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Message from the President of the United States to the two Houses of Congress, at the commencement of the first session of the Thirty-third Congress : Annual Report of the Secretary of War, 1853

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MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES

TO THE

TWO HOUSES OF CONGRESS,

AT THE

COMMENCEMENT OF THE FIRST SESSION

OF

THE THIRTY-THIRD CONGRESS.

December 6, 1853.—Read, and ordered to be printed; and that 10,000 copies in addition to the usual number be printed for the use of the Senate.

PART II.

WASHINGTON:
ROBERT ARMSTRONG, PRINTER.
1853.

REPORT OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington, December 1, 1853.

SIR. I have the honor to submit the following report of the operations of this department during the past year:

The authorized strength of the army (as now posted) is 13,821, officers and men; but it will be seen by the accompanying table, prepared in the Adjutant General's office, from the latest returns, that the actual strength is only 10,417. Of this number, 8,378 are employed in the frontier departments or are now on the route to them.

It gives me pleasure to say that the measures taken for the protection of the inhabitants of our frontiers have, under the direction of able and zealous commanders, been more than usually successful. The troops have everywhere been actively and constantly employed. Indian depredations have been comparatively infrequent, and, except in California and Oregon, have not attained more than a local importance.

In the Indian country immediately west of the Mississippi but two or three instances of collisions have occurred. Arrangements are now in progress which, by the establishment of new posts in more favorable positions, will enable the department to dispense with a number of the smaller and less important posts; to give increased security to that frontier; to employ a greater force for the protection of the emigration crossing the great plains of the west; and, at the same time, materially diminish the expenses of the military establishment in that part of the country.

In Texas, Indian hostilities have diminished in frequency and in importance, and in a majority of the cases that have been brought to the notice of the department, the depredations have been committed by Indians from Mexican territory. As the Rio Grande is the boundary between this country and Mexico, and the positions to be occupied on it for the protection of that frontier and the fulfilment of our treaty stipulations with the republic of Mexico will, in all probability, be permanent, the force on that river has been considerably increased, and arrangements are now being made, under the direction of Major General Smith, aided by an experienced officer of engineers, to select the most suitable positions for the attainment of these objects, and for the construction of field works for their defence. As a part of this system, orders have been given for the establishment of a strong post on the Rio Grande, opposite the Mexican town of El Paso, in the neighborhood of which Indian hostilities and collisions between the frontier inhabitants of the two countries have occurred. It is also in contemplation to establish a large post at the point where the great trail of the Comanche Indians crosses the Rio Grande. Other dispositions for the control of the Indians on the northern frontier of Texas are also in progress, and, when they are completed, the department hopes with confidence to give a very great degree of security to both the Mexican and Indian frontiers of that State.

New Mexico has been comparatively exempt from Indian disturbances during the past year. The few that have occurred have generally been traced to marauders and outlaws, for whose actions none of the tribes of that country can justly be held responsible. Those to which they nominally belong have given assurances which, it is believed, they are endeavoring in good faith to carry out, of their intention to apprehend and deliver up these marauders, and restore the property plundered by them.

The Indians of California and Oregon are numerous and warlike; but as they were divided into small independent bands, having no general head, and were in a great measure destitute of firearms, their hostilities in previous years were not important. Now, however, that the rapidly extending settlements of those countries are driving the Indians from their accustomed haunts and crowding them into narrower limits, they are forced into combinations both formidable and frequent. Within the past three years their hostilities; the result in many instances of the intrusion and aggressions of the whites, have been almost uninterrupted; and it is officially known that, in northern California and southern Oregon alone, within this period, the lives of more than a hundred whites and several hundred Indians have been sacrificed in collisions between the two races. The force in that country is not now, and never has been, sufficient; and, impressed with the idea of its entire inadequacy, the department some time since ordered a regiment of artillery to the Pacific, and it was designed to send there an additional regiment of infantry, but it was found that the state of the service would not then, nor does it yet, admit of it. The first mail from the Pacific, subsequent to the issuing of this order, brought intelligence of renewed hostilities, in which more than forty lives were lost. By the zeal and activity of General Lane, (delegate from Oregon Territory,) in command of a volunteer force, aided by the few regular troops that were in the neighborhood, hostilities were suppressed, and the Indians compelled to sue for peace. These operations appear to have been conducted with great energy and judgment, and, in the final conflict, General Lane and Captain Alden (the latter in command of the regular troops) were both severely wounded while gallantly leading a charge against the Indians. There is, however, no assurance that peace can be maintained, unless a force adequate to the control of the Indians is stationed in their midst. It is the intention of the department that this shall be done, and as soon as possible a considerable additional force will be sent to the Pacific, and one of the brigadier generals of the army ordered there to command.

The vast territories between the Rocky mountains and the Sierra Nevada are inhabited by numerous and warlike bands of Indians. Hostilities are now existing between them and the inhabitants of Utah Territory, and they are constantly occurring on the emigration routes through that country from the western States to our possessions on the Pacific. It is due to our citizens who are settled in, or pass through, those remote regions, that their lives and property should be protected; but the department is without the means of fulfilling this duty.

The measures adopted by the Department of the Interior under the last administration, for the removal of the few Seminoles remaining in Florida, having failed, it was considered advisable to transfer the control of these Indians to this department, for the purpose of emigrating them to the country west of the Arkansas. An experienced officer of the army, who is well acquainted with their character and possesses their confidence, has been entrusted with this duty; and with a view to strengthen his efforts, and at the same time be prepared to use coercive measures, if such should be necessary, a force consisting of nine companies of artillery is posted in the peninsula of Florida. It is hoped that the measures thus taken will be attended with favorable results.

The appropriation of March 3, 1853, for remounting the four additional light batteries, authorized by the act of March 3, 1847, has been found sufficient to remount but three of them. It is recommended that, in the appropriations for the support of the army for the next fiscal year, provision be made for mounting and equipping the remaining company.

For the details of the movements of troops during the past year, and their present disposition, reference is respectfully made to the report of the commanding general and the accompanying tables, which are transmitted herewith.

The disposition and employment of the army must depend upon the necessities of the service; but if nothing unforeseen should occur, it is proposed to arrange two of the regiments of artillery to the Canada frontier, and to the Atlantic and Gulf coasts, the third to the Rio Grande boundary, and the fourth to the Pacific coast. The troops on the seaboard will be concentrated as much as possible, and at each of the posts occupied by them will be provided the means necessary for the instruction of officers and men in all the duties of their profession. The same course will be adopted, as far as practicable, at the posts on the Mexican frontier and Pacific coast, occupied by the artillery, and generally wherever it can be done consistently with a proper degree of economy. Of the three cavalry regiments, one will be required in Texas, one in New Mexico, and the remaining one for the western frontier, for service on the plains, and for the protection of emigrants. A fourth is needed for the Pacific and the country between the Rocky mountains and the Sierra Nevada, and it is hoped that Congress will authorize its organization. Three regiments of infantry are required in Texas, two on the frontier west of the Mississippi, one in New Mexico, and the remaining two in the Indian country of the Pacific. In another part of this report I shall invite your attention to the necessity for an increase of this force.

The companies of several of the regiments, particularly the cavalry and artillery, are now greatly dispersed, serving in different departments and under different commanders. Advantage will be taken of any movement of troops that may hereafter become necessary, and without incurring any great expense for that object alone, to concentrate the companies of the same regiment, as much as possible, so that they may be under a common commander, and subject, in some degree at least, to the control and supervision of their colonels or regimental commanders.

With an army three times as great as ours, it would be impracticable so to guard all points of our extended frontier as entirely to prevent Indian depredations. It is, therefore, the intention of the department to post the troops in large bodies at commanding positions among the Indians, and to restrain aggression by the exhibition of a power adequate to punish. They will not be likely to engage in hostilities if their families are in the power of the troops during their absence.

The multiplication of small posts, however much it may appear to have been called for by the necessities of the service, is of more than doubtful policy. The system is expensive far beyond any good results that are attained by it. It is injurious to the decipline, instruction, and efficiency of the troops, and it is believed that it often invites aggression by that exhibition of weakness which must inevitably attend the great dispersion of any force. The benefits of the proposed change will be an improvement in instruction and discipline, a greater degree of efficiency and usefulness, and a material diminution of expense.

The distribution of the *materiel* of war required for the defence of a country, or the use of its army, is intimately connected with the movements and positions of the *personnel* of that army. The facilities of communication between the depôts where these supplies are stored or can be obtained, and the points on our seaboard and northern and northwestern frontiers where they may be required, are so great, that, so far as these are concerned, no change in the present arrangement seems necessary.

The communication with New Mexico, though tedious and expensive, is not liable to foreign interruption, and would not be changed by the occurrence of war. The case is somewhat different with regard to Texas, and essentially so with regard to the country bordering on the Pacific, which, from its wealth, is the most inviting, and from its remoteness is, of all our possessions, the most exposed to the attack of a foreign enemy. In view of the ever-possible contingency of war, and the difficulty of providing for it after it has occurred, it becomes important to take, at as early a period as possible, all necessary precautions for the security of our distant territory. As the appropriation for the "armament of fortification" for the last three years has either been refused or greatly reduced, under the impression that it depended upon the prosecution of the "system of permanent fortifications," it is proper to remark, that this provision is not dependent upon the extent to which that system is carried, but is indispensable to any system of coast defence that may be adopted.

The construction of permanent fortifications, and the creation of arsenals and depôts, is necessarily the work of time; but the armanent for the most important points, both in Texas and on the Pacific coast, should, at the earliest practicable period, be sent to them, and when in position, temporary works, sufficient for defence against any sudden attack by a naval force, could readily be thrown up by the labor of the troops.

There should also be sent to the Pacific coast, and stored at suitable points, the ordnance and ordnance stores needed for its defence, and to the arsenals on the Columbia river, and on the bay of San Francisco, the machinery and other means needed for the construction, equipment and repair of all the *materiel* of war. Depôts should also be formed of such other supplies as are not perishable in their character. With a water transportation of sixteen thousand miles, and land routes impracticable for the transportation of heavy supplies, it will be too late to adopt these measures when the communication by sea is liable to interruption; and no prudent nation should trust, in matters of such vital importance, to the chances of a future that no human sagacity can foresee. As many of the supplies proposed to be sent to Texas and to the Pacific are now in depôt in the Atlantic States, no great expense or loss would be sustained by their transfer, even if the necessity for their use should not occur for many years to come. As a measure of prudence and economy in the transportation of such as may be sent to the Pacific, it is suggested that, whenever naval vessels are sent to that coast, there be sent with them such stores as they can conveniently carry in addition to their own supplies.

The state of the recruiting service is exhibited by the accompanying report and tables prepared by the adjutant general, who is charged with the details of that service.

The demand for labor has been so great throughout all parts of our country during the past year, that this service has not been so successful as in former years. In consequence of this, and the fact that a number of the companies heretofore serving on the seaboard have been transferred to "remote stations," where, under the authority vested in the President by the act approved June 17, 1850, the maximum organization obtains, it is estimated that 4,600 recruits will be required for the service of the ensuing year. To obtain these at the present rates of pay, and in the present prosperous state of the country, can scarcely be expected; and it is important that some measures should immediately be taken for maintaining the full number of the rank and file of the army authorized by law.

It is shown by an examination of the statistics of the army, from 1826 to the commencement of the war with Mexico, that the average excess of the legal over the actual strength of the army has been, during this period, 18 per cent. of the latter; that the average actual loss by desertion has been 12¾ per cent., by discharges for disability and other causes 7 per cent., and by deaths only 4 per cent., or that the total loss, independent of discharges by expiration of service, has been 23¾ per cent. of the actual strength of the army. Since the termination of the war with Mexico, the excess of the legal over the actual strength has been 19 per cent.; the average loss by desertion, 16 per cent., by discharges for disability and other causes, 8 per cent., and by deaths, 4 per cent., or a total loss, independent of discharges by expiration of service, of 28 per cent. A part of the per centage of the desertions is due, however, to the excitement on account of the discovery of gold in California, the excess from that cause, in one year alone, being 530 over the average of the three succeeding years.

It is found, by an analysis of the desertions from 1826 to 1846, that if we exclude the excess, due to local and temporary causes in 1832 and 1836, there was, as the condition of the soldiers was ameliorated by increase of pay, &c., a gradual diminution in the proportion of desertions, and that when the difference between the pay of the soldier and the value of the corresponding classes of labor in civil life was slight, they were comparatively infrequent, being, at two different periods, only $7\frac{1}{2}$ and $4\frac{1}{2}$ per cent. of the actual strength of the army, and that they increased in a direct ratio with the increasing prosperity of the country, reaching, when the disproportion was greatest, 21 per cent. The same causes influenced, as was to be expected, the number of re-enlistments, the proportion in the last four years being only 17 per cent., while in the three years immediately preceding the war with Mexico it was 25 per cent. of the number of discharges by expiration of service.

These results may be traced to two principal causes:

1. The disparity between the pay of the soldier and the value of labor in civil life.

2. The fact that length of service carries with it no reward, either in increased pay, rank, or privilege.

Both these causes are the fruitful source of dissatisfaction and desertion, and they prevent the re-enlistment of the most valuable men. There are other causes that have their influence, but do not materially affect the general results.

It may aid in the consideration of these results, and in the suggestion of remedial measures, to state some of them in another form:

Thus, in an army of ten thousand men, which is about the actual strength of our military establishment as at present organized, there will be annually, under existing circumstances of pay and service—

1,290 discharges by expiration of enlistment.
726 discharges for disability, &c.
330 deaths, and
1,465 desertions, or 3,811 vacancies annually, of which only 219 are filled by re-enlistments. The actual annual loss to the army, to be supplied by the enlistment of new men, will therefore be 3,592. In other words, more than one-third of the army must every year be recruited, and transferred from the depôts to their regiments, abridging very materially the term of the soldier's efficient service. It is found that a majority of the desertions, and a very large proportion of the disabilities and deaths, occur in the first year of the enlistment. It will, therefore, be of paramount importance, in devising any measures for keeping the ranks of the army full, to adopt such as will prevent as many desertions, and induce as many re-enlistments, as possible. Every desertion that is prevented, and every re-enlistment that is induced, saves the expense of the enlistment and transfer of a recruit from the place of enlistment to his company, the time (often of the utmost importance) occupied in this transfer, and the danger of death or disability in becoming acclimated.

The remedial measures that immediately suggest themselves are—

1. An increase of   per cent. of the present pay of the soldier.

2. An additional increase for each successive period of five years, so long as he shall remain in the army.

3. Provision for the promotion to the lowest grade of commissioned officers of such of the non-commissioned officers of the army as may be found qualified for, and by their conduct, character, and services entitled to, such advancement.

The depreciation in the value of money, as measured by the wages of labor and the cost of all the necessaries of life, has been so great, that the pay of the soldier is, relatively, less now than it was prior to the increase granted by the law of July 7, 1838.

The necessity and propriety of the second measure proposed are believed to be equally great; but, in order to elucidate it, it will be necessary to exhibit some of the data upon which this opinion is based. With regard to the proposed increase of pay for length of service, it is suggested—

1. That every soldier who, having been honorably discharged from the service of the United States, shall, within one month thereafter, re-enlist, shall be entitled to $2 per month in addition to the ordinary pay of his grade for the first period of five years after the expiration of his first enlistment, and a further sum of $1 per month for each successive period of five years, so long as he shall remain continuously in the army.

2. That soldiers now in the army who have served more than one enlistment shall be entitled to the benefits of this provision according to the length of their continuous service; and that service during the war with Mexico, although for a less period than five years, shall be counted as five years' service.

3. That soldiers who served in the war with Mexico, and received a certificate of merit for distinguished services, as well those now in the army as those that may hereafter enlist, shall receive the $2 per month to which that certificate would have entitled them if they had remained continuously in the service.

Skill and experience, in all branches of business and departments of labor, meet their appropriate reward, not only in civil life, but in all the departments of the government, except among the enlisted men of the army, where the recruit of yesterday, for services utterly disproportioned in value, receives the same compensation as the veteran of thirty years. The justice of increasing the soldier's pay according to the value of his services is obvious, and the economy of doing so is susceptible, it is believed, of easy demonstration.

With the extension of our territory, the cost of sending recruits to their regiments has enormously increased; and it is estimated that the expenses of the enlistment, the transportation and subsistence, the loss by desertion, and by deaths and discharges for disability of unacclimated recruits, will average $91 for each man enlisted under the present system. If to this be added the pay, clothing, medical attendance, &c., of the recruit, from his enlistment until he joins his company, the actual cost of each man, from his enlistment until the period when his actual service commences, will be $121.

If the suggestion above made, for increasing the pay of the soldier according to length of service, should be adopted, and should be as successful as is anticipated, it is believed that it will, in the course of six years, in connexion with the other measures proposed, reduce the annual loss in the army from thirty-five to ten or eleven per cent. The number of men now in the army who would be entitled to the increased pay which this system proposes is less than one thousand; but the number would be rapidly increased by re-enlistments, and the maximum number entitled to the increased pay would be attained in six years. This number would be constant, or subject only to slight fluctuations; but as the greater portion of the men entitled to increased pay would then belong to the first and second classes, the expenditure on this account would increase gradually, as the men pass successively from the lower to the higher grades of increased pay, until in about twenty-five years the maximum expenditure on this account will be attained. That limit will also be constant, and will not exceed $300,000 a year. If to this sum be added the cost of enlisting 1,050 men, to meet the annual loss, (say 10½ per cent.,) and the bounty for 1,160, the estimated number of re-enlistments under the proposed system, the cost of maintaining a full organization under that system will be $119 per man, against $121 under the present system. When the value of the services rendered, the superior character of the men, and the consequent diminution of offences, and the expenses they entail, are considered, the economy of the proposed measure becomes apparent.

These estimates are based, as far as practicable, upon known facts, and are conjectural only in that which relates to the working of the proposed system. It will increase the expenditures for the pay of the army only so far as it succeeds in restraining desertions and inducing re-enlistments; and this increase in the pay will be more than correspondingly diminished in the expenditures of the other departments of the army.

The proposition in relation to the extra pay of soldiers who have received certificates of merit, is an act of simple justice to men who, by construction of the law, were deprived of the benefit of the seventeenth section of the act of March 3, 1847. Under the operation of that construction, which virtually reduced their pay, they refused to re-enlist, but it is believed that, to a considerable extent, they would now enlist, if the benefits of the law should be extended to them.

To carry into effect the third measure proposed, it is recommended that the President be authorized, under regulations to be established by law, to confer the brevet of second lieutenant upon such meritorious non-commissioned officers as may, by examination before an army board, be found qualified for the duties of commissioned officers; and to fill a certain portion of the vacancies which may occur in that grade, as now authorized by law, by attaching such non-commissioned officers as supernumeraries to the army, to serve according to their brevet, and be promoted as cadets under like circumstances now are.

There is another class of non-commissioned officers, of long and faithful and often highly distinguished services, who, from want of education, are not qualified to become commissioned officers, but are eminently fitted for, and deserving of, positions of subordinate responsibility and trust. To provide for the advancement of this class, it is respectfully recommended that authority be granted to appoint a limited number of fort keepers, or barracks masters, to be employed at such of our permanent fortifications as are not occupied by troops, and as substitutes for the civil agents employed by the quartermaster and engineer departments, receiving a compensation intermediate between that of the highest grade of non-commissioned and lowest grade of commissioned officers. These duties would be as efficiently performed, and at a diminished expense to the government.

These suggestions, if carried out, will not be burdensome to the service by increasing the number of officers beyond its wants, nor expensive beyond commensurate advantages.

It has been the policy of our government to maintain only a small army in peace; but it should also be our policy to be prepared for the event of war by making that army as efficient as possible—efficient not merely in the operations required of it in the field of battle, but in all the various duties of a campaign, including economy of life and health, and in its capacity for disseminating instruction and discipline among those whom the emergencies of war call into the field unprepared to meet its hardships, and ignorant of the means of guarding against its vicissitudes. In all the operations of war, efficiency and economy, if not synonymous, are at least correlative terms; and that army which is the most efficient will at the same time be the most economical. To attain this efficiency, it is essential that the *personnel* of an army should be intelligent and capable; but it is idle to hope that men of this character can be obtained unless their pay bear a fair proportion to that which they would receive in the corresponding employments of civil life. Patriotism or a sense of duty will not in time of peace fill the ranks of an army; nor will pay alone be sufficient to develop all the elements of efficiency. The hope of advancement is the foundation of professional zeal and success, and this incentive should exist in the army as well as in civil life. Its honors and distinctions should be open to all, that they may incite the ambition and stimulate the zeal of all.

In making these suggestions I have had principally in view the improvement of the army; but it is my opinion, founded upon the experience of our past history, that, if adopted, they would also produce economical results.

As indicated in a previous part of this report, I respectfully invite your attention to the necessity for an increase of the army. It may be instructive, in the consideration of this subject, to refer to the strength of our military establishment as it has existed at different periods, and to the circumstances that controlled its organization.

In 1808 the legal strength of the army was 9,991, which was increased early in the year 1812, "for the defence of the Indian frontier," to 10,353. The war with England followed soon after this increase, and at its conclusion the "peace establishment" was fixed at 12,383 officers and men, and so continued until 1821, when it was reduced to 6,126. This organization was continued until 1832, when it was increased to 7,129. In 1836 it was increased to 7,958, and in 1838 to 12,139. These last additions were made during the existence of Indian hostilities, (the Black Hawk and Florida wars,) and although previously recommended, with the view of preventing them, were not authorized until their actual occurrence had demonstrated the wisdom of the recommendation. In 1842, at the close of the Florida war, the army was reduced to 8,613, which number, with slight changes, was continued until, in the early part of 1846, the regiment of mounted riflemen was added for the protection of the emigration on the Oregon route, making the aggregate 9,418. At the close of the war with Mexico its organization was fixed at 10,120. In 1850 it was increased by a sliding scale, which admitted a total strength, if all the companies of the army were posted at "remote stations," of 14,731. As they are now posted, the authorized strength is 13,821; but, for reasons which have already been explained, the actual number is less by 3,326 men.

It will be seen by the above statements that, in a period of forty-five years, the military peace establishment of the country has been augmented less than four thousand men. In the same period our country has increased in population more than eighteen millions, and in territory a million of square miles. In 1808, our Indian frontier requiring troops for its protection was less than 1,000 miles in extent, and there were no long lines of communication requiring defence. Now that frontier has increased to more than 3,000 miles; and our communications through the Indian country, traversed annually by thousands of our citizens, and requiring constant protection, to more than 4,000 miles. Our seaboard and foreign frontier have been greatly increased; and of the latter, over 2,500 miles are Mexican frontier, along which, besides the duty of guarding and protecting our own inhabitants, is the superadded obligation (by treaty) of also protecting the inhabitants of Mexico from the Indians living within our limits. By the annexation of Texas, and the acquisition of New Mexico and California, our Indian population has been increased from 240,000 to more than 400,000, a very large portion of whom, predatory and war-like in their habits, are, for the first time, brought into contact with our people; the result of this is a state of continued disturbance. It has been the policy of our government, by grants of land and pre-emption rights, to induce the rapid settlement of our western wilds. The intimate contact thus produced between the two races, the proneness of the Indian to maraud, and of the whites to intrude upon the Indian lands, cause constant collision. Aggressions on the part of either lead to retaliation, which unfortunately falls far more frequently upon the innocent and unoffending than upon the guilty; and retaliation leads to war. To repress these disturbances troops must be collected from different points, and transported over difficult and expensive routes, to the scene of the troubles, or the militia of the country must be called out. In either case heavy expenditures, without considering the derangement of business and the loss of life and property, are the consequence. In the mean time other portions of the frontier are stripped of the troops required for their defence; and this weakness invites new aggression, and renders new movements of troops and renewed expenditures necessary for their suppression. As the natural consequence of this, the expenditures of the army are very great in proportion to its strength. A reasonable increase of the army, if it did not entirely prevent these disturbances, would at least diminish their frequency, and produce immense saving of money, property, and life.

The disposition of the army, and the assignment of troops to the frontier departments, have been noticed in another part of this report. The force allotted to each is manifestly inadequate. It cannot be increased in any one of them without withdrawing troops from other points where their presence is equally necessary. Your attention is respectfully invited to the recommendation of the commanding general in relation to this subject. In the views expressed by him I fully concur, except that I am of the opinion that a portion of the increase which he recommends should be attained by the addition of another regiment, rather than by so great an increase of the company organization.

After a full consideration of what is now and probably will hereafter be required of the army, I urgently recommend that the minimum organization of all companies be fixed, as in the mounted riflemen, at sixty-four privates, and that there be added to the present military establishment one regiment of dragoons and two regiments of riflemen.

This increase is materially less than that recommended by the commanding general, and is considered absolutely indispensable to the proper efficiency of the military service. It will give a minimum organization of 15,528 officers and men, but may be expanded—if the limit fixed by the law of June 17, 1850, be continued—to 17,414, and on a war establishment of 128 privates per company, to 27,818; giving, for a state of war, an effective increase of from 10,000 to 12,000 men, without the creation of new regiments. The experience of the last forty years has demonstrated the wisdom of maintaining, in peace, a military establishment that is capable of the greatest expansion in war. The increased efficiency and economy of companies thus expanded, from a nucleus of experienced and disciplined men, more than compensate for the additional expense of maintaining skeleton regiments in time of peace.

I also recommend that another company of sappers and miners be added to the engineer corps, for the purposes for which the present company was authorized. The usefulness and economy of this class of soldiers has been practically demonstrated, both in peace and war.

The duties of hospital stewards are of a very important character, requiring a considerable degree of intelligence and general knowledge. There is no provision for their enlistment, and it is sometimes difficult to find suitable persons among the enlisted men of the army. It is recommended that authority be given for the enlistment, under the direction of the surgeon general, of as many as may be necessary for the public service, to receive the same compensation as is now authorized by law.

I concur fully in the views expressed by the commanding general in relation to the extension of the pension system to the widows and orphans of officers and soldiers of the regular army, and commend the subject to your favorable consideration.

The experience of every year gives increased force to the recommendations heretofore made for a retired list for disabled and superannuated officers. The casualties of the war with Mexico have greatly increased the number who are incapable of the performance of any active duty. The plan recommended by my predecessors for several years past would retire them on a just compensation, promote efficient officers in their stead, and thus greatly contribute to the good of the service without any new charge upon the treasury.

The pay of officers of the army was established many years ago, when the value of money was much greater than at this time. What was then only a reasonable and just compensation is now entirely inadequate; and I accordingly recommend to your favorable consideration the propriety of its being increased in proportion to the increased cost of living. This is only a measure of justice to all, but it is especially due to those whose duties require them to serve at stations where the comforts. and often the necessaries of life, command such exorbitant prices as to place them beyond the reach of those who have no other means than their pay.

The 17th section of the act of March 3, 1847, authorized the President to attach non-commissioned officers who distinguished themselves in the war with Mexico, by brevet of the lowest rank, to any company, and to bestow certificates of merit upon soldiers who were in like manner distinguished. Many of the non-commissioned officers who were recommended for distinguished conduct were not attached, in consequence of a want of qualification, but would have received a certificate of merit if the terms of the law had not precluded it. It is respectfully recommended that the President be now authorized to grant certificates of merit to distinguished non-commissioned officers who were not considered eligible for the position of commissioned officers.

I recommend to favorable consideration the suggestions of the quartermaster general in his report, submitted herewith, for the increase of the comfort of troops in barracks, the augmentation of the allowance to soldiers when unavoidably employed as mechanics, teamsters, and laborers, and also the proposed changes in relation to storekeepers and barrack masters and the settlement of the accounts of disbursing officers.

The act of 1808, for "arming and equipping the whole body of the militia of the United States," makes an appropriation for supplying the several States and Territories annually with such arms and equipments as are used by the United States troops—the quota due to each being determined by apportioning the whole amount according to the returns of the militia made to the adjutant general of the army. These returns are furnished irregularly by some of the States, and by others not at all; and it results from this irregularity that the actual supplies of arms and equipments furnished to the States and Territories under the law of 1808 are not distributed, as prescribed by that law, "in proportion to the number of the effective militia in each;" nor is it probable that the regularity and uniformity in these returns requisite to apportion these supplies as the law requires can be obtained. The only remedy for this seems to be to adopt the mode of apportioning the arms and equipments to the several States and Territories authorized in the case of the State of Iowa, by the act of March 3, 1853, which was according to representation in Congress.

In connexion with this subject I respectfully invite your attention to the importance of providing the militia of the country with the proper books for tactical instruction. They are furnished with arms at the expense of the United States, and, although they are required by existing laws to observe the systems of instruction adopted for the regular army, no provision has yet been made for supplying them with the necessary books for that purpose. According to the estimate of the commanding general, an annual appropriation of \$20,000 for a few years would be sufficient for this object.

For the condition of the Military Academy I refer to the report of the chief engineer, and the accompanying highly commendatory report of the last board of visitors, in which you will find further confirmation of the estimate placed on the value and efficiency of that institution. The recommendation of the board to increase the academic term to five years is one which has been frequently presented by preceding boards of visitors, and which is believed to be sustained by important considerations. The low standard of acquirement now fixed to entitle a cadet to admission must often lead to the introduction of those whose previous education has been very defective; and the study of the scientific and military branches included in the course leaves little time for the acquisition of that knowledge of international law, of language, and of literature, demanded by the interests of the service. An officer of the army may often be required promptly to decide upon questions of national law where errors would be seriously injurious to his country; and his reports and memoirs are the channels through which deeds most illustrating his country's history are transmitted to other people and to other times. To raise the standard of acquirement to be possessed previous to admission to the academy would in some degree deprive the institution of its present popular character, by excluding those who from the want of early advantages could not then pass the preliminary examination. The grade of cadet being the lowest in commission known to our army, should be as it now is, within the reach of youths in every condition of life; and this, together with the fact that by the mode of appointment all sections and all parties are fairly represented, gives to the institution that character which should belong to it as a part of the military establishment of the United States. If, then, a more finished education than that which is to be obtained by the course now prescribed be desirable for the officers of the army, the recommendation of the board for an increase of the academic term presents, it is believed, the least objectionable mode of effecting that object. The estimates submitted for the support of the military academy for the ensuing year are recommended to favorable consideration.

The appropriations for fortifications, made at the last session of Congress, are all in the course of application to the several works for which they were respectively granted. These works were designed to protect interests of great value; but there are other points of seacoast and interior frontier which equally require protection, and the estimates submitted for these also are recommended to favorable consideration, under the belief that when completed these fortifications will be the most reliable, and by far the most economical, mode of defence the government could provide. An opinion has to some extent prevailed that the growth of our country, the increased facilities of transportation, the application of steam to the propulsion of war vessels, and the improvement in implements of war, have lessened, if they have not removed, the necessity for fortifications upon our frontier. This is an opinion which is apt to result from a long continued state of peace, and which history teaches has been usually abandoned when nations have been subjected to the test of defensive war. President Monroe, than whom few will be considered higher authority on this subject, in a special message to Congress, March 26, 1822, urged the completion of the system of defences which was adopted immediately after, and in view of the effects of the war of 1812, and urged his recommendation by the enormous expense, the waste of life and property, and the general distress of the country, which had resulted from the want of such preparations before the commencement of that war; and he further gave this impressive admonition: "Should another war occur before it is completed, the experience of the past marks, in characters too strong to be mistaken, its inevitable consequences; and should such war occur, and find us unprepared for it, what will be our justification to the enlightened body whom we represent for not having completed these defences?"

The increase of our population, attended by extraordinary progress in all the pursuits of peace, has not led to any change in the policy of our government which would indicate in the future a purpose to sustain a large military establishment, or to wage aggressive wars. If, then, in the future as in the past, the policy of our government is to be that of peace, and the citizens of the country are to be relied on for its defence whenever war shall occur, it is not perceived how the past or prospective growth of our country can remove the necessity or propriety of the proposed defences.

The Paixhan gun and other improvements in the implements of war, and the application of steam to the propulsion of vessels of war, seem to me rather to have increased than diminished the value of fortifications. The rapid progress of a steam fleet, by diminishing the opportunity for preparation after the point of attack is determined, increases the necessity of fortifying the main avenues of approach. The Paixhan gun adds to the efficiency, and consequently to the value, of fortifications; for the fire of large shells is more formidable to the timbers and rigging of a ship than to the masonry of a fort, and a steam vessel must expose a larger surface subject to injury than a sail vessel of the same class.

The report of the Secretary of War, in answer to a resolution of the House of Representatives of the 3d of March, 1851, containing the views of the chief engineer of the army and other officers of that corps and of the navy, presents the whole subject under consideration so fully, that it is not deemed necessary to add more on this occasion.

The action of Congress at its last session is considered indicative of the intention to continue this system of defence, and gives reason to hope, that the appropriations asked for at this session for the further prosecution of these works will not be withheld.

The exposed and defenceless condition of the Pacific coast claimed and received the early attention of the department, and prompt measures were taken for the application of the appropriation made at the last session of Congress for the defence of the harbor of San Francisco. But the minute examinations requisite before the commencement of the works, and the inquiries to be made as to the places of supply and the means of procuring materials, have limited operations to the preliminary preparations for construction, such as erecting the requisite accommodation for workmen, levelling sites, and making the detailed surveys for the fortifications.

At the last session of Congress an appropriation of $150,000 was made to ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean; and the act required that the several reports relative to the explorations should be laid before Congress on or before the first Monday of February, 1854.

The time allowed, and the money appropriated, it is feared, will prove insufficient for the complete solution of this important problem. A vast extent of country was to be accurately surveyed, and numerous lines, thousands of miles in extent, to be examined; and it is hardly, therefore, to be hoped that such data can be collected as will satisfactorily answer the question proposed. But it is confidently believed that much information will be added to the stock previously possessed, perhaps enough to determine the practicability of the proposed enterprise.

The following general sketch of the country to be explored will give some idea of the magnitude of the examination required:

The western portion of the continent of North America, irrespective of the mountains, is traversed, from north to south, by a broad elevated swell or plateau of land, which occupies the greater portion of the whole space between the Mississippi river and the Pacific ocean. The crest of this plateau, or the water-shed of the country, is nearly midway between the Pacific coast and the Mississippi. It may be represented on the map by an undulating line traced between the head-waters of the streams which flow eastward and those which flow westward. It divides the whole area between the Mississippi and the Pacific into two nearly equal portions—that on the east being somewhat the larger. This crest of the water-shed has its greatest elevation in Mexico; and thence declines to its lowest point about the latitude of 32°, where it has a height of about 4,500 feet, between the waters of the Rio Grande and those of the San Pedro, a tributary of the Gila. From this parallel it increases in altitude northward, and reaches its maximum near the 38th parallel, where it is about 8,000 feet high. Thence it declines as we pass northward; and, in latitude 42° 24′, it has an elevation of, say 7,000 feet; and in the latitude of about 47° it is reported to be at least 1,000 feet lower. The heights here given are those of the lowest passes over the crest or water-shed of the great plateau of the country, and not those of the mountain peaks and ridges which have their base upon it, and rise, in some cases, to the height of 17,000 feet into the region of perpetual snow.

The slope of the plateau, on the east and south, towards the Mississippi and the Gulf of Mexico, is comparatively gentle; and in Texas is by several steps, of which the highest is that known by the name of the Llano estacado, or Staked plain. It is traversed by the Missouri, the Platte, the Arkansas, and other large rivers which rise among the mountains near the crest, and flow eastward and southward in channels sunk beneath the general surface level of the plains.

In latitude 42°, near the source of the Platte, it has an elevation of about 5,000 feet above tide; and in the same latitude on the Mississippi, about 1,000 feet. Towards the sources of the Arkansas, in latitude 36°, it has a height of 4,000 feet; and in the same latitude on the Mississippi, 275 feet. These elevations give an average declination, eastward, to the whole plain, of about four and a half feet per mile, and southward of about two and a third feet.

The crest of the plateau, and nearly the whole of its western portion to the Pacific, is occupied by a great mountain system—the continuation of the Andes of South America. It has a variable breadth, narrowest, within our possessions, near the Gila, in latitude 32°, where it has a width of about 500 miles, and attains its greatest expansion in the parallel of 40°, where it occupies a space of about 900 miles. On this mountain base, as has been said before, are situated a series of elevated peaks, ridges, and ranges. Those on the eastern side are nearly continuous for about 900 miles, and known by the name of the Rocky mountains; those on the western side are perhaps less continuous, though equally elevated above their base, and designated as the Sierra Nevada, Coast Range, Cascade mountains, &c. The whole space between these extreme ranges is occupied by high peaks, and in various directions by a series of ridges, including elevated valleys, and forming great basins, having no outlet to the sea. The most important of these is Salt Lake basin, having an elevation of 4,100 feet.

This mountain region is not, as is frequently supposed, a single chain, but a system extending from a little east of the crest of the watershed to near the shores of the Pacific, and occupying about one-half of all the space between the Mississippi and the Pacific ocean. The position of this belt of mountain region, stretching from north to south, gives rise to a peculiarity of climate and soil. Fertility depends principally upon the degree of temperature and amount of moisture, both of which are much affected by increase of elevation; and the latter, also, depends on the direction of the wind. The upper or return current of the trade wind, flowing backward towards the northeast, gives a prevalence of westerly winds in the north temperate zone, which tends to spread the moisture from the Pacific over the western portion of our continent.

These winds, however, ascending the western slope of the mountain ridges, are deprived of their moisture by the diminished temperature of the increased elevation; and hence it is that the plains and valleys on the eastern side of the ridges are generally parched and barren, and that the mountain system, the highest chain of which, known as the Rocky mountains, by presenting as it were a screen against the moisture with which the winds from the west come laden, has for its eastern margin a sterile belt, which probably extends along the whole range, with an average width of about 250 miles.

These general views, derived as they have been from imperfect data, may yet serve to give some idea of the immense magnitude of the work necessary to construct a railway from the Atlantic to the Pacific. No work for artificial communication has ever exceeded it in extent and physical difficulty. Its execution, however, is within the means and power of the American people. The degree of practicability, and the comparative economy and eligibility of routes, cannot be determined without accurate instrumental surveys. An error in the selection of the route may involve the useless expenditure of many millions, and the ultimate value of the work; for this choice should not depend alone on apparent ease of construction, but also upon the productive character and general resources of the country through which it passes.

From the foregoing sketch, it will be perceived that the lines of exploration must traverse three different divisions or regions of country lying parallel to each other, and extending north and south through the whole of the western possessions of the United States. The first is that of the country between the Mississippi and the eastern edge of the sterile belt, having a varying width of from 500 to 600 miles. The second is the sterile region, varying in width from 200 to 300 miles; and the third, the mountain region, having a breadth of from 500 to 900 miles.

Explorations show that the surface of the first division, with few exceptions, falls in gentle slopes from its western boundary to the Mississippi at the rate of about six feet to the mile, and that it offers no material obstacle to the construction of a railway. It is, therefore, west of this that the difficulties are to be overcome. The concurring testimony of reliable observers proves the second division, or that called the sterile region, to be so inferior in vegetation and character of soil, that it has received, and probably deserves, the name of the desert. The construction of a railway through this region will be attended with obstacles which, though not insurmountable, will be scarcely less difficult to overcome than the elevations in the mountain passes of the next division.

Report also gives the character of extreme sterility to much of the country embraced in the mountain region; yet, in the conflict of opinion on this subject, and amid the variety of accounts which have been given of it, doubts have arisen in the minds of many as to the possibility of the existence of such extensive regions within our possessions unsuited to the purposes of man. To settle this question, with which the construction of a railway is intimately connected, the parties have been instructed to collect all the facts which may have a bearing on the capacity of these regions to support human life.

It was necessary, before determining what routes should be explored, to examine the information which had already been obtained. Only three parties had extended their explorations with proper instruments from the Mississippi to the tide-waters of the Pacific. The first and most northern was by the way of what is called the South Pass and the Sierra Nevada. The second, through Santa Fé, the copper mines, and along the Gila; and the third, by the way of the Zuni river and the Colorado.

Other surveys have been made with barometric levels over detached portions of the region to be explored. The information thus obtained, though limited, is specific as far as it goes, and gives just ideas of the elevations and other obstacles to be surmounted. Much valuable and reliable information has also been furnished by the Mexican boundary survey.

The explorations of Lewis and Clarke, who crossed to the Pacific, and those of Colonel Long, while they throw much light on the general geography and topography of the country, and have served to indicate the routes to be explored, do not give profiles of the regions passed over.

Reports from travellers, who have gone over the continent entirely without instruments, are as various and conflicting as the routes themselves, and even of the same route totally different accounts are given. Any information other than that based on accurate instrumental measurement, though it may be of some importance in indicating routes to be surveyed, is of little value in determining the question of a railway. It is necessary for this purpose to have well-determined facts and not vague impressions.

The expedition of Lewis and Clarke showed the probability of a considerable indentation in the crest of the water-shed of the continent near the forty-seventh parallel of north latitude, and indicated the possibility of a railway route in this region, from the head-waters of the tributaries of the Missouri across to those of Clarke's river.

The party first organized under the act of Congress was the one to explore this line, which claimed the earliest attention, from the known severity and length of the winter, and the necessity of commencing operations early in the year. It was placed in charge of Governor Stevens, of Washington Territory, who was directed to operate from St. Paul's, or some eligible point on the Upper Mississippi, towards the Great Bend of the Missouri river, and thence on the table land between the tributaries of the Missouri and those of the Saskatchawan, to some eligible pass in the Rocky mountains. A second party, commanded by Captain McClellan, under the direction of Governor Stevens, was directed to proceed at once to Puget sound, and explore the passes of the Cascade range, meeting the eastern party between that range and the Rocky mountains.

Taken in geographical order, the next survey directed to be made was that entrusted to Captain Gunnison, corps topographical engineers. He was instructed to explore the route near the thirty-eighth parallel of latitude, by the Huerfano river and Coochu-to-pa, or some other eligible pass, into the mountainous region of the Grand and Green rivers, and westwardly to the Vegas of Santa Clara and Nicollet's river of the Great Basin; and thence northward to the vicinity of Lake Utah. Reliable information, furnished by persons who had been extensively connected with the western explorations of the government, gave sueh assurance that no railway pass could be found north of Kern river, into either the Sacramento or San Joaquin valley, that it was not deemed proper to expend any part of the limited means appropriated in such a search; and having learned that the Mormons of the Great Salt Lake were making a survey for a railroad from their settlement to Walker's pass, Captain Gunnison, whose former intercourse with their engineer would enable him to obtain whatever information he possessed, was directed to procure a report of that survey, thus connecting his line with the survey ordered to be made near the thirty-fifth parallel.

Postponing for future operations, if further surveys shall be ordered, the exploration of a route from Salt Lake across the Sierra Nevada to the valley of the Sacramento, Captain Gunnison was directed to return from the Great Basin through the Timpanago cañon, or other passes, and across the Weber and Bear rivers, by the coal basin, to such point of disbandment as his discretion might direct.

The next line is that near the thirty-fifth parallel, which is in charge of Lieutenant Whipple, of the corps of topographical engineers. He was directed to ascend the valley of the Canadian river, to pass round the mountains east of the Rio del Norte, and enter the valley of that river at some point near Albuquerque; thence to extend his explorations west through Sierra Madre and the mountains west of the Zuni and Moqui countries, to the Colorado of the west; and, proceeding in the direction of Walker's pass, to continue his survey by the most direct and practicable line to the Pacific ocean. Much testimony in favor of the practicability of this line indicated it as a proper route for exploration.

Another line further south is that suggested by the surveys of Major Emory in 1846, and those of the boundary commission of the last two years. This may be called the line of the 32d parallel. It passes around the extremity of the Guadalupe mountains of Texas, in about latitude 31°, and crosses the Rio Grande near Dona Aña, or Frontera, in about latitude 32°, and thence follows the table lands west to the San Pedro river, and thence along the Gila river to its mouth. A portion of this line passes through the territory of Mexico, and another portion is north of the line of operations of the boundary commission, and consequently these were not included in the boundary survey. The gaps thus existing in this line are to be filled up by the survey of Captain Pope, and that under the direction of Lieutenant Parke, both of the corps of topographical engineers. The instructions to the latter were not given until recently, because the survey with which he is charged requires a part of the line to be run within the limits of Mexico. The Mexican government have, however, removed the difficulty, by granting authority to the United States to make all explorations necessary to determine the practicability of a railway route in this region.

Several partial routes on the Pacific side, to connect, as before described, with those from the east, were directed to be surveyed by Lieutenant Williamson, of the corps of topographical engineers. He was instructed to examine all the passes eastward, from the valley of the San Joaquin and the Tulare lake, and subsequently to explore Walker's and other passes which exist in the high range of mountains, apparently the southern continuation of the Sierra Nevada. The experience of almost every party which has crossed the continent shows the necessity of fitting out a separate party, on the shores of the Pacific, to explore the Sierra Nevada, and the other elevated ranges near that coast. Parties reaching these great barriers from the Atlantic side are too much fatigued and exhausted to make elaborate surveys. It is also necessary that these parties should commence operations early in the spring, in order to complete the field work before the heavy snows interrupt progress.

Copies of the instructions given to all the parties are hereto appended. From these it will appear that the officers of the different expeditions have been directed to observe and note all the objects and phenomena which have an immediate or remote bearing upon the railway, or which may serve to develop the resources, peculiarities, and climate of the country. For this purpose they have been supplied with full sets of instruments for determining the latitude and longitude of places, the courses and distances of the routes, and the topography of the country on either side, within accessible distances; with the means of ascertaining the variation of atmospheric pressure, and other meteorological phenomena; and two of the parties with instruments to determine the direction and intensity of the magnetic force. They have been instructed to observe the prevailing direction of the wind, the amount of rain, the degree of temperature and humidity of the atmosphere. They are also required to report on the geology of the country, to gather specimens of the different rocks and soils, to make collections of the plants and animals, and to collect statistics of the Indian tribes which are found in the regions traversed. The information which will be derived from this series of observations will be of much value in establishing the capacity of the country to sustain population and furnish articles of commerce. The astronomical observations are indispensable in fixing the geographical position of the principal points of the route, and for improving the map of our western possessions. The magnetic observations are of importance, in accurately tracing the line between the points determined by astronomical observations. It is well known that the magnetic needle has an irregular and sometimes fitful variation, amounting to a difference of eighteen degrees between Washington city and the western coast of Oregon, and the law by which this variation is increased or diminished has not been ascertained.

The meteorology of the country has a direct bearing on the question of the construction of a railway. The amount of snow which will probably be found along the route should be ascertained, and this will depend on the temperature and humidity of the place. As we advance to the north the amount of vapor diminishes, and hence the quantity of snow which falls will be less; but, on the other hand, it will lie longer, on account of the diminution of temperature. It was therefore deemed proper that the hygrometrical state of the atmosphere should be measured by suitable instruments, and the mean temperature ascertained by thermometrical observations of the soil at a few feet below the surface.

A knowledge of the geology of the country is important, as affording essential data relative to the construction and use of the railway. It teaches, in advance of an expensive experience, the obstacle which will be presented by rocks to be excavated, and their fitness for use in masonry, and discloses the presence of sand, which may drift over the track, or damage the rubbing parts of the machinery. From the character of the geological formation is to be inferred the probability of the existence of coal; and, from the dip and strata of the rock, the feasibility of procuring water by artesian wells for the use of the engines; and whether or not the supply may be extended beyond this want, and happily serve for the irrigation of the land. Should this last result be obtained, it would furnish the means to convert a sterile waste into a fertile region, and add to the power and wealth of the United States, by extending their settlements in a continuous chain from sea to sea.

Observations were directed to be made as to the zoology and botany of the country, which enter into the question of the choice of routes, because they are indicative of the capacity of the country to sustain life and furnish materials for construction.

Allusion has been made to the inadequacy of the appropriation for surveys to ascertain the best route for a railroad from the Mississippi river to the Pacific ocean. In determining the route of ordinary railroads through thickly-settled countries, of easy access, one-half per cent. on the actual cost of construction is not considered too liberal an allowance for the preliminary surveys; and therefore it cannot be expected that the best line of a road which has been estimated to cost one hundred millions of dollars can be located, through an uninhabited and comparatively unknown region, for one hundred and fifty thousand dollars.

There is but little doubt that the best line which can be chosen will present a combination of nearly all the obstacles which have up to this time been successfully encountered by the art of the engineer, and that any haste or negligence which should cause an improper location of the road to be made must lead to consequences which would endanger the success of the whole enterprise.

A striking illustration of the value of opinions not based on instrumental survey is presented in the developments made by Lieutenant Williamson's exploration of Walker's pass. It will be remembered that this famous gap was considered a fixed point, and the various speculations on routes, differing in everything else, generally concurred in tending to Walker's pass. Recent information from Lieut. Williamson establishes the fact that this pass is impracticable for a railway.

The information which has been received from the parties now in the field is too limited and imperfect to justify an opinion on the question proposed by the act of Congress. When the reports of these parties shall have been received, or at the date prescribed by Congress, it is my purpose to submit a condensed statement and map, exhibiting all the reliable information possessed, with profiles annexed of all instrumental surveys which have at any time been made, and which serve to answer the inquiry contained in the act of appropriation under which surveys are now in progress.

If I seem to have pressed the magnitude of the obstacles to a successful execution of the contemplated work, it has not been to suggest the abandonment of the undertaking, but only to enforce the propriety of much caution in the preliminary steps, and the necessity for concentrating all the means which can be made available to the completion of so gigantic a project.

Preconceived opinion or prejudice, personal interest, and sectional rivalry, must be held subject to the developments of instrumental survey, and subservient to the purpose of final success, or the result to be anticipated is failure. And when from the consideration of the magnitude of the difficulties to be overcome we pass to the importance of the effects to be produced, there is enough to sustain patriotism in the sacrifice of any personal or local interest which may be involved. Its commercial and agricultural advantage, its political and military necessity, have attracted the attention and excited the interest of our whole country. Congress has, by its appropriation, manifested the purpose to obtain such information as will secure a proper location of the road. The necessity for more rapid means of communication has been referred to in other parts of this report when treating of the defence of our southern boundary, the western territory, and the Pacific coast. Duties and interests of vital importance, other than these, arise in the consideration of the construction of a railroad to the Pacific, but, as they do not fall under the charge of this department, I have not attempted to present them; nor have I deemed it proper, in this communication, to offer my views as to the means or the mode by which the general government may constitutionally aid in the attainment of the contemplated object.

The absence of navigable streams in a large portion of our recently acquired territory, and the existence of the vast arid and mountain regions already described, have entailed upon the government a very heavy charge for the transportation of supplies, and for the service of troops stationed along our new frontier, and operating against the predatory and nomadic Indians of those regions. The cost of transportation within that country, for purposes connected with military defence, amounted in the year ending June, 1853, to $451,775 07.

The modes of transportation now used—wagons drawn by horses, mules, or oxen—besides being very expensive, are necessarily circuitous in the routes travelled, slow, and generally so unsatisfactory as to prompt inquiry for means which may be attended with better results. In any extended movement these wagon trains must depend upon grass for forage, and their progress will seldom average more than twelve miles per day. It often happens, in traversing the country just referred to, that long spaces are encountered in which there is neither grass nor water; and here the consequence must be, severe privation and great destruction of the animals employed, if not the failure of the objects of the expedition. These inconveniences are felt in all movements between the distant posts of that section, and seriously obstruct, sometimes actually defeat, the pursuit of the mounted Indians of the plain, who, by their intimate knowledge of the places where the small supplies of water and grass are to be found, are enabled to fly across the most arid region, after having committed depredations on our frontier population, or upon the trains of merchants and emigrants.

Beyond the difficulties here contemplated in connexion with transportation to the interior, it is proper to look to those which would arise in the transportation of supplies for the defence of our Pacific coast in the contingency of a war with a maritime power. Our experience has been confined to a state of peace, and to the use of routes of communication which pass beyond the limits of our territories. Reasoning from the difficulties which have been encountered in supplying points where it was necessary only to traverse a part of the space which lies between the Pacific coast and the points of supply, it may be claimed as a co - clusion that it would not be practicable, with the means now possessed, to send across the continent the troops, munitions, and provisions which would be required for the defence of the Pacific coast. A railroad, such as has been contemplated, to connect, by the most eligible route, the Mississippi river with the Pacific ocean, would but partially remove the difficulty. It would serve to transport troops and to supply depôts along the route and at the extremity of the line, but there would still be a vast region of the interior too remote from its depôts materially to feel its effect.

On the older continents, in regions reaching from the torrid to the frozen zone, embracing arid plains and precipitous mountains covered with snow, camels are used, with the best results. They are the means of transportation and communication in the immense commercial intercourse with central Asia. From the mountains of Circassia to the plains of India they have been used for various military purposes—to transmit despatches, to transport supplies, to draw ordnance, and as a substitute for dragoon horses.

Napoleon when in Egypt used with marked success the dromedary, a fleet variety of the same animal, in subduing the Arabs, whose habits and country were very similar to those of the mounted Indians of our western plains. I learn, from what is believed to be reliable authority, that France is about again to adopt the dromedary in Algeria for a similar service to that in which they were so successfully used in Egypt.

For like military purposes, for expresses, and for reconnoissances, it is believed, the dromedary would supply a want now seriously felt in our service; and for transportation with troops rapidly moving across the country, the camel, it is believed, would remove an obstacle which now serves greatly to diminish the value and efficiency of our troops on the western frontier.

For these considerations it is respectfully submitted that the necessary provision be made for the introduction of a sufficient number of both varieties of this animal, to test its value and adaptation to our country and our service.

In connexion with the means to be adopted, to overcome existing difficulties in the transportation of troops and army supplies, I further invite your attention to the condition of Fort Yuma, at the junction of the Gila and Colorado rivers. It is now supplied from San Diego, by the overland route, at enormous expense.

Attempts have been made to send supplies through the Gulf of California and the Colorada river; but the latter, by reason of the shoals at its mouth, not being practicable for sea-going vessels within a considerable distance of our southern boundary, it becomes necessary, at some point within the limits of Mexico, to transship on light-draught boats, or to haul the stores across the Mexican territory. The importance of possessing a port for this purpose is too apparent, under existing circumstances, to require or justify explanation.

The works of harbor and river improvement have made satisfactory progress during the past season, under the direction of the chiefs of the two corps of engineers; to whose reports, herewith submitted, I refer for particular information in regard to them. These reports have been made in more than usual detail, in order to embrace the information which the Senate, by a resolution passed the 3d of March last, requested the departmeut to transmit with the annual report.

The appropriations for these works having been made in August, 1852, the arrangements for executing a large majority of them had been made before I entered upon the duties of this department. In determining upon the few plans that have been submitted to me, my view has been that such only should be adopted as could be executed with the existing appropriations. The general provision in regard to these works is a simple direction to apply a certain sum to a specified object, without any intimation of an intention on the part of Congress to make further appropriations, and I deemed it to be improper to expend those appropriations in commencing works on a scale which the department has not means to complete, and which must in a great measure be lost, unless Congress make further appropriations for them. These views, however, were not held by the department when most of the works authorized by the act of August, 1852, were planned; but the mode, extent, and cost of the several improvements, seem to have been considered as matters of discretion, and the plans adopted for their execution do not appear to have been governed in regard to cost by amounts of the appropriations, but would require for their completion large additional grants, amounting in some cases to almost tenfold the original appropriations. In some cases corporations and associations of citizens have come forward with offers of voluntary contributions in aid of the appropriations made by Congress; but as it was not deemed competent for this department to receive money from such sources, either by way of loan or gift, a regulation was adopted, under which States, cities, corporations, or individuals, desiring to aid any work, are permitted to construct portions of it under the direction of the officer in charge, who superintends their operations, and audits the accounts for work done, for payment by the contributing parties, but does not receive the money, or assume any control whatever over it. Such parties, moreover, have been distinctly informed that they were to have no claim whatever upon the government for reimbursement of the expenditure thus made by them.

In the prosecution of these works of internal improvement, the department has encountered some of those difficulties which were to be expected from the indefinite nature of its powers in regard to them. In a recent case, the right of the United States to a pier erected for the improvement of a harbor was disputed by the riparian proprietors. The pier, which had originally abutted on their lands, caused an accretion which followed its extension far into the lake, and these parties, who were entitled to the accretion, claimed the pier also, as attached thereto. The United States having possessed no title to the submerged soil, or other jurisdiction than that claimed by the general government over navigable waters, the question involved the power to preserve the work. In another case, the improvement of the navigation of a river entirely within the limits of a State, and for which an appropriation had been made by Congress, was found already to have been undertaken by a company under a State charter granted for that purpose. It happened, in both cases, that circumstances existed which rendered an accommodation easy; the riparian proprietors, wanting the pier only for a wharf, were content to hold possession under the government, waiving the question of title; and the navigation company were willing that the appropriation should be expended in furtherance of the object for which it was made, the plans of operation fortunately concurring, so that satisfactory terms were agreed upon. It is manifest, however, that cases might readily occur, and probably will occur, where the interests of opposing parties cannot be brought into harmony; and I do not feel that the government is acting prudently in expending large sums upon objects which may be converted to individual profit.

Referring to the earlier action of the government upon this subject, we find, in several statutes prior to 1823, the cession of jurisdiction made a condition precedent to the construction of particular works of harbor improvement; and it appears by the language of the act of May 7, 1822, (3 Statutes, 699,) that such cessions were understood to be necessary in all cases, but the requirement was thereafter discontinued, and the practice of obtaining cession of jurisdiction ceased also.

Subsequently, in view of the danger of eviction from public works after the expenditure of large sums of public money upon them, a joint resolution, approved September 11, 1841, required that no public money be expended upon any site or land thereafter purchased for armories, arsenals, forts, fortifications, navy yards, custom-houses, light-houses, or other public buildings whatever, until the written opinion of the attorney general shall be had in favor of the validity of the title, and also the consent of the legislature of the State in which the land lies shall have been given to the purchase. But, so far as I am advised, this department has not construed this act to apply to the sites of structures for the improvement of harbors or rivers, or deemed it necessary to purchase land, either with or without the consent of the legislature of the State, for any such purpose.

The legislation of Congress, and the past action of this department, both having necessarily received the approval of each President under whose administration they occurred, did not leave me at liberty to regard it as an open question, whether or not the act does properly include within its meaning such constructions as are made for the protection and improvement of harbors and rivers. To guard against the conflict of jurisdiction, which may equally arise on the site of a pier, a jettee, or breakwater, as upon that of a fort, dock-yard, or custom-house, and warned by recent experience of the probability of such occurrence, it is submitted whether future appropriations, if any shall be made for such constructions, should not be subjected to the requirements of the act of 1841 above referred to, and the conduct of the government thus be made to correspond with its earlier action, and conform more strictly to the provisions of the 8th section of the 1st article of the constitution in relation to the purchase of places for the erection of forts, magazines, arsenals, dock-yards, and other needful buildings.

The difficulties here referred to would be readily avoided by adhering to the practice of the earlier period of the government, in giving the consent of Congress to the laying of tonnage duties by the States for works of internal improvement, or by pursuing the policy recommended by President Monroe, and restricting the appropriations to works to be commenced and executed under State authority. The barrier thus sought to be interposed by President Monroe rested on a distinction which seems soon to have been forgotten or disregarded; and in 1848 President Polk endeavored to restore the government to its original policy, proposing, as a substitute for appropriations from the public treasury, that by State legislation, and with the consent of Congress, tonnage duties should be laid for purposes of harbor and river improvement. This mode, than which none could be more equitable, none more consistent with that principle of equal burdens and benefits to every section which pervades the constitution and characterizes all its provisions, would certainly avoid that conflict of jurisdiction to which attention has been invited, and in all places having a considerable commerce, subject to the imposition of tonnage duties, would be entirely adequate.

For the protection of ships-of-war and of commerce from storms and the attacks of hostile fleets, lake and seacoast harbors of refuge are essential adjuncts to other means of national defence, and intimately connected with the maintenance of a navy. As such harbors would sometimes have little or no commerce, and then special duties and taxes could not be made available for their improvement and protection, it would be requisite in such cases to treat the constructions as government works, and to acquire the right of soil and jurisdiction over the site.

The public right of use of all the navigable waters of the United States belonging equally to all their citizens, and some of the rivers of our country washing many States, and consequently not subject to the jurisdiction of either, these national highways bear peculiar relations, as such, to the powers and functions of the general government. Its dependence upon them for the transportation indispensable for the defence of the frontiers, and the other vast interests which are involved, are so well known that it cannot be necessary to enforce or elucidate them.

In considering these necessities and interests, one is forcibly reminded of the change which has occurred in the condition of our country since the date when the Union was founded.

Population and commerce are no longer confined to tide-water and the neighborhood of the seacoast, but the unexplored wilderness has become the seat of populous States and of commercial cities. The application of steam to river navigation has borne the tide of commerce for thousands of miles beyond the tide of the sea; and a case is herein presented which the framers of the constitution could not have anticipated or specifically provided for.

If the enjoyment of this public right, and the interest and convenience of the general government, shall be deemed sufficient to warrant further operations for the removal of temporary and accidental obstructions in their natural channels, additional appropriations will be required for the expenses of the steam dredges and snag-boats; but if Congress shall decide to discontinue their employment for this purpose, it will be advisable that directions should be given to dispose of the boats and other means which have been provided for their use, before deterioration and decay shall have rendered them valueless.

Within a few years past an unusual number of suits have been brought against officers of this department, some being actions for damages for acts done by officers in the performance of their duty, and others attacking the title of the government to public property of great importance, or involving rights of more or less consequence. It has been usual, when the department has employed counsel, to engage in preference the services of the district attorneys; but it is not their duty to attend to such suits, and it is therefore necessary to make special contracts with them, in the same manner as if they were not in the public service, and to pay their fees from the contingent fund of the department. It would, in my opinion, be for the public interest that the district attorneys should be required by law to take charge of all suits involving the interests of this department; and that their fees for such service being regulated by law, should be audited and settled by the proper accounting officers.

The survey of the lakes, as it progresses, continues to afford results of practical usefulness.

No appropriations for military and geographical surveys west of the Mississippi have been made for some years past; but with the remains of former appropriations, some explorations, promising results of much value, have been undertaken. It is to be hoped that Congress will concur in the expediency of continuing these appropriations, which have afforded the means of obtaining that general information respecting the interior of the continent which is so necessary to the government, and of such essential advantage to the population now spreading itself over those territories.

Contracts have been made for the continuation of roads in Minnesota, agreeably to the provisions of the act of January 7, 1853, making appropriations therefor. An act of the same date directs the construction of two military roads in Oregon. Each of these was placed in charge of a competent officer, with instructions (copies of which are annexed) to locate and mark the line of the road as speedily as possible, and so to direct his operations as to secure a practicable wagon road for the benefit of the fall emigration and other travel. The commencement of one of these works was delayed by the difficulty with the Rogue River Indians; but a contract was made for rendering the other, from Walla Walla to Steilacom, passable by the 15th of October last, and it is presumed its conditions have heen fulfilled.

By the third section of the law approved March 3, 1853, it is enacted, "that the Secretary of War be directed to report to Congress whether, in his opinion, it would not be more economical, proper, and advisable, to cause all the arms of the United States to be made by contract." In complying with this requirement, I shall exclude all political considerations involved in the question of manufactures by the general government; and, as I suppose was intended, confine the expression of opinion to the relations the subject bears to the military service, and to the relative merit of the existing system, and that of contracting for the manufacture of all arms. Viewing the armories as a part of the military preparations for the common defence, it is deemed essential that they should be under the control of the War Department, and advantageous, if not necessary, that such establishments should exist under the charge of competent and experienced officers of the army, to the end that a uniformity may be obtained, and all the improvements and efficiency secured, which professional zeal and skill would seek and produce. To this, the existing state of the case, as a standard, I have referred the proposition to make all arms by contract, and have reached the following conclusions:

1. As to the economy of the measure. Under a proper administration of a national armory, it is believed that arms can be obtained

cheaper by government manufacture than by contract. Labor and all materials may be obtained upon as good if not better terms by the public than by private armories, because of the greater promptness and security of payment. The permanence of employment must constitute an inducement to workmen to enter the national workshops. But suppose these things to be equal, and the disadvantage cannot certainly be on the side of the government, it follows that the original cost would not be greater in the public than in the private armory. To this, in the case of the government manufacture, there is nothing to add; but in the case of the private contractor there must be a profit on the manufacture, not only sufficient to cover the interest on the investment, but also the hazard which will attend a contract necessarily made for a short period. Experience has established several facts which seem to my mind conclusive as to the economy of the present mode of manufacturing small arms. Since the year 1840 the cost of making *muskets* has been so much reduced as to exclude competition, and no contracts for them have since that year been made. The price paid for those then contracted for was as high as $16 25 for some, and not less than $14 50 for the residue. At the national armories the prices averaged about $10 for muskets. Since 1840 the contract price for rifles, based on the cost at the national armories, has been reduced from $14 50 to $11 62½ each, which exceeds the cost of that arm at Harper's Ferry armory, during the last fiscal year, by $1 60.

Without the practical knowledge of the actual cost of manufacturing arms now secured to the government by the results at the national armories, there would be no standard for determining proper rates for contracts, and without the means which these armories afford to supply the wants of government, there is reason to believe it might be subjected to extraordinary prices for arms required from time to time.

2. As to the propriety of the measure. It is believed that national establishments for the manufacture of arms are necessary, to improve their models and to keep up the standard of materials and workmanship. Whilst the interest and professional reputation of an officer of the army in charge of a national armory would impel him to introduce all improvements, his military associations would lead him to learn, and his military experience teach him, the value of new modifications, made either in his own or other countries. On the other hand, the interest of the private contractor would be to reproduce indefinitely the model originally furnished to him; because every change would require either the abandonment of his tools, machinery, &c., or a modification to adapt them to the manufacture of the improved model. For this reason, and also because his workmen would be less expert upon a new modification than upon a form to which they were accustomed, every change would be to the contractor an evil in which he would see increased trouble and diminished profits.

The national armories are also necessary to keep up the standard of workmanship and finish in the contract establishments. The arms made by contract are subjected to inspection by workmen detached from the national armories for that purpose. These inspectors, when not employed in the contract service, resume their positions at the national armories, and return to each contract inspection with a refreshed recollection of the standard of excellence of the government work. This advantage would be lost if all arms were made by contract; and the tendency would be steady deterioration by the slow and imperceptible sinking of the standard, instead of the improvement which has resulted from the furnishing of new models and constant improvements in the government manufactures, to which the inspectors require the contract arms to conform.

3. As to the advisability of the measure. If the views taken under the two other heads be correct, it follows that it would not be advisable to make all arms by contract. Neither would I think it wise to restrict the manufacture of all arms to the national armories. Pistols, for instance, are now made by contract, because the number required by government is so small that it was deemed more economical to procure them by contract than to provide the separate machinery and tools required for their manufacture, at least until a model for that arm shall be adopted more satisfactory than the one now in use, and likely, therefore, to be more permanent. Also small numbers of particular arms are sometimes required; and in such cases it may be better to procure them by contract than to provide the machinery required for their peculiar construction. But it is still more important that the government should have the power to contract for the manufacture of arms in the event of an exigency under which a greater number might be required than the public armories, upon a scale adapted to ordinary circumstances, would be able to supply. Instead of any conflict in the use of the two modes of supply, they are believed happily to harmonize in the production of cheap and effective firearms. In the last case supposed, the government establishment would furnish the models to private contractors and serve as a guide to fix the price which should be paid; whilst it would protect the government from being driven, by its necessity, to submit to extraordinary demands and perhaps injurious delays.

It is believed that the excellence of the government manufacture has not been quite equalled by that of private contractors, even with all the advantages that now exist in supplying models and inspectors. Upon examination of a report made by the commander of the arsenal, to which the rifles used by the voltigeur regiment in the war with Mexico were returned, it appears that of the total number, five hundred and twenty-three, the two hundred and fifty-seven made at the national armory required the repair of forty-five of their parts—the two hundred and sixty-six made by contract required the repair of ninety-six of their parts; showing a difference in favor of the government arms of more than two to one. The case is believed to be a fair one, and to present conclusive proof of the higher standard of material and workmanship in the government arms.

It is not known whether, by the use of the term "all the arms of the United States," it was intended to include the heavy guns or cannon. I will however remark, that all cannon are now made by contract, Congress having made no provision for a national foundry; and will take this occasion to recommend an appropriation for that object The just admixture of metals, and the casting of bronze pieces require much mechanical skill and no little scientific attainment. The examination of ores, and the casting of iron into cannon, are subjects which, have attracted much consideration from the Ordnance department, and present a wide field for further investigation and experiment. The rigid inspection which such guns now receive has improved, and is still improving, their quality; but it is believed there would be a more rapid advance in knowledge, and a higher standard of excellence attained, if the advantage of a national foundry were possessed.

While on the subject of procuring arms for the United States, I deem it proper to refer to a matter which has heretofore received attention and been the subject of frequent inquiry—that is, the establishment of a national armory on the western waters. The propriety of having such a national establishment in the west is generally conceded; and perhaps one reason why it has not been done is because the two United States armories at Springfield (Massachusetts) and Harper's Ferry (Virginia) are sufficient for the manufacture of all the arms required by the government, and the wants of the country in this respect do not require a third. When the two armories were established, they were necessarily both located east of the Allegheny mountains, because the manufacturing facilities of the west were then undeveloped, and neither the material nor the labor requisite for them was of easy procurement there. Now, however, the case is just the reverse.

Besides the more equal and equitable distribution of these national establishments, geographically, the removal of one of them to some proper site on the western waters would be a more convenient and economical arrangement than that now existing. It would save the cost of transporting from a manufactory in the east all the arms required for use and distribution in the western part of the country, either for the government or the militia of the western States. All the materials required for the manufacture of arms are more abundant and cheaper in many places of the west, where motive power, either by water or steam, is readily attainable, and where the services of skilful artisans are to be readily had to any desirable extent and on reasonable terms. These considerations alone seem to render it advisable to establish a western national armory. But when to them is added the fact, that the eastern portion of the country has, for so many years, enjoyed a monopoly of these government manufactories, it appears to settle the question; and as but two armories are wanted to supply all the small arms for the United States, the removal of one of them westward seems the best way of effecting the object. The tools, machinery, and many of the most costly parts requisite for manufacturing, are not difficult of transportation, and may easily and at little cost be sent from either of the armories, and set up in suitable buildings previously constructed for the western armory. The transfer will thus leave no government property behind, but the buildings which may be usefully applied to purposes of private manufacture, and can doubtless readily be disposed of.

The work for the extension of the Capitol, which by your order of the 23d of March was transferred from the Department of the Interior to the War Department, has been prosecuted with due diligence under the special charge of Captain M. C. Meigs of the corps of engineers; and it gives me pleasure to bear testimony to the manner in which that officer has discharged his duty—fully sustaining his reputation for professional skill, zeal, and fidelity. He was placed upon this duty April 4, 1853, and directed specially to examine into the condition of the foundation, which had been previously laid, and minutely to inquire into the arrangements for warming, ventilating, speaking, and hearing.

A thorough examination of the foundation was made by excavating down to the soil upon which it rested, and by cutting at different points into or through the masonry. The result was a report that less hydraulic lime had been used than was desirable, but that the strength of the foundation was sufficient for the proposed structure. The arrangements for ventilation and hearing were not found satisfactory, and these being the great objects sought in the proposed extension, certain alterations in the plans were designed, and a board, composed of Professors A. D. Bache and Joseph Henry, was commissioned, May 20, 1853, to make inquiries upon acoustics and ventilation, as connected with the adopted plan and proposed alteration. The board visited and made various experiments in the principal public rooms of the cities of Philadelphia, New York, and Boston. After full examination of the various rooms visited, and a discussion of the phenomena presented, they reported on the 24th of June last in favor of the modifications of the plans for the extension of the Capitol as proposed by Captain Meigs.

To construct a room of sufficient dimensions for the House of Representatives, so as to secure to each member the power easily to make himself heard from his seat at every point in the room, was an object of such high usefulness in legislation, and a problem of such difficult solution, as to require thorough investigation, with all the aids which science could lend; and in view of the many unsuccessful attempts which have been made in our own and other countries to attain that result, success will be, in addition to its utility, an object of just national pride.

In addition to this special object, the modifications proposed were believed otherwise to increase the convenience and facilitate the intercourse of the houses of Congress, and materially to add to the architectural effect of the building. As soon as the plans submitted received your approval, the consequent changes in the foundation walls were pressed with all possible rapidity; and the work has, since then, been steadily prosecuted, without other delay than that which has necessarily resulted from occasional interruptions in the delivery of material; and these have been overcome, as far as might be, by purchases in other markets which could be made available. The stain which appeared upon the marble after it had been placed in the walls created some anxiety, and specimens were submitted to skilful chemists for analysis. The results gave assurance that the discoloration would disappear, and in some instances observation has sustained that expectation. This is the more gratifying, because the marble is of most beautiful quality, and it might not have been possible elsewhere to procure a material which would have corresponded with it.

I refer for further details to the accompanying report of Captain Meigs; and, with a view to a rapid completion of the building, recommend to favorable consideration the estimate presented by him for the fiscal year ending in 1855.

An appropriation was made at the last session of Congress for the purpose of bringing water into the city of Washington. In order to obtain an ample and constant supply, from a source so elevated as to avoid the necessity for the use of machinery, it was decided that the water should be brought from the Great Falls of the Potomac, through a conduit nine feet in diameter. Upon the adoption of this plan, immediate application was made to the legislature of Maryland, in which State the source of supply lies, for their assent to the proposed work, which being given on conditions readily complied with, some portions of the necessary land were selected and purchased, and as soon as the season would permit, a considerable force was put upon the work. The works are estimated to cost rather less than $2,300,000; and when completed will be capable of delivering nearly 70,000,000 gallons of water daily, at an elevation of fourteen feet above the upper floor of the Capitol. For further information and details, I refer to the report of the chief engineer.

I deem it necessary to invite attention to the condition of the public building occupied by this department, which contains accommodations for less than half its bureaus; and not being fire-proof, but on the contrary especially defective in its construction, does not afford proper security for the numerous papers and records, the loss of which would be irreparable. This subject has been repeatedly urged upon the attention of Congress by my predecessors, and I concur with them as to the necessity of providing a fire-proof building, of sufficient dimensions to accommodate all the bureaus connected with this department.

To the accompanying reports of the commanding general of the army and the chiefs of the several branches of the military service, I refer for full information in relation to the duties with which they are respectively charged. For the success which attends the administration of army affairs, we are in no small degree indebted to the ability, experience, and good faith of these officers. The report of the commanding general exhibits the distribution and numerical strength of the army, and shows how disproportionate our small military establishment is to the duties required of it. Professional skill, zeal, and fidelity, have done much to compensate for the want of numbers; but the increased privation, toil, and danger, incident to a service so varied and extensive, have greatly added to its list of casualties during the past year.

I have the honor to be, very respectfully, your obedient servant,

JEFFERSON DAVIS.

To the PRESIDENT.

List of documents accompanying Report of the Secretary of War.

INDIAN HOSTILITIES IN OREGON.

HEADQUARTERS CAMP ALDEN,
Rogue River, O. T.

SIR: On the 17th of August I received information at my residence, in Umpqua valley, that the Rogue River Indians, assisted by the Klamaths, Shastas, the bands living on Applegate and Grave creeks, had united and attacked the settlements in Rogue River valley, near Jacksonville; that a number of persons had been killed, a large amount of stock killed or driven off, and houses and grain burned; and that companies were being formed for the defence of the settlements and for the purpose of a general war upon the Indians.

I promptly notified the citizens of the neighborhood, and advised with Major Alvord, who was then present, engaged in the location of the road from Myrtle creek to Camp Stewart, and immediately proceeded, accompanied by Captain Armstrong, Messrs. Cluggage, Nickol, and some ten others, to the scene of hostilities. On the 21st I arrived at the headquarters of our forces, on Stewart creek, where I found Capt. Alden, of the 4th infantry, who had promptly, upon the first information being received by him at Fort Jones, on Scott's river, repaired to Jacksonville with ten men of his command, all who were fit for duty, and forthwith proceeded to take energetic measures for an active and effective campaign, by appointing four commissioners of military affairs, and mustering into service all the volunteers for whom arms could be procured. His force, on my arrival, consisted of companies under Captains Goodall, Miller, Lamerick and Rhodes, commanded by Col. John Ross, the whole under the command of Col. Alden. These troops had been actively engaged in scouring the country in all directions, and had succeeded in driving the main body of the Indians to their strongholds in the mountains; pack trains were being collected in view of an extended pursuit of the Indians, and all other preparations were being made with the utmost despatch.

At the request of Col. Alden and the troops I assumed the command of the forces, and on the 22d, at 4 o'clock a. m., left camp for the mountains, having divided the forces into two battalions in order better to scour the whole country.

One battalion, composed of Captains Miller and Lamerick's companies, under the command of Col. Ross, were directed to proceed up Evan creek, which emptied into Rogue river from the north, and continue on, if no traces of the Indians were found, until the two detachments should meet at a point designated; but if the trail was found, to follow it and bring the Indians to battle. At the head of the other battalion, composed of Captains Rhodes and Goodall's companies, commanded by Col. Alden, I proceeded by the way of Table Rock in the direction of the point designated on Evan creek. After advancing about fifteen miles beyond Table Rock I discovered the trail of the Indians, and encamped upon it. I took up the line of march early next morning, and followed the trail with great difficulty, the Indians having used every precaution to conceal it. The country was exceedingly mountainous and almost impassable for animals, and as the Indians had fired the country behind them, the falling of the burning timber and the heat delayed our progress, while the dense smoke prevented us from ascertaining with certainty the face of the country. About noon we came to the place at which they had encamped a few nights before, by the side of a stream in a dense forest; here they had killed a mule and a horse they had captured in a battle some days previous, and used them for provisions. From this point we had more difficulty in finding the trail, it having been very carefully concealed and the mountains lately fired, but after some delay we again struck it. Late in the evening we came to the main fork of Evan creek, now called Battle creek, where we came to a spot at which the Indians had again encamped.

Beyond this all trace of the Indians seemed to be lost, and after searching in vain for the trail until dark, we were forced to encamp. The valley was very narrow, and almost entirely covered with an impenetrable thicket of maple vines, leaving scarcely room for the men to lie down on the bank of the creek; the animals were closely tied to the bushes, there being no grass or forage of any kind.

The command was ready to move by daylight; a party on foot early discovered the trail, and after cutting out the brush for nearly a quarter of a mile, we succeeded in reaching it with the animals. About a mile further up we crossed Battle creek, and ascended a high steep mountain which forms the dividing ridge of the numerous branches running into Rogue river; this part of the country had not been fired. About 9 o'clock a. m. we arrived at another Indian camp on the ridge, at a spring very difficult of access on the side of a mountain. On leaving this camp we found that the woods had been recently fired, which induced me to believe that the Indians were not far in advance of us. About a half a mile from the spring, as I was riding slowly in front, I heard the crack of a rifle in the direction of the enemy; without halting, I proceeded to a point commanding the rapid descent of the trail from the mountain, and halting, could hear persons talking in their camp about four hundred yards distant, in a dense forest thick with underbrush, which entirely obstructed the view. As the troops came up, they were ordered in a low voice to dismount, tie their animals, and prepare for battle. Col. Alden, at the head of Capt. Goodall's company, was directed to proceed on the trail and attack the enemy in front, while a portion of Capt. Rhodes' company were directed to follow a ridge running to the left of their trail, and turn their flank. Col. Alden proceeded to engage them in the most gallant manner, his well-directed fire being the first intimation of our approach. It being found impracticable to turn their flank, Capt. Rhodes proceeded at once to engage them on their right; the men were now deployed, taking cover behind the trees, and the fight became general. I was delayed a few minutes on the hill for the arrival of the rear guard; these were dismounted, and all, except fifteen men, I immediately led into action. On arriving on the ground, I found Col. Alden, who had been shot down early in the fight, dangerously wounded, in the arms of his faithful sergeant, and surrounded by a few of his own men. The battle was now raging with great fierceness, our men coolly pouring in their fire, unshaken by the hideous yells and war-whoops of the Indians, or by their rapid and more destructive fire. After examining the ground, and finding that the enemy were securely posted behind trees and logs, and concealed by underbrush, and that it was impossible to reach them except when they carelessly exposed their persons in their anxiety to get a shot at our men, I determined to charge them. I passed the order, led forward in the movement, and within thirty yards of their position received a wound from a rifle ball, which struck my right arm near the shoulder joint, and passing entirely through, came out near the point of the shoulder. Believing at the time that the shot came from the flank, I immediately ordered our line to be extended, to prevent the enemy from turning our flank, and the men again ordered to cover themselves behind trees. This position was held for three or four hours, during which time I talked frequently to the officers and men, and found them cool and determined on conquering the enemy. Finding myself weak from the loss of blood, I retired to the rear to have my wound examined and dressed.

While here the Indians cried out to our men, many of whom understood their language, that they wished for a talk, that they desired to fight no longer, that they were frightened and desired peace. Mr. Tyler was despatched by Capt. Goodall to inform me of the desire of the Indians to cease firing and make peace; by this time Robert Metcalfe and James Bruce had been sent into their lines to talk, and having informed them that I was in command, they expressed a great desire to see me. Finding that they were much superior in numbers, being about two hundred warriors, well armed with rifles and muskets, well supplied with ammunition, and knowing that they could fight as long as they saw fit, and then safely retreat into a country exceedingly difficult of access, and being desirous of examining their position, I concluded to go among them. On entering their lines I met the principal chief Ive, and the subordinate chiefs Sam and Jim, who told me that their hearts were sick of war, and that they would meet me at Table Rock in seven days, where they would give up their arms, make a treaty, and place themselves under our protection. The preliminaries having been arranged, the command returned to the place where they had been dismounted—the dead were buried, and the wounded cared for. By this time Col. Ross with his battalion arrived, having followed our trail for some distance. This gallant command were anxious to renew the attack upon the Indians, who still remained in their position, but as the negotiations had proceeded so far, I could not consent. That night was spent within four hundred yards of the Indians, and good faith was observed on both sides.

At the dawn of day I discovered that the Indians were moving, and sent to stop them until a further talk had been held. Accompanied by Col. Ross and other officers, I went among them and became satisfied that they would faithfully observe the agreements already made. By the advice of the surgeon we remained that day and night upon the battle-ground, and then returned to Table Rock.

Too much praise cannot be awarded Col. Alden; the country is greatly indebted to him for the rapid organization of the forces, when it was entirely without defence; his gallantry is sufficiently attested by his being dangerously wounded, while charging at the head of his command, almost at the enemy's lines. Captains Goodall and Rhodes, with their companions, distinguished themselves from the beginning to the end of the action, for their cool and determined bravery; no troops could have done better. The command of Col. Ross, under Captains Miller and Lamerick, although too late to participate in the action, made a severe march through the mountains, and arrived on the ground one day sooner than I expected them; their presence was of great assistance to us.

Our loss in the battle was three killed—Captain Pleasant Armstrong, privates John Scarborough and Isaac Bradley; and five badly wounded—Colonel Alden, myself, and privates Charles C. Abbe, (since dead,) Henry Flesher, and Thomas Hays. The Indians lost eight killed, and twenty wounded, seven of whom we know to have since died.

Soon after my return from the mountains, Capt. A. J. Smith, first dragoons, arrived at camp with his troop from Port Orford. His arrival was most opportune; his presence during the negotiations for a peace was of great assistance, while his troop served to overawe the Indians.

The governor of the Territory, upon the first information being received by him, promptly ordered out a company under Captain Nesmith, and sent them as an escort for a large quantity of arms and ammunition which were procured from Fort Vancouver. Captain Nesmith arrived after the negotiations had been commenced, but was of great service to me, from his intimate knowledge of the Indians and their language. Lieut. Kautz, fourth infantry, accompanied Captain Nesmith, and had in charge a twelve-pound howitzer and caisson, which he brought safely into camp, although the road is a very difficult one, and seldom travelled by wagons.

A commission from the governor, as brigadier general, reached me a few days after I had assumed command, at Col. Alden's request.

A treaty of peace has been made with the Indians, and I have no doubt with proper care it can be strictly maintained. The tribe is a very large one, and to a great extent controls the tribes in this part of the country; a peace with them is a peace with all. This, in my opinion, can only be perfectly secured by the presence of a considerable military force in this valley. I would, therefore, most earnestly recommend the establishment of a military post in the Rogue River valley without delay.

To Robert Metcalfe, who acted for me as a scout and guide, I am indebted for the faithful discharge of his duty. John Crosby and James Bruce also did good service in the same capacity.

On the expedition to the mountains, from the 22d to the 26th, N. G. T. Vault acted as my volunteer aid. At that time Capt. C. Lewis joined the command, and handsomely performed the duties of assistant adjutant general until the 29th, when compelled by sickness to resign. Since that time Capt. L. F. Mosher, late of the fourth Ohio volunteers, has performed the duties of that office. Dr. Edward Shiel, George Dart, Richard Dugan and L. A. Davis, the commissioners appointed by Colonel Alden, were most active in the discharge of their duties, and kept the command supplied with provisions, transportation, and other necessaries for carrying on the war. Major Charles S. Drew, assistant quartermaster, with his assistants, performed their duties with promptness and accuracy. Dr. E. H. Cleveland, surgeon general, and his assistants, were unremitting in their attention to the sick and wounded.

I have the honor to be, very respectfully, your obedient servant,

JOSEPH LANE.

Brigadier General Hitchcock.

Yreka, California,
October 18, 1853.

Sir: I regret that I have suffered so much from debility, consequent upon my wound, that I have been unable to make a detailed report of my participation in the late military operations in this valley; yet, as some official communication from me may be of importance in showing the necessity of furnishing more regular troops for the defence of this frontier, and also to prove the necessity of the call I made upon the volunteers, I make an effort to-day to communicate a brief statement, which will reach you before the meeting of Congress.

On the 7th of August last I received at my post, Fort Jones, California, a petition signed by the principal citizens of Jacksonville, Oregon, representing that the settlements in Jackson county were threatened by a combination of several tribes of Indians, numbering about 250 warriors armed with rifles, and well supplied with ammunition; that several white men had been killed, and that the men of the valley were unprovided with arms. They earnestly requested me, therefore, to furnish them with all the men and arms at my disposal for their defence.

Of the 22 men of my company present at the post, 11 were on the sick report and unable to march. In a few hours, however, I packed 25 muskets, 5 carbines, and 600 rounds of ammunition, on mules, and with all my disposable force, amounting to but 10 men, I marched for the scene of hostilities.

Passing through Yreka, California, I learned that the representations made in the petition from Jacksonville were by no means exaggerated; and, accordingly, I enrolled a volunteer company of 80 men. I reached Jacksonville August 9th, and finding that no disposition had been made for providing subsistence for the volunteers, I recommended to the citizens the appointment of a board of commissioners, composed of gentlemen having the confidence of the community, and who should immediately take measures to provide all necessary supplies. This proposition was acceded to at once; and a board consisting of four gentlemen of the place was appointed by myself, bearing the title of commissioners of military affairs in Rogue River valley. I informed the board, as I had also apprized the citizens of Yreka, that I had no special authority to raise volunteers, or to pledge the general government for payment of their expenses; but that an appropriation by Congress would be requisite for this purpose, expressing, at the same time, my personal belief and conviction that Congress would not withhold the necessary appropriation. With this understanding, I enrolled two companies of volunteers at Jacksonville, and, on the 11th instant, mustered the companies at Camp Stewart, 7 miles from town. A company of independent volunteers, 20 strong, joined me there; making the whole force, including my own men and the Yreka volunteers, about 200 men. I learned that the Rogue River Indians had taken a strong position near Table Rock, about 10 miles distant from Camp Stewart. Their force was estimated at 250 warriors, 150 of this number being armed with rifles and well supplied with ammunition. I made dispositions at once to attack them that night; when suddenly, at dusk, a man rode into camp at full speed, announcing, in the hearing of all the troops, that the Indians had appeared in force in the valley, that they had just killed two white men, had burnt a house and several hay-stacks, and that the families in the north of the valley were in imminent danger of being massacred. At this announcement, 20 men of the independent volunteers, who were already mounted, awaiting orders to march to Table Rock, darted off at full speed in the direction of the burning house, the light of which was distinctly visible at camp. I was compelled to suspend the attack, and to permit the companies raised in the valley to mount and hasten to the defence of their houses and homes. This panic disconcerted the movement, and it was not until the 16th instant that I had force enough present to organize another plan of attack. As I had no officer of the regular army under my command, and was therefore without a quartermaster or commissary sufficiently conversant with the duties of those departments, the burden of that duty fell upon myself.

Nevertheless, the necessary issues of subsistence continued daily to overrun the proper allowance. These extra issues were chiefly caused by the frequent detachments necessarily sent from the main body, and the want of familiarity, on the part of the volunteers, with the proper arrangement and usages of a company mess, and the economical use of the ration.

On the 16th of August, discovering that the Indians had disappeared from their position near Table Rock, and had fled to the mountains, from whence it was apprehended they would descend in small bands to waylay the pack trains on all the roads leading to the valley, the war at once assumed a new character of imminent danger to the whole of southern Oregon. Under these circumstances, believing that, from the nature of the service, the safety of the valley would be hazarded if I should retain the command, burdened with all the details of every subordinate department, I did not hesitate to request General Lane to relieve me from the command of the volunteers. Between the 16th and 20th of August I had succeeded in organizing a pack train and commissariat, and had made every preparation to pursue the Indians wherever they were to be found.

On the 20th General Lane assumed the command, and on the 22d marched in pursuit. The general's report of operations from that day has already been forwarded to your office.

The thorough knowledge of the country which he displayed, the gallantry and skill which he exhibited in the pursuit and in the engagement, satisfied me perfectly that I had acted for the good of the country in relinquishing the command of the volunteers to him. I hope that

I shall be able, by the next mail, to forward a report in detail of all the military operations from the day when I took command until the arrival of General Lane, viz: two skirmishes of Lieut. Griffin's scouting party with a large body of Applegate Indians, the scattering of the troops from the 11th to the 16th, the gallant defence of Lieut. Ely's scouting party of 25 men against a band 100 Indians, and the prompt movement of Captain Goodall with his company of volunteers, preceded by a small detatchment led by Mr. J. D. Cosby and Elijah Heard, to the rescue of Lieut. Ely.

I am, very respectfully, your obedient,

B. R. ALDEN,
Captain Fourth Infantry

The Adjutant General of the Army,
Washington, D. C

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REGULATIONS AND ORDERS IN REGARD TO HARBOR AND RIVER IMPROVEMENTS.

[Appended to this report in compliance with a resolution of the Senate of March 3, 1853.]

I.

Regulations in relation to river and harbor improvements.

I. All civil works of public improvement committed to the War Department will hereafter be planned and constructed under the direction of either the chief of the corps of engineers or the chief of the corps of topographical engineers, as may be deemed most advisable.

II. The several works assigned by the Secretary of War as above shall be committed to officers of said corps respectively, under the special approval of the secretary. Every officer in charge of a work shall be under the orders of, and responsible to, the head of his own corps. Whenever it may be necessary to commit a work to a civil agent, he shall be appointed by the Secretary of War, to be in like manner responsible to and under the orders of the bureau to which his work has been assigned.

III. From each of the above-mentioned corps a board shall be organized, to consist of three members of the corps, who shall be aided, whenever it may be deemed necessary, by a naval officer, to be detailed by the Secretary of the Navy for that purpose.

To this board shall be submitted, by the respective chiefs of corps, all plans or projects for river and harbor improvements. Every plan or project for a work will be accompanied by an estimate of its cost. If the estimate should vary from any heretofore made, the reasons for such variance will be given.

