island beach, north of New inlet, Pamlico sound, as a proper site; and Mr. Ferguson was of opinion that the base could not be moved further southward. The base of verification would be best placed nearly midway between the Fire island and the Bodie's island bases. The distance from the south end of the Fire island base, to the mouth of Broad creek, on Kent island, is about two hundred miles; and from Price's point to the Bodie's island base, about two hundred and twenty miles. The position of Kent island thus fulfils the condition in regard to the division of the distance. This is not the case with Smith's island, opposite the mouth of the Potomac, which was suggested for the site; its distance from the northern point named being more than two hundred and sixty miles, and from the southern point less than one hundred and sixty miles. Besides, the topography of the island renders it unsuitable for the purpose.

It is not necessary to detail the circumstances which ultimately put the reconnoissance for this base under my immediate direction. I examined Kent island, accompanied by Assistant F. H. Gerdes; found a site nearly midway of the island, in a north and south direction, for a base of between five and six miles in length, and ascertained that there were no serious obstacles in the way. To determine more accurately the best site, and the precise amount of obstacles to measurement from the irregularities of the ground, Assistant H. L. Whiting was directed to make a plane-table survey

of that part of the island, and Assistant R. D. Cutts to run a line of levels. At the instance of Assistant Ferguson, I further directed a plane-table survey to be made of the northern part of the island, to ascertain if a better site for the base could be obtained there. The first line was, however, found to be most favorable; and a preliminary reconnoissance by Assistant Gerdes showed that its extremities could readily be connected with the main or western shore. The measurement of the base, shown in sketch D, was accordingly directed; and, subsequently, the execution of the triangulation immediately connected with it, nearly as there shown. Assistant Ferguson was aided in this work by Assistants J. C. Neilson and R. D. Cutts. The preparations for the measurement were made between the 18th and 30th of April; the foundation for the monument at the northern end was laid, and the allignment and preliminary measurement, with a chain, made by the 3d of May; and on the 5th of June, the final measurement of a line of five miles and four-tenths long was completed. The time occupied in this measurement shows at once the diligence of the party, and the practicability of the site. The apparatus used was the same, with slight changes, which was employed by Mr. Hassler and his assistants in measuring the original base line upon Fire island. This, of course, tends to make the verification more rigid. Although the final verification cannot be had until the primary triangulation is brought to this base, it is yet satisfactory to know that the results afforded through the secondary triangles show a remarkable coincidence in the length of one of the sides, as computed from this base and from the original one—the difference not exceeding twenty inches in twelve miles.

2. The reconnoissance for continuing the *primary triangulation* from Mr. Hassler's work southwards, was commenced by Assistant Ferguson in March, and carried to within about six miles of Annapolis. The scheme of triangulation then laid out has been found generally practicable.

The triangulation from the ends of the Kent island base was commenced in July, and seven primary and one secondary station have since been occupied: they are shown in sketch D by the mark (o,) and are connected by the stronger lines. The area included in the triangulation is four hundred and twenty square miles. The number of points observed upon, from the different stations, including the secondary as well as the primary points, is—from the first 17, second 7, third 4, fourth 5, fifth 10, sixth 16, seventh 6; and from the secondary station, 3. At two stations observations for *latitude* and *azimuth* were made. The number of observations for time was 84; for latitude, 1,342; and for azimuth, 36. Throughout the season Mr. Cutts has assisted in the astronomical observations and calculations, and Mr. Neilson in reconnoissance and other general duties.

The instruments used have been the second size (two feet) Troughton theodolite of the coast survey, and a Troughton repeating circle.

The season has not been generally favorable to work; but the progress already made leaves only five stations to complete the intended connexion with the Kent island base. When that is done, the work executed by Mr. Hassler and his assistants will be included between two bases of verification about three hundred and thirty miles apart, and between which the survey will be nearly or quite complete, reaching from Maryland to Massachusetts.

3. A *reconnoissance* has been in progress for connecting Washington with the present primary triangulation, from lines near Baltimore, or near

Annapolis, for extending the present work southward, and for carrying it along the Potomac river. This has been executed by Lieutenant Henry Prince, of the United States army. The conclusions already arrived at will be put to the test of a closer examination when the season is more advantageous for such work; they render it probable, however, that this connexion will be by no means difficult. I would here acknowledge the kind and liberal communication by J. H. Alexander, Esq., of Baltimore, of the results of a reconnoissance made by him for the triangulation of the State of Maryland, during part of which Mr. Hassler and he made their explorations together, and interchanged views.

4. A *secondary triangulation*, intended to furnish points sufficiently near together for use in the plane-table surveys, was commenced in May last, near the head of the Chesapeake, at a point on the Northeast river, where the plane-table work of last year was discontinued.

Application was made to the War Department for the detail of officers of the army for service upon the work, in conformity with the directions of Congress, and this triangulation was intended for one of these parties. As it was some time before the arrangements necessary for the transfer of officers already engaged in other duty could be made, Assistant Theodore W. Werner was sent to begin this work. It continued under his charge until the latter part of June, when it was assigned to Captain Joseph E. Johnstone, of the United States topographical engineers, and with occasional intervals (produced by his illness) it remained under his immediate charge during the season. He has been assisted by Lieutenant Benjamin, of the United States army, and Mr. Werner has generally acted under his immediate direction. The party was transferred to the outer shore of Cape Henlopen at the close of July, to avoid, as far as practicable, the ill effects of the unhealthy location of the work, and returned to the bay about the middle of October. It had thus occurred that the responsibility of the first part of each of these triangulations has fallen upon Mr. Werner. The progress of the work upon the Chesapeake is shown in sketch D, near the head of the bay. It covers an area of 95 square miles, and 29 stations have been occupied. It has made progress since the sketch was furnished, and will prepare the way for a plane-table party in the spring.

5. *The plane table surveys* in progress this season upon the Chesapeake extend, on the western shore, nearly from South river (below Annapolis) to the junction with the previous work, which crossed the neck of land between the Delaware and Chesapeake; those portions of the shores where the secondary triangulation afforded sufficient data for the plane-table parties having been selected for their operations. One of these was in the neighborhood of Annapolis, where Assistant F. H. Gerdes began his work on the 20th of April. The progress of his plane-table survey is shown on sketch D. Sheets numbered 1 and 2 have been completed, and No. 3 has been commenced, including, on the southwest, parts of the West and South rivers, and extending northward and eastward beyond the Magothy. To this work a *tertiary triangulation* (shown in the sketch) was added, to furnish points for the topography, not immediately on the shore of the bay. The area included in the plane-table work is about 51 square miles; the length of shore line surveyed, 150 miles; and of roads, about 41 miles. The area within the triangles, which have been computed, is about 68 square miles; the number of stations occupied, about 31; and of points observed upon, 39. The work was interrupted during one month by the ill-

ness of Mr. Gerdes, and more than a fortnight was devoted by him to reconnoissance for the main triangulation.

6. It has already been stated that the western part of Kent island (on sheet No. 4, sketch D,) was surveyed in the spring, by Assistant H. L. Whiting.

7. The *plane-table work* on sheets Nos. 5 and 6, extending from the mouth of Bush river northward, and from the mouth of the Patapsco westward, was commenced by Assistant George D. Wise, on the 1st of July. The first sheet takes in Poole's, Spry, Carroll's, and Mullin's islands, and the mouths of Gunpowder, Middle, and Back rivers; the second includes the shores of the Patapsco to Baltimore. The area surveyed is 35 square miles; the length of shore line, 22 miles; and of roads, 22 miles. This party has not suffered from sickness during the season, though it has carried on the work in this quarter from July to the present time. A small vessel has been hired for facilitating the operations.

8. The *plane-table survey*, near the head of the bay, (sheets Nos. 7 and 8,) was commenced by Mr. J. J. S. Hassler in October, and considerable progress will be made in it before the season closes.

9. The *hydrography* of the Chesapeake was commenced on the 1st of June, by a party detailed for duty in the survey by the Navy Department, under the command of Lieutenant George M. Bache of the United States navy, previously attached to the party of Commander Gedney. A vessel was hired for their use until the Nautilus, which had been loaned by the survey to the revenue service, could be restored. In July the party was sent to execute the off-shore work, south of Cape Henlopen, as already stated, and returned to the Chesapeake about the middle of October. The work was commenced with the harbor of Annapolis and the adjacent roadstead, and continued up the Severn river into Round bay, and northward from a line (*a b* of sketch D) from Thomas's point, to a point on Kent island north of Bloody point. It will probably reach Bodkin point, at the mouth of the Patapsco, before the close of the season, covering an area of more than 150 square miles. This party has co-operated with the land party of Assistant Gerdes, at work in the same quarter, receiving the trigonometrical points and shore line as determined by him. The amount of work done, and the manner in which the changes from this part of the work to that outside the peninsula were made, have been highly satisfactory. Nearly all the materials for a chart of Annapolis harbor and roads will be prepared this winter; and if adequate means are granted to publish the current work, without neglecting the accumulations of past years, the chart may be issued within the coming year. This harbor, before the use of ice-boats at Baltimore, was frequented during the winter by vessels of the largest class, is still occasionally used by them, and is much resorted to by coasters in heavy weather. Nineteen feet of water can be carried up the Severn river into Round bay. There is an anchorage for men-of-war from 4 to 5 miles southward and eastward of the city of Annapolis, in from 5 to 7 fathoms water.

V.—*The coast of North Carolina.*

It has not been practicable to commence the measurement of the base or the triangulation there during the past season; but, if the appropriation permits, the work will be commenced in the spring. The measurement of

a base line is the most expensive operation of the survey, in proportion to the time occupied; and with an appropriation of 20 per cent. less than that of the preceding year, we have had to bear the entire expense of one of the two bases measured within the past year, and part of the expense of the other.

VI.—*The coast of the Gulf of Mexico.*

Measures have already been taken for beginning the work on the coast of Louisiana, Mississippi, and Alabama, by the requisite minute reconnoissance; and it will be prosecuted as vigorously as any other part of the work, should the necessary appropriation be granted. The party intended for the prosecution of the work will take the field before the close of December.

VII.—1. The determination of the difference, of longitude of points on our coast, and of different European observatories, is in progress, by the computation of observations already on record, and by new observations, including those of occultations, moon culminations, and by the exchange of chronometers. We shall ultimately be able to present a body of results from the calculations of older observations, and from new data, of great value to the work, and creditable to the science of the country. The observations at Cambridge will be furnished by W. C. Bond, Esq.; those at Philadelphia, by Professor E. O. Kendall; and the calculations are in charge of Sears C. Walker, Esq., of Philadelphia. Mr. Walker's report shows that considerable progress has already been made in the reductions committed to him—five out of nine classes of astronomical phenomena brought to bear on the longitude of a central point connected with the survey being completed, embracing the results of seventy-two different observations. Professor Kendall has already furnished interesting approximate results of observations with an Ertel circle for latitude, and reports progress in the other parts of his work. Mr. Bond has reported the results of occultations and moon culminations observed by him in 1834, 1837, 1839, and 1840, and calculated by Professor Peirce, of Harvard university, and is preparing a report on the results of the exchange of chronometers by the steam vessels between Liverpool and Boston.

2. As part of a system for checking computations of observations in the survey of the coast, it was determined to have a separate set of calculations, made by scientific men, not otherwise connected with the work. A beginning, merely, of this system, has been made by the computations, by Professor Stephen Alexander, of Princeton, of the latitude of Brooklyn, from the observations of last spring. The azimuths observed by me during the season are in the same hands.

VIII.—*Calculations, drawing, and engraving.*

1. During the last winter, the parties who had been in the field the previous summer and autumn were chiefly occupied in calculating their observations, and completing or making drawings. The draughtsmen in the office were employed on the maps of assemblage and record, and in preparing the sheets of the map of Long Island sound for the engravers. The

reduced drawing of this map has been completed; and that of Delaware bay and river, and of the approaches, has been commenced.