The duties of each of these boards shall be as follows:

1. To examine, approve, modify, or reject every project or plan of civil improvement proposed by any officer or civil agent, under instructions from the chief of the corps.

If any of said plans be approved by the board, with or without modification, they will submit them, with such remarks as may be thought necessary, to the chief of the corps.

If the board reject the plan of the officer or agent, they will either substitute a plan of their own, or they will recommend the course they may think best for procuring another project, at the same time returning the rejected project with their objections.

Any member of the board shall have the privilege of making a minority report.

In every case, the said chief will lay the project under consideration and the recommendation of the board, together with any minority report, before the Secretary of War, with any remarks he may have to make in support, by way of amendment, or in opposition.

On the approval of a plan by the Secretary of War, it shall be carried into execution, without alteration, by an officer of the corps to which the subject was assigned by the Secretary of War, or by a civil agent employed for the purpose, under the direction of the chief of that corps.

If, however, in the opinion of the said officer or agent, circumstances should demand an alteration or abandonment of the plan, he will promptly report all the circumstances to be laid before the board, who, if they deem it necessary, will consider the subject anew.

2. The board will, as often as they may deem necessary, detail from their number one or more members for the inspection of works under execution.

The duty of these inspectors shall be to examine carefully and report to the board the character of the work in relation to prices paid, the quality of materials and workmanship, and the general system of expenditure and administration; also as to the conformity to the approved plan, and how far the actual expenditures conform to or vary from the estimate; if they should exceed the estimate, the cause of such excess.

Every such report shall be submitted to the Secretary of War by the chief of the corps, whose duty it shall be to call the attention of the secretary to any point demanding notice, and especially to any neglect, want of skill, misconduct, or mal-administration on the part of any officer or agent in charge, whether knowledge of the same shall come to him through the reports of inspectors or in any other manner; and it shall also be the duty of the chief to make frequent personal inspections of these operations.

3. All plans and estimates to be submitted to Congress for new works, or for the completion of works already commenced, or the repairs of old works, will be prepared under the direction of the boards, and communicated to the chiefs of their respective corps.

IV. Each board shall have an office in the building of this department, and, when necessary, shall be assisted by one or more subaltern officers of the corps, and also by one or more clerks, who shall record the proceedings in a book, and perform such other duties as may be imposed by the board.

Whenever the business of the board shall not require them to be in session, the members shall be employed in the inspections above provided for, or on other duty, as the chief of the corps, with the sanction of the Secretary of War, shall direct.

C. M. CONRAD,
Secretary of War.

WAR DEPARTMENT, *September* 10, 1852.

II.

General Order.

The following works provided for by the act entitled "An act making appropriations for the improvement of certain rivers and harbors," shall be executed under the direction of the chief of the corps of engineers, viz:

1. All works and surveys on the Atlantic and rivers emptying into it.
2. All works on the Gulf of Mexico, including those on the rivers emptying into it, except those of the Mississippi river, of which only the superintendence of the removal of the bar at its mouth shall be assigned to him.
3. All surveys, estimates, reports, and other papers relating to the works placed under the direction of the chief engineer, will be transferred to him by the colonel of the topographical corps.

All other works than those above mentioned, embraced in the act, are assigned to the chief of topographical engineers.

C. M. CONRAD,
Secretary of War.

WAR DEPARTMENT,
Washington, September 16, 1852.

III.

WAR DEPARTMENT,
Washington, September 16, 1852.

Brevet Colonel Sylvanus Thayer, Lieut. Colonel René E. De Russy, and Brevet Colonel John L. Smith, of the corps of engineers, will continue the board of river and harbor improvements, provided for by section 3 of the regulations in relation thereto, for the works to be executed under the direction of the chief of said corps.

C. M. CONRAD,
Secretary of War.

IV

WAR DEPARTMENT,
Washington, September 16, 1852.

Lieut. Colonel James Kearney, Brevet Lieut. Colonel Stephen H. Long, and Major Hartman Bache, of the corps of topographical engineers, will constitute the board of river and harbor improvements, provided for by section 3 of the regulations in relation thereto, for the works to be executed under the direction of the chief of said corps.

C. M. CONRAD,
Secretary of War.

V.

WAR DEPARTMENT,
Washington, September 17, 1852.

Brevet Lieutenant Colonel Stephen H. Long and Brevet Colonel William Turnbull, of the corps of topographical engineers, and Charles B. Fisk, esq., are appointed a board, under the provisions of "An act making appropriations for the improvement of certain harbors and rivers," approved August 30, 1852, "to report upon the expediency of an additional canal around the falls of the Ohio river; and the comparative cost, advantages, and disadvantages of making such additional canal on the Kentucky and Indiana shores of said river, respectively; and also the cost, advantages, and disadvantages of enlarging and extending the present canal so as to avoid the rocks at Sandy island, retaining the locks in their present condition."

Lieutenant James W. Abert will act as secretary to the board.

C. M. CONRAD,
Secretary of War.

VI.

WAR DEPARTMENT,
Washington, September 18, 1852.

Captain William R. Latimer, of the United States navy, and Major William H. Chase, Brevet Major J. G. Barnard, and Brevet Major P. G. F. Beauregard, of the corps of engineers, are appointed a board to make an examination of the mouths of the Mississippi river, with a view to determine the most convenient pass leading into the Gulf of Mexico through which a ship channel, of sufficient capacity to accommodate the wants of commerce, can be opened; and to report upon other points in relation thereto, specified in the clause making an appropriation for this work, contained in "An act making appropriations for the improvement of certain harbors and rivers," approved August 30, 1852.

C. M. CONRAD,
Secretary of War.

VII.

Rules and regulations for the government of the officers and crews of snag-boats, and of the agents, mechanics, laborers, &c., employed on local works relating to the improvement of the western rivers.

PRELIMINARY REGULATIONS.

Item 1st. All works and operations for the improvement of the Ohio, Mississippi, Arkansas, Missouri, and Illinois rivers, will be subject to the direction and superintendence of an officer of the corps of topographical engineers, who will be aided in the performance of all appropriate duties by one or more assistants, military or civil, to be appointed by the express approval of the Secretary of War, grounded on satisfactory testimonials confirmatory of their capacity and fitness for such appointments.

Item 2d. The superintendent, with the aid of his assistants, shall perform all duties recognised by the regulations of the corps of topographical engineers as pertaining to his command, and shall make all such returns, reports, estimates, regulations, inspections, projects, &c., &c., as are required by those regulations, with all practicable punctuality and precision.

Item 3d. The superintendent may employ a competent, skilful, and experienced civil assistant, to serve as secretary and accountant, at a salary not exceeding $5 per day, whose duty it shall be to record all proceedings in reference to the works and operations confided to the superintendent, keep the archives relating to western river improvements in a manner conformable to the usages of the topographical bureau in such respects; prepare and settle accounts for services rendered under different appropriations; and, in general, to perform such other duties, whether financial or clerical, as the superintendent may from time to time require.

Item 4th. A competent and experienced clerk may be employed by the superintendent for each snag-boat, at a compensation not exceeding $60 per month, who may also serve as clerk of the boat, with an additional compensation of $30 per month—or $90 per month for services in both capacities; whose duty it shall be to serve on board of the boat; keep all minutes, papers, &c., relating to the enrolment, services, payments, discharges, &c., of officers, men, cooks, and others employed on board of the boat; to make such contingent payments, and render such accounts for occasional services, repairs, &c., as may be required by the superintendent. He shall, moreover, keep a journal of the operations, movements, and work done by the boat, showing the number of snags, logs, and other obstructions raised and removed, the localities at which these operations have been performed, the provisions, fuel, and other articles purchased for the use of the boat, and the payments made therefor; and in general to attend to all matters relating to the progress and cost of the operations carried on by the boat.

Item 5th. All other officers, men, &c., constituting the boat's crew, may be employed by the captain of the boat, with the approval of the superintendent, and at rates of compensation not exceeding those hereinafter specified, unless otherwise instructed.

Item 6th. It shall moreover be the duty of the captain of each boat, and the agent of each local work, to encourage and promote industry, cheerfulness, good behavior, and a well-regulated police, in all respects, in their respective commands. It shall also be the duty of each captain to impart all the information and advice he is able to give, in order to enable the clerk of his boat to keep a correct journal and make correct reports of all proceedings had on board.

Item 7th.—As a general rule, payments for services, &c., shall be made quarterly, as early as practicable after the expiration of the quarter for which payments are due, and returns thereof shall be made to and through the superintendent to the Topographical bureau, in accordance with the requirements of law and regulations, so far as practicable, due allowance being made on account of the remoteness of the points at which payments must be made.

Item 8th.—Compensation for services on board of snag-boats may be graduated in a manner not to exceed the following rates, viz:

To captain and mate of a snag-boat, (one or both experienced in snag business,) per month	$——
Superintendent's clerk, per month	——
Boat's clerk, per month	——
Engineer and assistant engineer, (one or both being experienced blacksmiths,) per month	——
Pilot and assistant pilot, (one or both being experienced pilots,) per month	——
Carpenter, (skilful and experienced,) per month	——
Steward, per month	——
Cook, per month	——
Deck hands, firemen, and laborers, each, per month	——
Cabin boy and washwoman, each, per month	——
Striker and assistant blacksmith, per month	——

Item 9th.—The superintendent shall ascertain, as nearly as practicable, the actual daily cost (all expenses included) of working a snag-boat or other craft, in order that any boat may be transferred (as occasions may frequently require) from service under one appropriation to service under another, at a determinate rate per day, to be charged against any appropriation under which service may be performed; whereby all the boats may be enabled to serve under either or all the appropriations, and during a longer period of every year, than could be done by confining their operations, respectively, to particular districts.

Item 10th.—All persons, whether officers or laborers, to be employed in the prosecution of the snag business, on engaging in the public service are required to sign articles of enrolment and agreement, binding themselves, respectively, to abide by and conform to the rules and regulations herein prescribed, and more particularly explained under the following head, viz:

RULES AND REGULATIONS

For the government of the officers and crews of snag-boats, and of the agents, mechanics, laborers, &c., employed on local works relating to the improvement of the western rivers.

ARTICLE 1. All officers, mechanics, laborers, &c., employed on works of all kinds relating to the improvement of the western rivers, harbors, &c., are required to affix their signatures to these rules and regulations at the time of engaging in the public service, and will be bound to serve under the command of the officer named and on the terms specified in the subjoined enrolment,

ART. 2. All orders and instructions emanating from the Topographical bureau of the War Department, or from the superintendent, or agent representing said bureau or superintendent; also all orders and commands given by officers of superior grade to officers and men serving in subordinate capacities, shall be promptly and cheerfully obeyed.

ART. 3. Disobedience of orders, neglect of duty, abandonment of service, gambling of all kinds, intemperance, profanity, vulgarity and other immoral and disorderly conduct, are strictly prohibited; and any officer, mechanic, or laborer that may be guilty of any or either of these offences, or of violating any other stipulation contained in these articles, shall be liable to dismission from the service at the discretion of the officer in command.

ART. 4. Quarterly payments for services at the rate specified in the subjoined enrolment shall be made as early as practicable after the expiration of each quarter; and, for that purpose, funds will be placed at New Orleans, St. Louis, Louisville, or Cincinnati; or, if deemed advisable, at any other point on either of the rivers included within the superintendency where government funds may be conveniently deposited for safe-keeping.

ART. 5. Deductions shall be made, in settlement by pay-rolls, for lost time occasioned by absence from duty, sickness, or other inability, except in cases of injuries received in the service; also for any and all items of public property carelessly damaged, lost, or wasted in the service, by the individual guilty of such delinquencies, and to whom payments are due.

ART. 6. Payments shall be made as above, in full, to all who have served faithfully and acceptably through the entire period of their enrolment, to the date of their final discharge from the service.

ART. 7. Good and wholesome food, adapted to the comfortable and healthy subsistence of boatmen; also such medicines and medical instructions as are ordinarily required and used as remedies for diseases incident to river service, shall be provided and furnished to all employed in the service.

ART. 8. No ardent spirits, or intoxicating liquors of any kind, shall be introduced, kept, or used on board of any of the public boats, or at any of the local works.

ART. 9. All articles of clothing, bedding, &c., for the use of officers, laborers, &c., shall be procured by and at the expense of those for whom such articles may be required.

Art. 10. No officer, mechanic, or laborer shall absent himself from his appropriate place or duty except by permission of his immediate commanding officer; and no leave of absence shall be granted on any occasion for a period of more than seven days in any calendar month.

Art. 11. Any officer, mechanic, or laborer who may find it necessary to be absent more or less than seven days, may, with the consent of his commanding officer, and at his own expense, employ an acceptable substitute to serve in his stead during such absence; and in such a case no deduction shall be made on account of lost time, as contemplated in the fifth article of this code.

Art. 12. The boats on board of which and the localities at which the officers, mechanics, and laborers are respectively to serve, will be such as may be designated by the superintendent of western river improvements.

Art. 13. The captains of the snag-boats and other craft, and the agents specially charged with the superintendence of individual local works, shall be appointed by the special approval of the Secretary of War, in conformity to such credentials and recommendations as he may deem satisfactory; and these officers shall receive all their instructions from the superintendent, and be held accountable for the careful observance and faithful execution of all orders and instructions emanating from that officer, who, in the discharge of his duties, shall be subject in all respects to the directions of the Topographical bureau, expressly sanctioned by the Secretary of War.

Art. 14. The captains and agents as above shall be held accountable for the preservation, proper management, efficient employment, and economical use of boats and other public property committed to their charge; also for the judicious control, direction, discipline, and employment of all subordinate officers, mechanics, and laborers employed under their respective commands. They are moreover charged with the supervision and faithful arrangement of all accounts, records, returns, &c., that may be required by the superintendent, for the purpose of exhibiting full and clear reports of their proceedings, and of the operations and services performed under their directions, and especially of all contingent expenditures incurred in the prosecution of the duties assigned them respectively. They are moreover held responsible for the maintenance of good order, correct discipline, a well-regulated police, and a careful observance of these rules and regulations within their respective commands.

Enrolment.

For and in consideration of the wages set opposite to our names respectively, we, the subscribers, do hereby promise and agree that we will serve in the capacities, at the rates of compensation, and during the periods herein designated, unless sooner discharged; that we will obey all lawful and proper orders and commands that may from time to time be given for our guidance and direction by the commanding officer under whom we may be required to serve; and that we will perform all appropriate duties required of us with promptness, zeal, fidelity, and to the best of our abilities. We moreover promise and agree to abide by and conform to the foregoing rules and regulations during our continuance in the public service. We moreover bind ourselves, our heirs, and legal representatives to the faithful observance and fulfilment of each and every stipulation herein prescribed and contained.

Terms of enrolment for service.

[Here leave blank for name of boat, of captain or officer commanding, of station, &c.]

Names of subscribers.	Nature of employment.	Wages per month.		Duration of service.		Names of witnesses.
Signatures.	Capacities.	Dollars.	Cents.	From	To	Signatures.

WASHINGTON, *April* 27, 1853.

The foregoing "rules and regulations," articles of enrolment, &c., are hereby approved and adopted for the government of all employed on duties relating to the improvement of the rivers therein mentioned.

JEFFERSON DAVIS,
Secretary of War.

VIII.

WAR DEPARTMENT,
Washington, June 4, 1853.

In every case where money is furnished by a State, city association, or individuals, in order that the same may be expended in the further prosecution of a work of harbor and river improvement to which Congress has given its sanction by a special appropriation, and it shall be requested by the authorities or persons having charge of such money that the officer of engineers in charge of such work shall be allowed to continue the operations in conformity with the plans and designs adopted by the War Department, to the extent the money so provided will permit, the officer of engineers (or other agent of the general government) may be instructed to comply with the request, under the following conditions:

1. The officer or agent is to have no connexion with, nor responsibility for, the disbursement of the money so furnished, further than that he may give, from time to time, in compliance with any bargain or

contract made under such provision of money, a statement of the amount of work done or materials supplied.

2. It must be perfectly understood, by the authorities or persons supplying money in every such case, that the direction or supervision by the government officer or agent of the operations so carried on is not to constitute nor to imply any claim, or shadow of claim, on Congress for reimbursement, nor is to be considered as pledging the general government to any support of that particular work or improvement beyond that already given by Congress.

JEFFERSON DAVIS,
Secretary of War.

SURVEYS FOR A RAILROAD ROUTE TO THE PACIFIC.

Instructions to Governor I. I. Stevens.

WAR DEPARTMENT,
Washington, April 8, 1853.

SIR: The War Department being directed by a recent act of Congress to survey the several routes of a railroad from the Mississippi river to the Pacific ocean, it has been determined to explore and survey a route from the sources of the Mississippi river to Puget's sound, and the following instructions are given in relation to it, and for the information and direction of the several branches of the service:

1. The exploration and survey is placed in charge of Isaac I. Stevens, Governor of the Territory of Washington, to whom all officers detailed for the same will report for instructions.

2. The general project of the operation, subject to such modifications as circumstances may direct, is to operate from St. Paul's, or some eligible point on the Upper Mississippi, towards the great bend of the Missouri river, and thence on the table land between the tributaries of the Missouri and those of the Sarkatchanan, to some eligible pass in the Rocky mountains. A depôt will be established at Fort Union, at the mouth of the Yellow Stone, and a portion of the party will rendezvous there and await the coming up of the main body. A second party will proceed at once to Puget's sound and explore the passes of the Cascade range, meeting the eastern party between that range and the Rocky mountains, as may be arranged by Governor Stevens.

3. As in the prosecution of this exploration and survey it will be necessary to explore the passes of the Cascade range and of the Rocky mountains from the 49th parallel to the head-waters of the Missouri river, and to determine the capacity of the adjacent country to supply, and of the Columbia and Missouri rivers and their tributaries to transport, materials for the construction of the road, great attention will be given to the geography and meteorology, generally, of the whole intermediate region; the seasons and character of its freshets, the quantities and continuance of its rains and snows, especially in the mountain ranges; to its geology in arid regions, keeping particularly in view the bringing of water to the surface by means of artesian wells; its botany, natural history, agricultural and mineral resources; the location, numbers, history, traditions and customs of its Indian tribes, and such other facts as shall tend to develop the character of that portion of our national domain, and supply all the facts which enter into the solution of the particular problem of a railroad.

4. Brevet Captain George B. McClellan, already under orders to report to Governor Stevens, is assigned to duty on this survey according to his brevet rank.

5. Capt. John W. T. Gardiner, 1st dragoons; Capt. Joseph Roberts, 4th artillery; 2d Lieut. Johnson K. Duncan, 3d artillery; 2d Lieut.

Rufus Saxton, jr., 4th artillery; 2d Lieut. Cuvier Grover, 4th artillery, and Brevet 2d Lieut. John Mullan, jr., 1st artillery, are assigned to duty on this survey, and will report to Governor Stevens for instruction.

6. In addition to Lieutenant A. J. Donelson and ten non-commissioned officers, artificers and privates of the engineer company, already under orders for the expedition, one sergeant, two corporals, one musician and sixteen privates of company D, first dragoons, now stationed at Fort Snelling, will be placed at the disposal of Governor Stevens; and in view of the character of the service, the officers of the company are required to select none but tried men and animals for the duty.

7. In the exploration of the Cascade range, the brigadier general in command of the Pacific division will assign to Captain McClellan two officers from those who may volunteer for the service, and thirty men to be selected from the several companies stationed in the Territory of Washington and on the Columbia river. Every facility will be given to Captain McClellan and his party in the discharge of their difficult and important duties, and much is expected from the hearty co-operation and assistance of the officers and troops stationed in the Territory.

8. The several administrative branches of the service will, on requisitions duly approved by Governor Stevens, supply the officers, soldiers and civil employés of the expedition (except the scientific corps and their assistants) with transportation, subsistence, medical stores and arms. The Quartermaster's department will supply funds to provide means of transportation and to pay for the hired men of the department attached to the command. The Subsistence department will supply rations or funds for their purchase. The Ordnance department will furnish forty Colt's revolvers, forty Sharp's patent rifles, forty ordinary rifles, and a mountain piece, with the necessary ammunition, and a travelling forge. The Surgeon General's department will assign a medical officer to the command having skill as a naturalist, provided he can be detailed without detriment to the service.

9. After the completion of the survey of the passes of the Rocky mountains, such portions of the officers, troops and employés, both of the escort and of the scientific corps, as are not needed in the operations westward to the Pacific, will be despatched homeward by new routes, still further to develop the geography and resources of the country. Such of the officers and troops as are not wanted for office duty will report to their several stations; all civil employés not necessary for a similar purpose will be discharged, and the office force will proceed to such point as may be designated by Governor Stevens, to prepare the usual reports.

10. After the completion of the field examinations, the expedition will rendezvous at some point in the Territory of Washington, to prepare the usual reports, sending to Washington at the earliest practicable moment a summary of the principal events of the expedition, and a railroad report, to be laid before Congress, on or before the first of February, to be followed at a later period by an elaborate report presenting a full account of the labors and results of the expedition.

11. The sum of forty thousand dollars ($40,000) is set apart from the appropriation for the survey thus entrusted to Governor Stevens.

JEFFERSON DAVIS,
Secretary of War.

His Excellency Isaac I. Stevens,
Governor of the Territory of Washington, Washington City.

Instructions to Captain J. W. Gunnison.

War Department, *May* 20, 1853.

Under the tenth and eleventh sections of the Military Appropriation act of March 3, 1853, directing such explorations and surveys as to "ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean," the War Department directs a survey of the pass through the Rocky mountains in the vicinity of the head-waters of the Rio del Norte, by way of the Huerfano river and Cooch-to-pa, or some other eligible pass, into the region of Grand and Green rivers, and westwardly to the Vegas de Santa Clara and Nicollet river of the Great Basin; and thence northward to the vicinity of Lake Utah, on a return route, to explore the most available passes and cañons of the Wahsatch range and South pass to Fort Laramie.

The following instructions relative thereto are issued for the government of the different branches of the public service:

1. The party for this exploration will be commanded by Captain J. W. Gunnison, topographical engineers, who will be assisted by First Lieutenant E. B. Beckwith, 3d artillery, and such civil assistants as the Secretary of War may approve.

2. The adjutant general will detail the necessary escort, whose subsistence and transportation will be furnished by the Subsistence and Quartermaster departments.

3. Upon the proper requisitions, officers on duty at the various military posts on the route, in the Commissary and Quartermaster departments, will furnish, as far as possible, all necessary supplies, which will be paid for at cost prices from the appropriation for the survey.

4. Medical stores will be furnished by requisitions upon the surgeon general.

5. Ammunition and arms may be obtained from the Ordnance department.

6. The party being organized, will collect the necessary instruments and equipments. It will then repair with the utmost despatch to Fort Leavenworth, and, with the escort, proceed to the Huerfano river, making such reconnoissances from the Missouri river as will develop the general feature of the country and determine the practicability of a railroad across the plains, and its connexion with eastern lines of commerce.

The more minute reconnoissances will continue up the Huerfano into the San Luis valley; and thence through the most eligible pass to the valley of Grand river, and westwardly to the vicinity of the Vegas de

Santa Clara; and thence, on the most advisable route, either along the Nicollet river or to the west of the ranges of mountains bordering that stream, into the basin upon that route, to the Great Salt Lake; thence to Lake Utah, and through the Timpanagos cañon or other passes, and across the Weber and Bear river by the coal basin, to Fort Lamarie.

Competent persons will be selected to make researches in those collateral branches of service which affect the solution of this question of location, construction and support of a railway communication across the continent, viz: the nature of the rocks and soils; the products of the country, animal, mineral, and vegetable; the resources for supplies of material for the construction and means requisite for the operations of a railway, with a notice of the population, agricultural products, and the habits and languages of the Indian tribes; meteorological and magnetic observations; the hygrometrical and electrical states of the atmosphere, and astronomical observations for determining geographical points, shall be made, in order to develop the character of the country through which the party may pass.

On or before the first Monday of February next, Captain Gunnison will report the result of his investigation.

After the completion of the field-work the party will be disbanded; the escort ordered to ; and Captain Gunnison, with such officers and assistants as he may deem necessary, will proceed to prepare for Congress a detailed report of his operations.

The sum of forty thousand dollars is set apart for the execution of the duties intrusted to Captain Gunnison.

JEFFERSON DAVIS,
Secretary of War.

Capt. J. W. Gunnison,
Topographical Engineers.

Instructions to Lieutenant A. W. Whipple.

War Department,
Washington, May 14, 1853.

Under the 10th and 11th sections of the Military Appropriation act, approved March 3, 1853, directing "such explorations and surveys" to be made as might be deemed necessary to ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean, the War Department directs such explorations and surveys to be made as will develop the availability for this purpose of that portion of our territory which lies near the parallel of 35° north latitude. The following instructions with reference thereto are issued for the government of the different branches of the public service:

1. The party for this exploration and survey will be commanded by First Lieutenant A. W. Whipple, of the topographical engineers, who will be assisted by Brevet Second Lieutenant J. C. Ives, topographical engineers, and such civil assistants as may be required and the Secretary of War approve.

2. The adjutant general will detail the necessary escort, transpor-

tation of the provisions and equipage of which shall be furnished by the quartermaster general. Second Lieutenant D. S. Stanley, 2d dragoons, will act as quartermaster and commissary to this expedition.

3. Upon the proper requisitions, officers on duty in the Quartermaster and Commissary departments, at the various military posts upon the route, will furnish, as far as possible, all necessary supplies, which will be paid for at cost prices from the appropriation for the survey.

4. Medical stores will be furnished by requisition upon the surgeon general.

5. Ammunition and arms may be obtained from the Ordnance department.

6. This party being organized, will collect the necessary instruments and equipments. It will then repair to the field with the utmost despatch, and proceed with the survey and reconnoissance in question. The main party will rendezvous at some convenient point on the Mississippi river, and thence proceed by the most favorable route westward toward Rio del Norte. From hasty reconnoissances, and from such information as can be obtained from other sources, it may be determined from what point upon the river Mississippi the proposed railway should commence, and whether it may be advantageously connected with any railway already projected, by States or companies, westward from that river.

The reconnoissance will continue along the head-waters of the Canadian, cross Rio Peros, turn the mountains east of Rio del Norte, and enter the valley of that river at some available point near Albuquerque; from thence, westward, extensive explorations must determine the most practicable pass for a railway through the Sierra Madre, and the mountains west of the Zuni and Moquis countries, to the Colorado. In these explorations Fort Defiance can be made a depôt for supplies, and may furnish subsistence and transportation thence for the remainder of the route. From Walker's pass it would be advisable to pursue the most direct and practicable line to the Pacific ocean, which will probably lead to San Pedro, the post of Los Angelos, or San Deigo.

Lieutenant Whipple will immediately detail an officer, with a small party, to proceed directly to Albuquerque, in New Mexico, in order to make that place a cardinal astronomical point in the survey, and to hasten preparations for the necessary explorations in the mountainous regions of New Mexico before the approach of winter.

Over such portions of the route as evidently afford no material obstacle to the construction of a railway, a rapid reconnoissance will suffice. This work, however, must be checked by numerous geographical points, determined by astronomical observations. Through mountain passes greater accuracy will be necessary, in order to determine (roughly) the grades and curves to be adopted, and the probable expense of their construction. Great attention will be given to those collateral branches of science which more or less directly affect the solution of the question of location for the proposed railway; the nature of the rocks and soils; the means of obtaining water upon arid plains, whether by tanks or artesian wells; the products of the country—animal, mineral, and vegetable; its population and resources; its supply of timber and other materials for the construction of a railway; the location, character, habits, tradition, and language of the Indian tribes.

Meteorological and magnetic observations will be attended to; hygrometrical and electrical states of the atmosphere will be noticed, and all practicable measures will be adopted, in order to develop the character of the country through which the party is to pass.

On or before the first Monday of February next, Lieut. Whipple will report the result of his investigations.

After the completion of the field-work, the party will be disbanded in California; the soldiers, no longer required, will be placed at the disposal of the commanding officer of that department; and Lieutenant Whipple, with such officers and assistants as he may deem necessary, will proceed to prepare for Congress a detailed report of the operations of the survey.

The sum of forty thousand dollars will be set apart to defray the expenses of the survey thus intrusted to Lieutenant Whipple.

JEFFERSON DAVIS,
Secretary of War.

Lieut. A. W. Whipple,
Topographical Engineers.

Instructions to Lieutenant R. S. Williamson.

War Department,
Washington, May 6, 1853.

Under the 10th and 11th sections of the Military Appropriation act, approved March 3, 1853, directing such explorations and surveys to be made as might be deemed necessary "to ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean," it has been determined to organize a party to operate in California, to survey and explore the country lying west of the lower Colorado, and a route connecting that portion of California with the Pacific ocean.

1. The party for this exploration and survey will be commanded by Lieut. R. S. Williamson, topographical engineers, who will be aided by Lieut. J. G. Parke, topographical corps, and by the following civil assistants, viz: One mineralogist and geologist; one physician and naturalist; two civil engineers; one draughtsman, who, in addition to their stipulated compensation, will be allowed the actual cost of their transportation to and from California; packers, &c., will be employed in California at prices not exceeding those paid by the Quartermaster's department for such employés.

2. The party will rendezvous at Benicia, in California, and, having organized, will proceed to examine the passes of the Sierra Nevada leading from the San Joaquin and Tulare valleys, and subsequently explore the country to the southeast of the Tulare lakes, to ascertain the most direct practicable railroad route between Walker's pass, or such other pass as may be found preferable, and the mouth of the Gila; from this point the survey will be continued to San Diego.

3. In this exploration great attention will be paid to every point connected with the location of a railroad. A general profile of the route explored will be determined by means of barometric measurements; and, generally, the topography, meteorology, geology, natural history, the character of the Indian tribes of the country, &c., will be studied as closely as circumstances will permit.

4. The commanding general of the Pacific division will assign an escort of mounted troops to accompany the expedition, consisting of not less than three non-commissioned officers and twenty-five privates. Picked men and horses only will be sent on this duty; and the commanding officer of the escort will be instructed to furnish Lieut. Williamson such aid and assistance as will tend to facilitate his operations. Transportation for the provisions, equipage, &c., of the escort, will be furnished by the Quartermaster's department.

5. Lieutenant George B. Anderson will be detailed for duty with Lieut. Williamson's party.

6. The Quartermaster and Commissary departments will furnish to Lieut. Williamson such animals, equipments, stores, provisions, and other public property as he may need for the use of the expedition, and which can be spared, to be paid for out of the appropriation for the survey, at cost at the place of delivery. On the requisitions of Lieut. Williamson, the Ordnance department will furnish arms, &c., and the medical department medicines, &c., for his party.

7. The object of the expedition having been accomplished, all employés whose services may be no longer required will be discharged; and Lieutenant Williamson, with the office corps, will proceed to prepare as full a report as possible, to be laid before Congress, as required by the act above cited, on or before the first Monday in February next; to be followed at a later period by a more elaborate report, showing in full the results of the expedition.

8. The sum of thirty thousand dollars is set apart from the appropriation for the expenses of the survey thus intrusted to Lieutenant Williamson.

JEFFERSON DAVIS,
Secretary of War.

Lieut. R. S. Williamson,
Topographical Corps.

Instructions to Lieutenant J. G. Parke.

War Department,
Washington, November 18, 1853.

Sir: The President of Mexico has given to this government authority to make surveys within the Mexican territory, in connexion with the examination of railroad routes to the Pacific, and you are selected to make such a survey in accordance with the instructions below, provided a suitable party can, as is believed, be organized with the means which will be placed at your disposal.

For this purpose a draft on the assistant treasurer at San Francisco for five thousand dollars is herewith enclosed to you; and orders have been given to Lieutenant Williamson to supply you with all the funds he can spare, and all the animals, equipments, &c., which may be disposable for the object, on the disbanding of his party.

A similar order has been given to Lieutenant Whipple, though it is hardly expected that aid from him will be necessary should these instructions reach you before the party of Lieutenant Williamson is disbanded. If, however, Lieutenant Williamson should have sold his animals and equipments, you may find Lieutenant Whipple's assistance essential to your success. It is to be distinctly understood that neither of those officers is to deprive himself of anything necessary to the prompt completion of his report. The organization and outfit of your party are to be completed on the most economical scale that can be prudently adopted.

The necessary orders have been given for the detail of an escort and supplies for the same.

You will confer with Lieutenant Williamson upon everything relating to the organization and outfit of your party, and to your plans for the prosecution of the work.

You will use the utmost despatch in commencing and prosecuting the duty assigned to you, and observe the following instructions in regard to it:

Referring to a sketch from the office of the Mexican boundary survey, hereto annexed, you will commence the barometric levellings on the Gila a little above "Pima village," at a place marked Dry creek; follow the line by Tueson, thence by blue line marked Nugent's wagon trail, to angle in red dotted lines marked "Brackish pool," east of Salt Lake.

It may be that a better and shorter line exists from the point of departure on the Gila to the point on the San Pedro where blue line or Nugent's wagon trail strikes it. The mountains in that cut-off are described to be generally parallel to the river San Pedro, and the belief exists that a good route can be found through them on the line indicated.

From the point marked "Brackish pool," just east of Salt Lake, as far east as the first stream, marked "Sienega," along the dotted red line, a survey and line of barometric levellings has been carried by the Mexican boundary survey. But it would be well to make the survey continuously along the red and blue line eastwardly, until it strikes Cook's wagon trail, and thence by the shortest distance and most practicable route to the valley of the Rio Bravo, to some point between "Dona Aña" and "Frontera," eight miles north of El Paso.

A more eligible and direct route from the region of the said Salt Lake to the point indicated on the Rio Bravo may be found. If information or observation on the ground shall so suggest, you will not confine yourself to the wagon trails described, but depart from the line indicated at any convenient point.

Bear in mind these wagon trails are faint, and not as broad or well marked as the great emigrant trail known as Cook's route, which, having been sufficiently explored, will not receive your attention.

The levels have been carried continuously by Major Emory along the valley of the Gila; and it might facilitate the operation not to unpack the barometer until the party shall have reached the point of departure from the Gila.

As the whole country between the Gila and the Rio Bravo, embraced in the parallels of latitude 32° and 34°, has been well covered with astronomical observations, it will probably not be necessary for you to impede your progress in checking the run of your work by elaborate astronomical observations. A sextant and chronometer, by which you can obtain your latitude, will, it is believed, prove sufficient to check your work.

The profile of the region traversed, showing the gradients which a road passing over it must encounter, is the information most wanted. It is therefore recommended that you take the barometric height at every point on the line to be surveyed, which may be important in the elucidation of this subject.

On reaching the Rio Bravo, it may add little to the expense of your party to bring it all the way into the settlements on the Red river. If so, you will take some new route from Dona Aña, passing through the northern part of Texas, and make a barometric levelling of the same.

Very respectfully, your obedient servant,

JEFFERSON DAVIS,
Secretary of War.

Lieut. J. G. PARKE,
Topographical Corps, San Diego, California.

WAR DEPARTMENT,
Washington, November 18, 1853.

SIR: Authority has recently been obtained from the President of Mexico to make surveys within the Mexican territory in connexion with the exploration of railroad routes to the Pacific, and so soon as your survey is completed Lieut. Parke will be detached from your command to conduct such an expedition, under instructions of this date from the department, which are herewith transmitted.

You will please furnish him for this purpose with all the funds you can spare, and all the animals, stores, equipments, &c., which may be in serviceable condition, without however depriving yourself of anything necessary to the prompt completion of your report. He has been directed to confer fully with you upon everything relating to the organization and outfit of his party and to his plans for the prosecution of the work, and you will please give him the benefit of your advice and aid whenever they can be of service to him. The department would gladly avail itself of your experience to conduct this survey if it could do so without delaying your report of that which you have already been assigned to; but in view of the anxiety of Congress and the public generally to learn the result of the explorations commenced last spring, the reports must be delayed as little as possible beyond the period mentioned in your instructions, which moreover is the time limited by law for their presentation to Congress.

Very respectfully, your obedient servant,

JEFFERSON DAVIS,
Secretary of War.

Lieut. R. S. Williamson,
Topographical Corps, San Diego, California.

War Department,
Washington, November 18, 1853.

Sir: Lieutenant J. G. Parke is about to organize and fit out a surveying party under instructions from this department of this date, and is authorized to receive from you, on the conclusion of the survey now conducted by you, all the funds you may not need, and any animals, stores, equipments, and other property which may be in serviceable condition, which you can spare without interfering with the prompt completion of your report.

Very respectfully, your obedient servant,

JEFFERSON DAVIS,
Secretary of War.

Lieut. A. Whipple,
Corps of Topographical Engineers.

Instructions to Brevet Captain J. G. Pope.

Bureau of Topographical Engineers,
Washington, October 7, 1853.

Sir: Your letters of 28th August and your estimate have been received. I send, herewith, a copy of a report upon the same from this office.

The survey as directed from Dona Aña, *a b*, will be made. On arriving at *b*, it is presumed that it will be as convenient and as economical to persevere with the survey, from *b* to *c*, *d*, Preston, as to return from *b* to Albuquerque, or to go down to San Antonio; you will therefore persevere with the survey in the direction indicated.

General Garland will be written to in reference to the detail of Lieutenant Garrard, (1st dragoons,) and to the escort. These questions must be referred to his discretion.

A nautical almanac for 1852 was long since sent to you. One for 1853 and one for 1854 are now on their way.

On arriving at Preston, you will make all discharges necessary to reduce expenses, will report your arrival there, and will there await further orders, occupying yourself in the preparation of the report and map of your survey.

Your estimate is for $14,600. You are authorized to draw on this bureau at times, as funds are wanted, for an amount in the whole not exceeding $15,000.

You can call on the Ordnance department for arms and ammunition; also upon the quartermaster and the commissary for such supplies as they can furnish you, and which will tend to lessen your expenses.

The depôt of the Mexican boundary survey at El Paso will supply you with such instruments as it has to spare, on your application and receipt.

You will not forget that one of the chief objects of this survey is to determine the military capabilities of the line; and, as an important auxiliary, its properties for a railroad should also be carefully developed.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel of Corps of Topographical Engineers.

Brevet Captain J. POPE,
Topographical Engineers. Albuquerque, New Mexico.

MILITARY ROADS IN OREGON.

Instructions to Brevet Captain G. B. McClellan.

WAR DEPARTMENT,
Washington, D. C., May 9, 1853.

SIR: The construction of the military road from Walla-Walla to Steilacomb, Puget's Sound, authorized by the act of Congress, approved January 7, 1853, is assigned to you under the general directions of Governor I. I. Stevens. You are authorized to make a requisition for such part of the appropriation as may be necessary to conduct the preliminary surveys and location of the road. These being accomplished, you will enter into contracts with responsible persons for the construction. In order to avoid delay, you are authorized to draw upon this department for a portion, or the whole of the appropriation, as soon as you have formed the required contracts, which will be at once forwarded to this department for its sanction.

It is important that this road should be opened in season for the fall emigration; you will, therefore, use every exertion to do so.

Should it be found impossible to accomplish this, you will, at least, endeavor to fix the line of the road, especially through the Cascade mountains, and to perform such work on the most difficult portions as will enable the emigrants to render the route practicable by their own exertions, detaching a suitable person as guide and director to meet them at Walla-Walla. Should you find it advisable, you are authorized to let out different portions of the road, or different kinds of work, on separate contracts. On account of the peculiar nature of the work, you may find it advisable, instead of contracting for the performance of a specified amount of work, to contract for the supply of the necessary laborers and tools, taking precautions to secure good ones. In any event, you will so arrange your operations as, first, to secure a practicable wagon road between the extremities of the road; devoting the remainder of the funds at your disposal to the improvement of the more important points, always endeavoring to make the whole road a good one.

Very respectfully,

JEFFERSON DAVIS,
Secretary of War.

Brevet Captain GEORGE B. MCCLELLAN,
Corps of Engineers.

Instructions to Brevet Major Benjamin Alvord.

WAR DEPARTMENT,
Washington, May 30, 1853.

SIR: The construction of the military road from the mouth of Myrtle creek, on the Umpqua river, to Camp Stewart, in Rogue River valley, authorized by the act of Congress, approved January 7, 1853, is assigned to you. You are authorized to make a draft for such part of the appropriation (twenty thousand dollars) as may be necessary to conduct the preliminary surveys and location of the road. These being accomplished, you will enter into contracts with responsible persons for the construction. In order to avoid delay, you are authorized to draw upon this department for a further portion, or the whole of the appropriation, as soon as you have formed the required contracts, which wi.l be at once forwarded to this department for its sanction. Your drafts, drawn in pursuance of this authority, will be cashed by the Collector of Customs at San Francisco or Oregon city. Should you find it advisable, you are authorized to let out different portions of the road, or different kinds of work, on separate contracts. On account of the peculiar nature of the work, you may find it advisable, instead of contracting for the performance of a specified amount of work, to contract for the supply of the necessary laborers and tools, taking precautions to secure good ones. In any event, you will so arrange your operations as, first, to secure a practicable wagon road between the extremities of the road; devoting the remainder of the funds at your disposal to the improvement of the more important points, always endeavoring to make the whole road a good one.

Jesse Applegate, of Youcalla, Oregon, near Myrtle creek, has been recommended by Governor Lane and General Adair as having much knowledge of the route of the proposed road. You would do well to see him, and if you find him well informed on the subject, it might be advantageous to secure his services on the work.

Very respectfully, your obedient servant,

JEFFERSON DAVIS,
Secretary of War.

Brevet Major BENJAMIN ALVORD,
4th Infantry, Dalles of the Columbia, Oregon.

CAPITOL EXTENSION.

U. S. CAPITOL EXTENSION OFFICE,
Washington, October 22, 1853.

SIR: I have the honor to report the progress of the works for the extension of the United States Capitol.

On the 1st of December last the architect reported the condition of the work as follows:

"The cellars of both wings are completed; the arches to support the basement floors are finished, and the outside marble-work is progressing rapidly."

On the 23d of March, the work, which by the terms of the appropriations had been placed under the special direction of the President of the United States, was transferred by his order from the Department of the Interior to the War Department, and on the 4th of April I had the honor to receive the following orders from you:

"WAR DEPARTMENT, *April* 4, 1853.

"SIR: Having been detailed, on the 29th of March, by the chief engineer, to take charge, under this department, of the public interests connected with the extension of the Capitol and erection of the wings of the Patent Office building, you will proceed to take such measures as may be necessary for the proper execution of these works.

"As upon you will rest the responsibility for the proper and economical construction of these buildings, you will consider yourself fully empowered to make such changes in the present administration as you may deem necessary, and to regulate the organization hereafter as your experience may dictate.

"In the disbursement of the moneys appropriated by Congress, you will conform to laws and the usages of the Treasury Department.

"Your attention is particularly called to the condition of the foundations of the extension of the Capitol. Unfavorable reports have been spread abroad, and it is due to the public sentiment that a careful examination be made. If you are satisfied, upon examination and inquiry, that they are safe, no further steps will be necessary. If they are not, you will take such measures as will be effectual to make them so.

"You will examine the arrangements for warming, ventilation, speaking, and hearing. The great object of the extension of the Capitol is to provide rooms suitable for the meeting of the two houses of Congress—rooms in which no vitiated air shall injure the health of the legislators, and in which the voice from each member's desk shall be easily made audible in all parts of the room. These problems are of difficult solution, and will require your careful study.

"It will be proper for you to visit, at a convenient time, some of the principal rooms for public assemblies in our larger cities, and especially to examine those which it is understood have been successfully constructed.

"The quarries from which the materials are obtained should be inspected by you at an early day.

"Such books as you may need for your instruction and assistance will be furnished from the library of this department. A copy of a clause in the act of 3d March, 1853, making appropriations to supply deficiencies, is enclosed for your information.

"You will freely consult with this department, and make your reports directly to this office.

"Very respectfully, your obedient servant,

"JEFF'N DAVIS,
"*Secretary of War.*

"Captain M. C. Meigs,
"*Corps of Engineers, Washington.*"

I proceeded immediately to make the requisite examinations of the foundations, and of the plans and construction of the work.

The foundations were examined by excavating so as to expose the soil upon which they rest, and by mining in many places into or through the masonry. Upon this examination, I made to you, on the 28th of May, a detailed report, concluding as follows:

"While I regret that a larger proportion of hydraulic lime was not used in the foundations, so as to give greater dryness and solidity to the masonry, I do not apprehend any danger of their failure, and report as my opinion, the result of a careful examination and much reflection on the subject, that they are sufficient to bear the weight of the proposed structure."

In examining the plans of the halls intended for the meeting of Congress, I became satisfied that they were not such as to promise a favorable result.

After a careful study of the subject, I caused plans to be prepared in accordance with the views set forth at length in my letter to you of 19th May, a copy of which accompanies this report.

This letter and the plans proposed by me for the completion of the south wing were referred to Professors A. D. Bache, of the Coast Survey, and Joseph Henry, of the Smithsonian Institute, as a commission on acoustics.

I was directed to accompany them, and to aid them in an examination of the principal public rooms of the cities of Philadelphia, New York, and Boston, with a view to making such comparisons between rooms of different forms and sizes whose acoustic qualities had been determined by the surest test, experience, as might throw light upon this difficult subject.

They visited many different public buildings, among which were, in Philadelphia, the Girard college; Eastern penitentiary, in whose long halls some curious phenomena were noted; Musical Fund hall; Circular church, in Sansom street; new concert room, in Chesnut street; several theatres, and other public rooms.

In New York and Brooklyn, the Metropolitan hall; Niblo's theatre and concert room; Castle garden; the Tabernacle; rotundo of the Exchange; St. Bartholomew's church; Dr. Bethune's, Dr. Beecher's, and many other churches.

In Boston, the new Music hall; the vaults under Beacon hill reservoir; the legislative halls; Faneuil hall; the Melodeon, &c.

The examination of these different rooms, in most of which experiments were tried, by speaking in different parts of the room, by noting the duration, loudness, and source of the echo, the effect of external noises, &c., and of most of which sketches, showing the general form and dimensions, were taken, gave a series of observations which, when properly studied and completed, as is intended by the commission in some further experiments, cannot fail to be of great value.

Enough was seen to enable the commission to make a partial report upon the 24th June last, in which they say:

"They are now prepared to report that the principles presented to them by Captain Meigs are correct, and that they are judiciously applied.

"They are of opinion that the plans should be provisionally adopted, in order that the building may not be delayed, subject to such modifications in the details as may result from further study of them by Captain Meigs, or from the experiments and observations of the commission.

"This general adoption of the plans will not, it is believed, interfere with any changes of details likely to be found desirable."

Upon receipt of this report and your recommendation, the President adopted the plans which had been prepared for the south wing, and its construction was immediately commenced.

The plans for applying the same principles to the north wing were prepared as soon as possible, and received the approval of the President upon the 5th July.

These plans were prepared by the accomplished architect, Mr. Thomas U. Walter; and I am happy in being supported by his opinion, that not only will the legislative halls be better adapted to their main purpose as rooms for debate, but that the architectural beauty and the convenience of the buildings will be increased by the changes which have been made.

Since then the work has been pressed with all possible rapidity.

The Hall of Representatives is 137 feet long, 92 feet wide, and about 30 feet high. Upon three sides it is surrounded by a wide gallery, capable of seating 1,200 persons. Arranged in a semi-circle upon the floor are 300 separate desks for the members, like those now in use in the Senate chamber.

The space between the front of the gallery, which is rectangular, and the semi-circular railing outside of the members' seats, affords room for sofas, for the use of those persons admitted to the floor of the House, and also for a further provision of desks for members, should the House ever be increased. The space under the galleries is enclosed, and occupied by coat and cloak rooms.

The ceiling will be of iron, suspended from the iron-roof truss, with proper openings for ventilation, and with large spaces filled with ground or stained glass, which will diffuse a uniform light over the whole floor. The intensity of this light can be modified by louvres under the glazed portions of the outer roof.

At night the hall will be lighted by gaslights placed above the glass of the ceiling, thus excluding the glare, heat, and smell of the gas, and preventing contamination of the atmosphere by the products of combustion.

The ventilation of so large a room as this, liable to frequent and great fluctuations in the number of persons within it, will require special provision. By supplying constantly a large quantity of pure air, at a moderate temperature, however, a perfect ventilation can be obtained. The only reliable mode of doing this is by using a fan or other blowing engine to supply the air, and by warming it as it enters, by pipes filled with moderately-heated water.

The notes on acoustics and ventilation accompanying this report will show how it is proposed to arrange this ventilation. To that paper I must refer, also, for the reasons which induced me, after a careful study of all the published authorities I could find on the subject, to recommend the particular construction adopted for the legislative halls. I do not doubt that the rooms we are now constructing will be the best debating rooms of such size ever built.

The position of the Hall of Representatives, in the centre of the south wing, allows it to be surrounded by retiring, conference, and committee rooms, post office, offices of the clerk of the House, &c., of easy access. The corridor, which nearly surrounds the hall, affords free communication, from the various doors leading into the hall, to these rooms. At the same time, the public being excluded, during the business of legislation, from some parts of these corridors, members of committees, clerks, and officers, will not be liable to interruption, as in the old Capitol, in passing from the hall to the committee and conference rooms, and offices of the engrossing clerks. Much time, precious in the last hours of a session, will be saved by the convenient arrangements here made.

There are five doors leading into the hall from the surrounding corridor. Two private staircases lead from the hall itself to the basement story. Some of these different entrances will, in the most crowded state of the Capitol, always afford to the members the means of avoiding the annoyance, bustle, and confusion which are so common in the lobbies of the old Capitol.

The retiring rooms and conference rooms will be very convenient and very beautiful.

In the plan of the south wing, under construction when I was placed in charge of this work, all the offices of the House, all the committee rooms, retiring rooms, &c., were separated from the hall by a broad corridor open to the public; and the only entrance to or exit from the House was through this corridor.

No one who has seen the crowds which collect in the public lobbies of the houses during the last days and nights of a session of Congress, can fail to understand the disadvantages of this single entrance, and the great advantages of the public and private communications of the new plan.

The public galleries are spacious—seating about twelve hundred people. They will be entered from a spacious corridor in the second story, reached by broad flights of marble stairs. These stairs will be the most stately in the country, and when embellished with our beautiful native marbles will, I trust, compare favorably with any abroad.

The reporters' gallery is above the Speaker's chair. It occupies one side of the hall. Behind it is a broad corridor, to be reserved for the use of the reporters, with desks at which their notes can be written out, and telegraphic apparatus, by which a speech may be in process of transmission to the remotest constituent before its delivery is concluded.

The Speaker's room and the retiring rooms of the House open directly into the hall on one side, and on the other upon the noble southern portico, which is accessible only from them, and is thus reserved for the use of the members. The Speaker's room is directly behind the Speaker's chair, and on each side of it is a retiring room; thus affording to each of the great parties, into which the House must always be divided, a room for consultation.

The most striking parts of this wing, after the Hall of Representatives itself, are the entrance lobby, decorated with coupled Corinthian columns and ceiled with marble, the magnificent marble staircases, and the wide corridor which crosses the basement from north to south. This is twenty-four and a half feet broad, and contains thirty Corinthian marble columns. The enriched, arched, and panelled ceilings of the corridors of the principal story will also afford opportunities for architectural embellishment.

The basement, the division walls of which are completed, contains seventeen committee rooms, lighted from the outside corridors, and eleven interior rooms, which have only a secondary light, and which will be used for the storage of books and documents.

When this wing is completed it will be necessary to enlarge the northern door of the present House of Representatives, and remove the galleries and temporary wooden floor. This will, like the central rotundo, be a room for the assemblage of the public, whom interest or curiosity bring to the Capitol during the sessions of Congress. I have seen the rotundo thronged; and as each year our population increases, and the interests connected with legislation enlarge, greater numbers will be drawn towards the Capitol, and more room will be needed. This noble hall will thus be turned to a useful purpose, and be kept clear and unencumbered in its original state. It has been the scene of so many important events of the history of the country, that no one can desire to see it changed, by being cut up into committee rooms or encumbered with shelves.

The principal floor contains, besides the Hall of Representatives, the vestibule, the corridors, and grand staircases, fourteen well-lighted rooms.

The hall of the Senate is arranged upon the same principles as are applied to the House of Representatives. Its smaller size—112 by 82 feet—renders it less difficult to construct, and leaves room for larger and more magnificent corridors and retiring rooms.

The suite of apartments embracing the Senators' retiring room, the Vice President's room, conference rooms, and their approaches, will be of unrivalled beauty.

The same facility of ingress and egress by public and private doors and private stairs, will enable Senators, as well as Representatives, to escape the throng of the public rooms.

The offices are conveniently arranged. The grand staircases, corridors, &c., are of corresponding splendor with those in the south wing; and the plan offers as many striking features of various architectural beauty, without monotonous repetition.

The western and northern porticos are reserved for the use of Senators and the officers of the Senate.

The changes in the plans rendered necessary extensive alterations in the foundation walls, which were effected by cutting through the arches of the basement floor, and, through the openings thus made, removing earth excavated from foundations.

These foundations were made of concrete, resting upon the natural soil. In some parts of the work, many feet below the cellar floors, about thirteen hundred cubic yards of concrete foundation were thus laid. The walls resting upon this concrete, for speed, and also for economy of construction in the dark and intricate vaults of the cellars, in which the handling of stone would have been difficult and expensive, were built of brick, and were carried up to the level of the basement floor.

The contractor who had undertaken to execute the brick-work of the Capitol extension, when called upon to commence work, objected that the season was advanced, and that he had lost the opportunity of collecting a force, as he had expected, before the rise of wages. As his price was so low as to make it manifest that he could not execute the work properly except at a ruinous loss, I recommended that he should be released from his contract, and the work done, as it should be, by day's work. You approved this recommendation, and the work has been executed economically and thoroughly, under the direction of skilful and trusty foremen, and to the entire satisfaction, I believe, of both the workmen and the superintendents. The men are paid according to their skill and industry, and seem to be industrious and contented. I have never seen a better body of mechanics.

The contractor, who had engaged to deliver ten millions of bricks, failed before he had delivered one-and-a-half millions, and to prevent the work from stopping, I was obliged to purchase at an advanced price in the market of Washington. This city could not supply enough for the daily use of the work, and it was very important to have not only enough for this season, but a stock on hand to be applied next spring, during the time when it is practicable to build before any bricks can be made. I therefore proceeded to Baltimore, Philadelphia, and New York, in all of which cities I purchased bricks to be delivered here during the fall and winter. For the difference between the cost of these bricks and the contract price, the contractor and his sureties are bound to the United States.

The discoloration of the marble has received my attention. When I took charge I caused many blocks to be removed from the walls, understanding that a promise had been given that this should be done. Specimens of the marble were submitted to skilful chemists for analysis, and a report has been received which satisfies me that these stains will disappear in time. Some which were very conspicuous shortly after the blocks were placed in the wall have already almost entirely disappeared; and I do not doubt that when the water—which is contained in all green masonry—dries out, the walls will present the most beautiful specimen of marble-work in the United States.

Some delay has been caused by the want of a few blocks of marble necessary to complete the basement walls. They are expected shortly, when a large quantity of stone, already cut for the principal story, can be set.

About two-thirds of the arches covering the basement of the south wing are at this date turned, and the others are proceeding rapidly.

The north wing was not commenced quite so early; but its basement will, if the weather continues favorable, be covered this fall.

With the liberal appropriations made by Congress, the only limit to the rapidity of building hereafter will be the possibility of getting marble. The whole quantity of marble received up to this date is 75,639 cubic feet; and, though it has not come lately as rapidly as I could wish, I doubt whether so large a quantity of so beautiful a material has ever before been delivered at a public building in the same space of time.

When I took charge of the work, I found a doubt cast upon the legality of the contracts for the extension of the Capitol, particularly the contracts for the marble and for the marble cutting.

Not being willing to take the responsibility of carrying on these contracts while this doubt remained, I requested you to submit them to the Attorney General of the United States. His opinion, of the 6th May, sustains the contracts, and removes all doubt upon the subject.

The only contracts made during the year were with Frederick A. Burch for laying bricks, and with C. Wendell for ten millions of brick. Copies of them accompany this report.

With a view to obtaining American marbles for the interior decoration of the Capitol, an advertisement has been issued. Specimens have been received from various places, though they are not so numerous as is desirable. The most beautiful thus far received is from Tennessee, and a quantity of this has been ordered.

Cash account.

Available on 1st December, as shown by the report of the architect of that date	$104,200 03
Amount appropriated in deficiency bill for the year ending 30th June, 1853	400,000 00
Amount appropriated for service of year ending 30th June, 1854	600,000 00
	1,104,200 03
Amount expended from 1st December, 1852, to 30th September, 1853	322,383 54
Amount available 30th September, 1853	781,816 49

For the service of the year ending June 30, 1855, the sum of $750,000 will be required.

I have the honor to be, very respectfully, your obedient servant,

M. C. MEIGS,
Capt. of Engineers, in charge of Extension U. S. Capitol and of Washington Aqueduct.

Hon. JEFFERSON DAVIS,
Secretary of War.

List of papers accompanying the report.

I. Order of President transferring Capitol extension to Department of War.
II. Report on foundations.
III. Letter to Secretary of War, enclosing plan of proposed changes in extension United States Capitol.
IV. Notes on acoustics.
V. Letter of Secretary of War to Professors Bache and Henry.
VI. Orders of Secretary of War to Captain Meigs to aid Professors Bache and Henry.
VII. Partial report of Professors Bache and Henry.
VIII. Contract with F. A. Burch—bricklaying.
IX. Contract with C. A. Wendell—bricks.
X. Advertisement for specimens of marble.

I.

EXECUTIVE OFFICE, *March* 23, 1853.

Believing that the public interests involved in the erection of the wings of the United States Capitol will be promoted by the exercise of a general supervision and control of the whole work by a skilful and competent officer of the corps of engineers or of the topographical corps, and as the officers of those corps are more immediately amenable to the Secretary of War, I hereby direct that the jurisdiction heretofore exercised over the said work by the Department of the Interior be transferred to the War Department, and request that the Secretary of War will designate to the President a suitable officer to take charge of the same.

FRANKLIN PIERCE.

II.

OFFICE OF EXTENSION OF U. S. CAPITOL,
Washington, May 28, 1853.

SIR: I have the honor to report the result of an examination of the foundations of the extension of the United States Capitol, as instructed in your letter of 4th of April.

The committees of engineers and topographical engineers, who in March, 1852, at the request of the Senate Committee on Public Buildings, examined these foundations in their then condition, reported that they found the walls to rest uniformly upon the natural soil of gravel and clay.

They caused holes to be dug as low as or below the level of the bottom of the foundations at the four corners of the building.

I caused nine other holes to be sunk, to examine the soil upon which these foundations rest.

The result of my examination agrees with theirs, except that I found one short pier in the north wing, the foundation of which, not being sunk so low as that of the outer wall with which it is bounded, has not reached the natural soil. This I have directed to be underpinned.

The nine wells sunk by myself in addition to four made at the inspection of March, 1852, make thirteen points at which the sub-soil of this foundation has been examined, and are enough to enable me to speak with confidence. I have no hesitation in saying that the soil is such as to bear securely the weight of the building.

I examined the outside of the foundation walls carefully where they were exposed by the removal of the earth. This outside face, having been built very near the vertical face of the excavation made for the foundations, is left rough. I was enabled to see that the joints were generally well filled with mortar. I saw some few cavities in one or two places which I examined, but not more than were to be expected in so large a work, where it is impossible to inspect every stone that is laid. I also examined the walls by cutting into them in many places, generally from the inside. Holes were cut reaching into the heart of the main walls—in one place quite through.

The wall is 6′ 9″ thick above the cellar floor, being thicker below that level. The breadth of the footing varies with the depth, being in no case less than seven or eight feet; and on the west front, where the wall under the inner range of columns and that under the main wall of the building are founded at a depth of nearly forty feet below the basement floor, the two foundations are joined in one mass of twenty feet in width.

I found the main wall to be composed of stones of various sizes, large and small; not so large as to make the handling of them expensive, nor so large as I have used in the facing of scarp walls of fortifications, but quite as large as I have wished to use in the rubble backing of these walls, and quite large enough to make a very strong and substantial wall. The stone is the blue gneiss of the Potomac quarries; and though it is said that the heart of the wall contains (particularly in the south wing) some weathered stone, there is no reason to apprehend that any weight likely to come upon these 6′ 9″ walls will ever crush the worst of these stones. None of it, certainly, is as easily crushed as any natural earth on which a wall can rest.

The quality of the mortar used is defective. Its color generally indicated, where I examined it, the presence of some cement. In a few places it was so light-colored as to induce me to think that there was no cement. Wherever I found the mortar white, it was quite soft; where the color was darker, indicating cement, it was harder; but it had not generally set so hard as a mortar made of cement, lime, and sand, in good proportions, and placed fresh in the wall, would have done in the period that has elapsed since this wall was built.

The masons employed to open the walls for examination removed the stones by loosening them with crowbars, and mined into the walls without the use of any cutting tools. Had the mortar contained one-third or one-half as much cement as lime, they would have needed stonecutters' chisels and hammers to remove or cut off the stones.

I think that the cement may have been left too long mixed, or else that there was not enough of it used.

By way of comparison, I examined the foundations of the south projection of the old Capitol building. These were put in about forty years since, and I found the mortar white, evidently containing no cement, and still soft.

While I mention the condition of the mortar as a defect, I do not consider it a fatal one.

It must be remembered that forty years ago the use of cement was almost unknown in this country, and the foundations of all the large buildings erected at that time must have been laid with common lime mortar; such is the construction of the old Capitol, as we see from observation.

Fortress Monroe was built with lime mortar, and examinations of the old walls show that the mortar in the centre of them is now as green and soft as when first laid.

The stones in the main wall of the Capitol extension where I opened them were well laid, the joints well filled, and the stones, large and small, packed closely together. Though the mortar was not generally hard, it was by no means in the soft state of that of the old Capitol, or that it would have been had no cement been used. It was hard enough to keep the stones together, and to prevent any lateral displacement.

The footings of the piers and partition walls are very broad. These walls being thinner, generally about 3′ thick, and finished with two roughly-dressed faces of rough-squared stones, are still more compact than the outer wall, and having fewer joints, are less liable to compression.

A very careful examination of the interior face of the outer walls of both wings, looking particularly into the re-entering angles at the heads of the piers, did not enable me to discover a single crack or evidence of recent settlement. The inside of the walls has generally been pointed, in some cases roughly pointed, as the wall was built, which is the best method; in others, pointed afterwards with a different mortar. Had there been any settlement since this was done, it would have certainly shown its effects in cracking the pointing. When we consider that these walls vary in height from 15 to 40 feet, being founded on horizontal benches cut in descending the side of the hill. I think it a proof of good work to find the settlement so uniform as not to have caused cracks.

In conclusion, while I regret that a larger proportion of hydraulic lime was not used in the foundations, so as to give greater dryness and solidity to the masonry, I do not apprehend any danger of their failure, and report as my opinion, the result of a careful examination and much reflection upon the subject, that they are sufficient to bear the weight of the proposed structure.

I have the honor to be, sir, respectfully, your obedient servant,

M. C. MEIGS,

Capt. Eng., in charge of Ex. U. S. C. and Wash. Aqueduct.

Hon. JEFFERSON DAVIS, *Secretary of War.*

III.

OFFICE OF EXTENSION OF U. S. CAPITOL,
Washington, May 19, 1853.

DEAR SIR: I have the honor to enclose a report prepared by the architect of the United States Capitol, giving the history of the formation of the plans for the extension of that building now under construction.

I have attached to his plan (G) a fly, showing the arrangements which I have recommended for securing a better Hall of Representatives than is provided by the plans heretofore proposed.

Having verbally, in my interview with the President and yourself, fully explained the proposed changes, with the aid of large drawings showing the accommodation to be afforded, it is not necessary here to enter into detail.

I will only repeat my own conviction, that the proposed change will secure a better room for speaking and hearing, and better accommodations for the members and officers, and business of the House.

I am happy in being supported by the opinion of the architect, who says, as you will perceive, that the alterations, besides securing these advantages, will enhance the beauty of the hall.

I have prepared some notes upon the application of the general principles of acoustics and ventilation, which have guided me in devising the plan which I propose.

They contain the views I expressed to you verbally, and which I proposed to write out for submission to some gentlemen of eminent scientific reputation.

While I feel quite confident that I am correct, I shall be happy to be sustained by their approval if right, and will be much better satisfied to be corrected if wrong, than to be permitted to go on and fail in so important an undertaking.

The changes which I recommend in the plan of the south wing, in order to carry out the above views, are shown upon drawings which have already been explained to you.

I would like to have an opportunity to show them to the gentlemen to whom you will refer these notes.

To lay down general principles correctly is not sufficient security that the application of them will be judiciously made.

I am, sir, very respectfully, your obedient servant,

M. C. MEIGS,

Captain of Engineers, in charge of Capitol Extension.

Hon. JEFFERSON DAVIS, *Secretary of War.*

IV.

Notes on acoustics and ventilation, with reference to the new Halls of Congress, by Captain M. C. Meigs, United States Corps of Engineers, May, 1853.

Experience shows that the human voice, under favorable circumstances, is capable of filling a larger space than was ever probably enclosed within the walls of a single room.

Herschel, in his admirable treatise on sound, gives a few instances which are instructive.

Lieut. Foster, on Parry's third Arctic expedition, found that he could converse with a man across the harbor of Port Bowen, a distance of 6,696 feet, or about 1¼ miles.

Dr. Young records that, at Gibraltar, the human voice has been heard at a distance of 10 miles.

I have myself on the shore of Lake Champlain, at evening, heard the echo of the voice returned from the opposite shore, at a distance of nearly two miles, the sound having travelled between three and four miles before it returned to the ear.

If sound be prevented from spreading, and losing itself in the air, either by a pipe or an extensive flat surface, as a wall or still water, it may be conveyed to a great distance.

Biot heard a flute clearly through a tube of cast iron (the water-pipes of Paris) 3,120 feet long. The lowest whisper was distinctly heard. In fact, the only way not to be heard was not to speak at all.

Standing on the platform used by the painters in the new Congressional Library, Professor Henry and myself conversed in a low tone, hearing distinctly from one end of the room to the other. The room is 99 feet long. The platform is about 7½ feet below the deeply-moulded iron ceiling.

Professor Reid states, in describing his lecture and practical class-rooms, which together occupied a space of about 80 feet square, that in every part, both of the lecture-room and of the practical class-room, whether crowded or empty, the slightest whisper, or the loudest noise, was heard distinctly without offensive reverberation, or the necessity of any exertion of the voice beyond that used in conversation.

The favorable circumstances seem to be a perfectly tranquil and uniformly dense atmosphere, absence of all extraneous sounds, absence of echoes and reverberation, vicinity of reflecting surfaces, and perhaps in some measure the presence of substances which conduct sound well.

A pure atmosphere being favorable to the speaker's health and strength, will give him greater power of voice and more endurance; thus indirectly improving the hearing by strengthening the source of sound, and also by enabling the hearer to give his attention for a longer period unfatigued.

The analogy between sound and light in regard to their progress, reflection, and refraction, seems well established.

By employing reflectors of proper forms, sound emanating from one point can be collected to a focus at another.

When the reflector is a plane surface, the angle of reflection is equal to the angle of incidence.

Experiments under water show that in passing from a denser to a rarer medium, there is an angle of total reflection.

The speed of its transmission varies with the elasticity and density of the medium.

Like light, it is confused by passing through air unequally rarified by heat.

It is more difficult to trace the progress of sound than of light. Sound is invisible during its passage, and cannot be traced as light is, by illuminating the motes in its path; nor is the ear as accurate in estimating the direction from which it receives sound, as the eye is in determining the direction of the source of the light which falls upon it. But finding a strong analogy to light in those cases where it can be followed, we may reasonably, within proper limits, infer it in others.

The effect of echoes in a small room is generally unnoticed; the echo returns so quickly that the ear receives it as coincident with the original sound, to which it in that case merely adds strength, perhaps prolonging it very slightly.

If the room be larger, and the echoing wall so distant that the interval is sensible, the echo makes confusion.

If on a calm day we advance towards a wall, producing at each step some sound, we will find a point at which the echo ceases to be distinguishable from the original sound. The distance from the wall, or the corresponding interval of time, has been called by Professer Henry the limit of perceptibility. This limit will vary with the nature of the sound; if the sound be sharp and distinct, as that produced by striking some hard substance, we will find the limit of perceptibility less than for the more prolonged sound produced by the voice.

The limit will probably vary also with the acuteness of the ear; some persons being probably able to separate sounds undistinguishable to others.

The general limit is probably about 30 or 35 feet. It should be ascertained exactly, and in constructing a room for public speaking, the height of the ceiling should not exceed this limit.

The sound will then be strengthened to the speaker himself by the echo. The interval between the original and reflected sounds will be shorter for all his hearers than for himself, as will be evident from the adjoining sketch of its path, [see Sketch A at the end of the volume,] where twice the line S E, the path of the voice and echo for the speaker, is evidently longer than the difference between S H and S C H, which are the paths of the direct and reflected sounds to one of the auditors.

The direct echo from the ceiling then becomes an advantage, by strengthening without confusing the sound.

But echo acts in still another way by being repeated between opposite surfaces.

The effect is like the multiplication of the image of a candle between two opposite and parallel mirrors. I have noticed it in the long unfinished room of the Smithsonian, where the sound produced by clapping the hands is repeated so as to resemble a laugh—ha! ha! ha!

In this case the distance between the end walls is such as to separate the successive echoes; but when the walls are nearer, the sound becomes continuous, and is the ringing sound often produced in speaking in empty rooms, and called reverberation.

This might trouble us between the ceiling and floor of our room; but a thick carpet absorbing sound and not reflecting it, will remove this difficulty.

The great size of the room needed for the meeting of the House of Representatives, makes it impossible to bring the walls within the limit of perceptibility. Professor Reid proposed in the houses of Parliament to make the ceiling high in the centre, declining towards the sides, with floors and galleries rising from the centre towards the walls, thus reducing the height and surface of the walls, so as to diminish the quantity of sound reflected from them as much as possible. All regard for architectural beauty forbids the adoption of this construction, which seems to have been modelled upon an empty tortoise-shell.

Breaking the walls into deep panels has also been proposed.

But when we recur to the limit of perceptibility, we shall perceive that a panel or recess must be over 30 feet deep to separate the echoes from the bottom of the recess, and from the face of the wall.

The surfaces of mountains covered with trees and rocks return echoes. No wall of an inhabited apartment can be made rougher than these natural reflectors.

A simpler and more effectual method of controlling the echoes from the walls, will be to cover them with drapery absorbent of sound.

The echoes from the ceiling are thus turned to account, and those from the floor and walls guarded against; but the echoes from small objects and surfaces may still be troublesome unless provided for. The trunks of trees in the edge of a forest return together a distinct echo. The beams under the flooring of the Menai suspension bridge are instanced by Herschel as giving a curious echo; and even such small objects as the vertical iron rods composing the fence on Pennsylvania avenue in front of the President's house, will be found to return a singular whistling echo to the sound made by striking a smart blow upon the pavement on a still night.

To guard against this, it will be sufficient to cushion the chairs and cover the desks with some material which will not reflect sound.

This may seem, and may possibly be, an unnecessary precaution; but I wish to leave no possible cause of confusion unnoticed, and to point out what I consider the means to obtain, for the first time, a room perfect in its acoustic arrangements.

Having thus disposed of the question of echoes and reverberations, the next essentials to perfect and distinct hearing are a tranquil atmosphere and the absence of extraneous sounds.

I consider them together, as we shall find that the precautions essential to obtain the one will also secure the other.

Windows, in cold weather, separating the warm air within from the cold air without, serve as refrigerators, cooling the air in contact with the glass. The air, thus rendered heavier, immediately falls, and a descending sheet of cold air is produced, which, on reaching the floor, spreads over it in a cold stratum, and to persons of sensitive nerves or feeble health causes great inconvenience, being felt as a draught upon the feet and legs. And many an unfortunate page has been blamed for leaving open a door, when the draught really has been caused by this air cooled by the closed glass of an adjacent window. The circulation thus produced of air of different densities, is unfavorable to distinctness of hearing. As the ascending hot air along a stovepipe or heated wall causes irregular refraction of light, and produces a tremulous appearance in all objects viewed through it, so sound, irregularly refracted, becomes less clear and distinct.

If we exclude external windows, and light the room only from the roof, we get rid of this fruitful source of discomfort and indistinctness; at the same time we obtain a pleasanter light, ample for all useful purposes, as is proved by its adoption in all the best constructed picture galleries.

We also exclude the sounds of the exterior, which, saturating the air as it were, distract the attention, and even overpower the voice we wish to hear, as the diffused light of day causes the stars to disappear.

Open windows for hearing will be worse than closed ones; they not only let irregular, disturbing currents of air in, but they let the voice out—acting like black spaces in the wall of a room, which do not return the light which falls upon them.

The common mode of warming and ventilating public rooms is fatal to perfection of hearing.

One or several columns of intensely heated air are introduced through holes in the floor. Being much warmer than the air of the apartment, they immediately rise to the ceiling. If the exit apertures for foul air are above, this fresh and heated air alone escapes, having done nothing for the apartment except to cause whirls and currents, such as we see in a column of smoke passing from a chimney on a calm day. The irregular refraction of sound through these currents of unequal density tends greatly to produce confusion.

If the exits for foul air are below, the hot air accumulates at the top of the room, and, gradually displacing the cooler air, forces it out through these passages.

Professor Reid relates that he has found the air near the ceiling of a room at the boiling temperature while those on the floor were complaining of cold.

Here we have strata of different densities and unequal refractive power, and hence confusion of sound.

As the warm air must ascend to the top of the room, I propose to let it do so in a large trunk outside of the apartment—pass into a space above the ceiling, and thence by numerous holes find its way, as through a sieve, into the room.

By a steam-driven fan, or other mechanical means, we can pump air, in any desired quantity, into any spot to which we choose to direct it.

I would drive all the air required for the supply of the room through a maze of hot-water pipes, raising the whole of it to the temperature desired—60° or 80°, as the case might be.

If the room be thirty feet in height, and it be desired to change all the air in it every fifteen minutes, enough air should be pumped in above to cause a general descent of the whole body of air in the room at the rate of two feet a minute.

This would be an imperceptible current. The exit should be by numerous holes in the floor, perhaps through the carpet, or the risers of the platforms on which are the members' chairs.

Three important advantages would thus be gained: the avoidance of all eddies, a nearly homogeneous and tranquil atmosphere, and the immediate removal downwards of any dust from the carpet, which would thus be prevented from rising, to be inhaled into the lungs.

To prevent the disturbance and contamination of the atmosphere by the gaslights, I would place them above the glass of the skylights—the space between those in the ceiling and those in the roof being separated from the chamber into which the fresh air should be admitted.

In summer the same apparatus which sends in warm air in winter would supply a constant breeze, and if the temperature of the external air was too high it might be cooled by jets of water from pipes in the air passages, or even by melting ice.

To recapitulate, then, I propose to place the ceiling at such a height as to be within the limit of perceptibility, and thus strengthen the voice; to destroy reverberation between the ceiling and the floor, by a thick carpet on the latter; to prevent echoes from the walls, by drapery; from the chairs and desks, by cushioning or covering them; to keep out extraneous sounds, by making the room an interior apartment lighted only from above; to secure a tranquil atmosphere, uniform in its density and refraction of sound, by excluding all currents of hot or cold air; to secure a constant supply of pure air at the temperature desired for the room, by mechanical means introducing the air through all parts of the ceiling and taking it out through all parts of the floor—thus also to remove dust; to prevent all interference with ventilation by the lights at night, by placing them outside the room above the skylights.

I feel confident that, by observing the above-described precautions, we will obtain rooms as near perfection as is possible—"rooms in which no vitiated air shall injure the health of the legislators, and in which the voice from each member's desk shall be easily made audible in all parts of the room."

This was the problem proposed to me for solution.

In conclusion, I have the honor to repeat the request made verbally some days since, that the above notes and observations may be submitted to some person of scientific reputation, the weight of whose authority may sustain me if I am right, or correct them if wrong.

Respectfully submitted to the Hon. Jefferson Davis, Secretary of War, by his obedient servant,

M. C. MEIGS,

Captain of Engineers, in charge of Extension of U. S. Capitol and Washington Aqueduct.

V.

WAR DEPARTMENT,
Washington, May 20, 1853.

GENTLEMEN: Captain Meigs, of the corps of engineers, has submitted some notes upon acoustics and ventilation in reference to the construction of the new hall for the House of Representatives.

By direction of the President, who is desirous of obtaining the best scientific authority within reach upon this subject, I enclose them for your perusal, with a request that you will give them such consideration and make such remarks upon them as you think proper.

The importance of this subject to the convenience and health of Congress will be a sufficient excuse for troubling you thus far.

If you will appoint a time for an interview, Captain Meigs will lay before you the drawings showing the plan of construction which he proposes.

Very respectfully, your obedient servant,

JEFFERSON DAVIS,
Secretary of War.

Messrs. A. D. BACHE, LL. D.,
and JOS. HENRY, LL. D.

VI.

WAR DEPARTMENT,
Washington, June 7, 1853.

SIR: You will accompany Professors Henry and Bache to Philadelphia and New York and Boston, if they desire it, and assist them in making such experiments in regard to the acoustic phenomena of some of the public rooms in those cities as they may think necessary to enable them to report upon the proposed alterations in the plans for the south wing of the Capitol extension.

Having concluded this business, you will proceed to make an inspection of the marble quarries, visiting the quarry from which the Capitol is supplied, and such others in the neighborhood as you may find it desirable to examine.

JEFFERSON DAVIS,
Secretary of War.

Captain M. C. MEIGS,
Engineer in charge of Extension of U. S. Capitol.

VII.

JUNE 24, 1853.

SIR: The undersigned have examined, as you requested, the principles proposed by Captain M. C. Meigs, of the corps of engineers, with reference to the acoustics, heating, and ventilation of the Hall of Representatives, to be erected in the Capitol extension building, and the plans which have been prepared by Mr. Walter in accordance therewith.

They have also visited, with Captain Meigs, many of the principal buildings in Philadelphia, New York, and Boston, and have examined them in reference to their acoustic qualities.

They propose to make a full report to you on the subject, with a descriptive memoir by Captain Meigs, and to continue their experiments upon points of detail not definitively settled in their judgment.

They are now prepared to report that the principles presented to them by Captain Meigs are correct, and that they are judiciously applied.

They are of opinion that the plans should be provisionally adopted, in order that the building may not be delayed, subject to such modifications in the details as may result from the further study of them by Captain Meigs, or from the experiments and observations of the commission.

This general adoption of the plans will not, it is believed, interfere with any changes of details likely to be found desirable.

Very respectfully, yours,
A. D. BACHE,
JOSEPH HENRY.

Hon. JEFFERSON DAVIS,
Secretary of War.

VIII.

Agreement between the United States of America, of the first part, by Thomas U. Walter, architect, acting under the authority of, and for and in behalf of, the said United States, in the erection of the extension of the Capitol, and Frederick A. Burch, bricklayer, of the city of Washington, D. C., of the second part, witnesseth:

That the party of the first part, having decided that all the brick-work required to complete the aforesaid extension of the United States Capitol shall be done by contract, hereby enters into agreement with the party of the second part to execute the same according to the terms and stipulations hereinafter set forth.

The party of the second part, in consideration of the matters hereinafter referred to and set out, covenants and agrees, to and with the party of the first part, to lay all the bricks required to complete the aforementioned extension of the United States Capitol for *two dollars and forty-nine cents* per thousand, kiln count, understanding that this price is to cover the cutting of all groin and other arches, and all jobbing; also all tools, scaffolding, rigging, and everything necessary to the proper execution of the work. And the said party of the second part further agrees to execute all the aforesaid work in the best and most workmanlike manner—fully equal to the work already done on the said extension of the Capitol—and to proceed with it as rapidly as may be required, understanding that the work is to be done according to such plans and directions as may be furnished from time to time by the architect, and that every part of it is to be subject to his approval.

The party of the first part, in consideration of the premises, covenants and agrees to pay the party of the second part at the rate of *two dollars and forty-nine cents* ($2 49) per thousand, kiln count, for all the bricks laid by the said party of the second part in the aforesaid extension of the Capitol, in accordance with the foregoing provisions, conditions, and requirements, and in conformity to the stipulations of this contract.

And it is hereby mutually understood by the parties that the party of the first part is to furnish, at its own proper cost, all the bricks, lime, sand, hydraulic cement, and whatever other materials may enter into the execution of this contract and become component parts of the buildings, and to cause them to be deposited on such portions of the Capitol grounds as may be designated by the party of the second part, provided the same shall not interfere with the other departments of the work, nor with the police arrangements of the Capitol. And the party of the second part is to furnish at his own proper cost all the work and labor required in executing the aforesaid brick-work, including all the tools, scaffolding, rigging, and whatever other implements may be required in performing this contract.

And it is further agreed and provided, that in case the architect shall at any time be of opinion that this contract is not duly complied with by the party of the second part, or that it is not in due progress of execution, or that the said party of the second part is irregular or negligent in the performance of this contract, in such case he shall be authorized to declare the same forfeited, and thereupon it shall become null, as far as it regards the party of the first part. And the party of the second part shall have no appeal from the opinion and decision aforesaid; and he hereby releases all right to except to or question the same in any place or under any circumstances whatever. But the party of the second part shall still remain liable to the party of the first part for all damages occasioned to the said United States by such non-compliance, irregularity, or negligence: *Provided, however*, That the aforesaid action of the architect shall only be taken with the advice and consent of the Secretary of the Interior: *And provided also*, That, in order to secure the faithful and punctual performance of the covenants made by the party of the second part by these presents, and to indemnify and protect the party of the first part from loss in case of default and forfeiture of this contract, the said party of the first part shall be authorized to retain in its hands ten per cent. on the amount of moneys at any time due to the said party of the second part, until the moneys thus retained shall amount to five hundred dollars; after which the work shall be paid for in full from time to time, leaving the aforesaid dollars in the possession of the party of the first part until the completion of the contract.

And in consideration of the moneys heretofore stipulated to be paid to the party of the second part, he hereby covenants and agrees to make no charges for extra work beyond those recognised by this contract, and to make no appeal hereafter to Congress for additional compensation.

And it is further stipulated and agreed, that no member of Congress shall be admitted to any share or part of this contract or agreement, or to any benefit to arise therefrom; and this contract shall be, in all its parts, subject to the terms and conditions of an act of Congress, approved on 21st day of April, 1808, entitled "An act concerning public contracts."

It is also expressly understood and agreed, by and between the parties hereto, that if Congress should at any time fail to make the appropriations necessary to carry on the aforesaid work, that then, and in such case, the execution of this contract shall be suspended until such appropriations shall be made, without thereby creating any claim on the United States by the said contractor.

And for the true and faithful performance of all and singular the covenants, articles, and agreements hereinbefore particularly set forth, the subscribers hereunto bind themselves jointly and severally, their and each of their successors, heirs, executors, and administrators.

Thus covenanted and agreed by us the parties aforesaid, this 29th day of December, 1852, as witnesseth our hands and seals.

THOMAS U. WALTER, [SEAL.]
FREDERICK A. BURCH. [SEAL.]

Signed, sealed, and delivered in presence of—
J. W. DENHAM,
FRANCIS MOHUN.

In consideration of the premises in the foregoing agreement between the United States of America, represented by Thomas U. Walter, architect, of the one part, and Frederick A. Burch, bricklayer, of the city of Washington, D. C., of the other part, and of one dollar to us the subscribers hereto in hand paid by the United States aforesaid, we, Barrack Hall and William H. Gunnell, of the city of Washington, D. C., hereby guarantee the full, punctual, and faithful performance of the foregoing contract on the part of the said Frederick A. Burch; and we hereby agree to be answerable for all damages which the said United States may sustain, or the said Frederick A. Burch may become liable to pay, in consequence of any neglect, failure, or omission on his part, punctually, faithfully, and fully to perform said contract, and every part thereof.

Witness our hands and seals this 29th day of December, in the year of our Lord one thousand eight hundred and fifty two.

B. HALL, [SEAL.]
W. H. GUNNELL. [SEAL.]

Signed, sealed, and delivered in presence of—
JNO. S. WALLACE.

IX.

Agreement between Cornelius Wendell, of the first part, and Captain Montgomery C. Meigs, of the United States corps of engineers, of the second part, acting under the authority of, and for and in behalf of, the United States of America, in the erection of the extension of the Capitol, witnesseth:

That the party of the first part, in consideration of the matters hereinafter referred to and set out, covenants and agrees, to and with the party of the second part, to furnish and deliver, at the proper cost of the said party of the first part, on the grounds of the aforesaid extension of the United States Capitol, in such places as the said party of the second part may designate, ten millions of thoroughly burnt bricks, made by hand, of tempered clay, in all respects fully equal in quality to the samples deposited in the office of the Extension U. S. Capitol, and marked with the name of the party of the first part, and to conform in every particular to the municipal laws of the city of Washington. And the aforesaid party of the first part further agrees to furnish and deliver the said *ten millions* of bricks at such times and in such quantities as the said party of the second part may direct, commencing within *thirty* days after this contract receives the approval of the Secretary of War: *Provided nevertheless*, That the average delivery on the whole contract shall not exceed *two hundred and fifty thousand* per week; and that all the bricks so delivered shall be subject to the approval of the party of the second part, and be received or rejected as he may direct.

And the party of the second part, in consideration of the premises, covenants and agrees to pay to the party of the first part the sum of five dollars and eighty-eight cents for every thousand bricks delivered in accordance with this contract; and that the payments shall be made monthly, if so required by the party of the first part: *Provided, however*, That in case the party of the second part shall at any time be of opinion that this contract is not duly complied with by the party of the first part, or that it is not in due progress of execution, or that the said party of the first part is irregular or negligent, in such case he shall be authorized to declare this contract forfeited; and thereupon the same shall then become null, and the party of the first part shall have no appeal from the opinion and decision aforesaid. And he hereby releases all right to except to or question the same, in any place or under any circumstances whatever; but the party of the first part shall still remain liable to the party of the second part for the damages occasioned to him by the said non-compliance, irregularity, or negligence: *And provided also*, That in order to secure the faithful and punctual performance of the covenants above made by the party of the first part, and to indemnify and protect the party of the second part from loss in case of default and forfeiture of this contract, the said party of the second part shall be authorized to retain in his hands, until the completion of the contract, *ten per cent.* on the amount of moneys at any time due to the said party of the first part.

And it is further stipulated and agreed, that no member of Congress shall be admitted to any share or part of this contract or agreement, or to any benefit to arise therefrom; and this contract shall be in all its parts subject to the terms and requisitions of an act of Congress passed on the twenty-first day of April, in the year of our Lord one thousand eight hundred and eight, entitled "An act concerning public contracts."

And this contract is also expressly understood to be subject to the terms and conditions of the joint resolution of Congress approved April 14, 1852, containing a proviso in the following terms, to wit: "*Provided*, Nothing herein contained shall be so construed as to authorize any officer of the United States to bind the United States by contract beyond the amount appropriated by Congress, or to sanction any such contract heretofore made:" *Provided also*, That it is expressly understood and agreed, that this contract, nor any part thereof, shall be sublet nor assigned; but that it shall be well and truly carried out and fulfilled in good faith by the above recited party, and that all payments on account thereof shall be made to the aforesaid party of the first part, his heirs, executors, or administrators: *And provided further*, That this contract shall not be binding upon the United States until it shall have received the approval of the Secretary of War.

And for the true and faithful performance of all and singular the covenants, articles, and agreements hereinbefore particularly set forth, the subscribers hereunto bind themselves jointly and severally, their and each of their successors, heirs, executors and administrators.

Thus covenanted and agreed by the said parties this 30th day of April, in the year one thousand eight hundred and fifty-three, (1853,) as witness their hands and seals.

C. WENDELL, [SEAL.]
M. C. MEIGS, [SEAL.]
Captain of Engineers.

Signed, sealed, and delivered in presence of—
THO. U. WALTER,
W. J. FITZPATRICK.

—

Know all men by these presents, that we, John J. Jarvis and James Waddell, of the city and county of Albany, State of New York, are held and firmly bound unto the United States of America in the full and just sum of of twenty thousand dollars, lawful money of the United States, to be paid to the said United States, or to its proper agent or attorney duly authorized to receive the same; to which payment well and truly to be made and done, we bind ourselves and every of us, our and every of our heirs, executors, and administrators, in the whole, and for the whole, jointly and severally, firmly by these presents. Sealed with our seals, and dated this twenty-seventh day of April, anno Domini one thousand eight hundred and fifty-three.

The condition of the above obligation is such, that if Cornelius Wendell, his heirs, executors, or administrators, do and shall well and truly execute a contract which he, the said Cornelius Wendell, has entered into with Captain Montgomery C. Meigs, of the United States corps of engineers, for and in behalf of the United States, by which he has contracted to furnish and deliver, at his own proper cost, *ten millions* of thoroughly burnt bricks, made by hand, of tempered clay, in all respects fully equal to the samples deposited in the office of the Extension of the United States Capitol, for the sum of *five dollars and eighty-eight cents per thousand*, the said contract being hereto annexed, then the foregoing obligation to be void and of none effect; otherwise to remain in full force and virtue in law.

JOHN J. JARVIS, [SEAL.]
JAMES WADDELL. [SEAL.]

Signed, sealed, and delivered in presence of—
H. N. DOWD,
JOHN STUART.

UNITED STATES COMMISSIONER'S OFFICE,
Albany, N. Y., April 27, 1853.

I certify that I am acquainted with John J. Jarvis and James Waddell, both of the city of Albany, in the State of New York, the sureties named in the above bond, and that they are severally freeholders and residents of the said city of Albany, New York, and, in my opinion, sufficient sureties for the purposes mentioned in the within bond.

R. J.,
U. S. Commissioner Northern Dist. of N. Y., 2d circuit.

Marble for Extension United States Capitol.—To owners of Marble Quarries.

CAPITOL EXTENSION OFFICE,
Washington, D. C., May 4, 1853.

In order to collect information in regard to American ornamental marble, suitable for the interior decoration of the extension of the United States Capitol at Washington, all persons owning veins or quarries of marble within the United States, which are worked or capable of being worked, are invited to send specimens to this office.

The specimens should be in blocks of cubical form six inches square on each face.

The following information should accompany each specimen: exact locality, State, county, and town, nearest post office, name of owner, price per cubic foot at the quarry, cost of delivery at the nearest steamboat or railway stopping place, size of blocks that can be obtained, with some general description of the quarry, noting the direction, thickness, and dip of the beds or veins into which the rock is divided. The specimens should not vary much from the dimensions above given; they should be boxed up, and a copy of the paper giving the information required should be enclosed in the box and another sent by mail. The box to be distinctly marked with the name of the sender, as well as directed to this office.

The specimens should be sent by the ordinary channels of commercial transportation, and reasonable freight will be paid upon their delivery at this office.

Editors of country papers generally which circulate where marble is known or suspected to exist, may confer benefits upon their districts by giving this advertisement an editorial notice.

Papers receiving a copy of this advertisement from this office are requested to insert it in the weekly for three months, and send a copy of their paper, with their bills, to this office.

M. C. MEIGS,
Captain of Engineers, in charge of Extension U. S. Capitol.

REPORT OF THE COMMANDING GENERAL.

HEADQUARTERS OF THE ARMY,
New York, November 16, 1853.