2. Four sheets of the map of New York bay and harbor, and of the environs, nearly completed under the direction of my predecessor, have been published; and one hundred and sixty-nine copies have been distributed, under authority of the act of Congress. The number of institutions entitled to these maps, in the different congressional districts, whose representatives have signified their wish to receive them, exceeds the whole number which we are authorized to present to foreign governments, departments of our own government, and to literary and scientific institutions at home and abroad. Moreover, no provision has been made for furnishing the charts to the Navy Department for our national vessels. I would, therefore, respectfully suggest that application be made to Congress to authorize the further distribution to literary and scientific institutions, and to associations connected with commerce and navigation, of five hundred copies of the maps and charts published at the office of the survey, and the supply to the Navy Department of the number required for our national vessels. The maps just referred to will be for sale in the principal cities on the seaboard, under the same act of Congress, in the month of December or January. The price affixed to them by the Treasury Department is merely sufficient to cover the cost of the paper and printing, and cannot interfere with their general use; it is lower than that of the British government charts, and quite as low as that of the French.

3. The small map of New York bay and harbor, on the scale of $\frac{1}{80000}$, (about a mile and a quarter to the inch,) will be ready for publication about the 1st of January next, and will be issued soon after.

4. The first sheet of the southern shore of Long Island, on the scale of $\frac{1}{80000}$, is now nearly completed.

5. The engraving of the three sheets of Long Island sound, upon the scale just given, has been commenced; the outlines are upon the copper, and some progress has been made in the lettering.

6. One sheet of the map of Delaware bay and river is also in outline upon copper, and a portion of the soundings are engraved. This map will include in three sheets, on a scale of $\frac{1}{80000}$, the river and bay, with the approaches as high up as the head of tide at Trenton, N. J. It is arranged so as to take in the Five-fathom bank off Cape May, and the Hen and Chickens and Indian river shoals off Cape Henlopen, and will present a continuous map of the river to Philadelphia.

7. One of the detached harbors on Long Island sound is ready for engraving.

Charts of seventeen harbors and anchorages in the sound were prepared by the party under the charge of Lieut. Com. Blake, while surveying in that quarter. Some of these places are of importance as harbors of refuge for coasting vessels, and others on account of the commerce of the towns upon them. The charts are accompanied by sailing directions. The hydrography is complete; materials for the topography are in the office; and the work of reduction, or rather of revision and preparation for engraving, has already been commenced. It must be obvious, however, that this can advance but slowly, if the means for its execution are to come out of the ordinary annual appropriation, so that the work shall advance only in relative proportion to its importance when compared with the other parts of the work. On

this kind of work, the contract system might readily be tried, and its results in reference to minutely accurate topographical and hydrographical work might be observed.

8. The office of the survey at Washington was, until May last, under the immediate charge of Assistant C. M. Eakin; and since then, comprehending the whole period of my absence in the field, has been under that of Lieut. A. A. Humphreys, of the U. S. topographical engineers. A new distribution of duties and of work in the office was made in the spring, and has led to a very considerable increase of efficiency, especially in the engraving department. The proof-sheets which have been from month to month transmitted to me, have exhibited an amount of work done within the last six months exceeding so much the calculations based upon a previous period, that I am now almost prepared to find the execution of the maps in the office an economical arrangement. That it leads to the system and accuracy altogether indispensable in such work, cannot be doubted. A definite opinion can, however, be formed better after the trial of a full year. In estimating its advantages, it should be remembered that the engraved plates belong to the government, and that any number of impressions can be taken off, when and as required, and at the mere cost of the press-work and paper. The details of the engraving department have been under the immediate charge of Assistant John Farley. Assistant F. H. Gerdes was occupied in the reduction of the map of Long Island sound until he took the field in May. Assistant M. C. Fairfax has been employed in miscellaneous work connected with the maps of record and assemblage, and especially with the projections for, and reduction of, the map of Delaware bay and river. Mr. B. Gluck, draughtsman to Lieut. Com. Blake's party, has also been employed in the office since October; and Mr. D. H. Burr was temporarily employed from June to August. Lieuts. C. P. Patterson and Joshua Humphreys, U. S. N., have been engaged during the summer in arranging and finishing the charts heretofore deposited in the office by Commander Gedney, U. S. N.

With all the assistance to be derived from the organization above referred to, from the very effective labors of Lieut. Humphreys and Assistant Farley, and from the employment of such additional persons as our means permit, experience has rendered it certain that we cannot publish the accumulated materials of past years, without putting aside the results of the present. The remedy for this, I purpose presenting in another part of my report.

9. The two mechanicians have been engaged chiefly in the repairs of instruments, which, if done elsewhere, would probably have cost more than the amount of their compensation. On this head, I am collecting data to form a just conclusion.

10. The amount of work thus accomplished in the survey of the coast, and in connexion with it, required the diligent co-operation of all the parties concerned, and affords the best evidence of successful exertion on their part.

The civil assistants heretofore employed upon the survey have all been retained. Application was made at the beginning of the season for the detail of six officers of the army, under the special provision of the act of Congress, for duty on the work; and five were detailed in consequence. The duties assigned to them have been already stated. The number of naval parties has been increased from two to four.

It has required close economy to sustain the necessary expenditures of the parties, thus increased in number, with an appropriation reduced by one-

fifth in amount. From the comparison of the expenditures with the estimates, I am, however, encouraged to believe that, with the aid of a balance from the appropriation of the previous year, we shall be able to execute the work marked out, without materially disturbing the present arrangements. More than once, however, I have had occasion to regret the unavoidable decrease in the efficiency of a party, by the necessary decrease in expenditures; and I am satisfied that true economy, the yielding of results proportionate to the means expended, would be consulted by a more liberal scale of appropriation.

The survey has lost within the past year, by death, (October 12, 1844,) the services of Assistant Hugo L. Dickins, who had been connected with the work for ten years, and had earned a most desirable reputation by the faithful and able discharge of his duties.

IX. The present condition of the work will admit of the following arrangements for its progress during the next year. The field operations are referred to as before, in geographical order, beginning at the eastward.

1. In the eastern section, the primary triangulation may be extended as far east as Nantucket, and north as Cape Ann, and the connexion with the eastern base may be completed. The secondary triangulation may be carried through Martha's Vineyard sound, around Cape Cod, into Cape Cod bay. The topography of the shores, and the hydrography of Buzzard's bay and of the Vineyard sound, may be nearly or quite completed.