SIR: The military establishment, "in all that regards its discipline and military control," being placed by the army regulations under my immediate orders, I deem it a duty to submit the following statements and professional suggestions for the consideration of the higher authorities:

DISTRIBUTION OF THE ARMY.

Eight companies of the 3d artillery—six in the harbor of New York and two in Texas—are under orders for California.

The companies of the 2d artillery, at Forts Monroe and Moultrie, are under orders to exchange stations with an equal number of companies of the 1st artillery in Florida.

The companies of the 1st artillery heretofore at Baton Rouge and New Orleans barracks, are under orders for Texas. The one at Baton Rouge to be replaced by a company of the 2d.

The companies of mounted riflemen heretofore stationed on the Missouri frontier are under orders for the Cherokee nation, ultimately to go to the department of Texas, when the two companies of the 7th infantry now there are to go to the department of the west.

The 2d regiment of infantry now in California to be broken up, the privates to be assigned to companies on the Pacific, and the officers and non-commissioned officers to come to the Atlantic coast to recruit their companies. The destination of this regiment, and that of the two companies "L" & "M" of the 1st artillery, now on the recruiting service, is not as yet determined.

When the foregoing movements shall have been made, the following will be the distribution of the troops, under existing orders:

DEPARTMENT OF THE EAST.

COMMANDED BY BREVET MAJOR GENERAL JOHN E. WOOL.

Canada frontier from Lake Superior to Maine.

Three companies of artillery; aggregate strength about.....	164

Atlantic frontier from Maine to Florida.

Boston harbor, two companies of artillery; aggregate about..	85	
New York do.........do.........do.........do............	123	
Baltimore do.........do.........do.........do............	137	
Norfolk do.........do.........do.........do............	104	
Charleston do.........do.........do.........do............	79	
		528

Florida and Louisiana.

Two companies of the first and eight companies of the second artillery; aggregate about		395
Total		1,087

DEPARTMENT OF THE WEST.

COMMANDED BY BREVET MAJOR GENERAL DAVID E. TWIGGS.

Northwestern and Missouri frontiers and routes to Oregon and New Mexico

Two companies of artillery; aggregate about	83	
Two companies of dragoons....do.....do	120	
The 6th regiment of infantry...do.....do	675	
		878

Arkansas frontier and Indian country west of Arkansas and in northern Texas, and route to New Mexico.

Two companies of artillery; aggregate about	116	
The 7th regiment of infantry...do.....do	513	
		629
Total		1,507

DEPARTMENT OF TEXAS.

COMMANDED BY BREVET MAJOR GENERAL PERSIFER F. SMITH.

Mexican frontier from the mouth of the Rio Grande to and including El Paso, and Indian frontier of Texas and route to New Mexico.

Six companies of artillery; aggregate about	474
Six....do....of dragoons....do.....do	398
The regiment of mounted riflemen; aggregate about	642
The 1st regiment of infantry..........do......do	480
The 5th...do.......do..............do......do	657
The 8th...do.......do..............do......do	643
Total	3,294

DEPARTMENT OF NEW MEXICO.

COMMANDED BY BREVET BRIGADIER GENERAL JOHN GARLAND.

Two companies of artillery, Nine....do....of dragoons, The 3d regiment of infantry, } aggregate about	1,611
Total	1,611

DEPARTMENT OF THE PACIFIC.

COMMANDED BY BREVET BRIGADIER GENERAL ETHAN A. HITCHCOCK.

Oregon and California.

Eleven companies of artillery, three companies of dragoons, one regiment, (4th infantry,) and a detachment of ordnance; aggregate estimated	1,600
Total	1,600

In the foregoing memoranda, general recruiting depôts and recruits, armories, arsenals, the ordnance and other staff departments, are not included.

INCREASE OF THE ARMY.

By reference to the preceding statement, it will be seen that in the whole department of the west, in which lies the routes to Oregon and New Mexico, our northwestern and Missouri frontiers, containing numerous bands of Indians, but two companies of dragoons are posted. Fort Atkinson, at the crossing of the Arkansas on the route to New Mexico, having been abandoned, on account of the difficulty of supplying the post, entire reliance must now be placed on marches of detachments of cavalry to give security to our lines of communication with New Mexico and California. Other cavalry duties on those frontiers are likewise arduous and incessant, and at least one regiment of dragoons or mounted riflemen appears to be necessary for the department of the west.

On the Pacific coast another regiment of infantry is also needed. The Indians in California and Oregon, as in New Mexico and Texas, are troublesome and require frequent correction

To accomplish these objects, at least one additional regiment of cavalry and one of infantry are needed; and I beg to repeat, in this communication, that experience has shown that the strength of our regiments is always below the numbers allowed by law. On distant service two-thirds of the legal complement is a large estimate for the actual strength; and with a view to a farther augmentation, the propriety of giving authority to the President to increase, at his discretion, the number of privates in the different regiments from seventy-four to eighty-four per company, it is hoped, may be urged upon Congress.

DISCIPLINE AND INSTRUCTION.

The dispersed condition of the troops, since the termination of the Mexican war, has not been favorable to instruction and discipline. Recent orders, however, reorganizing military departments, abolishing geographical divisions, and directing partial concentrations of troops on our frontiers, will greatly tend to improvement. Much also may be accomplished by requiring from department commanders half-yearly inspection reports, the result of continued intercourse and observation, and not limited to inspections at stated times. The great extent of our frontiers renders it impossible that such detailed observations should be made by two inspectors general; and those officers may be usefully employed in inspections of the headquarters of military departments, arsenals, and other public works.

REVISION OF THE RULES AND ARTICLES OF WAR.

In my last annual report I recommended that this subject be referred to a board of officers to report a revision of the articles of war, to be laid before Congress. The present military code, established in 1776, and revised in 1806, provided for the punishment of many offences by stripes and lashes. The power of courts-martial to decree that punishment, except in cases of desertion, having been repealed, many specific offences are punished at discretion, and the punishments consequently vary with the constitution of the courts. Other material changes and discrepancies, introduced from time to time, have given a form so entirely new to the code, that a revision is essential, alike for discipline, uniformity, and perspicuity. Much, it is believed, might be done in the revision, to improve discipline, by incorporating a system of rewards with punishments.

RECRUITING SERVICE.

The great body of our army being employed in Texas, New Mexico, California and Oregon, has involved the necessity of sending detachments of recruits from the more populous districts, over long lines of communication, to reinforce the distant regiments. These detachments consist generally of green recruits, and are necessarily without instruction or discipline. It is but natural, therefore, that disorders and desertions should occur on the routes, as the detachments are, moreover, without the full number of officers and non-commissioned officers deemed necessary to insure subordination in organized companies of regular troops. To remedy these evils, and others involved in the present system of recruiting for the army, I respectfully suggest that regiments serving on distant stations be divided into *service* and *depôt* companies, and that the recruiting of each regiment be conducted by officers from its own depôt. Two companies, with a field officer from a regiment, would be sufficient as depôt companies, which, besides being usefully employed as police garrisons on the Atlantic and northern frontiers, would instruct the men enlisted for their own regiment, maintain its maximum strength, and by alternation of duty on the frontiers and in depôt with the other companies, afford relief to officers who might otherwise always remain on remote stations. The change recommended would, it is believed, facilitate recruiting, and give to the officers and men of the depôts a reciprocal interest in each other, which the present system cannot create.

I also beg to invite the attention of the Secretary of War to the following extracts from my last annual report:

Tactical Instruction for the Militia.

By existing laws the militia are required to observe the systems of instruction provided for the regular army, and yet no provision has been made for furnishing them with the necessary systems, although some nine millions of dollars have been appropriated in the last forty years towards *arming* them. Without books to teach their *use*, the arms themselves are of little value. Hence it is again recommended that the books be supplied. The additional annual expense need not exceed $20,000, and that only for a few years. See the remarks on this subject in my previous report of 1851.

Retired list for Superannuated and Disabled Officers.

(I beg to refer again to my report of 1851.) The necessity for some such measure has been greatly increased by the Mexican war, the number of officers of junior grades wounded in that war having swelled the invalid list, which previously consisted almost exclusively of officers of the senior grades, disabled by the infirmities of age. The creation of such a list ought not to be mistaken for an extension of the pension system. The officers who would be placed on it are already in the receipt of full pay without performing any duty. The system so often recommended would retire them on a just compensation, promote efficient officers in their stead, and thus greatly contribute to the good of the service, without any new imposition on the treasury.

Pension Laws.

It would seem but just that the pension laws provided for the navy should be extended to the army. No reason is seen for the discrimination between these kindred branches of the public service. The pensions in both cases come out of the general fund, and, as both share common dangers, and undergo equal vicissitudes in the discharge of duties, the same rewards should be appointed to each. The widows and orphans of deceased naval officers, seamen, and marines, receive five years' pensions, renewable every five years, whether the deaths occurred in battle or were caused by disease contracted in service; while the widows of army officers receive pensions only when their husbands have been killed in action, and then but for five years. Widows of the enlisted men [non-commissioned officers and privates] of the army receive no pensions, no matter what the circumstances, although the laws allow pensions to the widows and orphans of volunteers (whether officers or privates) who may have been killed, or have died from any cause while in service. Such unequal legislation ought surely to be corrected, and no time is more appropriate than the present. The subject of pensions is well presented in a report dated January 7, 1846, made by the Committee on Military Affairs of the Senate.—[*See Sen. Doc.* 43, 3*d vol.*, 1*st Sess.* 29*th Cong.*]

I have the honor to remain, sir, with high respect, your obedient servant,

WINFIELD SCOTT.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

A.—*Organization of the regular army of the United States*—1853.

	Major general.	Brigadier generals.	Adjutant general.	Assistant adjutant general, (lieutenant colonel.)	Assistant adjutants general, (majors by brevet.)	Assistant adjutants general, (captains by brevet.)	Judge advocate.	Inspectors general.	Quartermaster general.	Assistant quartermasters general.	Deputy quartermasters general.	†Quartermasters.	Assistant quartermasters.	Commissary general of subsistence.	Assistant commissary general of subsistence.	Commissaries of subsistence, (majors.)	Commissaries of subsistence, (captains.)
General officers	1	2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aids-de-camp to general officers	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Adjutant general's department	......	......	1	1	4	8	......	......	......	......	......	......	......	......	......	......	......
Judge advocate's department	......	......	......	......	......	......	1	......	......	......	......	......	......	......	......	......	......
Inspector general's department	......	......	......	......	......	......	......	2	......	......	......	......	......	......	......	......	......
Quartermaster's department	......	......	......	......	......	......	......	......	1	2	2	5	28	......	......	......	......
Subsistence department	......	......	......	......	......	......	......	......	......	......	......	......	......	1	1	2	8
Medical department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Pay department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Corps of engineers	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Corps of topographical engineers	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Ordnance department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1st regiment of dragoons	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2d regiment of dragoons	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aggregate of dragoons	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Regiment of mounted riflemen	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

1st regiment of artillery	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2d regiment of artillery	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
3d regiment of artillery	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4th regiment of artillery	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aggregate of artillery	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1st regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2d regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
3d regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4th regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
5th regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
6th regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
7th regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
8th regiment of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aggregate of infantry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Non-commissioned staff unattached to regiments	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Grand aggregate	1	2	1	1	*4	*8	*1	2	1	2	2	5	*28	1	1	2	*8

* *Two* of the four assistant adjutants general, (majors by brevet,) *two* of the eight assistant adjutants general, (captains by brevet,) *six* of the twenty-eight assistant quartermasters, and *three* of the eight commissaries of subsistence, (captains,) belonging also to regiments, and being reported in the strength thereof, to avoid counting them twice, are excluded as *staff* officers from the columns "total commissioned" and "aggregate" of their respective departments. The regimental and staff commissions held by these officers are of *unequal* grades, and hence they are not affected by the provisions of the 7th section of the act of June 18, 1846. The like remark is applicable to the *judge advocate* of the army, who is also a captain in the ordnance department.

† Under the act of July 19, 1848, section 3, vacancies in the grade of quartermaster cannot be filled until the number of quartermasters be reduced to *four*.

A—*Organization of the regular army of the United States*—Continued.

	Surgeon general.	Surgeons.	Assistant surgeons.	Paymaster general.	Deputy paymaster general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants.	Second lieutenants.	‖ Brevet second lieutenants.	Military storekeepers.
General officers	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aids-de-camp to general officers	......	......	......	......	......	......	......	......	......	......	*4	......	......	......	......	......	......
Adjutant general's department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Judge advocate's department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Inspector general's department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Quartermaster's department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	2
Subsistence department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Medical department	1	22	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Pay department	......	......	......	1	2	25	......	......	......	......	......	......	......	......	......	......	......
Corps of engineers	......	......	......	......	......	......	1	2	4	†16	......	......	......	12	8	6	......
Corps of topographical engineers	......	......	......	......	......	......	1	1	4	†18	......	......	......	10	2	8	......
Ordnance department	......	......	......	......	......	......	1	1	4	†14	......	......	......	12	4	2	15
1st regiment of dragoons	......	......	......	......	......	......	1	1	2	10	......	1	‡1	10	10	3	......
2d regiment of dragoons	......	......	......	......	......	......	1	1	2	10	......	1	‡1	10	10	3	......
Aggregate of dragoons	......	......	......	......	......	......	2	2	4	20	......	2	‡2	20	20	6	......
Regiment of mounted riflemen	......	......	......	......	......	......	1	1	2	10	......	1	‡1	10	10	3	......

1st regiment of artillery	......	......	......	......	......	......	1	1	2	12	......	‡1	‡1	24	12	2	......
2d regiment of artillery	......	......	......	......	......	......	1	1	2	12	......	‡1	‡1	24	12	3	......
3d regiment of artillery	......	......	......	......	......	......	1	1	2	12	......	‡1	‡1	24	12	1	......
4th regiment of artillery	......	......	......	......	......	......	1	1	2	12	......	‡1	‡1	24	12	2	......
Aggregate of artillery	......	......	......	......	......	......	4	4	8	48	......	‡4	‡4	96	48	8	......
1st regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	5	......
2d regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	4	......
3d regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	4	......
4th regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	4	......
5th regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	5	......
6th regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	5	......
7th regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	4	......
8th regiment of infantry	......	......	......	......	......	......	1	1	2	10	......	‡1	‡1	10	10	2	......
Aggregate of infantry	......	......	......	......	......	......	8	8	16	80	......	‡8	‡8	80	80	33	......
Non-commissioned staff unattached to regiments	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Grand aggregate	1	22	72	1	2	25	18	19	42	†206	*4	‡15	‡15	240	172	‖66	17

* The four aids-de-camp being taken from regiments and reported in the strength thereof, to avoid counting them twice, are excluded as *staff* officers from the columns of "total commissioned" and "aggregate."

† By the act of March 3, 1853, section 9, a lieutenant of engineers, topographical engineers, or ordnance corps, having served continuously fourteen years, is entitled to promotion to the grade of captain, but this does not increase the number of officers in the several corps.

‡ The adjutants of artillery and infantry, (12) and *all* the regimental quartermasters, (15) being taken from the subalterns, and accounted for in their several regiments as belonging to companies, are excluded as regimental *staff* officers from the columns of "total commissioned" and "aggregate."

‖ Under the 4th section of the act of April 29, 1812, "making further provisions for the corps of engineers," one brevet 2d lieutenant is allowed for every company. The number authorized is, consequently, *one hundred and fifty-nine.* The number now attached to the army is *sixty-six.*

A—*Organization of the regular army of the United States*—Continued.

	Sergeant majors.	Quartermaster sergeants.	Principal or chief musicians.	Chief buglers.	† Ordnance sergeants.	Sergeants.	Corporals.	Buglers.	Musicians.	Farriers and blacksmiths.	Artificers.	‡ Privates.	Enlisted men of ordnance.	Total commissioned.	Total enlisted.	Aggregate.
General officers	......	......	......	......	......	......	......	......	......	......	......	......	......	3	......	3
Aids-de-camp to general officers	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Adjutant general's department	......	......	......	......	......	......	......	......	......	......	......	......	......	10	......	10
Judge advocate's department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Inspector general's department	......	......	......	......	......	......	......	......	......	......	......	......	......	2	......	2
Quartermaster's department	......	......	......	......	......	......	......	......	......	......	......	......	......	34	......	34
Subsistence department	......	......	......	......	......	......	......	......	......	......	......	......	......	9	......	9
Medical department	......	......	......	......	......	......	......	......	......	......	......	......	......	95	......	95
Pay department	......	......	......	......	......	......	......	......	......	......	......	......	......	28	......	28
Corps of engineers	......	......	......	......	......	10	10	......	2	......	......	78	......	49	100	149
Corps of topographical engineers	......	......	......	......	......	......	......	......	......	......	......	......	......	44	......	44
Ordnance department	......	......	......	......	......	......	......	......	......	......	......	......	250	53	250	303
1st regiment of dragoons	1	1	1	2	......	40	40	20	......	10	......	500	......	38	615	653
2d regiment of dragoons	1	1	1	2	......	40	40	20	......	10	......	500	......	38	615	653
Aggregate of dragoons	2	2	2	4	......	80	80	40	......	20	......	1,000	......	76	1,230	1,306
Regiment of mounted riflemen	1	1	1	2	......	40	40	20	......	20	......	640	......	38	765	803

1st regiment of artillery	1	1	......	......	......	48	48	......	24	......	24	*548	......	54	694	748
2d regiment of artillery	1	1	......	......	......	48	48	......	24	......	24	*548	......	55	694	749
3d regiment of artillery	1	1	......	......	......	48	48	......	24	......	24	*548	......	53	694	747
4th regiment of artillery	1	1	......	......	......	48	48	......	24	......	24	*548	......	54	694	748
Aggregate of artillery	4	4	......	......	......	192	192	......	96	......	96	*2,192	......	216	2,776	2,992
1st regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	39	524	563
2d regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	38	524	562
3d regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	38	524	562
4th regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	38	524	562
5th regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	38	524	562
6th regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	39	524	563
7th regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	39	524	563
8th regiment of infantry	1	1	2	......	......	40	40	......	20	......	......	420	......	38	524	562
	1	1	2	......	......	40	40	......	20	......	......	420	......	36	524	560
Aggregate of infantry	8	8	16	......	......	320	320	......	160	......	......	3,360	......	305	4,192	4,497
Non-commissioned staff unattached to regiments	......	......	......	......	†64	......	......	......	......	......	......	......	......	......	64	64
Grand aggregate	15	15	19	6	†64	642	642	60	258	40	96	‡7,270	250	962	9,377	10,339

* Two companies in each of the four regiments of artillery being equipped as light artillery, are allowed, in consequence thereof, "sixty-four" instead of forty-two privates. See act "to increase the rank and file of the army, &c.," approved June 17, 1850, section 1.

† By the act of April 5, 1832, section 2, "providing for the organization of the ordnance department," the number of ordnance sergeants cannot exceed "*one* for each military post." The number actually in service is *sixty four.*

‡ By the act of June 17, 1850, (cited in the first note on this page,) section 2, the President is authorized, whenever the exigencies of the service require it, to increase to *seventy-four* the number of privates in any company "serving at the several military posts on the western frontier, and at remote and distant stations." In the table the minimum or fixed organization is given, viz: *fifty* privates to a company of dragoons, *sixty-four* to a company of light artillery and riflemen, and *forty-two* to the artillery and infantry. Under the authority conferred upon him, the President has directed that the number of privates be carried up to *seventy-four* in the several companies serving in Texas, New Mexico, California, and Oregon, as well as those stationed at Forts Snelling and Ripley, on the upper Mississippi; Fort Ridgely, on the Minnesota river; Fort Riley, on the Kansas; Fort Arbuckle, on the Washita river; and Forts Kearny and Laramie, on the Oregon route. There being at this time *one hundred and twenty-three* companies serving at, or *en route* to, these distant stations, the authorized increase in the number of privates is 3,498; making the "total enlisted" (as the troops are now posted, or *en route*) 12,782, and the "aggregate" 13,821. If *all* the companies belonging to regiments (158) were serving at the distant stations described, the additional number of privates allowed would then be 4,488—thus increasing the "total enlisted" to 13,772, and the "aggregate" to 14,731.

Adjutant General's Office, *Washington, November* 20, 1853.

S. COOPER, *Adjutant General.*

B.—*General return of the army of the United States, compiled from the latest returns, (of different dates,) corrected at the Adjutant General's office.*

	PRESENT.																							
	For duty.																							
	Major general.	Brigadier generals.	Adjutant general.	Assist. adjutant general, (lieutenant colonel.)	Assist. adjutants general, (majors by brevet.)*	Assist. adjutants general, (captains by brevet.)*	Judge advocate.	Inspectors general.	Quartermaster general.	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.	Assist. quartermasters.*	Commissary general of subsistence.	Assist. commissary general of subsistence.	Commissaries of subsistence, (majors.)	Commissaries of subsistence, (captains.)*	Surgeon general.	Surgeons.	Assistant surgeons.	Paymaster general.	Deputy paymasters general.	Paymasters.	Colonels.
General officers	1	2																						
Aids-de-camp to general officers																								
Adjutant general's department			1	1	4	7																		
Judge advocate's department							1																	
Inspector general's department								2																
Quartermaster's department									1	2	1	5	25											
Subsistence department														1	1	1	7							
Medical department																		1	21	64				
Pay department																						1	23	
Corps of engineers																								1
Corps of topographical engineers																								1
Ordnance department																								1
1st regiment of dragoons																								1
2d regiment of dragoons																								
Aggregate of dragoons																								1

Regiment of mounted riflemen	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
1st regiment of artillery	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
2d regiment of artillery	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
3d regiment of artillery	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
4th regiment of artillery	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Aggregate of artillery	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
1st regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
2d regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
3d regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
4th regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
5th regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
6th regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
7th regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
8th regiment of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Aggregate of infantry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Non-commiss'd staff unattached to reg'ts	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Military Academy detachments	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Principal rec'g depot, Ft. Columbus, N. Y.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Cavalry rec'g depot, Jefferson barr'ks, Mo.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Recruiting depot, Newport barracks, Ky.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Recruits at rendezvous and in route	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Grand aggregate	1	2	1	1	4	7	1	2	1	2	1	5	25	1	1	1	7	1	21	64	....	1	23	10

* *Two* of the assistant adjutants general, (majors by brevet,) *two* of the assistant adjutants general, (captains by brevet,) *six* of the assistant quartermasters, and *three* of the commissaries of subsistence, (captains,) belonging also to regiments, and being reported in the strength thereof, to avoid counting them *twice*, are excluded as *staff* officers from the columns "total commissioned" and "aggregate" of their respective departments. The regimental and staff commissions held by these officers are of *unequal* grades, and hence they are not affected by the provisions of the 7th section of the act of June 18, 1846. The like remark is applicable to the *judge advocate* of the army, who is also a captain in the ordnance department.

B—*General return of the army of the United States*—Continued.

	PRESENT.																						
	For duty.																						
	Lieutenant colonels.	Majors.	Captains.*	Aids-de-camp.†	Adjutants.‡	Regimental quartermasters.‡	First lieutenants.	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Sergeant majors.	Quartermaster sergeants.	Principal or chief musicians.	Chief buglers.	Ordnance sergeants.	Sergeants.	Corporals.	Buglers.	Musicians.	Farriers and blacksmiths.	Artificers.	Enlisted men of ordnance.	Privates.
General officers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Aids-de-camp to general officers	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Adjutant general's department	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Judge advocate's department	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Inspector general's department	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Quartermaster's department	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....
Subsistence department	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Medical department	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pay department	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Corps of engineers	2	2	12	....	....	....	8	3	8	....	....	....	....	....	....	2	2	....	2	....	15	....	34
Corps of topographical engineers	1	4	17	....	....	....	10	2	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ordnance department	1	4	9	....	....	....	9	3	3	14	....	....	....	....	....	....	....	....	....	....	....	245	....
1st regiment of dragoons	....	2	4	....	1	1	4	4	1	....	1	1	1	1	....	27	21	13	....	5	....	....	283
2d regiment of dragoons	....	2	3	....	1	1	5	4	....	....	1	1	1	1	....	21	25	14	....	3	....	....	267
Aggregate of dragoons	....	4	7	....	2	2	9	8	1	....	2	2	2	2	....	48	46	27	....	8	....	....	550

Regiment of mounted riflemen	1	1	2	....	1	1	4	7	1	....	....	1	1	1	....	27	23	12	....	8	....	....	249
1st regiment of artillery	1	....	7	....	1	1	5	5	2	....	1	....	....	....	....	24	28	2	11	....	15	....	247
2d regiment of artillery	....	2	8	....	1	1	10	3	2	....	1	1	....	....	....	38	33	3	11	....	11	....	242
3d regiment of artillery	....	2	8	....	1	1	10	8	1	....	....	1	....	....	....	32	37	2	12	....	15	....	397
4th regiment of artillery	1	2	8	....	1	1	10	5	2	....	1	1	....	....	....	35	31	3	13	....	15	....	328
Aggregate of artillery	2	6	31	....	4	4	35	21	7	....	3	3	....	....	....	129	129	10	47	....	56	....	1,214
1st regiment of infantry	1	1	6	....	1	1	3	7	....	....	1	....	1	....	....	25	24	....	19	....	....	....	155
2d regiment of infantry	....	1	7	....	1	1	3	7	3	....	....	1	2	....	....	20	19	....	3	....	....	....	131
3d regiment of infantry	....	1	6	....	....	1	4	6	1	....	1	1	1	....	....	24	32	....	13	....	....	....	413
4th regiment of infantry	1	2	7	....	1	1	8	2	....	....	1	1	2	....	....	25	17	....	11	....	....	....	170
5th regiment of infantry	1	1	4	....	1	....	3	8	2	....	1	1	1	....	....	27	19	....	19	....	....	....	323
6th regiment of infantry	1	1	6	....	1	1	5	6	4	....	1	1	2	....	....	16	21	....	13	....	....	....	172
7th regiment of infantry	....	....	4	....	1	1	4	6	3	....	....	1	1	....	....	24	23	....	13	....	....	....	156
8th regiment of infantry	1	....	4	....	1	1	4	8	....	....	1	1	2	....	....	27	27	....	17	....	....	....	264
Aggregate of infantry	5	7	44	....	7	7	34	50	13	....	6	7	12	....	....	188	182	....	108	....	....	....	1,784
Non-commiss'd staff unattached to regiments	....	....	....	....	....	....	....	....	....	....	....	....	....	....	64	....	....	....	....	....	....	....	......
Military Academy detachments	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	1	2	1	3	....	58
Principal recruit'g depot, Ft. Columbus, N. Y.	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	6	8	....	19	....	....	....	118
Cavalry recruit'g depot, Jefferson barr'ks, Mo	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	2	2	....	....	....	....	50
Recruiting depot, Newport barracks, Ky	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	4	....	2	....	....	....	50
Recruits at rendezvous and in route	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	19	9	....	4	....	....	....	101
Grand aggregate	12	28	122	4	14	14	109	94	41	16	11	13	16	3	64	428	407	52	184	17	74	245	4,208

* By the act of March 3, 1853, section 9, a lieutenant of engineers, topographical engineers, and ordnance, having served continuously fourteen years, is entitled to promotion to the grade of captain; but this does not increase the number of *officers* in those corps.

† The aids-de-camp, being taken from regiments and reported in the strength thereof, to avoid counting them *twice*, are excluded as *staff* officers from the columns "total commissioned" and "aggregate."

‡ The adjutants of artillery and infantry, (12) and *all* the regimental quartermasters, (15) being taken from the subalterns, and accounted for in their several regiments as belonging to companies, are excluded as regimental *staff* officers from the columns "total commissioned" and "aggregate."

B—*General return of the army of the United States*—Continued.

	PRESENT.																
	On extra or daily duty.					Sick.					In arrest or confinement.						
	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	General staff officers.	Field officers.	Cap ains.	Subalterns.	Enlisted men.	Total commissioned.	Total enlisted.
General officers																3	
Aids-de-camp to general officers																	
Adjutant general's department																10	
Judge advocate's department																	
Inspector general's department																2	
Quartermaster's department																32	
Subsistence department																7	
Medical department						1					1					88	
Pay department						1										25	
Corps of engineers					1					3					3	36	62
Corps of topographical engineers																43	
Ordnance department																44	245
1st regiment of dragoons					82					27					14	18	476
2d regiment of dragoons				1	98				1	34				2	19	20	485
Aggregate of dragoons				1	180				1	61				2	33	38	961

Regiment of mounted riflemen	......	......	....	......	49	....	....	....	....	57	......	......	....	....	20	18	448
1st regiment of artillery	......	......	....	......	67	....	....	....	1	39	......	......	....	....	17	24	451
2d regiment of artillery	......	......	....	1	75	....	....	....	....	23	......	......	....	....	19	29	457
3d regiment of artillery	......	......	....	......	53	....	....	1	....	36	......	......	....	....	55	33	640
4th regiment of artillery	......	......	....	......	70	....	....	....	....	57	......	......	....	....	39	31	593
Aggregate of artillery	......	......	....	1	265	....	....	1	1	155	......	......	....	....	130	117	2,141
1st regiment of infantry	......	......	....	1	82	....	....	....	....	25	......	......	....	....	33	21	365
2d regiment of infantry	......	......	....	......	60	....	....	....	....	16	......	......	....	1	18	24	270
3d regiment of infantry	......	......	....	2	126	....	....	....	....	31	......	......	....	....	23	21	665
4th regiment of infantry	......	......	....	1	85	....	....	....	1	42	......	......	....	....	17	24	371
5th regiment of infantry	......	......	....	1	71	....	....	....	....	38	......	......	....	....	41	22	541
6th regiment of infantry	......	......	....	......	208	....	....	....	....	49	......	......	....	....	10	26	493
7th regiment of infantry	......	......	1	......	113	....	....	....	....	50	......	......	....	....	31	20	412
8th regiment of infantry	......	......	....	......	64	....	....	....	....	45	......	......	....	....	28	19	476
Aggregate of infantry	......	......	1	5	809	....	....	....	1	296	......	......	....	1	201	177	3,593
Non-commissioned staff unattached to regiments	......	......	....	......	......	....	....	....	....	......	......	......	....	....	......	......	64
Military Academy detachments	......	......	....	......	60	....	....	....	....	6	......	......	....	....	1	......	136
Principal recruiting depot, Fort Columbus, N. Y.	......	......	....	......	61	....	....	....	....	15	......	......	....	....	9	......	237
Cavalry recruiting depot, Jefferson barracks, Mo	......	......	....	......	3	....	....	....	....	......	......	......	....	....	4	......	64
Recruiting depot, Newport barracks, Kentucky	......	......	....	......	5	....	....	....	....	5	......	......	....	....	......	......	70
Recruits at rendezvous and in route	......	......	....	......	11	....	....	....	....	1	......	......	....	....	2	......	147
Grand aggregate	......	......	1	7	1,444	2	....	1	3	599	1	......	....	3	403	640	8,168

B—*General return of the army of the United States*—Continued.

	ABSENT.															PRESENT AND ABSENT.			
	On detached service.					With leave, or on furlough.		Without leave.		Sick.		In arrest or confinement.							
	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Commissioned officers.	Enlisted men.	Commissioned officers.	Enlisted men.	Commissioned officers.	Enlisted men.	Commissioned officers.	Enlisted men.	Total commissioned.	Total enlisted.	Commissioned officers.	Enlisted men.	Aggregate.	* Number of recruits required.
General officers																3		3	
Aids-de-camp to general officers																			
Adjutant general's department						1								1		10		10	
Judge advocate's department																			
Inspector general's department																2		2	
Quartermaster's department						4								4		34		34	
Subsistence department	2													2		9		9	
Medical department	2					3				2				7		95		95	
Pay department	1									2				3		28		28	
Corps of engineers		1	3	7	26	2								13	26	49	88	137	12
Corps of topographical engineers										1				1		44		44	
Ordnance department			2	2	9	4	2							8	11	52	256	308	
1st regiment of dragoons		1	4	11	126	1	5	1		2	8		1	20	140	38	616	654	215
2d regiment of dragoons		1	5	8	88	3	4			1	3		4	18	99	38	584	622	271
Aggregate of dragoons		2	9	19	214	4	9	1		3	11		5	38	239	76	1,200	1,276	486

Regiment of mounted riflemen	....	1	4	7	111	5	8	3	1	....	12	......	21	20	153	38	601	639	264
1st regiment of artillery	....	1	3	16	54	5	7	5	....	....	6	......	2	30	69	54	520	574	244
2d regiment of artillery	....	....	3	13	42	7	5	3	....	....	4	......	....	26	51	55	508	563	251
3d regiment of artillery	....	1	3	15	5	......	6	....	6	1	4	......	2	20	23	53	663	716	361
4th regiment of artillery	....	....	1	16	22	4	3	....	....	2	7	......	6	23	38	54	631	685	169
Aggregate of artillery	....	2	10	60	123	16	21	8	6	3	21	......	10	99	181	216	2,322	2,538	1,025
1st regiment of infantry	....	1	2	10	60	3	2	....	....	2	2	......	3	18	67	39	432	471	412
2d regiment of infantry	....	3	2	5	43	3	10	....	....	1	1	......	3	14	57	38	327	365	517
3d regiment of infantry	....	....	3	6	79	6	5	1	....	1	8	......	4	17	96	38	761	799	83
4th regiment of infantry	....	....	3	6	75	5	8	....	....	....	6	......	5	14	94	38	465	503	379
5th regiment of infantry	....	....	5	7	61	2	3	1	3	2	13	......	4	17	84	39	625	664	207
6th regiment of infantry	....	1	3	4	77	3	3	1	....	1	3	......	5	13	88	39	581	620	263
7th regiment of infantry	....	2	2	6	58	5	3	2	....	1	2	......	2	18	65	38	477	515	187
8th regiment of infantry	....	2	3	5	66	5	14	....	1	2	14	......	4	17	99	36	575	611	269
Aggregate of infantry	....	9	23	49	519	32	48	5	4	10	49	......	30	128	650	305	4,243	4,548	2,317
Non-commiss'd staff unattached to regiments	....	....	....	....	......	......	....	....	....	....	....	......	....	....	......	....	64	64	......
Military Academy detachments	....	....	....	....	......	......	....	....	....	....	....	......	....	....	......	....	136	136	......
Principal recruit'g depot, Ft. Columbus, N. Y.	....	....	....	....	14	......	....	....	....	....	....	......	....	....	14	....	251	251	......
Cavalry recruit'g depot, Jefferson barr'ks, Mo.	....	....	....	....	......	......	....	....	....	....	1	......	....	....	1	....	65	65	......
Recruiting depot, Newport barracks, Ky	....	....	....	....	4	......	....	....	....	....	....	......	....	....	4	....	74	74	......
Recruits at rendezvous and in route	....	....	....	....	7	......	2	....	....	....	....	......	....	....	9	....	156	156	......
Grand aggregate	5	15	51	144	1,027	71	90	17	11	21	94	......	66	324	1,288	961	9,456	10,417	3,422

* The "number of recruits required" is calculated for each regiment according to the stations of the several companies at the present date—the number of *privates* varying according to station, as explained in note (‡) to table A, [on page 103] showing the legal organization of the army. The number of enlisted men necessary to complete the military establishment is obtained by deducting from the whole number of recruits required to fill up all the regiments the several detachments at the Military Academy, the three depots, (Fort Columbus, Newport barracks, and Jefferson barracks,) and the recruits at rendezvous and in route. The number required for regiments and corps is 4,104; the number at the Military Academy, at depots, and in route, is 682; leaving 3,422 as the number of recruits yet required to fill up the establishment.

ADJUTANT GENERAL'S OFFICE, *Washington, November* 20, 1853.

S. COOPER, *Adjutant General.*

C.—*Position and distribution of the troops in the Eastern Division, under Headquarters,*

DEPARTMENTS AND POSTS.	SITUATION.	COMMANDING OFFICERS.	GARRISONS. Number of companies.	GARRISONS. Regiments.
Military Department No. 1.—Command suspended. (The posts in this department are under the immediate orders of the division commander.)				Division staff......
Fort Sullivan..............	Eastport, Me..............	....	..	....
Fort Preble................	Portland Harbor, Me........	....	..	....
Fort Constitution..........	Portsmouth Harbor, N. H....	....	..	....
Fort Independence.........	Boston Harbor, Mass........	Capt. and Bt. Maj. J. B. Scott.	2	4th artillery......
Fort Adams	Newport Harbor, R. I........	....	..	....
Fort Trumbull..............	New London, Conn..........	....	..	....
Fort Griswold	New London, Conn..........	....	..	....
Aggregate of the 1st	department	....	2	....
Military Department No. 2.—Command suspended. (The posts in this department are under the immediate orders of the division commander.)				
Fort Brady.................	Sault de Ste. Marie, Mich...	Captain F. N. Clarke........	1	4th artillery ......
Fort Mackinac	Michillimackinac, Mich......	Capt. & Bt. Maj. T. Williams.	1	....do..........
Fort Gratiot...............	Outlet of Lake Huron, Mich.	....	..	....
Aggregate of the 2d	department	....	2	....
Military Department No. 3, commanded by Colonel and Brevet Brigad'r General J. B. Walbach. Headquarters, Baltimore, Md.				
				Department staff..
Fort Niagara...............	Youngstown, N. Y..........	Captain J. P. McCown......	1	4th artillery ......
Fort Ontario...............	Oswego, N. Y	....	..	....
Madison Barracks	Sackett's Harbor, N. Y......	....	..	....
Plattsburg Barracks	Plattsburg, N. Y	....	..	....
Fort Columbus	Governor's Island, N. Y.....	Capt. & Bt. Maj. J. T. Sprague.	..	Depot general recruiting service.
Fort Wood	Bedlow's Island, N. Y......	....	..	....
Fort Hamilton..............	Narrows, New York harbor..	Capt. & Bt. Maj. W. W. Morris	2	4th artillery......
Fort Lafayette.............	........do........do.......	....	..	....
Fort Mifflin	Delaware River, Pa.........	....	..	....
Carlisle Barracks	Carlisle, Pa...............	....	..	....
Fort McHenry..............	Baltimore Harbor, Md.......	Capt. & Bt. Lt. Col. F. Taylor	2	1 company (light) 1st artillery; 1 company (light) 2d artillery.
Fort Washington	Potomac River, Md.........	....	..	....
Aggregate of the 3d	department	....	5	....

the command of Brigadier and Brevet Major General John E. Wool. Troy, New York.

PRESENT.																											ABSENT.							PRESENT AND ABSENT.		
Brigadier generals.	Assistant adjutants general (majors by brevet.)	Assistant adjutants general (captains by brevet.)	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.*	Assistant quartermasters.	Commissaries of subsistence (majors.)	Commissaries of subsistence (captains.)	Surgeons.	Assistant surgeons.	Deputy paymasters general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	*Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants.	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Enlisted men.	Total commissioned.	Aggregate.	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Total commissioned.	Aggregate.	Commissioned officers.	Enlisted men.	Aggregate.*
1	1	1															2								5	5								5		5
																								1		1									1	1
																								1		1									1	1
																								1		1									1	1
										1						1				2	1	1		71	6	77	1		1	3	4	5	9	11	75	86
																								1		1									1	1
																								1		1									1	1
																								1		1									1	1
										1						1				2	1	1		77	6	83	1		1	3	4	5	9	11	81	92
																1					1			49	2	51				2	2	2	4	4	51	55
										1						1						1		52	3	55				2		2	2	5	52	57
																								1		1									1	1
										1						2					1	1		102	5	107				4	2	4	6	9	104	113
													1							1					2	2								2		2
																1				1		1		46	3	49				2		2	2	5	46	51
																								1		1									1	1
																								1		1									1	1
																								1		1									1	1
									1							1				1		12		361	15	376				1	21	1	22	16	382	398
																								1		1									1	1
										1						1			1	1		2		112	6	118			1	4	3	5	8	11	115	126
																								1		1									1	1
																								1		1									1	1
																								1		1									1	1
									1							2				2	1			127	6	133				4	2	4	6	10	129	139
																								1		1									1	1
									2	1			1			5			1	6	1	15		654	32	686			1	11	26	12	38	44	680	724

*Lieut. Tallmadge acting as aid-de-camp.

C—*Position and distribution of the troops*

DEPARTMENTS AND POSTS.	SITUATION.	COMMANDING OFFICERS.	GARRISONS. Number of companies.	GARRISONS. Regiments.
Military Department No. 4, commanded by Colonel and Brevet Brigad'r General J. Bankhead. Headquarters, Fort Monroe, Virginia.				
Fort Monroe	Old Point Comfort, Va	Colonel and Bt. Brig. Gen. J. Bankhead.	2	2d artillery
Fort Johnston	Smithville, N. C		..	
Fort Caswell	Oak Island, N. C		..	
Fort Macon	Beaufort, N. C		..	
Fort Sumter	Charleston Harbor, S. C		..	
Fort Moultrie	do do	Capt. and Bt. Maj. W. Hays.	2	2d artillery
Castle Pinckney	do do		..	
Aggregate of the 4th department			4	
Aggregate of the division			13	

Adjutant General's Office, *Washington, November* 20, 1853.

in the Eastern Division, &c.—Continued.

PRESENT.																											ABSENT.							PRESENT AND ABSENT.		
Brigadier generals.	Assistant adjutants general (majors by brevet.)	Assistant adjutants general (captains by brevet.)	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.	Assistant quartermasters.	Commissaries of subsistence (majors.)	Commissaries of subsistence (captains.)	Surgeons.	Assistant surgeons.	Deputy paymasters general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants.	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Enlisted men.	Total commissioned.	Aggregate.	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Total commissioned.	Aggregate.	Commissioned officers.	Enlisted men.	Aggregate.
..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	1	2	..	1	1	2	..	..	..	91	9	100	1	..	..	3	..	4	4	13	91	104
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	....	1	..	..	..	..	..	..	..	....	1	1
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..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	1	..	2	..	45	6	51	..	1	2	4	2	7	9	13	47	60
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	....	1	..	..	..	..	..	..	..	....	1	1
..	..	..	..	..	..	..	..	..	2	..	..	..	1	..	1	3	..	1	1	3	..	2	..	141	15	156	1	1	2	7	2	11	13	26	143	169
1	1	1	..	..	..	..	..	..	4	3	..	..	2	..	1	11	2	1	2	11	3	19	..	974	58	1022	2	1	4	25	34	32	66	90	1008	1098

S. COOPER, *Adjutant General.*

D—*Position and distribution of the troops in the Western Division, under* *Headquarters, New*

DEPARTMENTS AND POSTS.	SITUATION.	COMMANDING OFFICERS.	GARRISONS. Number of companies.	GARRISONS. Regiments.
Military Department No. 5.—*Command suspended. (The posts in this department are under the immediate orders of the division commander.)*				Division staff....
				Department staff.
New Smyrna*	New Smyrna, Fla.	Capt. and Bt. Maj. A. Lowd.	1	2d artillery
Fort Capron*	Indian river, Fla	Capt. and Bt. Maj. F. Woodbridge.	1	2d artillery
Key West Barracks	Key West, Fla	Capt. J. Vogdes	1	1st artillery
Fort Myers*	Caloosahatchie, 140 m's south of Tampa Bay, Fla.	Capt. and Bt. Maj. W. H. French.	3	1st artillery
Fort Meade*	Pea Creek, 46 m's from Tampa.	Capt. H. D. Grafton	3	1 co. 1st art'y; 2 cos. 2d art'y.
Fort Brooke*	Tampa, Fla	Second Lieut. R. B. Thomas.	...	Detachments
Barancas Barracks, Pensacola harbor. Fort McRee, Pensacola harbor. Fort Pickens, Pensacola harbor.	Pensacola, Fla	Lt. Col. and Bt. Col. J. L. Gardner.	1	1st artillery
Fort Pike	Petite Coquille, La		...	
Fort Macomb	Chef Menteur, La		...	
Fort Jackson	75 miles below N. Orleans, La		...	
Baton Rouge Barracks	Baton Rouge, La	Capt. J. B. Ricketts	1	1st artillery
New Orleans Barracks	New Orleans, La	Capt. and Bt. Lt. Col. G. Nauman.	1	1st artillery
Newport Barracks	Newport, Ky	Maj. and Bt. Lt. Col. W. Hoffman.	...	Recruiting depot.
Aggregate of the 5th	department		12	
Military Department No. 6, *commanded by Colonel and Bt. Brig. Gen.* N. S. Clarke. *Headquarters, Jefferson barracks, Missouri.*				
				Department staff.
Fort Ripley	Upper Mississippi, Min. Ter.	Capt. J. B. S. Todd	1	6th infantry
Fort Snelling	Near St. Paul, Min. Ter	Lt. Col. and Bt. Col. F. Lee.	2	1 co. 1st drag's; 1 co. 3d art'y.
Fort Ridgely	On Minnesota river, 90 miles from Fort Snelling.	Capt. and Bt. Maj. S. Woods.	3	6th infantry
Fort Leavenworth	Missouri river, Mo	Col. T. T. Fauntleroy	2	1 co. 1st drag's; 1 co. 4th art'y.
Fort Riley	Kansas river, Nebraska Ter.	Capt. C. S. Lovell	4	6th infantry
Fort Kearny	Oregon route	Capt. H. W. Wharton	1	6th infantry
Fort Laramie	Oregon route	First Lieut. R. B. Garnett	1	6th infantry
Jefferson Barracks	Near St. Louis, Mo	Capt. and Bt. Maj. C. F. Ruff.	...	Cavalry recruiting depot.
En route to Arkansas frontier, Fort Gibson.		Capt. M. E. Van Buren	2	Mounted riflemen
Aggregate of the 6th	department		16	

The command of the 5th department was suspended by special orders (Adjutant General's Office) No. 179, of
The posts marked * are included in that district.

the command of Brigadier and Brevet Major General David E. Twiggs. Orleans, Louisiana.

PRESENT.																											ABSENT.							PRESENT AND ABSENT.		
Brigadier generals.	Assistant adjutants general (majors by brevet.)	Assistant adjutants general (captains by brevet.)	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.	Assistant quartermasters.	Commissaries of subsistence (majors.)	Commissaries of subsistence (captains.)	Surgeons.	Assistant surgeons.	Deputy paymasters general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants.	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Enlisted men.	Total commissioned.	Aggregate.	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Total commissioned.	Aggregate.	Commissioned officers.	Enlisted men.	Aggregate.
1	1	..	1	..	..	1	..	..	..	1	1	1	..	..	..	..	1	..	..	1	1	..	..	....	10	10	..	..	..	...	...	...	....	10	....	10
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	....	...	....	..	..	..	...	...	...	....	...	....	....
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	..	..	19	3	22	..	..	..	3	...	3	3	6	19	25
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	1	..	..	33	3	36	..	..	..	3	2	3	5	6	35	41
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	36	2	38	..	..	..	2	7	2	9	4	43	47
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	2	1	..	..	109	5	114	..	..	2	8	13	10	23	15	122	137
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	1	1	..	..	70	4	74	1	..	1	6	17	8	25	12	87	99
..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	33	2	35	..	..	..	...	...	...	....	2	33	35
..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	1	1	..	..	..	..	28	4	32	..	..	1	3	...	4	4	8	28	36
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	...	1	..	..	..	...	...	...	....	...	1	1
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	...	1	..	..	..	...	...	...	....	...	1	1
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..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	2	..	..	30	3	33	1	..	..	3	...	4	4	7	30	37
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	..	..	40	3	43	..	..	..	2	5	2	7	5	45	50
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	1	..	8	..	75	11	86	..	..	..	...	4	...	4	11	79	90
..	..	..	..	..	..	..	..	1	..	6	..	..	..	1	1	8	..	1	1	7	6	8	..	476	40	516	2	..	4	30	48	36	84	76	524	600
..	..	1	..	..	1	..	..	..	1	..	..	3	1	..	..	..	..	..	..	..	..	..	..	....	7	7	1	..	..	...	...	1	1	8	....	8
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	..	..	41	3	44	..	..	..	1	1	1	2	4	42	46
..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	1	..	..	..	3	1	..	..	85	7	92	..	..	1	1	38	2	40	9	123	132
..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	2	..	..	..	1	1	1	..	120	7	127	..	..	1	4	58	5	63	12	178	190
..	..	..	..	..	..	1	..	..	1	1	..	..	1	..	1	2	..	1	1	2	2	..	..	145	13	158	..	..	..	1	7	1	8	14	152	166
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	3	..	..	..	2	3	2	..	200	11	211	1	..	1	3	28	5	33	16	228	244
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	1	..	41	3	44	..	..	..	1	13	1	14	4	54	58
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	1	..	..	60	3	63	.	..	1	1	3	2	5	5	63	68
..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	1	1	..	..	5	..	137	9	146	..	..	..	3	2	3	5	12	139	151
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	94	2	96	..	..	1	4	...	5	5	7	94	101
..	..	1	..	..	1	2	..	..	4	5	..	3	2	1	1	12	..	2	2	10	10	9	..	923	65	988	2	..	5	19	150	26	176	91	1073	1164

October 25, 1852, and the command of the troops in East Florida instituted, with headquarters at Tampa Bay.

D—*Position and distribution of the troops*

DEPARTMENTS AND POSTS.	SITUATION.	COMMANDING OFFICERS.	GARRISONS. Number of companies.	GARRISONS. Regiments.
Military Department No. 7, commanded by Col. Henry Wilson. Headquarters, Fort Smith, Ark.				Department staff.
Fort Smith	Arkansas	Capt. & Bt. Maj. T. H. Holmes	1	7th infantry
Fort Gibson	Cherokee Nation, west of Arkansas.	Capt. and Bt. Lt. Col. B. Bragg	4	1 co. 3d art'y; 3 cos. 7th inf'y.
Fort Arbuckle	Wild Horse Creek, west of Arkansas.	Capt. S. G. Simmons	2	7th infantry
Fort Washita	False Washita, west of Arkansas.	Capt. and Bt. Maj. H. J. Hunt	2	1 co. 2d art'y; 1 co. 7th inf'y.
Fort Towson	Choctaw Nation, west of Arkansas.	Capt. and Bt. Maj. D. P. Whiting.	1	7th infantry
Aggregate of the 7th	department		10	
Military Department No. 8, commanded by Colonel and Brevet Major General P. F. Smith. Headquarters, Corpus Christi, Texas.				Department staff.
Fort Merrill	Nueces River, 50 miles above Corpus Christi, Tex.	Capt. T. Duncan	2	Mounted riflemen
Fort Ewell	Nueces River, crossing of Laredo and San Antonio road.	Second Lieut. G. W. Howland.	2	Mounted riflemen
Fort Brown	Brownsville, Tex.	Maj. G. Porter	5	3 cos. 4th art'y; 2 cos. 7th inf'y.
Ringgold Barracks	Rio Grande, via Brownsville, Tex.	Lieut. Col. W. Seawell	5	1 co. 4th art'y; 4 cos. 8th inf'y.
Fort McIntosh	Laredo, Tex	Capt. G. W. Wallace	2	1st infantry
Fort Duncan	Eagle Pass, Tex.	Bt. Lt. Col. T. Morris	5	1st infantry
Fort Clark	Head of Las Moras river, Tex.	Capt. J. H. King	2	1st infantry
Fort Inge	Leona river, 90 miles from San Antonio, Tex.	Maj. S. B. Crittenden	2	Mounted riflemen
Fort Mason	Llano river, 110 m's northwest from San Antonio, Tex.	Capt. and Bt. Col. C. A. May.	1	2d dragoons
Fort Terrett	Head of Llano river, Tex.	Capt. R. S. Granger	2	1 co. 2d drag's; 1 co. 1st inf'y.
Fort McKavett	San Saba river, 165 m's from San Antonio, Tex.	Bt. Lt. Col. J. V. Bomford	1	8th infantry
Fort Chadbourne	Oak creek, 95 miles from Fort McKavett, Tex.	First Lieut. J. M. Hawes	2	1 co. 2d drag's; 1 co. 8th inf'y.
Post on Clear Fork of Brazos	Phantom Hill, Waco P. O., Tex.	Capt. and Bt. Maj. H. H. Sibley.	2	1 co. 2d drag's; 1 co. 5th inf'y.
Fort Belknap	Red fork of Brazos river, Tex.	Capt. and Bt. Maj. H. H. Merril.	2	1 co. 2d drag's; 1 co. 5th inf'y.
Fort Graham	Jose Maria village, Brazos river, Tex.	First Lieut. R. H. Anderson	1	2d dragoons
En route to Ft. McIntosh, Tex	Camp near Austin, Tex.	Col. G. Loomis	4	5th infantry
En route to Ft. McIntosh, Tex	Camp near San Antonio, Tex.	Lt. Col. & Bt. Col. C. A. Waite	4	5th infantry
En route to El Paso, Tex.	Camp near Fort Clark	Maj. and Bt. Lt. Col. E. B. Alexander.	4	8th infantry
En route to Fort Duncan, Tex	Camp near Laredo, Tex.	First Lieut. R. B. Ayres	2	3d artillery
In the field			2	Mounted riflemen
Aggregate of the 8th	department		52	

in the Western Division, &c.—Continued.

PRESENT.																											ABSENT.							PRESENT & ABSENT.		
Brigadier generals.	Assistant adjutants general (majors by brevet.)	Assistant adjutants general (captains by brevet.)	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.	Assistant quartermasters.	Commissaries of subsistence (majors.)	Commissaries of subsistence (captains.)	Surgeons.	Assistant surgeons.	Deputy paymasters general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants.	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Enlisted men.	Total commissioned.	Aggregate.	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Total commissioned.	Aggregate.	Commissioned officers.	Enlisted men.	Aggregate.
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..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	..	1	..	1	2	..	..	47	6	53	..	3	1	...	4	4	8	10	51	61
..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	3	..	..	1	1	3	1	..	155	10	165	..	..	1	6	35	7	42	17	190	207
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	2	..	..	..	1	..	1	..	108	5	113	..	..	..	4	11	4	15	9	119	128
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	2	..	..	76	5	81	..	..	1	2	2	3	5	8	78	86
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	1	..	..	39	4	43	..	..	..	...	3	...	3	4	42	46
..	..	..	..	..	..	1	..	..	1	3	..	1	..	..	..	8	..	1	1	5	8	2	..	425	31	456	..	3	3	12	55	18	73	49	480	529
..	..	1	..	1	..	4	..	1	..	..	..	4	1	..	..	..	1	..	..	..	..	..	..	....	13	13	1	2	..	...	...	3	3	16	....	16
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	1	1	..	68	5	73	..	..	1	2	52	3	55	8	120	128
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	2	..	..	104	3	107	..	..	2	3	25	5	30	8	129	137
..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	1	..	..	..	4	2	2	..	251	11	262	..	..	4	7	32	11	43	22	283	305
..	..	..	..	..	..	..	..	..	..	2	..	..	..	1	..	3	..	1	1	..	4	1	..	250	13	263	..	..	2	9	60	11	71	24	310	334
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	2	..	..	63	3	66	..	..	1	4	19	5	24	8	82	90
..	..	..	..	..	..	..	..	..	..	2	..	..	..	1	1	3	..	1	1	2	3	..	..	200	14	214	..	2	2	5	31	9	40	23	231	254
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	1	..	..	75	4	79	..	..	1	4	3	5	8	9	78	87
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	1	..	2	1	..	..	126	6	132	..	..	2	2	25	4	29	10	151	161
..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	1	1	1	..	..	..	80	5	85	..	..	..	1	10	1	11	6	90	96
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	1	..	..	98	3	101	..	..	1	2	6	3	9	6	104	110
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	54	2	56	..	..	..	1	4	1	5	3	58	61
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	95	2	97	1	..	2	4	9	7	16	9	104	113
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	1	..	..	103	3	106	1	..	1	2	29	4	33	7	132	139
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	2	..	..	..	..	1	..	..	125	4	129	..	1	..	3	17	4	21	8	142	150
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	43	2	45	1	..	1	...	9	2	11	4	52	56
..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	1	..	1	1	1	..	203	6	209	1	1	4	7	43	13	56	19	246	265
..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	3	..	..	..	1	5	1	..	227	12	239	..	..	1	3	30	4	34	16	257	273
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	2	4	..	..	176	7	183	..	1	4	4	40	9	49	16	216	232
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	2	..	..	94	4	98	..	..	2	5	16	7	23	11	110	121
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	90	2	92	..	..	2	4	39	6	45	8	129	137
..	..	1	..	1	..	4	..	1	2	12	..	4	2	3	4	19	1	5	3	21	34	7	..	2525	124	2649	5	7	33	72	499	117	616	241	3024	3265

D—*Position and distribution of the troops*

DEPARTMENTS AND POSTS.	SITUATION.	COMMANDING OFFICERS.	GARRISONS. Number of companies.	GARRISONS. Regiments.
Military Department No. 9, commanded by Col. and Bt. Brig. Gen. John Garland. Headquarters, Albuquerque, New Mexico.				Department staff.
Fort Masschusetts	Utah country, 85 miles from Taos, N. M.	Maj. G. A. H. Blake	2	1 co. 1st drag's; 1 co. 3d inf'y.
Cantonment Burgwin	Near Taos, New Mexico	Second Lieut. R. Ransom	1	1st dragoons
Fort Union	Moro river, New Mexico	Capt. N. C. Macrae	3	1 co. 2d drag's; 1 co. 2d art'y; 1 co. 3d inf'y.
Fort Marcy	Santa Fe, New Mexico	Capt. and Bt. Maj. W. T. H. Brooks.	1	3d infantry
Albuquerque	Albuquerque, New Mexico	Capt. and Bt. Maj. J. H. Carleton.	1	1st dragoons
Las Lunas	25 miles below Albuquerque, on Rio Grande, N. M.	Capt. R. S. Ewell	1	1st dragoons
Fort Conrad	Valverde, N. M	Capt and Bt. Lt. Col. D. T. Chandler.	2	1 co. 2d drag's; 1 co. 3d inf'y.
Fort Fillmore	Brasito, 40 miles above El Paso, N. M.	Maj. E. Backus	3	1 co. 2d drag's; 2 cos. 3d inf'y.
Fort Webster	Copper Mines, Apache country, N. M.	Maj. E. Steen	3	1 co. 1st drag's; 1 co. 2d drag's; 1 co. 3d inf'y.
Fort Defiance	Navajoe country, 190 m's west of Albuquerque.	Capt. and Bt. Maj. H. L. Kendrick.	3	1 co. 2d art'y; 2 cos. 3d inf'y.
En route to Fort Fillmore	New Mexico	First Lieut. J. N. Ward	1	3d infantry
Aggregate of the 9th	department		21	
Aggregate of the	division		111	

ADJUTANT GENERAL'S OFFICE, *Washington, November* 20, 1853.

in the Western Division, &c.—Continued.

PRESENT. Brigadier generals.	Assistant adjutants general (majors by brevet.)	Assistant adjutants general (captains by brevet.)	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.	Assistant quartermasters.	Commissaries of subsistence (majors.)	Commissaries of subsistence (captains.)	Surgeons.	Assistant surgeons.	Deputy paymasters general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants.	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Enlisted men.	Total commissioned.	Aggregate.	ABSENT. General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Total commissioned.	Aggregate.	PRESENT & ABSENT. Commissioned officers.	Enlisted men.	Aggregate.
..	..	1	..	..	..	1	..	1	..	1	..	3	..	..	..	..	..	..	..	..	..	..	..	....	7	7	..	1	..	...	...	1	1	8	....	8
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	2	..	..	125	4	129	..	..	2	2	22	4	26	8	147	155
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	60	1	61	..	..	1	2	9	3	12	4	69	73
..	..	..	..	..	..	2	..	1	..	1	..	..	..	..	..	2	..	..	..	1	2	..	..	181	9	190	..	1	1	4	51	6	57	15	232	247
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	1	..	..	75	3	78	..	..	..	2	6	2	8	5	81	86
..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..	..	1	..	56	3	59	..	..	..	3	30	3	33	6	86	92
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	71	1	72	..	..	..	2	10	2	12	3	81	84
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	2	..	..	98	4	102	..	..	1	4	31	5	36	9	129	138
..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	1	1	..	1	1	1	2	2	..	259	11	270	..	3	2	3	6	8	14	19	265	284
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	1	..	..	..	..	..	1	..	162	4	166	..	..	1	7	5	8	13	12	167	179
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	3	2	..	..	192	7	199	..	..	2	2	53	4	57	11	245	256
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	72	2	74	..	..	1	1	...	2	2	4	72	76
..	..	1	..	..	..	3	..	2	1	8	..	4	..	..	3	9	..	1	1	6	12	5	..	1351	56	1407	..	5	11	32	223	48	271	104	1574	1678
1	1	3	1	1	1	11	..	4	8	35	1	13	4	5	9	56	2	10	8	50	71	31	..	5700	326	6026	9	15	56	165	975	245	1220	571	6675	7246

S. COOPER, *Adjutant General.*

E—*Position and distribution of the troops in the Third or Pacific Division,* *Hitchcock. Headquarters,*

DEPARTMENTS AND POSTS.	SITUATION.	COMMANDING OFFICERS.	GARRISONS. Number of companies.	GARRISONS. Regiments.
Military Departm't No. 10.—(The command of this department is merged in that of the Pacific Division.)				Division staff......
Fort Yuma................	Mouth of Gila, Cal.........	Captain and Brevet Major S. P. Heintzelman.	3	2d infantry ....
Mission of San Diego.......	Near San Diego, Cal........	Captain H. S. Burton........	2	1 co. 1st artillery; 1 co. 3d artillery.
Rancho de Jurupa	Santa Anna River, Cal.......	Captain C. S. Lovell........	1	2d infantry ....
Presidio San Francisco......	Near San Francisco, Cal.....	Captain E. D. Keyes	1	3d artillery........
Benicia Barracks...........	Benicia, Cal	Major H. Day...............	..	Headquarters 2d infantry detachm't.
Benicia Arsenal	Benicia, Cal	First Lieutenant and Brevet Captain C. P. Stone.	..	Detachment of ordnance.
Fort Miller.................	San Joaquin River, Cal......	Captain and Brevet Major H. W. Wessells.	2	2d infantry.......
Fort Reading	Cow Creek, Upper Sacramento, Cal.	Major and Brevet Colonel G. Wright.	2	1 co. 2d infantry; 1 co. 4th infantry.
Fort Humboldt	Humboldt Bay, 220 miles north of San Francisco.	Captain and Brevet Lieut. Colonel R. C Buchanan.	2	4th infantry.......
Fort Jones	Yuka, Siskiyou county, Cal..	First Lieut. J. B. Collins	1	4th infantry.......
In the field................	Northern California	First Lieut. R. C. W. Radford	2	1st dragoons.......
En route via Cape Horn.....	....	Colonel W. Gates.....	6	3d artillery........
Aggregate of the 10th	department................	....	22	....
Military Departm't No. 11.—(The command of this department is merged in that of the Pacific Division.)				
Fort Orford	Port Orford, Oregon.........	Second Lieut. R. Williams...	..	Detachm't 1st dragoons.
Fort Dalles................	Columbia River, Oregon......	Major G. J. Rains...........	2	4th infantry.......
Fort Vancouver	Vancouver, Wash. Ter......	Lt. Col. B. L. E. Bonneville.	2	4th infantry.......
Steilacoom	Puget's Sound, Wash. Ter...	Captain and Brevet Major C. H. Larnard.	2	4th infantry.......
Fort Lane.................	Near Table Rock, 8 miles from Jacksonville, Oregon.	Captain and Brevet Major G. W. Patten.	4	1 co. 1st drag's; 3 cos. 2d infantry.
Aggregate of the 11th	department................	....	10	....
Aggregate of the	division..................	....	32	....

ADJUTANT GENERAL'S OFFICE, *Washington, November* 20, 1853.

under the command of Colonel and Brevet Brigadier General Ethan A. San Francisco, California.

PRESENT.																											ABSENT.							PRESENT AND ABSENT.		
Brigadier generals.	Assist. adjutants general (majors by brevet.)	Assist. adjutants general (captains by brevet.)	Assistant quartermasters general.	Deputy quartermasters general.	Quartermasters.	Assistant quartermasters.	Commissaries of subsistence (majors.)	Commissaries of subsistence (captains.)	Surgeons.	Assistant surgeons.	Deputy paymasters general.	Paymasters.	Colonels.	Lieutenant colonels.	Majors.	Captains.	Aids-de-camp.	Adjutants.	Regimental quartermasters.	First lieutenants	Second lieutenants.	Brevet second lieutenants.	Military storekeepers.	Enlisted men.	Total commissioned.	Aggregate.	General staff officers.	Field officers.	Captains.	Subalterns.	Enlisted men.	Total commissioned.	Aggregate.	Commissioned officers.	Enlisted men.	Aggregate.
.	1	..	..	..	1	3	..	..	1	..	..	3	1	..	..	..	..	..	..	1	..	..	1	....	13	13	2	..	..	..	....	2	2	15	....	15
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	2	..	..	..	3	2	..	..	106	8	114	..	..	1	3	29	4	33	12	135	147
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	..	..	55	3	58	..	..	1	5	28	6	34	9	83	92
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	1	..	..	30	4	34	..	..	..	..	9	..	9	4	39	43
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	2	..	..	..	31	3	34	..	..	..	2	....	2	2	5	31	36
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	1	1	1	..	..	..	18	5	23	..	1	..	..	5	1	6	6	23	29
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	25	2	27	..	..	..	..	....	..	....	2	25	27
..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	1	..	..	..	..	2	1	..	45	6	51	..	..	1	2	5	3	8	9	50	59
..	..	..	..	..	..	1	..	..	..	2	..	..	..	..	1	..	..	..	..	1	2	..	..	63	7	70	..	..	2	3	2	5	7	12	65	77
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	1	..	..	64	3	67	1	..	1	1	18	3	21	6	82	88
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	..	..	21	3	24	..	..	..	3	6	3	9	6	27	33
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	19	2	21	1	..	2	2	51	5	56	7	70	77
..	..	..	..	..	..	..	..	..	1	1	..	..	1	..	2	5	..	1	1	3	3	1	..	470	19	489	..	1	2	12	9	15	24	34	479	513
..	..	..	..	..	..	2	..	..	1	9	..	..	1	..	4	13	..	2	2	17	12	2	..	947	65	1012	2	2	10	33	162	47	209	112	1109	1221
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	13	1	14	..	..	..	..	....	..	....	1	13	14
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	1	..	..	..	2	1	..	..	73	6	79	..	..	1	1	15	2	17	8	88	96
..	..	..	..	..	..	1	..	..	1	..	..	..	..	1	..	1	..	1	1	1	..	..	..	92	7	99	..	1	1	1	16	3	19	10	108	118
..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	2	2	..	..	95	6	101	..	..	1	..	16	1	17	7	111	118
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	3	1	..	92	8	100	..	..	..	6	18	6	24	14	110	124
..	..	..	..	..	..	1	..	..	1	2	..	..	..	1	1	7	..	1	1	5	6	2	..	365	28	393	..	1	3	8	65	12	77	40	430	470
..	1	..	..	..	1	6	..	1	3	11	..	3	2	1	5	20	..	3	3	23	18	4	1	1312	106	1418	4	3	13	41	227	61	288	167	1539	1706

S. COOPER, *Adjutant General.*

F.

ADJUTANT GENERAL'S OFFICE,
Washington, November 20, 1853.

Statement showing the whole number of recruits enlisted in the army from the 1*st of October*, 1852, *to the* 30*th of September*, 1853.

I.—GENERAL RECRUITING SERVICE.

Lieut. Col. J. J. Abercrombie, 2d Infantry, General Superintendent.

Eastport, Me	3	
Boston, Mass	114	
New York, N. Y	313	
Albany, "	47	
Syracuse, "	39	
Rochester, "	103	
Buffalo, "	173	
Philadelphia, Pa	64	
Pittsburg, "	79	
Pottsville, "	27	
Harrisburg, "	32	
Lancaster, "	1	
Baltimore, Md	66	
Cumberland, Md	18	
Newport, Ky	107	
Louisville, Ky	18	
Chicago, Ill	90	
St. Louis, Mo	159	
Number of recruits enlisted for the general service		1,453

II.—MOUNTED SERVICE.

New York, N. Y	269	
Carlisle, Pa	11	
Philadelphia, Pa	123	
Baltimore, Md	116	
Number of recruits enlisted for the mounted service		519

III.—REGIMENTAL SERVICE.

1st regiment of dragoons	28	
2d regiment of dragoons	28	
Regiment of mounted riflemen	9	
Total mounted troops		65
1st regiment of artillery	89	
2d regiment of artillery	119	

3d regiment of artillery	61	
4th regiment of artillery	236	
Total artillery		505
1st regiment of infantry	11	
2d regiment of infantry	14	
3d regiment of infantry	12	
4th regiment of infantry	3	
5th regiment of infantry	20	
6th regiment of infantry	176	
7th regiment of infantry	21	
8th regiment of infantry	8	
Total infantry		265
Corps of sappers and miners		28
Detachment at West Point		28
Total number enlisted from the 1st October, 1852, to the 30th of September, 1853		2,863

IV.—RECAPITULATION.

For the general service	1,453	
For the mounted service	519	
By regiments, dragoons and mounted riflemen	65	
By regiments, artillery	505	
By regiments, infantry	265	
Sappers and miners, and detachment	56	
		2,863

V.—Amount recruiting funds in the hands of officers of the army September 30, 1852	$10,966 64
Amount of recruiting funds advanced to recruiting officers from October 1, 1852, to September 30, 1853	34,848 00
	45,814 64
Amount of funds accounted for from October 1, 1852, to September 30, 1853	32,582 59
Balance in the hands of recruiting officers September 30, 1853	13,232 05

Respectfully submitted.

S. COOPER,
Adjutant General.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

G.

Number of recruits enlisted in the army.

Station.	From Oct. 1, 1852, to Sept. 30, 1853.	From Oct. 1, 1851, to Sept. 30, 1852.	Difference.
GENERAL SERVICE.			
Eastport, Me	3	....	3
Boston, Mass	114	245	131
Providence, R. I	....	25	25
New York, N. Y	313	461	148
Albany, N. Y	47	168	121
Syracuse, N. Y	39	101	62
Rochester, N. Y	103	210	107
Buffalo, N. Y	173	91	82
Philadelphia, Pa	64	240	176
Pittsburg, Pa	79	101	22
Pottsville, Pa	27	86	59
Harrisburg, Pa	32	....	32
Lancaster, Pa	1	....	1
Baltimore, Md	66	89	23
Cumberland, Md	18	....	18
Newport, Ky	107	185	78
Louisville, Ky	18	54	36
Chicago, Ill	90	112	22
St. Louis, Mo	159	124	35
New Orleans, La	....	70	70
	1,453	2,362	909
MOUNTED SERVICE.			
New York, N. Y	269	331	62
Carlisle, Pa	11	24	13
Pittsburg, Pa	....	65	65
Philadelphia, Pa	123	24	99
Harrisburg, Pa	....	13	13
Columbia, Pa	....	26	26
Baltimore, Md	116	159	43
	519	642	123
REGIMENTAL SERVICE.			
1st regiment of dragoons	28	41	13
2d regiment of dragoons	28	21	7
Regiment of mounted riflemen	9	53	44
	65	115	50
1st regiment of artillery	89	102	13
2d regiment of artillery	119	32	87
3d regiment of artillery	61	211	150
4th regiment of artillery	236	257	21
	505	602	97

G—Continued.

Station.	From Oct. 1, 1852, to Sept. 30, 1853.	From Oct. 1, 1851, to Sept. 30, 1852.	Difference.
REGIMENTAL SERVICE—continued.			
1st regiment of infantry	11	9	2
2d regiment of infantry	14	10	4
3d regiment of infantry	12	8	4
4th regiment of infantry	3	102	109
5th regiment of infantry	20	8	12
6th regiment of infantry	176	233	57
7th regiment of infantry	21	17	4
8th regiment of infantry	8	2	6
	265	389	124
Sappers and miners	28	18	10
Detachment at West Point	28	46	18
	56	64	8

RECAPITULATION.

	From Oct. 1, 1852, to Sept. 30, 1853.	From Oct. 1, 1851, to Sept. 30, 1852.	Difference.
General service	1,453	2,362	909
Mounted service	519	642	123
Regimental service	891	1,170	279
	2,863	4,174	1,311

REMARKS.

The general recruiting service for the year has been conducted as heretofore, no material change having been made in the rendezvous. The depot for the collection and instruction of recruits for the general service was removed from Fort Wood, on Bedlow's Island, to Fort Columbus, on Governor's Island, in the harbor of New York, on the 26th of November, 1852, the former place being considered too limited in extent to carry out a proper system of instruction, and being wanting in the necessary accommodations for the recruits. The depot for the collection and instruction of the recruits for the mounted service was removed in October, 1853, from Carlisle Barracks, Pa., to Jefferson Barracks, Mo., and it is intended to establish additional rendezvous for the mounted service at several points in the West. The recruiting service for the cavalry, as well as for other regiments, is now under the direction of the superintendent of the general recruiting service in New York. Colonel Plympton, of the 1st infantry, was relieved as superintendent by Lieutenant Colonel Abercrombie, of the 2d infantry, on the 1st of July, 1853. With an increased number of recruiting officers, the service has materially fallen off, and the returns show, as above, that one thousand three hundred and eleven men less were enlisted in the year ending September 30, 1853, than in the year preceding.

S. COOPER, *Adjutant General.*

ADJUTANT GENERAL'S OFFICE, *Washington, November*, 20, 1853.

REPORT OF THE QUARTERMASTER GENERAL.

QUARTERMASTER GENERAL'S OFFICE,
Washington City, November 22, 1853.

SIR: In compliance with the provisions of the regulations, I have the honor to report the operations of the Quartermaster's department for the fiscal year commencing the 1st day of July, 1852, and ending the 30th of June, 1853.

At the date of my last annual report the apparent balance in the hands of officers and agents unaccounted for, amounted to		$442,655 65
To which are to be added:		
1st. Remittances and payment of drafts in the fiscal year		3,784,972 68
2d. Proceeds of the sales of public property		68,714 26
Making the whole apparent amount to be accounted for		4,296,162 59
From which are to be deducted:		
1st. Expenditures on account of previous years, not included in my last report, and for deficiencies in those years, paid in the present year	$651,507 72	
2d. Expenditures in the fiscal year ending June 30, 1853	2,819,581 05	
3d. Deposites to the credit of the Treasurer	26,000 00	
		3,497,088 77
Leaving to be accounted for		799,073 82
But from this sum should be deducted the sums due by the following individuals, late of the rifle regiment, viz:		
Lieut. George W. Hawkins	$70,050 00	
Lieut. W. C. Irvine	46,418 64	
Lieut. F. S. K. Russell	33,898 87	
		150,316 41
Leaving a balance of		648,757 41

The gentlemen named have been several times reported; and although they could not be prevailed on to render their accounts, it is believed that most of the money for which they are accountable has been applied to the public service. These officers served in Oregon; they were not of the Quartermaster's department, but were appointed by their respective commanding officers to perform duty, temporarily, in the department. All of them are out of service; and as they are now beyond the control of the department, and can only be reached by the law officers of the government, I do not perceive the advantage of continuing to report the balances for which they are accountable; and shall, in future reports, omit them.

Captain Folsom, against whom there is an apparent balance of $113,337 16, came to this city a few months ago to arrange his accounts, as far as possible, for settlement, but, in consequence of the state of his health, was obliged to leave: he has a clerk, however, employed upon his accounts; and it is understood that he will soon be here himself. The difficulty in his accounts was occasioned by the loss of vouchers in the fire at San Francisco in May, 1851.

Lieutenant Lendrum, of the third artillery, who for some time acted in the department at the artillery post near San Francisco, California, is deficient $6,272 06, owing, as he reports, to the loss of his funds and vouchers in the fire at San Francisco in May, 1851. This officer, as well as Captain Folsom, it is understood, will petition Congress for relief.

Accounts are due from twenty-one officers, whose joint accountability amounts to $123,649. One of them, Lieut. Bold, is dead; another, Lieut. Scott, is out of service. Fourteen are in New Mexico, California, and Oregon; two are in the Choctaw Nation, and the remainder in Texas. Seventy thousand dollars of the amount was placed in the hands of an officer to be taken to New Mexico for the service of the department in that Territory; the whole of which sum, it is ascertained, was unexpended at the close of the year, and is applicable to the payment of claims outstanding at that time, and to the service of the present year.

One hundred and forty-eight officers whose accounts have been received had in their hands, at the close of the year, balances amounting to $420,677 07, which, it is believed, will be equal to all the outstanding claims against the department that accrued within the year.

The supplies due from the department, including fuel for officers and men, forage for the horses of the several mounted corps, and for the horses, mules, and oxen of the trains, straw for soldiers' bedding, stationery used in the transaction of public business, materials for the repair of buildings, horse-shoes, horse-shoe nails, and medicines for horses, mules, and oxen, tools and building materials for the repair of the public buildings, saddles and other horse equipments for the mounted corps, clothing, tents, and other equipage for the army, have been regularly and promptly supplied to those entitled by the laws and regulations to receive them.

Transportation has been furnished for all supplies required for the army, also for the movement of the headquarters or field and staff of twelve regiments, for one hundred and forty-four company movements, and two thousand one hundred recruits—a portion of the supplies, as well as of the companies and recruits, from one extreme of the Union to the other.

As far as the means at my disposal have permitted, repairs and improvements have been made at the several posts throughout our Territories; but in consequence of the sum of $195,000—estimated for improvements in Texas, New Mexico, California, and Oregon—not having been granted at the last session of Congress, many improvements, indispensable to the health and comfort of the troops, are necessarily postponed. I am not aware of any objection on the part of the House of Representatives to the appropriation asked. It is understood to have been left out in consequence of a difference of opinion between the Committee of Ways and Means and that on Military Affairs, as to which of them should take charge of it and report it for the action of the House.

The work authorized by Congress at its last session to be established at the mouth of the Republican Fork of the Kanzas river was commenced, under the superintendence of Major Ogden. Much labor has been done, and materials procured for future operations. A steam sawmill is in operation, with shingle machine, lath saws, and mortising machine attached. The original plan contemplated barracks of stone for eight companies. Only three companies were detailed at first for the garrison, and they arrived so late in the season that, with the difficulties to be overcome, more than quarters sufficient for the officers and men of two companies, according to the plan, could not be completed; they will, however, during the winter, shelter the four companies of which the garrison is now composed.

Major Ogden reports that the estimate for the work, based upon prices of labor and material at the time it was made, has proved entirely too small. Prices have increased thirty per cent., and in place of two hundred soldiers which it was estimated might be employed as mechanics and laborers, only from sixty to seventy could be spared from other duties. The increase in the prices of labor and materials, with the addition to the hired force rendered necessary by the small military force furnished, will increase the expense of the work about seventeen thousand dollars; and the barn, stables, granaries, and other buildings necessary for a large mounted force, are estimated to cost about twelve thousand dollars more—making together twenty-nine thousand dollars required to complete the work.

The work authorized at the head of navigation, on the Minnesota river, has been commenced; but the material of which it was proposed to build it proving not to be so good as was supposed, and it being decided not to ask for a further appropriation for it, the question as to the change in the material from stone to wood has, by your instructions, been referred to the commanding officer. The population in Minnesota Territory is extending so rapidly westward that this post, though now distant from the settlements, will probably soon be surrounded by them; a change, therefore, to a cheaper material for the work, will not in that view of the case be objectionable.

The balances of the several appropriations under the direction of the Quartermaster's department, now remaining in the treasury, would, all together, be sufficient for all the probable demands of the service within the fiscal year, were they certainly available; but it is apprehended that large sums will be taken from the current appropriation in the settlement of officers' accounts at the treasury, and be brought to the credit of war appropriations, and be rendered unavailable. This cannot be certainly known until the war accounts be all settled. It is understood that those accounts will be closed early in the winter, when, should the apprehension above expressed be well founded, the authority of Congress will be necessary to apply to the current service the amounts thus taken away from the appropriation.

The estimate for the next fiscal year is based upon the best data attainable. Some of its items are less than similar items for the present year, some are equal, and one, barracks and quarters, is greater than the sum appropriated for this year. The increase of this item grows out of the necessity of occupying new positions in advance, on the Mexican and Indian frontiers, and of securing to the troops at all the posts occupied better accommodations than have been provided for them heretofore. The government has furnished a standard of suitable accommodations in the dwellings constructed at the navy-yards, the marine barracks, and the ordnance stations and armories. Navy and marine officers not only have excellent quarters and abundance of them at their stations, but have the more necessary articles of furniture provided at the public expense. The ordnance officers, both at the ordnance stations and the armories, have quarters not only of a very superior quality, but generally double the quantity provided for officers of corresponding grades in other corps.

The officers of the army cannot perceive the justice of allowing furniture to navy and marine officers and denying it to them; nor can those of the line, and the active staff, see any good reason why so great a difference should be made between them and the ordnance. They do not expect to be sumptuously quartered; but they have a right to expect that comfortable buildings be provided for them and their commands at the posts they are compelled to occupy. The whole estimate, if the amount be appropriated, will be barely sufficient to provide ordinary accommodations for the officers and men at the posts now occupied, and those which it may be necessary to occupy.

Two items, forage and transportation, I have reduced—whether wisely or not, time must determine. Our army, averaging not more than twelve thousand men, is performing services equal to those of any fifty thousand men in any other army in the world. Long, rapid, and expensive movements are being constantly made, to supply the want of numbers, and often through portions of country entirely destitute of forage and subsistence, both of which, as well as all other supplies, have to be transported at a heavy cost. Neither of the items now referred to, it is obvious, can be much reduced until cultivation shall have greatly extended, and more certain, cheap, and rapid modes of communication be provided.

The estimate for clothing and equipage is greater than the appropriation for the present year. This estimate has, every year since the close of the Mexican war, been made out not for the whole allowance of clothing and equipage due to the army for the ensuing year, but merely to supply a deficiency after applying to the service all the war stock on hand which could be made available. This item will continue to increase, as less of the war stock shall annually be available, until the whole of that stock be absorbed; when, if present prices of labor and materials remain unchanged, the probable annual estimate will be about eight hundred thousand dollars.

Our territories are now so extended, that several permanent depots for the concentration of supplies for the troops have become necessary. Three such depots are required in Texas, two in California, one in Oregon, one at least in New Mexico, and one at Fort Leavenworth. To take charge of these depots, and to perform the duties connected with them, a storekeeper is necessary at each. I respectfully recommend that application be made to Congress to authorize the President to appoint as many military storekeepers as the service may require, not exceeding eight, with suitable compensation.

In addition to the storekeepers, it would add greatly to the security of the public buildings and other property at the several posts, and in that way promote economy, if the condition of the ordnance sergeants were improved, and the sphere of their duties enlarged. I recommend that they be recognised as barrack-masters at their respective posts, and be charged with such duties in regard to the clothing and other property of the Quartermaster's department as the Quartermaster General, with the approval of the Secretary of War, may direct; and that, for this additional service they be allowed an extra compensation of from five to ten dollars per month, according to the duties and responsibilities imposed upon them, to be determined by the Secretary of War.

In the discharge of the laborious and responsible duties of the Quartermaster's department, I am compelled to employ, constantly, more than a hundred officers who are not of the department: from forty to fifty of them are assistant commissaries, who, in that capacity, receive additional compensation; but the remainder receive nothing for their extra services. Many of them perform laborious, responsible, and highly important duties, in the discharge of which they are subjected to losses and expenses which they can ill afford. Justice would seem to require that they be allowed an additional compensation sufficient, at least, to cover necessary extra expenses and small losses. I recommend, as an act of justice to this deserving class of officers, that, for a number not exceeding fifty at any one time, the same additional compensation be allowed which is now paid to assistant commissaries; and that the ration now withheld from all regimental and other subordinate staff officers be allowed to them.

Fifteen hundred and sixty soldiers were employed, during the year, on extra duty at the several posts, as laborers and mechanics, and were each paid a per diem of fifteen cents and commutation for the whiskey ration authorized by law. Now, while I doubt the policy of employing soldiers on any other labors, or in constructing any other works, than those which may be connected with their own operations, yet the occasions are of daily occurrence when the necessities of the service compel commanding and staff officers so to employ them. The rate of extra compensation allowed them was established more than thirty years ago, when laborers could be obtained at half the wages which they now command. To make the service efficient, the men who are employed must feel satisfied that they are receiving justice at the hands of their country: this is far from being the case when they are employed as mechanics and laborers at the pittance now allowed. Sound policy requires that this allowance be increased. To laborers and teamsters I would recommend a per diem of twenty-five cents, and to mechanics forty cents, when employed anywhere east of the Rocky mountains; and thirty-five for the former and fifty for the latter, when employed west of those mountains. But even with these increased rates, soldiers should never, if possible, be employed as teamsters, except with the companies or corps to which they belong. When public trains are required to transport supplies from the depots to the outposts, or from one outpost to another, teamsters should be hired at rates to secure reliable men.

In arranging the clerkships in this office, Congress, at its last session, authorized three of the first or junior class, with salaries of nine hundred dollars. That sum might be sufficient for young men, employed as copying clerks; but mere copyists would be of little service here: all employed in this office must be qualified for higher duties. There is no desk in the office where, if the clerk employed perform his duty, the second class of compensation is not fully and honestly earned. The gentlemen receiving the lowest class of compensation perform their several duties faithfully, and earn much more than they receive. As an act of justice to them, I respectfully ask for their cases your favorable consideration, and, through you, that of the President and Congress.

By the legislation of Congress, the Quartermaster's department is charged with a heavy money and property accountability, the accounts and vouchers for which must be separated, and sent for settlement to the Second and Third Auditors of the Treasury. Officers on the frontiers and in the field cannot keep appropriation accounts; and it often happens that not only vouchers in the same account, but items in the same voucher, have to go to the two Auditors; and every officer of the department, as well as every officer commanding a company or detachment of mounted troops, is obliged to make to the Quartermaster General's office two property accounts every quarter—one for the Second, and the other for the Third Auditor.

Such is the state of things now, that if canvass be taken from the same bale to make or repair a wagon cover, and to make or repair a tent, or tent-fly, the quantity used for each must appear upon a separate return, because the quantity used in the latter case must be accounted for to the Second Auditor, and in the former to the Third; and if plank and nails be taken to make a floor and bunks for the accommodation of the sick in a hospital tent, or for the troops in an encampment, these materials must be accounted for on one return to the Third Auditor; while the tents, tent-poles, and flies must be accounted for on a separate return to the Second Auditor. I have no preference as to the Auditors, but I do hope that one or the other of them may be authorized by law to receive and settle all the accounts of the officers of the Quartermaster's department, without reference to the other.

We have now on the regular military establishment three mounted regiments and several companies of horse artillery, requiring constantly, either in service or in preparation for service, three thousand horses; and we have constantly employed in the trains, and at the several garrisons, about five thousand horses and mules, and there is not a single veterinary surgeon authorized by law. There should be organized, and placed under the direction of the Surgeon General of the army, a veterinary corps, to consist of a competent number of surgeons and assistant surgeons, who should be assigned to duty at depóts, and with mounted regiments, squadrons, detachments, cavalry, and artillery schools of instruction, and trains. More is lost every year by the sacrifice of horses and mules, for want of proper veterinary aid, than would support the expense of such a corps for two or three years. I recommend that such a corps be employed, and that a veterinary school be established, where officers of dragoons, mounted riflemen, and light artillery, as well as the candidates for the veterinary corps, may receive competent instruction in all that relates to the care, management, and diseases of horses and mules in the public service.

The operations of the army, in connexion with all our new territories, are greatly embarrassed, and vast expenses incurred, by the want of good roads through those territories, and suitable improvements in the navigation of their harbors and rivers. Every military man knows that the expansion of our population over those territories, without the means of rapid communication, so far from increasing our military power, has diminished it at least one-third. The military power of nations depends not so much upon their force and resources, as the capacity to concentrate promptly that force and those resources at the points where they are required to be used. To make our military power effective even for defence, the improvement of the harbors and rivers of Texas, California, Washington, and Oregon, and the construction of railroads to connect those States and Territories, as well as New Mexico, with each other and with the States east of the Mississippi, are indispensably necessary. Let these works be completed, and our military power, whether for offence or defence, will be quadrupled.

Our extensive territories, bounded west by the Pacific, are separated from the strength and power of the nation by vast deserts and lofty mountains, over which it requires months to communicate. With those territories our only channels of rapid communication are through foreign States. Suppose our country at war with one of the great maritime powers of Europe; our Pacific coast would be immediately blockaded, and the communications through the States above referred to cut off; our people on that side of the continent would be deprived of their commerce, and, from the undeveloped state of their agriculture, would be left without the means of self-support; and being beyond the reach of effective and timely support from the mass of the nation, through our own territories, would be starved out and compelled to capitulate in less than six months.

To prevent such a result the works proposed are necessary; but they are upon so great a scale that timid men may be startled and alarmed at their magnitude, and believe their accomplishment impossible; but that which ordinary men think impossible, men of genius find only difficult. We possess abundant resources in science, mechanical skill, and pecuniary means, to complete all the works required for the full development of our military power, and the nation has only to will those works to accomplish them. To carry them out successfully, all that is necessary on the part of our public men is that honest determination of purpose and intrepidity of intellect which should ever distinguish the leaders of a great and free people, and which are sufficient to insure the faithful and energetic appliance of the national means to national objects.

With high consideration and respect, I have the honor to be your obedient servant,

TH. S. JESUP,
Quartermaster General.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

REPORT OF THE PAYMASTER GENERAL.

PAYMASTER GENERAL'S OFFICE,
November 21, 1853.

SIR: I have the honor to submit herewith a report of the transactions of the Pay department for the fiscal year ending 30th June, 1853.

It will be seen by the tabular statement herewith that there remained in the hands of paymasters on the 30th of June, 1852, applicable to payments due in the first quarter of the last fiscal year, the sum of $362,194 47, in addition to which they have received from the treasury and other sources, exclusive of amounts transferred from one to another, the sum of $2,795,095 21, making a total to be accounted for of $3,157,289 68.

Expended as follows:

Payments to regular troops	$2,404,246 10
Payments to volunteers	149,349 89
Three months' extra pay to regulars	12,190 58
Three months' extra pay to volunteers	5,863 42
In paying the Military Academy	94,706 83
Total expended	2,666,356 82
Leaving a balance of	490,932 86

This balance is unusually large, arising from the necessity of sending to New Mexico $100,000 in gold, for the accommodation of officers and discharged soldiers, which did not reach its destination and could not be disbursed before the close of the fiscal year; the balances, however, have, as far as heard from, been expended and accounted for since the commencement of the present year.

As far as returns have been received, the troops have all been paid to the 31st of August, and many to the 31st of October. No complaint has been heard from any quarter; and it gives me pleasure to state that the officers of this department have discharged their duties to my entire satisfaction.

I would respectfully bring to your notice the very serious embarrassment under which all disbursing officers labor for the want of some provision of law for the safe-keeping of the public funds. The order of the Secretary of the Treasury of 28th of June last has relieved all in the vicinity of Washington, New York, Boston, Charleston, New Orleans, and St. Louis; but at all other points they are subjected to great risk, from the fact that they are frequently compelled, in the discharge of their duties, to absent themselves for several weeks from their stations, and must leave their funds in charge of their clerks or some other agent. I would suggest that it be made the duty by law of all depositaries of the public money, such as collectors, receivers and others, to receive the moneys of disbursing officers on deposite, and pay them out on their checks; or, in the absence of such depositaries, the best means of security the nature of the case will admit.