2. In the next section, (from Narragansett bay to New York bay, and thence to the capes of the Delaware,) in which the triangulation and topography generally are completed, further magnetic observations for the charts of the harbors of the sound, and further observations of the currents in New York bay and harbor, and the adjoining bays, may be made. Observations on the gulf stream, of first importance to the mariner approaching America, may be made off the coasts of Massachusetts, New Jersey, and Delaware.

3. In the next section southward, the secondary triangulation on the outside of the eastern shore of Maryland and Virginia, the topography from Cape Henlopen southward, the hydrography south of Indian river, in-shore and off-shore from the limits of the previous section, may be in progress.

4. On the Chesapeake, the connexion of Mr. Hassler's work with the base of verification on Kent island may be completed; the primary triangulation may possibly be pushed below Kent island; the secondary triangulation may be extended southward; and the topography of the eastern and western shores, to the limits of the triangulation, be nearly or quite completed; the hydrography may be carried nearly to the head of the bay, and up the Patapsco, into the harbor of Baltimore.

5. In North Carolina, a base line may be measured, if not previously done; the reconnoissance for the primary triangulation be extended; and the triangulation itself be commenced.

6. The operations shown by the reconnoissance in Louisiana, Mississippi, and Alabama, to be desirable, may be commenced.

7. The proper work in the office would be—1st. The reduction and projection of the observations of the year, and the preparation of such results as are complete in themselves, for immediate publication. 2d. The commencement of the reduction of the map of Buzzard's bay, and the engraving of a separate sheet of the harbor of New Bedford and Fairhaven. 3d. The reduction and engraving of the approaches to Delaware bay, for

the map of the bay and river. 4th. The preliminary reduction of the upper section of the Chesapeake, and its final reduction and engraving, when the primary triangulation is complete. 5th. The reduction and engraving of a chart of Annapolis harbor, the adjacent roadstead, and the Severn river, to Round bay, inclusive. 6th. The reduction of the work on the Patapsco.

The work just referred to would occupy nearly the whole force which we have in the office, with the assistance of the field parties in the reduction of their work. Our present force is hardly more than is necessary to keep pace with the work of each year. The interests subserved by the survey of the coast would be materially benefited by putting forth every year such results as are complete in themselves—or even approximate results, noting them however, as such. It is also important as a means of spreading useful information, and essential to a healthy condition of the work itself, that every result of observation be published as soon as practicable after it has been obtained; and this might be done without much expense every year. Entire publicity would thus be given to every part of the work.

8. In the way of what has been stated to be the proper office work for the year, and in the way of the publication just referred to, there stand a large amount of useful materials, the accumulation of past years—in part quite ready, and in part nearly ready for publication. Among these are data for the publication of maps of the coast from Point Judith to Cape Henlopen, including Long Island sound and the coast of New York, (the southern shore of Long island;) of separate charts of the chief harbors and anchorages of Long Island sound; of the coast of New Jersey, and of separate charts of the harbors of refuge upon it; of the Delaware bay and river to the head of navigation. These materials should be put in shape and published before the current work of the year can be approached. A moderate increase of the appropriation for the work, beyond what is required to keep it in progress, would enable us to publish gradually the valuable maps and charts just referred to.

9. If we were thus supplied with the requisite means, while satisfactory progress would be made in the field-work, we should be able to spread before the country, in rapid succession, a mass of useful matter, which otherwise must remain unworked for some years, and at the same time to keep pace in our publications with the observations. In the early beginning of a work, such a system is either impracticable or exceedingly difficult of accomplishment; but after the work has made a certain progress, it becomes comparatively easy. Resources have been created, and results multiply in an increasing ratio. What was perhaps unavoidably fragmentary in the beginning, becomes systematic. If enabled to execute such a plan for a few years, I could answer with some degree of accuracy the often repeated question of how long a time it will take to complete the survey of the coast.

10. These remarks are not intended as an introduction to a request for a large appropriation, though I sincerely believe that in a work like this, essentially temporary, true economy is consulted by appropriations which will make its completion speedy. I leave this matter of policy, with all due respect, to the Executive and to Congress, with whom its final decision rests; and taking that policy as I find it established by appropriations of past years, I mean merely to propose that, for the additional work which I suggest, the appropriation be placed at its former limit. Adequate means will, I trust, thus be furnished, to render the results already obtained available to the

country, and to keep up in publication with the progress of the work. With close economy, the field work and current office work, as herein stated, can be done for a sum exceeding by about eight thousand dollars the appropriation of last year; and an additional sum of twelve thousand dollars, which would bring the appropriation to the limits of preceding years, would diminish rapidly the accumulation of results which I have described.

The estimate for the continuation of the work during the next fiscal year is (in round numbers) as follows:

For carrying on the survey in the eastern, middle, and three southern sections of the work.

For six triangulation parties - - - - -	$39,000
For five topographical parties - - - - -	16,000
For four hydrographical parties - - - -	13,500
For calculations, &c. out of the office - - - -	2,500
For calculations in the office, drawing, engraving, and publishing of current work - - - - - -	15,000
For instruments, maps, books, &c. - - - -	3,000
For reduction, drawing, and engraving of work of past years -	12,000
	$101,000

With this appropriation, which does not exceed that of recent years, I feel confident that the work marked in outline in the foregoing report may be accomplished; the field and water operations be carried on in the eastern, middle, and three southern sections of the work; and the speedy publication of the results be secured. It supposes the same aid which, during the last year, has been derived, under authority of Congress, from the War and Navy Departments. The amount thus asked is recommended, after examination, by the head of the Treasury Department, and attached to his annual estimates.

11. While I thus submit an estimate grounded upon the past policy of the Executive and Congress in reference to the progress of the survey of the coast, I should be wanting to my duty if I did not show how the work might be more rapidly advanced. I feel the more obliged to make this statement, because selfish motives might be supposed to prompt me, as superintendent of the work, to desire its continuance rather than its completion.

In addition to the operations already marked out for the next season, a triangulation to connect the work on the coast of New Jersey with the primary triangulation across New Jersey, or on the Delaware, may be made at an expense of about $2,000; a secondary triangulation may be commenced in North Carolina, so as to prepare the way for topographical surveys, and for the sounding parties in the following year: this, with the subsidiary operations rendered necessary by it, would require an additional sum of $4,000. A reconnoissance of the shores of North Carolina, South Carolina, and Georgia, may be made, to determine the sites for at least two new base lines. The character of the operations which the country requires may be determined, and one of the base lines may be located preparatory to measurement. The cost of these operations would be about $5,000. The reconnoissance on the coast of the gulf of Mexico might be pushed east-

ward into Florida, at a cost of about $1,500. Upon the triangulations and other operations in Louisiana, Mississippi, and Alabama, the sum of about $6,000 may be advantageously expended. The instruments and other apparatus required for these operations will cost about $6,000. The employment of steam vessels, instead of sailing vessels, in sounding, will very much expedite the work. The cost of one vessel, suitable in tonnage and arrangement, will be about $17,000. The engraving of the charts of the harbors and anchorages of Long Island sound, in New York and Connecticut, may be pushed rapidly forward, at a cost not exceeding $2,500. The calculations, reductions, and drawings connected with the additional work, will require about $3,000. Thus the immediate benefits of the survey may be extended to nearly every part of our coast in a very few years, and a beginning of those benefits at once realized, at an additional cost of not exceeding $47,000. These operations form part of the general system of the coast survey, and their cost cannot be diminished by postponing them.

The scale of the work being thus expanded, arrangements of the parties in reference to the division of labor become practicable, which are impracticable while the work is on a smaller scale; and the division of labor must lead to economy as well as to rapidity of progress. It will thus occur that, with a very moderate increase in the civil force, and in the aid required from the army and navy, the survey may be carried at once to portions of our coast which, by the present scale of appropriation, cannot soon be reached; and its completion, within a reasonable time, may be rendered certain.

Very respectfully submitted by

ALEX. D. BACHE,
Superintendent of survey of the coast.

To the Hon. GEORGE M. BIBB,
Secretary of the Treasury.

Extract of a letter of Lieutenant Commanding George S. Blake, United States navy, assistant in the survey of the coast, relating to a new channel in Delaware bay.

SCHOONER GALLATIN,
Philadelphia, January 11, 1844.

DEAR SIR: In reply to your letter of the 6th instant, relative to the recent discoveries made in the Delaware bay by the parties of the coast survey engaged there, I beg to say that our charts show a perfectly safe and direct channel, practicable for merchant vessels of the largest size, at *low water*, and, when the tide is two-thirds up, for frigates, to the westward of a narrow dangerous ridge, about fourteen miles long, running through the middle of the bay, called upon the old charts Joe Flogger, or Folger, and where no channel has heretofore been supposed to exist.

The advantages of this discovery to the commerce of Philadelphia, as well as to the naval establishment there, when this channel is properly buoyed, must be very great. It is somewhat more direct than the main channel; and I am informed that in winter, when the navigation of the bay is obstructed by floating ice, this channel is generally perfectly clear.

Another important fact is, that the channel, for its whole length—nearly fourteen miles—may be regarded as a good harbor in northeast gales of

wind, the sea being entirely broken from it by the Joe Flogger shoal. Heretofore, pilots of vessels bound up the bay, have, in the night time, or thick weather, *frequently* entered this channel, and, not knowing that they could pass through it, have run back, and, sounding the southern extent of Joe Flogger, entered the main channel.

Other discoveries have been made in the Delaware of much importance. Among them, three channels over the "ridges of Cape May," which, when buoyed, will be of very great utility to the great and increasing coal trade of Philadelphia, as this track has heretofore been regarded practicable for vessels drawing but nine feet, and then only when the tide was at half flood. The channels alluded to are, at *low water*, perfectly safe and direct for vessels drawing thirteen, seventeen, and eighteen feet.

A dangerous shoal, heretofore known to but few, if any, of the pilots, lying very near the main ship channel, having but eleven feet water upon it, has been traced out.

I should add, that there is no chart extant of the Delaware deserving the name. The situation assigned by the most authentic chart to one of the principal light-houses is nearly *seven* miles in error. Many dangerous shoals having but few feet water upon them, and upon which numerous wrecks have occurred, are laid down from three to five miles from the truth; and the bay is in one part represented as *fifteen* miles in width, when it is actually but *seven*.