Respectfully, your obedient servant,

BENJ. F. LARNED,
Acting Paymaster General.

Hon. JEFFERSON DAVIS,
Secretary of War.

Statement showing the amount remaining in the hands of each of the disbursing officers of the Pay department, and unaccounted for on the 1st July, 1852; the amount remitted to each from the treasury, or turned over by other agents, during the fiscal year ending June 30, 1853; the amount accounted for by accounts and vouchers of expenditure, or by transfer to other agents or replacements in the treasury; and the balance unaccounted for, to be applied to payments in the first quarter of the next fiscal year.

Paymasters.	Balances in hand and unaccounted for on the 1st July, 1852.	Amount remitted from the treasury and turned over by other ag'ts during the year end'g June 30, 1853.	Total received, to be accounted for.	Amount expended in paying regular troops.	Amount expended in paying volunteers.	Amount paid for three months' extra pay to disch'd regular troops.	Amount paid for three months' extra pay to disbanded volunteers	Amount expended in paying the Military Academy.	Amount turned over to other agents or replaced in the treasury.	Total accounted for.	Balance unaccounted for, to be applied to payments in the next fiscal year.
T. P. Andrews, dep. paymaster gen..	$44,692 95	$665,550 67	$710,243 62	....	....	....	....	....	$710,243 62	$710,243 62	....
T. J. Leslie..........................	3,168 69	559,640 43	562,809 12	$318,897 45	$6,157 78	$2,097 00	$1,241 51	$14,449 90	214,114 70	556,958 34	$5,850 78
D. S. Townsend....................	2,618 15	65,113 06	67,781 21	49,316 10	4,834 35	361 24	....	....	13,219 52	67,731 21	....
A. D. Steuart.......................	42,065 19	267,045 56	309,110 75	49,881 33	569 15	126 00	240 00	....	248,512 64	299,329 12	9,781 63
Benjamin Walker..................	1,220 82	346,842 47	348,063 29	93,652 03	877 86	283 00	465 00	....	250,172 44	345,450 33	2,612 96
E. Van Ness........................	180 81	155,252 85	155,433 66	135,132 45	342 88	1,005 00	225 00	....	3,106 00	139,811 33	15,622 33
S. Denny............................	3,492 60	394,824 05	398,316 65	253,517 29	46,923 57	2,460 34	2,527 50	....	82,893 81	388,322 51	9,994 14
D. Hunter	1,720 34	203,664 24	205,384 58	116,265 29	....	396 00	27 00	80,256 93	5,111 00	202,056 22	3,328 36
L. J. Beall...........................	11,999 64	62,677 42	74,677 06	56,569 25	195 33	177 00	69 00	....	5,724 27	62,734 85	11,942 21
A. J. Coffee.........................	28,813 38	266,807 60	295,620 98	110,359 22	1,837 96	492 00	377 41	....	54,947 32	168,013 91	127,607 07
J. Y. Dashiell.......................	10,517 83	164,829 56	175,347 39	81,606 54	28,694 94	165 00	....	....	50,111 62	160,578 10	14,769 29
S. Maclin............................	7,871 97	139,355 51	147,227 48	79,960 88	....	33 00	....	....	63,072 91	143,066 79	4,160 69
A. W. Gaines.......................	3,261 22	63,247 85	66,509 07	54,622 46	14 29	129 00	....	....	8,206 66	62,972 41	3,536 66
G. H. Ringgold.....................	22,039 10	100,185 06	122,224 16	105,587 99	1,037 54	1,305 00	153 00	....	....	108,083 53	14,140 63
A. G. Bennett.......................	113 08	1,533 77	1,646 85	1,646 85	....	....	....	....	....	1,646 85	....
H. Leonard..........................	21,532 05	399,912 03	421,444 08	118,561 28	13,235 80	336 00	490 00	....	243,056 56	375,679 64	45,764 44
R. B. Reynolds.....................	28,870 80	53,430 79	82,301 59	72,733 45	....	948 00	21 00	....	5,613 89	79,316 34	2,985 25
Henry Hill	8,753 39	147,032 18	155,785 57	115,465 58	26,450 62	542 00	....	....	500 00	142,958 20	12,827 37
F. A. Cunningham.................	42,781 71	168,167 55	210,949 26	18,786 35	16,850 41	111 00	....	....	103,654 58	139,402 34	71,546 92
G. C. Hutter........................	9,619 13	94,281 29	103,900 42	98,440 59	....	243 00	....	....	3,079 00	101,762 59	2,137 83
A. J. Smith..........................	11,242 85	104,835 74	116,078 59	106,480 76	....	579 00	....	....	....	107,059 76	9,018 83
N. W. Brown........................	29,626 45	144,494 81	174,121 26	74,316 44	209 00	....	....	....	87,835 01	162,360 45	11,760 81
A. S. Johnston.....................	15,198 34	98,282 95	113,481 29	111,181 91	1,084 38	159 00	....	....	1,056 00	113,481 29	....
J. R. Hagner........................	4,165 99	221,871 70	226,037 69	96,248 74	34 03	....	27 00	....	128,849 05	225,158 82	878 87
B. W. Brice.........................	6,627 99	120,302 28	126,930 27	85,015 87	....	243 00	....	....	32,405 61	117,664 48	9,265 79
C. H. Fry	....	101,400 00	101,400 00	....	....	....	....	....	....	....	101,400 00
Total	362,194 47	5,110,581 42	5,472,775 89	2,404,246 10	149,349 89	12,190 58	5,863 42	94,706 83	2,315,486 21	4,981,843 03	490,932 86

Paymaster General's Office, *November* 21, 1853.

BENJ. F. LARNED, *Acting Paymaster General.*

[illegible]

[illegible] the papers.

With great respect, [illegible]

[illegible]

Hon. Lawrence [illegible]

[illegible]

REPORT OF THE COMMISSARY GENERAL.

OFFICE OF COMMISSARY GENERAL OF SUBSISTENCE,
Washington, October 19, 1853.

SIR: I have the honor to submit the following report of the operations of this department during the past year, and to transmit herewith an estimate for the subsistence of the army for the fiscal year ending June 30, 1855.

The posts on the northern frontier, Atlantic sea-board, and western frontiers of the old States, have been furnished with subsistence by contract, whilst the troops in southern Arkansas, Texas, New Mexico, California and Oregon, have been supplied by purchase in the open markets of the old States, or countries adjacent to the posts. All, it is believed, have been amply supplied with good and wholesome provisions.

Issues have been made to Indians at many of our posts, and with a beneficial influence on our relations with them. Subsistence has been furnished at the frontier posts to the employés of the Mexican boundary commission, exploring parties on the Pacific railroad, and suffering emigrants.

The experiments on the "solar evaporated salt of Syracuse," testing its value in curing and preserving pork, are still in progress; so far as they have proceeded, the results show this salt to cure the pork as well as that from Turk's Island; but that it discolors the surface of the pork to such a degree as to render it less marketable.

The increased price of provisions throughout the country renders it necessary for me to increase my estimates for the next fiscal year above that of the last; and I have, accordingly, estimated the cost of the ration at twenty-five cents.

The accounts of the officers of this department have, in general, been correctly rendered; the few exceptions being due to the vicissitudes of service having separated the officer from his papers.

With great respect, your obedient servant,

GEORGE GIBSON,
Commissary General of Subsistence.

Hon. JEFFERSON DAVIS,
Secretary of War.

REPORT OF THE SURGEON GENERAL.

SURGEON GENERAL'S OFFICE,
November 1, 1853.

SIR: I have the honor to submit to you a report upon the fiscal transactions and other matters relating to the medical department of the army, for the year ending on the 30th of June, 1853.

The amount of the appropriation for the medical and hospital department, remaining on the 30th June, 1852, was:

In the hands of disbursing agents		$5,606 07	
In the treasury of the United States		122,034 71	
Amount appropriated per act approved August 31, 1852		51,670 00	
Amount of auction sales in New York		1,279 76	
Amount of auction sales in New Orleans		454 12	
			$181,044 66
Of this sum there has been expended on account of pay and other claims of private physicians contracted in—			
1847	$121 63		
1848	11,819 00		
1849	119 34		
1850	3,155 93		
1851	908 34		
1852	4,304 90		
1853	9,068 93		
		29,498 07	
On account of medical supplies contracted in—			
1847	90 09		
1848	154 99		
1849	547 58		
1850	607 67		
1851	154 69		
1852	2,424 20		
1853	24,117 69		
		28,096 91	
Amount turned over to surplus fund per act August 31, 1852		88,078 18	
Leaving in the hands of disbursing agents		1,528 80	
And in the treasury of the United States		33,842 70	
			$181,044 66

From the foregoing statement of the fiscal transactions of the medical bureau of the army, it appears that twenty thousand four hundred and twenty-nine dollars and fourteen cents ($20,429 14) were paid on account of the claims of private physicians, for services rendered, and three thousand nine hundred and seventy-nine dollars and twenty-two cents ($3,979 22) for medical and hospital supplies, purchased antecedently to the fiscal year commencing on the 1st day of July, 1852; leaving as the expenditure of the department, on account of compensation to private physicians, during the last fiscal year, the sum of nine thousand and sixty-eight dollars and ninety-three cents ($9,068 93,) and for medical and hospital supplies twenty-four thousand one hundred and seventeen dollars and sixty-nine cents ($24,117 69.)

The necessary medical supplies for the army have been regularly provided by the medical purveyors in New York and in New Orleans, under instructions from this office, and have been duly forwarded, either directly to the several military posts on the frontiers, or to the depôts in the Pacific division, in New Mexico and Texas, to be thence distributed to the different posts as required by the necessities of the service.

Ample provision has also been made, as usual, at the several military posts on the line of travel, for supplying with medicines, &c., the emigrants who take sick while *en route* to California and Oregon; and I have the gratification of saying that the medical officers of the army, and the attendants in those military hospitals, have, by giving their professional and personal attendance to those who required medical and surgical aid, fully carried out the benevolent intentions of the government towards the adventurous pioneers who happened to become sick, or received injuries, while traversing the wilderness.

Having in my last annual report adverted to the fact that a very considerable additional expense had been annually incurred for several years past in the renewal of supplies damaged, destroyed, or lost in transportation to the more distant stations occupied by troops, I am happy to be able to state now, that the losses thus occasioned during the last year have been much less than heretofore. No inconsiderable damage and loss are still, however, sustained from the want of proper storehouses, to secure the hospital property from the inclemency of the weather, &c., &c.

The frauds so extensively committed in the adulteration of drugs and medicines, and in the importation and sale of spurious articles, long since attracted the attention of this bureau; and, in order to secure to the army pure and reliable medicines, they have been for many years past purchased in open market by experienced medical officers, specially selected for that purpose, and whose duty it is to examine, and, when necessary, to submit to chemical analysis, the articles they are required to furnish.

Since the stringent law, enacted by Congress, to prevent the "importation of adulterated and spurious drugs and medicines," it is found that adulterations of those articles are made more extensively than before in this country; so that it is difficult to procure medicines which are not either admixed with some foreign substance, or from which some portion of the active principle has not been subtracted by chemical process. The effort to suppress the foreign trade has had the effect, it would seem, to give more than ordinary activity to the home manufacture of spurious articles of medical supply; and it remains for Congress to devise some other means for suppressing the practice of dispensing to the public, drugs and medicines which, if not positively hurtful, are known to be without efficiency, and therefore are injurious, by superseding the administration, at the proper time, of other and more active remedial agents.

Although, under the system adopted by this bureau, adulterated medicines have seldom found their way into the army, still, as it is an object of the greatest importance that these supplies should be absolutely pure, it is now contemplated to attain that end by having, as far as practicable, the medicines furnished to the army purchased from the naval laboratory at Brooklyn.

This establishment was organized a year or two since, under the auspices of the Bureau of Medicine and Surgery of the navy, and placed under the direction of a medical officer of that branch of the public service; and the plan now proposed to be adopted will serve to enlarge the operations of that institution, while it will also secure to the army pure and unadulterated articles of medical supply.

The annual report of the sick and wounded of the army, as exhibited in the tabular statement herewith transmitted, and which is compiled from the monthly and quarterly reports required from the medical officers, shows the following results:

The number of officers and men remaining sick on the 30th of June of last year was 645, and the number of cases of disease which occurred during the twelve months succeeding thereto was 29,575; making in all 30,220 cases of indisposition that have been under treatment by the medical officers of the army during the year ending on the 30th of June, 1853.

Of the whole number of sick reported, 28,974 were restored to duty, 38 were furloughed, 227 were discharged from the service, 43 deserted, and 280 died, (including 94 from epidemic cholera;) leaving, on the 30th June last, 658 still on the sick report.

The mean strength of the army for the year ending June 30, 1853, was, according to the returns made to this office, 9,994; and as the number of cases of indisposition reported during the same period was 29,575, it follows that the proportion of cases of disease to the number of officers and enlisted men in the army was 2.95, or that, on an average, each individual was sick very nearly three times during that year.

It will also be perceived from the foregoing data, that the ratio of deaths to the number of officers and enlisted men was as 1 to 35.69, or 2.80 per cent.; and that the proportion of deaths to the number of cases of disease treated was as 1 to 107.92, or 0.92 per cent.

The meteorological observations have been continued as heretofore at the various military posts occupied by troops. Ten years' observations, from 1843 to 1852 inclusive, have been arranged, and tabular statements of mean temperatures, clearness of sky, &c., &c., are now being drawn up for publication. When finished, this work will complete a series of thermometrical and other observations on the weather, continued through a period of thirty-one years. The value of these observations increases with each succeeding year; and they are no doubt calculated in time, taken with similar results obtained at sea and in other localities, to throw great light upon the laws of climate, varieties of temperature, annual fall of rain, &c., &c.

The number of approved candidates awaiting appointment to the medical staff of the army having been of late reduced to two, it was deemed advisable to make provision for the future exigencies of the service; and, accordingly, a board of medical officers has been ordered, to convene on the first of December next in the city of New York, for the examination of applicants for appointment, as well as of assistant surgeons for promotion, in the medical department of the army.

I had it in contemplation at one time—that is, when the military force was dispersed in small bodies all over the land—to ask for an increase of the number of the officers of the medical staff of the army to the extent, at least, of the number of posts occupied by troops. Since the system of concentrating the troops into larger bodies, and the abandonment of certain posts not requiring a garrison, has been adopted, however, I have concluded to leave to others, who know better than I do what futurity may bring forth, to decide upon the policy of augmenting at this time the strength of the medical department of the army.

The subject having been repeatedly brought to my notice, I cannot let the present opportunity pass by without submitting a few remarks upon the "rights and disabilities" of the assistant surgeons of the army.

By the 24th section of "An act to increase the present military establishment of the United States, and for other purposes," approved July 5, 1838, it was enacted, "That, hereafter, the officers of the pay and medical departments of the army shall receive the pay and emoluments of officers of cavalry of the same grades, respectively, according to which they are now paid by existing laws."

Under this law, assistant surgeons of over five years' service draw forage, or money in lieu thereof, for three horses, the same as captains of dragoons; and assistant surgeons of less than five years' service forage for two horses, as allowed to lieutenants of dragoons.

This law (still unrepealed) continued in force from July, 1838, to March 3, 1845, the date of the approval of "An act making appropriations for the support of the army for the year ending the 30th June, 1846," the fourth paragraph of which act reads thus:

"For commutation of forage for officers' horses, sixty-four thousand dollars: *Provided*, That general and field officers shall not be entitled, in time of peace, to draw forage, or money in lieu thereof, for more than three horses each, to be owned and actually kept in service; officers of the regiments of dragoons below the rank of field officers, for two horses each; and all other officers now entitled to forage, for one horse each, to be owned and actually kept in service."

It will be perceived that, by the operation of this proviso to an appropriation bill, the emoluments of officers of the medical staff, in time of war, will be the same as under the law of July 5, 1838; while, in time of peace, the allowance of forage to assistant surgeons ceases to be assimilated to officers of the regiments of dragoons of the same grades, the former being allowed forage for one horse only. Whatever may have been the propriety of restricting an officer's allowance for forage to one horse in those staff corps whose duties do not require the officer to be mounted, or to keep horses, the rule does not hold good with respect to the officers of the medical department of the army. Whether in the field, at a post on the frontiers of our country, or in a city like this, his duties require that he should have the use of horses. In the field, marching with troops, his presence is required alike with the élite, or front guard, in the centre and on the flanks, and in the rear of the column of march. He must obey a call to a sick or wounded man, whether in the centre, or at the extreme points of the line of march. At posts on the frontiers, also, he is at any moment liable to be called to the saddle to accompany a detachment of mounted men on a scout, &c.; and he must have more than one horse for himself and for the private servant who necessarily accompanies him. And even when stationed in our cities, he cannot perform his duties on foot; for what with the resident officers and their families dispersed throughout the town, the officers transiently in the city on furlough, or travelling under orders, &c., the medical officer must have horses at command, or be subjected to hack-hire, &c., &c., to enable him to meet his engagements. The allowance for forage is not strictly an emolument to the officer, whose duties absolutely require him to be mounted; while the deprivation of the allowance is a tax upon that officer, not exacted from others, whose duties do not require them to be mounted. Again: It may be that, at certain points, no forage can be obtained by an officer individually; so that if the necessary amount of forage is not allowed by law, and furnished by the Quartermaster's department, he cannot possibly subsist the number of horses he requires to enable him to do his duties with facility.

Having seldom, if ever, advocated an increase of compensation to the commissioned officers of the line or staff of the army, I trust that I offend not against propriety in thus endeavoring to put the assistant surgeons of the army in a right position before those whose province it is to provide the means by which an officer can best perform his duties to his country.

I avail myself of this occasion to call the attention of the Department of War to the fact, that it is very difficult to obtain from the rank and file of the army proper persons to discharge the duties of stewards and wardmasters in our military hospitals; and that even when a non-commissioned officer or private is found qualified for the duty and is willing to serve, there is, as a general rule, great opposition on the part of the commanding officer of the company to which the man belongs, to his being taken from the company. To obviate this difficulty, it is respectfully recommended that authority be given to enlist, or to engage for a term of years, a certain number of qualified persons to serve specially as hospital stewards. These men can be brought into the service as non-commissioned staff officers, and be mustered and paid as such; or they can be enlisted like other soldiers, but with the distinct understanding that they are to be supernumeraries in a regiment or corps, and of course not specially attached to any organized company of the line of the army.

It may not be amiss for me to suggest also the propriety of making some provision by which to requite the hospital attendants and nurses for the sleepless nights they have to pass, the loathsome duties they have to perform, not to speak of the painful anxiety they have frequently to endure, while watching over the bedside of the suffering and perhaps dying individual intrusted to their care.

In treating upon this subject in my last annual report, it was stated, among other things, that of all the soldiers of the army who were placed on "extra duty," the hospital attendants were the only persons who did not receive extra compensation for extra services rendered. And why should this be so?

Not an officer nor a soldier of the army, I believe, but what would be gratified to have the hospital attendants embraced in the law granting extra compensation to men on extra duty.

And could the voice of the numerous emigrants who have traversed the wilderness along the line of our military posts be heard on this question, they would also, by general acclamation, pronounce in favor of meting out a full measure of reward to those untiring and wakeful men who have always been found willing and ready to minister, by day and by night, to the wants and to the comforts of the traveller stricken down by disease, and whose misfortunes alone gave him a claim to their aid.

All of which is respectfully submitted

TH. LAWSON,
Surgeon General.

Hon. JEFFERSON DAVIS,
Secretary of War.

Annual report of the sick and wounded of the army of the United States for the year ending June 30, 1853.

Quarters.	REMAINING LAST REPORT.			TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR.													
				Fevers.								Eruptive fevers.					
	Sick.	Convalescent.	Total.	Febris continua communis.	Febris intermittens quotidiana.	Febris intermittens tertiana.	Febris intermittens quartana.	Febris remittens.	Febris typhus.	Febris typhus icterodes.	Febris sudatoria.	Erysipelas.	Rubeola.	Scarlatina.	Variola.	Varioloid.	Vaccina.
September 30, 1852	......	......	......	35	1,475	884	11	393	31	1	......	7	1	......	....	....	....
December 31, 1852	......	......	......	20	1,414	918	19	133	10	33	......	6	......	1	....	4	....
March 31, 1853	......	......	......	10	803	496	34	58	2	......	......	7	......	2	4	5	....
June 30, 1853	......	......	......	20	951	853	5	73	3	......	2	10	4	1	....	....	1
Grand total	360	285	645	85	4,643	3,151	69	657	46	34	2	30	5	4	4	9	1
Causes of death	......	......	......	1	1	......	......	5	16	4	......	2	......	......	....	....	....

Annual report of the sick and wounded, &c.—Continued.

Quarters.	TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR. Diseases of the organs connected with the digestive system.																
	Cholera.	Colica.	Cynanche parotidæa.	Diarrhœa.	Dysenteria acuta.	Dysenteria chronica.	Dyspepsia.	Enteritis.	Gastritis.	Hæmatemesis.	Hepatitis acuta.	Hepatitis chronica.	Icterus.	Obstipatio.	Peritonitis.	Tonsillitis.	Cholera epidemic.
September 30, 1852	90	130	3	1,257	327	24	48	5	19	......	7	2	6	285	2	45	183
December 31, 1852	15	82	13	740	239	21	35	6	19	1	5	2	10	145	2	68	3
March 31, 1853	3	66	9	353	122	9	25	2	12	1	4	2	3	180	......	78	......
June 30, 1853	16	96	7	626	148	26	36	3	11	1	3	2	1	240	4	41	......
Grand total	124	374	32	2,976	836	80	144	16	61	3	19	8	20	850	8	232	186
Causes of death	......	......	......	17	8	22	......	......	3	1	......	......	......	......	1	......	94

Annual report of the sick and wounded, &c.—Continued.

TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR.

Quarters.	The respiratory system.										
	Asthma.	Bronchitis acuta.	Bronchitis chronica.	Catarrhus.	Hæmoptysis.	Laryngitis.	Phthisis pulmonalis.	Pleuritis.	Pneumonia.	Influenza.	Congest. pulmonalis.
September 30, 1852...	6	13	3	249	4	6	6	42	5	32	....
December 31, 1852...	11	55	10	807	6	7	4	47	19	......	....
March 31, 1853.......	7	60	7	862	5	10	10	66	45	79	....
June 30, 1853.........	10	29	15	346	10	2	9	30	23	38	2
Grand total.........	34	157	35	2,264	25	25	29	185	92	149	2
Causes of death....	....	2	1	1	....	....	21	1	13	......	....

Quarters.	The brain and nervous system.												
	Apoplexia.	Cephalalgia.	Chorea.	Delirium tremens.	Epilepsia.	Mania.	Melancholia.	Meningitis.	Neuralgia.	Paralysis.	Tetanus.	Encephalitis.	Congest. cerabic.
September 30, 1852...	....	118	....	42	17	2	3	....	21	6	1	1	....
December 31, 1852...	....	84	....	32	22	3	....	3	15	5	....	1	....
March 31, 1853.......	1	50	4	38	14	4	3	1	29	6	....	....	....
June 30, 1853.........	2	97	....	28	18	5	4	1	40	2	....	....	1
Grand total.........	3	349	4	140	71	14	10	5	105	19	1	2	1
Causes of death....	2	......	....	6	1	....	....	1	......	2	....	1	3

Quarters.	TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR.																					
	The urinary and genital organs.													The serous exhalent vessels.					The fibrous and muscular structures.			
	Calculus.	Cystitis.	Diabetes.	Enuresis.	Gonorrhœa.	Ischuria et dysuria.	Nephritis.	Orchitis.	Strictura urethræ.	Syphilis primitiva.	Syphilis consecutiva.	Ulcus penis non syphiliticum.	Cerebritis.	Anasarca.	Ascites.	Hydrocele.	Anæmia.	Accident.	Pernio.	Podagra.	Rheumatismus acutus.	Rheumatismus chronicus.
September 30, 1852	2	3	....	4	112	10	2	24	5	38	26	3	....	4	2	....	....	....	....	1	147	69
December 31, 1852	....	3	....	1	70	4	....	16	6	41	43	1	....	5	1	....	....	....	28	....	186	88
March 31, 1853	....	7	....	....	80	4	4	13	3	34	36	2	....	3	....	1	....	....	22	3	205	60
June 30, 1853	1	2	2	2	94	3	4	21	9	34	43	......	....	2	2	....	....	....	3	1	173	53
Grand total	3	15	2	7	356	21	10	74	23	147	148	6	....	14	5	1	....	....	53	5	711	270
Causes of death	....	1	....	....	......	1	....	....	....	......	1	......	1	2	5	....	1	1	....	....	......	1

Annual report of the sick and wounded, &c.—Continued.

Quarters.	TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR.																	
	Abscesses and ulcers.				Wounds and injuries.													
	Fistula.	Phlegmon et abscessus.	Ulcus.	Cause not reported.	Ambustio.	Amputatio.	Concussio cerebri.	Contusio.	Fractura.	Luxatio.	Punitio.	Subluxatio.	Vulnus incisum.	Vulnus laceratum.	Vulnus punctum.	Vulnus sclopeticum.	Vulnus contusum.	Drowned.
September 30, 1852..........	2	566	156	......	23	3	6	359	21	10	......	111	115	68	33	11	3	......
December 31, 1852	7	361	120	......	19	1	7	392	13	18	......	119	113	45	26	10	3	......
March 31, 1853..............	5	386	105	......	33	......	10	358	28	13	5	132	126	54	17	12	8	......
June 30, 1853	8	454	120	......	24	......	2	457	12	31	1	110	91	56	22	14	8	......
Grand total	22	1,767	501	......	99	4	25	1,566	74	72	6	472	445	223	98	47	22	......
Causes of death	......	3	1	1	2	......	2	1	......	......	......	......	......	1	1	5	......	1

Annual report of the sick and wounded, &c.—Continued.

Quarters.	TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR. All other diseases.																			
	Amaurosis.	Aneurisma.	Angina pectoris.	Cachexia.	Debilitas.	Ebrietas.	Hæmorrhois.	Hemeralopia et nyctalopia.	Hernia.	Morbi cutis.	Morsus serpentis.	Necrosis.	Odontalgia.	Opthalmia.	Otitis.	Pericarditis.	Prolapsus ani.	Scorbutus.	Scrofula.	Splenitis.
September 30, 1852	....	....	6	1	62	79	50	7	13	61	4	......	55	124	33	1	......	66	1	....
December 31, 1852	....	....	4	2	50	77	35	......	8	62	......	1	47	86	19	......	......	77	2	1
March 31, 1853	....	....	6	....	22	85	30	7	8	48	......	......	93	90	29	......	......	113	6	5
June 30, 1853	3	....	2	3	25	82	46	9	9	67	2	2	53	125	19	1	1	89	4	....
Grand total	3	....	18	6	159	323	161	23	38	238	6	3	248	425	100	2	1	345	13	6
Causes of death	....	1	....	....	2	1	......	......	......	......	1	......	......	......	......	2	......	2	....	....

Annual report of the sick and wounded, &c.—Continued.

Quarters.	TAKEN SICK OR RECEIVED INTO HOSPITAL DURING THE YEAR. All other diseases. Suicidium.	Toxicum.	Varix.	Vermes.	Hypertrophy of heart.	Ictus solis.	Anchylosis.	Asphyxia.	Morbi varii.	Total.	Aggregate.	Returned to duty.	On furlough.	Discharged service.	Deserted.	Dead.	REMAINING. Sick.	Convalescent.	Total.
September 30, 1852	2	27	4	4	2	1	....	....	496	8,886	....	....	10	63	12	153	......	......	......
December 31, 1852	....	5	2	1	4	....	....	....	359	7,684	....	....	6	45	13	58	......	......	......
March 31, 1853	1	2	6	6	1	....	1	....	357	6,276	....	....	4	51	8	37	......	......	......
June 30, 1853	1	31	4	8	7	....	3	....	378	6,729	....	....	18	68	10	32	......	......	......
Grand total	4	65	16	19	14	1	4	....	1,590	29,575	30,220	28,974	38	227	43	280	354	304	658
Causes of death	5	1	....	....	1	....	....	1	....	....	....	....	....	......	....	280	......	......	......

Annual report of the sick and wounded, &c.—Continued.

Quarters.	MEAN STRENGTH.		
	Officers.	Enlisted men.	Total.
September 30, 1852	533	9,532	10,065
December 31, 1852	527	9,654	10,181
March 31, 1853	537	9,678	10,215
June 30, 1853	495	9,019	9,514
Aggregate			39,975
Average			9,994

TH. LAWSON, *Surgeon General.*

REPORT OF THE CHIEF ENGINEER.

ENGINEER DEPARTMENT,
Washington, November 30, 1853.

SIR: I have the honor to submit the annual report of the operations in charge of this department.

FORTIFICATIONS.

The appropriations made at the last session of Congress for fortifications are all in the course of application under able supervision, and with satisfactory progress, except in two or three cases retarded by the unhealthiness of the season, and excepting also in the case of the California coast, a delay inseparable from the preparation of the broken and difficult sites to be occupied at the entrance of San Francisco bay, and the adaptation thereto of the plans of the defences. The five engineer officers who were sent to California to unite in the charge of these defences with one already there, have lost no time in making surveys, in providing lodgings for workmen, and making all other necessary preparations for as early a completion of them as the grants of Congress may allow.

The obvious importance of advancing these works to a state of efficiency, at the earliest day practicable, will, it is hoped, induce Congress to afford all the means that can be judiciously applied, remembering that prices there, as compared with those on the Atlantic coast, are likely to be as four or five to one. It ought to be here stated that this department expects soon, on specific requisitions from the engineer officers on the spot, to have to call for additions to the sums conjecturally proposed for those objects in the annual estimate.

All the fortifications provided for at the last session are necessary to the security of important places; and they require, moreover, the sums specified in the estimates for the coming year as the least that will be consistent with an advantageous continuance of operations. These estimated amounts are given in accordance with the rate of expenditure adopted by Congress, and not as that most advantageous to the public interest. But as it has often been my duty to urge the great saving that would result from larger grants, recommended also by the earlier accomplishment of the object in view, I will now only add, that whenever political events shall indicate an approaching war, it will be indispensable greatly to augment the rate of appropriation on several points; and I would say that even now too great liberality cannot be extended to certain defences in progress, especially those at Key West and the Tortugas, and, as before stated, those at San Francisco.

But there are other defences upon vital points of the seacoast and interior frontiers that need the further support of the legislature, quite as much as those provided for at the last session of Congress.

The items of the estimates are divided into three portions—

1. For repairs and improvements of forts actually existing, and

garrisoned permanently or occasionally. These are finished works; some of them very old, as for example the old Spanish fort St. Philip, below New Orleans; all of them in a more or less efficient state; all indispensable to defence, and many of them the sole reliance of the places they cover. The object of the estimate, as respects these, is to make repairs; augment efficiency; to increase accommodations in the way of storage, wharfage, magazines &c.; to protect the site from abrasion by the ocean; to enlarge the site when the limits of the public ground are too near the fort, &c. The total estimate of this portion is $185,000.

2. For repairs and improvements of barracks, quarters, storehouses, &c., in these actually existing forts. All of these items are small, giving a total of $90,885; they are necessary to the accommodation, comfort, and health of the garrison, and are founded, almost without exception, on the requisitions of the officers of the garrisons or of the Quartermaster's department.

It is difficult to believe that opposition can be made to either of the above portions of the estimate, if seacoast fortifications are admitted to be of any advantage whatever; and I therefore now refer to the *third portion* of the estimate, which includes fortifications in course of erection, some on the verge of completion, the others in different states of advancement.

As respects this portion of the system of defence, there has been doubt and discussion, in and out of Congress; but, as I think, on mistaken views of the object and nature of the several projects. Some allege that the system contemplates lining the whole coast with fortifications, with the purpose of preventing the landing of invading armies; others allege that it is useless to build forts within harbors for their defence, because an enemy can land notwithstanding at a thousand intermediate places, and march upon his object. Some assert that the coast is already the best-fortified coast in the world. To some it appears that the forts are unnecessarily large, and provided with an armanent unnecessarily numerous; to others that they are entirely inadequate to resist or arrest the enemy's squadron; while others would depend wholly on naval defences.

The rapidity with which intelligence can be communicated by the electrical telegraph, and men transferred by railroads from the interior to the seacoast, are thought by some greatly to lessen the necessity of such defences, while the changes lately made in the armament of war vessels, and the application to them of steam as a locomotive power, are believed by others to confer great superiority over fortifications as they have heretofore been conducted.

I have discussed these and other like questions so frequently and so much at length heretofore, and particularly in my report to honorable Secretary Conrad under date of November 1, 1851, that I quite reluctantly offer thereon the brief remarks that seem to be called for by the manner in which the subject has been of late considered in Congress.

The main idea of the system of defence, long ago adopted and already to a great extent carried out by the nation, is simply and in a few words this, namely, to provide at all the valuable points on the frontier exposed to the attacks of a powerful maritime enemy, adequate protection.

Now, as these points are not all of equal value, the works for their protection should not only be graduated in their strength to their respective values, but should, besides, be attended to in a corresponding order as to time. This value, moreover, may arise from different circumstances, and be compounded of several considerations. The great cities have a high value as such; in some, this is augmented by their being at the same time the sites of naval establishments, the entrepôts of great commerce, &c. Even small towns may be of great interest from the presence of such establishments, or from being the centres of a great trade. Other places may owe a very high importance entirely to their strategic position in reference to offensive or defensive operations, naval or military.

In a careful discrimination of the points upon our coast, several classes, arranged according to the order of value or importance, were formed; all of little comparative value being thrown into a very numerous class, to be attended to (if ever provided with permanent defences) only after all others shall have been secured, and probably by some future generation.

It is not claimed for this system that it is without errors, but it is insisted that in the main it is just and wise. It has been generally adhered to, there having been a few deviations effected by local influences.

The adaptation of the plans of defence to the several localities has been most studiously and carefully considered, and not with reference merely to technical principles. Some of the most valuable places may be well covered by the simplest and cheapest arrangement of a large number of heavy guns inaccessible to surprise or *coup de main;* others may be unapproachable by succor for a considerable time, and must therefore depend on a somewhat protracted resistance of their defensive works. In some, the localities simplify the project by their great natural strength; in others all has to be provided by science and skill. In these, and many other diversities of circumstances, the design has been to protect the given object in the most economical manner compatible with a reliable defence. If in the early days of the present system there were some projects of unnecessary magnitude and cost, the reproach cannot be laid at the door of our own engineers; nor can such a remark be justly made of any of the later plans.

The design of the system is therefore to protect, according to their respective values, important places of the country from the enterprises of a powerful maritime enemy by means that shall always be at hand, always ready, and always sufficient. It has nothing to do with armies disembarked for conquest upon the countless intermediate landings. These are left, if such there should be, to the forces that will spring up from the neighborhood and pour in from the interior. Here the spontaneous vigor of the country will be sufficient, and fortifications unnecessary. But against the danger we are guarding. When the enemy, clothed impenetrably to small arms, discharges his destructive missiles from an unapproachable position, all mere mortal vigor will be futile, and the crowding of brave men upon the shores but uselessly increase the havoc.

The point just touched may be the clearer for another word or two. Forces summoned by telegraph, and transported speedily from the country by railroad, can have little or no beneficial influence in defending a place against the kind of attacks from which we are trying to guard the country. In the first place, these railroads generally touch the coast at populous points, where men armed with muskets and rifles already exist in more than sufficient numbers, if numbers were of any avail; in the next place, neither numbers nor the military means carried with them, can (as just said) in any way act to avert the blows of the enemy or to inflict injury in return. Besides, even if essential assistance could be thus supplied, there are numerous important places which railroads do not approach.

Although, therefore, in a few places having a small local population, the succor received by railroad might avert a protracted attack, the general effect of railroads upon the system we are considering would be quite unimportant.

I cannot undertake here to discuss at any length the effect upon our system of fortifications of the application of steam as a locomotive power to war vessels; the great tendency must be, not only to make defences of some sort more than ever necessary, but also to increase their number. Thus, as war steamers can penetrate by channels too shallow for sailing ships, avenues have now to be defended that were formerly closed by nature; as hostile expeditions may fall upon the coast, in anticipation of any notice of their approach, no time will be left for the preparations of temporary or auxiliary means of defence, but all must be kept permanently present and ready. While exposed only to attacks from sailing vessels, Great Britain, relying on her great naval ascendency, did little, for a long course of years, to strengthen the fortifications of her coast; so little, indeed, that Mr. Pitt (1786) reproached Parliament in the following words: "To prove the utility of fortifications, he appealed to the important and calamitous situation in which we were placed in the late war. A considerable part of our fleet was confined to our ports, in order to protect our dock-yards; and thus we were obliged to do what Great Britain had never done before, to carry on a defensive war—a war in which we were under the necessity of wasting our resources, and impairing our strength, without any prospect of any possible benefit by which to mitigate our distress," &c. Since the introduction of war steamers into navies, however, that nation, well knowing how suddenly and unexpectedly large squadrons of war steamers might assail her ports, and too wise to tie down her own naval force to the passive duty of defending them, has expended, and is now expending, very large sums in improving and augmenting her seacoast fortifications. The United Service Journal for the present month of November, for instance, contains a notice that the extensive works at the citadel, western heights of Dover, will soon be commenced. "That there are extensive works going on also at the castle, (Dover,) in addition to those in progress at Hythe, Deal," &c. "That the fort at Sconce point, Isle of Wight, progresses with great rapidity; that it is to mount fifty heavy guns." "That a second fort is contemplated at the Needles, at Cliff's end, further round than Sconce point," &c.

We know, too, that France, although she has for centuries been protected by fortifications upon her seacoast from the superior fleets of her enemy, is now very materially augmenting the permanent defences of her ports. There is certainly nothing in our situation, geographical or political, to make these lessons inapplicable to us. If more remote from an enemy, we are still within the quick reach of his squadrons, while our remoteness greatly lessons the chance of warnings; and it surely would not be wise in us to reject, for interested theories and wild conceits, the counsels of an experience approved by safety and success through numerous wars. There is, moreover, no nation under the sun to which the policy of permanently protecting the vulnerable points of the frontier is so applicable, because, requiring for defence in time of war little in addition but what may be supplied by each locality, the characteristic enthusiasm and impetuosity of the nation, instead of being harassed by frequent calls to the exposed places, disheartened by long watchings, and demoralized by an idle camp life, may be concentrated in offensive enterprises; thus, in every form, turning away the contest, and leaving our own land to the pursuits of industry and skill.

While adverting to the experience and practice of warlike nations, it may be enough, on the alleged defects of fortifications consequent upon recent changes in the ordnance employed by ships, to say that fortifications now under construction in England, France, &c., have in no respect changed their character. They have been repaired and enlarged, as before said; but the only other changes made have been, not in the forts, but in their armament; it being a matter beyond dispute that this same new ordnance, while it is not more effective in silencing the fire of forts than the old, is greatly more destructive to shipping.

It will not be inappropriate here to notice, as briefly as I can, the charge that the ordnance for which our forts have been adapted is entirely too small. In connexion with this subject, pains have been taken to exhibit the effects of the great guns now in common use in ships—the assertion being made that the walls of forts erected before such use must crumble under their fire. Accurate knowledge of the facts concerned in these points would have saved the trouble of making such statements, and prevented the injury that may possibly have been done to a great national interest. The facts simply are, that the walls of none of our forts can be battered down by guns, however large, otherwise than by lodging their shots in a systematic manner, which means that successive shots are to be so lodged as to cut a horizontal trench through the wall of the length required for the breach. To fire balls, even the heaviest, against the face of the walls, without such a systematic arrangement of efforts, will not, within any period of time likely to be devoted to such employment, cause them to fall, nor lessen the advantage they afford as covers for the garrison. Such of these balls as enter the embrasure will, of course, do great damage; but for such effects it is not necessary that the balls should be large.

As to the objections made against the forts on account of the small size of guns mounted therein, it ought not to have been expected, in consulting the tables of armament at any particular period, that there would be found other calibres than such as had been then adopted by the government. If this were a fault, it was not a defect in the forts, because, as might easily have been ascertained, they were adapted to any calibres. Embrasures constructed at the very commencement of the present system, more than thirty years ago, are perfectly adapted to the eight-inch columbiad, the best shell-gun of that calibre yet made; and the terrepleins of all the forts are ready for the heaviest guns that the Ordnance department shall think proper to provide.

The country may rest assured that there has been no lack of nor tardy knowledge as to the changes and improvements made in other countries in any matters that might possibly bear upon our military defence or efficiency; and that, with no other delay than the investigations and trials demanded by an honest care of the public interest, there is nothing really important devised, at home or abroad, that has not been profited of. And, moreover, in the face of all the loose and sweeping criticism that for a time jeoparded one of the most important interests of the nation, I will add that, so far as it has been carried out, our system of defence, as adapted to the peculiar dangers from which we are to guard; to our geographical isolation, and vast extent of frontier; to our small military establishment; to the characteristics of our people; to the sources of support and succor; to local peculiarities; and as contrived and executed technically, is the most complete, as a system, in the world. That such would be the judgment of a competent and unprejudiced examination, I am sure.

I have not specially noticed the idea, that the proper defence of our harbors is to be found in naval means, instead of fortifications. Having discussed this point heretofore at length, and desiring now to keep this report within as narrow limits as possible, I must refer for my views thereon to my report of November 1, 1851, and to previous reports. We have seen above, however, the views entertained on this point by Great Britain, which of all nations has the largest naval force to apply in that way, but which is adding daily to her fortifications, in order to leave her fleets available for more appropriate employments.

Our system of defence, although well advanced, is yet incomplete, even in some of the most important points on the coast; and it is for the advancement of works in hand as these that the estimates "for fortifications under construction" are proposed.

On the seacoast, these are for the defence of the Penobscot, a river possessing a large commerce, fine anchorage, and populous and thriving cities; for the defence of Boston, and its navy yard; Narragansett roads; New York, and its navy yard; Philadelphia, and its navy yard; Baltimore, Hampton roads, and Norfolk, with its navy yard; Charleston; the entrance to Cumberland sound; Pensacola, and its navy yard; Key West; the Tortugas; San Francisco, and the outlet of Lake Champlain.

All these fortifications have received the especial approval, first of the appropriate committees, and then of Congress itself. They are more or less advanced, some quite near completion; and they are necessary to the security of great interests. Here, to repeat minute explanations of their several designs would seem uselessly to occupy time, since information, in the utmost detail, is at command whenever there may be interest expressed for such investigations.

As a part of the same system, I have to ask the approval of Congress to some projects of fortifications not yet commenced, but necessary at important places. *The first is at New Bedford,* the third city in the Union as regards registered tonnage, a place of great wealth; and with no other defences than an old and wholly inefficient six-gun battery. *The next is for Sandy Hook,* in order to command the lower bays, and render a close winter blockade of the city of New York impracticable. *The third is for Ship island,* (Mississippi,) designed to cover the eastern approaches to the city of New Orleans, and also the coast of this part of the gulf, by protecting a most excellent anchorage for our commerce and cruisers. The fourth and last now proposed is *for a tower and battery at Proctor's landing,* at the foot of Lake Borgne, whence a good road, wholly undefended, leads directly to New Orleans. All these have been before pressed upon attention and supported with reasons at large.

A short statement of the present condition of the several fortifications will be given under the head of each.

Fort Mackinac, Michigan.—No work has ever been done by this department upon this old fort, but it is now necessary to make some repairs, as has been urged by the officer in command, and reported by the engineer officer sent to examine.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $5,000

Fort Wayne, Detroit, Michigan.—The fort is ready for the armament. Some of the wood and metal work is in need of paint.

It is now necessary to finish the barracks and erect a fire-proof storehouse and officers' quarters.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $15,000

Fort Porter, near Buffalo, New York.—The fort is in condition to receive its armament. No appropriation is asked.

Balance in treasury 1st October, 1853 .... $17,231 43

Fort Niagara, New York.—This fort needs some repairs; and there is a great want of accommodation for troops and of store room and hospital room.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $10,000

Fort Ontario, Oswego, New York.—This work needs repairs, and some expenditures are called for on the buildings.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $5,000

Fort Montgomery, Rouse's point, New York.—The condition of the work is unchanged since last year. An appropriation is asked for the resumption and continuance of active operations.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855.................................$15,000

Fort Knox, Narrows of the Penobscot, Maine.—Operations were resumed on the 20th of July last. Extensive excavations of earth and stone have been made. The casemated traverse for flanking battery B is in progress—the walls and piers being nearly completed. The magazine of this battery is finished.

The beton foundations of the scarp and counter-scarp of the main work are laid. An inclined plane from the wharf to the ditch of the fort, for the transportation and lifting of materials, is prepared.

It is expected the next year to complete the two casemated traverses, to advance the scarp and counter-scarp walls, and to execute a portion of the embankment of the glacis.

Balance in treasury October 1, 1853.......................$39,000
Probable amount to be expended by 30th June, 1854......... 39,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855................................ 20,000

Fort Preble, Portland harbor, Maine.—Nothing has been done during the year.

The old sea-wall, destroyed by a gale, should be at once rebuilt in a permanent manner. It is important that the site be extended by the purchase of neighboring land.

Some repairs are required on barracks and quarters.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $8,500

Fort Scammel, Portland harbor, Maine.—This work is in charge of a fort-keeper, beyond whose services nothing has been done during the year.

A future appropriation will be necessary for this fort, but none is asked for at present.

Fort Constitution, Portsmouth harbor, New Hampshire.—No expenditures have been made during the year.

Some repairs of buildings are necessary.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855.............................. $1,180

Fort McClary, Portsmouth harbor, New Hampshire.—Nothing has been done during the year. No appropriation is asked.

Fort Winthrop, Boston harbor, Massachusetts.—The excavation for the tower has been carried to the depth of eight feet, and a deep road has been cut for the transportation of materials into the ditch. Six thousand cubic yards of earth have been excavated, and applied in embanking the south glacis.

During the next year the excavation will be completed, and the scarp carried as high as possible.

No appropriation is asked for next year.

Balance in treasury 1st October, 1853	$29,573
Probable amount to be expended by 30th June, 1854	29,573

Fort Independence, Boston harbor, Massachusetts.—For want of funds, nothing has been done during the year. It is proposed to complete the work the coming year.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	$10,000

Fort Warren, Boston harbor, Massachusetts.—The work was resumed in May last, since when labors have been directed, principally, to the following objects, viz:

First. Building breast-height walls, finishing parapets, laying pintle-blocks, and making other arrangements requisite for mounting the guns in the lower tier of the south battery, and on front No. 1, and the left face of front No. 5, of the main work.

Second. Preparing window frames and sashes, door frames and doors, laying floors, building cisterns, putting up brick furrings, &c., for casemate quarters. And

Third. Pointing the escarp.

By the end of next season, it is believed that the fort will be ready to receive its entire armament.

Balance in treasury October 1, 1850	$35,000
Probable amount to be expended by 30th June, 1854	35,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	30,000

Fort Adams, Newport harbor, Rhode Island.—For want of means, nothing has been done during the last year further than keeping the works in as good order as practicable under the charge of a fort-keeper. Small labors, in the way of completion and preservation, should be applied to various parts of the work; for which, together with the redoubt and the wharf, and the completion of quarters already commenced, an appropriation is asked.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	$35,000

Fort Griswold, New London harbor, Connecticut.—Nothing has been done at this work except to keep it in order. No appropriation is asked.

Fort Trumbull, New London harbor, Connecticut.—The portcullis and exterior gate are now under construction, and will be put in place soon.

The remainder of the appropriation will be applied to repairing the wharf, roads, &c., and rebuilding the fence around the public property.

The fort has been kept in order during the year.

No further appropriation is asked.

Fort Schuyler, East river, New York.—Since the last annual report, one man has been employed in care of the public property.

Towards finishing this fort, the same sum is asked as was applied for last year.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $15,000

Fort Wood and sea-wall on Bedlow's Island, New York harbor.—After completing what could be done last year with the means in hand, operations were closed and the property stored.

Further work is needed on the fort and exterior of the sea-wall; and a permanent wharf should be built.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855.................................. $4,500

Fort Hamilton, New York harbor.—Some gun platforms have been laid down, blinds made, and a magazine fitted up at this work.

A permanent wharf is much needed for this position, for which an appropriation is asked.

Repairs are necessary on some of the out-buildings.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $11,000

Fort Lafayette, New York harbor.—Nothing has been done here during the last year. The roof over the barbette battery will soon need repairs, as also the roof of the piazza.

No appropriation is, however, asked at present.

Fort Richmond, Staten Island, New York harbor.—With a view to the preservation of the work during its suspension, the masonry was levelled as uniformly as possible, and covered with concrete, mastic, and boards.

The very important position of this work—the best at the entrance to New York harbor—makes its early completion a matter of unquestionable policy.

It is hoped that the means of resuming work on it will be afforded this year.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855.......................... $60,000

Governor's Island, New York harbor.—New drains have been laid in the parade, and the entrance repaired. Strong metal gutters have been substituted for the tin ones of the barracks, and other small repairs executed. The sea-wall of Castle William must be extended, and various small repairs are needed at the castle and at Fort Columbus.

Considerable repairs and extensions are necessary for the buildings occupied by the troops.

Estimate of the amount required to be appropriated for fiscal year ending 30th June, 1855	$30,000

Fort Mifflin, Delaware river.—For repairs needed at this old work, the sum of $2,000 is asked.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	$2,000

Fort Delaware, Delaware river.—The foundation grillage was laid at the date of last year's report, and the work traced upon it ready for the masonry substructure. Two thousand cubic yards have been laid in this part of the work, and as much more is expected to be put down before frost. Thirty thousand superficial feet of stone have been cut, enough probably to lay three courses around the work. Operations will be continued during the winter, mainly stonecutting; a few carpenters will be employed, preparing cranes, derrics, and centering for the next season's work. A gang of laborers will attend the stonecutters and carpenters, and be employed filling the parade with earth.

Wages have risen from twenty to thirty-three per centum during the season's operations.

Balance in treasury October 1, 1853	$118,000
Probable amount to be expended by 30th June, 1854	118,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	50,000

Fort Carroll, Sollers' Point Flats, Baltimore harbor.—The preparatory or constructing wharves, with a small exception, have been finished. Four hundred and forty-eight sheet piles have been driven and sawed off on fronts three and four. One hundred and seventy-two foundation piles have been driven on fronts four and five, all of which, except six, have been sawed off ready for the cut granite. The seventh or leveling course of the sea-wall of front two is nearly finished. One hundred and forty blocks of cut granite have been laid, by means of the diving-bell, in the sea-wall of front three; making one hundred and eighty-three blocks of cut granite laid in the sea-wall this season. Three hundred and twenty-two blocks of cut granite have been received this year, and an equal number, in addition, is expected to be delivered before the close of the season.

Sickness to a very great extent has prevailed here during the months of July, August and September, which has prevented our obtaining a sufficient force of mechanics and laborers, and has very materially affected the progress of the work.

The coming year it is proposed to complete the sea-wall and fill the same with concrete; and to fill so much of the foundation of the fort proper, and lay the grillage on the same, as can be accomplished.

Balance in treasury October 1, 1853 .... $30,000
Probable amount to be expended by 30th June, 1854 30,000
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855 50,000

Fort Madison, Annapolis harbor, Maryland.—The existing appropriation remains unexpended, as reported last year, there being no officer available for the superintendence of the work. No appropriation asked.

Balance in treasury October 1, 1853 .... $4,820 20

Fort Washington, Potomac river, Maryland.—The fort is in an efficient condition. Some repairs are necessary to quarters and barracks.

Fort Monroe, Old Point Comfort, Virginia.—Nothing has been done during the past year.

It is proposed to finish the modifications of the magazines the next year, to erect a new wharf, and to make repairs and improvements ir barracks, quarters, &c.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $20,000

Fort Calhoun, Hampton roads, Virginia.—The removal of the loading, and the resumption of the work on this fort, so important for the defence of Hampton roads and the approaches to the Norfolk navy yard, are proposed, but without asking any appropriation for the coming year.

It appears that the subsidence of the work is at an end.

Balance in treasury October 1, 1853 .... $18,596

Fort Macon and preservation of its site, Beaufort harbor, North Carolina.—Very little has been done since 1846. Some repairs are needed to barracks and quarters, and also a little further work for the preservation of the site.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855 .... $3,000

Repairs of Fort Caswell and preservation of its site, Smithville, North Carolina.—Nothing has been done since 1847. It is necessary to renew the floor of the citadel, to repair the roof, grade some of the slopes, and point some masonry; and also to expend something for the better protection of the site.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855 .... $7,000

Fort Moultrie and protection of its sites, Charleston harbor, South Carolina.—An exposed point, near the fort, requires protection from the heavy sea which rolls into the harbor in eastwardly storms. A jetty should be built out at right angles to the shore. For this an appropriation is asked.

Some repairs and improvements are necessary on the buildings occupied by the garrison.

Estimate of funds required to be appropriated for fiscal year ending June 30, 1855 .... $16,950

Fort Sumter, Charleston harbor, South Carolina.—A large quantity of bricks, shells, and gravel, has been accumulated during the past summer, which will be applied to the completion of quarters, building arches of gun casemates, and forming terrepleins thereon. It is proposed the next season to complete the defensive works of the fort, and to continue the accommodations for the garrison.

Balance in treasury October 1, 1853	$106,000
Probable amount to be expended by June 30, 1854	106,000
Estimate of amount required to be appropriated for fiscal year ending June 30, 1855	20,000

Preservation of the site of Fort Johnson, and repair of the wharf, Charleston harbor, South Carolina.—The work designed to protect the site is complete, with the exception of a few feet in length.

The only wharf giving access to this position is decayed, and requires rebuilding from low water up, to provide the means of landing government supplies. This wharf contributes materially to the preservation of the site.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855 .... $4,200

Repairs of quarters and barracks at Fort Johnson, Charleston harbor, South Carolina.—One building has been repaired, and another raised one story. It is designed to complete the latter and put a new roof on a third; for which purpose a small appropriation is asked.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855 .... $1,200

Repairs of Castle Pinckney, Charleston harbor, South Carolina.—The site of this work, frequently overflowed, should be raised above the tide; this is essential to the health, no less than the comfort, of the garrison.

The sea-wall, protecting the foundation of the work, has been injured by storms, and should be repaired without delay.

Some repairs are required by the quarters and barracks.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855 .... $5,500

Fort Pulaski, Savannah river, Georgia.—A fort-keeper has been engaged during the year in the preservation of property and police of the fort. The mud should be removed from the ditches and feeding canal, leaks in the arches are to be stopped, and pointing renewed, and some other small works executed.

An advanced battery is to be constructed to increase the fire of the channel. A permanent wharf is also needed.

Balance in treasury October 1, 1853...................... $19,500
Probable amount to be expended by June 30, 1854......... 19,500

Repairs of Fort Jackson, Savannah river, Georgia.—The work yet to be done comprises finishing counter-scarp and sub-scarp wall, completing scarp and wharf, making drawbridge and machinery, embanking dikes, grading parade, arranging flank guns, and construction of officers' and soldiers' quarters.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855................................ $20,000

Fort Clinch, Amelia island, mouth of Cumberland sound, Florida.—The unfinished sea-wall exposed to injury has been secured, during the past year, by the labor of the fort-keeper. It is proposed the coming year to press forward in particular those portions of the fort that lie next and act most upon the channel.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855................................ $25,000

Fort McRee, Pensacola harbor, Florida, including preservation of its site.—The site of the fort has been recovered where it was encroached on by the sea.

For the construction of the south exterior battery, and to render the works for the preservation of the site permanent, the following estimate is submitted:

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855................................ $27,000

Fort Pickens, Pensacola harbor, Florida.—Nothing has been done during the year. No important operations are anticipated. Slight repairs are necessary.

An appropriation must soon be asked for repairs and preservation of wharf, improvement of quarters, barracks, &c.

Fort Barrancas and barracks thereat, Pensacola harbor, Florida.—The works remain unchanged in condition since last year. The most pressing object now is the construction of the advanced redoubt, for which, and some minor matters, together with progress on buildings for the accommodation of troops, an estimate is added.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855................................ $50,000

Fort Morgan, Mobile point, Alabama.—For want of means no progress has been made here during the last year. The coming season it is designed to finish the enlargement of barracks and quarters, to repair quarters, and to execute some necessary work on the fort itself.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855.............................. $20,000

Fort Gaines, Dauphin island, Mobile bay, Alabama.—The United States have complied with the law of Alabama providing for acquisition by them of land, by paying into court, for distribution, the assessed value of the site of the proposed fort; a decree giving them title has been rendered by the chancellor of the court, and application has been made to the governor of the State for cession of jurisdiction over the land, in pursuance of the requirements of the law above referred to.

No appropriation asked at present.

Balance in treasury 1st October, 1853.................. $13,000

Fort Pike, Rigolets, Louisiana.—The death of the engineer officer in charge of this work prevents an exact report of its condition. It is supposed that the small repairs contemplated last year have been executed.

Some further labors are necessary, however, to its preservation, especially some for the security of the site.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855.............................. $4,000

Fort Macomb, Chef Menteur Louisiana.—The fort needs protection from the wash of the bayou in front, which is wearing away the site; the bridge across the ditch must be replaced, and some other repairs are needed.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855........................ $10,000

Battery Bienvenue, Bayou Bienvenue, Louisiana.—The death of the officer in charge of this work has prevented the receipt of the usual report therefrom. It is supposed, however, that the repairs designed have been effected.

No appropriation is asked.

Tower Dupré, Bayou Dupré, Louisiana.—A small appropriation for fort-keeper and contingencies is asked.

Estimate of amount required to be appropriated for fiscal year ending June 30, 1855................................. $500

Fort Jackson, Mississippi river, Louisiana.—A fort-keeper has attended to preservation and care of public property during the year.

Materials are on hand for the breast-height walls, but want of means has prevented their application. Barracks and quarters have to be extended, and the exterior battery completed.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855............................. $20,000

Fort St. Philip, Mississippi river, Louisiana.—A fort-keeper was employed taking care of the property and mowing the slopes.

Further repairs have to be made; the advanced batteries to be completed, and provision made for the accommodation of the garrison.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	$35,000

Fort Livingston, Grand Terre island, Louisiana.—Nothing has been done during the year. A fort-keeper has had the property in charge, and has attended to mowing the slopes, &c.

The fort can soon and easily be put in a state of defence.

No appropriation is asked at present, and it is hoped none will be nceessary; but there is, within a short time, an encroachment on the site by the sea, which must be prevented.

Balance in treasury 1st October, 1853	$6,414 46

Fort Taylor, Key West, Florida.—Operations were resumed in May, and have been continued since that time; the force has been employed in building bridges, wharf, and cement house; excavations have been made for foundations of piers, and these foundations have been commenced. The coming year it is designed to prepare for the lower tier of guns.

Balance in treasury October 1, 1853	$50,000
Probable amount to be expended by 30th June, 1854	50,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	75,000

Fort Jefferson, Garden Key, Tortugas island, Florida.—In May, 1852, the work was suspended, in consequence of the failure of the appropriation bill. Under the grant made at the last session, operations have been resumed, a force has been collected, arrangements made for procuring materials, and new machinery where needed, old machinery put in order, and a quantity of lumber, cement, and other materials, received. At the same time, sheet-piles have been driven for the coffer-dam of the scarp-wall, on fronts two and five, and a large supply of coral has been collected for concrete. The foundation of the counter-scarp of front five has been faced with an enrockment of coral for its protection from the sea.

With the existing appropriation it is proposed to complete the foundations of the scarp-wall, and raise its superstructure to low-water level; to lay the foundations of the piers of the gun casemates; and to apply the excavated earth to the embankment of the parade.

The next fiscal year it is designed to raise the scarp and piers to the height of nine feet above low water; to construct two additional cisterns, and continue embanking the parade of the work.

Balance in treasury 1st October, 1853	$85,000
Probable amount to be expended by 30th June, 1854	85,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	50,000

Forts on the western frontier of Texas.—An officer of engineers, with a small detachment of engineer soldiers, was sent, on the 4th August, 1853, to the Rio Grande, to act under the orders of the general commanding that department, in designing and constructing defensive works on that line. No reports have been received specifying his labors thus far; but it will undoubtedly be necessary to appropriate money to defray the expense thereof. The estimate contains an item towards that object; but as this is wholly conjectural, it may be necessary, on receiving the reports of the officer, to make an enlarged call.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	$100,000

DEFENCE OF SAN FRANCISCO, CALIFORNIA.

Fortifications on Alcatraz island, San Francisco bay.—The appropriation for the defence of San Francisco has been assigned, between the works designed, for Alcatraz island and those for Fort Point. The requisite measures have been taken for a prompt and active prosecution of the works. The final surveys of Alcatraz island are complete; the temporary buildings for shelter of workmen and materials, the necessary work-shops and mess-house, the temporary wharf and road leading thereto, are sufficiently advanced to permit commencing the excavation of the ditches, and the work on the northwest and southeast batteries. It is intended to complete, the present year, all the batteries designed for this island, with their flanking caponniers, ditch, and road. For interior defensive buildings, provision for a few additional guns, escarpment of the island, and a permament wharf, additional means will be required.

Balance in treasury October 1, 1853	$205,000
Probable amount to be expended by June 30, 1854	205,000
Estimate of amount required to be appropriated for fiscal year ending June 30, 1855	100,000

Fortifications on Fort Point, entrance to San Francisco bay.—A minute survey of the ground has been made, and barracks for 40 men, mess-room, stable, and forge are erected. Four thousand two hundred cubic yards of material have been excavated. An old Spanish work of brick has been taken down, and its materials secured for use hereafter.

The death of the senior engineer officer in California, who had the particular charge of this work, may somewhat delay its progress; but not, it is hoped, very materially. This officer, Brevet Lieutenant Colonel Mason, conspicuous in the operations in Mexico, arrived at San Francisco laboring under disease contracted by crossing the Isthmus of Panama. In his zeal in the discharge of the important duties confided to him, he was led to neglect his enfeebled health, and was soon prostrated by a return of the isthmus fever. Under the pressure of his extreme anxiety for the rapid prosecution of his work, he grew gradually worse, until his life became the sacrifice to his unremitted efforts.

An officer of rank and experience is now under orders to proceed to California with all haste and assume the duty; in the meantime, the active and energetic officers on the spot are believed to be doing their utmost to expedite operations.

Balance in treasury October 1, 1853	$205,000
Probable amount to be expended by June 30, 1854	205,000
Estimate of amount required to be appropriated for fiscal year ending June 30, 1855	100,000

MILITARY ACADEMY.

The report transmitted herewith by the Board of Visitors, assembled at West Point at the annual examination in June last, exhibits the opinion of a body of enlightened men, drawn from all sections of the Union, on the actual condition of the Military Academy, and also their views as to contemplated objects of improvement. With the single remark that, in a very late inspection of the institution, I found all the departments operating harmoniously and successfully, under the able and zealous direction of the superintendent and the academical and military staff, I may refer to the report of the Board of Visitors for information as to particulars in the respective courses of administration and instruction.

Certain recommendations, not yet acted upon by Congress, that I have heretofore felt it my duty to make, without consuming time in here repeating them, are still subject to, and urged upon, the approval of that body.

The estimate of the expenses of the Military Academy for the next fiscal year, as handed in by the superintendent, is as follows:

For current and ordinary expenses	$29,725 00
For gradual increase and expense of library	1,000 00
For Board of Visitors	3,000 00
For forage for artillery and cavalry horses	8,640 00
For replacing dead and wounded artillery and cavalry horses	1,000 00
For repairs and additions to professors' quarters	5,000 00
For commencement of officers' quarters	20,000 00
For enlarging and improving hospital of cadets	6,500 00
For cavalry exercise hall	20,000 00
Total	94,865 00

It will be noticed that, separate from the items which contemplate the erection of new buildings—deemed essential by successive boards of visitors, by the authorities of the academy, and indeed by all who have opportunity to examine the circumstances—the total of the above estimate is $64,865.

The explanation of the estimate by the superintendent, as well as of the detailed estimates of the several departments which go to make up the above general statement, is appended to this report.

For many reasons, most of which have been presented in former reports from this department, it is considered very advisable to extend the course at the academy to one of five years instead of four. The year thus added to the academical course would afford time for giving more thorough instruction in some of the subjects now taught, and for the introduction of others of great importance. Each congressional district would then have a graduate for every five years, instead of one in four years, as at present; by which the annual number of graduates would be lessened by one-fifth. This reduced number would correspond nearly with the average yearly vacancies now occurring in the army.

Thus, young officers of greater qualifications would be secured to the army, while there would be an annual saving in the military expenses of the country of nearly $17,000.

This extension has been frequently recommended by the boards of visitors at the academy, including the board of the present year.

I now give a very interesting statement, showing the condition in life of the cadets for the last eleven years. It must be understood that this information is derived from the cadets themselves.

Statement exhibiting the condition in life of the cadets at the Military Academy, West Point, for the last twelve years, from 1842 to 1853 inclusive.

	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.
Parents are, or were, farmers or planters	59	61	61	68	72	67	69	75	70	63	67	58
Do.......do......mechanics	14	12	15	22	22	25	22	21	16	14	14	13
Fathers are, or were, judges or lawyers	27	25	30	35	33	30	29	23	34	33	34	35
Parents are, or were, merchants	18	15	23	27	29	29	31	38	36	38	35	35
Do.......do......boarding-house or hotel keepers	5	2	4	3	7	6	4	2	2	2	3	3
Fathers are, or were, physicians	12	15	15	13	21	19	21	21	18	14	14	13
Do.......do......of the army, navy, or marine corps	14	16	16	13	11	13	17	17	18	22	24	27
Do.......do......clergymen	4	6	6	6	5	3	3	4	4	4	3	5
Do.......do......in the civil employment of the general or State governments	5	15	16	9	5	2	3	7	7	8	10	11
Miscellaneous—as bank officers, editors, professors, engineers, masters of vessels, &c	15	11	15	23	35	36	41	24	32	30	30	26
Occupations not stated, or no occupation	48	34	23	17	1	2	2	8	7	11	13	7
Total	221	212	224	236	241	232	242	240	244	239	247	233
Of these numbers, there are without fathers living	26	57	44	48	42	41	54	48	40	45	36	35
Do.......do......do....without either father or mother living	22	16	18	15	21	20	18	16	26	17	19	17
Total orphans	48	73	62	63	63	61	72	64	66	62	55	52
Of these numbers, the parents are stated to be in moderate circumstances		156	150	164	192	182	193	203	215	207	218	206
Do..........do............do............reduced........do	182	26	37	36	35	38	40	29	25	16	9	8
Do..........do............do............indigent........do		6	8	8	8	8	4	4	2	2	......	......
Do..........do............do........independent in life	......	6	10	12	6	4	5	4	2	14	20	19
Do..........do............do........in unknown circumstances	39	18	19	16	......	......	......	......	......	......	......	......
Total	221	212	224	236	241	232	242	240	244	239	247	233

List of officers, professors, and teachers of the Military Academy, constituting the academical and military staff, on the 30th of September last.

Captain and Brevet Colonel Robert E. Lee, corps of engineers, superintendent and commandant.

Dennis H. Mahan, LL. D., professor of civil and military engineering.

First Lieutenant and Brevet Captain Gustavus W. Smith, corps of engineers, assistant professor of civil and military engineering.

First Lieutenant Charles S. Stewart, corps of engineers, acting assistant professor of civil and military engineering.

William H. C. Bartlett, LL. D., professor of natural and experimental philosophy.

First Lieutenant Joseph J. Reynolds, third artillery, assistant professor of natural and experimental philosophy.

First Lieutenant Edward D. Stockton, first infantry, acting assistant professor of natural and experimental philosophy.

First Lieutenant Joseph H. Wheelock, fourth artillery, acting assistant professor of natural and experimental philosophy.

Albert E. Church, LL. D., professor of mathematics.

First Lieutenant William G. Peck, A. M., topographical engineers, assistant professor of mathematics.

Second Lieutenant Delavan D. Perkins, fourth artillery, acting assistant professor of mathematics.

Second Lieutenant Absalom Baird, first artillery, acting assistant professor of mathematics.

Second Lieutenant Chauncy McKeever, third artillery, acting assistant professor of mathematics.

Second Lieutenant John A. Mebane, second artillery, acting assistant professor of mathematics.

Second Lieutenant Alexander J. Perry, second artillery, acting assistant professor of mathematics.

Jacob W. Bailey, A. M., professor of chemistry, mineralogy, and geology.

First Lieutenant and Brevet Captain Edward C. Boyton, first artillery, assistant professor of chemistry, mineralogy, and geology.

Second Lieutenant Caleb Huse, first artillery, acting assistant professor of chemistry, mineralogy, and geology.

Rev. William T. Sprole, chaplain, professor of ethics and English studies.

First Lieutenant and Brevet Captain Henry Coppee, A. M., assistant professor of ethics and English studies.

First Lieutenant Charles C. Gilbert, first infantry, acting assistant professor of ethics and English studies.

Second Lieutenant Alexander Piper, third artillery, acting assistant professor of ethics and English studies.

Robert W. Weir, N. A., professor of drawing.

First Lieutenant Richard S. Smith, fourth artillery, assistant professor of drawing.

First Lieutenant and Brevet Captain Trueman Seymour, first artillery, acting assistant professor of drawing

Captain George W. Cullum, corps of engineers, instructor of practical engineering.

Second Lieutenant James C. Duane, corps of engineers, assistant instructor of practical engineering.

Brevet Second Lieutenant Quincy A. Gilmore, corps of engineers, assistant instructor of practical engineering.

Brevet Second Lieutenant James B. McPherson, corps of engineers, assistant instructor of practical engineering.

Mr. Hyacinth R. Agnel, professor of the French language.

First Lieutenant Theophilus d'Orémieulx, first infantry, assistant professor of the French language.

First Lieutenant John H. Greland, fourth artillery, acting assistant professor of the French language.

Second Lieutenant Beekman DuBarry, third artillery, acting assistant professor of the French language.

Captain and Brevet Major Robert S. Garnett, seventh infantry, commandant of cadets and instructor of infantry tactics.

First Lieutenant Anderson O. Nelson, sixth infantry, assistant instructor of infantry tactics.

First Lieutenant Henry B. Clitz, third infantry, assistant instructor of infantry tactics.

First Lieutenant Cadmus M. Wilcox, seventh infantry, assistant instructor of infantry tactics.

Second Lieutenant Milton Cogswell, eighth infantry, assistant instructor of infantry tactics.

First Lieutenant and Brevet Major George H. Thomas, third artillery, instructor of artillery and cavalry.

First Lieutenant Delos B. Sacket, first dragoons, assistant instructor of cavalry.

Second Lieutenant Roger Jones, mounted riflemen, assistant instructor of cavalry.

Mr. Patrice de Janon, instructor of the sword exercise.

Military Staff.

First Lieutenant and Brevet Major Fitz John Porter, fourth artillery, adjutant.

John M. Cuyler, M. D., surgeon.

James Simons, assistant surgeon.

First Lieutenant Richard S. Smith, fourth artillery, quartermaster and assistant commissary of subsistence, and treasurer.

Letter explanatory of the Military Academy estimates.

U. S. Military Academy,
West Point, October 8, 1853.

General: I have the honor to hand herewith an estimate of funds for the United States military academy, for the fiscal year ending 30th June, 1855.

The objects embraced in the estimate for current ordinary expenses are those already authorized, and the amount differs but little from that appropriated last year.

In the department of infantry tactics $50 has been included, to increase the army pay of the enlisted soldier employed in the office of the commandant of cadets, to command the services of one capable of performing the copying as well as other duties of the office.

In my report of last year the want of quarters for the officers on duty at the academy was stated. Experience since that time has convinced me of the advantages of also adding to the houses of the professors. They are inadequate to the healthful accommodation of their families, and inferior to those provided at the colleges and State institutions. An appropriation of $5,000 is asked to render them more comfortable.

A portion of the cadet barrack is devoted to the accommodation of the officers. These quarters are much needed for the use of the cadets, and there are other disadvantages attending their present application. It is therefore proposed to construct a suitable building for officers' quarters. A plan and estimate, now in preparation, will be submitted for your approval, and $20,000 is asked for its commencement.

I think it my duty also to inform you that the cadets' hospital does not furnish sufficient or suitable accommodations to the sick. It is so constructed that several patients have frequently to be crowded into one small room, and is besides entirely destitute of those necessaries and comforts so advantageous to a sick room, and particularly agreeable to the young, distant from home and separated from their friends. It is inferior in every respect to the hospital for the enlisted men of the post, and not equal to other army hospitals. It is proposed to add a second story to the building, or covered gallery, and certain other arrangements, of which a plan will be submitted for your approval, for which $6,500 are asked.

I cannot help again calling your attention to the necessity of a hall for cavalry exercise and instruction. The knowledge of cavalry tactics is necessary to the cadets in the performance of their duty in the army. It is so recognised, and a sufficient number of horses, dragoons, and cavalry officers have been placed at the academy for their instruction. The three higher classes are instructed in this branch, and are divided into squads, and parade daily at stated hours, as in their other studies. When the weather permits, the instruction is given on the plain; but from September to June, the period allotted to this course, the weather and ground in this climate are so often unfit for this exercise in the open air, that for the want of a hall the regular lesson must be omitted, and the provision and expense of men and horses lost to the country, and the time and opportunity to the cadets. A sheltered room is as necessary, in my opinion, for the proper and economical instruction of this course as any other. It requires one of large dimensions, and must be built for the purpose. A plan and estimate of the proposed building have been submitted to you. Two thousand dollars are already appropriated for its commencement, and the balance of the estimate, $20,000, is now asked for its completion.

I am, very respectfully, your obedient servant,

R. E. LEE,
Bt. Col. Engineers, Supt. M. A.

Gen. Jos. G. Totten,
Chief Engineer, Washington City, D. C.

Report of the Board of Visitors to the West Point Academy.

West Point, *June* 18, 1853.

Sir: In acceptance of an invitation addressed to the undersigned by the Department of War, we assembled at West Point on the 1st of June instant, and proceeded, by the election of a president and secretary, duly to organize the Board of Visitors for the year 1853. Immediately after our organization we were conducted by Colonel Lee, accompanied by the academic staff, through the several departments of the Military Academy, and thereby afforded an ample opportunity to become acquainted with its internal regulations and arrangements.

By a vote of the board, committees were appointed upon the subjects of instruction, discipline, police administration, and fiscal affairs; who, after having attended to the duties assigned them, reported to the board, and their reports are herewith transmitted. The examination of the cadets commenced on the 2d day of June, at 9 o'clock, a. m., and continued till 1 o'clock, p. m., and from 3 o'clock to 5 o'clock, p. m., and during the same hours, from day to day, Sundays excepted, till the 18th day of June, when it was concluded. The examination was conducted in the presence of the Board of Visitors, chiefly by the professors in the several departments, aided by their assistants, and extended to all the branches of instruction through which the several classes had passed during the previous year. The mode of examination was eminently thorough, and adapted to test severely the scholarship of the cadets. With but few exceptions, we are happy to report that the test was borne with distinguished success.

At the board there was but one opinion as to the great value of this institution to the American republic. The conviction was clear in every mind that by no other agency could military science be diffused, and skill in the art of war attained, so generally and successfully as by this. If war is still to be practised among the nations, and if we as a nation have no guarantee of perpetual exemption from its calamities, then the cultivation of the art of war, even to the highest possible degree, is entirely consistent with the strongest claims of humanity. Here knowledge becomes invested with the attribute of mercy as well as power. The truly skilful general, who knows how to adapt the best means to the end proposed, while he conquers, saves human life, and often saves but to conquer.

The moral power of this institution in its adaptedness to secure to our Union internal tranquillity, and preserve unbroken our pacific relations with foreign powers, can hardly be over-estimated. In the highest and most comprehensive sense it is national in its character, representing in its members every State in our growing confederacy, and proffering its high privileges to intrinsic merit, regardless of the factious distinctions incident to almost every form of human society. No sectional or social jealousies can here be awakened. The cadets are *all* the sons of the republic, and learn to regard with filial affection every part of it as their common country. At the very commencement of their cadetship, under the solemn sanctions of an appeal to their Maker, they pledge themselves to a life of fidelity to the American Union; and through the whole period of their training they are brought under influences admirably fitted to cherish and strengthen within them a patriotism as broad in its scope and lofty in its aims as was the spirit which animated the immortal founders of this priceless confederacy.

At the same time, by the efficient maintenance of this institution, foreign powers are admonished, that while it shall ever be our aim to render exact justice to them, we have both the disposition and the ability to maintain and defend our rights and honor as a nation. History abundantly proves that an adequate state of national defence is the surest guarantee for the continuance of national peace; and events in our own history, fresh in every mind, show that we have no arm of defence on which we may rely with higher confidence than the skill and bravery of the sons of West Point.

Moreover, if it is important to the perpetuity of our popular system of government that useful knowledge should be generally diffused among the people, what agents can be found more efficient in the accomplishment of this end than the well-disciplined and highly accomplished graduates of this institution—scattered as they are through every State of our Union—uniting theory with practice—illustrating the practical value of science—enlarging its boundaries—multiplying the sources of human happiness, and augmenting man's dominion over nature?

We all agree in sentiments of profound respect for the learning and high character, the wisdom and discretion, of the officers at the head of the institution composing the academic board. We were strongly impressed with the high physical, intellectual, and moral bearing of the cadets, and the evidence exhibited at their examination of their close attention to study, and their disposition and ability to learn.

We are of the opinion that important improvements should be made in some of the present buildings, and that several new ones should be erected. We are entirely united in the conviction that nothing should be left undone necessary to place the institution in the highest state of efficiency; and that the present is the time to accomplish the object, while we have at the head of the War Department an officer who knows how to appreciate its value, from its effects upon the welfare of the country, in war as well as in peace.

1st. The revised regulations for the United States Military Academy require that instruction shall be given in cavalry tactics. To carry out this requirement, we are all of us entirely satisfied that a new building should be erected without delay. A decent regard for safety to the lives and limbs of the cadets requires this, as well as their successful progress in this branch of instruction. It is the opinion of the superintendent that the course of equitation cannot be properly taught without it, and that the room now used for the purpose is extremely dangerous to the lives and limbs of the cadets.

It is estimated that, in addition to the amount before appropriated, ($2,000,) the sum of $21,197 will be required for this object.

2d. The cadets' hospital should be enlarged and improved. A brick front should be built extending to the centre, flush with the front of the wings, to connect the wards with the additional space so formed by cutting the present windows into doors; also, two projections in rear, equal in width to the north and south wards, which shall contain the staircases, water-closets, and bath-rooms; the whole to be raised one story (ten feet) in addition to the present height of the building. To accomplish this will require an appropriation of $6,500.

3d. Quarters for sixteen officers and two families should be constructed, in the form of a brick building of two stories, with a basement, with two wings, (one for each family.) It is estimated that it will require about $28,000 to accomplish this object.

4th. Suitable additions may be made to the quarters of the professors by an appropriation, in addition to the amount already appropriated, ($3,000,) of $5,051 35.

5th. Suitable stables may be erected by an appropriation, in addition to the amount already appropriated, ($8,000,) of $7,491.

6th. We are of the opinion that the number of the cadets should be increased, so as to correspond with the number of Senators of the United States, by adding two from each State, and that the recommendations of Senators in each State should have great weight in selecting the cadets from their respective States to make up this increased number.

7th. We are of the opinion that great care should be taken in the selection of cadets; that is, to be made from among those who have the highest qualifications—physical, intellectual, and moral.

8th. That the period of instruction should be extended to five years. This may be accomplished without any additional expense to the nation, and with great advantage to the cadets. They should be qualified to take and hold with honor to themselves the highest positions in civil as well as military life.

9th. We are of the opinion that the decisions of the academic board, as to the capacity and conduct of the cadets, and their qualifications to be admitted and continued in the academy, should be considered as final and conclusive.

10th. We are all of the opinion that the pay of the cadets should be increased, making it at least $28 20 per month; and a very large majority of the board are of the opinion that it should be increased to $30 per month.

11th. We concur in the recommendations made by the Board of Visitors last year, that the pay of the superintendent should not be less than $3,000; that the pay of the instructors of French and drawing should be made equal to that of the principals in other departments; that the principal instructors of practical engineering and of artillery, &c., should be allowed the same compensation as other principal professors; that the first assistant instructor of drawing and French should be allowed the same pay as the first assistant in all the other departments; that all the secondary instructors and teachers taken from the army should be allowed $10 per month extra pay; and that the fencing master, who now instructs two classes, should be allowed the pay of $900 per annum.

12th. If the period of instruction should be extended to five years, we are of the opinion that the study of elocution, writing, English composition, history, and the evidences of christianity, should make a part of the course to be arranged by the academic board; and that the study of rhetoric should be postponed to the second year. For additional facts and arguments in favor of the measures we recommend, we refer to the reports of the several committees above named.

13th. We concur in the recommendation especially of the committee on instruction, that an appropriation of $5,000 should be made for the purpose of establishing at this point *a museum of artillery*, and for the reasons by them stated.

In conclusion, we would express the unmingled pleasure we have derived from the discharge of our duties as a Board of Visitors. Upon our arrival we were received with distinguished courtesy by the superintendent and other officers of the institution, and during the entire progress of our labors every possible facility has been afforded us for accomplishing the ends of our appointment. We close our investigations and reluctantly leave this place, celebrated alike for its natural attractions and its historic interest, more profoundly impressed than ever with the importance of this Military Academy to the highest interests of our nation, and in the confident assurance that its future career will be as honorable as its past history has been useful and patriotic.

HENRY E. DAVIES, *New York, President.*
A. V. BRUMBY, *Georgia, Secretary.*
DANIEL GOODENOW, *Maine.*
WM. G. BATES, *Massachusetts.*
E. W. ANDREWS, *Connecticut.*
JOHN C. GROOME, *Maryland.*
K. RAYNER, *North Carolina.*
JAMES PURVIANCE, *Mississippi.*
DWIGHT JARVIS, *Ohio.*
JOSHUA BAKER, *Louisiana.*
GEORGE T. WARD, *Florida.*
GEORGE TEMPLE, *Iowa.*
HENRY S. BAIRD, *Wisconsin.*
FRANCIS HEWSON, *Pennsylvania.*

To the honorable SECRETARY OF WAR.

Report of the Committee on Fiscal Affairs.

The committee on fiscal affairs, having performed the duty assigned them, beg leave to report:

It appears that the amount appropriated by Congress for the support of the Military Academy for the fiscal year ending June 30, 1853, was, as per statement A..	$130,050 00
Of this sum, according to the usages of the War Department, there was to be disbursed under the direction of the Paymaster General's department	83,470 00
Leaving	46,580 00

to be disbursed under the direction of the Engineer department, which is the branch of the War Department having the immediate supervision of the Military Academy.

The above sum of $83,470 is appropriated to the following objects, viz:

For pay of officers, instructors, cadets, and musicians...	$80,409 00
For commutation of subsistence	2,263 00
For commutation of forage of officers' horses..........	768 00
For commutation of clothing for officers' servants	30 00
Making the aforesaid sum of............	83,470 00

Of this last sum, $59,375 56 have been expended on account of the pay of the corps of cadets from July 1, 1852, to April 30, 1853, inclusive, which is the date of their last payment.

The amount to be disbursed under the direction of the Engineer department, as before stated, is, as per statement B		$46,580 00
The amount of appropriations for the fiscal year ending June 30, 1852, unexpended, was, as per statement B..		10,688 94
But there were received from other sources the following sums, as per statement B, viz:		
For wood cut on public land.................	$223 87	
For lumber, &c.	86 43	
For lead	7 88	
For two worn-out oxen	128 94	
For eight condemned horses	74 41	
		521 53
Making an amount of............................		57,790 47
available for the purposes of the institution during the fiscal year ending June 30, 1853.		
Of this sum, it appears there has been expended to June 7, 1853		29,312 79
Leaving an amount available on the same day of..		28,477 68

Of this sum, there remained in the treasury undrawn ...	$24,500 00
And in the hands of the superintendent................	3,977 68
	28,477 68

By "the treasury" is meant the Treasury of the United States, from which the amounts are drawn upon estimates made for each particular subject; and all the moneys are kept in the treasury till requisitions, upon proper estimates, are made.

The amount of available means in the treasury and in the hands of the superintendent, other than the sums appropriated for the gradual increase and expense of the library, board of visitors, cavalry-exercises hall, apparatus for warming buildings, new equatorial telescope, purchase of artillery and cavalry horses, and forage for artillery and cavalry horses, is .... which is to the credit of the fund for current and ordinary expenses.	$12,214 65
And of this sum, about .... will be expended during the present month.	3,500 00
Leaving a balance to be applied to the objects specified of..	8,714 65

There has been heretofore appropriated, for the construction of a building for the instruction of cavalry tactics, the sum of $2,000 none of which has been expended, because the amount is entirely inadequate to the purpose contemplated. This sum is still subject to the direction of the superintendent, and must remain unexpended till a further appropriation is made by Congress. According to the estimate of the superintendent, $19,197 more will be necessary to the erection of such a building as will be in keeping with the character of the institution and necessary for the public service.

The committee are convinced of the great importance of the contemplated improvement, and advise its recommendation in the general report of the board.

After exhibiting the foregoing statement of the fiscal affairs of the Military Academy, the committee have but little to add to the comments of previous boards. The system of administering the finances of the institution being the same now it has been for years, the committee can do but little more than to report the statements of their predecessors. The committee have had extended to them every facility for examining the books and vouchers, and the manner of keeping the accounts in the office of the quartermaster and treasurer, the faithful head of which, Lieutenant R. S. Smith, and his able and accomplished clerk, Mr. F. Newlands, have, with the utmost politeness and alacrity, submitted the books and vouchers to our examination, and furnished us promptly with all the information called for.

Paper marked B shows that the expenditures for the current and ordinary expenses of the institution during the past year amount to $29,312 79. Paper marked C exhibits the amount paid to the officers, instructors, and professors connected with the Military Academy on account of their connexion with the army, to be $35,805 72; the additional amount paid them in consequence of their duties at the institution, $17,630 04; and their total pay to be $53,435 76. Paper marked D shows the expenditures on account of the cadets for the past year to be $77,309 79, each cadet receiving $24 per month, as now provided by law.

From this it appears that the annual expenditure for the current and ordinary expenses of the academy is....	$29,312 79
The pay of officers, instructors, and professors, beyond the amount paid them as officers of the army........	17,630 04
The pay of the cadets..................................	77,309 79
Amounting in all to the sum of..........	124,252 62

This amount of expenditure the committee consider to be very small, compared with the very great importance of, and benefit derived from, the Military Academy.

The committee, in looking over the amount of the salaries paid to the professors in the academy, discover that the professors of drawing and French are paid only $1,500, while the other professors are paid $2,000. The committee can see no reason or justice in this. Upon inquiry, as well as from what we have witnessed, we are led to believe that the labors of the departments of drawing and French are equal to those of the other professorships; and of the great importance of those branches of education in the Military Academy, the committee have become now thoroughly convinced during the progress of the examination. The present head of the department of drawing is a gentleman of whose genius and reputation the country should feel proud; and we therefore advise, in common with several boards of visitors that have preceded us, that the general report of the board recommend that the salaries of the professors of drawing and French be increased to $2,000, the salary paid the other professors.

There has been heretofore appropriated the sum of $3,000 for improvement and additions to officers' quarters. This sum is still subject to the direction of the superintendent, who has hesitated in its expenditure, for the reasons that it is entirely inadequate to the object had in view. There are seven professors whose quarters are so small and restricted as to render them inconsistent not with comfort, but with their absolute wants. Many of these gentlemen have families, for whose comfort their present quarters are entirely too small, leaving them no apartment for study, or for the arrangement of apparatus, books, drawings, cabinets, &c. From the estimate of the superintendent, an additional appropriation of $5,051 35 will be required in order to make such improvements to officers' quarters as are absolutely necessary; and the committee earnestly recommend that such additional appropriation be asked for.

The committee have become convinced, from an examination of the manner in which the cadets are paid, and the amount of pay allowed them, that the pay of the cadets should be increased from $24 to $30 per month. The committee do not believe that the pay should exceed their actual wants; and they are of opinion that $30 per month is as little as the cadet can get along with, without aid from his parents or friends, or incurring debt, which should be guarded against if possible. The cadets receive their pay once every two months. From paper marked D, it appears that the amount actually necessary for the support of each cadet for two months, is $53 53; whereas the amount received from the government of the United States by each cadet for two months, is $48; leaving a difference of $2 76½ per month, or $33 18 per year, amounting in the four years' course to $132 72, which must be paid by the graduate after his graduation, or liquidated from his private means. Paper marked E shows that for four years, from May 1, 1849, to May 1, 1853, the pay of the cadets *actually did* fall short of the amount required for their support $4 97 for ten months, being $29 82 per year, or $119 28 for the four years. From an examination of the books in the Treasury Department, it appears that the amount of deposits from private resources, by the present graduating class of fifty-one cadets, amounts to an average of $55 48; and yet twenty-one of them are in debt to the average amount of $15 53, and thirty leave $31 38 to their credit. So it seems that, with the present pay, the most economical, but for private resources, would leave it in debt to an amount averaging $24 10 each.

If the government pretends to educate a portion of its sons for its own special use, it should do so in fact and in deed. The gratitude and respect which the soldier should feel for his country, that has adopted and educated him, should suffer no abatement by the consideration that but for private aid he could not have supported himself. Besides, the present insufficient pay gives to those young men whose friends and parents may be in affluent or easy circumstances a decided advantage over those who have no such reliance for assistance. The committee believe, from information received from authentic sources, and from a thorough investigation of the subject, that $30 per month is necessary to defray the expenses of each cadet, so as to enable him to live respectably.

By a wise regulation, the cadets are not allowed to receive their pay in person except in special cases, and then only in inconsiderable sums and by special order from the superintendent. The treasurer receives their pay, passes the amount to the credit of each in the books of his office, and also in a pass-book furnished to each cadet on his entering the academy; and in the pass-book, as well as in the books of his office, he enters every article purchased by the cadet. Each cadet is thus enabled to see at a glance the state of his account, the amount of his indebtedness, and the amount to his credit. No cadet can procure any article except on an express order from the superintendent, who has thrown on him the responsibility of seeing that economy is observed, and that the cadets are kept within the limits required by the state of their funds. The committee can discover no change or improvement to be recommended in the present admirable system of disbursing the fund appropriated for the pay of the cadets, and of checks against carelessness and extravagance in paying it out.

The committee have confined themselves, in their recommendations for additional appropriations, to those objects only for which appropriations have been heretofore made, but which have not been expended, of the inadequacy of the appropriation to the purposes contemplated. These the committee considered as coming within their especial province, as being connected with a statement of the fiscal affairs of the academy. The failure of the committee to recommend appropriations suggested by other committees is not to be construed into opposition or disbelief of their necessity.

K. RAYNER,
GEORGE T. WARD,
DANIEL GOODENOW.

A.

Statement showing amount of appropriations for support of the United States Military Academy for the fiscal year ending June 30, 1853.

Amount appropriated		$130,050 00
Amount to be disbursed under direction of the Paymaster General's department, as follows, viz:		
Pay of officers, instructors, cadets, and musicians	$80,409 00	
Commutation of subsistence	2,263 00	
Commutation of forage for officers' horses	768 00	
Commutation of clothing for officers' servants	30 00	
		83,470 00
Amount to be disbursed under direction of the Engineer department, as follows, viz:		
For as per statement B		46,580 00
		130,050 00

The sum of $59,375 56 has been expended on account of the pay of the corps of cadets, from July 1, 1852, to April 30, 1853, inclusive.

R. S. SMITH,
Lieutenant, and Quartermaster U. S. Military Academy.

QUARTERMASTER'S OFFICE, U. S. MILITARY ACADEMY,
New York, June 9, 1853.

B.

Statement of funds available and disbursements made by the superintendent of the United States Military Academy during the fiscal year ending June 30, 1853, and to include June 7, 1853.

For what purpose.	Unexpended of the appropriation for the fiscal year ending June 30, 1852.	Appropriation for the fiscal year ending June 30, 1853.	Amount received from other sources.	Total available for fiscal year ending June 30, 1853.	Expended to 7th June, 1853.	Available on 7th June, 1853.	In hands of the superintendent.	In treasury.	Am'nt required for buildings in addition to that already appropriated.
Current and ordinary expenses, viz:									
Repairs and improvements	$1,832 12	$9,000 00	*$447 12	$11,279 24	$10,367 89	$911 35			
Fuel and apparatus	158 25	6,500 00	....	6,658 28	5,827 78	830 47			
Postages	19 57	50 00	....	69 57	27 54	42 03			
Forage	292 18	1,760 00	....	2,052 18	929 16	1,123 02			
Stationery	89 37	300 00	....	389 37	211 66	177 71			
Transportation	420 77	1,800 00	....	2,220 77	905 78	1,314 99			
Printing	272 33	700 00	....	972 33	214 00	758 33			
Clerks	....	1,730 00	....	1,730 00	1,502 49	227 51			
Miscellaneous and incidental expenses	....	2,440 00	....	2,440 00	994 91	1,445 09			
Department of engineering	1,613 73	....	....	1,613 73	....	1,613 73	$1,214 65	$11,000 00	....
Department of philosophy	....	100 00	....	100 00	6 48	93 52			
Department of mathematics	245 81	....	....	245 81	9 13	236 18			
Department of chemistry	229 75	72 88	....	302 63	229 49	73 14			
Department of ethics	115 12	....	....	115 12	41 75	73 37			
Department of drawing	125 41	77 09	....	202 50	128 11	74 39			
Department of artillery and cavalry	....	420 00	....	420 00	361 86	58 14			
Department of infantry tactics	95 92	50 03	....	145 95	28 06	117 89			
Improvements and addition to officers' qrs.	....	3,000 00	....	3,000 00	....	3,000 00	....	....	$5,051 35
Additional pay to lithographer and pressman	....	100 00	....	100 00	56 71	42 29			
Gradual increase and expense of library	678 61	1,000 00	....	1,678 61	1,372 18	306 43	306 43	....	....

B—Continued.

For what purpose.	Unexpended of the appropriation for the fiscal year ending June 30, 1852.	Appropriation for the fiscal year ending June 30, 1853.	Amount received from other sources.	Total available for fiscal year ending June 30, 1853.	Expended to 7th June, 1853.	Available on 7th June, 1853.	In hands of the superintendent.	In treasury.	Am'nt required for buildings in addition to that already appropriated.
Board of visitors	....	$3,000 00	....	$3,000 00	....	$3,000 00	....	$3,000 00	....
Cavalry-exercise hall	$2,000 00	....	....	2,000 00	....	2,000 00	$2,000 00	....	$21,197 00
Apparatus for warming buildings	2,500 00	....	....	2,500 00	....	2,500 00	....	2,500 00	....
New equatorial telescope	....	5,000 00	....	5,000 00	....	5,000 00	....	5,000 00	....
Purchase of thirty artillery and cavalry horses	....	3,000 00	†$74 41	3,074 41	....	3,074 41	74 41	3,000 00	....
Forage of artillery and cavalry horses	....	6,480 00	....	6,480 00	$6,097 81	382 19	382 19	....	....
	10,688 94	46,580 00	521 53	57,790 47	29,312 79	28,477 68	3,977 68	24,500 00	....

* For wood cut on public land	$223 87
For lumber, &c	86 43
For lead	7 88
For 2 worn-out oxen	128 94
	447 12
† For 8 condemned horses	74 41

R. S. SMITH,
Lieutenant, and Quartermaster United States Military Academy.

QUARTERMASTER'S OFFICE,
United States Military Academy, West Point, New York, June 9, 1853.

C.—*Statement of the rank, pay, and emoluments of the officers, professors and instructors, connected with the United States Military Academy at West Point, N. Y.*

	Rank.	Army pay per annum.	Pay on duty at the Academy.	Pay.
Superintendent	Brevet colonel	$2,628 00		$2,628 00
Professor of engineering			$2,000 00	2,000 00
1 assistant professor	1st lieutenant engineers and brevet captain.	981 96	200 04	1,182 00
1 ......do	2d lieutenant of engineers	981 96		981 96
Professor of natural and experimental philosophy.			2,000 00	2,000 00
1 assistant professor	1st lieutenant of artillery	834 00	348 00	1,182 00
1 ......do	1st ....do..... of infantry	834 00		834 00
1 ......do	2d ....do..... of artillery	774 00		774 00
Professor of mathematics			2,000 00	2,000 00
1 assistant professor	1st lieutenant of topographical engineers.	981 96	200 04	1,182 00
5 ......do	2d lieutenant of artillery	3,870 00		3,870 00
Professor of chemistry, &c.			2,000 00	2,000 00
1 assistant professor	1st lieutenant of artillery and brevet captain.	834 00	348 00	1,182 00
1 ......do	2d lieutenant of artillery	774 00		774 00
Professor of ethics			2,000 00	2,000 00
1 assistant professor	1st lieutenant of artillery and brevet captain.	834 00	348 00	1,182 00
1 ......do	1st lieutenant of infantry	834 00		834 00
Professor of drawing			1,500 00	1,500 00
1 assistant professor	1st lieutenant of artillery	1,002 00	348 00	1,350 00
2 ......do	do .... do	834 00		834 00
Instructor of practical engineering.	Captain of engineers, commanding company.	1,302 00		1,302 00
1 assistant instructor	2d lieutenant of engineers	981 96		981 96
1 ......do	Brevet 2d lieut. of engineers	981 96		981 96
Professor of French			1,500 00	1,500 00
1 assistant professor	1st lieutenant of infantry	834 00	348 00	1,182 00
1 ......do	1st lieutenant of artillery	834 00		834 00
1 ......do	2d ....do .... do	774 00		774 00
Instructor of infantry tactics.	1st lieutenant of artillery and brevet major.	1,074 00	926 00	2,000 00
3 assistant instructors	1st lieutenant of infantry	2,502 00	360 00	2,862 00
1 ......do	2d ....do .... do	774 00	120 00	894 00
1 instructor of artillery and cavalry.	1st lieutenant of artillery and brevet major.	1,668 00		1,668 00
1 assistant instructor of artillery.	1st lieutenant of artillery and brevet major.	834 00		834 00
1 ass't instructor of cavalry	1st lieutenant of dragoons	1,077 96		1,077 96
1 ass't instruetor of cavalry	2d lieut. mounted riflemen	1,077 96		1,077 96
1 instructor of fencing			720 00	720 00
1 surgeon		1,788 00		1,788 00
1 assistant surgeon		1,470 00		1,470 00
1 adjutant	1st lieutenant of artillery and brevet captain.	834 00	363 96	1,197 96
		35,805 72	17,630 04	53,435 76

In addition to army pay, all officers receive an additional ration for every five years' service, the value of which is commuted at $6 per month. All the above disbursements are made by the pay department.

R. S. SMITH,
Lieutenant, and Quartermaster U. S. Military Academy.

June 9, 1853

D.

Statement of authorized amounts paid by the treasurer of the United States Military Academy, exhibiting the annual total amounts for two months, together with the average amount applicable for each cadet, for all articles enumerated, from May 1, 1852, *to May* 1, 1853.

On what account paid.	May and June.	July and August.	September and October.	November and December.	January and February.	March and April.	Total amounts.	Average amount for two months.	Average amount applicable for two months.	Remarks.
Bank fund	$113 50	$127 75	$131 00	$129 50	$120 25	$115 37	$737 37	$122 89	$0 50	Voluntary subscription by cadets for the support of a band of musicians.
Board at mess commons	3,391 63	3,864 85	4,141 87	4,545 63	4,253 16	4,087 42	24,284 56	4,047 44	16 71	The amount charged each cadet being pro rata, and fixed by a board of officers, who examine and audit the accounts of the purveyor of the cadets' commons.
Washing	878 95	893 62	1,046 34	1,029 08	959 04	913 38	5,720 41	953 40	4 00	$2 per month, winter and summer.
Commissary store department	1,003 03	2,812 79	4,149 19	1,558 98	962 40	978 83	11,465 22	1,910 87	7 76	Conducted by the commissary of cadets. Articles furnished, viz: text-books, stationery, under-garments, equipments, room furniture, &c.
Commissary clothing department.	1,775 41	4,229 87	1,353 77	1,939 07	2,602 21	2,009 38	13,909 71	2,318 28	9 66	Conducted by the commissary of cadets. Articles furnished, viz: uniform clothing, citizen's clothing, and authorized military frock coats for cadets when going on furlough.
Commissary shoemaker department.	592 51	953 35	642 14	535 44	394 38	387 75	3,505 57	584 26	2 43	Conducted by the commissary of cadets. Shoes and repairs done by contract, under the inspection of the commissary of clothing.
Postage	164 10	101 37	177 13	129 73	69 01	107 87	749 21	124 73	52	Postage of letters and newspapers—one newspaper allowed to each cadet, provided he makes application for the permission.
Barber, shoe-blacking, varnishing, &c.	167 92	190 27	189 04	183 22	164 75	182 97	1,078 17	179 69	74	This embraces shoe-blacking, hair-cutting, varnishing accoutrements, &c.
Baths taken by the cadets	114 70	52 95	118 68	118 94	110 04	110 72	626 03	104 37	44	A small charge for each bath, only sufficient to pay the expenses of the bathing establishment.
Sundry orders on refectory	....	166 00	2 00	4 00	9 00	3 00	184 00	30 66	13	For soda water, fruit, candy, pies, &c. The order must be obtained from the superintendent.
Dialectic Society	126 55	....	....	....	....	....	126 55	21 09	09	Subscribed for by the members of the society on the approval of the superintendent.
Iron bedstead and table fund	22 40	29 60	35 60	34 40	29 10	28 00	179 10	29 85	12	This is only charged the *fourth* class for their use, at 20 cents per month, for the *first year only*, which is applied to keep the articles in repair.

Steel rules and triangles, and drawing boards.	68 92	....	....	....	....	....	68 92	11 49	05	An annual charge for their use, and to keep them in repair.
Lithographic department	96 06	....	....	....	....	205 82	301 88	50 31	21	Charge for the use of lithographic works, written by the officers and professors to aid in the course of instruction in their several departments.
Use of cap plates and plumes..	26 04	....	....	....	....	....	26 04	4 34	02	An annual charge for plumes and cap ornaments, furnished for the use of the cadets.
Damages quartermaster's department.	14 35	92	5 60	11 14	3 27	2 86	38 14	6 36	03	This embraces damages and loss of books from the Military Academy library, damages of barracks, breaking window-glass, &c.
Damages ordnance department.	26 99	3 09	7 54	19 44	1 74	6 08	64 88	10 81	04	This embraces damages for ordnance department for cavalry, artillery, and infantry accoutrements, loss of the same, &c., which reverts to the United States.
Damages mess commons.......	10 62	8 43	15 04	16 54	20 09	12 78	83 50	13 91	05	Charge of damages of tumblers, plates, dishes, knives and forks, &c., which is signed by the cadets when the said damage is done, agreeably to the regulations of the mess commons.
Policing barracks, and making fires, &c.	91 14	118 04	125 80	220 36	203 97	210 73	970 04	161 67	68	For distributing fuel, policing barracks, attendance on furnaces. This amount is averaged at each settlement according to the number of cadets at muster, and charged accordingly.
Dentist	15 50	....	....	258 00	4 00	....	277 50	46 25	19	Services rendered cadets on the recommendation of the post surgeon, by approval of the superintendent of the United States Military Academy.
Dancing master	....	500 00	....	....	....	....	500 00	83 33	35	Subscribed for by the cadets of the United States Military Academy.
Cotillon parties	....	241 22	....	....	....	....	241 22	40 20	17	Subscribed for by the cadets of the United States Military Academy, and given during the months of July and August. This is a voluntary subscription.
India-rubber cape fund.........	40 30	29 60	....	58 40	....	....	128 30	21 38	09	Purchased for the benefit of the cadets, who are charged only for the use of the same, and are responsible for the loss of the India-rubber cape.
Sundry accounts paid	270 27	199 39	....	....	18 00	....	487 66	81 27	33	Subscription to newspapers, which are authorized by the superintendent; subscription to organist, charge for furnace, express freight, cartage, and small subscription, &c.
Balance of cash paid cadets....	8,923 34	228 27	213 19	583 42	1,359 57	248 02	11,555 81	1,925 97	8 02	When graduating they receive the balances due them, including their equipment fund, and the furlough class receive the balance that may be due them to 1st July.

Amount received from the government of the United States by each cadet in two months, $48. Difference between his pay for two months and the amount expended by each cadet, which must be liquidated by him either after graduating or from his deposit made on entering the United States Military Academy, $5 53.

R. S. SMITH, *Lieutenant, and Treasurer United States Military Academy.*

TREASURER'S OFFICE, UNITED STATES MILITARY ACADEMY, *June* 8, 1853.

E.

Abstract of authorized amounts paid by the treasurer of the United States Military Academy, on account of the corps of cadets, for the four years commencing May 1, 1849, and ending May 1, 1853, exhibiting the annual total amount, the average amount for two months, together with the amount applicable for each cadet for two months.

	Amount.	Total amount per annum.	Average amount for two months.	Average amount applicable for two months.	Number of cadets.
May and June, 1849	$17,722 32				
July and August, 1849	14,330 50				
September and October, 1849	11,260 60				
November and December, 1849	9,913 00				
January and February, 1850	9,757 49				
March and April, 1850	8,865 03	$71,848 94	$11,974 82	$52 06	
May and June, 1850	18,308 83				
July and August, 1850	14,945 02				
September and October, 1850	11,627 14				
November and December, 1850	10,588 38				
January and February, 1851	11,016 48				
March and April, 1851	9,371 30	75,857 15	12,642 85	53 40	
May and June, 1851	18,623 82				
July and August, 1851	13,938 86				
September and October, 1851	11,007 74				
November and December, 1851	9,903 41				
January and February, 1852	10,589 04				
March and April, 1852	8,931 67	72,994 54	12,165 76	52 89	
May and June, 1852	17,934 23				
July and August, 1852	14,751 38				
September and October, 1852	12,353 93				
November and December, 1852	11,375 29				
January and February, 1853	11,283 98				
March and April, 1853	9,610 98	77,309 99	12,884 82	53 63	
Total average		74,502 65	12,417 06	52 97	234
Amount received from the government of the United States by each cadet for two months				48 00	
Difference between his pay for two months and the amount expended by each cadet, which must be liquidated by him either after graduating or from his deposits made on entering the United States Military Academy				4 97	

RECAPITULATION.

Average amount expended for one year	$74,502 65
Average amount expended for two months	12,417 06
Average amount applicable for each cadet for two months	52 97
Amount received from the government by each cadet for two months	48 00

R. S. SMITH, *Lieutenant, and Treasurer U. S. M. A.*

TREASURER'S OFFICE, WEST POINT, *June* 9, 1853.

Report of the Committee on Police.

The committee to whom was intrusted the inquiry into the police of the Military Academy, have the honor to report:

That they are under many obligations to the efficient officers of this post for the valuable aid rendered to them in their labor of investigation. Your committee had free access to every building, room, book and paper; every information sought for was readily given, and nothing withheld.

They found the principal building neat, substantial, and well adapted, with some exceptions, to the wants of the institution. They visited the library and examination hall, the chapel, barracks, riding school, stables, hospital, officers' quarters and dragoon quarters. No improvements suggested themselves as being required in the examination hall and chapel. The cadet barracks were found clean and well ventilated. It is recommended that the sliding curtains which partition some of the rooms be removed, and the inspecting officer will thus have facility to discharge his duties. Some alteration in the interior arrangement of the entries and stairways, designed for a strict surveillance over the cadets during study hours, have been suggested and are highly approved. Your committee found the riding hall (which had formerly been erected for the storage of gun-carriages) totally unfit for its present purpose; inconvenient from its size, and dangerous from the peculiar irremediable features in its construction—whereby many accidents have occurred, and some have resulted seriously to the cadets. To unnecessarily expose these young men to the loss of life and limb, while acquiring knowledge in an essential branch of their profession, is at war with the dictates of policy and humanity. An appropriation sufficient to complete a building of instruction in this most important arm of the public service cannot be too strongly urged.

The hospital ought to be improved and furnished with the proper appliances for the recovery of its inmates. Alterations in the present system of employing nurses, as recommended by the surgeon to former boards, should be adopted.

An appropriation of $400 is asked for such food and nourishment as may be required in the sick rooms.

Many of the officers are not furnished with quarters, while some of the buildings occupied as such are inconvenient and uncomfortable.

The especial attention of the government is called to the want of the proper stabling room at this post. The present buildings are in a state of decay, badly ventilated, and afford but poor shelter from the cold winter storms; many valuable animals have consequently been lost, or so seriously injured as to be unfit for service. Your committee recommend an appropriation for the buildings which have been designed to protect this species of the public property. Some additional grading upon the plain in front of the flagstaff is needed as room for infantry manœuvres.

The dragoon quarters were inspected. The sleeping apartments are badly ventilated, and are not adapted to promote the health and decent comfort of the men. To sustain this opinion a single instance is cited:

twenty-four men lodge for the night in one room, which only should be tenanted by one-fourth of that number.

Your committee recommend the removal of the confectionery from the limits of the public property, because they believe it has not answered the end designed. It tempts the cadet into extravagant and unprofitable habits, involves him in debt, adds nothing to his health; besides, it is out of keeping with the stern military rigor so characteristic of the academy.

Your committee now proceed to give their views upon the code of government in the particular department allotted to their investigation. They will not go into details, but simply state that the rules and regulations for the conduct of the cadet are admirably designed to promote his physical, mental and moral vigor; they prepare him for the service of his country, and in no way do they conflict with its republican spirit. Reward is given where merit has won it, and punishment is inflicted where it cannot be avoided. By a wise combination of varied instruction with rigid discipline, the graduate is made a useful citizen and efficient soldier; he draws on the resources he has acquired, and turns them to the profit of his country. Labor and enterprise, guided by his skill, bring her wealth and prosperity; for here he has been taught to run a locomotive, to work a saw-mill, and build a bridge, at the same time that he is trained to lead her armies to victory, to conquer an empire, or drive the invader from her shores. In peace or war he repays with compound interest the cost of his instruction. Your committee having now discharged their duties, will return to their homes convinced of the great practical utility of the institution, and with a high estimate for the integrity of the gallant men who now hold its management in their keeping.

F. HEWSON,
JOHN C. GROOME,
DWIGHT JARVIS.

Report of the Committee of Instruction.

GENTLEMEN: We find thorough instruction in all the departments to have been the constant aim of the academic staff, and to have reached a high degree of perfection.

From the mode of conducting the public examinations; the recitations of sections in their own rooms throughout the course; the high attainment of so large a number in every class; the subdivision of the classes into small sections, with an assistant for each; the visit of the professors to all parts of the classes to which they respectively belong, looking over, instructing, and properly directing all their assistants, thus insuring the daily recitations of every individual member of the classes, and a thorough understanding of the studies so absolutely demanded, we see the happiest results. It proves to us incontestibly the labor, patience, skill, and high standing of the professors in the various departments of the institution.

We are sorry to have found many cases of bad elocution; sometimes from indistinctness of articulation and omissions of words. We would therefore recommend more attention to the English studies—the introduction of *rhetoric* and *elocution*, even at the cost of neglect of some branches now taught in the institution, or an extension of the course of studies to *five years*. The latter would possess the double advantage of including all, and permit such a judicious subdivision of the present course as to mitigate its severity.

We are of the opinion that a museum of artillery is much wanted here. France and England have them on a very large scale. We would therefore recommend one for the West Point Academy, to contain the arms of the different nations with whom we may be at war. For this purpose we would further recommend an appropriation of five thousand dollars, with which to purchase all the different kinds of arms and models used by civilized nations.

There is a room here in which our trophies are deposited which can serve for a number of years for this purpose, and will render all future expenditure very small. That this country should have the means of keeping up with the various improvements in all arms, is so evident as to require no argument. We would, however, suggest that every art should have its history; and as a further reason, it would be a saving of treasure to the nation by preventing the testing of arms the utility of which may have long since been settled.

In conclusion, it is with great pleasure we can assure you that in the given time of four years as much has been accomplished as could be; that the professors and their assistants are justly entitled to the highest commendation; that the acquirements of the cadets are highly honorable to them; that the object of the government in the establishment of the institution, in a military point of view, has been attained, and that the whole country has been greatly benefited by the diffusion of scientific and military information.

JOSHUA BAKER,
JAMES PURVIANCE,
E. W. ANDREWS.

West Point, *June* 15, 1853.

Report of the Committee on Discipline.

The committee on discipline report, that the duty assigned them has been discharged with all the care practicable. The rules and regulations touching this branch of the service have been so long maturing under the advice of able and practical men, that it may appear presumptuous on the part of the committee to recommend any material modification of them. They seem in the main to be wisely adapted to accomplish the end designed—the highest degree of order attainable. The committee, however, after careful deliberation and inquiry, cannot resist the conviction that such rules as require all matters in relation to cadets which have been heard and decided by the academic board here, to be reported to the Secretary of War for his affirmation or reversal, should be so far modified as to withdraw from the War Department the power to return a cadet here who has been found deficient by the academic board, or whose demerit has reached the point now provided by the regulations of the academy. It seems to the committee that the superintendent and able officers now here, as well as those usually detailed for this service, are fully qualified to determine finally and conclusively upon the two subjects above indicated. They who see the cadets daily, hear their recitations, and are familiar with the conduct of each in the minutest particular, it can hardly be necessary to argue must be, of all others, the most suitable persons to determine upon the propriety of admitting or returning them. The practice of returning cadets to the academy by the authorities at Washington, after a suspension or dismissal by the academic board, which the committee are informed has to some extent prevailed, it is easy to conceive may, and indeed must, become injurious. A cadet who feels that there is a power elsewhere to whom he can appeal, and where through his friends he can bring to bear an influence sufficient to restore him to his place, notwithstanding he is incapable of mastering the course of studies prescribed for him, or has by his conduct forfeited the confidence of his instructors, and given the most indubitable proof that he does not appreciate the liberality of the government in providing for his education, it requires no reasoning to convince any one, may do great mischief by his evil example; and when returned here, in the case supposed, his power to do evil is greatly increased, by urging upon his companions his own success in setting at nought the authorities here. Assuming that the object of the government in maintaining the school is to obtain for education the best intellects the country affords, as well as young men of good character, it seems to the committee very clear that a cadet being found deficient in intellect, or who has so deported himself as to receive the number of two hundred demerit marks in any one year, should at once, and forever, give place to another who can acquire the confidence of the officers in charge of the academy. When it is considered that each cadet is, on two successive days immediately following any report of his delinquency, apprized of the precise character of the charge against him, and has, by an application to the superintendent, a right to be heard, and will be relieved from the charge if he presents a reasonable excuse, or shows any error in the officer making it, the argument in favor of permitting the decision here, touching the conduct of a cadet, to be conclusive, is greatly strengthened if not rendered impregnable. The committee are very decidedly of opinion that a modification of the rule, or a change of the practice in these two particulars, cannot be too strongly urged. Abundant evidence has been furnished the committee of the vigilance of the officers in enforcing the rules for the discipline of the corps. It is seen in the order and neatness of the quarters of the cadets; in their gentlemanly and manly bearing; in the facility and accuracy with which their duties on parade are performed; and last, though not least, in their examination, which, though thorough and rigid, has been quite satisfactory, and creditable to teacher and pupil. The committee take great pleasure in tendering to the officers and professors of the academy their most cordial thanks for their kindness in communicating information upon every subject, and exhibiting to the committee every matter they desired.

DWIGHT JARVIS,
HENRY S. BAIRD,
GEORGE TEMPLE.

WEST POINT, *June* 14, 1853.

Report of the Committee on Administration.

WEST POINT, *June* 11, 1853.

The committee do not feel called upon to suggest any changes in the organization of the academic staff, nor can they perceive that any such changes are necessary for the welfare and prosperity of the institution. Everything indicates that the administration of its affairs is in good hands, and that the whole country may reasonably expect from it the most desirable results. The regulations established for its government are duly enforced, and the cadets appear to yield to them a cheerful obedience.

The attention of the committee has been drawn to the consideration of the expediency and necessity of erecting a new building for cavalry exercise. We are aware that the subject has been before Congress, upon the urgent recommendations of former boards of visitors, and we cannot add to the force of the arguments made use of by them in favor of the measure. We should regret to be compelled to believe that there is a greater indifference to the safety of human life and limbs in this country than in most others. It is enough for us to say that, in the opinion of the superintendent, the course of equitation cannot be properly taught without it, "and that the room now used for the purpose is extremely dangerous to the lives and limbs of the cadets." In this opinion we entirely concur. The appropriation required for the erection of such a building will amount to some $20,000. We can hardly excuse ourselves if we neglect to bring this subject, so far as we are able to do so, most emphatically to the notice of those who have the power, and we doubt not the disposition also, to remove the evil.

The committee concur in the opinion of the surgeon, that the hospital for the cadets now occupied is very defective in the number, the arrangement, and the ventilation of the wards, and wanting in many of the comforts and conveniences so important to such an establishment. There are but five rooms that can be occupied by the sick, and these are only capable of accommodating ten patients—two in each room. It is estimated that the sum of $6,500 will be necessary to make such additions and improvements as the health and comfort of the cadets absolutely require. We concur also in the opinions expressed by the Board of Visitors last year, that the dwellings of the professors do not afford them adequate accommodations; that they should be enlarged, and a study or office should be erected for each adjoining his quarters. It is estimated that the sum of $5,051 35, in addition to the sum already appropriated, ($3,000,) will be required for this purpose.

We concur also in the opinion that additional buildings should be erected for the use of the assistant professors, and of officers detailed as acting assistant professors, who now occupy rooms in the cadets' barracks, and for others. It is estimated that the sum of $28,000 will be needed for this purpose.

To erect such new stables as are deemed necessary, it will require an additional appropriation of $7,491.

If it shall be the intention of Congress to increase the number of cadets corresponding with the number of Senators of the United States, it may not be deemed a work of supererogation for the committee to express the opinion that such increase may be made without any additional expense for instruction. The academic staff, as at present organized, will be sufficient, with such officers as may be detailed from the army without injury to the public service, to supply the additional instruction which may be required.

If the cadets educated here are not needed immediately and directly for the public service, still the influence of their education, skill, and example diffused through the community in the walks of private life, will be of immense advantage to the nation. It is a mistake to suppose that theirs is a life of idleness. No men living are required to be more industrious. It is the crowning excellence of the institution that arrangements are made by which all their time is suitably employed. They, while here, have no time to contract vicious habits. The delusion is dispelled, if they ever before were under its influence, that they can become wise and learned without study, or distinguished without merit. If it is indeed true that "intelligence is the life of liberty," we shall have in them a self-sustaining and ever-increasing power, diffusing sentiments of respect for our national Union, discountenancing sectional jealousies and combinations, and ever ready to maintain the cause of law and order, to enforce justice, and defend the rights of the nation against internal and external aggression.

From a careful investigation of the subject the committee have come to the conclusion that the pay of the cadets should be increased. Previously to 1845 it was $28 20 per month; it is now $24 per month. For the last four years there has been a deficiency, on an average, of a fraction short of $2 40 per month in the pay of each cadet to meet his expenses. The consequence is, that many of them, after practising the most rigid system of economy, are obliged to leave the institution involved in debt. Those who have escaped this humiliating position have usually had aid from their friends, or some other means than their pay, to meet a portion of their expenses.

If military strength is worth anything, it is worth all it will cost to maintain this institution in the highest degree of efficiency. The expense of acquiring and preserving military science by its agency is small indeed, compared with the expense, in other nations, of supporting large standing armies. It gives us moral power, which tends greatly to secure internal tranquillity and peace with other nations. In the event of war, the guiding spirits in its operations must hereafter come from among those who have graduated here. Indeed, we shall never be able to compute the value of the services of those who commanded the volunteer corps at Buena Vista, and in the subsequent battles in Mexico.

While the committee are not prepared to recommend a higher standard than that now required by law as a qualification for admission to the academy, they will take the liberty to suggest that too much care cannot be taken in selecting for cadets young men of undoubted talents. The institution is maintained for the benefit of the whole nation, and not to give patronage to those who recommend or appoint the cadets. This object should be kept in view. It is no benefit to the nation or to the individuals selected that persons should be sent here for short periods without sufficient physical or mental power to enable them to stand the test of a critical and thorough examination. They should at least possess "a genius for hard work."

If the period for instruction should be extended to five years—and we are of the opinion that it should be—more attention could be given, and with much profit, to acquiring a more thorough English education and a knowledge of the Spanish language, now made almost indispensable in the education of officers of the army. Our cadets should be qualified to take and hold advantageously not only the highest positions in the army, but the highest positions also in civil life.

DANIEL GOODENOW,
A. V. BRUMBY,
WM. G. BATES.

To the Board of Visitors.

Corps of Engineers.

The Engineer department is seriously embarrassed by the want of officers, and must, therefore, again press the necessity of an increase of the corps.

As considerable time must at any rate be consumed in effecting an augmentation, only to be safely brought about by small annual additions, it is the more urgent that the earliest provision practicable be made.

The services of the officers of this corps owe their value not to their academical education merely nor mainly, but to a practical engineer education acquired in long-continued professional pursuits, upon which they all engage the moment they graduate, and in which they are thenceforward incessantly occupied. These, besides great personal attention and labor, involve the application in every form of the scientific principles acquired at the academy; the prosecution of studies in various branches of science and knowledge; the personal supervision of complicated constructions; the management of large bodies of mechanics and laborers; the various business transactions connected with qualities, prices, purchases, contracts, &c.; the safe regulation of disbursements; together with punctual and exact accountability at the treasury, &c., &c. These, and such like matters, constituting a practical school, through which it is indispensable to pass for the officer to be fitted for the higher and greater responsibilities devolving on his growing experience. An increase in numbers can only be safely made, therefore, by additions to the foot of the corps. That it can thus be safely made has been demonstrated by the success that has attended an invariable adherence to that course for half a century.

In general terms, the proposition is to add to the foot of the corps yearly, for a few years, a small number of qualified graduates of the United States Military Academy, and to make, within the same period, promotions within the corps gradually and to a fixed extent. The average annual addition, the total addition, and the process to be specified in the law.

Of the forty-three commissioned officers of the corps of engineers, deducting fifteen who are employed either in the office of the Engineer department, in duties of the military academy, or on the coast survey, &c., and six of the youngest lieutenants, who have not yet had the experience requisite for taking separate charge of operations, there remain but twenty-two officers. Of this, number, moreover, six are employed in California, or on the route to Oregon, or on the Texas frontier; leaving on this side of the continent but sixteen officers to conduct operations on more than forty fortifications now actually in the hands, for construction or repair, of this department.

The inspection, construction, &c., of light-houses is made a duty by law of this corps; and, accordingly, eight or nine of the officers are now charged with such employments. Besides which, more than thirty works of river and harbor improvement, appropriated for by Congress, are also in their hands. Following up the principle of giving to the public the utmost advantages of qualifications acquired in their diversified and active experience, these officers now, as heretofore, and as will be hereafter, are called on to direct various other public operations.

A full and minute specification, unsuitable to this communication, would place the necessity of the measure for which I am contending—the material economy, and in many respects the great public advantage—in a light that could hardly fail to be satisfactory to every mind. And I shall be prompt in a matter which I deem so important to the general good, and so urgent, to supply all useful information, whenever a favorable reception of the proposition shall be intimated.

In the mean time, I beg, for other remarks on this subject, to refer to my annual reports for 1849 and 1850.

In this connexion I have to ask your attention to the advantages that will result from an increase of the sapper, miner, and ponton force.

The present single company is in excellent condition, and, with the exception of a portion of recruits, well instructed. A detachment is now serving under Major Delafield, of the corps of engineers, in preparing defences on the Rio Grande frontier. Another under Lieutenant Donelson, of the same corps, is assisting Governor Stevens in the exploration of the northern route to the Pacific. Another is engaged on the coast survey. These detachments, all rendering valuable service to the country, so lessen the force at West Point, however, that with the number under instructions as recruits, and those required to aid in the course of practical engineering at the Military Academy, and to guard the engineer property there, few remain for other duties not less important—in particular, for the duty of assisting in the construction of fortifications, and also for the peculiar duty of maintaining existing forts in repair. This last I have always deemed an important function of these troops; and so soon as we shall have men enough to maintain at each fort a force of two or three to eight or ten, according to its size, we shall be able to avert injury and deterioration that otherwise would involve large expenditures. This service will not supersede nor interfere with the employment of the garrison, but will be independent of it, and necessary, whether a garrison be present or not. But the duty can be performed only by persons duly trained. This training can be given in a proper manner only at a moderate rate with our present means; and I therefore recommend that Congress be asked to grant, at an early day of the present Congress, a single company in addition, on the same organization as the present one.

This is the place for me to refer to an estimate that I have handed in for the "repair and preparation of the ponton bridge train, to be stored and kept in readiness for the field," $25,000.

It seems of importance that the preparation suggested should be made at once; the building erected for the purpose at West Point will allow the train to be well stored, and the engineer company will be able to keep the train in readiness for the field, so that the whole or any part, with a portion of the engineer company as pontoniers, may be despatched to any section of the frontiers with the first detachment of troops.

RIVERS AND HARBORS, &C.

The works of this character intrusted to the Engineer department have been prosecuted during the year with all the vigor practicable. They have been distributed among the officers whose previous duties had placed them in the vicinity of the several localities to be surveyed or improved, or under whose charge they could be executed with the greatest efficiency and economy.

Among them are many surveys of harbors and inlets, and of rivers having their sources far in the interior. To insure obtaining the most reliable results from these examinations, care has been taken that they should all be made by the officers in person, excepting only certain instances, where the localities to be examined came within the immediate operations of coast-survey parties; in these cases it was considered that despatch and economy in the entire expenditure would be promoted by blending the survey required for the harbor improvement with that about to be undertaken by the coast survey. In accordance with this view, the surveys required of the James and Rappahannock rivers, and of Georgetown harbor, South Carolina, have been confided to the coast survey. Much information has also been derived from other surveys completed or in progress under that office. The demands upon the personal attention of the officers of the engineer corps in executing these surveys have been great, and in some cases they have unavoidably been hindered by them from expediting works of improvement also confided to their care. The surveys, with a few exceptions, are now finished, and their results available for the action of Congress.

Most of the improvements directed by the law required the use of dredging apparatus; the demand this produced was much larger than the country could immediately supply, and it has been necessary, in making contracts, to allow, in most instances, time sufficient for new machinery to be constructed, in addition to that needed for effecting the excavation. The great depth of water in which a portion of the work is to be done, and the exposed nature of some of the localities, have necessitated corresponding caution and deliberation in fixing the character of the apparatus to be selected, and have required machinery and vessels of unusual power and strength to be prepared. The prevalence of a devastating pestilence through the country bordering on the Gulf of Mexico has greatly retarded all operations in that section of country—officers, workmen and contractors, having alike been prostrated by it. The works advanced during the year, to the extent of the means available, are the breakwater at Richmond Island harbor, Maine; Portland harbor breakwater; Kennebunk piers; Marblehead sea-wall; Plymouth beach; preservation of Great Wood's Hole harbor; Hyannis breakwater; removal of Pot rock, Hellgate, New York; Delaware breakwater; works at Chester harbor; construction of steam-dredges, &c., for the Atlantic coast; opening a ship-channel from the Mississippi river to the Gulf of Mexico. Several of these are finished, but most of them need additional appropriations for their completion.

A statement of the progress made during the year upon each work follows:

Removing the rocks obstructing the navigation near Falls island, Cobscook bay, Maine.—The locality has been examined, and the removal of the obstructions decided on. A satisfactory proposition to execute the work by contract has not, however, thus far been received.

(For report of surveying officer, &c., see appendix A.)

Balance in treasury October 1, 1853	$4,800
Probable amount to be expended by 30th June, 1854	4,800
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	4,000

Breakwater at Owl's-head harbor, or at Rockland harbor, in Maine, as the War Department shall decide.—The two positions have been examined and surveyed, but no determination between them has yet been made—much difference of opinion existing as to the relative suitableness of the two places for the work and the comparative advantages which each offers for the protection of commerce. It is expected that the selection will be made in time for the completion of the breakwater during the next working season.

(For reports of the surveying officer, see appendix B.)

Balance in treasury 1st October, 1853	$14,800
Probable amount to be expended by 30th June, 1854	14,800
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	15,000

Survey in reference to the construction of a breakwater on the east side of the Island of Martinicus, Maine.—Several positions have been examined, and projects for the work based on the surveys are in hand, subject to the future action of Congress.

(For reports of surveying officers, see appendix C.)

Balance in treasury 1st October, 1853	$750

Improving the Kennebeck river from the United States arsenal wharf, in Augusta, Maine, to Lovejoy's narrows.—The river has been examined, and a project for its improvement prepared and approved. The great temporary demand for dredging machinery has caused bidders for the work to advance their prices much beyond its value. It is hoped that propositions will be obtained in season for next year's operations at reasonable rates.

(For report of survey and other documents, see appendix D.)

Balance in treasury October 1st, 1853....................	$5,800
Probable amount to be expended by 30th June, 1854......	5,800
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855..........................	6,500

Breakwater at Richmond Island harbor, Maine.—After seeking ineffectually for an equally efficient and more economical process for the execution of this work, the officer in charge finally determined to use stone for the entire breakwater. Accordingly, 7,000 tons of rock, varying from one-fourth of a ton to two and three tons, have been deposited within the line of the work, consuming the means applicable to it. The harbor is of importance not only to the commerce of Portland, but to that of the entire New England region. The work is at the height of low water in its mid-channel portion. It should be raised to six feet above high water throughout its whole extent.

(For report of officer in charge, see appendix E.)

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855..........................	$50,000

Repairing the breakwater in Portland harbor, Maine.—The means available for this work have been applied to it. The capping is still wanting for a length of 800 feet; the work is dangerous in its present condition, and the unfinished portion should be completed, for which purpose an estimate is furnished.

(For report of officer in charge, see appendix F.)

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855..........................	$8,000

Repairing the piers at Kennebunk, Maine.—The eastern pier has been prolonged to the Perch rocks, and thence in-shore about thirty feet; from whence it is continued to the sand hills by a catch sand of triangular frame-work.

The western pier has been repaired, and also connected with the sand hills by a similar catch sand. The "Hardinge wharf" has been raised above high tides, ballasted and repaired.

No further appropriation is asked.

(For report of officer in charge, see appendix G.)

Repairs of sea-wall at Marblehead, Massachusetts.—The sea-wall has been fully repaired with the old materials through its whole length, and is now as substantial as it ever was.

No additional appropriation is asked.

(For report of officer in charge, see appendix H.)

Protection of Great Brewster island, in the harbor of Boston, Massachusetts.—Work was resumed early in the spring and continued until August, when the want of an officer to take immediate direction rendered it advisable to close the operations, since when nothing has been done beyond what was necessary for the security of the unfinished work.

Thirteen hundred cubic yards of stone and concrete masonry have been laid, extending the sea-wall two hundred and fifty linear feet; the wall has been backed with earth, and a temporary wing has been formed for the protection of the unfinished work.

Balance in treasury 1st October, 1853	$18,100
Probable amount to be expended by 30th June, 1854	18,100
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	30,000

Protection of Lovell's island and sea-wall, on Deer island, Boston harbor, Massachusetts.—These works are in nearly the same condition as last year. They require some repairs.

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	$2,500

Survey in reference to the improvement of the harbor of Scituate, in connexion with the North river, Massachusetts.—The survey is completed, but other pressing avocations ot the officer in charge has delayed his investigation of the improvement desired. The maps of the survey, with a report examining into the feasibility of accomplishing the objects desired, will shortly be rendered.

Survey in reference to the construction of a breakwater at East Dennis, Barnstable bay, Massachusetts.—This survey is completed. The harbor of Dennis lies at the bottom of Cape Cod bay, about midway between Plymouth and Provincetown. Though much exposed, it is the only point between the two places where deep water approaches the shore; hence its suitableness as a site for a harbor of refuge against north and northeast blows, for vessels engaged in the commerce of Boston and the neighboring ports.

(For report of surveying officer, see appendix I.)

Balance in treasury October 1, 1853	$1,450

Repairing the injuries done to the government works on Plymouth beach in the great storm of 1851.—The beach which protects Plymouth harbor is weak, through an extent of nearly two miles, and subject to incursions of the waves in heavy gaves. In this extent, some six or seven breaches were formed by the gale of 1851. The most serious of these have been closed by a structure of triangular frames or brush fence, amounting in all to about 2,400 running feet, but upwards of 1,000 feet of breach yet remain unclosed. The whole weak portion, about 8,500 feet, should be protected by a brush fence, to complete which an appropriation is asked.

(For report of officer in charge, &c., see appendix K.)

Balance in treasury October 1, 1853 .... $4,000
Probable amount to be expended by June 30, 1854 4,000
Estimate of amount required to be appropriated for fiscal year
year ending June 30, 1855 13,000

Preservation of Cape Cod harbor, at or near Provincetown, Massachusetts.—The application of the same kind of protection heretofore employed, viz: checking the drifting of the sand, by planting beach grass in it, has been approved; but the delay in the passage of the necessary law, by the State of Massachusetts, granting the requisite jurisdiction over the land to the United States, has prevented the use of the last spring season for planting the grass. This will be done next year. The existing appropriation is reported by the engineer officer in charge as sufficient for the work.

(For report of officer in charge, &c., see appendix L.)

Balance in treasury October 1, 1853 .... $4,950
Probable amount to be expended by June 30, 1854 4,950

Preservation of Great Wood's Hole harbor, Massachusetts.—A rough stone wall, closing the northern and principal breach, about 300 feet wide, is completed. To protect the adjacent shore bank, and to close a small opening to the southward, a small addition to the present means is required.

(For report of officer in charge, &c., see appendix M.)

Balance in treasury October 1, 1853 .... $590
Probable amount to be expended by June 30, 1854 590
Estimate of amount required to be appropriated for fiscal year
ending June 30, 1855 2,000

Repairing the breakwater at Hyannis harbor, Massachusetts.—The breakwater has been rebuilt and levelled for a distance of 400 feet from the eastern head; 220 feet of this were finished by a solid capping of heavy split stone, on the 30th of September last, and the remaining 180 feet are now probably secured. This will exhaust the appropriation. 750 feet will then remain needing similar repairs, to effect which a further appropriation is necessary.

(For report of officer in charge, &c., see appendix N.)

Balance in treasury October 1, 1853 .... $1,500
Probable amount to be expended by June 30, 1854 1,500
Estimate of amount required to be appropriated for fiscal year
ending June 30, 1855 15,000

Survey of Taunton river and New Bedford harbor, Massachusetts.—*Taunton river.*—The survey is completed. It became necessary to withdraw the surveying officer for other duties before his report could be made, and to place the subject in the hands of another officer, whose report is expected to be ready for any action that Congress may take on the subject.

Balance in treasury October 1, 1853 .... $600

New Bedford harbor.—This survey shows that 18 feet of water can be brought, at low water, over the bar at the entrance of the estuary on which the city and opposite town of Fairhaven are situated; and that the same depth can be carried up, on the Fairhaven side, to opposite the lower end of New Bedford. From this point the channel of the city wharves does not afford much more than 10 feet of water. The navigation is constantly becoming worse, owing, it is believed, to the encroachments on the channel by wharf building, and to a bridge built within the present half-century across the estuary, and connecting the two places. This bridge, resting on extensive foundations of loose stone thrown overboard, greatly obstructs the flow of the tide up and down.

Besides a general commerce, this place is the port for 350 whale-ships, manned by over 10,000 seamen, and representing eight and a half millions of capital. The importance of arresting the further progress of the evil, and of affording this trade all necessary accommodation, is pressing. As the method most adapted to the existing state of things, the officer in charge considers that the foundations and piers of the bridge should be removed, and the wharves choaking the gorge between Fish island and the city taken away, so as to open a fair channel for the water next the town. This being done, to dredge a passage 200 feet wide, with a depth of 17 feet, from the foot of this channel to the deep water below the town. The cost of these operations, independent of the value of the bridge and wharf property, is estimated at $70,300.

(For report of officer in charge of survey, see appendix O.)

Removing obstructions near the mouth of Seekonk river, harbor of Providence, Rhode Island.—The law providing for removing a rock at this locality having been modified so as to admit of the removal of any obstructions thereat, a contract has been entered into for dredging a channel through the crook, under which about 12,000 cubic yards of sand and shells have been removed. By the last reports, about 5,000 yards more will be excavated, so as to afford a channel of ten feet depth at low water, with a width of one hundred and fifty feet. To complete the requisite improvement, this channel should be widened to two hundred and fifty feet, as it is now too narrow for the number of vessels frequenting the harbor.

(For report of officer in charge, &c., see appendix P.)

Balance in treasury 1st October, 1853	$1,750
Probable amount to be expended by 30th June, 1854	1,750
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855	5,000

Survey of the harbor of Providence, Rhode Island.—This survey is completed. In addition to the removal of the obstruction at the crook, the officer in charge recommends the excavation of a channel throughout the length of the inner harbor, which is now shoaling, and is too narrow and incommodious for its commerce at almost any stage of the tide. Such a channel, two hundred feet wide and affording nine feet depth at low water, would require the removal of about 270,000 cubic yards of matter, and would cost $67,500.

(For report of officer in charge of survey, see appendix B.)

Improvement of the harbor of Bridgeport, Connecticut.—A cut 100 feet wide has been made over the inner bar, requiring the excavation of 13,000 cubic yards of sand and gravel.

The machinery is placed at work on the outer bar, to make a corresponding cut there.

(For report of officer in charge, &c., see appendix Q.)

Balance in treasury 1st October, 1853	$5,500
Probable amount to be expended by 30th June, 1854	5,500
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855	22,000

Removing Middle rock, New Haven harbor, Connecticut.—A contract was made in November, 1852, by the officer in charge, with Mr. B. Maillefert, for the removal of this rock to the depth of seventeen feet at low water, for the amount of the appropriation. After firing thirty-six charges of powder upon it, Mr. Maillefert reported his inability to effect the reduction for the sum contracted for, and a new agreement was entered into with him to reduce the rock to the level of thirteen and a half feet for the amount of the appropriation; this being considered to be as large an amount of work as could be effected by any other plan of operations for the same sum of money. After firing fifty-four charges more, the contract was substantially abandoned by Mr. Maillefert, he having found that their effect was much less than he had anticipated. A survey of the locality has shown that there are two other rocks lying to the westward of the Middle rock, and nearly on a line with it and the southwest ledge, having on them fourteen and thirteen feet water, respectively, at low tide. The cost of removing all three to a depth of seventeen feet, is $72,000.

(For report of officer in charge, &c., see appendix R.)

Balance in treasury 1st October, 1853	$6,000

Survey of the harbor of Port Jefferson, New York, with reference to the improvement thereof.—This survey is completed. The harbor is a deep and large sheet of water, with lateral reservoirs opening into Long Island sound. The prevailing winds and currents act unfavorably upon the entrance, shoaling the water, and threatening to close it altogether. The situation of the present opening is such as to produce a winding and irregular direction in the tidal currents, and to impair their velocity. The officer in charge is of the opinion that, by collecting and directing all the water now running out on the ebb into a single channel, the inlet may be preserved from further deterioration, and its depth maintained. A new inlet is forming in a position more favorable to the harbor than the present. This will probably become the principal if not the only entrance, and seems to be the one most suitable to be confirmed by the efforts of art.

(For report of officer in charge of survey, see appendix S.)

Continuing the improvement of the navigation of the Hudson river above and below Albany, and not above Troy.—A careful survey and study of the river were made by the officer placed in charge of this improvement; after full consideration of which, he was authorized to apply the existing grant to the execution of the more urgent portions of his project. But at this time it became necessary to assign to this officer the execution of important military duties on the Rio Grande, and to place this, together with his other duties in New York, in the hands of another officer already much occupied with diversified labors. This change was necessarily a cause of delay. The officer however reports that, after due inquiry, he has received several propositions for the execution of the contemplated improvement, and that he confidently expects that he will be able to negotiate a contract with responsible parties in time to commence operations before the close of the season.

(For report of officer in charge, &c., see appendix T.)

Balance in treasury 1st October, 1853....................	$49,000
Probable amount to be expended by 30th June, 1854........	49,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855..........................	50,000

Further improvement of the harbor of New York by removing the rocks at Hellgate and Diamond reef, in the East river.—The work of reducing the rocks at Hellgate, which had previously been successfully prosecuted by public-spirited citizens of New York, passed into the hands of the government in October, 1852. A careful survey, made at that time, showed 18 feet 4 inches of water on the highest point of Pot rock at low tide. A similar survey now exhibits 22′ 4″ at the highest point, and the area of the rock, down to 24 feet, much diminished. The cost of this reduction is $17,622 65. For the further sum of $6,000 the officer in charge expects to destroy the rock above 24 feet water. The same method is believed to be applicable to all the rocks now obstructing the East river in that vicinity; and the engineer urges a liberal appropriation to be made to this object, so important to the commerce of this great port every day, and which, in case of war, will afford most desirable facility of egress and ingress for national ships.

(For report of officer in charge, &c., see appendix U.)

Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855..........................	$20,000

Removal of the bar at the junction of the Passaic and Hackensack rivers, in Newark bay, New Jersey.—It is designed to deepen the west channel (being the continuation of the channel of the river above through this bar) by about one and a half feet, with a width of three hundred feet. This will require the excavation of 100,000 cubic yards of matter. The present appropriation will be applied to obtaining a narrow channel of the desired depth, viz. 11′ 6″, which can be afterwards widened. A contract has been made for dredging this channel, the work to be completed this year, but the contractor has been dilatory in commencing. His dredging apparatus has been taken to the bay.

(For report of officer in charge, &c., see appendix V.)

Balance in treasury 1st October, 1853	$8,500
Probable amount to be expended by 30th June, 1854	8,500

Survey of the sand-bars in Newark bay, New Jersey.—The survey executed shows that, at the southern extremity of the bay, there is a bar, and also a rocky ledge, which obstruct the flow of the tide into it. It is of the first importance that these should be removed. Besides the bar at the juncture of the Passaic and Hackensack rivers, there are also oyster-beds in the bay channel, and a shoal forming in the bed of the former river. These should be dredged out. These improvements are estimated to cost twenty-five thousand dollars.

(For report of officer in charge of survey, see appendix V.)

Survey of Shewsbury river, New Jersey.—The river has been surveyed from its mouth, in New York bay, up to the junction of its two branches. The obstructions to its navigation are between these limits. This portion of the river flows parallel to the ocean shore, and is separated from it by a sand-beach of a few yards' width. Across this beach, in storms, the waves roll, loaded with sand, which is deposited in the channel of the river, forming obstructions, to be gradually removed by the scour of the ebb-tide of the stream. Sometimes the violence of the storm breaks the beach entirely away, producing a new inlet, that afterwards gradually moves along the beach down towards the original mouth of the river, which eventually becomes the outlet again. To prevent these incursions of the sea, the beach must be built up and widened. This should be done by forming parallel brush fences along it of the cedars growing in the neighborhood, and loading these with sand, to be dredged from the river, thus strengthening the beach and regulating the current by the same process. This work would require to be constantly watched, and the first injuries repaired.

(For report of survey by officer in charge, see appendix W.)

Survey of Cranberry inlet, New Jersey.—This survey is completed. Cranberry inlet, lying towards the northern end of Barnegat bay, has been closed for forty years. A recent attempt to open it, made by persons interested in the navigation, has shown that it is scarcely practicable to do so. The commerce of the bay now finds its outlet at Barnegat inlet, lying twenty miles to the southward—a difficult entrance, and one which adds considerably to the length and danger of most voyages, their destination being New York city. A canal, of two miles or less in length, would connect the head of Barnegat bay with the waters of Marrasquan river, and afford through its mouth a safe and easy access to the ocean for all vessels plying to the northward. This canal would be of small cost, and easily made. Its construction is recommended by the surveying officer as the most essential facility required by the commerce of a large portion of New Jersey. Some dredging in the bay and river is also desirable.

(For report of officer in charge of survey, see appendix X.)

Repairing the public works at Little Egg harbor, New Jersey.—An examination of this locality exhibited the fact that great and controlling natural changes were in progress, in consequence of which the works in question were almost swept away, and the locality they were designed to protect entirely changed in its character. The harbor, however, is not injured, nor its facilities of access impaired, nor is any reason for present apprehension apparent.

It is intended to make further investigations of this subject. In the interim no further appropriation is asked.

(For report of officer in charge, see appendix Y.)

Balance in treasury 1st October, 1853.................. $8,452

Continuation of the Delaware breakwater.—Nearly 7,000 tons of stone have been deposited upon the breakwater, raising 440 feet of unfinished work to its full height.

Six hundred and fifty-two feet of existing work are yet to be raised to the proper height, requiring 10,500 tons of stone to be deposited.

But a small portion of the ice-breaker has been brought up to the required height. About 25,000 tons of stone will complete this, and fill up the excavations that exist at the ends of both works. The officer in charge urges a liberal appropriation for the breakwater, which he regards as eminently national in its character; and expresses his confident belief that, by an alteration in the profile of its upper portion, a great saving can be effected, without prejudice to stability, and with some gain in point of appearance.

(For report of officer in charge, &c., see appendix Z.)

Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855.......................... $30,000

Construction of a harbor on the east side of Reedy island, Port Penn, Delaware.—The construction of an ice harbor requires two lines of obstructions, extending from the shore to deep water—one to turn the ebb, and the other the flood ice. The harbor designed for this position has five open isolated timber piers in each line; the outermost in about twenty-two feet water. Reedy island, as well as the bed of the river, is composed of soft mud to a great depth; hence it was necessary to drive piles to obtain a foundation for all preliminary objects, as store-houses, buildings, timber-sheds, truck-ways, engine platforms, &c. This has made the work of preparation both slow and costly. Four piers of the lower line are however finished, and the fifth is under way. It is expected that three piers of the upper line will also probably be finished this season. The total area of the finished harbor will be about twenty-four acres, more than half of which will afford over twelve feet water.

To finish the upper line of piers next season, an additional grant of $30,000 will be wanted.

(For report of officer in charge, see appendix A A.)

Balance in treasury 1st October, 1853....................	$8,090
Probable amount to be expended by 30th June, 1854........	8,090
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855..........................	30,000

Repairing the piers and improving the harbor of New Castle, Delaware.—So far as is expedient, the repairs of the old work in this harbor are in progress.

A pier is about to be built in the prolongation of the New Castle and Frenchtown Railroad Company's wharf, for the purpose of protecting the harbor from the effects of flood ice. This is all the present appropriation will effect. It will leave an indifferently sheltered harbor. The national importance of the position is considered to require a spacious and well-protected harbor; and towards this result additional appropriation is asked.

(For report of officer in charge, see appendix B B.)

Balance in treasury 1st October, 1853....................	$13,500
Probable amount to be expended by 30th June, 1854.......	13,500
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855...........................	15,000

Repairs of the works at the harbor of Chester, on the Delaware river.—The repairs were all completed in June last, under a contract, and the work has been well and thoroughly executed. No further appropriation is needed.

(For report of officer in charge, see appendix C C.)

Improvement of the Patapsco river, from Fort McHenry to the mouth of said river.—In consequence of the non-completion, within the specified time, of the steam-dredge and appurtenances, authorized by Congress to be built for the waters of the Chesapeake bay, &c., but little work has been done by the government in the improvement of the Patapsco river up to this date; the dredge is finished and in operation, working in conjunction with the new steam-dredge recently built by the authorites of the city of Baltimore, for the purpose of improving the navigation of said river.

In order to carry out the minimum system of the improvement of this river as projected, it is proposed to apply to it two additional steam-dredges, ten scows, and a steam-tug for towing the scows to the place of deposit for the excavated matter.

(For report of officer in charge, &c., see appendix D D.)

Balance in treasury 1st October, 1853....................	$19,500
Probable amount to be expended by 30th June, 1854.......	19,500
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855...........................	10,000

Removing obstructions at the mouth of the Susquehannah river near Havre de Grace, Maryland.—The great demand for dredging apparatus during the year has prevented a contract being entered into for the commencement of the removal of these obstructions.

Should the government build a machine, the work can be completed for three-fourths of the cost of doing it by contract, inclusive of the amount to be paid for the apparatus. To effect the improvement (in this way) in accordance with the approved project of the officer in charge, will require the sum of $45,000. If this idea be not sanctioned by Congress, resort will be had to contracts with the owners of dredging machinery, and as much work accomplished with present means as possible.

(For report of officer in charge, &c., see appendix E E.)

Balance in treasury 1st October, 1853	$9,900
Probable amount to be expended by 30th June, 1854	9,900
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855	35,000

Construction of a steam-dredge, equipment, and discharging scows for the waters of the Chesapeake bay and Atlantic coast.—Measures were taken by correspondence, and by examination of the most approved dredges in operation near Philadelphia, New York, and Albany, to obtain a plan of machine best adapted to digging in deep water and in exposed situations.

A suitable machine and scows were contracted for; their completion was delayed by the difficulty of procuring lumber and mechanics; they are now in operation in the improvement of the Patapsco river.

With a view to economy and efficiency, two dredges and a tug, needed for the improvement of the Patapsco river, are proposed to be constructed for the general service of the Atlantic coast; they can thus be applied from point to point as most needed.

(For report, &c., see appendix F F.)

Balance in treasury 1st October, 1853	$4,000
Probable amount to be expended by 30th June, 1854	4,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	50,000

Improvement of the James and Appomattox rivers below the cities of Richmond and Petersburg, Virginia—James river.—With the assistance of the coast survey, a minute examination of the rocky foundation of the bars in the river, near Richmond, has been made, from which it results that, by the aid of dredging, fifteen feet water can be carried to the city wharves at Rockett's at high water.

A contract has been entered into for an approved and suitable dredging machine, and operations will be commenced as soon after its delivery as practicable, in the manner proposed by the local engineer.

(For report, &c., see appendix G G.)

Balance in treasury 1st October, 1853	$18,750
Probable amount to be expended by 30th June, 1854	18,750
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	50,000

Appomattox river.—Under a contract made in June last, work has been commenced for the improvement of this river; but in consequence of various delays, and the absence of a suitable dredging machine, but little progress has been made. Arrangements are now being made by the contractor for a new and efficient machine, and it is hoped the work will soon go on satisfactorily.

To continue the work an additional appropriation is asked.

(For report of officer in charge, &c., see appendix H H.)

Balance in treasury 1st October, 1853	$18,750
Probable amount to be expended by 30th June, 1854	18,750
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	50,000

Survey of the Rappahannock river, Virginia.—The survey of this river, with a view to its improvement, has been busily prosecuted by officers of the coast survey during the past summer. The project for the improvement will be presented as soon as all necessary information is obtained.

Re-opening a communication between Albemarle sound, North Carolina, and the Atlantic ocean, by the construction of a breakwater across Croatan sound.—On a very careful examination of all the local circumstances, by the engineer officer in charge, it was thought best to suspend the construction of the breakwater provided for by the law, for the present, at any rate, and to commence by opening the inlet by artificial means; after this, to build two piers—one on each side of the opening—for its preservation. It is believed that the breakwater will be found unnecessary, and as it would be a very costly structure, it should be dispensed with if possible. But the present appropriation is, by its terms, applicable only to the construction of a breakwater, and the law should therefore be so modified as to admit of the use of the grant for the general purposes of the improvement. To open the inlet to a depth of eight feet, at high water, will cost, it is estimated, $250,000; and the officer in charge asks the appropriation of $200,000 for the purpose, in addition to the existing grant, which should also be made applicable to the designed works of improvement. The present estimates for harbor and river improvements being kept down to the sums granted by the act of 30th August, 1852, this proposition of the officer is not adopted in the estimates; but the department would consider it very advantageous, if this work is to be prosecuted, to grant the whole sum at once.

(For report of officer in charge, &c., see appendix I I.)

Balance in treasury 1st October, 1853	$49,700
Probable amount to be expended by 30th June, 1854	49,700
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855	50,000

Completing the improvement of Washington harbor, North Carolina.—The appropriation for this work has been applied, in part, to the removal of stumps and logs from the channel of the river a little below the town. Those stumps only are removed which come within eight feet of the surface, and within one hundred and fifty feet of the centre of the channel. It is expected that the existing grant will suffice to complete the improvement.

(For report of officer in charge, &c., see appendix K K)

Improving Cape Fear river at and below Wilmington, North Carolina.—In accordance with the authorized plan of improvement, attention has first been given to the protection of Baldhead point, on the east side of the main entrance to the river, by the construction of jettees projecting from the shore. This work is producing the best effects. The city of Wilmington has contributed $60,000 to the improvements. The engineer in charge is confirmed by his observations, in the opinion of the commission, that on the due execution to completion of the plan proposed by them, the main bar of the Cape Fear river will be restored to its original capacity in 1738, of about twenty feet at high water.

(For report of commission, &c., see appendix L L.)

Balance in treasury 1st October, 1853	$12,000
Probable amount to be expended by 30th June, 1854	12,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	50,000

Survey of the harbor of Georgetown, South Carolina.—An arrangement for the execution of the survey was entered into by the officer in charge with the superintendent of the coast survey. The field-work is understood to be complete; the charts and reports have not reached the engineer, who, in consequence, is not yet able to offer a project of improvement.

Improvement of the harbor of Charleston, South Carolina.—The officer in charge of the improvement repaired to his station as soon as the health of the district warranted his doing so. His views, with those of the commission on the subject, being submitted to the board of engineers, were approved, and he was authorized to carry the project into execution. The character of the work, and the exposure of the site of the improvement, necessitate the greatest strength in the machinery designed to be used, and corresponding care in planning and preparing the apparatus.

Regarding the improvement as of great importance to their commerce, the city council of Charleston have provided a fund of $30,000, to be applied, under the care of the government officer, to the furtherance of the work.

Measures are accordingly in hand for the construction of powerful machinery, and its application, as far as the means provided will allow.

(For the report of the commission and other documents, see appendix M M.)

Balance in treasury 1st October, 1853	$48,100
Probable amount to be expended by 30th June, 1854	48,100
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	70,000

Dike to Drunken Dick shoal, Charleston harbor, South Carolina.—The work is suspended during the progress of the excavation of the channel in its vicinity.

Removal of obstructions in the Savannah river at a place called the Wrecks, and the improvement of the navigation of said river.—The commission appointed last year on this improvement, having presented a project therefor, it was duly confirmed, and the officer in charge instructed to proceed with the execution of the works contemplated. A contract for dredging has been accordingly entered into, under which work is in progress, and machinery and materials are in process of collection for closing and deflecting dikes.

(For report of the commission and other papers, see appendix N N.)

Balance in treasury 1st October, 1853	$26,000
Probable amount to be expended by 30th June, 1854	26,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	70,000

Survey of the river Ocmulgee, Georgia.—The officer to whom this survey was intrusted is now executing it.

Survey of the river Savannah, from Savannah to Augusta, Georgia.—The survey was undertaken as soon as the more pressing duties of the officer, and the subsidence of freshet in the river, would allow. The field-work is completed, and the maps of the survey are in course of preparation. The principal obstructions to navigation are sand-bars, snags and timber-rafts, and rapid currents. The officer in charge proposes to open the navigation by means of a vessel to be propelled by steam, and fitted both for dredging and removing the obstructing timber. The cost of the work is estimated at $55,000.

(For report of surveying officer, see appendix O O.)

Survey of the following rivers in Georgia, viz: the Flint up to Albany, and the Chattahoochie up to Columbus.—These surveys have been made.

Chattahoochie.—The falls at Columbus limit the navigation from the Gulf of Mexico; below there the river is navigable for steamers of considerable size, except in the low stage of water, when smaller steamers are employed until the water falls below twenty-four inches, when batteaux only can be used. With seven feet or upwards the navigation is safe and easy. The impediments, in a low and medium stage, are snags, rocks, sand-bars and overhanging trees. Of these, the snags are most formidable and dangerous; they occupy every variety of position and locality—old ones are said to change their places, and new ones are planted. The other obstacles are few in number, and when once known can be avoided.

The means required for removing the snags are simple, and the cost will be inconsiderable compared with the results. Including those about the banks, their number is about nine hundred. The rocks obstructing the channels occur in seven localities; they require to be blasted and scattered over the bottom. There are but two sand-bars over which the channel requires to be improved, the amount of deepening needed being eighteen inches and six inches respectively. This it is proposed to effect by wing-dams. The hanging trees must be cut away. These improvements should be effected simultaneously and as rapidly as possible. The total cost is estimated at $30,000.

(For report of surveying officer, see appendix P P.)

Flint river.—The head of navigation, for the present, is at Albany; to open it further up, even for small steamers, it would be necessary to remove several shoals. With more than six feet of water, the navigation is easy and safe, there being but one snag, and no overhanging trees, from Albany to the mouth. When the water falls below six feet, the navigation becomes impeded by detached shoals, consisting of boulders, varying in size from a few inches to three or four feet, and sand accumulated among them.

With a channel-way forty feet wide and thirty inches deep, in the droughts of summer, the navigation could always be continued in small steamers, and this depth would be sufficient for the business of that season. To effect it, it will be necessary to remove the loose rocks and cut through the limestones in a few places, the greatest excavation required being fifteen inches.

The improvement is estimated to cost $12,000.

(For report of surveying officer, see appendix Q Q.)

Repairs of sea-wall, St. Augustine, Florida.—The defects needing repair are cavities in the foundation, which has separated from the superstructure, undermining of the enrockment, and a general loss of pointing.

The work of repair is in progress, and the means in hand are sufficient for the purpose.

Filling in behind the United States sea-wall in the harbor of St. Augustine, Florida.—Operations have been delayed by the difficulties of obtaining lumber with which to build the scows needed for this work. This lumber having recently been received, two large scows have been constructed. The work is expected henceforward to progress regularly to completion.

No further appropriation is needed.

(For report of officer in charge, see appendix R R.)

Improvement of the river St. John's, Florida.—This, the principal river of Florida, has a depth of water from the bar at its mouth to Jacksonville of twelve to fifteen feet; whence to Pilatka, ten to twelve feet may be carried; the whole distance being about 100 miles. The country is gradually settling up, the river affording the outlet to the productions of the eastern section of the peninsula, and being the site of nearly all its saw-mills—a great and increasing branch of commerce. Any ship-canal or railroad for the transit of the peninsula will probably have its eastern termination on this river.

There is but slight obstruction to navigation within the 100 miles specified above. The difficulty lies in the bar, at the mouth. This bar is of hard sand, and affords but seven feet water, with a constant liability to change, from storms. The great object to be attained is to deepen the passage into the river and make it permanent. The attention of persons interested has been directed to this point, and one matured and specific plan for effecting this has been offered. The originator has great confidence in its success, and it does not involve a large expenditure; while the officer in charge, who has carefully and minutely examined the localities, cannot look to this plan as promising a satisfactory result. He finds himself unable to present any other with confidence, and desires that the subject may be given to the deliberations of a commission of scientific and experienced persons, whose determinations may be expected to afford a plan of improvement, the best that the case will admit of, and one in which all who are interested will acquiesce. It is hoped that this course, delayed by the unavoidable absence of persons whom it is very important to have on the commission, will soon be carried out.

(For report of surveying officer, see appendix S S.)

Balance in treasury 1st October, 1853	$7,958 35

Connecting the waters of the Indian river and Mosquito lagoon, at the Haulover, Florida.—A contract for digging such a canal, between the river and lagoon, as the means would afford, was entered into, and the work is just completed. To give the banks of the excavation a gentle slope, and place the whole in a condition favorable to permanence, an additional grant is needed.

(For report of officer in charge, see appendix T T.)

Balance in treasury 1st October, 1853	$4,600
Probable amount to be expended by 30th June, 1854	4,600
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	5,000

Improvement of the harbor of Mobile, Alabama, at Dog River bar, and the Choctaw pass.—Through the excellent charts of the coast survey and by the personal observations of the engineer in charge, ample information in regard to this improvement was soon obtained.

Contracts for a powerful dredger and the necessary scows have been made, and another contract for the excavation of a large amount of obstructing matter has been entered into.

The raging of the epidemic on the Gulf coast has delayed the completion of the dredger, which, however, is probably ready at this time; on its delivery, the work of excavation will at once be commenced. Under the contract for this purpose, it is expected that a depth of channel of ten feet at low tide will be obtained.

To complete the contemplated improvement, which requires a depth of twelve feet, an additional appropriation will be needed.

(For report of officer in charge, &c., see appendix U U.)

Balance in treasury October 1, 1853	$22,463
Probable amount to be expended by 30th June, 1854	22,463
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	40,000

For survey of East Pascagoula river, Mississippi.—The officer to whom this survey was confided visited the river, and probably completed the survey; but no report was received from him. He was burdened with an overpressure of duties, by his zeal and laboriousness in the discharge of which he was kept within the region through which the recent epidemic raged with unprecedented fury, and to this he fell a victim, after seeing his household nearly desolated by its ravages.

The survey will be completed as soon as an officer can be provided for its execution.

Balance in treasury 1st October, 1853	$4,000
Probable amount to be expended by 30th June, 1854	4,000

Construction of a harbor on Lake Pontchartrain, near the city of New Orleans.—Under the plan proposed by the commission for an artificial harbor at this point, as large a portion of the work as the appropriation will complete is in progress, and its early completion is anticipated. The middle row of piles of the projected line of shelter is driven for a length of 1,000 feet, and the string pieces have been bolted on; about half of the piles of the inner row are driven, and all those of the fender for the same length of work. Bad weather and the raging epidemic have prevented more rapid progress. The appropriation will suffice to construct about 1,600 feet.

(For report of commission, &c., see appendix V V.)

Balance in treasury 1st October, 1853	$20,000
Probable amount to be expended by 30th June, 1854	20,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855	25,000

Opening a ship-channel of sufficient capacity to accommodate the wants of commerce through the most convenient pass leading from the Mississippi river into the Gulf of Mexico.—This channel has been completed, with a depth of 18 feet and a width of 300 feet at low tide, as required by the contract made with two of the New Orleans towboat companies by the late Secretary of War. The contractors having notified the officer in charge of the work that it would be ready for final inspection at a date within the limit specified in the contract, it was accordingly so inspected on the 8th November ultimo, by Brevet Majors Beauregard and Reynolds, as a board constituted for the purpose by the War Department. After a careful and thorough inspection, the board report their opinion that the contractors have fully complied with all the conditions of their contract, having excavated a channel, which is straight and of the required dimensions. A map exhibiting the position, dimensions, and soundings of the channel is in preparation by them.

They express the opinion that, from the nature of the river, it is more than probable that unless annual appropriations are made to keep open the present channel, it will ere long fill up again to about its original depth; and they advise that a *bell buoy* should be established at the entrance of the pass, near one of the outside buoys, to direct the pilots in dark nights and foggy weather.

The channel itself will be marked by buoys, put down in accordance with the directions of the Light-house board.

(For report of commission, &c., see appendix W W.)

Survey in reference to removal of obstructions to the navigation of Bayou La Fourche, Louisiana.—The survey made shows that the obstructions to the navigation consist of great numbers of snags which project above low water, and for the distance of eighteen miles almost entirely prohibit the passage of steamboats during the summer and fall months. They are about sixty miles below the upper end of the bayou, in the vicinity of the intersection of the "La Fourche and Barataria canal" with the bayou.

To remove these snags and sunken logs to the depth of five feet below low water would probably require the service of a good snag-boat during two working seasons, the estimated cost of which is $31,500, inclusive of the boat at $14,000.

This appropriation is urged by the residents on the stream, not only as a grant for the benefit of its commerce, but also on the ground of a claim to have the obstructions removed, which were deposited in it for the defence of New Orleans during the war of 1812–'15.

(For report of surveying officer, see appendix X X.)

Balance in treasury 1st October, 1853.................. $1,500

Surveys of the harbors at Sabine, Galveston, Paso Cavallo, Velasco, Brasos de Santiago, and Corpus Christi, and the rivers Sabine, Brasos, and Trinity, Texas.—These have been executed, except the survey of the Brasos river. *Sabine harbor.*—The improvement desired is the opening of a new and direct channel in place of the present crooked one, which cannot be navigated by a steamer. The bottom being of soft mud, a steamship drawing ten feet can readily pass.

The cost of the improvement, including $4,500 for the half cost of dredging machine, to be used also on the river, will be.. $7,000

(For report of surveying officer, see appendix Y Y.)

Galveston harbor.—The bar of this harbor is distant from land, and probably not susceptible of improvement. Additional facilities for crossing it at night and in bad weather are needed.

The extremity of Galveston island is cutting away, and the adjacent channel has filled up from thirty to twelve feet. To arrest this injurious action, a breakwater should be thrown out from the east end of the island; preliminary to which there should be several months' careful observations on the tides, currents, and winds, by an intelligent person; for which purpose an appropriation is asked.

Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855, for continuing the survey of Galveston and other harbors in Texas................. $4,000

(For report of surveying officer, see appendix Z Z.)

Paso Cavallo harbor.—The bar at the mouth of this harbor is, next to Galveston, the best on the coast; eight and a half feet water can generally be had by waiting a few hours; the channel is straight, and the bar is smoother than those to the south. The bar, as also the shoals from Decrow's point to the channel, is very changeable. The anchorage is good under Pelican island, and also between the middle ground and the west shoal.

(For report of surveying officer, see appendix A B.)

Harbor of Velasco.—Velasco is at the mouth of the Brasos river. There is good holding ground both within and without the bar. The bar of sand is very shifting, with a depth of 4½ to 6 feet water. Constantly changed by storms in position and depth, no mode of permanent improvement presents itself.

(For report of surveying officer, see appendix A C.)

Brasos de Santiago harbor.—The bar of this harbor is probably the roughest on the coast of Texas. In fall, winter, and spring, it may be depended on for 8 feet; in summer, it is sometimes as shoal as 6½ to 7 feet. The anchorage outside is excellent, in about 8 fathoms blue clay. The harbor within is large enough for all the trade now carried on through it.

The channel from Brasos to Point Isabel can be depended on for 3½ feet, which is sufficient for the lighters running between the two places.

The bar of the Rio Grande averages about 4 feet, but is often less than 3½ feet. After violent storms there have been found 7½ feet for a short time. This bar is very shifting.

(For report of surveying officer, see appendix A B.)

Corpus Christi harbor.—This harbor is the most open and unobstructed on the coast of Texas; the difficulty is in entering it. There are two entrances, viz: Corpus Christi pass and Corpus Christi bayou; the latter is the entrance used. The bayou has from 7 to 11 feet water, but is obstructed at both ends. The surveying officer recommends that the channel be deepened over these obstructions to 5 feet, which require the removal of 15,000 cubic yards of mud and 1,500 of shelly matter.

(For report of surveying officer, see appendix A B.)

Sabine river.—This river is 738 miles in length, from the Gulf of Mexico to Belgord, Texas, the head of navigation. Rocky shoals and sand-bars render an attempt to procure a low-water navigation above Belgrade—distant 178 miles from the Gulf—inexpedient, if not impracticable.

The obstructions to navigation consist of leaning trees, occasional rafts, snags, large logs, abrupt turns, "narrows," and rocky shoals; all of which can be removed without difficulty, and the river be improved in a thorough and permanent manner, so as to afford a low-water navigation at all times up to Belgrade, and the use of the river for the most important six months of the year the whole distance of 738 miles to Belgord.

The total cost of the improvement, including $4,500 for a dredge-boat, to be used also in Sabine harbor, and $14,000 for a snag-boat, is estimated at	$152,750
For the improvement up to Belgrade the cost will be (inclusive of $18,500 for machinery)	53,000

(For report of surveying officer, see appendix Y Y.)

Brasos river.—The survey of this river has been delayed by the varied demands for other duties upon the officer having it in charge, and hindered by the prevalence of yellow fever and his own sickness of the disease. The survey is expected to be accomplished in a short time.

Improvement of the navigation of the Colorado river, Texas.—The snag-boat heretofore used in the improvement of this river was obtained by the United States in July last, and has been repaired for use. Part of her machinery had to be sent to New Orleans for repair; difficulties consequent upon the ravages of the pestilence there and in Texas, prevented an early completion of the repairs.

The vessel is launched and waiting a crew.

The wood-cutters sent to the Colorado in August, to provide fuel for the boat, became sickly and were discharged.

Balance in treasury 1st October, 1853....................	$14,000
Probable amount to be expended by 30th June, 1854.......	14,000
Estimate of amount required to be appropriated for fiscal year ending 30th June, 1855..............................	10,000

(For report of officer in charge, see appendix A D.)

Trinity river.—This river is practicable for steamboats during high water for about 600 miles, during low water for about 100. The obstacles to its navigation are overhanging timber, snags, and the bar at its mouth. This last is the great difficulty. The surveying officer presents a plan, but with hesitation, for providing a depth of 5 feet over the bar, which is ample for the purposes of the river. The obstructions in the river can be easily removed. The country depending on the river is rich, and its production rapidly increasing from the immense emigration of planters to its fertile lands.

(For report of surveying officer, see appendix A E.)

Balance in treasury 1st October, 1853......................	$1,500

Survey of the San Antonio river, Texas.—It appears from the survey made of this river that it rises about four miles above the city of San Antonio; from which place to Goliad its improvement is almost impracticable, and is not looked for by the people.

From Goliad to the sea the bed is of coarse sand, and extremely uniform in width and depth. The banks have a steep slope, and the river flows through a level prairie country. The width of the stream is from one hundred to one hundred and fifty feet, and the depth varies from three feet to twelve.

The principal obstructions are a fall two miles below Goliad, a raft at the head of Fagan's island, and another at the fork of the mouths of the river; and the overhanging timber with which the banks abound, for a distance of eighty miles.

The rock causing the falls is soft limestone, and may be cut away to the required depth of three feet at low water with axes.

Both rafts being afloat, they can be easily removed by the use of suitable machinery, such as is now in the Colorado.

The overhanging trees should be cut down.

The cost of these improvements, securing a channel of three feet at low water from Goliad to the mouth, is estimated at $19,300, including $10,000 for a snag-boat.

(For report of surveying officer, see appendix A F.)

Balance in treasury 1st October, 1853 .... $1,500

WASHINGTON AQUEDUCT.

Supply of water for the cities of Washington and Georgetown.—The surveys have been made, plans proposed and adopted by the President. The right of way to some portion of the aqueduct line has been acquired, and machinery prepared. Quarters for laborers and mechanics, and storehouses at the Great Falls, are in progress. Tools are provided, and arrangements made for commencing the work; and such a final location is in progress as will enable it to be put under contract as fast as the right of way can be acquired.

Balance in treasury 1st October, 1853	$79,000
Probable amount to be expended by 30th June, 1854	79,000
Estimate of amount required to be appropriated for the fiscal year ending 30th June, 1855	1,000,000

(For report of officer in charge, see appendix A G.)

All which is respectfully submitted.

J. G. TOTTEN,
Brevet Brigadier General and Col. Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

APPENDIX TO REPORT OF CHIEF ENGINEER.

APPENDIX A.

AUGUSTA, MAINE, *February* 2, 1853.

SIR: I have to transmit herewith a report on "removing the rocks obstructing the navigation near Falls island, Cobscook bay, Maine." I ask for an appropriation of $1,200, in addition to the sum of $5,000 already appropriated for this operation.

I have the honor to be, sir, very respectfully, your obedient servant,

JOHN NEWTON,
Lieutenant of Engineers.

REPORT AND ESTIMATE OF "REMOVING THE ROCKS OBSTRUCTING THE NAVIGATION NEAR FALLS ISLAND, COBSCOOK BAY, MAINE."

Map 1 gives the general representation of that part of the State in which the proposed site for improvement is situated.

Map 2 represents the country in the immediate neighborhood of "Falls island."

The two passes, one on each side of "Falls island," which connect the two principal divisions of "Cobscock bay," are of small dimensions. This, taken in connexion with the great rise and fall of the tide, gives such velocity to the current as to render navigation dangerous, and in the direction opposite to the tide current, impossible.

The two channels are obstructed with many ledges of rock, the most formidable and dangerous of which are the "High-tide" and "Half-tide" ledges in the north, and the "Two-hour" rock in the south channel. These obstructions are marked respectively, A, B, and C, in map 2. The summit of the "High-tide" rock is about level with the high water of a low course of tides. That of the "Half-tide" is 3½ feet lower than the preceding. The "Two-hour" rock is covered at two hours' flood.

A low course of tides gives 14½ feet rise and fall; the highest tide known was 27½ feet; the average rise and fall is about 20 feet.

The south channel is alone used by the vessels navigating Cobscook bay, the passage being made on the flood and ebb tides, near the time of high water. The north channel is never used, except by small vessels and boats, at certain stages of the tide.

Four modes of improvement suggest themselves, viz: the removal of A and B, that of B and C, that of C, and finally that of B.

Solid contents of A = 6,780 cubic yards.	From the report of Lieutenant Colonel Long, September 20, 1837.
Do....do..... B = 2,076 ....do....	
Do....do..... C = 2,212 ....do....	

The first two plans are considered too costly; the third, if carried into effect, would still leave the south channel obstructed by "Fox island" and "Whitney rock," the presence of which renders the pass dangerous, and even impracticable, in many directions of the wind. The fourth is therefore recommended, as making the north channel practicable during certain directions of the wind, while the south channel might still be used in the event of winds unfavorable to a passage through the former. This improvement made, it is to be observed that vessels would seldom or never be detained, or debarred a passage through one or the other channel.

A vessel bound up would reach the "Falls" a little before high water, when the force of the current is much diminished; after passing this place, she might reach either Whitney or Dennysville on the same tide, owing to the increased lateness of the hour of high water, as you proceed up the bay.

If the "Half-tide" rock be taken away to a depth of 10½ feet, which would bring it on a level with the low water of a low course of tides, or 14 feet below the summit of the "High-tide" rock, it is considered that a vessel drawing 10 feet of water could pass with safety one hour before high water.

Estimated cost of removing the "Half-tide rock," 190 feet long and 60 feet wide.

1,986 days drilling rock, at \$1 25	\$2,482 50
271 days splitting, at \$1 25	338 75
680 days removing, at \$1 25	850 00
sharpening tools	211 00
120 days of overseer, at \$3 50	420 00
2,500 pounds of powder, at 10 cents	250 00
10,000 feet of safety fuse	40 00
Steel	100 00
Tin canisters to contain charges	120 00
Contingencies	1,187 75
	6,000 00

Total estimated cost between \$5,000 and \$6,000. The depth of water around the rock is very great.

The population of the district benefited by the proposed improvement is about 4,000; number of saws, about 19; value of lumber manufactured, \$105,000 per annum. The lumber is principally small; number of large class schooners engaged in trade, is 10. Ship building is carried on to a small extent; and manufactures, for which the water power of this region affords a good chance, are entirely in the future. Bark and fuel would be exported if the navigation was improved.

All of which is respectfully submitted.

JOHN NEWTON,
Lieutenant of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington.

APPENDIX A—1.

ENGINEER DEPARTMENT,
Washington, February 18, 1852.

SIR: The board of engineers for river and harbor improvements have considered the project of Lieutenant Newton, corps of engineers, for the removal of the rocks obstructing the navigation near Falls island, Cobscook bay, Maine, and approve it, with the recommendation that, as an object of national importance, the additional appropriation necessary for the completion of the work be made by Congress.

The winter season being adverse to exposed work in the latitude of Maine, I propose, with your approval, to instruct him to commence work in the spring; and should a contract be found to promise more economical results than day's work, he will be directed to prepare such proposals as will invite the attention of bidders, and these will be issued from this department. The work to be done by drilling, splitting, and blasting.

The report of Lieutenant Newton, with two maps, and the approval of the board of engineers, are submitted herewith.

Very respectfully, your most obedient servant,

JOS. G. TOTTEN,
Brevet Brig. Gen. and Col. of Engineers.

Hon. C. M. CONRAD,
Secretary of War.

Approved February 22, 1853.

C. M. CONRAD, *Secretary of War.*

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX B.

ROCKLAND, MAINE,
December 1, 1852.

SIR: In obedience to circular of November 16th from the Engineer department, I transmit report on Rockland and Owl's-head harbor, with approximate estimate of the cost of a breakwater at the former of the above localities; also, report on the rocks obstructing the navigation of Cobscook bay, Maine, with approximate estimate for the removal of the same. I am obliged, for want of time or paper to copy, to transmit the map of Rockland harbor, with the request to have it copied and returned at the earliest convenience of the department.

As soon as I can make a reconnoissance of Martinicus island and the Kennebeck river, reports will be furnished for these localities.

Circular of November 16th was not received until my return from Cobscook bay, on the 25th.

I have the honor to be, sir, &c., &c.,

J. NEWTON,
Lieutenant of Engineers

COBSCOOK BAY.

With respect to the rocks obstructing the navigation of Cobscook bay, near Falls island, it is to be remarked that these occur in the two narrow channels (separated from each other by this island) which connect the two principal sheets of water into which Cobscook bay is divided.

Owing to the great rise and fall of the tide in the western part of the bay—which may be stated at twenty feet, on an average—a large volume of water is forced through these narrow passes, with such velocity as to render all navigation in a direction opposed to the current impassable. But the great obstacle to the transit of vessels consists in the presence of certain rocks in the north and south channels, which make the currents exceedingly winding, and increase the chances of loss of vessel and life.

Rafts and the smallest class of vessels use the north channel, and this only in the downward passage.

The south channel is used in the up and down passage by the large vessels—about eight or ten in number—which of late years have begun to transport lumber, &c., from Dennysville, Whitney, and the other places on the western branch of Cobscook bay.

It is proposed to remove two rocks marked "A" and "B" in the map of this locality. The former is called the "High-tide rock," from being just covered by the high water of a low course of tides, and the latter the "Half-tide rock," because its summit is a lttle above the level of mid-tide.

The "Half-tide rock" is the most dangerous, because the current setting directly over it during a part of the tide renders it impossible to be cleared.

If the "High-tide rock" be afterward removed, it is supposed that the current will pass straight through the channel, and the navigation be rendered safe and expeditious.

The project of improving the north instead of the south channel, is based upon its being the shortest and most direct passage up and down.

Estimate.

Removal of rock "A" to a level 17 feet below its summit, being 6,780 cubic yards, at $2 50	$16,955
Removal of rock "B" to the same level, being 2,076 cubic yards, at $2 50	5,190
Total for improvement of north channel	22,145

In the south channel is the "Two-hour rock," marked "C," which derives its name from being exposed at two hours ebb, and which is dangerous, for the same causes that have been mentioned in respect to the "Half-tide rock." Vessels bound up, attempting to pass between this ledge and the island, often lose the wind, from the interposition of the high ground and the great rapidity of the current, and run the risk of being lost upon it. The rock "C" being inaccurately placed in the map, has been marked in its correct position in pencil.

It is the opinion of some entitled to weight that the removal of the "Half-tide rock" would sufficiently improve the north channel, and after this operation that it would be more advantageous to attempt that of the "Two-hour rock." Although I do not concur in this view, I yet think it desirable to remove the "Half-tide rock" first, and then, by the effect of this operation upon the navigation of the north channel, judge whether a further sum of money would be most advantageously employed in the north or in the south channels.

Removal of rock "C," being 2,212 cubic yards, at $2 50.... $5,530

I have relied for the cubic contents of these several rocks upon Lieutenant J. F. Cooper's report, and am indebted to his map of Cobscook bay, and to personal observation, for my information in relation thereto.

In case that the rock "C" were not removed, it would be necessary to mark it with a buoy or spindle.

The same is rcommended with respect to the rock near Leighton's point, (see map "B.")

Not thinking it advisable to commence work with less than $10,000, I request a further appropriation of $5,000.

OWL'S-HEAD HARBOR,

So styled from a cape of the same name, is a narrow pass of an average width of six hundred yards, and of little more than a mile in length; bounded on one side by the coast of Maine, and on the other by Munroe and Sheep islands.

It is completely shielded from all winds traversing the Atlantic, between E. and S. by W., by the interposition of Munroe and Sheep islands. Following in the same order, Ash island breaks the force of the winds between S. by W. and S. W. by S., allowing a rake of only three miles. From the last named point of the compass to N. E. by N. ½ N., the main land affords entire security. It thus appears that the harbor is protected by nature from winds at all points of the compass, with the exception of the angle between N. E. by N. ½ N. and E. The winds on this exposed quarter blow down Penobscot bay, with an average rake of twenty-two miles, until they get around as far easterly as E. N. E. ¼ N. From this last direction to E. the interposition of the Fox islands diminishes the rake to eight or nine miles.

The winds thus having access into the harbor, are the longest in their duration, and the most destructive in their effects, of any prevailing on this coast, and vessels lying here, and exposed to the heavy swell caused by them, frequently part their moorings and go ashore. The bottom is generally good holding ground; though the portion under the lee of the proposed breakwater, in map B, is represented to be greatly cut up, and consequently much impaired for the purpose of anchorage. The channel-way affords a good bottom; but vessels selecting this position are exposed to the full rake of storms, and are, besides, in the way of others running in for shelter.

ROCKLAND HARBOR,

Contiguous to that of Owl's-head, and situated at the S. W. extremity of Penobscot bay, is an indentation of the coast formed by the two headlands of Owl's-head and Jameson's point. It is the only harbor for the larger class of vessels between Townsend and Belfast, embracing an extent of coast of nearly seventy-five miles. These headlands are two miles nine hundred yards from each other, and may be said to form the entrance to the harbor, which is thereby exposed to the winds that range from N. N. E. to S. S. E. The wind being E. N. E., traverses twenty to thirty miles of the Penobscot bay before entering the harbor, which, with the great depth of water, occasions a very heavy sea. When the winds are more easterly the sea is less, on account of the interposition of the Fox islands, which, in the direction due E., are only eight or nine miles distant from the entrance to the harbor. When E. by S., or E. S. E., or near these points, a heavy sea is thrown in from the ocean, which is said to be more destructive than any other to which the bottom is exposed, though it passes into the harbor in a rather indirect manner, between the Fox and Munroe islands. These winds bring in a vast body of water, with a heavy ground swell, washing the wharves and causing vessels to drag their anchors. These storms are fortunately neither frequent nor long in their duration; so that winds from the N. of E. may be said to be, on the whole, the most hurtful to which this place is exposed. The harbor is accessible with all winds as long as a vessel can carry sail, and is free from obstructions, with the exceptions now to be named: A, called the N. ledge, of very small extent, having three or four feet over it at low water; and P, called the S. ledge, five or six feet. Besides these, there are several rocks along the line of shoal, making it unsafe for vessels drawing over ten feet to pass at low water. It would be well to have A and P marked in some manner, though the same is not necessary along the shoal, since the coasters do not draw as much water as ten feet. The bottom is a blue clay, and forms a most excellent holding ground; to this cause, and the fact of being furnished with superior ground tackle, it may be attributed that few of the vessels owned in Rockland drag their anchors or part their moorings.