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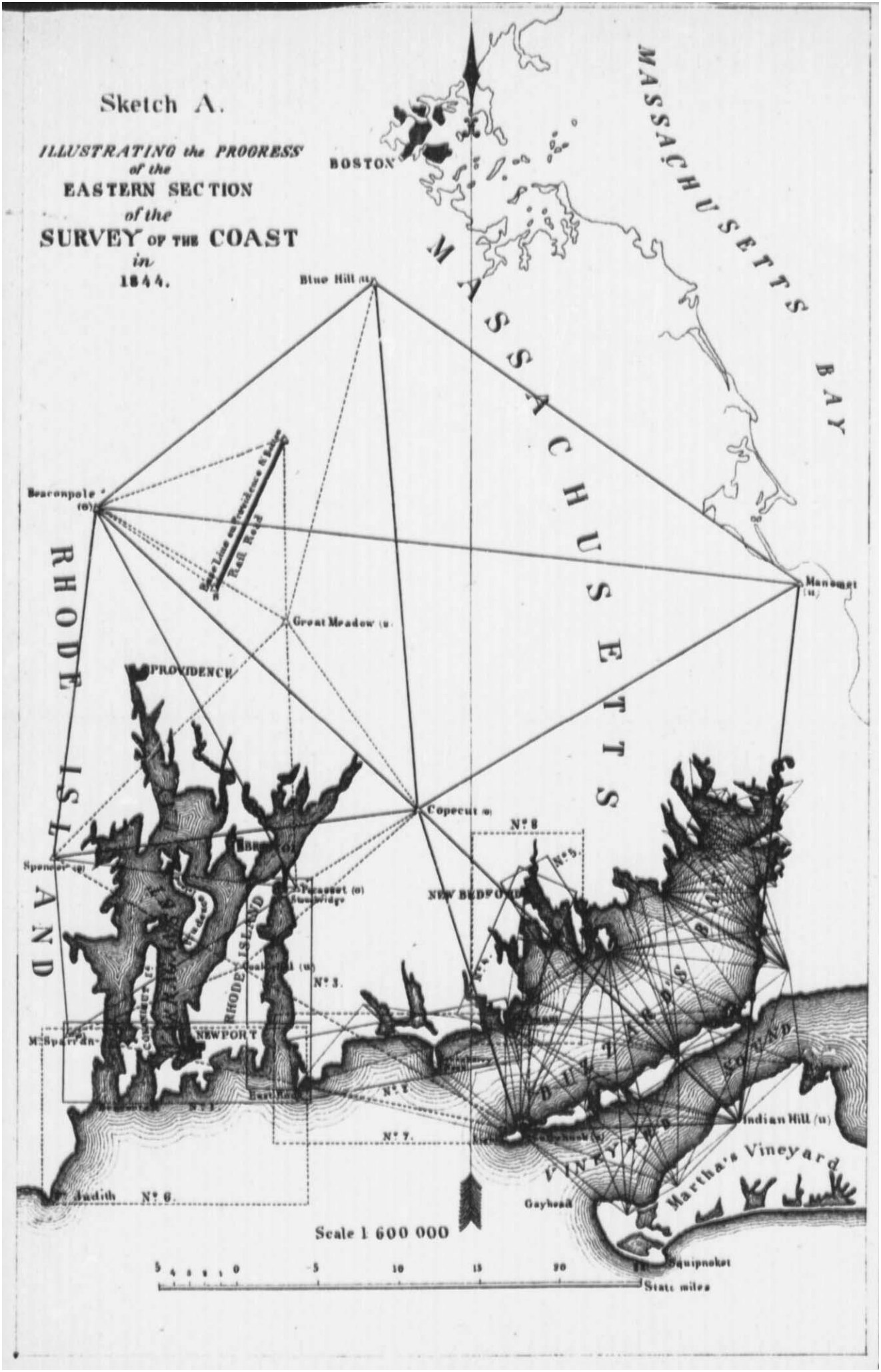
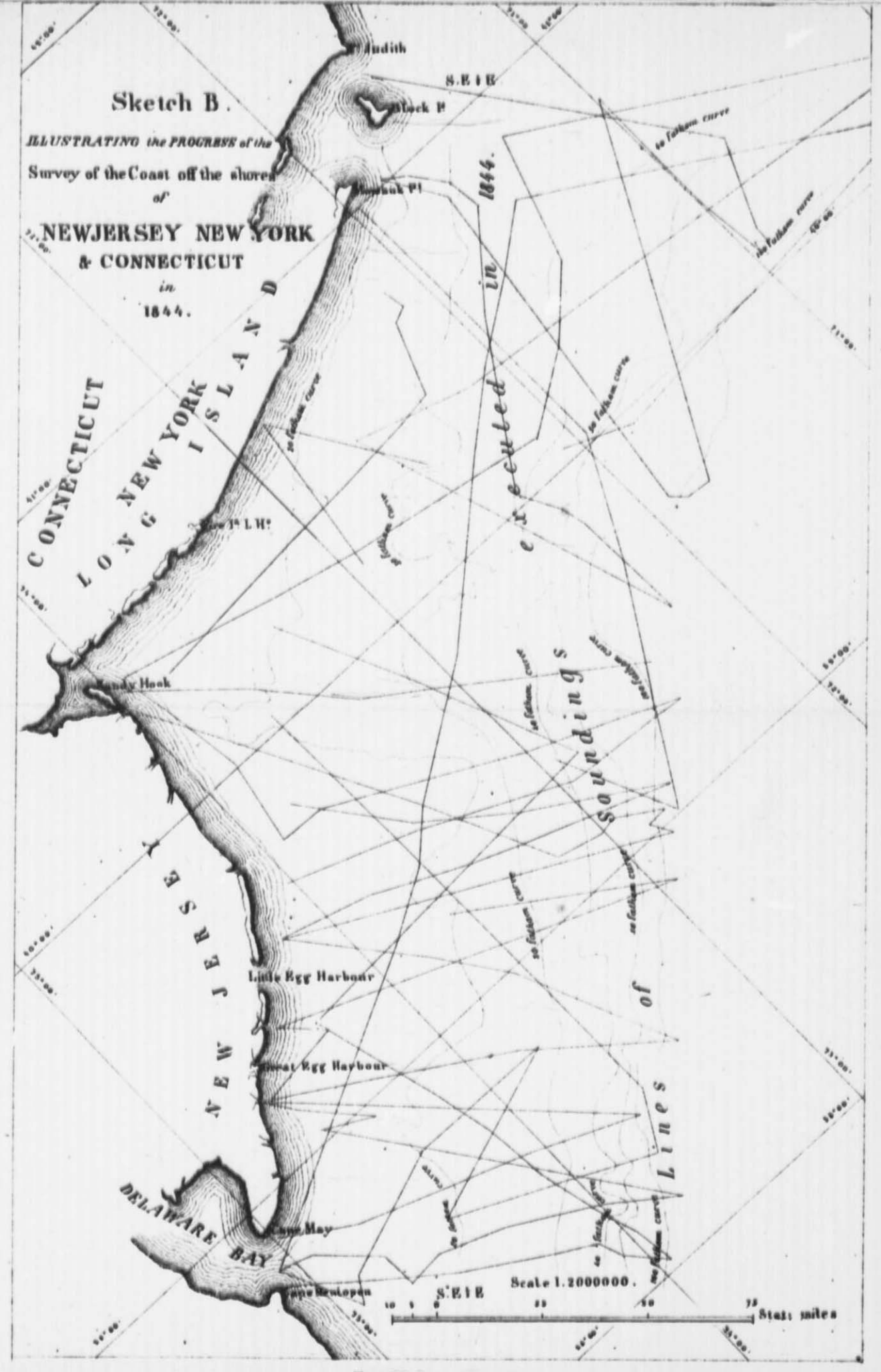
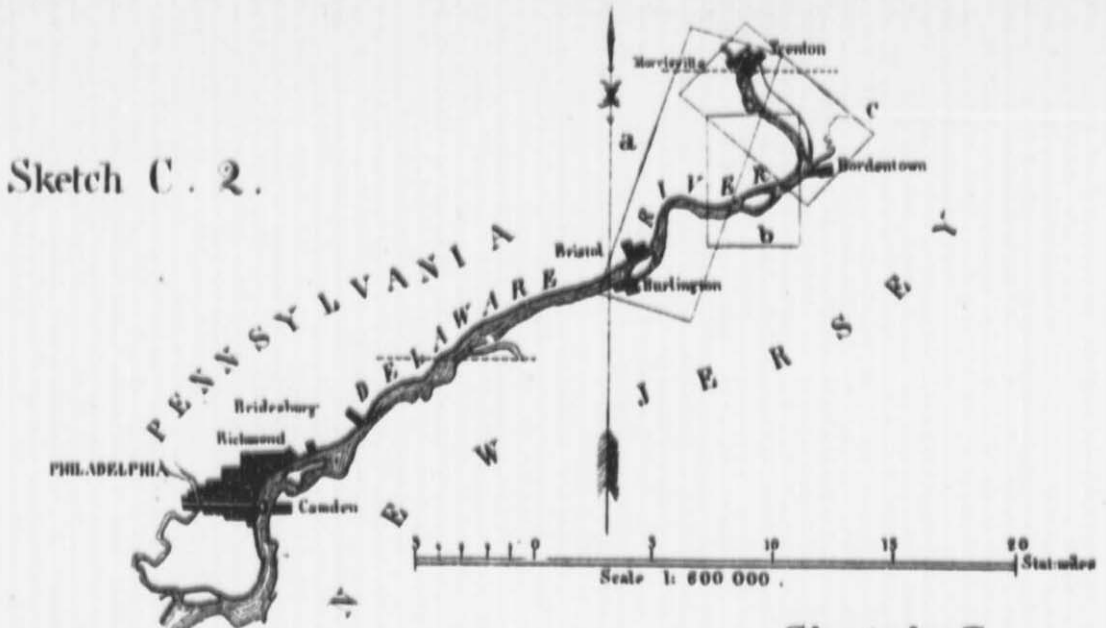
Very respectfully, your obedient servant,