Comparison of the relative merits of Owl's-head and Rockland harbors as a site for the proposed breakwater.

A sketch of the routes of the coasting fleet of the Penobscot bay and river may not here be amiss, (vide Blunt's chart.) Vessels bound down the bay can take the Muscle Ledge channel or the east channel. The former, which may be said to have been heretofore the only, and is even to this day the most frequented, extends from Owl's-head to Whitehead. After passing Owl's-head about three miles, the remaining portion of it is interrupted with numerous small islands and sunken rocks, rendering it sometimes unsafe for those best acquainted with its marks, and at all times impracticable for strangers. With a head wind and contrary tide, vessels are often unable to beat through, and are compelled to anchor. The east channel, between Munroe and Fox islands, is broad and remarkably free from obstructions; so that vessels detained among Muscle ledges, by the causes above enumerated, might proceed to their destination by steering into the east channel.

Vessels bound from Portland, Boston, New York, and the south, back into the bay, make Martinicus Rock light or Manhegan light; in the former case they take the east channel; and in the latter, after making Whitehead light, they may follow either the east or the Muscle Ledge channel. Vessels preferring the east channel need only a certain indication of having passed Two Bush island, to enable them to lay a straight course up Penobscot bay, and this even in thick weather, when it would be impossible for them to pick their way through the Muscle ledge. Ships and square-rigged vessels generally, together with the large class of coasters, prefer, for the reasons above given, the broad and open channel; but the greater number of coasters, from a strong adherence to custom, take the other, especially during the inclement season, though there is no safe harbor along its entire length to justify this partiality. Herring gut, which is a good though small harbor, lying to the west of Whitehead, is equally accessible, whether the one or the other be followed.

I have conversed with intelligent shipmasters on this subject, and I think as the east channel becomes better known and marked out it will be more and more frequented, to the diminution of the number of those who will take the other. Vessels running down the bay, with a storm threatening from the usual quarter, after passing Rockland and Owl's-head, find no safe harbor until they reach Herring gut, fifteen miles distant from the latter place; but this place being small is often crowded, and incapable of holding more; so that they are obliged to continue their course more than fifteen miles to Townsend, which furnishes a safe and spacious anchoring ground. Again, vessels bound up the bay, with a storm threatening, would not leave Townsend or Herring gut unless there was a good harbor at Rockland or Owl's-head. There is, therefore, a manifest impediment to safe and expeditious navigation from the absence of some protection at one of these places.

There is no circumstance with which I am acquainted, or if there be it is a very unusual one, which would enable a vessel to anchor under a breakwater at Owl's-head without the possibility of reaching Rockland. The plea that Rockland is a little more out of the direct track of vessels, is met by the fact, that those anchored here often get under way after a storm, and pass others in Owl's-head harbor either at anchor or about to start; the reason being that the spacious sheet of water in the former allows facilities for this operation, which the confined limits of the latter cannot afford to vessels huddled together in a small space. To illustrate this, suppose a storm from E. N. E. to have swept down the bay, but the wind, after having lulled so as to make it safe to venture out, still blows freshly, a vessel at Rockland can proceed on her course for Portland; but the same vessel, if at Owl's-head, might be surrounded with others bound up the bay, but unable or unwilling to get out in the face of the wind, the conclusion is manifest, she must await their movements.

A breakwater at Owl's-head, to fulfil the condition of making a harbor, ought at least to have the length given to it in map B. The maximum space protected by this structure would be determined by drawing a line through the end of it, along the general direction of the channel, for the reason, that a more favorable direction of the wind, as for instance along the line joining the Head with the extremity of the breakwater, would throw a heavy sea and a large amount of water, in an oblique direction, between the bold shores of Munroe island and the latter point; which circumstance would of course cause a great spread in the action of the water as soon as the compression was relieved.

The minimum space has been determined by drawing a line through the extremity of the breakwater and a point, distant, say one hundred and fifty yards from the north point of Munroe island. The area thus protected is seven acres. The protection afforded to shipping may be put at an average area of twenty-five acres.

It is my opinion that a breakwater in Owl's-head will impede navigation in proportion to the refuge afforded by it in time of storms. The width of the passage is diminished, and the velocity of the current increased to such an extent as to delay vessels which are going in or out, and meet those winds that are of frequent occurrence on this coast; a habit of stopping in the harbor for trifling causes will have the effect of delaying other vessels, which may not thereby have room to work through.

Beside the protection to general commerce by a breakwater at Rockland, there is a large local interest involved in this matter. Three hundred vessels, coasters and fishing craft, are owned here, and about two hundred more are estimated as trading with the place. Rockland, from a very small village, has grown into a large town of seven thousand inhabitants within the space of ten years, and is deservedly considered one of the most flourishing places in Maine. Its prosperity flows from a source which will probably not fail it, to wit: the manufacture of lime. The number of barrels of lime manufactured is now one million per annum; for the burning of which seventy thousand cords of wood are required.

The value of property annually afloat, and consequently exposed, is—

1,000,000 barrels lime, at 80 cents	$800,000
70,000 cords of wood, at $3	210,000
	1,010,000

To this must be added the value of the vessels.

Beside the support of its own population, Rockland supplies a large back country, and by this induces other branches of trade, which are continually augmenting. In fine, Rockland is increasing rapidly, and bids fair to increase for a long time.

In severe winters the harbor is sometimes obstructed with ice; but this is a point of but little practical importance—the duration of this obstruction short; the trade of Penobscot bay is arrested at the same time. New York, Boston, and other ports, from which coasters are expected, have previously been closed; and, finally, the number of coasters engaged in the winter trade is comparatively small.

For the above reason I recommend Rockland harbor as the site for the proposed breakwater.

In the comparisons of soundings made by myself, with those made at the time of the survey in 1835, it will be observed that there is a difference of one fathom. This may, as far as can be ascertained, be attributed to three causes: the great difference in the high and low water observed at the two periods; the positions chosen for the tide-gauges—that of the former survey being at Owl's-head, while the one used by me was placed in Rockland harbor; and finally, the practice which the coasters had, until prohibited by law during the present year, of throwing over the ballast after each trip.

The surface of the shoal is generally hard, and is supposed to be underlaid with rock; but I consider it necessary, before work be commenced, to make a thorough survey and examination of this locality.

There is not current sufficient in the harbor to be taken into calculation; and it is not probable that the erection of a breakwater will alter the bottom.

The breakwater is three hundred yards in length, and covers an average area of fifty acres. It has been designed of the minimum length, in my opinion, to subserve a useful purpose.

82,682 cubic yards of stone, in pieces ¼ to 2¼ tons and upwards, at $1 33	$110,242
11,625 cubic yards of sea-wall, in blocks of 2 tons and upwards, at $4	46,500
Add $\frac{1}{7}$ for contingencies	22,391
Total cost	179,133

The breakwater would answer a better purpose by being made four hundred yards long.

There is a difference in the views of the present report and of those made by the officers intrusted with the survey of Owl's-head harbor in 1836 and '37, but the great variation in the present circumstances of the case are sufficient to account for it.

Respectfully submitted.

JOHN NEWTON,
Lieutenant of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington.

APPENDIX C.

Augusta, Maine, *December* 17, 1852.

Sir: Pursuant with instructions of circular of the 16th ultimo, I sited Martinicus island, and made such measurements as were necessary in order to obtain a tolerable approximation to the cost of a breakwater upon its east shore.

The enclosed map is suitable only to give a general idea of the locality, in respect to its exposure to stormy winds, and its adaptation to the purposes of a place of refuge for vessels.

As will be perceived, the "cove" is exposed to storms coming in any direction from N. N. E. to S. S. E. On the east side it is partially protected by Indian ledge, the summit of this being about twenty feet above the level of highest tides. On the south it is bounded by Dexter's ledge, which is just covered at highest water. The depth of water when the tide is out is perceived to be too little to keep the vessels which may chance to be within the enclosure completely afloat. For this reason it is not now used as an anchorage during storms.

The "harbor" is exclusively used for this purpose; but, owing to its great exposure, vessels lying here during a gale are obliged to be attached to several anchors, and are generally abandoned by their crews to the chances of riding it out. This place is too narrow to afford a chance for swinging in the event of a change of wind; and it cannot, by the erection of any structure, be so land-locked as to make it safe to moor vessels side by side.

The "cove" is therefore preferred, notwithstanding its little depth of water; and it is supposed that a breakwater, constructed as represented on the map, will so shelter the space enclosed by it as to make it safe for vessels to lie there aground during the prevalence of the most violent storms.

I do not think, from the examination I was enabled to give to the east side of the island, that any position preferable to the one recommended in this report could be found, the improvement of which would also lie within the limits of a wise economy.

A common course of tides average twelve feet in rise and fall, while the highest may be put at fifteen feet.

There is an abundance of rock along the shores of the "cove," and around the circumference of the island, to supply all the different specifications of stone needed for the breakwater.

Approximate estimate.

North branch of breakwater from shore to Indian ledge—

1,900 cubic yards of sea-wall, at \$3 33⅓	\$7,333	
12,815 cubic yards of rough stone, at \$1	12,815	
		\$20,148

South branch of breakwater from Indian ledge to Dexter's ledge—

1,200 cubic yards of sea-wall, at \$3 33⅓	4,000	
8,647 cubic yards of rough stone, at \$1	8,647	
		12,647

Estimate of a wall along the west profile of the south branch, for the pupose of mooring a vessel under shelter, when it cannot, at time of low water, be run into the "cove," viz:	
144 cubic yards, at \$3 33⅓	\$480
Contingencies	5,000
Total	38,275

Martinicus island is about fifteen miles from Owl's-head, and directly in the track of many eastern and provincial coasters.

The fisheries in its neighborhood give employment to about fifty vessels during portions of the spring and fall, and to a greater number during the summer.

The island is about two miles long and one wide, containing from two to three hundred inhabitants. Twenty fishing vessels, averaging twenty-five tons each, are owned by them.

The above statements, bearing upon the question of the necessity of making a secure harbor somewhere on the island, have been furnished by persons residing there; and they further state that, under present circumstances, they are compelled to send away their vessels to winter elsewhere; and that, from the inconvenience to which the want of a harbor subjects them, they are debarred from embarking in the fishing business to the extent they would otherwise be enabled to do.

Respectfully submitted.

J. NEWTON,
Lieut. of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington.

Mem.—I think it proper to state that the above views are to be held in subjection to the information which a survey, carried on for a short time in the spring, may furnish in this particular, viz: the exact nature of the bottom—whether the rock, in many places, be not nearly exposed. For, from what I hear and infer, a large body of water will be thrown over the top of the breakwater, causing more or less agitation on the interior. It might make a great difference whether a vessel aground was working upon a body of sand several feet thick, or upon a rock nearly exposed.

J. NEWTON,
Lieut. of Engineers.

APPENDIX D.

Augusta, Maine, *December* 26, 1852.

Sir: Pursuant with instructions of circular of 16th ultimo, I give herewith an estimate, based upon the result of my inquiries, of the cost of improving the Kennebeck river from the United States arsenal wharf, in Augusta, Maine, to Lovejoy's narrows. This information, derived from various sources, although in the main consistent with itself, cannot be regarded as the best means of arriving at data for an estimate of cost. The results obtained must, therefore, be regarded in the light of approximations, more or less in accordance with the truth.

Since the date of Colonel Long's report, (September 20, 1837,) the citizens of Augusta have, at an expense to themselves of $9,500, attempted, in the course of the year 1845 or 1846, to dredge a suitable channel from the city to Shepard's point. Although their design was not effectually carried out, the result has, nevertheless, been regarded as beneficial to their shipping business.

The channel through the Gauge shoal was made 80 feet wide, while that through the Brits shoal had only 60 feet given to it. Through these two shoals it was intended to secure a low-water depth of 7 feet, but it was found upon trial impossible to accomplish this result without running into expense unforeseen in the beginning. The surface of the water above and below these places must have been of different levels, and it is easy to perceive that large obstructions like these bars must have operated as dams, and retained the water above them at a higher level. When, therefore, they were pierced, the low-water mark was found to become lower, while the high-water mark remained about the same level as before.

The debris, it is said, instead of having been removed to a safe distance from the excavations, was placed near the edges, the effect of which has probably been that rafts of logs and cakes of ice have swept back some portion of it. I should judge that the refilling from all causes has amounted to 1½ feet.

The Mill-brook shoal was excavated so as to give a water way 60 feet wide and 7 feet deep at low water. It is proposed to increase the width of the channels at this place and at the Brits shoal to 70 feet, and to excavate for a depth of 1 foot, in addition, through the Gauge and Brits shoals.

Estimated cost.. $4,500

Just below Shepard's point an excavation, as nearly as possible in the same line with the one already executed, should be made, of a width of 70 feet, and of a low-water depth of 7 feet. This, it is further recommended, should be undertaken before all other improvements of the river.

Lower down another excavation, 70 feet wide and 7½ feet deep at low water, through the Hussy shoal, will be found advantageous.

These, together with the removal of several small ends of bars, constitute all the improvements considered necessary between Shepard's point and Gardiner.

Estimated cost.. $8,300

Between Gardiner and Lovejoy's narrows the only obstructions brought to light by my inquiries are the sands below Nahumkeg island, having over them at present 7 feet at low water. It is proposed to excavate a space through them 100 feet wide and 1½ feet deep.

Estimated cost.. $200

Total estimated cost, between................. $13,000 and $17,000

The composition of the several bars and shoals enumerated is a mixture of gravel and sand, with and in them boulders.

There were taken a great many boulders of all sizes from the Gauge shoal, some of which, though very few in number, amounted to several tons in weight. Not so many were found in the Brits, and fewer still in the Mill-brook shoal.

Below Shepard's point it is said that one direction assumed for an excavated channel will carry it through a deposit of gravel, while another will lead through a mud formation.

The Hussy shoal is said to be composed of gravel, varying from ¼ to 5 inches in diameter.

The "sands," below Nahumkeg island, are composed of much finer materials than the preceding; they are probably entirely of sand, and are said not to shift.

The excavation through the Mill-brook shoal has not perceptibly changed in depth after the lapse of seven years; and although the channels through the Gauge and Brits shoals have, during the same time, filled 1½ feet, it may fairly be presumed that the piling up of the debris not far from the edge of the excavation will, in some measure, account for this.

I am not now prepared to recommend any *permanent* system of improvement, neither does it appear how this could be effected without a great expense; but I think that a dug-out channel through the several bars may be estimated to endure for seven or ten years.

A wing-dam, as indicated in the enclosed map, may be found of great utility in making the channel of easy access to vessels going down the river, as it would throw the current directly into its opening.

Respectfully submitted.

J. NEWTON,
Lieutenant of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington.

APPENDIX E.

Portland, *November* 30, 1852.

Sir: In answer to Engineer department circular, of November 16th, I have the honor to submit the following report of estimates:

Breakwater at Richmond Island harbor.

A glance at the coast survey chart of this harbor leads to the inference that Richmond island was once connected with the main land. But a few years since, the passage could be made to the island, dry-footed, at low water; now, at mean low tides, the water-way is nearly 200 yards wide, and has an average depth of three feet. In the setting in of the tides around the east and west points of the island, there is a tendency to still-water on a line from the interior salient of the island to the opposite shore salient, as indicated by the partial bar formed, while to the right and left of this line the water deepens rapidly. It is probable that this sand ridge would collect, were it not for the prevalence of east winds, which gives to the westerly flowing currents predominance over the easterly. The heavy waves of the prevailing storms add their force to that of the currents, to remove the bar as fast as it is formed. But if the natural tendency to deposition along this minimum line could be so assisted by artificial processes as to prevent the retrogressive effects of the prevalent northeast, east and southeast gales of winter, I doubt not that a permanent bar to the island would be raised above the sea. According to the distribution for Portland breakwater, only $5,000 will be available from the present appropriation for the work at Richmond island. My plans in connexion with this position are by no means matured. If this fund is not increased before next summer, I propose to expend it in raising (for the whole length of the bar, from shore to shore) an obstacle secure against storms, and as high as can be attained with the expenditure. I have not yet determined the absolute character of this barrier, whether it will be stone or wood, or a union of the two materials. The estimate is for a stone structure, (which will, doubtless, be best for the deeper part,) as per figures. [See Sketch B, at the end of the volume.]

Of course, the exact forms of the cross sections could not be accurately followed. On the contrary, the stone would be placed, directly from the lighters, into their position, according to their apparent fitness, while the vessel would lie aground. These stone should be very large, but not long, like dimension building stone, nor flat, like flagging stone, but rather prisms, cubes, and any irregular stone, which are abundant in quarries, and can be obtained for a small price above the transportation. The inshore portion of this wall would only require one layer of heavy stone, carried beyond the high-water line. The amount of stone required for this work will be about 4,000 cubic yards, which, at $1 25 per cubic yard, would be $5,000.

If this wall, thus constructed, should act as a catch-sand and form a bar to its level, another appropriation of equal amount would be sufficient to put a similar wall above this, which would rise above the highest tides. But as this second wall will be deeper, and ought to be broader on top, and rise some two or three feet above the highest tide, the next appropriation ought to be rather increased. I think $10,000 should be asked for; and if any money should be left after the stone structure should be finished, it would constitute a reserve fund, for promoting the formation of a beach and cultivating the beach grass.

Now, by the process of throwing in stone continuously, until the structure rises out of the water, (supposing the top surface to be three yards wide and the side slopes two-thirds,) 22,000 cubic yards of stone would be consumed, at a cost of $27,000.

If the cheapness of the construction would not decide, as between the two methods, in favor of the former, the want of available funds seems to necessitate such choice. The greater importance of the Richmond Island breakwater, as compared with the extension of that in

Portland harbor, induces me to prefer the former, in asking for appropriations for the next fiscal year.

Very respectfully, your obedient servant,

Z. B. TOWER,
Brev. Major of Engineers.

Brev. Brig. Gen. JOSEPH G. TOTTEN,
Chief Engineer, Washington, D. C.

APPENDIX E—1.

ENGINEER DEPARTMENT,
Washington, January 13, 1853.

SIR: I have the honor to submit herewith, for your consideration, copies of the reports of Brevet Major Tower, corps of engineers, and of the board of engineers of river and harbor improvements, in relation to a breakwater at Richmond Island harbor, Maine.

The board approve of Major Tower's project to connect the island with the main land, but think the connexion may be effected with greater advantage, and at less expense, by means of a brush wall secured by piles driven into the bottom, than by a stone wall as proposed by Major Tower.

A further examination will be necessary to show whether it will be practicable to make use of piles, as proposed. I will, with your approbation, first instruct Major Tower to make such examination as will enable the question of the proper material to be decided, and then direct him to proceed with the execution of the work.

Should a contract be found the best method of carrying on the operations, the advertisements necessary to elicit offers will be prepared and issued from this department.

A coast survey chart of the locality is furnished with this communication.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bvt. Brig. Gen. and Col. of Engineers.

Hon. C. M. CONRAD,
Secretary of War.

Approved January 19, 1853.

C. M. CONRAD,
Secretary of War.

The officer was directed to carry the foregoing project, as approved, into execution accordingly.

APPENDIX E—2.

PORTLAND, *February* 14, 1853.

SIR: I have the honor to submit the following remarks relative to the Richmond Island breakwater:

Prior to my general report, I considered various combinations of wood and stone for this structure, and, among others, a triangular frame-work filled in with ballast, extending across the deep water, and finished towards either shore by an enrockment. This system seemed to me one of the best that could be devised; but since it would involve an expenditure of more than twice the appropriation, I did not deem it necessary to lay plans and estimates before the Board of Engineers. A dike, with a medium batter 25 feet wide in the deepest water, decreasing in width towards either shore, made of alternate layers of fascines and stones, would probably, if constructed slowly, as the sand became filled up on each side, effect the end desired. But to build it at once to the level of high water, would require more funds than are available; nor would it then be secure against winter storms, unless modified by constructing the upper half entirely of stone.

Two rows of piles braced crosswise, placed ten feet apart in the channel and five feet at the half-tide line, and filled in with ballast, would doubtless endure long enough to be buried in sand. The piles would diminish the amount of stone required, and would prevent the damage to which a simple enrockment, so exposed to the surf, must necessarily be subjected. The means at hand would raise this dike to the level of half tide, making it equivalent to the stone structure previously recommended. As these various methods were open to the same objection, viz: the want of means to complete them, I concluded to adopt the stone enrockment, as the easiest of construction, knowing that it could be left at any stage of its progress without fear of other injury than the displacing some of the top stones by the waves.

During storms, the surf upon the Richmond Island bar must act with great force against any structure placed there. Nor can it be expected that, during the summer months, the sand will be banked sufficiently on each side of the breakwater to give it very much additional strength to withstand the autumn gales. And even though the crest of the sand formation should be successfully raised to the high-water level, unless supported by a solid core it would always be liable to serious damages. That part of Plymouth beach formed by the aid of triangular frames, placed side by side and ballasted with stone, has stood for twenty years; while other parts, though quite wide above the high-water plane, have been entirely broken through, and are liable to the same injuries at any moment.

The above remarks, however, do not lie against the use of a cheaper material than stone for the base of the breakwater in question. After sending my report on this subject, my attention was again called to a combination of stone and wood for the proposed structure, so that I determined to recommend placing a thick layer of trees for the lower part of the dike, the upper part being formed of ballast stones. This system, against which I apprehend the difficulty of construction might be urged as a serious objection, is exemplified upon the accompanying sheet of drawings. I know that it will be extremely difficult to hold so large a mass of brush together until weighted with stone, without the aid of a row of piles placed, say ten feet apart, across the channel; but with the assistance of these piles the construction would be very easy. Spruce trees, from twenty to thirty feet in length, are abundant in this vicinity, and would not cost more than two dollars a dozen delivered upon the bar. Allowing $1,000 for the cost of these trees placed in position, would leave a balance of $4,000 to be applied in building the stone part of the structure. I do not doubt that ballast for this purpose can be obtained from the island, where it abounds, for fifty cents per ton, or at most for a dollar per yard. Should the sand pile up five feet high across the channel and two feet on the bar, before the autumn gales set in, the breakwater would probaby stand.

The plan which the Board of Engineers request me to report upon, I presume, contemplates the driving of two rows of piles, and the filling up of the intervening space with trees and brush. A dike thus built, with piles strongly braced together, and with a sufficient weight of stone upon the brush to compact it and overcome its buoyancy, would probably endure the winter gales, provided the summer surf had previously piled up sand some four or five feet on each side of the wall. But if the piles are not well braced, and if the sand does not pack up more than two or three feet in the channel, I fear that the structure will be too slight to withstand the shock of the waves during the severe storms which are so numerous in this latitude. Doubtless it would be the safer method to raise the brush wall between the piles no higher than the half-tide level the first summer, leaving the remaining portion to be finished the next working season. If the Board of Engineers think this pile and brush structure, raised at once above high water, promises sufficient solidity, I recommend that it be built thus: drive two rows of piles, fifteen feet distant, in the deepest water, twelve feet apart where they cross the low-water line, and ten feet at the ends, in five feet soundings. The piles of each row, placed five feet distant from centre to centre, should be driven to a depth of ten feet, if possible, and project five feet above the high-water plane. The first three or four feet of the brush wall should be formed of spruce trees, placed crosswise, and projecting beyond the piles, the butts and tops alternating. In the remaining portion they may be laid lengthwise, principally, with a sufficient number of cross branches to tie the mass together. Stone enough should be placed on these trees to compact them and hold them in place. The piles ought to be capped across in pairs. They may be tied together in a less costly way by the aid of strips of plank three inches thick and eight inches wide, or by spruce poles five inches in diameter, spiked to the piles. I do not think it necessary to continue the pile structure so far towards either shore as it is drawn upon the plan forwarded. 650 piles will construct 1,620 feet of the dike; the remaining parts can be built more cheaply of brush covered with stone.

650 piles braced together, at $3, will cost	$1,950
The spruce trees required	800
1,600 cubic yards of stone	1,600

Contingencies—office expenses, superintendence, &c....	$250
Reserve fund....	400
	5,000

The Richmond Island bar has changed somewhat since the coast survey map was made. The channel opening was widened. The part D′ E (see general plan) sounding from eight inches to one foot at low tide. The line of shoal water has assumed the directions represented by the red lines, and I presume before next summer it will be again modified, more nearly approaching the black-dotted curve. The bar is formed of a coarser material than ordinary beach sand, very different from that which shows on the bottom through the shoal water. The slopes of the bar—gentle towards the east, and more steep on the other side—seem to indicate that this material is moved forward to its present position by the waves rolling westward. One would look for this result, both from the configuration of the coast line and the prevalence of east winds; because during these winds the waves of the ocean must make a circuit between the island and main land, sweeping the shore, and carrying the debris directly forward to the bar, until they meet the other waves coming around the west point of the island. These last waves strike the bar obliquely, and not being pent between two strips of land, are less charged with shore-washings. Now, when the breakwater is finished, I do not doubt that the east side will bank up with sand quite rapidly; but the action on the west side may be very variable under favorable circumstances, tending to form a bank against the base of the structure, which at another time may be entirely swept away. For this reason, perhaps the structure first recommended, modified by placing a layer of trees between two and three feet thick on the bar, and rising to a low-water level in the channel under the enrockment, would be quite as durable as any other equally cheap. The pile construction can be built to the high-tide plane for the funds available; but, since there is no certainty that this breakwater will receive much strength from a sand bank on the western side, perhaps it would be unsafe to expose so great a height to the waves. If carried only to the level of half tide, I think it would be secure.

I have tested the bar with an iron rod. Commencing on the island side at the ordinary high-water mark, the rod was forced down 12 feet; 100 yards further towards the channel, the rod was stopped at the depth of 4 feet by a hard, stony, and sandy formation, visible on either side at extreme low water. At a distance of 150 yards from the first trial, the rod was arrested on the crest of the bar at 3 feet depth. But at both these trial places, near the low-water line, the bar was forced through this hard crust to depths of 12 and 8 feet respectively; on the other side of the channel, at the water's edge, the rod having been forced down 3½ feet was stopped by the hard bed of the sea; 75 yards further up, the iron bar sunk to a depth of 6 feet before reaching the same formation. I do not think any rock underlies this bar within the reach of piles driven 10 feet. The men employed to make these trials have been accustomed to pile-driving for years, and it is their opinion that they may be driven at this place. Taking into account the difficulty of forcing them down, as well as the delays oc casioned by the surf upon the bar and the rising and falling of the tides, these piles driven will probably cost quite up to the price set down in the estimate. Should the pile structure be adopted, I would advertise in the two Portland papers thus: "Proposals for driving 650 piles, in two rows, across the channel between Richmond island and the main land, and towards either shore, till the end piles stand in five feet water during full tides, will be received till April 1, 1853. Also, proposals (the price per 1,000 feet being stated) for filling in between these piles with brush and spruce trees, from 10 to 30 feet in length, and for continuing the brush wall from the ends of the pile structure to each shore. Also, proposals per ton and per cubic yard for transporting large ballast or rubble stone from Richmond island, or from any other place, to cover over this brush wall; 1,600 cubic yards or 2,400 tons of stone will be wanted for this purpose. For further information, direct to Brevet Major Z. B. Tower, U. S. army, Portland, Maine."

Respectfully submitted.

Z. B. TOWER,
Brevet Major of Engineers.

Brevet Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX F.

Portland, Maine, *November* 30, 1852.

Sir: In answer to Engineer department circular of November 16th, I have the honor to submit the following report of estimates:

For breakwater at Richmond Island harbor, and repairing the breakwater at Portland harbor, Maine.

The breakwater in Portland harbor commences at Fury point, Cape Elizabeth, and extends 1,900 feet in length to the north and east, nearly parallel to the opposite shore, or Portland range of wharves. It interposes a permanent barrier to the heavy ocean swell, which, rolling in through the harbor entrance, spreads its volume of waters to the left, and onwards to the inner anchorage and line of piers. Except for that part of the harbor which lies towards Portland bridge, this breakwater is of little utility as against east gales, which create secondary waves of considerable force within the harbor range, some two and a half miles in length. There is no barrier, however, to the high winds and waves from the northeast, which, sweeping down through the passageway between Hog island and the main land, pass unopposed over the entire length of the inner anchoring ground. A breakwater at Fish point, the northeast salient of Munjoy, would partly cover the harbor in this direction; but, owing to the great depth of water off this point, such construction would involve enormous expenditures, and would only be justified under the plea of absolute necessity—a necessity which does not exist. The manner of improving the existing breakwater seems the present question for discussion under the late appropriation. If a line be drawn tangent to the south end of House island, and through the northeast end of the breakwater, it will meet the range of Portland piers at the Atlantic depôt. The wharves at this point are already the centre of a large business, and they promise soon to be the most important part altogether of the pier line; yet, situated on or without the covering line of the breakwater and House island, they are by far the most exposed part of the whole range of docks. The same reasons that justified the primary construction, can now be urged for its extension. Unfortunately the water is so much deeper as to render this prolongation of the sea-wall barrier very expensive. I can only give my opinion, that extending the present breakwater one hundred and twenty yards further to the northeast, would be a benefit to the inner anchorage and opposite line of wharves; leaving it for those interested to urge their claims for the requisite appropriations.

Estimate for extending Portland Harbor breakwater.

[See Sketch C, at the end of the volume.]

100 yards long, according to cross section, would give 13,777 cubic yards, at $1 20	$16,533
Top courses of split stone, 100 yards, by 9½ by 4 feet = 42,222 cubic yards, at $3 50	1,478
Amount required to extend Portland harbor 100 yards	18,011

Estimate for repairing Portland Harbor breakwater.

One thousand four hundred and forty feet of this structure have been completed, formed of ballast stone, below the reference twelve feet, and surmounted with a split-stone wall nine and a half feet wide by four feet high. The remaining portion, 860 running feet, is somewhat broken up on the top, an effect due to storms and ice. It needs repairs, and ought to be finished with a top wall for permanency.

860 feet of top wall, 9½ feet wide by 4 feet high = 1,210 cubic yards, at $3 50	$4,235
For finishing the end of the breakwater, placing the stone with care for future security and permanency, and for repairing other portions of the work injured, will require 300 tons stone, laid at $1	300
Contingencies, as increase of prices and extra labor	465
	5,000

This amount of $5,000 required for repairing Portland Harbor breakwater, is available from the appropriation recently passed by Congress.

* * * * * * *

Very respectfully, your obedient servant,

Z. B. TOWER,
Brevet Major of Engineers.

Brev. Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX F—1.

ENGINEER DEPARTMENT,
Washington, January 13, 1853.

SIR: Brevet Major Tower, corps of engineers, in charge of the repairs of the breakwater in Portland harbor, Maine, has submitted a proposition to finish the incomplete portion of the breakwater, which has been somewhat broken up by storms and ice, by putting on it a top wall of split stone, similar to that which now surmounts the finished portion of the work.

The board of engineers of river and harbor improvements approve of this proposition,

Major Tower further suggests an extension of the breakwater, to afford additional benefit to the harbor; but the board of engineers dissent from this, and prefer a pier-head to be constructed instead of such extension.

I have the honor to propose, for your approval, that I be authorized to instruct Major Tower to execute the repairs of the existing work, as the present appropriation will suffice for this purpose; and if he thinks these repairs may best be made by contract, he will be directed to prepare a suitable advertisement to produce the necessary competition, which will be issued from this office.

The proper mode of affording additional protection to the harbor, in respect to which the board and Major Tower differ, will be a question for consideration, in the event of an appropriation being made by Congress for that purpose.

A copy of Major Tower's report, with a map of Portland harbor, and the report of the board of engineers, are submitted herewith.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brevet Brig. Gen. and Colonel of Engineers.

Hon. C. M. CONRAD,
Secretary of War.

Approved January 18, 1853.

C. M. CONRAD, *Secretary of War.*

The officer was instructed to carry the project, as approved, into execution accordingly.

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APPENDIX F—2.

PORTLAND, MAINE, *January* 17, 1853.

SIR: I have the honor to submit the following report upon the Portland harbor and Richmond island breakwaters, with the accompanying drawings.

Portland Harbor breakwater.

Ten thousand dollars have been appropriated jointly for this breakwater and for that proposed to connect Richmond island with the main land. As it devolves upon me to recommend the distribution of this fund, I have decided, after investigating the results to be attained thereby, that $5,000 can be judiciously expended upon each construction. The harbor of Portland is entirely land-locked, and is less exposed than many more important harbors upon which the general government has expended nothing. The present breakwater was commenced some years since, after a very severe storm, attended by an extraordinary rise of the tides. These storm tides overflowed the wharves, and even removed two or three light tenements. On representation of the damages then sustained, an appropriation for the present structure was granted. Yet I question the efficiency of this work as a protection against another storm of the same severity, attended by an equal rise of waters. Breakwaters are a very efficient cover of anchoring grounds, and afford excellent protection to all kinds of shipping that seek refuge behind them, and they are indispensably necessary in open harbors, the wharves of which are exposed to the direct action of the sea waves; but they do not prevent the tides from overflowing the wharves; and even in land-locked harbors the range of waves is generally sufficient, in very severe storms, to cause much damage to the piers themselves, as well as to the buildings and merchandise stored upon them. Small harbors, equally with the more important ones along our coast, are much exposed to such gales, and, when they do occur, property in shipping, in wharves, and material upon them, is always damaged in proportion to its amount and degree of exposure. The violent and long-continued storm of April, 1851, occurring upon the new moon, was particularly destructive to maritime property in the harbors of the coast of Massachusetts. In the smaller harbors, losses were sustained in common with those having large shipping interests. And I am not aware of any effectual remedy against an extraordinary rise of the sea, such as occurs at intervals of fifteen or twenty years, other than building the wharves above the effect of such tides, which would make them extremely inconvenient for ordinary service. Land-locked as Portland harbor is, with its present line of breakwater, 1,900 feet long, stretched out opposite to the pier range, should the tides rise again as they did in 1831, overflowing the wharves to the same depth, the effect of the waves created within the harbor by an east wind, would be sufficient to injure much property upon these wharves. By these remarks I do not intend to imply that the Portland breakwater is useless; on the contrary, against the ocean waves rolling in between House island and Fort Preble, and spreading their waters to the left, onward towards the anchoring-ground and wharves beyond, it is a very efficient protection; and against the harbor waves produced by southeast winds it is a similar protection, both to shipping at anchor and to the line of piers. It is true that this structure is but a partial cover against the range of harbor waves due to east winds, and that the northeast gales which sweep down between Hog island and the main land pass unobstructed over the entire inner anchorage. But it is almost impossible, except in some peculiar localities, so to arrange a breakwater, as effectually to cover both the wharves and anchorage against all winds and waves, without shutting in the harbor so entirely as to render the passage of shipping extremely difficult, and the removal of ice next to impossible. The Portland breakwater narrows the moving body of waters within the inner harbor, increasing thereby the rapidity of the current, and preventing the channel from filling with sediment as rapidly as it would otherwise do. Some of the citizens interested wish the present structure extended as far as the Red buoy, and a harbor-light placed at the end. It is urged that strangers running in at night, as well as those better acquainted with the harbor, would find this light a very essential guide. Perhaps the light-house system may be so enlarged as to embrace this particular case. The extension above alluded to, as desired by the shipping interest, would doubtless be beneficial in proportion to its length; but an examination of the general map accompanying this report shows that the efficiency due to this limited extension would be small in comparison with the cost of construction. A breakwater across the Middle Ground, near the salient of Mount Joy, would partially cover the anchorage against northeast gales, and would probably be more useful than the extension of the present structure, though far more costly.

The $5,000 available for the Portland breakwater ought to be expended in finishing it. The unfinished part, B C, has been somewhat damaged at different points by the action of waves and ice. This part should be repaired, and the end, B, now rather deficient in height, raised to the level of the remaining portion. Three hundred tons of rubble will be sufficient for this work. I propose to extend the capping wall from C to B, six feet from the end of the enrockment, and over the inshore portion, E F. This wall should be constructed in a solid manner, partly of through stones ten feet long, and partly of stones five feet long and wide, extending half through the wall, which should be four feet high, and formed of two courses. At the end, all the stones should be fastened together by dogs, and should rest upon large and closely placed blocks of rubble. The capping wall, as built from C to E, is solid in its upper course; but the lower course is formed of cross-ties, fastened at the outer ends, by copper dowels, to longitudinal stones, the intervening spaces being filled with granite or quarry rubbish. When finished to its present length, the breakwater will be secure against injury from waves and ice, and will rise out of the water, so as to be ordinarily visible at night.

I submit the following estimate for completing the Portland breakwater, in conformity with the accompanying plans:

Estimate.

300 tons rubble, for repairs, and for raising the northeast end of breakwater to the same reference as the remaining part, at $1 per ton	$300 00
1,100 cubic yards of dimension stone, for extension of the capping wall, as per plan, at $4 per yard	4,440 00
Contingencies	260 00
Total estimate	5,000 00

I propose to do this work by contract, under my general superintendence, employing one person only as overseer. The contract can probably be executed within the limits of the estimate. Should it exceed that estimate, it will be necessary to draw upon the balance of the appropriation for such small excess, in order to accomplish the work proposed.

Estimate for extending the Portland breakwater 130 *yards.*

The whole interior mass of this extended portion may be formed of stone, obtained from quarries within the harbor, at $1 per cubic yard. The exterior, made of large granite blocks, will cost $1 50 per cubic yard. The whole amount of rubble necessary for the extension is 16,450 cubic yards, of which

12,337 cubic yards, at $1 per cubic yard, will cost.....	$12,337 00
4,113 cubic yards, at $1 50 per cubic yard, will cost...	6,170 00
130 yards' length of capping will give 549 cubic yards, which, at $4 per cubic yard, will cost...............	2,196 00
Contingencies, such as superintendence, office expenses, &c..	797 00
Total estimate..............................	21,500 00

Richmond Island harbor breakwater.

It is proposed to build a breakwater from Richmond island to the main land, from which it lies about a half mile distant, in order to create safe harbors of refuge against gales, varying in direction from northeast to southwest. But few years since the bar, extending from the interior salient point of the island to the opposite shore, was dry at low water. Now this bar is broken through for a distance of 200 yards, over which the sea flows at ordinary low tides to the average depth of three feet. Oxen, with carts, pass over to the island, in calm weather, during the lowest course tides. The ocean waves are divided by the island, around which they make a circuit, meeting upon this bar; so that, even in moderate weather, the wind being on shore, there is a line of breakers from A to B, (see plan.) In the flowing in of the tides there is a tendency to still water upon the bar; and were these compound effects of tides and waves always produced upon the same unvarying line, we might look for the formation of a beach permanently connecting the island with the continent. It is evident that this line must constantly change position, because in east and northeast storms the waves would meet to the west, and in west and southwest winds to the east of the bar; the degree of variation being regulated by the greater or less severity of these winds or gales. The currents, which are light, would be influenced by the same causes. Hence the central bar line, C D, crosses the channel at the deepest points, there being less water on either side. I am informed, by the proprietor of the island, that though the main bar retains its general position, still the sand on either side is raised or removed, shoaling or deepening the water very essentially, according to the prevalence of storms from different quarters.

It would seem an easy matter to assist the tendency to formation along the line A, C, D, B, by placing there a permanent obstacle to prevent the sands, during east or west winds, from being swept beyond this central line. Should this obstacle subserve the purposes intended, a sand bar would be formed to its top. This first progress being effected, a like structure could be raised upon the newly-formed bar to the level of high water, with the expectation that it would bank up the sands, on either side producing a permanent connexion between island and shore. Yet, for better security, it would be necessary either to raise this second structure five or six feet above high water, or, after the formation of the second portion, to build a third. The whole cost of the structures thus erected would not exceed $15,000. This amount would also build a triangular frame-work, filled in with rubble across the deeper part, finished towards either shore by a stone dike; the whole construction rising above the highest observed tides. Perhaps this latter structure would be preferable were the requisite funds available, because it would be earlier completed. But since $5,000 at most can be applied to this work during the approaching season, it must be such that no damage may result from leaving it unfinished at any given elevation. Hence I have concluded to recommend that the proposed breakwater be formed of rubble stones, thrown in along the line A, C, D, B, with a top surface three feet wide, and side slopes of 45°, according to the plans furnished with this report. The stone used should be large, but not long like building, nor flat like flagging stones, but rather irregular, massy blocks, abundant in quarries, suitable only for enrockments and rubble masonry. These stones ought to be landed from the lighters or scows at low water, so that they may be placed more advantageously than when thrown overboard. Such restriction upon a contractor would probably enhance the price of work per yard so much as to outweigh the advantages to be derived therefrom. Lee-shore waves or breakers are so effectual in removing sand from the ends of dikes upon beaches, especially when the action is crosswise, that I have deemed it necessary to estimate for a continuous line of enrockment from the island to the main land. The winter storms would probably open new channels, or at least sweep away the sand to a considerable depth, were the stone work to cease short of the shore line. The drawings submitted exhibit the project proposed so fully as to render further explanation unnecessary.

I have estimated the rubble stone at a high price, supposing it to be obtained from distant quarries. The proprietor of Richmond island has expressed a willingness to allow any amount of stone needed to be taken from the island shore. If any person will open a quarry there, he can doubtless contract to build the breakwater at a price twenty-five cents less per ton than it would cost were the stone to be brought from the distant established quarries.

Estimate for Richmond Island breakwater.

There will be required for this structure, according to the plans submitted—

3,600 cubic yards rubble stone, at $1 30 per yard	$4,680 00
One overseer, 80 days, at $2 per day	160 00
One assistant, 80 days, at $1 25 per day	100 00
Contingencies	60 00
Total estimate	5,000 00

I propose to execute this work by contract, employing one overseer and one assistant to superintend, personally and constantly, the delivery and placing of the rubble, keeping a faithful and accurate account of the number of tons used. This service, requiring the use of a boat, will doubtless give constant occupation to two persons for nearly three months; though I should prefer that the contractor should undertake to complete the work in half the time estimated for. There will be many sources of delay, such as rainy weather, storms, and breakers upon the bar, even during sea winds of medium strength. In consequence of such delays, I have estimated for eighty days, hoping, at the same time, to complete the work much within that limit. Should I succeed in effecting a contract for building this breakwater at a less price than is specified in the estimate, the funds available will carry the structure to a greater height than the accompanying plans indicate. As to the necessity of this breakwater, the question seems no longer open for discussion, as the Coast Survey department has already given it the sanction of its high authority, and Congress has added its approval by granting an appropriation to commence the structure.

I recommend that an additional appropriation of $10,000 be asked to finish the Richmond Island breakwater.

Respectfully submitted.

Z. B. TOWER,
Brevet Major Engineers.

Brevet Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX G.

Portland, *October* 13, 1852.

Sir: I have the honor to report that, in obedience to department orders, I have made a preliminary examination of the piers at the entrance of the harbor of Kennebunk. I forward the sketch accompanying, which is in the main quite correct, being copied from a map in the possession of the collector, the original of which map was forwarded to Colonel Abert. The piers at the entrance of Kennebunk river, three-fourths of a mile below the harbor of Kennebunk, were originally built of wood, and extended from A (see sketch) to B, on the east side, and from C to some point not far from D, on the west side of entrance. Having been rapidly destroyed by the sand-flaw portions of these piers, A K and B B were at different times replaced, by stone split to regular forms, and laid dry, in courses. The wood part remaining seems to be a trough filled with stones, the sides being braced together. Should the wood-work, from B to E, be swept away by a southeast gale, the great mass of sand in front of this frame-work, and all the stone with which it is loaded, would be moved into the channel. It is expected, therefore, that as soon as practicable the stone pier will be extended to the Perch rocks and turned into the sand bluff, on the line E E. When the line E G was constructed, it terminated in the sand bluff; but since that time the waves have evidently removed that bluff to the distance of some twenty feet. The wood-work inward at A need not be touched. On the western side the pier is much lower than on the eastern. It is not connected by any wood-work with the sand-bluff, and in south storms the waves break over and throw sand into the channel. The wood trough, shown as a continuation in dotted lines upon the sketch, has all disappeared to the sand level. This western side, however, is far less exposed than the eastern; and I think some frame-work of wood, constructed with little expense, may be placed on a line back, to catch the sand and prevent its being carried over into the channel. This wood-work would probably be buried in sand before time would elapse for its decay or destruction by the sand flaw. The stone pier will doubtless require another course at some future day, when the sand beach, in consequence of the proposed wood construction, shall be raised to the height of its present top course at H.

Harding's wharf (designed on the sketch) was purchased by government, has once been extended, and is a very convenient stopping place for vessels passing in or out of the harbor. If a vessel on its passage out is belated, it ties up at this wharf, for want of anchorage room. For example, were the wind from the south blowing into the mouth of the river, vessels could be warped down from the harbor and remain at this wharf until the next tide, before going to sea; hence this wharf is deemed of much importance by those citizens who own shipping, and they are very desirous that it may be repaired without delay. This wharf, rather roughly built, is somewhat dilapidated, high tides sweeping over it. It does not now possess the requisite strength to hold large ships in stormy weather, and should, since it is government property, be put in order by government. But this end cannot, or ought not, to be attained at the expense of more important interests. Therefore, since this wharf has no direct influence upon the safety of the channel navigation, further than that it covers a rocky salient point and serves as a convenient stopping place; and since the completion of the piers, to secure the channel against storms, appears to me the legitimate application of the $7,500 appropriated by Congress, I recommend that only so much of the moneys appropriated be expended this autumn as shall be required for the security of the two stone piers and the wood pier, from B to G. And further, in support of this conclusion, should the plans and estimates for the completion of the stone piers (which plans and estimates will be made after a thorough survey and levelling of the position) indicate that the whole amount, $7,500, or nearly that amount, will be required for the piers, then it would be injudicious, to say the least, to expend any money at present upon Harding's wharf. The repairs of this wharf, I think, ought to be deemed secondary to the full protection of the entrance to the river.

The following repairs ought to be made before winter, or as soon as they can conveniently be executed, viz.: Replacing a stone at F, on the W. pier, and forcing back one at *e*, partially displaced; replacing a stone at each of the points *a c d* of the eastern pier, and those stones now lying at *g* which have been thrown from the top of the wall. The course from which stone *c* has fallen, is just above the water-level of extreme low tide—that at *a* is partly under water. The bottom courses at *d* and *f* have each lost a stone, but those courses are above the low-water level. The stone at *e*, pushed from its true position, belongs to the fourth course from the top. At *b* the lower courses have settled, or have been so started by the waves as to open the vertical joints for three courses, six inches wide; similar openings have commenced at *a*. I recommend, therefore, that these stones out of position be replaced in the best manner possible, and secured by iron dogs, if they can be so secured, and that 100 tons of rubble stone—no stone of less than one ton weight—be thrown in, principally around the pier-head B, and at such other positions as appear to require such aid. A large quantity of rubble now lies round the foot of the western pier. There is also a small quantity round the eastern, but that is not enough for security. I would also repair the wood pier, from B to G, by replacing some twenty planks that have broken from it. This report is only preliminary to a more full one, and answers more particularly that part of the chief engineer's instructions relating to the repairs of the Kennebunk piers which ought to be made this autumn.

Very respectfully, your obedient servant,

Z. B. TOWER,
Brev. Major Engineers.

Brev. Brig. Gen. Jos. G. Totten,
Chief Engineer.

APPENDIX G—1.

Portland, *February* 7, 1853.

Sir: I have the honor to forward the following report on the piers of Kennebunk river, with an accompanying illustrative sheet of drawings:

Repairs of piers of Kennebunk, Maine.

As the board of engineers have already approved of the general plan proposed for completing these works, I should now merely forward my detailed plans and corresponding estimates, did I not desire to express myself more fully touching the improvements at the mouth of the Kennebunk river.

Wood Trough piers, ballasted with stone, commenced in 1822, were first placed where the stone structures now stand, at a cost of $9,000.

As early as 1829 they were repaired, and in part rebuilt, at an expense of $5,000. Again, in 1831 and '32, an additional expenditure of $2,875 was applied to their further repairs and extension. The ravages of the sea-worm, so destructive to these piers, rendered it apparent that structures of wood were unsuitable for this position. Hence the appropriation of $10,000, obtained in the year 1834, was expended in building the stone pier now standing on the western side of the channel. In like manner, $18,500, the appropriations for the years 1836–'37 and '38, were used in constructing one hundred and twenty-seven feet of the existing eastern pier. During the year 1842, one hundred and twenty feet of the timber pier, contiguous to the stone structure last erected, having been destroyed, the channel opposite became so filled in with sand as to diminish the soundings nearly three feet. To remedy the injuries thus sustained, a grant of $5,000 was made by Congress, and Mr. Remick, the then collector of Kennebunk, applied this fund in extending the eastern stone pier two hundred and eighteen feet further inshore, and in strengthening the remaining wood structure so judiciously, that up to this date the channel has been securely protected. The utility of these works of improvement is unquestioned. They protect the channel against the east and northeast gales on the one hand, and from the south and southwest storms on the other; piling up behind them the sand which would otherwise be thrown into the passageway, to be removed about from place to place, impeding the entrance and egress of shipping; or to be swept outward by the currents, and deposited anew along the general coast line as a bar of obstruction to navigation. Now ships of 1,400 tons, in ballast, pass freely out of the river on high-course tides. The ship-building interests of Kennebunk and Kennebunk port demand that the constructions at the entrance of the river should not now be left exposed at the vital point, endangering the utility of the whole system, upon which an expenditure of $50,000 has already been lavished. By reference to the general plan, in possession of the Engineer department, it will be seen that the salient beach, extending to the Perch rocks, is the important point now to be secured; for the wood piers, which support this beach, are partially decayed, and may be broken down under a long-continued and violent storm. In fact, these wood piers are the weak point of the existing line of constructions. Now, this salient neck of land being a loose sand formation, and being exposed to the heavy surf of the severe winter storms, moves inwards, or would do so, did no obstacle prevent such motion. On the other hand, the current from the river above, were it not for the existing wood pier, would infringe upon the interior shore line; and this double action of current and waves, if free to produce its effects, would sweep this sand-beach away entirely, leaving the stone pier almost useless. Formerly a wharf stood upon the Perch rocks, and extended quite back to the sand bluff. This wharf protected the position before the wood piers were built. The appearance of the shore line east of this point seems to indicate that the river mouth was formerly more seaward, and that it has, through ages past, been gradually and slowly retroceding. Indeed, it would be difficult to account for the existence, at the present time, of this salient sand beach, exposed so entirely to the wearing action of currents and waves, except on the supposition that it is but the remaining portion of a more extended formation which has gradually disappeared. The surest and most lasting construction to arrest this retrocession would be attained by extending the existing stone structure to the Perch rocks; and thence, curving inwards along the shore line, to the ledge above the water line, nearly half-way on the beach, which reaches to Harding's wharf. Such construction, placed upon secure foundations, would be permanent, and would effectually secure the object desired, as its inshore termination would abut against the solid rock formation of the coast. It would be quite costly, however, and it was not contemplated by the citizens asking for the present appropriation. It is their wish that the plan approved may be carried out; and I do not doubt that the pier proposed will secure the point in question, and effect all that is desired; only, I regret that the funds available are insufficient to construct the inshore portion of this pier entirely of stone, and with a deeper cross section; because, with the lapse of years, the wood structure, now standing contiguous, will decay and disappear; then the action of the river current, as before mentioned, will tend to undermine this wing wall, unless the substratum shoal prove more solid than the surface. However, such damages may be readily anticipated and prevented by the timely throwing in of ballast stones along the channel-face of the wall. The timber prolongation of this pier should extend at least twenty feet beyond the edge of the sand bank, for the reason, that the surf will be sure to find its way around the end if such precaution be omitted. It is not impossible that this bluff, rising only six or eight feet above high tides, and covered with a scanty growth of beach grass, may, under the wearing action of violent and long-continued storms, occurring upon high-course tides, be so much injured as to require, at some future day, additional expenditures for its protection. The wood part of the proposed structure ought to be substantially built, as it will support quite a heavy weight of embankment thrown up by the surf.

I have reduced the dimensions of the stone pier, since my first general report, in order to reduce the cost.

I have also estimated the stone work at $4 per cubic yard, instead of $3 50, because the lower courses of a part of the construction can only be accessible for a very short time during the lowest tides. This difficulty and delay in building these courses will add essentially to their cost. In like manner, the stone for the wing wall, instead of being laid directly from the freighting lighters, must be twice handled, or require a derric on shore. On attempting to repair the foundations of the eastern pier, I found them more injured than I had previously supposed. This pier was built upon sand and the loose stone fallen down from the old wood structure; hence the action of the sea has somewhat undermined it at different points. To remedy these injuries will require 250 tons of ballast stone to be placed against the lower courses of the seaward face, and one layer of stones, two feet square, in the cross section, set down on the channel side, nearly to a level with the bottom of the wall; the portions undermined being filled in with small stones.

The structures now described will probably consume the appropriation available. Should any fund remain on hand after their completion, it ought to be expended upon Harding's wharf; because government having purchased this structure, thereby assumed the responsibility of keeping it in repair. The capping timber of the boundary line of this wharf should be raised one foot above the present highest point, and should be tied together by cross pieces perpendicular to the front; the interior being filled in with brush and covered over with ballast. These repairs, though far from placing the wharf in complete order, would nevertheless be very efficient. The three iron staples, secured to the rocks on the shore and at the inner corner of the wharf, furnish fastening points for the largest ships that may have occasion to use them. The western pier, as I have stated previously, ought to be raised four feet higher, and connected by a substantial catch sand, with the sand bluff, about 150 feet distant.

Estimate for repairing piers at Kennebunk, Maine.

1,500 cubic yards of stone, laid at $4 per yard	$6,000 00
500 cubic yards of excavation, at 20 cents	100 00
250 tons ballast stone, repairing eastern pier	250 00
45 cubic yards dimension stone, for foundations of same pier, at $4	180 00
120 feet of wood pier, at $3	360 00
Already expended	100 00
Superintendence	250 00
	7,240 00
Contingencies—office expenditures, &c	160 00
Total estimate	7,400 00

To repair Harding's wharf thoroughly will cost $1,000. To finish the western pier, as described in a former report, will require an expenditure of $1,000. Should $2,500 be appropriated during the present session of Congress, these different works described may be completed.

It is possible that a small amount from the grant of $7,500 may be applied to the wharf after the completion of the eastern pier. I would like the privilege of changing slightly the position of the wing of this pier, if, in the process of construction, such change should be thought advisable.

Respectfully submitted.

Z. B. TOWER,
Brevet Major of Engineers.

Brevet Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX G—2.

ENGINEER DEPARTMENT,
Washington, January 13, 1853.

SIR: I have the honor to submit herewith the report of the board of engineers of river and harbor improvements, on the subject of repairing the piers at Kennebunk, Maine.

The board approve the proposition of the officer in charge of the work, and I concur therein, and recommend that he be authorized to carry his project into execution.

The project is to apply the existing appropriation to repair and secure the eastern pier, and to repair Harding's wharf, and should Congress grant the additional sum asked for, to repair the western pier, after completing the first mentioned works.

As the nature of the repairs is thus, in some measure, contingent upon an additional appropriation, I propose, with your approbation, to instruct the officer in charge of the work to defer its commencement until the close of the session of Congress, after which he will be directed to proceed with the operations, if he shall judge it most advantageous to carry them on by day's labor; but if he be of opinion that they may be conducted more satisfactorily by means of a contract, the necessary proposals will be prepared by him for issue from this department. A copy of the report of the officer in charge, Brevet Major Tower, with a map illustrating it, accompany this communication.

Very respectfully, sir, your obedient servant,

JOS. G. TOTTEN,
Brevet Brig. Gen. and Chief Engineer.

Hon. C. M. CONRAD,
Secretary of War.

Approved:

C. M. CONRAD,
Secretary of War

WAR DEPARTMENT, *January* 18, 1853.

The officer was instructed accordingly.

APPENDIX H.

PORTLAND, *March* 28, 1853.

SIR: I have the honor to enclose a sketch of Marblehead harbor and sea-wall, and to submit the following remarks in connexion therewith:

For repairs of sea-wall at Marblehead, Massachusetts.

The security of the harbor of Marblehead is contingent upon the preservation of the beach connecting Marblehead neck with the main land. Hence, as early as 1732, the colonial government caused a sea-wall to be erected along the middle line of the beach, from A to B, 1,800 feet in length. Also, the Legislature of Massachusetts, in 1787, raised funds by means of a lottery to extend this wall to the point C. This latter part is much more strongly built than the former, being 15 feet wide and formed on the two faces of large irregular stones, filled in with smaller rubble. The larger portion, first built, is about 10 feet wide at the base, built with little slope or batter, and is made up mostly of small stones like those of field walls. It seems, nevertheless, to have been very beneficial in banking up the sand on the bay side from 4 to 6 feet in height. At present, however, it is in a very dilapidated condition, as might be expected from its exposed situation and from the simplicity of the structure. It will be seen from the accompanying sketches that the wall is partly tumbled down, that there are some breaches it it. These damages have doubtless accrued in part with the lapse of time, and in part are due to the power of the waves in the great gale of April, 1851. One breach, about 30 feet wide, extends entirely through the wall, and is used as a road-way for teams carting seaweed from the beach. The other openings are partial, not extending to the base of the wall. These openings should be filled up with stones, and the whole wall repaired, as much as it can be, with the funds on hand. For this purpose I should use the loose scattering stone from the beach, most of which probably came from the wall, and, if necessary, purchase about 100 tons. I propose to engage a master stonelayer, who shall take charge of the work to be executed, employing from 6 to 10 men-laborers. He will be instructed to commence labor in May, so as to finish before the end of June, first repairing the breaches and then giving his attention to the most injured parts of the wall. I think, with the money available, all the openings can be filled and the wall quite improved throughout its length.

Very respectfully, your obedient servant,

Z. B. TOWER,
Brevet Major of Engineers.

Brevet Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX H—1.

Engineer Department,
Washington, April 7, 1853.

Sir: Brevet Major Z. B. Tower, corps of engineers, in charge of the repair of the sea-wall at Marblehead, Massachusetts, proposes to close the breaches in the wall with the stones lying on the beach, most of which probably came from the structure. If additional stones are needed they will be purchased. Any balance of means that may remain will then be applied to the general repair of the work. A master stonelayer to have charge of the operations, which will be executed by day's labor.

The board of engineers for river and harbor improvements approve this proposition, in which I also concur, and have the honor to recommend to you that I be authorized to instruct Major Tower to carry his plan into execution.

The report of Major Tower, with a map of the wall, and the report of the board, are herewith.

I am, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bvt. Brig. Gen. and Col. of Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved:

JEFFERSON DAVIS,
Secretary of War.

WAR DEPARTMENT, *April* 16, 1853.

The officer was instructed to carry the foregoing project, as approved, into execution accordingly.

APPENDIX I.

BOSTON, *November* 18, 1852.

SIR: I have the honor to submit to the department the following report on a survey with reference to the construction of a breakwater at East Dennis, Barnstable bay, Massachusetts:

In obedience to the orders of the department, dated September 29, 1852, I, early in the month of October, examined and surveyed the position above named, and the chart accompanying this report is the result of that survey. I do not claim for this chart anything more than general accuracy, for the season of the year and the time at my command would not admit of extreme minuteness; but it is, in my view, all-sufficient for the purpose for which it was intended, viz: the location of a breakwater.

The harbor of Dennis lies on the north shore of Cape Cod, at the bottom of Cape Cod bay, about midway between Plymouth and Provincetown, and with the exception of tide harbors, is the only one between those points; the tide ebbing out along the shore of the cape for long distances, in some cases as much as a mile. At Dennis, however, there is water enough for the largest ships, at all times of tide, within one-fourth of a mile from the shore. But, as a glance of the map will show, the position is very much exposed, and as it is at present, can scarcely be dignified with the title of harbor. An association of inhabitants of the vicinity, at their own expense, have constructed, just to the south of Nobscusset point, two wooden wharves with an interior basin, (the latter excavated out of a cornfield,) the whole protected from the sea by a rough jettee or breakwater of two rows of piles about 8 feet apart, filled in with stone, and extending from the foot of the bluff at Nobscusset point 600 or 700 feet in a southeast direction. Within the jettee (as shown on the chart) it is entirely dry at low water. In this little artificial harbor perhaps a dozen or fifteen fishing vessels can be accommodated. On the wharves are two or three stores for furnishing supplies to the fishermen, and sheds for packing mackerel. This wharf and basin property (called in the neighborhood the "Corporation works") has cost its owners between $20,000 and $30,000. The wooden breakwater has several times sustained injury during gales, but has as often been repaired, and seems to answer its purpose. A small income is derived from wharfage and storage fees from vessels making use of the wharves.

So far as the commerce and business of the place alone is concerned, this point may perhaps be considered of scarcely sufficient importance to warrant the construction of a costly work by the general government, but, in another point of view, such a work of the nature desired would undoubtedly be of very great utility. The whole commerce of Boston, and indeed of Massachusetts, would be benefited by a breakwater at this point; for the map shows that this entire line of coast is, during northerly and northeasterly winds, a lee-shore. During the severe gales and snow storms of winter and spring, vessels run great risk of getting embayed, and if driven on shore are almost inevitably lost in the breakers on these sandy beaches. Almost every year instances occur (and in this immediate vicinity) of ships going to pieces on the beach, with the loss not only of valuable property, but of life. But a breakwater at this point would prevent most of these disasters, for vessels aware of its existence could make a secure harbor under its lee, and lie at anchor there until the gale abated. A light-house on its eastern extremity would probably be necessary; but no reference having been made to that in the law, I have not thought proper to make more than an allusion to it.

The breakwater, as I have planned it, commences at the east extremity of the point of rocks which extends out from Nobscusset point; thence its direction is east northeast (by compass) 800 feet, thence 1,200 feet east by south; making a total of 2,000 feet.

My reason for the point of commencement is, that this point of rocks itself serves as a considerable protection, the greater part of it being dry at three-quarters ebb, and the whole at low water. Keeping somewhat to the north with the inner portion of the breakwater is necessary to reach a sufficient depth of water for anchorage. If this first direction were continued throughout the whole length, it would form an insufficient protection from the winds to the east of north, which would still cause considerable sea within it. A greater inclination towards the shore would both decrease the capacity of the harbor and increase the difficulty of entrance. For a protection from the heaviest seas which can come from the N. and N. N. W., the breakwater as located would seem to be effectual; its total length could not well be diminished, considering the capacity of harbor required and the exposed situation. (The breakwater at Hyannis, in a much less exposed position, is 1,200 feet long.) The depth of water in which it is placed averages about 18 feet at low tide, and 28 to 30 at high tide, shoaling gradually towards the shore—a depth quite sufficient for large vessels.

The cross-section which I have adopted has a base of 115 feet, diminishing to a width of 15 feet at top, in a height of 38 feet, the top being placed 6 feet above the highest tides and 20 feet above low water. The sea slope is about 1 upon 2, the inner slope 1 upon 1; the interior face being, however, nearly vertical for the upper 10 feet, with a view mainly to the saving of material. A breakwater with this cross-section and length would require, as near as possible, five million (5,000,000) cubic feet of stone, and to cover all expenses $10 per foot is not too much to allow. This would make the total cost $500,000.

Respectfully submitted.

CHARLES E. BLUNT,
Lieutenant of Engineers.

Brev. Brig. Gen. Jos. G. Totten,
Chief Engineer.

APPENDIX K.

Portland, *March* 31, 1853.

Sir: I have the honor to enclose a sketch of Plymouth beach, and to submit the subjoined remarks in relation thereto:

Repairs of public works at Plymouth beach, Massachusetts.

Plymouth beach is nearly a straight line, about two and a half miles long, and lies in a direction slightly oblique to the main, giving an interior space or anchorage quite protected from the east and northeast gales. The deep channel and the principal wharves are opposite the northern portion of the beach; and this portion, therefore, mostly formed by artificial means, requires to be preserved with especial care.

The triangular frame-work, extending from A to B, and finished, I think, in 1832, has raised the sand to its apex, above the ordinary tides, to an average width of 100 yards. From B to C the sand pile rises to an average height of 8 feet above the usual tides, and is about 50 yards wide, being in part supported inshore by the old dilapidated frame-work of 1816. The exterior line, as indicated on the sketch, bounds the bluff, which takes the ordinary sand slope. This bluff or shore line is quite above the ordinary tide line, which lies some 40 or 50 feet further seaward—in fact, it is the reach or limit of the waves. Grass grows upon this portion, though not abundantly, and on some of the higher mounds its roots have become dead. It appears, from experiments upon this beach, that where the sand has risen into hillocks some 10 or 12 feet high, the long beach grass, which has served to collect and pile up this sand, at length withers and dies. The small breach at C has been partially, though not securely, repaired by driving stakes from 4 to 5 inches in diameter, and about two feet apart, and interlacing them with twigs. This construction, though it serves to collect the sand blown against it, is altogether too slight to withstand the shocks of waves, and must inevitably be destroyed, if subjected to the force of the sea during a storm similar to that of April, 1851. Between C and D the sand bank widens, though it is not so high as the preceding portion. The exterior or shore line is quite as high as the general level, which does not vary much from 5 feet above the tide plane. At different lengths along this reach stakes have been driven, forming a catch sand, like that which repairs the small breach. At other points, seaweed gathered from the beach has been placed in rows, producing about the same effect as the stakes, interlaced with twigs. Grass is found upon this part of the beach, though of scanty growth;

and it is apparent that the waves of the gale of 1851 dashed upon it at different points, though it does not appear to have been submerged. At D is the great breach of April, 1851, about 800 feet long. The waves carried the sand through, and spreading it out on the interior marsh, leaving the opening on a level with the ordinary high tides. When the storm had subsided, as the sea no longer flowed through this breach, the gentle action of the summer waves commenced, though the progress was very slow, to move forward sand into the opening, till it reached the barrier erected by the citizens of the town of Plymouth. This barrier is made up of two rows of stakes, interlaced with twigs, It has stood nearly two years, and has subserved a good purpose, banking the sand 4 feet high. The exterior line, about 10 feet outside of the interior, is well preserved; while the latter, not being supported to the same height by sand, is inclined irregularly, and evidently incapable of withstanding much force. It was probably built more slightly than the outer line. Fortunately for these repairs, no severe gale has occurred during high-course tides since that of April, 1851, otherwise so slight a structure must have been completely swept away. From D to E the beach is wide, grassy, strong, requiring no assistance from artificial means to resist the power of the waves. Onward from E to the high land at L, the beach, or rather sand bank, varies considerably in height and width. The damages from storms have been slight, and are repaired as well as the position requires, as the interior formation is flats; and, though the sand bank should be thrown inwards, there is no channel to be filled up thereby. Moreover, the anchorage opposite is of much less importance, owing to the shallowness of the water, than that farther north. I do not mean to imply by these remarks that this portion may be entirely neglected, only that it is of secondary importance compared with that part opposite the channel and principal wharves, and that the style of repairs already adopted might be deemed sufficient.

Returning to the two breaches, C and D, I would recommend that they be more efficiently repaired, so as to place them beyond the reach of injury during severe and long-continued storms occurring upon high-course tides. Such a storm may not take place again for years; but since its recurrence is entirely unforeseen, it is necessary to provide against its effects now, while there are funds available for such purposes. There are various means of accomplishing this end, leaving part of the appropriation to strengthen weak points on other parts of the beach. Two rows of piles, 8 feet distant, (the piles of each row being 5 feet apart,) might enclose a wall of brush, weighted with stone, so as to be secure against any gales; or the piles may be dispensed with, the wall being formed of small trees, or fascines covered with stone. A single row of posts placed in contact, set down 8 feet into the sand, and extending 9 feet above ordinary tides, connected together by ribbon pieces at top and bottom, like a stockade, would be a cheap construction, and would doubtless be strong enough if supported at intervals of 5 feet by inclined struts fastened to the uprights by treenails. Two rows of piles, forming a trough, by being planked on the outer sides, and filled in with seaweed and gravel, or marsh sods taken from the interior shore, would accomplish the same end. It would be necessary to raise these structures only 5 feet above the present level to make them amply secure. Beach grass, cultivated along the beach, would tend to collect sand. But the best growth for this purpose is the bush bearing the beach plum, which grows upon sand beyond the reach of the waves. It seems to me that if a thick ledge could be formed of this shrub, for the whole length of the beach, it would gradually widen to the right and left, so as to give a growth almost impervious to the wind. I have seen these bushes growing quite thickly and attaining to heights of 8 and 10 feet.

As the former Secretary of War decided that the appropriation of $5,000 granted by Congress to repair the damages sustained by the public works at Plymouth beach, during the storm of 1851, could not be applied to the general strengthening of the beach, I beg leave to submit the following remarks in answer to this decision:

Plymouth beach is itself a public work, raised in great part by artificial means. The barrier to the sea waves is the sand bank, varying from fifty to one hundred and fifty yards in width, and collected by various devices. From A to B a frame-work of triangles, placed contiguous, and loaded with stone, has served to create the sand formation on either side. From B to C, in addition to the old frame-work, fascines and stone have been used, and grass grown, to effect the same end—the raising of a sand barrier to the waves. And beyond this point similar means, excepting the frame-work, have been adopted in times past, creating the bluff which now requires repairs. The frame-work, then, is not alone the public work upon Plymouth beach; nor is it more so than the fascines, the stone, the grass transplanted to raise the sand; nor more so than the sand bank itself. For it matters not whether this sand bank was raised directly by the cart and the shovel, or whether it was raised by more general means, by fascines or by catch-sands, such as grass, &c., it is the sand bank that is the breakwater; it is this that has been injured; it is this which requires replacing. It is true that the grass transplanted has been swept away; and I presume, under the decision, that might be replaced. But upon what replace it? Upon the portions breached? That would be a useless expenditure, before those portions have been again raised to the height proper for the growth of grass. Where the beach has been left untouched it will require no expenditures. Only where it has been injured need repairs be made; and I can see no objection to using the appropriation for such purpose.

When the board of engineers have decided upon the particular method to be adopted for repairing the damages to this beach, it will be necessary to appoint some one to take immediate charge of the construction, as I cannot personally attend to it.

In conclusion, therefore, I recommend that the great and small breaches, produced by the gale of April, 1851, be thoroughly repaired during the present summer, so as to place them beyond the power of future storms. Also that repairs be put upon other points, between B and D, which have been injured, and which require strengthening.

Also that the slight works, from D to the end of the beach, be strengthened at any places that seem to demand it.

Very respectfully, your obedient servant,

Z. B. TOWER,
Brevet Major Engineers.

Brev. Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

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APPENDIX K—1.

Engineer Department,
Washington, April 8, 1853.

Sir: Having, on the 12th January last, proposed to the late Secretary of War (in accordance with the views of the officer in charge of the work) that the appropriation "for repairing the injuries done to the government works on Plymouth beach in the great storm of eighteen hundred and fifty-one," should be applied from time to time to the work, as necessity might advise, he decided that the appropriation was applicable only to the repair of such injuries as had been done by the storm in question.

Major Tower, corps of engineers, the officer in charge, has since made a detailed examination of the beach, to ascertain the exact injury which it has received from the above cause. A great breach, eight hundred feet long, and a smaller one, were made by this storm, during which the sea also washed through in some other places, and did other injury.

Major Tower proposes to repair these injuries in a permanent and durable way, and suggests several devices by which the sand may be accumulated and retained in the deficient places.

The board of river and harbor improvements approve of Major Tower's views, and state a preference for brush walls as the means to be used for collecting the sand in the gaps and washed places.

With your approbation, I have the honor to propose to instruct Major Tower to repair the parts of the work injured by the storm of 1851, fully and permanently; the means of collecting and retaining the sand to be determined on after further examination and deliberation.

The report of Major Tower, with a sketch, and also the report of the board, are submitted herewith.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brev. Brig. Gen. and Colonel Engineers.

Hon. Jefferson Davis,
Secretary of War.

Approved:

JEFFERSON DAVIS,
Secretary of War.

War Department, *April* 28, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX L.

ENGINEER OFFICE,
Boston, December 27, 1852.

SIR: I have the honor to submit the following report in relation to the preservation of Cape Cod harbor, at and near Provincetown, Massachusetts:

Former appropriations for this object have been expended in planting beach grass on the sand beaches, of which this portion of the cape almost entirely consists, in order to arrest the drifting of the sand by the violent north and northwest winds, which drifting threatened to overwhelm Provincetown, as well as gradually to fill up the harbor. The sheet of Maj. Graham's chart, which accompanies this report, will show clearly where this grass was planted. The last operations were in 1839; since then the inhabitants have been careful in preventing cattle from running at large, and in protecting the brush wood which is springing up in many places. As a consequence of these precautions, the grass to the north and west of the town has, in the main, stood extremely well; in many places even extending and thickening considerably. Still, there are quite a number of bare spots, where the sand, during the last thirteen years, has gradually got the better of the grass. The principal of these bare places is between Grassy pond and Negro head.

Proceeding to the eastward from the Truro line, (of Graham's chart,) the grass does not appear to have stood so well, and in many places has entirely disappeared. The beach is here exposed to a long rake from the northwest, bringing down the sand from that quarter. The failure of the grass is attributed, by most of the inhabitants, mainly to its being put upon the ridge of the beach, instead of the hollows or lower portions. With the wind from the north to northwest, and even in *dry* northeasters, this sand is blown, not directly into Cape Cod harbor, but into East harbor. A portion of it is gradually covering the salt meadows in the upper part of that harbor; and another portion, when the tide is ebbing, is carried by that ebb-tide into Cape Cod harbor, increasing the spit which runs out opposite Beach point.

At extreme high water East harbor makes up a considerable distance, and at that time the width of the beach, between its head and the back, or Atlantic side of the cape, is very small. There are several low places where, at extreme tides, the water has forced a passage through. There is some danger that in a violent gale a permanent opening will be made, the precise effect of which cannot be predicted, but very probably serious injury might be caused to the harbor.

I propose, then, to expend the appropriation mainly in the same manner as previous ones, viz: the transplanting of grass to such places as will prevent the drifting of the sand I have referred to; repairing the bare spots to the north and west of the town, proceeding to leeward or eastward along the beach. From the Truro line (of Graham's chart) I propose to put in the hollows north and south of the ridge a strip of grass, extending somewhat past the mouth of East harbor.

Besides the planting of grass, I should place, at the low parts of the narrow beach at the head of East harbor, an ordinary post and rail fence, with brush round it, in order to form a nucleus for the accumulation of sand, and thus raise these low places.

Much of the failure of the grass to the north and west of the town may perhaps be due to the fact of its having been necessary to procure it from a distance, (in Truro,) transporting it in boats to the nearest points, and thence carrying it by teams to the beach where it was to be used. A considerable time thus often elapsed between its taking up and its replanting, and much of it consequently died. But this difficulty need not arise next year, as in parts of the beach to the southwest of the town the grass is as thick as an ordinary meadow, and may be thinned with advantage.

In my opinion, the same plan of operations which has been pursued in former years should be in the main followed in expending the appropriation. The plan is as follows:

The grass was planted along the ridge of the beach, in a strip 10 rods wide, being placed in separate bunches two or three feet apart. The work commenced as early as possible in the spring—say, perhaps, the middle of April—and continued until dry weather, which of course varies with the season; but about the middle of June would perhaps be the average time of closing. From forty to fifty days' labor could be had during this period. Fifty laborers were employed, besides three or four teams. One gang of these laborers dug up the grass, a second dug the whole for its reception, and a third placed and covered it.

The nature of the work being peculiar, and one with which the inhabitants of Provincetown and vicinity are familiar in their daily experience, I should think it advisable to employ them instead of importing Irish laborers, even though the latter might be procured at somewhat less. An agent for carrying on the work I do not think necessary; a good general overseer can undoubtedly be obtained, who would supervise the whole, assisted by two sub-overseers. I propose to be there at the opening and closing of the work, with two or three visits in the interim, or as many as my other duties will permit.

The planting in the hollow instead of on the ridge is the only deviation from the former plan which I propose. I think the experiment is worth trying, as the opinion seemed to be very general in Provincetown that the ridge was not the best place.

I subjoin an estimate, which is founded upon previous actual expenditures, and which probably will not vary far from the actual result.

Surface to be planted, say 170 acres, the grass itself being mostly procured from places already planted by the United States, will cost nothing.

Working days required . . . 45
Laborers. 50

Total days. . . . . .2,250, at $1 50.	$3,375 00
Overseers, 3, (2 at $2 and 1 at $2 50,) 45 days, at $6 50. .	292 50
Teams, 3 to 4, at $5, 45 days, at $17 50.	787 50
Cod line for bundling, $15; shovels and hoes, $27.	42 00
Post and rail fence, 50 rods, at $4.	200 00

Engineer officer's allowances for commutation and transportation, say	$173 00
	4,870 00
Leaving for contingent expenses of all kinds	130 00
Amount of appropriation	5,000 00

Very respectfully, your obedient servant,

CHARLES E. BLUNT,
Lieutenant of Engineers.

Brev. Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington.

APPENDIX L—1.

Engineer Department,
Washington, January 31, 1853.

Sir: I have the honor to submit herewith the report of Lieut. C. E. Blunt, corps of engineers, relative to the preservation of Cape Cod harbor, at and near Provincetown, Massachusetts.

This harbor, as well as the town, have been liable for years to destruction, from the drifting of the sands of the cape. This drifting has been arrested by planting beach grass to windward of the exposed points, the spreading of which has, in a great degree, fixed the surface of the sand. In some spots the grass requires renewal, and it should be extended to the eastward of its present limits, as the sand from that direction is now increasing a spit which makes into the harbor. Still a little farther east the beach is very narrow, and liable to be breached by the ocean.

Lieut. Blunt proposes to plant beach grass in the bare spots, and to extend the planting to the eastward, so as to check the drifting into the harbor, and to secure the weak places in the beach, by placing across them a post and rail fence, with brush around it, so as to collect the sand. As the people of Provincetown are expert in this work, he designs to employ them in executing it, and prefers to engage them at day's wages, with competent supervision.

The board of engineers for river and harbor improvements approve Lieut. Blunt's project with the exception of the kind of fence proposed by him for the narrow beach. They think wattled work, composed of stakes and brush, cheaper and better than a rail fence.

With your approbation, I will instruct Lieut. Blunt to proceed with the work whenever the season admits of it; the kind of fence to be determined on after further consideration.

The report of the board of engineers, and a map of the locality, accompany this communication.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. Gen. and Col. Engineers.

Hon. C. M. Conrad, *Secretary of War.*

Approved February 25, 1853.

C. M. CONRAD, *Secretary of War.*

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX M.

BOSTON, *December* 27, 1852.

SIR: I have the honor to submit the following report in relation to the preservation of Great Wood's Hole harbor, Massachusetts:

In obedience to the orders of the department, of the 29th September, I visited Wood's hole (southeast point of Buzzard's bay) early in the month of October, and ascertained that the appropriation ($2,500) had been obtained for the purpose of closing these breaches or openings into the harbor, from Vineyard sound and Buzzard's bay, but more particularly with immediate reference to the northern one. The coast survey tracing which accompanies this report shows the position of these openings, which I have marked A, B and C.

The southern one, C, is merely a narrow channel near the extreme west point, cutting off that point and making it an island; it is perhaps 150 feet in width, with about three feet of water, on a bottom of boulders and gravel. It does not appear to be of recent formation, and there is no appearance of any change now going on. It is entirely protected from action of the sea by its sheltered position; nor could I, from inquiry or observation, ascertain that its existence is of any damage to the harbor. The tide currents run very rapidly through it, and undoubtedly affect the management of vessels passing it through Vineyard sound, as well as vessels entering the harbor and anchoring. These currents can speedily and easily be stopped by throwing in a few hundred tons of granite boulders, obtained in the neighborhood.

The opening, B, on the western side of the harbor, is a low neck, over which, at very high tides and in gales, the tide flows, though not over the whole extent; a great part of it is marshy land. A portion of the wear of the Buzzard's bay side is probably at such times carried into the harbor; but this wearing action does not appear to be rapid, and the exposure is such, that the action of the sea in gales (northwest) is not direct, but along-shore. The damage accruing to the harbor at this point seems to me small, and very slowly, if it all, increasing; a stone wall, of the roughest possible kind, run across the neck, far enough from the bay side to be exposed to no action from the waves, would stop the passage of the tide, and in all probability a bank of gravel would soon accumulate on its western side and form a permanent barrier.

The third opening, at A, in the northern part of the harbor, is of much the greatest consequence, and is the one on which I propose to expend the whole of the appropriation. The sketch accompanying this report gives its general form, with the proposed wall for its closure.

The north and northeast winds have here the whole rake of Buzzard's bay, and bring in the sea with some force at this point. A cove, shown in the coast survey chart, has gradually been formed, and an opening made through the low neck at this point, through which the tide runs, most of the time, *from* Buzzard's bay, the rise there being several feet more than in the harbor. The eastern bank of this cove does not appear to wear, but on the western side it is rapidly being cut away, and the debris are carried directly into the harbor, forming a spit extending to the south, and upon which there are but one or two feet of water near the best anchorage ground.

The inhabitants of the neighborhood have, at different times, thrown in at the northern extremity of this channel rough boulders, as large as they could handle, and have thus formed a sort of dike, which has partially obstructed it.

I propose to place across this channel, which is only about four feet deep, a wall, to be carried also as far along the western bank as possible, and protecting the eastern portion of it, which during gales is entirely covered, as indicated in the sketch.

The present dike will serve as a complete protection to this wall where it crosses the channel. The dimensions I have fixed upon, twelve feet high and ten feet broad, appear to me ample.

There being so little water in the channel, and no more in the cove, the spit is quite inaccessible to vessels. Nothing but scows can approach it. This of itself seems to render the procuring of stone from a distance impracticable, and to force its obtaining in the immediate vicinity. Boulders of all sizes can be obtained from the land and beaches. These, roughly split by powder, will form a wall quite solid enough for the object. Across the channel I would throw in unsplit boulders up to low-water mark, and above that build the wall of blown stone. On the beach, and under the bank beyond, I would build it of blown split stone, only protecting the exterior from the under tow, (which is the principal action,) by placing rough boulders along its foot. The bank being thus protected, and the channel sloped, I am of opinion that in a few years a beach would form on the north side of the wall. The amount of the appropriation will not admit of carrying the wall as far as desirable along the bank; but I think that $5,000 more would not only effect this, but build the walls in breaches B and C.

My proposed mode of operation, and indeed the only one which appears to me under the circumstances practicable, is to take the boulders, split and unsplit, (from the neighboring beaches, where they lie or would be hauled,) into a scow furnished with a crane, which would transport them to the spot and lay them in their places. The part of the wall on the beach, and under the bank, which cannot be laid by a crane scow, would require a pair of movable shears or frame derric. Whether it is best to make a contract for the *whole work*, (securing its proper execution by my own presence when possible, and during my absence on other duty by a competent, faithful overseer, independent of the contractor,) or for the stone merely, is a point which I cannot at present decide. Walls of this kind are generally built in this neighborhood by quarrymen owning sloops or scows, who obtain the stone and lay it for so much a ton.

I can make only an approximate estimate, as follows:

Split boulders required, 2,000 tons, at 80 cents, (laid)........	$1,600
Unsplit boulders required, 500 tons, at 50 cents, (laid)........	250
Overseer and contingencies..	650
Amount of appropriation..	2,500

By authority of the Secretary of War, the old breakwater has been repaired this past autumn, at an expense of about $120.

Respectfully submitted.

CHARLES E. BLUNT,
Lieutenant of Engineers.

Brev. Brig. Gen. Jos. G. Totten,
Chief Engineer.

APPENDIX M—1.

Engineer Department,
Washington, April 4, 1853.

Sir: The officer in charge of the work for the preservation of the Great Wood's Hole harbor, Lieut. C. E. Blunt, corps of engineers, has reported that there are three breaches into the harbor, from Vineyard sound and Buzzard's bay, indicated on the accompanying map by the letter A, B and C. Of these, the northern one, marked A, is the only one where the harbor is suffering, or is likely to suffer, material injury.

He proposes to apply the whole existing appropriation of $2,500 to stopping this opening, by constructing across it a wall of boulders, split and unsplit, about twelve feet high and ten feet broad; extending this wall along the western bank, which is wearing away, as far as the means will allow.

The board of river and harbor improvements propose to close the three breaches by layers of fascines, placed diagonally to the direction of the line of work, the successive layers to be at right-angles to each other; the fascines to be ballasted by gravel, stones or sand, enclosed, so as to prevent their floating away.

As further information received from the officer in charge shows that, in consequence of the rocky character of the beaches, the proposed fascine-work cannot be secured by piles or stakes; and as he is of the opinion that nothing less substantial than a wall of boulders—to be unsplit up to low-water line, and roughly split above that level—is admissible, and he considers that a wall of heavy dimension stone, in courses, is the best, but the available means will not build such a wall, I have the honor to propose, for your consideration, that I be authorized to instruct Lieut. Blunt to carry out his project as far as practicable.

The work is of too little magnitude to attract the attention of contractors, and can be executed most advantageously by means of people in the vicinity, who are interested in having it done well, who have the requisite machinery, and whose experience makes them competent to do it.

Three letters of Lieut. Blunt with two drawings, and two letters of the board of engineers, are submitted herewith.

I am, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. Gen. and Col. Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved:

JEFFERSON DAVIS,
Secretary of War.

WAR DEPARTMENT, *April* 6, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX N.

BOSTON, *December* 27, 1852.

SIR: I have the honor to submit the following report on repairs of breakwater at Hyannis, Massachusetts:

The coast survey chart accompanying this report shows clearly the position of this breakwater. It is about 1,400 feet in length, with a breadth on the top varying from 20 to 10 feet, and a breadth at base equally variable, being in some places nearly 100 feet, while at its extreme western end it is less than 40. As far as I could ascertain, it was built on no regular plan, and the work was (a great part at least) executed under the supervision of civil agents, and without competent overseers. In its construction, rough stone (obtained in great part from the surface of the land and breaches in the vicinity) appears to have been carelessly thrown in, and sufficient batter does not appear to have been given to the exterior face above low-water mark; it being in fact nearly vertical, thus receiving the full force of the sea.

For about 150 feet in length at the east end, the top consists of a good pavement or course of heavy *split* stone, laid as headers, and about 70 feet at the west end is the same. These two portions are in good condition, and will require no repairs, with the exception of some stones at the *extreme* ends, which have been moved, and must be relaid. The intermediate portion of the breakwater is in a very rough state; there is no breach completely through, but several very nearly so, and the entire surface is very irregular, so much so that it was next to impossible to *walk* over it, being composed of rough blocks of all shapes.

Over the whole of this portion the sea breaks in southwest gales, which is the exposed quarter; and it should be raised about three feet.

It appears to me that this rough irregular portion should be levelled, and the whole raised by two courses of heavy split stone, (laid as headers on the outer face,) using iron bolts where necessary.

The whole breakwater is so much broken on the surface, and so variable in dimensions, that an accurate drawing of it would be extremely difficult; a sketch will be sufficient to illustrate its present condition and the proposed mode of repairing it. [See Sketch D, at the end of the volume.]

The shaded part is a section of the breakwater in its present condition, the dotted lines showing the proposed mode of levelling and raising by good split stone; headers on the sea face, which might occasionally extend through to the inner face.

A contract should, I think, be made for the execution of the entire work, with one or more individuals accustomed to the business, who themselves procure the stone required, and lay them in their places directly from their sloops; a competent practical man being *constantly* on the work as overseer, to direct in the operation and secure faithful execution. When not engaged with the other works under my charge, I shall visit the breakwater myself. The contract to be, to do the work at so much per ton of stone laid.

Probably the whole work could be performed by two stone sloops during the summer months, commencing in May, and completed by September 1st; of course the nature of the season will affect this point.

Only an approximate estimate can at present be formed, either of the quantity of stone required or of the cost. I give such an estimate on next page.

350 tons rough stone for levelling, laid in wall, at $\$1\frac{1}{7}$	$400
3,200 tons split stone, laid in two courses, each 1 foot 6 inches high, at $\$1\frac{1}{4}$,	4,000
Overseer, 100 days, at $2 50	250
Contingencies of all kinds	350
Amount of appropriation	5,000

I have adopted the preceding mode of execution as best adapted to the nature of the work, after obtaining all the information possible upon the subject.

Respectfully submitted.

CHARLES E. BLUNT,
Lieutenant of Engineers.

Brev. Brig. Gen. JOSEPH G. TOTTEN,
Chief Engineer, Washington City.

APPENDIX N—1.

ENGINEER DEPARTMENT,
Washington, January 31, 1853.

SIR: I have the honor to submit herewith the reports of Lieutenant C. E. Blunt, corps of engineers, and of the board of engineers of river and harbor improvements, in relation to repairing the breakwater at Hyannis harbor, Massachusetts.

The board concur with Lieutenant Blunt in his proposition, which is, to repair the middle portion of the breakwater by levelling the present irregular surface, and placing on it a capping of two courses of heavy split stone, laid with their ends to the outer face, and bolted where necessary. This will make the top of the breakwater three feet above extreme high water.

A few stones at the extreme ends must be relaid.

Lieutenant Blunt thinks the entire work should be executed by contract; and I propose, with your approbation, to instruct him accordingly, the first step to be the preparation of a suitable advertisement to procure competition for the work.

A coast survey map of the locality accompanies this communication.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brevet Brigadier General and Chief Engineer.

Hon. C. M. Conrad, *Secretary of War.*

Approved February 21, 1853.

C. M. CONRAD,
Secretary of War.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX O.

Newport, R. I., *November* 1, 1853.

Sir: I have the honor to submit the following report on the present condition of the navigation of the harbor of New Bedford, Massachusetts, with the plan proposed for the improvement of the same.

Under an act of last Congress appropriating $3,000 for the survey of Taunton river and New Bedford harbor, a survey was made of the latter by Lieutenant Rosecrans, of the engineers, a tracing of the map of which was received in September last, and a subsequent examination and reconnoissance of the harbor was made by me early in October following.

The harbor of New Bedford is formed by the estuary of Acushnel river, a small mill-stream heading about nine miles above that city and taking a southerly direction. Lying on the northerly side of Buzzard's bay, and being well sheltered at its mouth against most prevailing winds, by the projection of Fort point on the east side, and Palmer's island in the centre, the bar at the entrance from without being practicable for 18 feet water at low tide, whilst within there is found good anchorage and holding bottom in four fathoms water and upwards at the same stage, renders this a commodious, secure, and from its position an important harbor. The deep and unobstructed navigable water of this harbor lies on the eastern side, and is bordered by the village of Fairhaven, which to a certain extent has availed of the natural advantages for maritime trade so conveniently at hand. The city of New Bedford, on the western side, is at present separated from the deep waters of the harbor by an extensive shoal or flat of mud and sand, about 700 yards in width, over which there is an average depth of water at low tide of about ten feet. This shoal, which extends with variable depth entirely across the harbor, with the islands and bridges opposite the northerly portion of the city, interposes an effectual bar to the unobstructed navigation from the deep water of the harbor below up to the wharves of the city, or to the mile or upwards of good navigable water lying above the city, and the islands and bridge before mentioned.

It is affirmed, by the most experienced pilots in navigation, that good deep navigable water, sufficient for all the purposes of trade, at one time extended from below up to that part of the city in the neighborhood of Fish island, and around the latter; and this statement seems to be confirmed by the chart of Des Barres of 1776, which shows a depth of four fathoms from below up to Fish island, including the waters near it. At the present time the shipping interest of New Bedford is compelled to avail itself of a narrow artificial track or cut through the shoal before mentioned, lying in front of the wharves of the city, which had been partially excavated in an oblique direction through it, some fourteen years since, under an appropriation by the government for the improvement of this harbor, and which at this time is about two feet deeper than the contiguous portions of the shoal, but, being only about thirty feet in width, will of course only admit the passage of one ship at a time during high water; whilst the current of ebb and flood running obliquely across it, they are liable at any moment to be thrown aground, and thus to bar the passage up to the wharves of all others at a time when the harbor may be crowded with vessels, whose owners and all concerned are of course anxious for their immediate discharge.

From information obtained at this place, and deemed reliable, the city of New Bedford employs a whaling fleet of upwards of 300 vessels, tonnaging in the aggregate upwards of 1,000,000 tons, and manned by a number of seamen, differently estimated at from 8,500 to 10,000, whilst the capital embarked in this business is estimated from the same source at $7,000,000. There are also about 50 merchantmen and coasting vessels, including a few employed in trade with the British possessions in America and India. The village of Fairhaven opposite employs in the whaling business about 50 ships and 1,500 men, and a capital of about $1,500,000.

When we take into consideration the facilities of navigation to which a trade of this magnitude and value is entitled, it must be confessed that the present condition of the harbor of New Bedford is in this respect truly deplorable. The examinations and surveys which have been made lead to the settled conclusion that this shoal, which bars the approaches from deep water to the wharves at New Bedford, is not only on the increase, but that the entire channel or navigable water in front of the city, and passing between it and Fish island, including that portion lying above the bridge before mentioned, is gradually but certainly tending to fill up, and that this tendency has been accelerated, if not entirely brought about, by the well-meaning, but as is believed injudicious, creations for facilitating trade and commerce with this city by land and water.

The river opposite the upper portion of this city appears to have been formerly divided into three channels by the two islands (Fish and Pope's) lying nearly in a transverse line across it—all understood to have been once navigable.

Within the past half century a bridge has been built, under a charter from the State, connecting these islands and the opposite shores of the river and harbor, one effect of which has been to close substantially the passage on the eastern or Fairhaven side, so that the river at this point may now be considered as reduced to the two channels lying between Pope's and Fish islands, and between the latter and the New Bedford shore; the former passage being about 800 feet wide, with a channel of 12 feet depth, whilst that between Fish island and the city, now the principal channel for the trade, and originally narrow, is at present reduced, by the construction of solid wharves on either side, to 125 feet width, having a depth of 24 feet at low tide—the width at the bridge crossing just above this narrowest part being about 350 feet, the channel still retaining the same depth, and the bridge being passed by ships through a draw about 32 feet wide. This bridge, which appears to have been rebuilt about thirty years ago, has its crib piers founded, at or near the level of low water, upon masses of loose stone, thrown into and across these channels, at intervals of about 25 feet, with gentle slopes. From the depth of water in the narrow passage between Fish island and New Bedford, it will be readily perceived that the effect of this mode of construction upon the current would be that of a low, submerged dam, of variable height, thrown across a deep channel already too narrow to afford proper vent for the tide of ebb and flood, whilst the piers of the bridge occupy over one-third of the water way. The effect of this upon the flow of the water is precisely what might be expected. At ebb tide there is a considerable fall of water under the bridge or a relative rise above it, produced by this obstruction, which causes a large portion of the water, which would otherwise pass down this channel, to waste or pass off into the other channel between Fish and Pope's islands, with the additional effect of giving rise to an injurious deposit of sediment in the channel near the head of Fish island, where the waters are forced to take a new direction. Moreover, by the construction of the wharves on Fish island, and the extension of those immediately below on the New Bedford side, overlapping with the former in respect to the general direction of the current, obstructions are presented to the free entrance and passage of the flood tide through this channel. The current of the ebb through it is turned by the projection of the wharves below to a southeasterly direction, but soon assumes the general direction of the currents of the harbor to the south.

The narrowness of this passage tends to preserve within it a considerable depth of water, except at the artificial obstruction of the bridge, where the available depth in the centre of the draw appears to be about fifteen and a half feet at low water—the water way being chiefly confined to this opening. From an approximate calculation, it would appear that the quantity of water at ebb tide, passing down the centre or Pope's Island channel, is about two and a quarter times greater than that passing simultaneously between Fish island and the New Bedford shore.

The examinations which have been made appear to establish the fact, that the large body of water at ebb and flood now passes through the channel between Fish and Pope's islands, whilst the general currents of the harbor below follow the direction of that channel. The effect of this state of things upon the navigation immediately in front of the wharves of the city, below Fish island, will be apparent at a glance, the tendency being to produce cross currents and eddies, and the deposit of sediment under the lee of that island to the south, and directly in front of the city; whilst the obstructions to the free passage of the water at ebb tide through the Fish Island channel, already spoken of, tends equally to shoal and impair the navigation about the wharves opposite the north end of that island, and to force the water to follow the Pope's Island channel. From minute examinations made about the northern fork of these two channels, the bottom at the entrance of the central or Pope's Island channel was ascertained to be hard gravel and sand, and from thence to the bridge below of the same character, there being a channel passing around the head of Fish island in this direction of about twelve feet depth, deepening to fifteen feet towards the bridge. The current of ebb takes a direction square across the head of Fish island to the eastward. This bottom was not penetrated with iron rods; but it is conjectured that it is of a nature to resist, to some extent, erosion by the current, though susceptible of excavation. At the entrance of the other, or Fish Island channel, opposite the upper wharves of the city, was found a bank of soft mud in seven feet water, into which a pole could be thrust eight or more feet, the water gradually deepening towards the wharves to fourteen feet. It is understood that machinery has been used to deepen the water along here for the passage of ships.

The facts herein stated furnish very conclusive evidence that the passage between Fish island and the New Bedford shore is gradually filling up at the head, whilst the natural tendencies are still further to shoal and impair the navigation off the wharves lying below that island, and that the central, or Pope's Island channel, is increasing in depth and volume of water; this deepening is especially apparent below the bridge, as shown by the survey of Lieutenant Rosecrans herewith. This is now, in point of fact, the main channel of the river, and the thread of the current of ebb and flood; and, setting aside the bridge obstruction, the most direct navigable commmunication from the deep water of the harbor below to the navigable portion of the river lying above the islands and bridge. These circumstances, whilst favoring this channel, tend in a corresponding degree, as will be readily perceived, to the deterioration of the navigation immediately below Fish island in front of the city, as already noticed, which will appear more clearly on reference to the map herewith.

Having thus stated the particulars in relation to the present condition of this navigation, it now remains to propose some plan of improvement which may relieve the trade of this place from the inconveniences of the navigation under which it at present labors. It is evident that some steps must be speedily taken to this end, or the navigation of the harbor on the New Bedford side will stand a very fair chance of being ruined past remedy. These, whatever they may be, should have in view the counteraction, or entire removal, if practicable, of the causes which have brought about the present unfavorable condition of the navigation so justly complained of. Whilst these remain in full operation, a resort to dredging alone, for the purpose of thus creating artificial channels, may be looked upon as a temporary and hopeless expedient; whatever favor this mode alone of overcoming the difficulties may meet with, from individuals largely interested in wharf property in this harbor, though it might be applied with advantage in connexion with other projects that would tend to render the results thus obtained stable and permanent.

In considering the subject two plans present themselves, both of which, it is presumed, will be found sufficiently explained by the facts already adverted to in this memoir.

The first is, to accelerate by artificial means the course which nature now appears to be taking, and to turn or lead all the flowing water of the river through the central or Pope's Island channel, connecting the deep water of the harbor below with the navigable portion of the river above the bridge and islands by this route; removing the obstructions of the piers of the bridge crossing it, causing piles to be substituted, and a draw not less than eighty feet wide to be established in it; deepening and straightening this channel at its head, and below if found necessary, and closing the Fish Island channel altogether. This plan recommends itself, from the fact that the navigable waters above and below the obstructions would thus be connected by the shortest and most direct route; whilst this channel, which already conveys the great body of the tide, lies in the direction of the current of ebb and flood, and would therefore be most likely to possess the important element of permanency, as it would not be exposed to deterioration from cross currents. On the other hand, the main channel would thus be thrown to the distance of four hundred yards from the New Bedford shore. Hence the significant question might be raised, What is to become of the wharves in the lower part of the city, which have cost so much and are now so highly valued? It is reasonable to expect that the opposition of pecuniary interests would interpose an effectual bar to the adoption of this plan of improvement, however sound the principles might be upon which it is founded, considering only the question of the general navigation of the river, without reference to local interests; and although it would be but anticipating the ultimate fate which it is confidently believed nature has in store for this part of the harbor, if the circumstances as already described are suffered to remain as at present.

The second plan is to conduct all the flowing water of the river through the passage between Fish island and the New Bedford shore, removing, as a preliminary step, the obstruction of the piers and foundation of the bridge across this passage, and, if it is necessary to retain that structure, to cause it to be built on piles, and an eighty-foot draw established in it, as proposed for the other passage; to open a channel two hundred feet wide and seventeen feet deep at low water, by dredging, from the southern extremity of this passage in the most direct line through the flats opposite the city to the deep water below; removing the solid wharf now on the inner side of Fish island; and finally, to stop the passage of the current through the central or Pope's Island channel, by a permanent dike connecting the heads of Fish and Pope's islands.

By this plan the navigable waters above and below the city would be connected by a route much less direct than in the plan first proposed; yet the main channel of the river would in this case be brought contiguous to the wharves of the city for the most part, though diverging from the southern portion at a considerable angle towards the southeast, and though referred to the standard before alluded to, does not compare favorably with the first plan, unless there should be found under ground rocks, or such like obstacles, to the improvement of the central channel. Yet, considering the magnitude and importance of the interests concerned in the wharves of the city, it is thought advisable to adopt so much of the second plan as proposes to clear the Fish island passage of the artificial obstructions in it already mentioned as the first step, and conditionally thereon to excavate the two hundred feet channel below. The removal of the bridge obstruction would bring a greater body of water through this passage, especially at ebb tide, to the advantage of the navigation below, and lead off through it a large portion of the water now passing the Pope's Island channel at ebb tide. If, in due course of time after the execution of these improvements, it should be found that the central or Pope's Island channel still predominates, with a tendency to fill up the excavated channel below Fish island, the adoption of the plan first proposed would then seem to be indispensable to secure a permanent improvement of the channel of the river.

In addition to the large chart, a small printed map of the harbor is included herewith, exhibiting the harbor lines, as established by the commissioners in 1848. Any extension of the limits of the islands in this harbor, and especially to the form represented, would, it is believed, only add to the many difficulties which already beset this navigation.

As an estimate for the improvement of this harbor will be expected, I would remark, that in regard to the bridge obstruction in the Fish island passage, it is not now known whether there exists any authority in the general or state governments to cause its removal, or whether any or what remuneration to the company would be required in such case. The cost of this operation, I should judge, from a cursory examination, would be in round numbers $10,000.

To excavate a channel below, as sketched on the map, 200 feet wide, with a depth of 17 feet at low water, would require an average cutting of 5.2 feet, through a distance of 1,160 yards; the calculation from which data gives 134,000 cubic yards nearly of excavation. This quantity increased fifty per cent., and rated at thirty cents the cubic yard, excavated, measured in scows, and deposited to the southward near the head of Palmer's island, would cost $60,300. Seventy thousand three hundred dollars ($70,300) are therefore estimated as necessary to accomplish any improvement in this part of the harbor likely to be found generally and permanently beneficial to the commercial interests of New Bedford.

Should any grant be made towards effecting this improvement, I would recommend that the removal of the artificial obstructions in the Fish Island channel be made an indispensable condition in its application.

Respectfully submitted, by

Your obedient servant,

GEORGE DUTTON,
Captain of Engineers.

Brigadier General J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX P.

New Haven, Connecticut,
December 29, 1852.

Sir: The department having assigned to my charge the application of an appropriation of $5,000, made at the last session of Congress, for "removing a rock near the mouth of Seekonk river, harbor of Providence," I have the honor to report, that upon full investigation made at that place concerning the obstruction in question, it was ascertained that there was no rock obstructing the navigation in the waters of that harbor, nor, according to the most experienced pilots of the place, in the navigable portion of the Seekonk or Providence rivers, the junction of which forms the harbor of Providence.

There is, however, a very serious obstruction to the navigation of this harbor near the mouth of the Seekonk, caused by a bar composed of mud and sand intermixed with shells, which prevents the passage, except during high water, of vessels from the anchorage below up to the wharves of the city on both the Seekonk and Providence river sides, the eastern part of the city occupying the delta formed by these two rivers. This obstruction, known as the "Crook," appears to be the same relative to which the citizens of Providence formerly memorialized Congress, and for the removal of which an appropriation had been provided on two occasions of the passage through Congress, many years ago, of a bill for the improvement of harbors and rivers, both of which ultimately failed to become laws. It is presumed that the present appropriation had some reference to this improvement, or was founded upon the facts above noticed; but, from the terms in which the act is expressed, it is clearly inapplicable to the improvement which appears to be desired by the citizens of Providence.

In representing this matter to the department, I have, upon reflection, concluded that it might be proper for, and perhaps incumbent upon, me to report as far as practicable upon the nature of this obstruction, the mode of improving the navigation over it, and the probable cost of the improvement, as far as the cursory examination made will allow this to be done, leaving the details of the plan, and an estimate founded upon more authentic data, to be determined by the survey of this harbor, already provided for by act of Congress.

The Seekonk forms the principal branch of Providence river. At a short distance below its junction with the western or lesser branch, which passes through the centre of the city, and about half a mile below the southernmost wharves, lies the anchorage or outer harbor, where vessels await the rise of the tide to carry them over the obstructions up to the wharves of the city. From this point the Seekonk appears to be navigable for a good draught of water up to India point and bridge, on the eastern side of the city. There is also deep water along the wharves on the Seekonk side, which is separated from the main channel of that river by a shoal or flat called the Ohio. The deepest water of the western branch, which is the principal basin for the trade of the city, lies on its eastern side, and this channel connects with the one on the Seekonk side at the obstruction of the Crook. This bar has upon it but six feet depth of water at low tide, whilst the channel over it is crooked. The tide rising here six feet, gives twelve feet on this bar at high water. Along the wharves on Providence river, as the lesser branch is called, the water is about one foot deeper than over the shoal below, whilst on the Seekonk side there is about twelve feet at low tide. A sketch of the harbor is included herewith, which, without claiming to be accurate, may give an idea of the general character of this navigation.

The improvement in the harbor which appears to be required by the commercial interests of Providence, is the deepening and straightening the channel over the above-mentioned obstruction, in order to facilitate the passage of vessels up to the wharves of the city. To accomplish this, it would be requisite to excavate, by dredging machinery, a channel through the obstruction of about 450 yards estimated length, and three feet average depth of cutting, and, supposing the channel to be made 200 feet wide, the amount of excavation would be increasing the nett calculation 50 per cent.; 45,000 cubic yards, which, at 50 cents the yard, would cost $22,500, an amount which it is recommended to provide for this improvement in case it should be undertaken.

It is not intended by the present report to submit a definite project for the improvement of this harbor. An appropriation of $1,500 was made at the last session of Congress for the survey of the harbor of Providence, Rhode Island, which survey is now in the hands of an officer of the department, and will furnish all the data required to enable the plan of improvement to be laid down with an exactness which it is not possible now to arrive at. The principal object of this report is to submit a conjectural estimate of the amount supposed to be necessary to effect the improvement in this harbor desired by the citizens of Providence, and of the appropriation which it would be proper to make in the event that the execution of the work by the general government should be sanctioned by legislative authority.

I have the honor to be, respectfully, your obedient servant,

GEO. DUTTON,
Captain of Engineers.

Brig. Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX P—1.

New Haven, Connecticut,
April 20, 1853.

Sir: I have the honor to submit a plan and memoir for the application of the sum of $5,000, appropriated by act of Congress of August 30, 1852, for the removal of a rock near the mouth of Seekonk river, harbor of Providence, Rhode Island, and as explained by joint resolution of the 20th January, 1853, "construed to authorize the removal of any rock or other obstructions at the Crook on the entrance or mouth of Seekonk river, harbor of Providence, Rhode Island."

It is ascertained that the obstructions to navigation near the mouth of the Seekonk, in this harbor, which are complained of by those interested in the commerce of this place, is a shoal or bank known as the Crook, lying at the junction of the Seekonk and Providence rivers, and at the entrance to the inner harbor or principal basin for the trade of the place, and in a direct line from the latter to the deep navigable waters of the river below.

The Seekonk is the main branch of the lower Providence river, being the estuary of the principal stream, the Blackstone river, which discharges into the head-waters of Narragansett bay, and is navigable for coasters about four miles above Providence; whilst in that part of it which forms a portion of this harbor, about 21 feet at low tide can be carried up to India point on the eastern side of the city. A branch of this channel, containing about 15 feet water at low tide, passes from India point along the wharves on the south side of the city, or portion lying on the Seekonk, in a curved or semi-circular direction, and unites with the channel out of the lesser Providence river at Fox point, above and near the obstruction of the Crook. Between this shore channel and the main one of the Seekonk lies a shoal, sometimes bare, called the Ohio flat.

The great predominance of the current out of the Seekonk river, crossing the direction of that out of the lesser Providence river, has without doubt created and tended to maintain a shoal at the entrance to the inner harbor. According to the survey of this portion by Lieutenant Rosecrans, in December last, as compared with the city survey of the same ground in 1849, (both herewith,) there has been an increase in the general depth over this shoal, since the latter date, of about one foot; and I am informed by persons long acquainted with the changes in the navigation, that the water just below Fox point has been gradually deepening for many years previously. The only cause which can be assigned for this is the filling out and extension of Fox point, and the continuation of the wharf at that point in a southerly direction parallel with the eastern shore of the inner harbor, which has had the effect measurably to turn the current from the inner or shore channel, on the Seekonk, in a direction nearly parallel to that out of the inner harbor or lesser Providence river. A red line marked on the map shows very nearly the extent of this made ground, which was excavated from the hill in the rear. At the present time, vessels running in or out of the inner harbor are compelled to take a curved direction to the eastward from Fox point and the navigable water below, in order to avoid the obstruction of the Crook, upon which vessels are apt to ground, especially when bound inwards. To the westward of this shoal there is a narrow passage, occasionally used by steamboats, called Ruggles' channel, through which, according to the survey of Lieutenant Rosecrans, there are 6 feet water at mean low tide, the shoalest water on the Crook appearing by the same to be 4.3 feet. In the channel now used, lying to the eastward of the Crook, it appears from the same survey that between 7 and 8 feet at mean low water are passed over from Fox point descending.

The shoal about the Crook appears to be composed of mud, sand, and shells, and can, it is assumed, be readily excavated by dredging machinery. In proposing a plan of improvement for this portion of the navigation, it is assumed that we are limited by the act of appropriation to the space from the Crook inclusive to Fox point, or the entrance to the inner harbor. The channel of the latter lies close to its inner shore, which has been filled out nearly on a right line for its whole length to deep water. The western side is occupied by mud flats, bare at low water. Whilst the removal of the obstructions at the Crook would be a very great convenience to the commerce, the bulk of the commercial interest of this place, which is mostly located along the inner harbor, which is gradually filling up, would unquestionably, and for obvious reasons, favor the extension of this improvement from Fox point up to Weybosset bridge, through its whole length, near one mile. The improvement which seems to be required to meet fully the views of the commercial interests of this place, is to excavate a channel throughout the whole length of the river harbor, along its eastern shore, 200 feet wide and 9 feet deep at low water, and to fill out on the western side over the flats, carrying the harbor line on that side to within 350 feet from and parallel to the eastern side, and continuing this line to the channel below into not over four feet water at low tide; thence in a direction parallel to the main channel, so as not to interfere with that part below, which would serve as a beating channel at flood tide for coasters, (as indicated by a red line on the printed map herewith.) A project similar to this in its principal features has, I am informed, been already moved by parties interested in the navigation of the harbor. The progress of this improvement would probably, in a great measure, be governed by the growth and extension of the city to the southward. The southeastern portion, lying on the Seekonk, has already good navigable water within reach, but is less favorable for the location of business establishments on account of the heights directly in the rear, which have been already partially excavated for the construction of landings on that side.

It is now proposed to remove the shoal of the Crook and open a channel from Fox point to the deep water below, in a direction to be the continuation in a straight line of the channel of the inner harbor, or parallel to the eastern shore thereof, and to make this channel 200 feet wide and 9 feet deep at low water, as indicated by red lines on the map, which, with a rise of the tide of six feet, would allow the passage of most any description of merchantmen with their cargoes. It is believed that this artificial channel might be very much protected from deterioration by an extension in solid of the Fox Point wharf parallel to its direction, 80 yards southerly, (as shown in red lines on the map,) for reasons already adverted to; which extension might, at a future time, be carried to the main channel harbor. The present appropriation will probably be sufficient to excavate a channel of the depth proposed to the width of 150 feet, measuring from the eastern side of the harbor, which would equally, with the former width, include the removal of the Crook. The survey recently made by Lieut. Rosecrans enables the excavation required to form the channels proposed to be calculated with tolerable accuracy. According to his letter to me of the 8th instant, the mean range of the tides taken for six days in December last at the new moon, was 6′.06. The lowest low water below the plane of reference on the accompanying drawings was 1′.44, and highest water above it, 5′.97. From some remarks in the same letter, I infer that his plane of reference was the same as that used in the city survey of the inner harbor herewith. Not being entirely certain that it indicates the true mean low water, I have in the calculation added one-third to the nett calculated amount of excavation for the amount to be provided for.

The mean length of the channel will be 280 yards, and the mean cutting on the 150 feet width will be 2′.1, and that on the 200 feet wide channel, 2′.41.

The calculation, increased as before mentioned, gives—

For the 150 feet channel................	13,000	cubic yards, nearly.
For the 200 feet do..................	20,000	do.

It is proposed to execute the work by contract with persons having on hand the proper machinery, and it is supposed that 50 cents per cubic yard would be the outside limit of cost. On this supposition $5,000 would be required, in addition to the present grant, to complete the improvement proposed at this point. No estimate for any permanent auxiliary works is submitted, as constructions of this kind here are controlled by the city authorities.

Respectfully submitted.

GEO. DUTTON,
Captain U. S. Engineers.

Brev. Brig. Gen. J. G. Totten,
Chief Engineer.

APPENDIX P—2.

Engineer Department,
Washington, May 26, 1853.

Sir: Captain George Dutton, corps of engineers, in charge of the removal of the obstructions at the mouth of the Seekonk river, harbor of Providence, proposes to apply the means in his hands, and such grants as may be hereafter obtained, to dredging a channel of proper depth and width through this obstruction, so as to connect the depth of water of the outer harbor with that above; the present grant to be expended, in accordance with the law, between Fox point and the Crook.

The board of river and harbor improvements approve the project, in which I also concur.

I have the honor to propose it for your sanction, and that I be authorized to instruct Captain Dutton to proceed at once to contract for excavating as good a channel, over this lump, as his means will afford.

The reports of Captain Dutton and of the board, together with three maps, are enclosed herewith.

I have the honor to be, very respectfully, &c.,

JOS. G. TOTTEN,
Brev. Brig. Gen. and Col. of Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved:

JEFFERSON DAVIS,
Secretary of War.

WAR DEPARTMENT, *June* 1, 1853.

The officer was instructed to carry the project into execution accordingly, as approved.

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APPENDIX P—3.

NEWPORT, RHODE ISLAND,
October 20, 1853.

SIR: I have the honor to report herein the progress which has been made in the removal of obstructions to navigation in the harbor of Providence up to the 30th September ultimo, pursuant to an act of last Congress appropriating $5,000 for the removal of any rock or other obstruction at the Crook, or entrance or mouth of Seekonk river, harbor of Providence, Rhode Island.

The portion of the harbor including these obstructions was surveyed by Lieutenant Rosecrans in March last, and the plan of improvement subsequently adopted was, to excavate a channel, by dredging through the obstructions at or near the Crook, 150 feet wide and nine feet deep at low water, from the inner harbor or basin to the main channel of the river below, on a length of 280 yards, commencing at Fox point and running in a direction; the continuation in a right line of the channel of the inner harbor to be widened to the westward according to available means.

A contract on terms considered reasonable was entered into, June 30th last, with John C. Haskell, of New Bedford, Massachusetts, for the removal at this point, by dredging machinery, of 17,000 cubic yards of mud, sand, and shells, at a certain price per cubic yard, measured in scows provided for its reception, and conveyed to a proper distance; under which contract 11,985 cubic yards of this material have been removed from the obstructions lying in the channel indicated up to the 30th September last, and the balance of the contract is expected to be completed on or about the 1st December next.

The lump or obstruction known as the Crook, and composed of stiff mud and shells, upon which there was originally, according to the survey, 4.3 feet water at low tide, has been removed to the depth of from nine to ten feet, and the channel generally within the limits before mentioned deepened, at the *present date*, irregularly, to nine feet at that stage throughout its whole extent, with a slight exception, it being expected to accomplish this, and some widening to the westward at the lower mouth, with the present means. The principal channels in this harbor and the river below are marked out by dolphins composed of about five piles, each securely driven in to the bottom and banded together with iron. One of these (No. 9 of the survey, which marked the obstruction of the Crook) has been allowed to remain until it shall be found expedient hereafter to give it a new location to the westward of the present one. Vessels would now have the choice of passing either side of it, there being a clearance on its west side of about 104 feet.

Of the appropriation of $5,000, there was expended on the 30th June, 1853	$156 50
And to the 30th September, 1853	2,753 41
Leaving available on the 1st October, 1853	2,246 59

All which will require to be expended, during the fourth quarter of the present calendar year, in completing the improvement now in hand.

In order that the full advantages of the present plan of improvement may be realized, it seems necessary to increase the width of this new artificial channel one hundred feet further to the westward, from the crowded state at times of the entrance to the inner harbor, the channel of which, as well as that of the entrance, is too narrow for the wants of trade; making the whole width of the new channel 250 feet instead of 150, as at present, including the south end of the west side a little to the westward, and directing it towards a dolphin, No. 11 of the survey, so as to give an easier entrance from the channel below, as shown on the map herewith.

This would require, according to the nett calculation, an additional cutting of 15,640 cubic yards, including 2,060 cubic yards to truncate the obtuse angle formed by the western side with the main channel below.

The present improvement required, according to the same standard of calculation, 9,640 cubic yards of excavation for the 150 feet wide channel; and it is ascertained, from the experience of the past season, that near 16,000 cubic yards, as excavated by machinery, judiciously applied as possible, and measured in the receiving scows, are required to be provided for, to obtain nine feet depth clear of obstruction in the space thus estimated for, being an increase of near two-thirds over the calculated amount. Increasing accordingly the amount as ascertained above, we shall have 26,000 cubic yards very nearly to remove as a measure of the work to be done in the proposed extension of the improvement, which, at thirty cents the yard, including contingent expenses, being about the rate of cost of the present work, would amount to $7,800. This being estimated as necessary for the completion of the improvement in the manner proposed, it may perhaps not be out of place to remark, in this report, that with respect to the inner harbor, at present the principal basin for the trade of the city, a comparison of former surveys indicates that it is gradually shoaling. It is too narrow and incommodious for the commerce at almost any stage of the tide. To excavate a channel throughout its whole length, sufficient to accommodate the business establishments located along its border, say two hundred feet wide and nine feet deep at low water, over a length of 1,620 yards, would require the removal of about 270,000 cubic yards of dredged material, costing, at the rate of twenty-five cents the yard, the sum of $67,500.

The present harbor limits have been established by city ordinance on a line running southerly from Eddy's point, with a bearing of S. $9\frac{1}{4}°$ E., (supposed magnetic.) It is thought this limit might very properly be extended, and with advantage to the navigation, to a line running from Dorrance street wharf, tangental to the western culmination of the main channel below, through not over two feet water at low tide, on a bearing of about 24° with the true meridian, which would not interfere injuriously with the coasting navigation at any stage of the tide, and would bring the city limits along the border of a deep navigable channel, which nature has already provided within a very moderate distance.

Respectfully submitted, by

Your obedient servant,

GEORGE DUTTON,
Captain of Engineers.

Brig. Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX Q.

New York, *December* 11, 1852.

Sir: I have the honor to submit herewith a project and memoir relative to the improvement of the harbor of Bridgeport, Connecticut, for which an appropriation of $10,000 was made by Congress at its last session, and includes therein an estimate of the cost of completing the proposed improvement.

The harbor of Bridgeport possesses the comparative advantage of a considerable range of tide, which enables vessels of some burden to pass up to the wharves of the town over the obstructions at its entrance during the high stage of the water, whilst there is good holding ground on the outside, where vessels can in general lay with tolerable security whilst awaiting the rise of the tide to carry them in. The mean range of the tides here, according to the United States coast survey, is 6.6 feet, whilst that of spring tides is 8.8 feet. The entrance to the harbor is obstructed by two bars, known as the outer and inner bars; the former lying at the entrance from the sound, and distant by the channel-way $1\frac{3}{4}$ miles from the city, is composed of coarse and tolerably compact sand. On the western side of the channel over this bar a small iron light-house has been erected within the year past.

The inner bar, distant about 700 yards inside of the former, is composed of coarse compact gravel, except on its southern or lee side, contiguous to deep water, where it is sandy. After passing the outer bar, the deep water spreads out over a considerable space chiefly to the eastward, affording convenient room for beating up to the inner bar. The channel over both these bars is quite narrow at low tide, and that over the inner bar crooked. Previous to 1838 the depth of water over the outer bar at mean low tide was five feet, this depth covering the greatest portion of it; whilst over the inner bar there was, as is found at present, at the same stage of the tide, five feet, but confined to a very short distance, and deepening gradually to eight feet on each side. This bar on both sides, as well as the inner side of the outer bar, falls off abruptly into ten feet water; whilst the outer bar deepens gradually on the side towards the sound. The latter, at the time mentioned, was considered the greatest obstruction of the two, as vessels which could succeed in passing the outer found no difficulty in passing the inner bar. Since that time, however, the relations between the two bars have been changed, the outer being now practicable for about one foot greater draught than can be carried over the inner bar, the latter now forming the greatest obstruction. This change is not, however, attributable to any natural causes. During the year 1838, under an appropriation by Congress of $10,000 for the improvement of this harbor, dredging machinery was applied to the outer bar, and a channel said to have been 61 feet wide was cut upon it, commencing from the inner side. How far this cut was carried cannot be satisfactorily ascertained, as there is much obscurity in the official record concerning the matter. The report of Captain Swift, of 1838, states that a channel had been cut through the outer bar 61 feet wide and 8 feet deep at low water. The report of the local agent in charge of the work states the channel cut to be 60 feet wide and nearly 60 rods long. It is, certain, however, that the work was continued until the appropriation therefor was exhausted. Whatever may have been the depth originally obtained by the operation referred to, the result of careful examination just made shows that six feet mean low water can now be carried over this bar through a channel about 90 feet in width, beyond which lateral limits it shoals to five feet, being the general depth over this bar represented on the hydrographical chart of Lieutenant Blake, of the United States coast survey, made in 1837, the year previous to this dredging operation, which thus appears, after the lapse of fourteen years, to have had a marked and beneficial effect upon the navigation over this bar, as the channel cut still remains and affords an improvement over the original depth of one foot; whilst the effect of time appears to have been to level down the original irregularities on the bottom and sides of this cut, and give it a tolerably uniform section throughout.

From a very careful examination of the inner bar, no change can be detected in its form, or the depth of water over it, from that shown in the hydrographical survey of Lieutenant Blake, of 1837; nor does any marked difference appear on the outer bar, aside from the artificial cut mentioned, from the same chart. It may be proper to state, that the depth of five feet at mean low water, on the most prominent part of the channel over the inner bar, was assumed as the standard of comparison in the soundings taken; this depth being taken as invariable since the survey of 1837; which assumption was confirmed by the evidence of the practical pilots attached to the navigation.

It is assumed that a depth of eight feet at mean low water over these bars, in connexion with the rise of tide with which this harbor is favored, will be sufficient for navigation by that class of vessels which the trade of Bridgeport may require; and to this extent it is now proposed to improve the navigation over them.

To effect this, no better plan presents itself than dredging a channel through both of suitable dimensions. Although this method of improvement, as applicable to shifting sand bars, or to seaward bars in general, may be considered of temporary utility at most, if not altogether inexpedient and wasteful, yet in some instances, where the circumstances have been favorable, it has been attended with highly useful results. In the case of the harbor of Bridgeport, it is believed, these favoring circumstances exist in a sufficient degree to warrant the application of the method there, in preference to any plan of permanent structures with the same object, which, apart from their heavy cost and problematical results, would form dangerous obstructions to the navigation during the high stage of the waters.

The entrance to this harbor is retired from the sound or embayed and sheltered on the east by the projection of Stratford point, and to the southwest by the point of the Cows off Black Rock harbor—a position supposed to relieve it in a great measure from the injurious tendency of drift. Whatever there might be of this, is supposed to proceed from the westward.

The fact is established that the narrow channel cut over the outer bar in 1838, whether it has partially filled or not since that date, still remains and affords a decided and apparently permanent improvement in the navigation over that bar after the lapse of fourteen years, which I attribute to the stable character of the bar in general, the absence of drift, and the fact that the currents of ebb and flood tide through it are both parallel to its direction.

In regard to the inner bar, there can, I think, be no doubt that a channel cut through it would remain permanent, from the peculiarity of its composition, as already described, and its retired position sheltering it from any disturbing causes from the outside.

It is, then, proposed to cut a channel through both these bars by dredging, two hundred feet wide and eight feet deep at mean low water; to locate them as near as practicable to the present deepest water, and to give them the direction of the current of ebb and flood tide; to make them at first one hundred feet wide, and subsequently to widen them one hundred feet further on the eastern side. The first dimension would allow the commodious passage of vessels, whilst that ultimately proposed would permit of their beating through with a leading tide.

The position of these proposed channels is laid down on the chart herewith in red lines. That on the outer bar, which covers the present deepest water thereon, is so arranged, that while the current of the tides is parallel to its direction, the latter passes clear of the shoaler ground to the westward, whilst running in towards the inner bar. The proposed cut through the inner bar, the present channel over which is narrow and crooked, is laid down on a straight line, as near as practicable, in the direction of the tides of ebb and flood; whilst its lower extremity debouches into deep water, where there is sufficient sea room for manœuvring. The material excavated from the outer bar it is proposed to deposit on the shoal ground, three hundred yards to the eastward of it, and that from the inner bar to the westward of the southwest beacon when the state of the tide permits; otherwise upon the shoal ground three hundred yards eastward of that bar, so disposed of, it is believed, that it cannot interfere injuriously with any portion of the navigation. Some pains have been taken to determine, with accuracy, the extent of cutting required for these two proposed channels. The distance over the outer bar from eight feet depth at low water on each side at the location of the channel over it, is, as ascertained to be, two hundred and sixty yards, and that over the inner bar three hundred and twenty yards. The mean cutting, or rather the mean increase of depth required on the outer bar, is 1.96 feet, whilst that required on the inner bar is 2.56 feet. Experience has shown that the nett elements of the calculation thus obtained do not give, by considerable, the actual amount of earth required to be excavated and removed, to afford the required depth throughout the channel clear of obstruction. The amount of this difference depends, in some measure, upon the character of the machinery used, but is very material, whatever may be the plan. Judging from my own experience, and that of others, I conclude that fifty per cent. over the nett calculation is as small an allowance as ought to be made on this account; but that this would be sufficient in every case I consider as by no means certain.

We have, then, for the amount of excavation required on the outer bar, according to the design, $1.96 \times 260 \times 200 \times \frac{1}{9} = 11,324.44$ cubic yards, increasing which 50 per cent. gives $16,986\frac{2}{3}$ cubic yards requiring removal from the outer bar. And $2.56 \times 320 \times 200 \times \frac{1}{9} = 18,204.44$ cubic yards, which increased 50 per cent. gives $27,306\frac{2}{3}$ cubic yards to be removed from the inner bar. And for the completion of the improvement $44,293\frac{1}{3}$ cubic yards.

On the supposition that in the execution of this work the plan is adopted of building the necessary machinery and accessories, and applying them by means of hired workmen, I have to state, that the daily expenditure required to man and work a dredging boat and its relieving scows will be about twenty-five dollars. The actual cost of labor per cubic yard of earth removed by this machinery depends very much upon the locality, and its greater or less exposure, but may be set down at twenty-five cents at the outside. In this case the cost of executing the work is estimated as follows:

For the construction of a steam dredging machine of the most efficient kind	$15,000
Four receiving and dumping scows, at $600	2,400
Ground tackle, apparel, and furniture	1,800
Excavation and removal of 44,300 cubic yards of earth, at 25 cts	11,075
Superintendence, surveys, and contingencies	1,725
Amount of estimate	32,000

The present appropriation of $10,000 for this improvement will be inadequate to cover the cost of the machinery required. But it is believed that in this particular case the work may be obtained, executed, in part or whole, by competent and responsible contractors, accustomed to such work, and having on hand their own machinery. This course would enable the amount appropriated to be applied directly to the work of improvement, on the system of paying by the unit of quantity removed, by which the execution of a greater or less amount of work may be provided for, according to the available means, and the benefits expected from the appropriation will be the soonest felt. It is also quite probable that the whole work may be completed at a saving by this course; for if it were done by machinery built for the purpose and applied by hired workmen, the former would remain on hand, at the close of the operation, to be taken care of, or else sold at a monstrous sacrifice.

The cost of this work executed by contract, and limited in amount by the available means, would, as I have reason for believing, vary from fifty to seventy cents the cubic yard removed, according to the bar operated upon; and better terms could no doubt be obtained, were the means sufficient to cover the execution of the whole work.

For the above reasons, I do not hesitate to recommend, in the present case, the application of the system suggested. As the inner bar forms now the principal obstruction to the navigation into this harbor, and as the judicious removal therefrom of about 4,000 cubic yards of gravel would render its navigation as good as that at present over the outer bar, I would recommend the application in this way of a portion of the present appropriation, and that of the balance in deepening the outer bar. It must be borne in mind, that any very beneficial effect from deepening the latter bar will not be experienced unless the inner bar is improved at the same rate; though vessels, by being enabled to pass the outer bar, might obtain a more sheltered anchorage between the two.

As regards the immediate superintendence of this particular work, I have to state, that as the superintending officer will necessarily have to be absent therefrom a considerable portion of the time in the discharge of other duties, a trusty civil agent would be required to be always present on the spot, to keep an accurate account of the work done, and enforce the directions of the superintendent and the stipulations of contract. A public boat and a principal boatman will require to be attached to the operations; any additional hands that may be required to aid in inspection and surveys being temporarily hired for the occasion.

I would recommend that an appropriation of $22,000, being the difference between the amount of $10,000 already appropriated and the estimate hereinbefore submitted, be made for the continuation to the completion of this work upon the plan proposed.

Respectfully submitted.

GEO. DUTTON,
Captain of Engineers.

Brig. Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX Q—1.

Engineer Department,
Washington, January 31, 1853.

Sir: Captain George Dutton, corps of engineers, has reported a project for the further improvement of the harbor of Bridgeport, Connecticut.

Captain Dutton proposes to apply the existing appropriation by contract—first, to dredging a channel over the inner bar of this harbor one hundred feet wide, and to a depth of water equal to that now on the outer bar; and, secondly, the balance to be used in deepening the outer bar for an equal width, to eight feet at low water, if the means will effect so much.

Should additional appropriations be made, he proposes to complete the improvement by excavating the channel over both bars to the depth of eight feet at low water, and then to widen these channels to two hundred feet.

The board of engineers for river and harbor improvements have approved of Captain Dutton's project.

With your approbation, I will instruct Captain Dutton to apply the existing appropriation to the dredging of a channel of equal depth and width over both bars, and in such a way that any additional appropriation may be used to the greatest advantage towards increasing such depths and widths to those proposed by him for the dimensions of the completed improvement.

For this purpose he will be directed to prepare the necessary advertisement to draw the attention of contractors to the work, and forward it for issue from this office.

Captain Dutton considers the constant presence of a trusty civil agent to be necessary to the interests of the government, and in this I concur with him.

The reports of Captain Dutton and of the board, with a map, are submitted herewith.

I have the honor to be, very respectfully, &c.,

JOS. G. TOTTEN,
Brev. Brig. Gen. and Col. of Engineers.

Hon. C. M. Conrad,
Secretary of War.

Approved:

C. M. CONRAD,
Secretary of War.

February 5, 1853.

The officer was instructed to carry the projects, as approved, into execution accordingly.

APPENDIX R.

Newport, *November* 8, 1853.

Sir: I have the honor to submit the following report relative to the operations for the removal of the Middle rock at the entrance to the harbor of New Haven, Connecticut, for which an appropriation of $6,000 was made at the 1st session of the last Congress.

This rock, which is marked by a buoy and has over it 10 feet least depth of water at low tide, is the most eastern of a group of four, including the southwest ledge, upon which an iron beacon was erected in 1851, and which lie nearly in a right line across the deep water at the entrance of the harbor, in an easterly and westerly direction, distant about one mile to the southward of the light-house on Five-mile point, and occupying a length of about 600 yards, with channels between of 25 feet depth at low water.

It is proper to state, in the commencement, that the above appropriation appears to have been made upon the report and recommendation of the then collector of the port of New Haven, and was founded upon the favorable results obtained upon the rock obstructions in Hellgate, New York, by the process of submarine blasting of Benjamin Maillefert, and upon an intimation from the latter of his readiness to undertake the work of removing this rock to the depth of 17 feet at mean low tide, for the sum above named.

With the approval of the War Department, a contract was entered into with Mr. Maillefert, November 23, 1852, to remove this rock, by the first of June following, to the level of 17 feet below mean low water in the harbor of New Haven, for the sum of $6,000, the amount of the appropriation; this contract being amended under date of February 5, 1853, so as to define the level of mean low water by reference to a permanent beach mark fixed near the light-house on Five-mile point, and extending the time of completion to the 20th of July following.

Under this contract, Mr. Maillefert commenced operations on the rock on the 9th July last, and after firing upon it 36 charges of 125 pounds of powder each, according to his process, discovered upon examination that the effect thereof was not equal to his expectations; tha the rock was also larger than he supposed; and that, moreover, another rock existed in the neighborhood, at a short distance from the Middle rock, upon which he had been operating. He therefore concluded, on the 14th July, to suspend operations, notifying me of the fact, upon which I immediately repaired to New Haven. On the 22d July Mr. Maillefert came to the conclusion that he could not reduce this rock to the level of 17 feet water at low tide for the $6,000, amount of appropriation, and that therefore it would be impossible for him to fulfil the contract entered into on the 23d November, 1852. After some detention, caused by unfavorable weather, a minute examination was made by me of the locality, and a survey and measurement of the Middle rock, upon which Mr. Maillefert had been operating, was completed on the 29th July. This examination brought to light the existence of two other rocks lying to the westward of the Middle rock, and nearly on a line with it and the southwest ledge, having over them 14 and 13 feet least depth of water at low tide, respectively. The Middle rock was found at 17 feet depth below low water to have a horizontal area of 760 square yards, and a cubrical content above that level of 1,330 cubic yards; corresponding very nearly with an admeasurement of the same just previously made by Mr. Maillefert.

Upon due consideration and calculation, it was concluded, that by this process or any other the rock could not be reduced to the depth of 17 feet contracted for, for the amount of the appropriation; and a supplementary contract, dated August 2, 1853, was entered into with Mr. Maillefert to reduce this rock to the level of 13½ feet below mean low water, instead of 17 feet, for the said sum of $6,000—the time for the completion of the work being fixed on 1st November following. Under which he recommenced operations on the 9th August; and after firing 54 charges more upon the rock, under unfavorable circumstances as regarded the weather, he finally, on the 29th August, suspended operations thereon for the season, finding the effect of these charges much less than he anticipated, though some was apparent. And finally, concluding that the contract last entered into could not be completed for the amount of the consideration, he substantially abandoned it, and on the 22d September submitted his statement of the circumstances, including a proposition for his remuneration for necessary expenses incurred in the operations; which statement accompanies this report. None of the appropriation of $6,000 has yet been drawn from the treasury, nor any money paid on account of this contract, up to the present time; and thus the matter stands at present. I believe this contract to have been entered into with the United States by Mr. Maillefert in entire good faith, and that he has underrated the difficulty and expense of this rock removal, even by his process; and that previous to entering into the supplemental agreement of August 2, 1853, he had miscalculated the size of this rock, although its position is marked by the "Rocky buoy" located on its southern extremity. He appears to be of opinion that, in a survey made by him in 1850 with a view to making a proposal for the removal of this rock, he had mistaken one of those discovered during the past summer, as already mentioned, for the veritable Middle rock. But had his estimate of its size been even correct, it is shown that the result would have been still the same.

However this may be, the rock itself appears to have been more unyielding to the explosion of the charges fired on it than was evidently anticipated. It appears to be composed of the reddish-colored, coarse-grained granite found in this neighborhood, though not the hardest quality of that kind of stone. It may be added, that this locality being one ot peculiar exposure, an operation of this kind here would be more liable to interruptions and delays, and attended with a greater consumption of time, than in ordinary cases. Still, 90 charges appear to have been exploded on this rock, and although with a decided effect, yet such as was entirely out of proportion to that required to enable the contractor to realize suitable compensation, or to cover the actual cost of the work if carried to completion, either under the original or supplemental agreement, for the amount appropriated for this object. Mr. Maillefert, although in this case perhaps failing in the requisite degree of foresight, has nevertheless shown himself to be a skilful and energetic operator in this peculiar branch of business.

In addition to the facts in this case, it will, I presume, be expected of me to submit my views as to the course which, under the circumstances, it would be proper for the government to take in this matter. As has been before intimated, the appropriation of $6,000 made for this work, and subsequently shown to have been inadequate, originated, as there seems to be no doubt, in the confidence of the legislative branch of the government in the general utility and advantage of this process of Mr. Maillefert, which appears by the act aforesaid to have substantially endorsed the merit of the same, by a grant of money for this work, founded upon his estimate and promise of performance. It therefore seems reasonable and proper that he should be remunerated for his efforts and the expense he has incurred to fulfil the expectations which have been held out to the government and country from this process, the introduction of which he claims, and which had then, and is presumed still to have, the entire public confidence in the utility and importance of its results.

Should it be the policy of the government to continue this work to completion, according to the original design, and furnish the necessary means therefor, there can be no doubt that the effect of the operations thus far of Mr. Maillefert would possess their full value in any future one undertaken for the execution of this work, whatever process may be adopted; whilst it is certain that the practical operations thus far have been the same that they would have been under the process of Mr. Maillefert, had there been ample means available for the completion of the work by that method. Therefore, in the event of a further grant by Congress for the execution of this work upon the estimate of cost herewith subjoined, it is recommended that Mr. Maillefert be allowed another opportunity to complete the work which he commenced, upon condition that ample security be furnished therefor; and provided, moreover, that his terms are ascertained to be the most reasonable that can be obtained. And should the government decide not to proceed with the work, and refuse the grant of further means therefor, I would recommend that Mr. Maillefert receive suitable remuneration for his outlay and work thus far, to be fully and fairly ascertained hereafter by the proper agents of the government.

As before stated, a minute survey was made, under my immediate direction, of the Middle rock in July last. The two other rocks in the neighborhood, Nos. 2 and 3, before alluded to, and designated B and C, were at the same time examined, and the least depth of water over them at low tide ascertained, together with their general dimensions and relative position. A minute measurement of the two last was subsequently, and near the same time, made by Mr. Maillefert.

It is only during the summer season, with favorable weather and a certain stage of the tide, that operations of this kind can be properly performed at this locality. Drawings of these rocks are forwarded herewith. Upon the western one of the group, known as the southwest ledge, an iron beacon was erected in 1851, under the superintendence of the collector of the port, by Mr. Maillefert, under contract with the government, and serves to mark conspicuously that obstruction.

The character of these rock obstructions was ascertained as follows, the depths noted having reference to mean low tide at the mouth of the harbor:

The Middle rock, or No. 1, point A: Least depth 10 feet; area at 17 feet depth, 760 square yards; content at ditto, 1,330 cubic yards.

Rock No. 2, or point B: Least depth 14 feet; area at 17 feet depth, 435 square yards; content at ditto, 239 cubic yards.

Rock No. 3, or point C: Least depth 13 feet; area at 17 feet depth, 992 square yards; content as ditto, 600 cubic yards.

The removal or reduction of these rocks to 17 feet depth at low water, would allow the passage over them of the largest description of vessels engaged in the trade of this port at any stage of the tide.

The principle involved in the process of Mr. Maillefert for the removal of prominent submarine obstructions, as rocks, &c., is no doubt by this time well understood, and though not novel, is of recent introduction into this country. Its effect results from the momentary reaction, upon the substance to be broken up or removed, of a large volume of elastic gases instantaneously generated in the unelastic medium of water, under the pressure of a considerable head. As the cohesive resistance of the material operated on is supposed constant at all depths, it follows that within certain practical limits the effect bears a very sensible proportion to the depth of water in which the charges of powder may be fired; and hence the horizontal space occupied by the rock at any uniform or constant depth of proposed reduction, is an important element in the comparison of cost by this process, from the fact that the maximum effect would be produced by exploding the charges constantly at the lowest level, whilst this cost would of course be measurably influenced by the prominency or content of the rock.

An estimate of the cost of effecting the removal of these rocks must be for the most part conjectural, from the nature of the operation and the absence of reliable data to serve as a guide in establishing a rate of cost.

The process of Mr. Maillefert is supposed (as it is claimed to be) the least expensive mode of operation in bringing about these results, and is certainly the most practicable of application in exposed situations and deep water. Yet some rock removals in Hellgate during the past season, in about 22 feet water at low tide, by this process appears to have cost at the rate of $30 78 the cubic yard.

From an attentive consideration of all the facts and experience thus far obtained relative to the subject, I submit the following estimate for the removal of these rock obstructions to the depth of 17 feet at low water:

For the removal of the Middle rock, in addition to the amount of $6,000 appropriated	$30,000
For the rock No. 2, or B of survey	12,000
For the rock No. 3, or C of survey	30,000
Amount for the group	72,000

As these several rocks are not far distant from each other, it would seem that any plan of improvement here should have in view the reduction of all of them to one uniform depth, to bring about fully the results intended by these operations.

Respectfully submitted by your obedient servant,

GEO. DUTTON,
Captain of Engineers.

Brig. Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX R—1.

New York, *October* 27, 1852.

Sir: I have to inform the department that I completed on the 23d instant the examination of the harbors of Bridgeport and New Haven, and also at Providence, Rhode Island, in reference to the improvements contemplated therein in the harbor bill of last session of Congress, and shall shortly render my report to the department thereon, so far as relates to the character of the work to be done and the mode of its execution. A proposition has been made by Mr. B. Maillefert, who is now engaged upon the rocks in Hellgate, to break up and level the Middle rock, at the entrance of New Haven harbor, so as to accomplish the improvement desired, for the sum of $6,000. A copy of this proposal I forward herewith. Mr. Maillefert's process has been attended with so much success in similar works upon which he has been engaged, and is, as it would seem, so much less expensive in bringing about the result desired than any other known or practicable process, that although he has a monopoly of this one, it would seem advisable to accept his proposition. I am informed, by the collector at New Haven, that the lowest proposals formerly received by him from other quarters, for this or a similar work in that harbor, was between nine and ten thousand dollars, whilst that of Mr. Maillefert's was for the sum of $6,000; and that it was upon this last proposition that an item of this amount for that purpose was introduced into the harbor bill by the committee. The collector and the shipping interest at New Haven appear to take some interest in having this work attempted, and if possible executed, before the depth of winter, as better suiting the immediate wants of the trade. Mr. Maillefert's engagements in the harbor of New York at the present time, together with the advanced state of the season, appear to me to be much in the way of his being able to effect this result within the time above alluded to; though he thinks that four weeks will enable him to accomplish what he has on hand here.

The immediate object of this communication is to submit to the department this proposition of Mr. Maillefert, and request to be informed whether it approves of a contract being at once entered into with him for this purpose on the terms stated. The rock in question is about 110 feet long by an average width of about 50 feet at the depth of 17 feet below low water, having on its shoalest point 10 feet at low water, and will require to be cut down about 7 feet, so as to admit the passage of vessels drawing 16 feet at low water. Its position is correctly laid down on the coast survey chart.

The necessary contingent expenses for examinations and surveys have been and are expected to be light, as we have in this case the benefit of the coast surveys; but there will be nevertheless some, such as for hire of boats and oarsmen, marking or staking and buoying the parts of the channel to be opened. I would like to be informed if such are to be paid out of the appropriation for "repairs, preservation, and contingencies of the harbor works on the Atlantic coast," contained in the harbor bill, or whether they are chargeable to the appropriation for doing the work of improvement.

I have the honor to be, very respectfully, your obedient servant,

GEORGE DUTTON,
Captain Corps of Engineers.

Brig. Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX R—2.

Engineer Department,
November 2, 1852.

Captain Dutton recommends within that Mr. Maillefert's proposition to remove the Middle rock, in the harbor of New Haven, Connecticut, for the sum of six thousand dollars, the exact amount appropriated, be accepted.

I propose, with the approval of the honorable Secretary of War, to instruct Captain Dutton to prepare forthwith, and submit for approval, the proper written contract, taking care especially to secure the

completion of the work within the shortest period practicable, and to provide for a proper supervision of operations.

Respectfully,

J. G. TOTTEN,
Colonel and Chief Engineer.

Approved:

C. M. CONRAD,
Secretary of War.

NOVEMBER 2, 1852.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX S.

ENGINEER OFFICE, NEW YORK,
October, 1853.

SIR: I have the honor to submit the following report regarding the harbor of Port Jefferson, Long Island, its survey and proposed improvement:

July, 1853.—The survey was commenced by the measurement of a base line on the beach across the mouth of the harbor; by the establishment of a tide-gauge in the channel leading into it, and of station-signals at various points on the shores and in the waters; the soundings and triangulation were prosecuted, each line being sounded over twice.

In executing the surveys of rivers and harbors, I have devoted myself specially to discovering the impediments to navigation existing in the conformation of the harbor and its approaches; to their causes and remedies. In the case now being considered, these were to be found, if at all, at the mouth of the harbor. Inside there can be no improvements made by art. My principal attention was therefore directed to its mouth.

It is necessary to ask attention to the form and position of this harbor, in order to make distinctly known the influence ofthe several powers at work to produce the present state of things as ndicated by the accompanying map. This information is a necessary preliminary to the study of the practical problem that presents itself for solution—the permanent improvement of the harbor.

On the south side of the sound, and nearly opposite its widest part, occurs Old-field point, projecting into the sound. A little to the east of this, somewhat less salient, is Mount Misery. They are highlands about three miles apart, enclosing a bay about half a mile deep. The shore of this bay, after leaving the two headlands, is a low shingle beach, only a few yards wide Within this beach occur three tidal basins, communicating with the sound by a single channel, and of course all communicating with each other. One of these is the harbor of Port Jefferson. So much as to position. Now as regards the form particularly of the channel leading into the harbor from the sound. This is narrow; it opens on the sound to the northeast, and winds between the beach and a shoal to the south and east, till it passes across the beach opening in the harbor to the southeast, and near the east side of Port Jefferson harbor. The three interior bays unite their waters along the narrow beach separating them from the sound.

These circumstances of position and form have a very important bearing upon the powers acting here. These powers are, first, the tide in the sound. As the flood comes in, it meets Mount Misery and edges around it. Its velocity is checked, and the material it bore along is deposited in the bay. This material is sand and stones, transported in the water, or rolled by it along the bottom. Thus the sand beach just west of Mount Misery is being formed. During the ebb a similar result is in process to the east of, and occasioned by, Old-field point. Moreover, the exterior bay opens to the north and east, and is peculiarly exposed to the effects of winds from those directions. These are the prevailing and the most powerful, and their influence is to drive the waters of the sound and of the ocean into this bay, and to fill it with the materials transported by their power to and fro, and confirm, by their extraordinary and irregular action, the daily and regular action of the sound tide.

From the direction of the channel into Port Jefferson harbor, it is seen that the power of the flood tide around Mount Misery, and the power of the northeast storms, cross it nearly perpendicularly. That the waters of the sound, driven by either or both these powers, impinge against the sand beach, on the far side of this channel, previous to turning short to the east, to flow up into the interior bays. The effort of both these powers is to effect an opening across the beach in the line of their greatest power; that is to say, nearly northeast and southwest. One effect of their being stopped and turned to the east, is a retardation of velocity. A diminution of height of tide in the interior bays, a deposit of material where the velocity is stopped—that is, at the northeast point of the entrance—are consequences of this effect.

This point is gradually advancing west, till it now overlaps the interior opening of the channel, and a bar is being formed nearly parallel to the beach beyond. The current of flood rushes through this channel towards the southeast, and eddies round the southwest point of the interior entrance and occasions a deposit on this point, gradually increasing it towards the east. This formation has the injurious influence upon the power of the ebb, that the increase of the exterior point westerly, above mentioned, has upon that of the flood; that is to say, its velocity is retarded, and it does not run completely out. It will be seen, by a look at the map, that the line of greatest pressure of the enclosed mass of the flood, endeavoring to escape from the three interior bays, is nearly southwest and northeast, or nearly the same as that of the flood and of the northeast storms. It, however, is compelled to make a detour around the above-mentioned southwest point previous to getting into the channel. It will also be apparent that the current of ebb out of this channel meets that of the sound, and is thus subjected to additional obstruction and difficulty of escape.

The several obstructions above mentioned to the easy flow of the water into and out of these bays, resulting from the direction of the channel leading into them, all unite to increase the one effect—to diminish the scouring power of the ebb through this channel. This is the only power that can counteract the sound tide; and the prevailing winds and storms, in their efforts to fill this bay, close the channel totally and destroy the harbor; and, in order that it may accomplish this object effectually and permanently, the whole power of this ebb must be concentrated along one channel, and the direction of this channel must be that affording the greatest facilities to the entrance and exit of the waters. The fact mentioned above, and indicated by the form and position, that the line along which the flood exercises its greatest power is the same, for the ebb indicates this as the line sought for, the channel desired. It will be nearly perpendicular to the present channel at its exterior, opening on the sound to the northeast. The channel being straight, and in this direction, the flood will flow in without retardation, and consequently rise higher in the bays. The easterly and northeasterly winds will increase this effect, and thus the scour of the ebb will increase as the injurious effects of those winds increase. But, moreover, as the ebb will flow out without retardation, it must run to a lower level, and thus again add to its power. The interior bays will probably be deepened and the direction of the channel maintained permanent.

These deductions of theory seem to be corroborated by the fact, that a new opening into the harbor has recently been made in the place and direction indicated in the foregoing remarks, as those where and in which the greatest powers exercised by the natural agents. This new opening, I conceive, must become ultimately the principal if not the only one. It is that to be confirmed by art, if any is applied.

The people resorting to this harbor are fully impressed with the necessity of concentrating the power of the ebb along one channel, in order to keep it open, and preventing their harbor being closed entirely by the deposition of material brought in by the flood and the northeasterly storms. They suggest, and have of themselves attempted to close the new channel, but without effect. They also suggest that a breakwater be built to the east of the entrance of the present channel, in order to protect it from the dangerous deposits brought in by the prevailing storms. I am under the impression that this would prove but a temporary expedient. I see no more promising plan than to work with nature, direct its agencies and confirm its effects. Theory and fact testify alike regarding these.

Port Jefferson is a beautiful harbor in itself, and would doubtless be extremely valuable as a harbor of refuge to the multitudes of coasting vessels that pass it. I know of no other claim it has to special consideration.

I am, very respectfully, your obedient servant,

M. HARRISON,
Lieut. of Engineers

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX T.

Memoir on the improvement of the navigation of the Hudson river above and below Albany, provided for by an act of Congress of the 30th August, 1852.

HISTORY OF THE VARIOUS EFFORTS TO IMPROVE THIS NAVIGATION FROM 1797 TO 1852.

1797.—As early as 1797 the legislature of the State of New York appropriated moneys for improving the condition of the bed and channel of this river. A contrariety of plans seem to have been discussed and acted upon, and with varied success. Wing dams or jettees, contracting the river section at or about the point to be deepened, was the favorite system. From 1797 to 1818 the State had appropriated the sum of $148,707 94 for this purpose.

1804.—Mr. Genet, of Albany, seems to have been the first to suggest plans for this work, in opposition to what had been previously done. In 1818 he published a memorial addressed to the legislature of New York, stating that he moved to Albany in 1804, and occupied a farm at Greenbush. The sloop that conveyed him and his family was frequently detained by grounding on the bars between Kinderhook and Albany, several days being consumed thereby. He communicated his views for the correction of these evils to Governor George Clinton, satisfied in his own mind that neither scouring, digging, or damming, would answer the purpose.

The same year Governor Clinton recommended the improvement of the river below Albany to the legislature. It appointed a commission from captains of sloops and other citizens of Albany. They pursued the common and previously adopted method of damming and contracting the channel, to procure the removal of obstructions at particular spots, constructing several expensive structures; the result of which was to transfer alluvions from place to place, to add artificial to natural obstructions, to dam up the ice at the breaking up of the river, to render at all times more frequent the overflowing of the river, and to make the river worse than when left to itself. After fourteen years' observation, he was confirmed in the belief that a canal only could overcome these difficulties, and recommended such a system to Governor Clinton, (De Witt.) The latter referred the recommendation to Mr. Thomas Moore, of the District of Columbia, a gentleman who had made such subjects his study. A committee of the legislature, to whom the subject had been referred, say in their report that the bad success of the efforts previously made to remove obstructions in the river "was owing to the mistaken principles on which the improvement had been conducted, and to a want of due consideration to the natural causes by which they were produced."

Mr. Duer, the chairman of the assembly committee, reported on the 12th of March, 1818, basing their opinions upon those of Mr. Moore and Mr. Beckwith, of Hartford, Connecticut, who had studied the subject in other localities. Mr. Moore desired to "aid the efforts of nature where they are weak, without diminishing those that are strong; and by piers and dams, more judiciously located than those which had been hitherto built, it will be practicable to preserve forever a channel, wide enough for the purpose of navigation, as deep in the upper section of the river as it was in its primitive state; (?) and in the lower, deep enough for vessels of any burden. And if the indications of nature with regard to its direction are attended to, the flats will first emerge from the surface, in the upper parts of the tide waters, and successfully downwards, until at some future time the ravine of the Hudson will present a body of intervale land, with a narrow river running through it."

"Mr. Beckwith confidently calculated to produce 12 feet, at the height of summer tides, from Albany to Hudson, provided that not less than eleven additional piers or dams are constructed at proper places from Bath to Coeyman's." He estimated the expense to be $13,250.

Mr. Duer reported a bill, but it did not become a law.

1819.—Mr. Yates, chairman of a committee of the legislature of 1819, on the same subject, states: "That various, and in some measure contradictory, opinions have prevailed with respect to the best, most practicable, and least expensive mode of improving the navigation below Albany. That natural impediments exist, which evidently require the corrective hand of art, will not admit of doubt; and although some benefits have been derived from the efforts heretofore made, still they have failed of ultimate and complete success. Whether this has arisen from the want of some uniform plan, or from other causes, it is not supposed necessary here to decide. The committee, however, have collected all the information they could obtain, and present the same with their report. It consists of letters to and answers from the commissioners appointed to improve the navigation of the Hudson river; from Mr. Geddes, a celebrated engineer; from Mr. Genet, a well known scientific gentlemen, who has devoted his talents to this particular subject; from the mayor of the city of Albany; and from Mr. Gould, a respectable merchant of this city," (Albany.)

"The committee have also had under consideration the report made to the legislature at the last session by the committee appointed on the same subject, and the communications accompanying that report from Mr. Moore, of the District of Columbia, and Mr. Beckwith, of Hartford, Connecticut. From these documents it will appear that the plans suggested for improving the navigation consist—

"1. In the erection of piers and dams, as stated by Mr. Moore and Mr. Beckwith, and the commissioners for improving the river; or,

"2. Of projecting dikes or jettees, as adopted by Mr. Golbourne in deepening the river Clyde to Greenock, in Scotland; or,

"3. Of constructing a lateral canal on the principles urged by Mr. Genet.

"The erection of piers and jettees has been deemed by some as an experiment of a questionable nature, unless some general plan be adopted to terminate only where impediments shall cease to exist. When adopted partially, or to any limited extent, it has been found that in removing the old obstructions they almost invariably introduce or occasion others; and thus the evil only changes its locality, instead of losing its character. The dam near the seat of Stephen Van Rensselaer, in the vicinity of Albany, has been adduced as an evidence of the fact. That dam, it is alleged, has given birth to the island below it, and has also created very devious obstructions along the wharves in this city, (Albany.) Other instances have been mentioned, but the committee do not think it necessary to state them in this report."

"Golbourne's plan is not sufficiently explained to make its merits the subject of remark, or to induce its adoption without further information. It seems, however, to the committee that the deepening of the channel, and contracting its waters, must have a tendency to cause a too rapid current," &c., &c.

"The construction of a lateral canal has been urged with a force and reasoning difficult to resist, and has been considered by several scientific and judicious men the only practicable mode of improving the navigation below the head of tide water. It cannot, however, be concealed that some effective measures are indispensably necessary. The navigation of the Hudson river is an object of first importance. It is the great and natural highway of internal navigation, and has always had strong claims upon the fostering care and protection of the legislature. It connects the interior of the State with our great maritime and commercial emporium, and into whose lap it pours a great portion of the riches derived from our industry and products of the soil. It cannot, therefore, be viewed with indifference or treated with neglect. That its navigation has been and still is impeded by many formidable obstructions, is admitted; and it is equally true, if these obstructions can be removed, our duty as well as our best interests demand that this object be promptly attained. The committee recommend that a commission be formed to ascertain the best and most efficient plan for improving the navigation of the tide waters of the Hudson."

The commissioners (Israel Smith and Allen Brown) for improving the river in 1819 state: "That they have rebuilt the dam at the upper overslaugh, which, previously to the setting in of the winter, had materially benefited the channel of the river opposite to and for some distance below the dam. It is our opinion, corroborated as we think by the experience derived from the works already constructed, that if the several islands from the city to Castleton were connected by dams to the nearest main land, compressing the water into one current, a channel would be made; and, kept free from deposits of mud or sand, sufficient," &c. * * * "perhaps the aid of a mud-turtle may be found necessary."

Mr. Yates then asked Mr. Geddes' opinion on the plans of the commissioners—Moore's, Beckwith's, and Genet's. He declined giving an opinion, not having sufficiently examined the river.

The mayor of Albany (Elisha Jenkins) stated to Mr. Yates that, "notwithstanding it is agreed on all hands that the evils arising from the accumulation of sand and mud in front of our docks are most seriously and injuriously felt by all concerned in the river trade, yet it has been found impracticable to agree upon any general plan by way of remedy."

At the same time Mr. Genet stated to Mr. Yates, as his opinion: "That the improvement of the bed of the river, from the deep waters to Albany and the landings above, will continue to prove a vain, fruitless, expensive, and dangerous effort to coerce the unconquerable laws of nature; that, even for the accommodation of sloops and steamboats, its result is questionable; and hence the only true expedient is a ship-canal on the east side of the Hudson."

Mr. John Randall, jr., made a survey of the river from Troy to New Baltimore in 1819, giving this canal project and the soundings in the channel of the river. This survey was made under the direction of a commission, appointed by the legislature, consisting of Governor De Witt Clinton, Mr. Van Buren, and Mr. Genet. The latter again recommended and enforced his views in favor of the canal below Albany, and of longitudinal dikes between Troy and Albany. Mr. Genet remarks, that "the action of the dams (alluding to those existing at the time) is very limited; for example: at Fish-house dam, a large bank of loose sand is deposited, at a distance of six rods between the angle of a considerable dam erected there and the margin of a channel procured since by dredging. The portions of the main body of the current interrupted by the jettees, instead of being repelled in a certain angle across the stream on the other shore, incorporates itself on the contrary with the main body of the current, and contributes to increase its velocity at the point of meeting. Light bodies, thrown at the transverse dam at the overslaugh, have turned short at the corner of the dam, and been carried down with the main current. This is applicable only to lateral transverse dams. Where the whole body of the current strikes perpendicular rocks, or hard and high formations above the highest freshet, it corrodes at the base, deepens the channel, and is repelled in an angle of reflection, nearly equal to the angle of incidence, (?) as at Cuyler's bar and at the Hoheyebirge. Where perpendicular rocks, straight banks, or continuity of straight and perpendicular docks, parallel to the current, compel the water to pursue a straight course, the bed of the river is also deeper, and the velocity, protracted longitudinally, extends further than it does under the operation of dams running crossways, as is observed at a chain of perpendicular high rocks and a straight steep bank on the opposite shore, below Coeyman's overslaugh, and other places. The same fact is noticed in Italy by Frise, who states transversal dams, dikes, and jettees, to be fruitless for streams having a tendency to fill up their bed; and that longitudinal docks, running in a line parallel with the streams, would be wiser. The alluvial deposits, worked upon by the dams, have made new bars and islands below their sphere of action."

Such were Mr. Genet's view, in part, at that date. Nothing, however, resulted from the labors of the commission of which he was a member; yet it gave us a valuable survey by Mr. Randall, serving for reference, and enabling us now to ascertain the changes since produced in the river.

1820.—On the 1st March, 1820, Governor De Witt Clinton sent to the legislature the report of the commissioners for improving the Hudson, containing the preceding views of Mr. Genet. The commissioners, in their joint report, say the methods suggested as practicable for improving the tide-waters of the Hudson are, either the construction of piers and dams, to concentrate the current of the river, so as to give it, with the assistance of the engine called the mud-turtle, power sufficient to remove the bars on which it may be directed, and to prevent public deposits; or avoiding them by a lateral canal; or a combination of both.

The survey and plan of Mr. Randall, made for this commission, were put into the hands of Mr. Henry Butler, who had been engaged on the Connecticut river, to form a plan of improvement. His report, with the maps to which his reference is made, (accompanying the commissioners' report,) shows the best means suggested to the commissioners for deepening the channel of the river where necessary. After so stating, the commissioners then review the plans of Genet and Butler, and say: "Canalling is the most sure and permanent, and in the present instance, if the benefit to be derived from it is of such magnitude as to make its adoption advisable, the commissioners do not hesitate to recommend the canal as the most efficient plan for improving the navigation of the Hudson below Albany. Between Troy and Albany, the plan of Mr. Butler is recommended as the most eligible at present, as, from the experiment already made, it is ascertained to have produced a good effect, having deepened the channel at least twenty-two inches, giving it also a more regular curve, and rendering its passage more easy and convenient."

In regard to the damming system below Albany, the commissioners have not sufficient data from experience to calculate, with any certainty, "how far it would be effectual in deepening and keeping open a channel of the requisite depth, through all the obstructions which now exist or may hereafter arise. If adopted, therefore, it must be as an experiment, to be continued or abandoned according to the indications of its results."

The expense of Mr. Butler's plan above Albany, was...	$46,874 72
The expense of Mr. Butler's plan below Albany, was...	56,868 76
	103,743 48
Mr. Genet's plan for a canal would cost	$727,715 00

No appropriation was made by the legislature to carry either of these plans into effect, its only action being a resolution expressing its approbation of the labors of the commission.

In April, 1822, the governor of the State of New York enclosed to the senators and representatives in Congress resolutions of the legislature, calling upon Congress to improve the navigation of the Hudson. Mr. Van Buren presented the same in the Senate and advocated the measure.

1823.—On the 20th June, 1823, Mr. Benjamin Wright, a gentleman of eminence in the canal operations of the State of New York, wrote to Mr. Genet: "That the river in its present state is bad, I agree; that the attempts which are (as is said) about to be made to deepen the bar below Albany, will answer a valuable purpose, is, to say the least, doubtful; at the same time believing, as I do, that the permanent and effectual way of making a navigation, will be to adopt your plan of a canal to the river. But it takes time and many words to convince the public of their errors in these kind of improvements. You have lived in the country long enough to find out that every man in the community is a first-rate engineer, (in his own opinion;) and, without ever reflecting upon causes or effects, he makes up in his own mind a plan adapted to the case, and once settled down in the full belief of his own wisdom, he is tenacious to the last of his own schemes, and nothing but dear-bought experience will ever drive him from his ground. Apply these remarks to what you have seen acted over, by what was called improvement in the Hudson, in forming wing dams the last twenty years, and you will say that, at the time the plan of wing dams was commenced, nothing which the wisest and most experienced man in the community could have said would have driven them from that plan; and applying what has been to what will be, I set down that a few years more must be passed over, a few hundred thousand dollars expended in the bed of the Hudson, before the time will arrive when these self-made engineers will be cured of the mistaken plan of working in the bed of that river."

1824.—In 1824 Governor Yates called the attention of the legislature to the improvement of the navigation. He recommended an application to Congress for authority to collect a transit duty to prosecute the improvement of the river by a lateral ship canal, if that system be judged best. The governor's message was referred to a committee, and Mr. Green, the chairman, reported that they believed the time had not come to engage in any new project of such magnitude.

In February, 1824, Mr. Genet made an address to the legislature and citizens of Albany. In it he proposed—first, to give a general view of the nature and formation of the alluvions in the Hudson from Waterford to New Baltimore, and the impracticability of their final removal by contraction or excavation. He first advances the hypothesis that the county of New York, Long Island, and Staten Island, were formed by and from the alluvion of the Hudson; that by various causes the waters have subsided, and the alluvial formations are now made where the ocean ceases to flow back—to wit, at Castleton, Albany, &c.

He says, the first attempt to improve the navigation of the Hudson was by local excavation, and proved abortive. That the system of contraction was then brought forward, both above and below Albany, by contracting the current by wing dams, and procuring a corrosion and dislodgement of the alluvial deposits; and again very large dams were allowed for these contractions, and would have been continued, but for the views he presented to the legislature, as a commissioner of the State, in 1820, with Clinton and Van Buren. That the surveys perfected by the liberality of the legislature have procured the most perfect hydraulic knowledge of the section of the Hudson, including the seat of the alluvion; and we are now in possession of facts which evidently show that the protection of the velocity excited by the best dams in the river amounts to mere nullity, compared to the immense bulk of deposits which they ought to remove to procure a good sloop navigation, and which most accurate calculations have proved to exceed sixteen millions of hogsheads. That the momentum acquired by the action of these dams weakens as it progresses, and drops, at the end of its short career, the matter it had raised at the maximum of its force.

That longitudinal docks answer no better purpose, when by contraction they do not procure a force of corrosion, which, to be effective, must be the result not of swiftness alone, but of the weight of the falling water multiplied by its velocity, as it is exemplified at the overslaugh, where the river, contracted more than at any other place by an extensive longitudinal dam, runs swiftly and has less power than at a few other places where the river has more expansion, and at the same time more fall. And, finally, that the collateral creeks, formed by the river around several islands or alluvial deposits, are nearly all barred at their entrance, and deprive the river of no particle of the body of her own water, nor of any tributary stream. That we have learnt from the same survey the fact which proves why the systems of contraction, corrosion, and excavation, have answered no useful purpose. That overruling fact is, that from the deep waters below New Baltimore to Albany, the average fall of the land does not exceed one and a half foot, which explains why there is hardly any natural current; why the tide-waters, which are the only generators of what is taken for the current, keep in distinct strata or layers under the descending waters from above, and in their ascension left there almost bodily upwards, though the upper current continues to flow; why it is only at very low water, and where the tide is entirely spent and withdrawn, that the natural current feebly works on the bottom of the river, and opens sometimes a small changeable and sinuous passage. He then cites objections, under six heads, relating to health, rights of property, &c.; and in the sixth says, finally, if the extravagant idea of cross dams was given up, and only long docks of connexion resorted to, and if their miraculous operation was to deepen, by the acquired velocity of the stream, a flat bottom destitute of an efficient fall, the glorious result of that wonderful operation would be, that unless the connecting and contracting docks were considerably protracted, the evil would only be transferred, and places now enjoying the privileges of deep waters would be deprived of that advantage. The surveys, borings, and observations, made by order of the legislature, have proved that a uniform depth of twenty feet may be excavated on the whole line through the section in contemplation; that the soil is loamy on top, and generally composed of clay at the bottom.

1825.—In 1825 a dredging machine was put in operation between Troy and Albany, on Van Buren's bar. It commenced to excavate in four feet water, and where Clinton's survey was made in 1831 there were eight feet. The depth since the dredging was suspended (which was confined to a narrow channel) had lessened by deposits brought from the upper parts of the river. Washington bar, near Watervliet, was also deepened by dredging about the same time.

1829 to 1831.—The corporation of the city of Troy, finding it absolutely necessary to resort to some means to secure a navigation to their city, caused dredging to be made on the shoals in the river, and expended, between 1829 and 1831, the sum of five thousand dollars between Troy and Albany.

The subject thus rested until 1831, when an act of Congress authorized the first national inquiry in relation to this navigation. De Witt Clinton, jr., a civil engineer, with the aid of Messrs. Geo. W. Hughes and Charles N. Hagner, assistant civil engineers, appointed under this act, made a survey, which, with a report from Mr. Clinton, was communicated to Congress on the 30th March, 1832. This survey is minute, and doubtless reliable, serving a valuable purpose for reference, with the state of the river as shown by Randall, and subsequent surveys to be noticed hereafter. Tide tables were kept at Troy, Albany, Castleton, and New Baltimore, noting the surface in the morning; its rise above and below that plane was noted hourly to the end of the day, thus establishing the rise and fall during the day's operation; and the soundings were afterwards reduced to the lowest waters found in the register, and again to the lowest condition of the stream. The soundings on his survey are the lowest of the spring and autumn of 1831. He also gives the currents, which were ascertained by anchoring a boat, and let it swing with the tides, determining its direction by the compass, and its velocity by a sand-glass and line. The currents he found to vary constantly with the floods and ebbs. The bed of the river between Waterford and Troy he found to be slate rock covered with a thin coat of gravel. This survey, the best extant to that date, was in seven sheets. The report referring thereto was published as Doc. No. 189, House of Representatives, War Department, 22d Congress, 1st session. He describes the character of the channel and its impediments, as indicated on each sheet of the survey; various interesting facts connected with the currents and tides; and gives the following as the plan which he felt confidently assured would accomplish the improvement of the stream, viz: "To excavate straight channels in the direction of the current through the different shoals and bars, of sufficient width and depth to accommodate the trade; to construct parallel or single piers afterwards, whenever necessary to prevent the spread of water in the low state of the river, and to confine it to one channel, and to prevent too great velocity of current during floods; to let the water pass over the works; to secure the channel from being injured by the wash from the shore and islands; to protect their sides wherever necessary by wharfing, or by loose masses of stone; to place the soil excavated from the channels in the piers, or other secure places, to prevent it being again carried down by the stream; to have a dredge always at command to remove any local obstructions after the works are completed, and to secure them against the ice floods." He then proceeds to give his reasons for some of the above views. The total cost of improving the river from Waterford to the end of Clinton's survey near New Baltimore, he gives as $221,504.

1834.—The result of this survey and report of Mr. Clinton seems to have been the basis upon which Congress legislated on the 30th of June, 1834, appropriating the sum of $70,000. The expenditure of this sum was assigned to Captain Andrew Talcott, of the corps of engineers. The difficulties of deciding upon so intricate a problem as this section of the Hudson river presents, appear to have presented themselves with great force to the mind of this officer, (than whom very few if any were better qualified to investigate the subject,) and such as to induce him to ask the counsel and advice of a special board of officers of the corps of engineers. Such a board was ordered, consisting of Colonels Totten and Thayer, with Captain Talcott associated as the local engineer, and convened in November, 1834.

To this report particular attention should be given, as it is more comprehensive and more fully investigates the subject than any previously referred to. It was printed as Doc. No. 2 of the first session of the 24th Congress, House of Representatives pp. 139 to 158.

After examining the project of canals of various capacities, as a substitute for the river navigation, this board concluded that the cost of such a system, of a size to provide for all the commerce which at that date could be foreseen, would amount to $2,174,640, which does not include the cost of any improvement of the river above Albany, where a canal project was inapplicable. It then considers the improvements to be made in the bed of the river below Albany.

Section 32 gives the principle upon which the depth of water was to be obtained and regulated—to wit, greater or less contraction of the width, to obtain a corroding action from the freshets to give the required depth.

Section 34 implies the necessity of these freshets being regulated by dikes some feet above ordinary flood-tide level; and in section 35 it more particularly defines that it is the flood (freshet?) upon which it relies, but not all the flood, for several reasons; and then gives the reasons.

Then, in section 40, it investigates the expediency and propriety of making use of the freshet's corroding influence and power in deepening the channel, thus throwing the matter removed into the lower parts of the river, and at the same time conclude that the ebb and flood-tide action are of such slight influence as not to be considered.

In section 44 the board says, we may presume that the transported matter, instead of composing a stratum of several feet in thickness, put below the termination of the artificial works, will spread in a thin layer over many miles in length; and in section 48 it says, it would appear from the above statement (referring to a calculation of quantities of matter in sections 46 and 47) that the quantity of 2,000,000 cubic yards might be left to the disposal of the floods, with the probability that no harm would result therefrom to the lower portion of the river; and of course the probability would be the greater with the lesser quantity of 1,000,000 cubic yards.

In section 49, however, the board considers it prudent to resort to dredging to attain the necessary increased depth, leaving the corrosive action of the floods restrained by dikes to preserve the requisite depth; and then proceeds to describe the works to be constructed for the improvement of the river navigation. The dikes proposed by the board were to be 9 feet 8 inches, and 7 feet above lowest water in the several localities named; and, in conclusion, recommend that the attempt to improve the navigation of the Hudson be confined to the bed of the river, and that the cost thereof may be, for the most spacious and convenient arrangement, $819,624.

1835 to 1839.—The system devised by this board was being carried into effect, with modifications recommended from time to time by the local engineer, under the superintendence of Captain Henry Brewerton, of the corps of engineers, with appropriations of Congress amounting to $370,000, during the years 1835–'36–'37–'38 and '39, in the spring of which latter year the operations were suspended in consequence of a change of policy in the national councils on the subject of internal improvement. The labor was bestowed on the river between Troy and Van Wies' point, and consisted in the erection of longitudinal dikes, some transverse dams, and excavations from the bed of the river with steam-dredging machines.

The dikes and dams were not made as designated by the board of engineers, of timber filled in with stone, &c., but of sand, with the superior portion paved with stone; and it would appear that the corroding action of the freshets was brought about to a very great degree—whether designedly or otherwise is not known—instead of the prudential plan of gaining the depths by dredging, as recommended by the board, (p. 16.)

During Captain Brewerton's superintendence of these operations he made a survey of the river from Troy to Van Wies' point, which is highly valuable for reference at this date, to compare with the previous and subsequent surveys, showing the state of the navigable channel, and as a connected map covering this distance, is probably the most reliable and accurate trace of the water-lines of any survey to this date, (1853.)

The reports of Captain Brewerton, from year to year, published with the documents from the Engineer department accompanying the President's messages, explain all that was done on the river under his superintendence, and altogether greater in extent and effects than all previous operations combined.

After the abandonment of the works by the general government, in 1839, the citizens of Albany felt their interests so much at stake in the existence of the obstructions in the river below their city, that they raised, by subscription, and applied $1,500, in 1840, to excavate the channel through Castleton shoal.

1843.—The works, being suspended, were then transferred to the charge of the chief of the Topographical bureau, who, in 1843, considered it important, with a view to the resumption of the work, to cause a complete and minute survey of the river to be made from the dam above Troy to a point about one mile below New Baltimore. This survey was made by Captain Hughes, of the topographical engineers, who accompanied it with a report upon the condition of the river, upon the artificial works which had been erected to improve its bed, and upon the effects which they had produced, and also a review in detail of the plans which had been designed for the removal of the obstructions to the navigation. This report is dated 30th November, 1843, and is printed in House Doc. No. 53, 1st session, 28th Congress. It, with the previous surveys, is very important for reference at this time, in comparison with the other well-authenticated surveys of the same portion of the river, and particularly so, as giving the results of the changes caused by the works constructed under the superintendence of Captain Brewerton. It is the most reliable and minute survey of this extended section of the river to its date.

1845.—The sum of $4,000 was expended by the corporation of Albany, including sums subscribed by citizens of Albany and Troy, in excavating the serious obstructions to navigation through shoals at Castleton and Cuyler's bar.

1851.—A steam-dredging machine had been purchased by the corporation of Troy, to be ready at any time to remove the shoals so frequently forming in the channel between Troy and Albany. The welfare of Troy required that some watchful care and attention should be uninteruptedly bestowed upon this navigation; and the frequent use of a steam-dredging machine, to excavate a channel through the shoals, was the system and expedient resorted to by parties living in the vicinity directly interested in the result, not only as to the success, but also as regards the cost and useful result. The charge of this apparatus was put in the hands of Mr. Smiley, who makes his home in a great measure on board the machine-vessel—has it always in order for the moment necessity calls for its use, and by whose energy in its application Troy has continued to secure to herself a navigation which otherwise she could not have had. This is a useful lesson of experience in our future application of funds for the improvement of this river navigation.

During the spring and early part of the navigable season of 1851, this steam-dredging machine excavated large quantities of sand from the channel way, through Fish-house bar, along Seaver's island, and between Fish-house and Round shoals.

1852.—The evils of navigation not only continued to exist with the opening of the commercial season, but were of increased magnitude, and were more embarrassing in consequence of the immense increase of the trade passing over and through this intricate section of the river. The corporation of Troy was necessitated to use increased exertions with the steam-dredging machine, under Mr. Smiley, to remove and deepen the shoals down to Albany. He excavated 25,000 cubic yards of sand from a shoal at the head of Van Buren's island, 18,000 cubic yards from Washington bar, and afterwards spent some time in improving Kellogg's shoal, Covell's folly, Washington bar, and Round shoal. Below Albany I could learn of nothing being done since 1845. The evils, however, continued to increase, and Castleton and Cuyler's bars became so shoal as to call for immediate and prompt action. Such of the citizens of Albany and Troy as were engaged in the river trade, together with others of New York, subscribed $4,000 in the spring of this year to excavate Castleton and Cuyler's bars. So great was the increase of Castleton bar, that this sum would not suffice to open the navigation. The legislature of the State, being then in session, appropriated $10,000 to be applied to Castleton bar.

The State engineer, Mr. McAlpin, caused 45,636 cubic yards to be excavated from the Castleton bar between the 26th of May and 17th July, and 16,972 cubic yards from Cuyler's bar between the 19th of July and 21st of August, at an expenditure of $13,000 nearly. This expenditure sufficed to render the channel navigable throughout the year, affording great temporary relief and facility to the commerce and trade of Albany and Troy, and the widespread and extended portions of our Union receiving and forwarding supplies through this route.

In August, 1852, Congress appropriated the sum of $50,000 for "continuing the improvement of the navigation of the Hudson river above and below Albany, and not above Troy.

On the 13th of October, Major Delafield received instructions from the chief engineer to proceed to an examination of this subject, and prepare a project for continuing the operations within the meaning of the act of appropriation, together with a plan of administration, or mode of conducting and supervising the operations on these improvements. He proceeded on the 14th of October, and commenced at Albany to collect information, and to survey the river to ascertain its existing state and condition. He found that the State engineer, Mr. McAlpin, had, with the assistance of Mr. Octave Blanc, made a minute survey of Cuyler and Castleton bars, to enable them to apply the State appropriations advantageously. After having finished that survey, they made, in behalf of individuals of Albany, a general survey of the river from Albany to Four-mile point, near Hudson, with a view to a canal project along the western bank of the river. Having obtained the loan of the original field-notes and rough drafts of these surveys, they were made the commencement and basis of an extended survey and compiled map from Troy to Four-mile point; the part between Troy and Albany being a resurvey, under Major Delafield's directions. For this particular purpose, numerous soundings and additional points were ascertained and added to the information obtained by Mr. McAlpin and Mr. Blanc, which, with the surveys of the cities of Albany and Troy, by their respective city surveyors, and the surveys of Hughes, Clinton, and Brewerton, have all been used in the compilation of the shore lines of the map accompanying this memoir, and compiled expressly therefor.

The entire soundings are reduced to the same plane of reference, and particularly noted on the map; they were all made, and show the state of the river, after the subsidence of the freshets in 1852, and before the freshets in the fall of 1852 had produced any effect, the whole having been finished before the middle of December.

The shore lines of the accompanying map were at first, and generally throughout its whole extent, on one bank of the river or other, determined by compass courses and chained distances, points on the opposite sides of the islands and main being established by intersections of compass courses. It being considered important to establish, with more certainty and precision, the general direction of the several reaches or bends of the river between Troy and New Baltimore, a succession of directrices were determined by measuring the angles they mutually subtended with each other with a good theodolite; and when plotting the map, the compass survey was verified accordingly. Lieutenant Prime, of the corps of engineers, was in the field during the most of the survey, assisted by Messrs. Coleman, McKercher, and Hageboom.

Comparative state of the channel from 1819 *to* 1853.

Having given an historical account of the various efforts to improve the navigation of the Hudson river, with the views and opinions of the engineers who have written on this subject, and their respective plans, I now proceed to give a comparative state of the navigable channel and shoals, as deduced from the surveys of 1819, 1831, 1838, 1843, and 1852, showing the changes that have taken place between the dates of these surveys. These are facts from which we must infer how much of the change, be it improvement or otherwise, is due to the artificial works executed in conformity with the adopted systems, and how much is due to the remaining natural source of evil, not yet attempted to be controlled for want of means to complete the projects; whether or not such means are calculated to overcome the cause, and whether any other measures can be adopted more effectually to produce the desired result.

Washington bar or shoal.

1819.—4½ feet only could be carried over this bar in 1819; on a distance of 330 feet there was from 4½ to 5 feet water; and on 726 feet from 4½ to 6 feet. The channel crossed from the west to the east shore, making an acute angle (about 60°) with the direction of the river.

1831.—4½ feet only could be carried over—with 4½ to 5 feet on a distance of only 120 feet, above and below which it is from 9 to 12 feet, having washed away since 1819.

1838.—8 feet can now be carried over this bar, and the channel crosses the river from west to the east shore at an angle of about 45°.

1843.—8 feet 7 inches can now be carried over, and on the shoal distances above there is nearly 9½ feet water. The dike from Port Schuyler has been constructed long enough to have produced its results.

1852.—6 feet 8 inches only can at this time be carried over this bar. The shoalest point is nearly opposite the cut (enlarged by a breach) at Port Schuyler. This depth is continued on a distance of 600 feet, and above the cut the greatest depth for about 800 feet is from 7 to 8 feet.

Van Buren's bar.

1819.—4 feet water only can be carried over this shoal; on a distance of 1,848 feet, the water was from 4 to 5 feet deep. Two transverse dams had been made to improve this bar.

1831.—5 feet 7 inches can now be carried over this bar.

1838.—6 feet 1 inch can now be carried over. There is now 14 feet in a hole opposite the old dike, and in a line thence with the creek on the opposite shore. The channel is straight, and parallel with the dike constructed by Captain Brewerton, and runs nearest the western shore.

1843.—8 feet is now the depth on this bar, and on the 1,848 feet of shoal water of 1819 there is at this time from 8 to 11 feet water. The channel continues straight and parallel with the dike, as also nearest the western shore.

1852.—6 feet 9 inches only can at this time be carried over this bar, and on the shoal-water limits of 1819 there is now from 6 feet 9 inches to 8 feet.

Covell's shoals

1819.—4 feet water only on this shoal at this date. On a distance of 264 feet there is from 4 to 5 feet. The channel is crooked, and tends over towards the east shore.