GEORGE S. BLAKE.

A. D. Bache, Esq.,
Superintendent of Coast Survey, Washington.


Sketch A.
ILLUSTRATING the PROGRESS of the EASTERN SECTION of the SURVEY OF THE COAST in 1844.
BOSTON
MASSACHUSETTS BAY
MASSACHUSETTS
Blue Hill (u)
Bearenpole (o)
Providence & Stonington Rail Road
Great Meadow (u)
PROVIDENCE
RHODE ISLAND
Copecut (o)
Manomet (u)
Spencer (o)
Taunton (o)
NEW BEDFORD
Nº 8
Nº 5
Nº 3.
NEWPORT
Nº 2
Nº 1
Nº 7.
Nº 6.
Indian Hill (u)
Martha's Vineyard
Gayhead
Scale 1 600 000
Statute miles

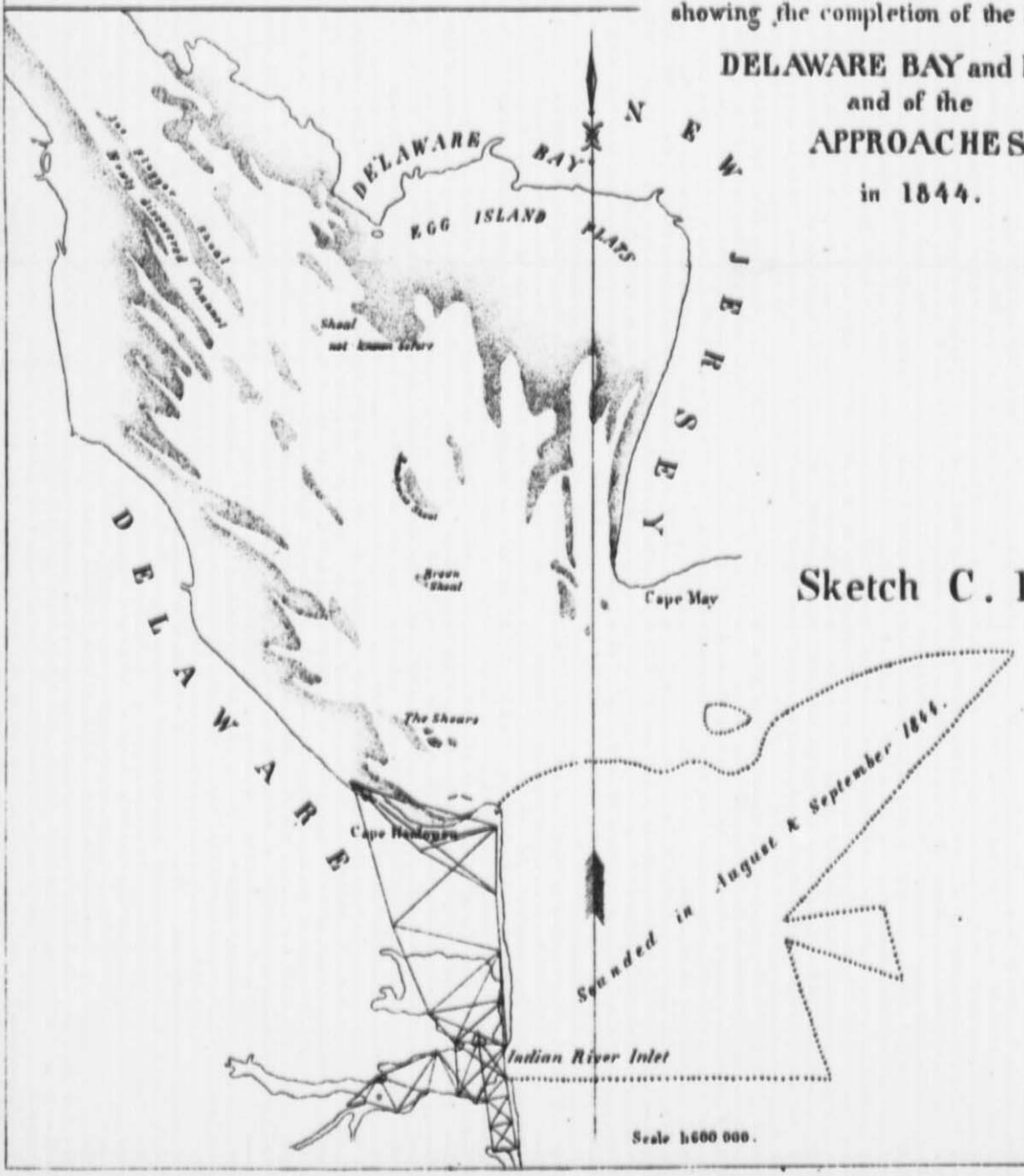

Sketch B.
ILLUSTRATING the PROGRESS of the
Survey of the Coast off the shores
of
NEWJERSEY NEW YORK
& CONNECTICUT
in
1844.
Judith
S.E I E
Block I.
Montauk Pt
CONNECTICUT
LONG ISLAND
NEW YORK
Sandy Hook
NEW JERSEY
Little Egg Harbour
Great Egg Harbour
DELAWARE BAY
Cape May
Cape Henlopen
Soundings
Lines
executed in 1844.
Scale 1.2000000.
Statute miles

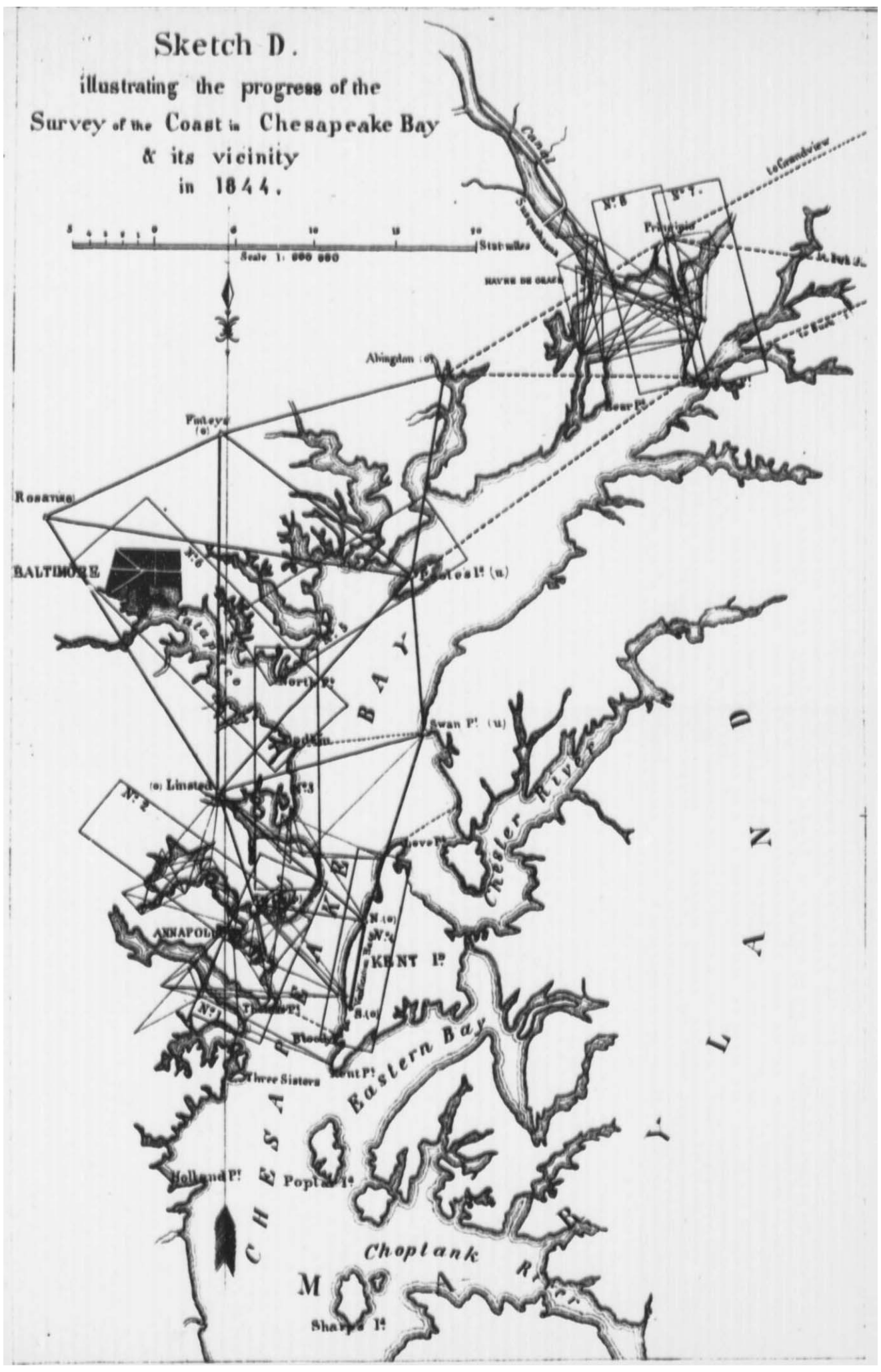


Sketch C.

showing the completion of the Survey of

DELAWARE BAY and RIVER and of the APPROACHES in 1844.




Sketch D.
illustrating the progress of the
Survey of the Coast in Chesapeake Bay
& its vicinity
in 1844.
Scale 1: 600 000
Statute miles
Canal
HAVRE DE GRACE
Abingdon
Pinleys
Rosaries
BALTIMORE
Swan Pt
Chester River
ANNAPOLIS
KENT Pt
Eastern Bay
Three Sisters
Holland Pt
Choptank R.
Shaw's Pt
CHESAPEAKE BAY
MARYLAND