1831.—9 feet 4 inches can now be carried over these shoals. The entire distance of 264 feet, on which there was from 4 to 5 feet in 1819, is now deepened to 11 feet and upwards.

1838.—7 feet 2 inches is now the depth on these shoals, and from 7 feet 2 inches to 8 feet over the shoal district of previous dates. The channel is about midway between the shores.

1843.—8 feet 2 inches can now be carried over these shoals, and from 8 feet to 9 feet 5 inches on the shoal district of previous years. The deepest water is now in a crooked channel, and is tending towards the east shore.

1852.—6 feet 6 inches can only be carried over at this time, and from 6½ to 7½ feet only on a distance of 800 feet.

Round shoals.

1819.—3 feet is the best water that can be taken over these shoals at this date. On a distance of 2,396 feet there is from 4 to 5 feet; on a short distance only it is limited to 3 feet, in one spot 5½ feet, and in one other 6 feet 3 inches within the above distance.

1831.—3 feet 10 inches can now be carried over these shoals, and on the shoal district of 1819 there is now from 3 feet 10 inches to 13 feet 7 inches water in the channel.

1838.—6 feet can now be carried over the shoals, with 9 feet at the head and 7 at the foot of them, varying from 6 to 9 feet. The channel is midway at the upper end, tending to the western shore at the foot of the shoals.

1843.—8 feet 8 inches can now be carried over the shoals, and from 8 feet 8 inches to 10 feet 3 inches on the shoal district of 2,396 feet of 1819. The channel is midway at the upper end, tending towards the west side at the foot.

1852.—5 feet 9 inches only can at this time be carried over the shoals, and 5 feet 9 inches to 9 feet 7 inches on the shoal district of previous years, the greatest depth (9 feet 7 inches) being found in a hole only.

Fish-house shoals.

1819.—4 feet water can be carried over, and 4 to 6 feet is found on a distance of 2,500 feet.

1831.—4 feet 4 inches water can be carried over, and 4 feet 4 inches to 6 feet is found on a distance of 2,500 feet.

1838.—5 feet 8 inches water can be carried over, and 5 feet 8 inches to 7 feet is found on a distance of 2,500 feet.

1843.—7 feet 7 inches water can be carried over, and 7 feet 7 inches to 9 feet 5 inches is found on a distance of 2,500 feet.

1852.—6 feet 8 inches water can be carried over, and 6 feet 8 inches to 8 feet 5 inches is found on a distance of 2,500 feet.

Kellogg's shoals.

1819.—4 feet water can be carried over, and 4 feet to 6 feet is found on a distance of 1,600 feet.

1831.—7 feet 7 inches water can be carried over, and 7 feet 7 inches to 12 feet is found on a distance of 1,600 feet.

1838.—6 feet 6 inches water can be carried over, and 6 feet 6 inches to 8 feet is found on a distance of 1,600 feet.

1843.—7 feet 2 inches water can be carried over, and 7 feet 2 inches to 9 feet 7 inches is found on a distance of 1,600 feet.

1852.—6 feet 5 inches water can be carried over, and 6 feet 5 inches to 9 feet is found on a distance of 1,600 feet.

Patroon's Lower island and Bath crossover.

1819.—6½ feet water was found opposite the upper dock at Bath shoaling, northwards to 3 feet 8 inches; 5 feet on the cross, with from 5 to 6 feet on a distance of 600 feet.

1831.—11½ feet is now found opposite the dock at Bath; 9 feet 6 inches can be carried over the Crossover shoal.

1838.—9 feet 2 inches only is now found along the upper dock at Bath, the channel running down that shore, and thence setting across to the Albany side, down which it runs, with from 12 to 16 feet, to the lower end of the canal basin.

——.—5 feet water was now found on the line of the Bath ferry.

——.—7 feet 4 inches only could now be carried over the Crossover shoal, which sounding was midway between Bath and Albany.

1843.—12 feet 2 inches water is now found along the upper dock at Bath, the channel running down that shore with 12 feet 6 inches to the lower dock, and thence across on the ferry-line with 7 feet 6 inches. The 5-foot shoal has disappeared, and become deeper, but the 12-foot hole between it and the end of Patroon's island has filled up to 6 feet. The deep channel had worked lower down than in 1838. Along in front of the docks at Albany, 13, 17, 15, and 11 feet water existed at this date, to the lower end of the canal basin; the channel setting across thence to Greenbush much the same as in 1838.

1852.—There is now 11 feet water opposite the docks at Bath, and 6 feet 7 inches water only can be found on the crossover.

Cuyler's bar.

1819.—4 feet water only could be carried over this bar at this date, and on a distance of 2,250 feet there was from 4 feet to 5 feet 5 inches water.

1831.—6 feet is now found over this bar, and on a distance of 1,500 feet there is from 6 feet to 7 feet 11 inches, having materially deepened since 1819. The channel is now along the east shore, setting across thence to Bogart's island from opposite the swash end of Small island.

1838.—7 feet 11 inches can now be carried over this bar, and from 7 feet 1 inch to 8 feet on the shoal district of 1819. The deepest channel now keeps along the east shore from Greenbush, setting close in to Duow's point; from thence it sets across the west shore, striking the head of and undermining the longitudinal dike at Bogart's island, making a wide shoal opposite the centre of the first dike below Albany.

1843.—7 feet 5 inches water can now be carried over this shoal, and from 7 feet 5 inches to 8 feet over the shoal district of 1819. The 8-foot curve is not found quite so high up the river as in 1838. The channel keeps along the east shore from Greenbush, setting close in to Duow's point; from whence it sets across to the west shore, coming nearest opposite the head of dam at Bogart's island, being changed since 1838, and become more midway of the river.

1852.—7 feet 7 inches can now be carried over this shoal, and from 7 feet 7 inches to 10 feet is found on the shoal district of 1,500 feet in 1831, the channel setting much the same as in previous years, very narrow, though gradually increasing in depth. The 7 feet 7 inches of this year is the result of dredging by steam-machine. (See historical sketch for the year 1852.)

Greenbush.

1819.—12 to 17 feet water is found in front of and parallel with the docks of Greenbush at this date.

1831.—12 to 25 feet water is now found, where in 1819 was 12 to 17 feet.

1838.—15 to 19 feet water is now found, where in 1819 was 12 to 17, and in 1831 was 12 to 25 feet.

1843.—27 to 13 feet 9 inches water is now found, where in 1819 was 12 to 17 feet, showing a considerable action in the freshet power.

1852.—15 to 26 feet 3 inches water is now found, where in 1819 was 12 to 17 feet; always preserving deep water, but varying materially, showing the action of the freshets to be very variable.

Overslaugh bar.

1819.—5 feet can be carried over this bar. The channel sets short across from east to west shore.

1831.—6 feet 1 inch is now found in the channel-way over this bar, which sets all along the west shore; and now the bar is found some distance lower down the river, and near the end of Beacon island.

1838.—7 feet 4 inches water can now be carried over the bar. The deep water along the east shore, shown in previous surveys, is reduced from 12 and 14 feet to 8 feet.

1843.—10 feet 2 inches water can now be carried over this section of the river, the channel being along Beacon island or west shore.

1852.—9 feet 4 inches water is now found over this section of the river, the eastern side of the river being now greatly filled up.

Van Wies' dam or pier.

1819.—10 feet water exists at the end of this pier. The channel between the end of the dam and Austin's rock varies from 9 feet 3 inches to 10 feet 7 inches.

1831.—8 feet 2 inches water only is now found, and just at the end of the dam. The channel deepens from the dam down to just above Austin's rock from 8 feet 2 inches to 13 feet 6 inches; from the dam upwards it shoals to 7 feet 6 inches, and on a line across from end of dam westward, from 8 feet 2 inches to 9 feet 2 inches.

1838.—10 feet 6 inches water is now found in this locality, in the channel, nearly about central between end of dam and western side, varying from 7 feet to 10 feet 6 inches across.

1843.—10 feet 2 inches water is now found in this channel, which at this time is near the dike, on the western shore, varying across from 8 feet to 10 feet 2 inches. There is still, at this date, less water in this contracted section than above and below it.

1852.—8 feet 9 inches water is the deepest that can now be carried through this section. The channel is nearest the dike on the western side, and it still continues deeper water, both above and below this contracted section, made so by artificial works on each side.

Austin's rock.

1819.—12 feet 3 inches can be carried by this rock on the west, with deep water increasing to 20 feet at Van Wies' point. The depth on the eastern side of the rock is not given in the survey of this date.

1831.—13 feet 11 inches to 15 feet 11 inches is now found across the channel, from the rock west. The deepest channel tends herefrom to Van Wies' point; 9 feet can be carried through the channel east of the rock.

1838.—8 feet 6 inches water is all that can now be carried through this contracted channel west of the rock, having filled since 1831 from 4 to 7 feet; 7.24 can be carried through the channel east of the rock. The deep water still tends towards Van Wies' point.

1843.—11 feet 6 inches can now be carried through on the west side, where it is now deeper than anywhere above. On the eastern side of the rock a wide and deep channel has been cut out, with 10 feet 7 inches water through it. The deepest water still tending towards Van Wies' point.

1852.—9 feet 5 inches is now the deepest water that can be carried through west of the rock, the channel having again filled. The eastern channel now admits of 7 feet being carried through; both eastern and western channels having filled since 1843. The power of the freshets has been very variable at this locality,

Van Wies' point.

1819.—20 feet is the deepest water in the channel opposite this point, which continues the same up and down the river some distance.

1831.—27 feet is the deepest water now found, directly opposite the point and about one-quarter of the width of the river from the western shore. It shoals from this depth, both up and down the river.

1838.—24 feet 8 inches is now the deepest water, and in a hole opposite the dock at this point and close along the west side, inclining thence to the east. The depth decreases rapidly up stream to 9 feet, and to 16 feet below.

1843.—22 feet 8 inches is the deepest water now found, but it extends higher up the river than in 1838, and close along the west side, inclining thence to the east.

1852.—22 feet 1 inch is the depth now found off this point; it is in a hole, but more extended and higher up the river than formerly. The channel runs across to the eastern shore and decreases below to 14 feet 3 inches, and rapidly to 9 feet 7 inches at Austin's rock. Here again the corroding power of the freshet is very variable. We have now got in a section of the river where no attempt was made to improve the navigation with the appropriations from 1835 to 1839.

Castleton and Winnies' pier.

1819.—It would seem that a shoal existed previous to 1819 about 2,500 feet above the upper dock at Castleton, that induced the commissioners to construct this very extended and projecting jettee. In 1819 the force of the flood tide set up along Cow island, with a corroding power to give a channel of 11 feet 3 inches, terminating near the foot of Smith's or Campbell's island with 9 feet 6 inches. The current or freshets and ebb tide down on the western shore to about the foot of the same island, with a corroding power giving seven feet in depth, leaving a crossover bar with from 4 feet 8 inches to 5 feet 7 inches depth of water between the channels, and entirely north of Winnies' pier. Below the end of the pier, and from near Smith's island down to the lower end of the village of Castleton, was nowhere less than 10 feet water in the channel. The shoal at this date was entirely above and north of Winnies' pier. No bar existed at Castleton at this date.

1831.—The flood tide corroding power ceased to set above Winnies' pier; the channel along Cow island, to the foot of Smith's island, being now reduced to a shoal, with irregular soundings. But the crossover in 1819 has deepened to give 9 feet water, where in 1819 was from 4 feet 8 inches to 5 feet 7 inches water; and this increased depth continues down to below the village of Castleton, with not less than 12 feet 2 inches water, extending, with even greater depth, down to the south end of Scammerhorn's island. No bar existed at Castleton at this date; on the contrary, a free, unobstructed, deep navigation was found in this section of the river.

1835.—Captain Brewerton's map does not extend so low down the river, and hence we have no information at this date. But, in the historical sketch, we find Castleton shoals existing as a serious impediment in 1840, soon after suspending work on the dikes and dams above. Now, for the first time, do we hear of this shoal.

1843.—At this date, the corroding power of the freshets and ebb tide has entirely conquered the influence of the flood tide, and has cut a deep channel over the shoal along the foot of Smith's island, thence along Cow island, losing itself with the power of the freshets just below the foot of the dam, (Winnies'.) There is now less than 10 feet water in the channel, over the shoal of 3 to 7 feet in 1831. The corroding power of the flood tide now acts to form a channel, ending with 8 feet, a little north of the upper dock at Castleton, from whence it continues to shoal upwards. The 8-foot curve from above now terminates just below the foot of the dam. Between these two curves is now found 8 feet 2 inches water on a distance of 1,000 feet, where in 1831 there was from 13 to 16 feet water.

1852.—Castleton bar is now known as one of the worst on the river. 7 feet 7 inches can be carried over at this time, after being excavated during the early part of the season, as stated in the historical sketch, page 21, at a cost of about $13,000.

The channel now increases from 7 feet 7 inches, up the river, to 18 feet, at the south end of Campbell's island, with 13 feet off Winnies' pier; and increases to 11 feet below, opposite the lower dock at Castleton.

The distance of 1,000 feet, which in 1831 was covered with 13 feet 11 inches to 16 feet, is, in 1843, filled up to 8 feet 2 inches, and is at this period, 1852, only 7 feet 7 inches to 9 feet.

About this section of the river the influence and benefits of the tide wave in a great degree cease, and but for its rise just at Castleton the navigation would be vastly more interrupted. The tide wave here is about one-half of the rise at New York; yet at Albany, only seven miles higher up the river, it swells only one-third. This loss of the rise of the tidal wave can only be understood as arising from the throttling or choking of the river by the numerous transverse dams and along-shore obstructions, with their consequent formations. When the river most needs this source of supply, to wit, in the absence of freshets, then the obstructions of art tend most powerfully to arrest its progress and swell up the river.

Head of Schodack channel.

1819.—4½ feet only could be carried over this crossover bar, at this period. The channel deepened suddenly below to 22 feet, and decreased above to 10½ feet water.

1831.—10 feet is now found in this channel just above the head of Schodack island, from whence it deepens to 16 feet below, and to 13 feet above. The crossover between 10 feet curves above, and below is very narow.

1843.—8 feet 7 inches water now exists, and becomes a bar about mid-river; deepening from thence downwards to 15 and 20 feet, and up the river to 14 and 15 feet water.

1852.—6½ feet is all the water that can now be carried over this bar. From it the channel deepens below to 18 feet, and above to 13 and 15 feet water. The bar has now become more extended, and the deep water has changed its position, the channel now turning suddenly to the west shore.

Nine-mile tree, Schodack island.

1819.—No impediment existed at this date. A wide and deep channel existed some distance above and below this point, with from 19 feet 7 inches to 22 feet water opposite the tree on Schodack island.

1831.—No impediment or trace of a shoal existed at this date. The channel is now wide, and 18 feet 7 inches deep; 16 feet being freely carried to the head of the island, and 26 feet 11 inches opposite the tree, deepening to 31 feet below.

1838.—At this date we have no information.

1843.—A trace of a shoal is forming at this time, being from 15 feet 6 inches to 19 feet 7 inches opposite the tree, where in 1831 there were

26 feet 11 inches. The channel still deepens below, but only to 20 and 25 feet, where in 1831 were 31 feet; and above it deepens to 19 feet, and then shoals to 17 feet, 15 feet, and 8 feet 7 inches. Great bodies of sand must have come from above to fill this valley.

1852.—18 feet 6 inches water is now found opposite the tree, but the channel has shifted and is more on the western shore. From opposite the tree it now decreases to 6 feet 5 inches above, and increases slightly below to 19 feet. There is at this date an extended bar, extending up to the head of the island, upon which is only 6 feet 5 inches water. A continued increase of matter, and to a very great extent, shows itself in this section of the river. The corroding power of the flood tide has apparently worked a deep channel along the west shore, where its influence is lost, the same power from the freshets and ebb ceasing before uniting their influences.

Mull's platt.

1819.—7 to $10\frac{3}{10}$ feet was the depth on a crossover bar at this place in 1819. The corroding power of the ebb tide and freshets comes down the east shore with 24 to $14\frac{1}{2}$ feet, and that of the flood, setting up the west shore, with 11 to 24 feet water; leaving between them this crossover bar of 7 to $10\frac{3}{8}$ feet.

1831.—$10\frac{1}{2}$ feet water is now found on the crossover near the foot of Shad island.

1843.—$9\frac{1}{2}$ feet water is now found on this crossover, but it is 1,500 feet lower down the river than in 1831.

1852.—$9\frac{1}{2}$ feet water still exists on this crossover, and is in about the same position as in 1843. The channel is, however, much wider.

Coeyman's bar and crossover.

1819.—$4\frac{1}{2}$ to 5 feet water only can be carried in the channel over this crossover bar. The channel keeps the west shore, with from 10 to 17 feet water, down to the foot of Mull's platt. From below it passes east of Barren island, thence up parallel with Coeyman's docks, tending to unite with the channel from above in a straight course, separated by this crossover bar of $4\frac{1}{2}$ to 5 feet water. Along the shore of Mull's platt is a false channel, or deep extended hole, with $10\frac{1}{2}$ to $22\frac{1}{2}$ feet water.

1831.—10 feet 11 inches water can now be carried over this bar. The deep false channel along Mull's platt still exists, but is separated from the main channel by a dry sand-bar. The channel runs about as in 1819, but Coeyman's bar has filled up considerably, having now in places but 1 foot 11 inches and 2 feet 11 inches water upon it.

1843.—12 feet can be carried through this channel and crossover bar. The direction of the channel is much changed from above; it is now thrown across the river nearly at a right angle to the head of Mull's islands, and thence back again to the west shore at Coeyman's docks, in the curve forming or bounding Coeyman's bar, which is now much extended, though with more water upon it than in 1831, the shoal's point being 3 feet deep.

1852.—7 feet 2 inches is all that can now be found on the upper crossover, and 9 feet 8 inches is all that can now be found on the lower crossover.

The deep water now extends down the west shore to opposite the end of Mull's platt, with from 14 to 20 feet water. There it suddenly crosses to the eastward, forming a crossover bar of 500 to 700 feet wide, with only 7 feet 2 inches water; then it continues down the eastern side to the north end of Mull's islands, when it again crosses suddenly to the western shore over a second crossover bar of 9 feet 8 inches water, and then from the lower Coeyman's dock again inclines to the eastward, passing with deep water between Barren and Mull's islands.

An extended surface north of the upper dock at Coeyman's is now bare at low water, which in 1819 had 16 feet water upon it; in 1843, 3 feet; and in 1852, none.

Barren island.

1819.—14 feet 7 inches to 23½ feet water was found in this channel in 1819.

1831.—18 feet 4 inches to 27 feet 8 inches water is now found in this channel. There is an effort making by the corroding power of the freshet with the ebb tide to force a channel through west of Barren island, and as far down as the south end of the island may be carried from 12 feet 7 inches to 6 feet 6 inches water. This channel loses itself in very shoal water. The flood is set entirely to the eastward, little if any passing through this western channel. Coeyman's docks have not been without great injury to the navigation in this part of the river. Such projections must injure any river navigation having a movable bed and shores.

1843.—17 to 22 feet is now found in the eastern channel. There is an effort from the corroding power of freshet and ebb, as well as that of the flood tide, to force a channel west of Barren island. Both Coeyman's and New Baltimore docks appear to have forced the channel to the eastward of Barren island. This island being rock is unchangeable, but the eastern side of the channel has and must continue to cut away.

1852.—8 feet only can now be carried through this channel. A crossover bar appear now to be forming from the south end of Barren island to the south end of Mull's islands, on which this limited depth of 8 feet only is found, where, in 1843, 10 to 12 was found, and in 1831, 13 to 17 was found.

Beacon, or Ten-Eyck's island, near and above New Baltimore.

1819.—1,650 feet was the length, and 410 feet the extreme width of this island in 1819. The channel was west of the island, with from 16 to 22 feet water, passing between the head of the island and a shoal to the west, dry at low water. West of this dry shoal was another channel of 10 to 12 feet. Both the eastern and western channel appear to have been the efforts by corrosion of the flood tide, and terminating below Ogden's or Mull's islands.

1831.—1,200 feet was the length and 150 feet the extreme width of this island in 1831. An eastern and western channel still exist with 14 feet water through them, being less than in 1819; through the western one a new channel now exists, passing east of the island, through which 14 feet can be carried; no bare shoal is now found at low water, and in general this section of the river has deepened.

1843.—875 feet was the length and 210 feet the extreme width of this island in 1843. The deepest channel is now east of the island, through which 14½ feet can be carried. The middle channel has now disappeared, being filled up. The most westerly one has but 10 feet 4 inches water through it, joining and passing Coeyman's overslaugh with 11 feet 8 inches water.

1852.—260 feet is now all that is left in length and 100 feet in width of this island, which was 875 in length, and 210 in width in 1843; 1,200 in length, and 150 in width in 1831; 1,650 in length and 410 in width in 1819.

The main channel is now (1852) very narrow, and east of the island, with 14 feet 3 inches through it, diminishing thence to 9 feet at Coeyman's overslaugh. There is no longer any western channel. This section of the river has filled up greatly and rapidly since the operations of 1835 to 1839.

Causes of the existing obstructions in the navigation of the Hudson river.

This branch of the subject we consider of the greatest importance. Upon the real and true causes producing the difficulties being ascertained and understood, can we hope to apply a proper remedy.

It would appear to have been the opinion of those who have heretofore written upon this river navigation, that the great cause producing the difficulties in the navigation was the deposit, in the slack-water sections of the river between Troy and Castleton, of the earthy matter brought down the Hudson and Mohawk from above the State dam near Troy of the one, and the Cohoes falls of the other.

The result of our investigations has satisfied us of the existence of several causes, separate and distinct at times, then combining their influences and powers, and all of them exceedingly irregular in both cause and effect, beyond our power to calculate, and exceedingly variable in their duration.

We believe these causes to be the ebb tide, the flood tide, the periodical freshests, ice, steamboat waves, artificial structures in the river, and grounding of vessels, and will endeavor to explain each, to which may be added one large rock.

Ebb tide.—The ebb tide, daily and throughout the year, operates to a greater or lesser degree in disturbing the bottom and banks of the river. Whenever its power is concentrated, either upon the bottom, upon a concave bend, or upon a point, it has sufficient force to cut away the opposing matter, which is deposited as soon as the force of the tide is again diffused and equalized over the width of the river. This power is frequently increased during the year by an increase in the supply of water, from the Hudson and Mohawk, by rains. This increase is accompanied with but little matter for subsidence. The numerous dams, and great quantity of water drawn into the artificial navigation of the State, deprives it of the ponderous matter, leaving only the lighter particles held in suspension to reach the section of the river under consideration, which, from their buoyancy, are carried and diffused into and through the lower sections, even to the ocean in part. This buoyant matter, consisting mostly of alumina and vegetable, can have but slight effect in the channels between Troy and New Baltimore; but the increased volume of water added to the ebb, gives the latter a greater corroding and abrading power on the points, (particularly of the islands,) concave bends, and bottom of the river where shoal; thus moving or cutting away the shores and bottom, producing a large supply of material for injury of the navigable channel at the nearest locality, at which the current slackens sufficient to allow the matter in suspension to be deposited. This distance is of very limited extent, and often within a mile of the position from which it was taken, and not by any means over an extended section, as has been supposed by some of the authorities cited in the historical sketch. Most of the matter is silicious; too ponderous to extend far. The vegetable and aluminous matter only extends so far as to produce but little injury.

Flood tide.—The current of the flood tide is another cause of disturbance, and acts as the ebb, except that it is more limited in its power, the current being checked by so much water as comes from above the State dam and Cohoes falls, in every period of about six hours, or time the flood is making. Its corroding and abrading power is nevertheless sufficient, when concentrated upon a point, bend, or shoal, to cut it away.

By the current of the flood tide must not be understood the effect of the tide wave, but only those particles of water that are seen to move with a current having a velocity of about two and half miles per hour. That current we may ascribe to the particles of water on the crest of the tide wave running down an inclined plane to fill the nearest valleys, acted upon or produced by the indraught, as it may be called, of such reservoirs or receptacles for the particles of water from the crest of the tide wave. This latter ascends the river altogether by another power, and at a much greater velocity, equal to nearly twenty miles per hour, on sections of this river. Its influence will be more particularly noticed as a remedy.

Freshets.—Of all the disturbing causes, the autumnal and spring freshets, which rise several feet, overflowing the islands, and frequently the landings and docks at Albany, and even Castleton, none are more powerful in the effects. With every foot or increment of rise, we have an increased inclination in the surface, and a corresponding increase of velocity. This increase of velocity varies in its direction with the rise, as with the overflow of the banks; the directrix or thread of current, taking the shortest line, passes over places that may previously have been in eddy. This irregularity subjects the islands and shores in this section of the river to abrasion or corrosion, as varied in locality as the quantity of water from the sources of the river. These freshets have power, unrestrained or uncontrolled, to cut away the banks and shores of the main land and islands, and remove the shoals from place to place; and we consider that it is this power, annually occurring, cutting away the existing islands, shores, and shoals, in the very section of the river under consideration, which produces the most disastrous results; moving vast quantities of matter from one reach and depositing it in another, varying in effect as the quantity of water producing them and their duration. It is these freshets that produce the power heretofore looked to as a remedy, in their influence as a scour to remove and deepen the bottom. Whether for good or evil, we will state our views under the head of remedies, here only remarking and inviting particular attention to these remarks, as indicating these freshets as the cause of the greatest evil to the navigation; and if such be the fact, as we believe, we cannot reconcile the apparent inconsistency of using the evil to cure the evil. We may add that this disturbing power of the freshets is, then, variable with the rise on account of the change of velocity, increasing its power along the shores, at the same time diminishing its power on the bottom, as the freshet rises; that it is variable, in consequence of taking new directions; that it is as variable on the bottom as the rise may vary in height; and that it is variable in the periods of its duration. To it, in some small degree only, is there an injury to the channels by the matter it brings from both the Hudson and Mohawk, limited in effect, as stated under the head of ebb tide.

Ice-dams.—In the winter season the navigation is generally closed by ice forming over the entire surface of the river. With the first freshets, however partial, this ice-barrier is broken up in places. Thus broken and put in motion by the current, the cakes or fields of ice are forced down the river, when, coming in contact with a part where the ice is locked and more firm from the shape of the shores, or where the force of the freshet has had less power to break it up, the detached masses are arrested, and either forced on top of the primitive ice or under it, cake after cake, breaking down in the one case, and filling under in the other, until a dam is formed sufficient to force the waters entirely into some new channel, when the sands wash from above against these ice-barriers, continue to accumulate until either warm weather or increased freshets remove the entire mass of ice, but leaving the injurious sand shoal as its fruit. These ice-dams are a frequent cause of difficulty in the channel, and as variable in their effects as the seasons and irregularity of the freshets. It must be borne in mind that they can only produce injurious effects in shoal water. In deep water the freshet finds room enough to pass under the ice.

Steamboat waves.—The powerful engine of the river boats displaces with its wheels, and in its rapid motion, a volume of water, which rushes to the chasm at the stern, as the vessel progresses from the surrounding waters, with a force proportional to the motion of the boat through the water. In shoal water, nearly all this motion is confined to the surface strata between the boat and the shore. As the boat progresses through the narrow shoal channels, she forces a wave in front, along the shore, which recedes with great velocity, filling the chasm behind as she leaves it. The velocity of this wave is greater than the motion of water produced by any other disturbing cause existing on the river; and, in consequence, cuts away the banks, and draws the matter into the navigable channel. This is felt and known as a serious impediment to high velocities on canals, and in like manner acts upon the river banks in shoal water. Like the ice, the injurious effects are only produced in shoal water.

Running aground of vessels.—Vessels, in ascending or descending, have now become so numerous, that it is a matter of frequent and almost daily occurrence to see one or more aground in the shoaler parts of this navigation, and not unfrequently broadside to the current; the consequence is, an increase in the velocity at the bow and stern, a deepening of the bed around the bow and stem, with a corresponding shoaling under the lee. When extricated, this shoal remains, and, presenting the same cause as the vessel, it then becomes a nucleus for the formation of a more extended shoal, producing impedíments that at times change the entire course of the channel.

Artificial structures.—The increasing commerce of this section of the country calls for continued facilities to load and unload vessels. Wharves are constantly being constructed, with the object in view of reaching the desired depth of water with the least expense.

It is not the interest of parties to study or look to the effect such wharves may have, either above or below them. It is often the case that they are constructed without its being considered how far they present elements for their own destruction, by the formation of shoals above or below, or by throwing the channel into new directions. In some instances, by repeated prolongations of these obstructions, or artificial works, the tide wave is checked, and its benefits are lost to the up-river navigation. Coxsackie, New Baltimore, and Coeyman's are remarkable places, where serious injury has been done to the navigation of the river by such structures. At Albany, the directions of the wharves or piers has not been without its injurious effects upon Cuyler's bar; and we cannot but believe that many of the jettees and transverse dams have also tended to injure the navigation of the lower sections of the river, although they have sometimes deepened it in the immediate vicinity of such artificial structures—as a general rule, the benefit in one section being attended with more or less injury below. As regards the longitudinal dikes, where the views of the board of engineers, as laid down in their 49th section, (see pages 18 and 19 of this memoir,) have been carried into effect, the results have been beneficial; but wherever these longitudinal dikes have created a scouring, corroding, or abrading power upon the bottom or shores, they must be classed with the causes of obstruction, their tendency being to remove the adjacent shoal, to deposit the matter below, and, as a general rule, to the injury of the lower sections of the river. To them Castleton difficulties must be attributed, notwithstanding the benefits they have secured at their immediate localities.

Austin's rock, near Van Wies' point, is an isolated mass, projecting from the bed of the river to within one foot of the low-water level, containing about 1,500 cubic yards. It bounds the present navigated channel, separating it from the eastern one, and limiting the width to a dangerous degree. This is the only rock requiring removal in this section of the river. A small boulder, between Troy and Albany, along the shore, should also be classed as an obstruction.

Such would seem to be the various causes that, collectively, render this navigation exceedingly embarrassing to the commercial community.

National importance of the navigation.

The Erie and Champlain canals enter the Hudson river at the upper end of the section of the Hudson under consideration; and all the property coming from or going to these canals must pass over more or less of this portion of the river. This trade, or commerce, renders the Hudson a national thoroughfare of that importance to the welfare and prosperity of the many, as can only be compared to the trade and commerce of the Ohio and Mississippi rivers, whose navigation require the fostering care of the national government.

During the year 1850 there arrived at tide-water, on the Hudson, through the canals, no less than 2,010,700 tons of property, valued at $54,452,430, mostly from the northern and western States, and Canada. During the same year, the property that passed up the canals, or from tide-water, amounted to 1,042,754 tons, valued at $100,923,292; making the sum of $155,475,722 as the value of the property that passed over this portion of the river, independent of an immense amount freighted by steamers, &c., that was received by railroads, the *tolls* upon which amounted, in 1850, to $130,424 92, paid to the State.

It was the production and handling of this immense amount of property, nearly all of which passed through the section of the Hudson under consideration, that promoted the agricultural, manufacturing, and commercial industry and prosperity of the multitude.

Of the single articles of wheat and flour alone, that passed over this section of the Hudson in 1850, it is known from official records that 363,186 tons, valued at $16,120,357, came from other States of the Union than New York; and for that item alone they must have received a corresponding value, as a remuneration for their industry. If we add thereto the supply for the same year from the State of New York, (the wheat-growing district of which cannot be considered as a local interest,) it swells the tonnage to 461,781 tons, and the value to $20,218,188.

The receipts at tide-water in 1852, up to the 22d of November, have been 3,162,375 barrels of flour, 6,062,312 bushels of wheat, 5,176,419 bushels of corn, and 2,044,106 bushels of barley.

So far the facts in support of this improvement being national, and not local, have been derived from the statistical records of the State of New York. If, now, we compare the inland trade passing through this intricate and difficult navigation, with the national statistics of commerce, the fact will be even more conclusively established that the improvement of the navigation of the Hudson river is a truly national enterprise, and worthy of as much of the fostering care and preservation of the government as any navigation in the country.

The total value of the exports of the growth, produce, and manufacture of the United States, for the year ending 30th September, 1851, was $196,689,718; and, as heretofore stated, the value of the tonnage up and down the New York canals in 1850 was $155,475,722; being equal to 79.04 per cent. of the entire annual exports of the supplies of national industry.

On taking the value of property that passed down the river only, (omitting its return or remunerating value, to wit, $54,452,430,) it is equal to 27.68 per cent. of the entire annual exports of the surplus of national industry.

It appears that this river improvement is not only directly beneficial in promoting the interests of our people, but also indirectly, by laying Canadians under contribution annually for the payment of so much of our labor as suffices to transport over this route property imported through our ports to the value of $2,890,306.

These facts, drawn from official records, leave no room to doubt the national character of this improvement.

Considerations on the system to be adopted at this time for improving the navigation.

The vast importance of the improvement of this navigation is fully established by the fact that property to the amount of $155,475,722 passed over the section of river under consideration during the last year, for which returns are complete.

The difficulties attending any artificial effort to improve it are acknowledged by all engineers who have studied or combatted such ever-varying and counteracting causes. The problem of securing a permanent and efficient improvement has, since 1797, been the study and effort of our State and national authorities. Their long-continued exertions, on various plans, in whole or in part carried into effect, have as yet failed of ultimate and complete success, leaving us with the results of their experience, as given in the preceding parts of this memoir, to guide us in preparing the present recommendations.

The system heretofore practised has been mostly to rely upon the periodical freshets, as a power regulated by dikes and dams, to scour a deeper channel. This power has been brought into action in two ways—one by the construction of wing dams and jettees, and the other by longitudinal dams. The first inquiry we have to make is, whether or not this power shall be used as a remedy under any circumstances.

The effect of jettees to produce this scour, although advocated and adopted from time to time by many, and in this river for a long series of years, yet the instances are few, if any, where a permanent and effectual benefit has been attained. It is not only our experience that justifies their rejection and condemnation, but that of Europe also. The French engineers employed on the Loire, Messrs. Smeaton, Telford, Reanie; and Stevenson, of England; Frise, and others, of Italy, have expressed their views very strongly against the use of this power. Their views and opinions are given at length in reports on the Clyde, Tyne, Ribble, and Port of Wells. As early as 1767, and down to the present date, the fallacy of this system has been pointed out, notwithstanding it has been followed by us for years on the Hudson, where the result, as in Europe, has been to deepen the channel where the contractions were made; but what has been removed by such artificial current has been lodged in the wider places where the current is more languid. In like manner longitudinal dikes act, and are objectionable where they are constructed to scour the channel. The result is doubtless to deepen the bed abreast such dikes, but, as in case of the jettees, only to deposit the matter in wider places where the current is more languid.

We can come to no other conclusion than that dikes, dams—longitudinal or transverse—and jettees, should not be permitted where they act to scour the bottom or abrade the shores.

The advocates for removing the bed of the river by the scouring power of the freshets, rely upon the matter so removed being deposited below, and diffused in a thin lamina down as far as Hudson, and even lower; or, in eddies and island chutes, beyond the reach of navigation. To this idea, we apprehend, is to be ascribed much of the failure in the projects heretofore adopted. A reference to the comparative state of the channels will show that while the dikes and dams have deepened, the localities about which they are constructed, from Troy to Van Wies' point, all the lower portion of this intricate navigation to New Baltimore has been greatly injured, new shoals having formed since these structures were made which did not exist previously. Castleton is a remarkable instance. The removal of many thousands of cubic yards of sand from this upper section of the river has been caused and effected by the force of the freshets, accelerated by the artificial works, and deposited in like quantity on some sand bar below, and not by any means distributed over a great length of lower river, with but imperceptible injury to the navigation.

Another objection to reliance upon longitudinal dikes in scouring a deep channel is, that the power, when available, does not act with any certainty upon the low-water navigable channel, which alone requires improvement. This freshet power is not directed on the line or route of the low-water channel. Every foot of rise by freshet changes the direction of this power until, at the maximum height, the slope of the surface is greatest, not only from the rise, but also from its taking the shortest line in its descent over islands and shoals, instead of winding about them. The eddies for deposit are at such times totally different from the eddies as the waters fall. Any calculation upon deepening the low-water channel (the only one requiring improvement) by such variable scouring power, must inevitably prove fruitless. This irregularity in the scouring power of the freshets is well known to exist on the Ohio river, where, during the high stage of water, the low-water channel way is in many reaches entirely within the eddy, and is filled up many feet. As the water falls gradually, the directrix restores itself to the low-water channel, and as gradually opens the low-water channel, through which the strongest current then flows, but over which the high water was an eddy or still water. The theoretical writers concur in enforcing the irregularity of this power. See Du Buat; also Course on Navigation, of the central school of arts and manufactures, in 1847 and 1848.

The scouring power of the freshets, (as well as that from the flood and ebb tide,) we consider, is not to be relied upon in any way. Yet it must command our attention, and the study should be to throw or lead its directrix, where we cannot render it a nullity, as much as possible in a route common with the low-water directrix of ebb and flood tide—the union of these three currents producing the most satisfactory results, and their opposition being antagonistical to uniform depth.

The scouring power of the freshet, when left to itself, or attempted to be controlled, we consider as a primary cause of all the difficulties existing in the navigation. Even in localities where neither dikes nor dams have been constructed, to increase its effect, it has power and force enough to cut away and remove islands and shoals, as well as the banks of the river upon which it impinges. It is this disturbance of the bottom and shores by the variable action of the freshets and tides, within the district of obstructed navigation, that furnishes the matter constantly creating new shoals, bars, and impediments, by the removal and destruction of others.

We come to the conclusion, then, that this corroding influence of the waters must be rendered nugatory in every way in our power, rather than resort to it as a remedy, and never indulge the hope of removing the difficulties of navigating this river by the very cause that produces them.

In considering the remedies to be adopted for the improvement of the channel of this river, we have to bear in mind that it is a tidal river, and not solely a freshet river. This consideration modifies materially the system that may be adopted, as the influence of the flood tide is a perpetual daily source of relief to the full extent of its rise. Its influence exists uninterruptedly for about ten months out of twelve of the year, with undiminished effect. The freshet, and great cause of all the disturbance of the channel, continues but two months.

Heretofore the action of the tide wave does not seem to have been considered in any way—either as to the effect the dams and jettees have in arresting and chocking its movement up the river, or the propriety of straightening the courses, or removing obstructions to its free passage. We consider this as an element of great value in the improvement that may be made. One of the river commissioners, in 1819, stated that from Kinderhook to Four-mile point, above Hudson, there was a bar, at the upper end of the narrow channel, with only seven feet at low water, and twelve feet at high water. Here we have the means of ascertaining the rise and benefit of the tide wave at Four-mile point to be five feet. And from Clinton's and Hughes' reports, we find that at Albany it is about two feet. Yet no effort or consideration had been given towards allowing this five feet wave to roll up the river uninterruptedly. On the contrary, artificial obstructions of various kinds were made with the view of benefiting the navigation—all tending, more or less, to cut off this reliable and valuable daily power and facility.

The advantage of the tide wave being available every twelve hours, giving in that period an increased depth in the channel equal to the rise, cannot be too much prized. It alone gives such a supply of water when most needed, to wit, during extreme low water in summer. While the freshet continues, no difficulty is found in navigating the river; then there is a superabundance of depth in the channel. It is only when the tide wave can have an influence that too little water is found for purposes of commerce; and then it is we can best promote the free ascent of this wave up the river. So soon as the freshets subside, we should look to this source of supply and daily periodical increase of depth from nature's never-ceasing power. Unlike the freshets of short duration, it is as continued as the revolution of the earth's satellite, to which we are accustomed to assign its controlling influence. There is every reason to believe it can be allowed to rise as high at Albany as it now does at Castleton, and that the time of high water at Hudson, Castleton, Albany, and Troy, may be made to approximate as the obstructions to the free ascent of the wave are removed.

System now recommended for improving the navigation.

The only system we can recommend, in which to place any reliance upon doing good at one place without injury at another, is to gain the necessary depth by the steam-dredging apparatus, the tide wave, and economising the supply of water at the low stage, by closing up side basins, island chutes, and other waste openings; taking special care thereby not to increase the velocity in any place to produce a "scour," either on the shores or bottom, with the freshet, ebb, or flood tides.

To this end, the dikes that may become necessary should be constructed of timbers with vertical faces on the channel side, filled with stone enough to overcome the buoyancy of the timber, the residue with matter taken from the channels by the steam dredge. The timber work should not be carried higher than the level of ordinary low-water mark. To that height it will never decay, and, being in fresh water, there is no worm to destroy it. On top of the timber to the level of ordinary high water they should be built up with quarry stone, placed on the exterior by hand, and in like manner as the paved surfaces of the existing dikes. Behind these structures, and in part within them, is formed a secure depôt or dumping ground for the sands taken from the channels by the steam dredges. The matter taken up by the steam dredges must not, under any circumstances, be placed where it can again be washed into the channels. Already a great amount of money has been improperly spent by throwing it upon shoals, from whence it has been washed down the river, to impede other parts of the navigation.

The height of any dike now to be built, we consider, should not in any case exceed that of ordinary high water. We only need to economise the water from the rivers above, and that of the tide wave to the level of high water of the flood tide. The freshets alone rising above that level, give, of themselves, a superabundance of depth, and any dike restraining them we consider a positive injury. We must give the freest possible and most hasty discharges to the freshet waters, which are the main sources of all the trouble and injury to the navigation. Let these freshets have vent, to escape rapidly and freely, and on no account confine them, to create a corroding, scouring influence; but, on the contrary, open wide the outlets for getting rid of the soil.

In addition to timber dikes, to economise the tide wave, the waste waters from the canals, and daily supply from the rivers, we must strongly recommend the necessity of similar structures to protect every shore, head of island, or other place, that may be cutting away by the currents. If these precautions are taken, there will then no longer be any material for the currents to act upon, or find food for creating new obstructions, other than on the bottom; and then, by vigorous efforts being made with steam dredges to remove the sand from the bottom, we gain a depth to which the currents no longer can disturb it; thus doing away with the causes of evil, and gaining a navigable channel that is likely to remain as unaltered as a canal bottom—it being then subject to no other injury than from sedimentary deposit of just such matter as the canals, and no more.

We must endeavor to leave the river in such a state that neither freshet, ebb, nor flood-tide currents shall have power to disturb the soil along the banks or bed of the river—rendering them incapable of removing a grain of sand, if practicable; then the powerful and economical means we have at command of steam dredging will, with every probability of success, conquer and overcome all difficulty. Observe, then, that we rely upon making the banks and bottom immovable, excavating the channel to attain the depth, as the true course to be adopted for improving this navigation.

In economising the supply of tidal and river water, by closing the island chutes with dams, we must study to give a direction to the volume of water ascending and descending; which direction shall be gradually drawn into the directrix of the low-water channel, and never, under any circumstances, abruptly oppose its passage. And so with the freshet waters, while allowing their escape freely, and in the shortest time, over low dams, to lessen its velocity, we must study to direct its volume over the same course as the low-water channel. If it passes mainly around and among the islands, it causes the crossover bars at the foot of the islands, which are so injurious, so to direct it, and at the same time not increase its velocity to produce the "scour;" we must resort to low dams in all cases. The limit of height for these dams is mainly to economise the supply or feed in the low stage of water; raising the dikes above that level produces an increase of the evil effects of the currents. We know, from examining the existing state of this river, as well as others, that a shoal or bar always covered with water, (even at extreme low stage,) suffices to arrest and change the course of the channel, in some cases on this river, as abruptly as at a right angle. We cannot, then, hesitate to believe that the freshet will in the main be drawn into a uniformly straight channel, bounded by immovable banks and deep bottom, by resorting to the system now recommended.

If the dikes closing the island chutes are limited in height as above, after the water has risen to fill the side valleys, (and one flood tide suffice therefor,) it may then commence to pass over them; but the main body having been given the straightest direction, as well as deepest, will naturally follow such course, when the side passes become eddies or still water for deposit. Every foot the freshet then rises, its injurious effects diminish in proportion as its velocity is lessened by more free escape; when there is no longer any power to act upon the bottom, and the sides being protected, injury ceases to be done. Hence, then, again we say, get rid of the scouring influence as soon as possible, and do all we can to prevent its acting upon the shores and bed. If we had no periodical freshets, there would be but little disturbing cause in nature to a uniform river. We might then excavate to what depth we pleased, and just so deep would the channel remain, except from the sedimentary matter brought from above Troy and the falls of the Mohawk, and this sedimentary matter is only found during the short periods of the freshet. At other seasons the water is comparatively clear; in addition to which, much of it is taken into the canals and other State works, where it parts with the sediment before being restored to the Hudson. There could, then, be no more cause for alteration in the navigation of the river than in a canal. Hence, then, we again repeat, let us abandon all further efforts to seek for aid from so destructive an element as the scouring power of currents, artificially increased by high longitudinal dikes.

To avail ourselves of the good effects of the tide wave must also be our study. Its advantages in giving increased depth to the navigation exists, when we most need it, in low stages of water. When concentrated upon a point, it is chocked and resisted in its ascent. In such cases we must endeavor to straighten the channel gradually, that the wave shall not be so obstructed; and if that be impracticable, we must protect the banks by timber dikes, as against the freshet scour. Against obstruction to its free ascent along the bed of the river, we must again resort to the dredging machine; thus, while we render its power of abrasion on the shores and bottom harmless, we gain the other highly important advantage—its free, unobstructed motion up the river in the shortest time, and with its greatest rise. There is no reason why this tide wave should not rise as high and even higher at Troy than Castleton, and be at its highest, in a very short space of time, after high water at the latter place, instead of, as at present, being two hours later. By straightening and deepening the river, all our experience, as well as that of Europe, proves this beneficial effect may be calculated upon. Should our anticipations from this source be fully realized, we gain at Albany about eighteen inches additional rise of tide, and consequently an equivalent to this depth on Cuyler's bar, and others below it.

Thus, while straightening and dredging out the channel, to counteract one set of causes of evil arising from scours, we at the same time, and by the same means, counteract the cause of obstruction to the tidal wave, by encouraging its free ascent up the river.

The ice dams are only to be rendered harmless by increasing the depth of the channel, and lessening the velocity of the freshet waters that produce them. All the dredging in the channel to counteract the injury from freshet, ebb and flood-tide current, and obstruction of the tide wave, at the same time, tend to prevent injury from the formation of ice. If there was no shoal upon which the ice could ground, its influence would be harmless; by opening a deep channel for the passage of the water beneath the ice, there is no dam formed so long as the channel remains; and this continuance is proportioned to the depth we secure by the dredging machine.

The grounding of vessels produces increased shoals, and a nucleus for the formation of others, as has been pointed out. This is obviated by persevering attention to deepen the channel with the dredging machine. But one cause of impediment to the navigation remains to be noticed, which is, the rocks in the channel; of these, three localities would seem to call for particular attention—one small mass along the shore above Bath; Austin's rock, near Van Wies' point, and some dangerous projections from a rocky formation in the channel a little above

Four-mile point, on the west shore. All these are to be removed by powder, and taken from the bed of the river, effectually and permanently obviating all difficulty and danger from this cause.

Estimate of cost.

To carry this system into effect requires time, as well as a certainty of sufficient funds to accomplish the whole undertaking uninterruptedly. To be commenced, suspended, and renewed, from time to time, will, in a great measure, frustrate the success that a continuous operation is calculated to produce.

The dredging and diking must progress simultaneously, as the latter is calculated to make secure depôt for the matter raised from the channels.

We consider it advisable to work with six steam-dredging machines, capable of raising each 1,000 cubic yards per day. For this dredging apparatus the following estimate is presented:

Cost of a boat for the steam-dredging machinery, 75 feet long, 30 feet beam, 8 feet sides, with cabin fitted for crew	$2,500
High-pressure engine, 25-horse power, (nominal,) 4 feet stroke, 12-inch cylinder, 3 boilers, of 30 inches diameter each, 16 feet long, bedded and fitted complete	3,000
Dredging apparatus, consisting of two sets of elevators, geared complete	4,500
	10,000
Such a dredging machine will require 6 lighters to receive the matter as it is raised—2 receiving load, 2 discharging, and 2 going or coming from depôt. They should be 55 by 13 feet by 3 feet 6 inches, and will cost $450 each	2,700
Outfit for the dredge-boat and lighters, to consist of anchors, warps, poles, boats, &c	500
	13,200
Six similar machines and lighters will cost	$79,200
That the scows or lighters may be transported expeditiously, a suitable towing or propelling power must be provided capable of carrying two loaded lighters against tide. This can only be insured by the use of a steam-tug. Such a vessel, of suitable power, will cost	5,000
To this we must add, for other machinery not now to be calculated, such as occasional rail-tracks and ways to convey part of the dredged matter beyond the influence of the currents, wheelbarrows for the same purpose, shovels, other tools and contingencies of outfit	10,000
Producing an outlay for six years' operation of	94,200

a sum amply sufficient for the machinery and apparatus of the most efficient and best description, capable of raising and conveying out of the channels 6,000 cubic yards per day.

These machines, we calculate, will have to work six years continuously to produce a satisfactory result between Troy and New Baltimore. In that period, 200 working days may be calculated upon as the maximum time per year for each machine—producing annually 1,200,000 cubic yards of earth removed.

The expense of working this machinery we calculate to be as follows: Each machine will require—

1 engineer, at $35 per month—say 10 months' work in the year	$350
1 foreman, or boss, at $40 per month—say 10 months' work in the year	400
1 fireman, at $20 per month—say 10 months' work in the year	200
4 scow tenders, 4 deck hands, 1 pump hand, and cleaner of lighters and assistant to engineer—9 men, at $18 each, $162; and for 10 months	1,620
300 tons of coal, or 1½ tons per day, at $4 per ton	1,200
25 cords of pine wood, or ⅛ of a cord per day, at $5	125
Oil, packing, and other items for engine, including repairs, at $5 per day, for 200 days	1,000
Cost of working each dredging machine and scows per annum	4,895
The 6 would cost annually	$29,370
And the cost or working the steam-tug 200 days, which would suffice to transport for the six dredges, working on the same or contiguous shoal, at $15 per day	3,000
Making the annual cost of working the 6 machines	32,370
And for the 6 years' operation, raising and disposing of 7,200,000 cubic yards of matter from the channels	$194,220
At the same time this dredging operation is in progress the dikes will have to be constructed. The extent of all that can be required between Troy and New Baltimore is 94,050 feet—making the base of these dikes on an average of 8 feet, with a crest of 5 feet, and depth of water of 6 feet, constructed on the face of 10 by 12 inch timbers, sawed on face and beds; ties every 8 running feet; an iron bolt in every 8 feet of such log, on the face of ¾-inch iron, with necessary back-binders, and stone to fill the same, will cost $1 92 per running foot—making the cost of the whole	$171,576

Thus making the entire cost to consist of—

Outlay for machinery	$79,200
Working machinery six years	194,220

Construction of timber-face dikes	$171,576
Cost of removing Austin rock, 1,580 cubic yards, at $3	4,740
Cost of removing rock between Albany and Troy	250
Cost of removing rock near Four-mile point	1,000
Making a total cost of	450,986

which suffices to excavate from the channels 7,200,000 cubic yards of matter and place it securely behind structures, from whence it cannot again be thrown into the channels. This is equivalent to excavating a channel 200 yards wide and 3 feet deep a distance of 18 miles.

If this system be carried into effect, it will require the first year the estimated cost of machinery	$79,200
One year's cost of working the dredges	32,370
And one-sixth the cost of the dikes	28,582
Together with the cost of removing the rocks	5,990
Total for first year's operation	146,142
Total for second year's operations	$60,952
And succeeding years the same sum	60,952

The value of the machines at the end of six years we estimate as equal to any contingencies not included in the estimate.

Conclusion.—Application of the $50,000.

We have finally to recommend the most judicious application of the appropriation now available, with the certainty that its expenditure is not to be followed immediately by any additional sum to perfect what may be commenced.

Keeping strictly in view the principles laid down in the "system of improvement," &c., we would propose the application of the available fund of $50,000 as follows:

1. To repair the dikes above Albany, closing the cut at Port Schuyler	$5,000
2. To repair the dikes below Albany, closing the cut therein, using the stone from the existing cross-dam as far as it will go therefor	5,000
3. To build 5,000 running feet of dike from Greenbush down to and beyond Duow's point, abreast of Cuyler's bar, at $1 92 per foot	9,620
4. To excavate 80,000 cubic yards of sand, &c., from Cuyler's bar and shoal, making a straight channel through the shoal, depositing all the excavated matter behind the dike, at 15 cents	12,000
5. To remove rocks on edge of channel about a mile above Four-mile point	1,000
6. To remove rocks along margin of channel between Bath and Troy	250

7. To remove Austin's rock, depositing material in dikes adjacent, 1,580 cubic yards, at $3 per yard..........	$4,740
8. To excavate about Castleton, to give relief, as soon as the freshets subside, at points where shoals are supposed to have formed with the last ice dams, and which will probably be the first expenditure....................	5,000
9. The preceding being provided for, a balance will remain for contingencies and to meet any deficiency that may happen by extension of the previous items...........	7,390
	50,000

To accomplish this work in the shortest time and to the greatest advantage, we must of necessity resort to contracts. They may embrace items Nos. 3 and 4, as one person having the means at command could most advantageously carry that improvement into effect. The other items would be better carried into effect under separate contracts. The contract system must of necessity be adopted, as the amount appropriated will not justify the building of dredging machines. Two, if not more, of such machines are owned about Albany and Troy. The owners of them have heretofore taken contracts on fair terms, which is much better than expending a large portion of the appropriation in building such apparatus.

All of which is respectfully submitted,

RICH. DELAFIELD,
Major of Engineers.

Gen. Jos. G. Totten,
Chief Engineer.

New York, *May* 25, 1853.

APPENDIX T—1.

Engineer Department,
Washington, July 11, 1853.

Sir: I have the honor to submit herewith, for your consideration, the elaborate report and map of Major Richard Delafield, corps of engineers, on the improvement of the navigation of the Hudson river, together with the separate views of the several members of the board of river and harbor improvements on this subject.

The appropriation by Congress of 30th August, 1852, provides for "continuing the improvement" of this navigation, for which appropriations were first made by the general government in 1834. At that time a project for the improvement was furnished by a special board of engineers constituted for the purpose. The execution of this project was intrusted first to Captain Talcott, and afterwards to Captain Brewerton, corps of engineers who continued in charge of the work until its suspension, for want of means, in 1839.

The plan of the special board for the improvement was to excavate a suitable channel by dredging machines, and to apply the excavated matter to the formation of longitudinal dikes rising above high water where needed along the shores, thus restricting the current of the river to a bed of more equable width; by which means it was expected that the freshets of the river would, by their scouring action, maintain the excavated channel.

Major Delafield, after a careful study of the subject, proposes to rely upon dredging, not only for the attainment, but also for the maintenance of the desired depth of water. He proposes to facilitate the up-flow of the tide by removing all impediments thereto, and by straightening the banks of the river by dikes rising to the level of high water. The scouring action of freshets he regards as injurious, and therefore limits the height of his dikes as above, so that the excess of water may escape over them into the bays behind; the shores, heads of islands, &c., to be protected from abrasion by suitable works.

Captain Brewerton, who was a member of the board of river and harbor improvements, differs from Major Delafield as to the means to be employed in effecting the improvement. His opinion is, that the system proposed by the special board of engineers should be carried out, modified only where experience has shown it to be necessary.

The senior member of the river and harbor board concurs in the views of the special board of engineers and in the general views expressed by Captain Brewerton. He looks upon high longitudinal dikes, with as straight a direction as can be given to them, and deep dredging, as the most effectual means to be resorted to to insure success.

The remaining member of the board of engineers thinks that scouring and scratching are preferable to dredging, on the score of economy; and proposes to reduce the height of all dikes to low-water level, considering that no means to develop the effect of the flood tide should be neglected.

While it is thus agreed on all hands that dredging and longitudinal dikes must be the great means of improving the navigation of this river, much diversity of opinion is seen to exist as to the extent to which the dredging should be relied on, and the most suitable dimensions for the dikes to have.

It appears to me, therefore, most advisable to limit our present determinations to the uses to be made of the means now in hand for the work, reserving a decision on the general plan of improvement until the local engineer shall have had the advantage of extended observations of the river at all seasons, together with full opportunity of studying and comparing the various opinions entertained on the subject.

The officer in charge of the work and a majority of the board agree that the existing appropriation should be applied to the following objects, viz: 1st, repairing the existing dikes above and below Albany; 2d, excavating channel through Cuyler's bar and shoal, and about Castleton; and, 3d, by removing Austin's rock, the rocks between Bath and Troy, and those obstructing the channel-way near Four-mile point. One member of the board, while indicating a preference for the construction of some new dikes, as the first object to be effected with the present appropriation, if it be sufficient for this purpose, still however regards the removal of obstructing rocks and the excavation of a channel-way as essential parts of the work.

I propose, then, with your approbation, to instruct Major Delafield to proceed at once with the execution of the above works, viz: excavating the channel at Cuyler's and Castleton, removing the specified rocky obstructions, and repairing the dikes—reserving the closing of the two openings in them, against which Captain Brewerton specifies reasons of a local nature, which may not have come to the knowledge of Major Delafield.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brev. Brig. Gen. and Col. of Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved:

JEFFERSON DAVIS,
Secretary of War.

JULY 29, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX U.

ENGINEER DEPARTMENT,
Washington, September 17, 1852.

SIR: The Secretary of War having assigned the works of river and harbor improvement on the Atlantic and Gulf coasts to this department, I have, with some other operations as to which you will receive particular instructions, to commit to your supervision the operations under the following item of appropriations, namely: For the further improvement of the harbor of New York, by removing the rocks at Hellgate and Diamond reef, in the East river, twenty thousand dollars.

In connexion with this subject, and as communicating important information, I transmit a copy of a letter of this date from Mr. E. Meriam, who has hitherto had the management of the works, with an estimate of the cost of finishing Pot rock in Hellgate, and Diamond reef off the Battery.

The operations have been conducted with remarkable economy as advantage, and it would seem very desirable to continue the same system; to that end it would be best probably to continue the agency of Mr. Meriam, who desires no compensation for his own services, and who it seems exercises very strict supervision over the expenditures of powder and other things. I have no doubt that you will be able to establish such an understanding with him that all the experience acquired by him, Mr. Maillefert, and other persons, may remain available to the completion of the work, with but little labor or trouble to yourself.

I desire your prompt report on the extent of work that can be done this year, and its probable cost.

Whether the powder and canisters already provided should not be taken by the government at the same rate as has been hitherto paid?

Whether the course of proceedings, including the employment of Mr. Maillefert, and allowances made to him, heretofore followed, should not be continued under the help of Mr. Meriam?

After conferring freely with the last-named gentleman, and satisfying yourself on the above and all other points deemed important by you, please inform the department, bearing in mind the necessity, at this late day in the season, of profiting by every hour.

I need hardly say that the operations of this season should be confined to Pot rock and Diamond reef; and that no payments can be made by you for expenses incurred previous to your being put in charge. Supposing it proper and desirable to receive the powder and canisters above mentioned, that will be, in all respects, a new purchase made by you.

I am, &c.,

JOS. G. TOTTEN,

Brevet Brigadier General and Colonel of Engineers.

Major W. D. Fraser,

Corps of Engineers, New York.

P. S. Enclosed herewith you will find a letter from E. Meriam, of this date, with estimate of completing the removal of Pot rock in the channel of Hellgate, and for the removal of Diamond reef in the East river; also, a statement of E. Meriam, dated Washington city, August 10, 1852, relating to operations in the neighborhood by removing rocks by submarine blasting, &c.

APPENDIX U—1.

U. S. Engineer Office,

New York, October 22, 1853.

General: I submit to the department my annual report of operations, under the act of Congress of August 30, 1852, appropriating "for the further improvement of the harbor of New York by removing the rocks at Hellgate and Diamond reef, in the East river," twenty thousand dollars.

The dangers of the passage of Hellgate, East river, had long since become proverbial, and various efforts were made from time to time to induce the government to undertake the task of removing them, but although reports were submitted and different plans proposed and discussed, nothing effective was done before the arrival in this country, October, 1849, of Mons. B. Maillefert,* a French engineer, who had been employed at Nassau, New Providence, by two of the officers of the royal engineers, in the removal of rocks from that harbor.

As it was believed, from the urgent appeals made to the government in behalf of the harbor of New York, which is emphatically the centre of commerce of this continent, that the Congress of 1850 would not ad-

* Mons. Maillefert had assisted in submarine blastings at Nassau, N. P.
It is officially known that such operations were successfully prosecuted in 1842-'4-'5-'8 and '9, by the British royal engineers.—*Engineer Department.*

journ without making some provision for its improvement, and that an opportunity might then be given for trying the new system of blasting, it was thought best to defer action until the fate of the harbor and river bill was decided. This bill having failed to pass, Mr. E. Meriam, a public-spirited citizen of New York, who had long before interested himself deeply in this matter, undertook to raise from private sources money enough to attempt the destruction of Pot rock and other dangerous rocks and reefs within and in the vicinity of Hellgate. He was induced the more readily to enter upon this enterprise from the confidence expressed by Mons. Maillefert in the efficiency and cheapness of what was called his plan of submarine blasting, and his willingness to make a contract to break down Pot rock to the depth of 24 feet mean low tide for $6,000; no payment to be made before the completion of the work. The perseverance and thorough devotion of Mr. Meriam to the cause enabled him after a while to overcome all difficulties; the money was raised, and Mons. Maillefert's proposition accepted, and the first experiment was made on Pot rock August 20, 1851.

From that time to the 28th of February, 1852, 284 charges were fired. Of these, 27 were of 78 lbs. of powder, and 257 of 125, and the whole amount consumed was 34,231 lbs. The total cost was $6,837 20. The effect produced will be referred to hereafter.

Meanwhile the other rocks were attacked, and the following is a brief statement of their original size, the number of charges fired, their reported effect, and total cost:

Frying Pan, at the depth of 20 feet, was 75 feet long and 33 wide, and had 9 feet of water over it at mean low tide. After firing 105 charges, by which 12,387 lbs. of powder were burnt, it is said to have been reduced to 18½ feet. Two of the charges were of 56 lbs.; 24 of 100; 79 of 125; and the total expenditure was $2,116 81.

Way's reef in Pot cove was, at the depth of 20 feet, 189 feet long and 60 wide, and its highest point about 5 feet below the surface of the water. Prior to the 26th March, 1852, and since the 12th June of the same year, 135 charges were fired, consuming 15,549 lbs. of powder. They varied in size from 62 lbs. to 125 lbs.: 20 being of 62; 17 of 100; 31 of 120, and 85 of 125, and the rock was reported to have been deepened to 14½ feet. The total cost was $2,543 66.

Shell-drake had 8 feet of water upon it, was 48 feet long and 17 feet wide. It was subjected to but six explosions, consuming 620 lbs. of powder; 8 feet of rock was said to have been removed, increasing the depth to 16½ feet, and the cost was $110 34.

Bald-headed Billy was entirely destroyed by Mons. Maillefert, for which he received $500.

Hoyt's rock was also removed, at a cost of $200.

Upon Diamond reef, which was 111 feet long, 33 feet wide, and 16 feet deep, 78 charges of 125 lbs. were fired, breaking it down it is said 2 feet, and costing $1,434 42.

Three blasts were made on Hallet's point, but without any apparent effect. They cost $69 02.

RECAPITULATION.

	Charges.	Pounds of powder.	Average cost.	Total cost.	Feet of rock removed.
Pot rock	284	34,231	$24 07½	$6,837 30	10 feet 4 inches.
Frying Pan	105	12,387	20 16	2,116 81	9 feet 6 inches.
Way's reef	135	15,549	18 84	2,543 66	9 feet 6 inches.
Shell-drake	6	750	18 39	110 34	8 feet 6 inches.
Bald-headed Billy	1	125	....	500 00	Wholly removed.
Hoyt's rock	8	1,000	....	250 00	Wholly removed.
Diamond reef	78	9,750	....	1,434 42	2 feet.
Hallet's point	3	400	....	69 02	No apparent effect.
Total cost	......	....	....	13,861 59	

Of the money expended under the direction of Mr. Meriam, who deserves great praise for the rigid economy exercised by him in its disbursement, $10,400 were raised by a 6 per cent. loan, and the remaining $3,461 59 are in the shape of unpaid bills. Mr. Meriam gave his time and attention for years to these objects, and superintended the operations just described without reward or compensation. He knew that he had done the public a great good; but whilst this was necessarily a source of profound satisfaction, it did not enable him to pay back the money already borrowed, or to cancel the outstanding claims.

As he and his supporters had acted independently of the government, it may be said that they have no right to ask it to assume their debts; but when it is considered that they were willing to risk their money on an experiment which the government ought to have tried; that they were laboring in a national cause, and that they succeeded in conferring a great benefit upon all navigating the East river, it must be acknowledged that the request is sanctioned by both justice and equity. I must, therefore, join with them in asking the government to assume at once these obligations, and to relieve Mr. Meriam from the unpleasant position into which his great interest in the public weal has placed him.

Mons. Maillefert having never before, in all probability, attempted the removal, by submarine blasting, of so hard a substance as Pot rock, soon discovered his inability to execute his contract, and was therefore compelled to abandon it. Mr. Meriam, however, in his anxiety to see the work progress, entered from time to time into new arrangements with him, and ended by agreeing to furnish all necessary materials, and to pay him $5 per charge; and this was the understanding between them up to the time the work was assumed by the government.

At the commencement of operations, Mr. Meriam, who naturally desired to connect the government as much as possible with him in his new enterprise, wrote to Professor Bache, the superintendent of the coast survey, giving a glowing account of his success. This, together with the deep interest felt by the professor in a matter of so much moment to the safe navigation of the eastern entrance into the harbor of New York, led to interviews between them, which resulted in the appointment of Lieutenant W. A. Bartlett, United States navy, then engaged on the coast survey, as his associate.

Lieutenant Bartlett immediately entered upon the discharge of his duties, and between the 3d of September, 1851, and the 27th of March, 1852, made various surveys of Pot rock, and those on which they were blasting. As the work progressed, the rocks became more and more broken down; and when the survey of Pot rock of March 27, 1852, was made, Lieutenant Bartlett certified there were twenty and a half feet water upon it.

This certificate became necessary, on account of the condition attached to Mr. Henry Grinnell's subscription of $2,000 to the fund, which was to be paid within a limited time, only when that depth of water had been attained.

Those facts are now mentioned, because they have an important bearing upon the subsequent history of the work.

As soon as the Congress of 1852 had passed the harbor and river bill, which contained an appropriation of "$20,000 for the further improvement of the harbor of New York," by the removal of those very obstructions, Mr. Meriam ceased to act as superintendent, and that duty, by instruction of the Engineer department, dated the 17th September, 1852, became mine. As I was required to continue operations on Pot rock, my first step was to survey it. Much to my surprise, I found eighteen feet three inches water upon it, instead of twenty and a half, as before reported; and I have ever since been at a loss to understand why this discrepancy existed between the survey of March 27, 1852, and that of October 19, of the same year. I must not be understood as imputing blame to, or condemning in any way, Lieutenant W. H. Bartlett, who, I sincerely believe, certified to what he thought was the truth; but in justice to myself I am compelled to state the fact, to explain why it is that so much was apparently done at so small an expense before I became the superintendent, and so little at so great since.

The truth is, that Pot rock being of a conical shape, and exposed to the action for ages of a very powerful current, was in all probability near its top worn into honeycombs, and yielded easily to the force of the first few discharges; but as the rock deepened it became much longer and wider and harder, and more difficult to break.

The accompanying map gives its plan as it originally was, its shape when surveyed by me in October, 1852, and its present condition. The accuracy of the first I cannot vouch for, because the data from which it was drawn were quite imperfect, though the best probably now in existence; but the others are trustworthy, for great pains were taken to have them correct.

In all three cases, only that part of the rock above the plane of reference, twenty-four feet below mean low tide, is given—the first showing the curves for every foot rise from 24 to 8, the second from 24 to 19, and the last from 24 to 23. The $6,837 30, marked on the second, is the cost of its reduction to that from its original form; and the $17,623 30 on the third, is the money expended between October 17, 1852, and October 3, 1853; making the whole cost, to the present time, $24,459 95, a sum of money very large, when compared with the quantity of rock removed, but by no means extravagant when all the surrounding difficulties are considered, and a proper contrast drawn between the previous and present condition of Hellgate.

The subject being new to me, when first assigned to this duty, I continued Mr. Meriam's agreement with Mons. Maillefert, which was to supply him with all necessary materials, and to pay him $5 per charge, and directed him to go on and fire 200 charges. When this was done a survey was made, and the practice of firing 200 charges, and making a survey after, was continued throughout the whole year. Each examination showed, that although the progress was slow, it was sure, and gave me renewed assurance that we had the means in our power, if we would use them, of reducing Pot rock to the required depth of twenty-four feet mean low tide, and of rendering it forever harmless to vessels of the very first class.

The great necessity of testing fairly this new system of submarine blasting induced me to confine myself wholly to Pot rock, being satisfied that, if it could be removed, the destruction of the others became an easy problem.

As Mons. Maillefert had, in the mean time, other engagements, the blasting did not proceed continuously; but from the 21st October, 1852, to the 23d September, 1853, 950 charges of 125 lbs. of powder were fired, leaving still a large part of the rock above twenty-four feet mean low tide; although, so erroneous were the impressions created by Mons. Maillefert's first successes, that Mr. Meriam, relying partly on incorrect surveys, estimated that 200 charges would do what 950 have failed to. Estimates based on such calculations are worthless; and indeed it is difficult in all such operations, unless the circumstances of the case are precisely the same, to judge correctly.

This mode of blasting is not, in my opinion, of universal application; and such failures as at New Haven on the southwest ledge must satisfy others that it is well founded. But as all the rocks and reefs about Hellgate are of a similar character, I have no hesitation in saying, that by applying to them the same means as in the case of Pot rock, they can all be removed.

The only surveys I have of them are those previous to September, 1852; but it is probable, judging from Pot rock, that they are not altogether correct, and cannot be relied on.

It was my intention to have surveyed them all myself, but my duties were too numerous to allow me sufficient time. It is not, however, of much importance; for the appropriation was too small to enable me to attempt any more this year than has been done, and the surveys are sufficiently accurate to assist in making estimates for further operations.

I should here remark, that the position of some of the rocks is such, being exposed at all times, except for a few minutes at slack water, to a very strong current, that the difficulties of getting correct surveys are very great, and that much care must be exercised, with some experience, to attain even good approximate results.

Last year, after having fired 200 charges, of 125 pounds of powder each, upon Pot rock, I submitted to the department, under date of December 2, an estimate of the probable cost of removing all the principal obstructions to the navigation of the East river at Hellgate, including Diamond reef, between the Battery and Governor's island, in the harbor of New York. A year's experience does not induce me to alter them much; for, although Pot rock is still above the depth of 24 feet, after being subjected to the shocks of 750 heavy charges, and will probably require 300 more to be brought down to the proposed level, the work to be done upon the others may fall slightly within the estimates.

These estimates are based upon the supposition that the rocks to be removed are no harder than Pot rock; for, if so, I have no correct data to go upon, as a very slight difference in their character might render necessary a new mode of operation entirely.

As before stated, the whole amount expended on Pot rock during the year was $17,622 65, and the number of charges 950, making the cost of each one $18 55; a slight increase over that of last year, arising principally from the enhanced value of tin, of which all the canisters are made.

Vessels taking the west channel on their way from the east are frequently brought up on a reef jutting out from the west shore, called Rhinelander's, and as a manifest improvement would be made by its removal, I have embraced it this year in my estimate.

300 charges on Pot rock, at $20 per charge	$6,000 00
500 charges on Diamond reef, at $20 per charge	10,000 00
500 charges on Frying Pan, at $20 per charge	10,000 00
800 charges on Way's reef, at $20 per charge	16,000 00
Removal of Hallet's point	15,000 00
Removal of some rocks along shore	5,000 00
Blasting Negro head	13,000 00
600 charges on Rhinelander's reef, at $20 per charge	12,000 00
	87,000 00
Of which is available	2,377 35
	84,622 65
Contingencies	5,377 35
Total estimate	90,000 00

The amount required for 1854	$50,000 00
The amount to be reimbursed for money expended	13,861 59
Total amount called for	63,861 59

Even admitting that the above estimate will fall below the amount actually required, the money expended for such improvements can bear no comparison with their value.

The time has been when the harbor of New York was blockaded by our enemies' vessels, and scarcely a sail could show itself beyond the Narrows. That time may happen again; and although a successful attempt was made by Commodore Decatur to carry his ships through Hellgate, it was found too hazardous to be tried again.

To speak of the benefits accruing to commerce would be repeating what every intelligent person knows full well; but to secure to our national ships of the first class an unobstructed channel through the East river from the city of New York, the centre of supplies to the ocean, is a matter though hardly thought of in time of peace, might become in time of war of the very first importance, not to New York alone, but to the whole nation; and as it is the duty of all those interested with the defences of the country to provide, if possible, against every contingency, I cannot close my report without earnestly invoking the aid of the government on behalf of a work which, whilst daily facilitating the great and daily increasing commercial interests of the country, may make the East river, in the hour of need, our only safe outlet to the sea.

I am, very respectfully, your obedient servant,

WILLIAM D. FRASER,
Brevet Major of Engineers

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX V.

Fort Hamilton, N. Y.,
January 27, 1853.

Sir: I have the honor to submit the following regarding the duties of river and harbor improvement recently assigned me:

Both the subject and the localities of these duties are new to me. I therefore beg leave, in the following report, to limit myself to somewhat general ideas, rather than enter into details, which a more thorough knowledge must enable me to arrange more satisfactorily than I can possibly do now. The peculiarities of the localities are, to be sure, strongly defined; the engineering principles applicable thereto are apparently clear; but in a matter so important I feel it essential to study both subject and locality, as much as circumstances will admit, before giving an opinion which, if it is of any influence at all, may influence to great good or great evil.

Works having in view the improvement of the navigation of three different neighborhoods have been intrusted to me. I will first speak of Cranberry inlet. A survey of this has recently been made by the coast survey agents. I asked for a copy of their map last fall. It was promised to me, but I have not yet received it; and as I have not yet been able to go there, I am entirely ignorant of the problem there involved, and can give no intelligent opinion regarding it. As, however, the inhabitants are doubtless desirous that something should be done as soon as possible, I respectfully suggest that ten thousand dollars be asked of the present Congress, if not too late. I have heretofore applied for orders to visit this locality, but have not yet received them.

I will, in the next place, speak of Shewsbury river. I went there about the middle of December. The results of this examination I had the honor to submit to the department a few days ago. They were briefly these: The waters of the ocean are very frequently (at almost every high tide during an easterly blow) driven across the narrow strip of sand beach separating them from the river into this latter, bringing with them immense quantities of loose sand that is incessantly changing its position in the river's bed. This is the chief difficulty; the first to be remedied. It is impossible to get a map that will correctly indicate the condition of this part of the river twenty-four hours after it is made. The thing to be done first is, not the survey called for by the law appropriating money, but a prevention to the introduction into the river of any more sand. This it was proposed to effect by building parallel fences along those parts of the narrow beach which were liable to be overflown by the ocean, placing brush in the interval of these fences, and keeping in pay all the time a person to watch the effects of the sea upon the beach, and to repair the first encroachments. This being done, the natural agents that are at work during ordinary weather will, as they have heretofore done, build up this intervening breach into hills, cover them with grass and bushes, and thus create an effectual barrier, probably the only one that can be created, to the encroachment of the sea. After shutting out the sea a useful survey may be made.

For the work relating to this river I asked an appropriation of ten thousand dollars.

There remains Newark bay to be spoken of.

Here I directed my attention first, and principally, to the northern part of the bay, in accordance with the instructions of the department, and with what, I presume, was considered of most importance by the commercial and political persons interested.

Enclosed is a map of the survey made of it.

I propose here to deepen the west channel, in the prolongation of the channel of the river above, commencing at the upper end of the bar at about the reference (7.00;) retaining this as the minimum reference in the centre of the excavated channel, giving it, between the horizontals of (6.00,) a minimum width of about 300 feet, and an increased width and depth at its entrance into the deeper water of the bay. This will give a minimum depth of about 11 feet 6 inches at ordinary high water.

I show on the map the limits of this excavation. Its dimensions are about 4,500 feet long, 400 broad, 1 foot 6 inches deep; giving about 100,000 cubic yards of matter to be excavated. I am unable to estimate what this would cost, nor can I say whether it can be done cheaper by contract than by my own agents; but I think it probable it can be done cheaper by contract. This, together with the necessity of my being absent on other duty, induces me to suggest that it be done by contract. I do not in any case deem any other local agent necessary than a trusty overseer.

The proposed depth may not be sufficient to satisfy the present requirements of the Newark merchants, but it is as much, if not more, than can be done with the money, and I think will in time prove itself sufficient.

An increased mass of tidal water will be introduced into the river, due to the increased water space created by this excavation. An addition to this again will be due to the increased facility presented to the tidal flow, by which its velocity and consequently its momentum are increased. The tide is thus made to flow during a longer time, and further up the river. There will result from these causes both more tidal and more land water in the upper part of the river. This upon its ebb, will produce an increased scour upon the bottom, and remove to deeper water all the sediment whose gravity is not sufficient to resist its power. And this, I think, must not only prevent any diminution in the depth of the west channel; but if the quantity of flood tide be not diminished by causes which I will elsewhere indicate, it will maintain a greater permanent depth there. There are other suggestions I have to make in this connexion most important to the commerce of these waters; more so to Newark, I conceive, than even the contemplated improvement on the Passaic bar.

I made a survey of the southern part of the bay last fall; the map of which, now in process of execution, has been delayed by my attention to other duties and by my illness. I was unable to make that survey as thorough or as large as I desired, first from the untimely desertion of my assistant surveyor, and also from the severity of the wind blowing over the open bay. I send a trace from a coast survey map instead.

By reference to this, it will be seen that the tide flows by two narrow channels east and west into the southern extremity of the bay. The two currents of flood meet west of Shuter's island, where there is, in consequence, a bar—a narrow, intricate channel, or, in other words, a serious obstacle to the progress of the tide through this western channel.

The larger mass of flood that fills Newark bay and its tributaries comes through the eastern channel. Previous to getting into the bay it has to round the acute angle of Bergen point. From this there extends, for some three or four hundred feet out, a rocky shoal, sometimes dry at low water; on the extremity of this a solid pier for a light-house has been constructed.

All along both shores of both narrow channels, constructions, various in kind and magnitude, are constantly being made between high and low water.

Art and nature here combine to inflict injury upon the commercial value of these waters, only excelled by that which they threaten for the future. They usurp and diminish the natural water space; they obstruct the flow of the tide and shut out the flood; in all their rise, diminish the quantity of water that reaches the upper country. Newark bay and its tributary rivers form a grand reservoir for the reception of the flood, which, by its ebb, keeps open the navigable channels of the rivers, of the bay, and of those its two channels to the sea. The more water there is admitted into the reservoir, the more thoroughly will all these navigable channels be kept open; and the more thoroughly the two tidal ducts are kept open, the more water will there be admitted into the reservoir. The reverse is also true. Any effect, good or bad, produced upon one is immediately transmitted to the other. The reservoir and its two tidal channels are so intimately dependent upon each other, that any change proposed for one necessarily involves a study of both.

It is not my province to suggest remedies for injuries inflicted by the artificial obstacles spoken of above. I, however, solicit attention to them as a growing evil, pregnant with results of the utmost importance to the future value of these waters, and especially to the commercial interests of Newark.

The natural obstacles mentioned above are, however, within reach of the engineer's remedies, and may easily be improved; and, this being done, much, I conceive, will have been done to obviate the injuries otherwise resulting. In fact, every consideration I can observe demands that the first and principal efforts of improvement be directed to the southern extremity of the bay. An improvement made there is a growing benefit extended to the whole course of the tide that flows through it. I am of opinion that, if the obstacles to the entrance of the tide were in some degree removed, very little money would be required for other localities. The bottom of the Passaic and the bar at its mouth is of soft mud, and must yield to the increased scour that would be created by this alone. By this means alone we abate a growing obstacle to the navigation of the Passaic, to which I solicit attention now. By reference to the map, it will be seen that a shoal exists in the middle of the river at the bend. This, I am told, is increasing, and is the cause of much annoyance. It is, in my opinion, an evidence that the closing of the tidal way around Staten island is diminishing the quantity of tide that reaches Newark.

My study of the subject convinces me that the obstacles to navigation of Newark bay that exist at its southern extremity demand the first and principal attention in any contemplated improvement of it. For this I now ask twenty thousand dollars. Next in importance is the bar at the mouth of the Passaic, now proposed to be dredged. If these two works are executed with tolerable effect, the shoal in the bend of the Passaic will, I think, disappear; the navigable channels be deepened; and the level of low water be materially lowered. This will render it necessary to cut off the tops and edges of some oyster-beds that now exist in the channel of the bay, which, though now not in the way, will then become obstacles of moment. These may also be a nucleus for that shoal in the river, only to be removed by dredging. For both these I presume five thousand dollars will be sufficient. I am of opinion that if some latitude be left, by the law appropriating for this purpose, as to the special locality where the money shall be applied, the interests of commerce will be consulted thereby. A more thorough acquaintance may bring to light localities more important than those specially designated in the law. I recapitulate—

Cranberry inlet.—I solicit orders to visit that locality this winter, and suggest that an appropriation of ten thousand dollars be asked of the present Congress, with some latitude in the phraseology of the law appropriating.

Shewsbury river.—I suggest that money be first expended in building up the beach along its lower part into a barrier against the inroads of the ocean; that the scour of the river be assisted by raking, to remove the foreign sand from its bed; and that a survey be then made. For this I suggest that an appropriation of ten thousand dollars is wanted.

Newark bay.—Bar at the junction of the Hackensack and Passaic rivers. I propose dredging the channel of the river across this bar, to get a minimum width of 300 feet, and a minimum depth at ordinary high water of 11 feet 6 inches. This is to be done by contract.

In the southern extremity of the bay, I suggest the amelioration of the bar and the rocky ledge, that present the most serious obstacles to the entrance of the tide into the bay and rivers. This locality, in my opinion, demands the first and greatest effort at improvement.

I suggest the subsequent removal of the shoal now forming in the bend of the Passaic, and dredging the oyster-beds in the channel of the bay. For these works I ask twenty-five thousand dollars.

I prefer not entering yet into any details as to the mode of operating in the southern extremity of the bay, nor do I suppose it yet necessary.

In anticipation of this system of river and harbor improvements being continued, I suggest that tide-gauges be established at different points of the same tidal course. If this is approved, I would establish one at Newark, and one on each of the channels by which it communicates with the sea. A record of observations being kept will show the effect of any work done in the channel upon the tide.

During my recent surveys I used a sloop belonging to Major Delafield's works: this he will need himself next spring. I shall, therefore, be under the necessity of hiring a similar one, not only as in all cases the most economical, but in some places the only mode of conducting my operations.

If the suggestions contained in the above report are sanctioned, I propose during the early spring doing the work at Shewsbury; during summer, that in Newark bay and at Cranberry inlet. This is suggested by the weather. I can work satisfactorily at Shewsbury, when nothing can be done at the other places.

I have the honor to be your most obedient servant,

M. HARRISON,
Lieutenant of Engineers

Brevet Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington. D. C.

APPENDIX V—1.

Engineer Department,
Washington, February 15, 1853.

Sir: I have the honor to submit for your consideration the project of Lieut. Harrison, corps of engineers, for the removal of the bar at the junction of the Passaic and Hackensack rivers, in Newark bay, New Jersey.

This project has been considered by the board of engineers of river and harbor improvements; and their report, which is approval of Lieut. Harrison's views, is also herewith.

The proposition is, to dredge the channel of the Passaic river across the bar, at the junction of the Hackensack and Passaic, to get a minimum width of three hundred feet, and a minimum depth, at ordinary high water, of 11 feet 6 inches. This is to be done by contract.

I propose, with your approbation, to instruct Lieut. Harrison to proceed with this work, by opening a channel through this bar of one hundred feet in width, and of such depth (not exceeding 11 feet 6 inches) as the present appropriation will secure; the balance, if any, to be applied, together with any additional means that may be provided by Congress, to increasing the width of the cut to that proposed by Lieut. Harrison.

With the view of entering into a contract for the work, I will call upon this officer to prepare the usual advertisement, and forward it for examination and issue from this office.

Two traced maps, explanatory of the project, accompany this communication.

Very respectfully, your obedient servant,

JOS. G. TOTTEN,

Brev. Brig. General and Col. of Engineers.

Hon. C. M. CONRAD, *Secretary of War.*

Approved February 21, 1853.

C. M. CONRAD,

Secretary of War.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX W.

ENGINEER OFFICE,

New York, October, 1853.

SIR: I have the honor to report, regarding the Shewsbury river, as follows:

September, 1853.—The work was commenced at the entrance of the river into New York bay, and thence pushed up the river to the point of junction of its two branches—the North and South Shewsbury.

From this point the directions of both branches withdraw from the ocean; and the channels of both, as I learned from the people and pilots on the river, remain permanent in depth and direction, and there are no difficulties to their navigation by the vessels built for the purpose. Below this point, however, the bottom consists of loose sand, that changes its position with every change in the motion of the water, and the channel changes in depth and direction with every tide. It is in this distance that all the difficulties occur, and here the aid of art is specially required. Deeming this the most important part of the river, and thinking it necessary to make its peculiarities, at least, known to the department this year, I labored to complete its survey this month, and succeeded in doing so. Want of time prevented my prosecuting the survey of the river beyond in time to submit it in my annual report. It is unavoidably deferred till later in the year.

The sand beach that separates the river from the ocean, along the greater part of this distance, is only a few yards wide, and so low, that an east wind on a full tide brings the waters of the ocean over it into the river. This is the source of the changes that occur in the river, and the occasion of all its difficulties of navigation.

The rush of water across the beach necessarily brings with it greater or less quantities of sand, which are deposited in the bed of the river. This diminishes the velocity and the quantity of the flood, and, of course, the scouring power of the ebb—the only power by which it can be removed from the river; two results may, and in fact do, occur at different times, depending upon the strength of these two agents—the one irregular and extraordinary, the other periodical. When the first power acts for a long time, or with more than usual strength, an "inlet" opposite the mouth of the north branch may be the consequence, and the river discharges itself immediately into the ocean. In the course of time this inlet moves gradually towards Sandy Hook, till the river resumes its original and present channel, and empties into New York bay. The second result may be, that an inlet is not formed, but the quantities of sand washed over into the river be gradually carried down by the ebb, and deposited near the river's mouth, when the velocity of the current of ebb diminishes, and its scour is not sufficient to transport it further. By this action the river's course is being gradually carried out, and the scouring power of the ebb increased, till another easterly storm brings over new quantities of sand, which must in the same manner be transported to, and deposited in, deep water near the entrance of the river into the bay. Spermaceti cove, for instance, is, and for years has been, shoaling. This is, doubtless, in some degree due to the deposition in it of sand, brought out of the river on the ebb.

This is a succinct history of the changes that have occurred in this river. The same order of things continues now, and will continue, till something is done to protect the river from the inroads of the ocean, and prevent the introduction into the river of new quantities of sand from the beach.

The sand that is introduced by the flood will be removed by the ebb; and if any facilities are given to the entrance of the flood, and its flow up the river, the power of the ebb will be increased, and the river must be deepened, and be rendered more permanent in its direction.

The work to be done to improve the navigation of this river is, first to build up the low and narrow beach separating it from the ocean, then to give a gentle and regular curve to its channel. To facilitate both these objects, some sand should be removed by dredging from the bed of the river, and deposited on the beach.

There is an abundant growth of cedar in the vicinity. If the brush of this were spread over the low parts of the beach and picketed down; if parallel brush fences were built, and the dredged sand deposited on the horizontal layers of brush, and between the fences, the beach would probably build itself up in a few years, as it has done already at each extremity of this length. It should be constantly watched, and the first injuries repaired.

The amount of tonnage owned on the two branches of the river, in small sail vessels and steamboats, is about five thousand tons. Their business consists in the transportation of produce, lumber, merchandise and passengers, and is estimated to amount in value, for a year, to seventeen hundred thousand dollars.

I have the honor to be, very respectfully, your obedient servant,

M. HARRISON, *Lieut. of Engineers.*

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington City.

Engineer Office, *New York, October,* 1853.

Estimate of funds required for the improvement of the navigation of Shewsbury river, New Jersey.

Material, (brush and lumber)	$1,000
Labor	4,000
Dredging, by contract	5,000
	10,000

M. HARRISON, *Lieut. of Engineers.*

APPENDIX X.

Engineer Office,
New York, October, 1853.

Sir: I have the honor to report, regarding the survey of Cranberry inlet, as follows:

August, 1853.—By reference to a map of the State of New Jersey, it will be seen that from the neighborhood of Cape May to that of Sandy Hook there extends along the coast a sheet of water separated from the open sea by a narrow strip of sand beach, and communicating with it by openings across this beach at several different points along its length. Cranberry inlet was, some forty years ago, almost the most northerly of these inlets. It was the inlet of Barnegat bay, nearly opposite the mouth of Sims' river, and some ten miles south of the Mitedeconk river. Though the locality is still called Cranberry inlet, it is, and for nearly forty years has been, high sand beach, presenting no advantages whatever either for making or maintaining an opening. Since the closing of Cranberry inlet, Barnegat inlet, twenty miles south of it, has formed the communication of Barnegat bay with the sea, and the only route of vessels from any part of Barnegat bay to get to sea. The geography of the localities will show that all the country on and near Barnegat bay, and the rivers emptying into it, are very much interested in getting a canal from the head of this bay into Squam river. It will very considerably shorten the time to their market, diminish the sea risks, enable them to put small steamers on the route from the bay to New York city, and thus develop the resources of all this country, open a new source of supply to the towns on New York bay, and offer increased facilities and diminished risks to all coasters from the south trading to New York.

The inhabitants of all the seacoast country of New Jersey are interested in this measure, as the first and most important work towards getting an entirely inland navigation from Cape May to Sandy Hook.

The survey of Cranberry inlet was commenced in August, and very soon completed, giving the conviction that the result of my labor in surveying this locality alone was of no avail for any useful purpose, unless the survey was extended to embrace other localities and parts of the bay; and that it was unwise, if not indeed impracticable, to reopen an inlet here. If, as was presumable, the law making the appropriation for this survey had in view the subsequent improvement of the navigation of the bay, the survey was necessarily to be extended, in order to get positive information upon the whole question, and not merely negative information of one particular locality.

This opinion of mine, regarding Cranberry inlet, I found, was that of the inhabitants of the adjacent country most interested in the navigation of the bay and best acquainted with it. They had of themselves attempted to make an opening across the beach near the former inlet, but were unsuccessful. It filled in as soon as the water began flowing through it, and it became manifest to them that an inlet could not be made and maintained without very great expense, even if at all; that any work in this sand, exposed to the accumulated power of the ocean, must be of doubtful duration. Hence a change of ideas as to what was best to be done, and hence, too, their petition to Congress; in answer to which it is supposed the appropriation of the survey of Cranberry inlet was granted.

A consideration of the facts mentioned above, and of the interests involved, induced me to extend the survey, so as to include the bay, from a line a little south of the mouth of Sims' river to the head of the bay, being a length of from ten to fifteen miles. This, however, was confined to soundings to define the position of the channel, triangulations to determine the position of the most prominent points of the shore, depending upon the coast survey maps for the details of the country, the minor bays and the tributary streams. My survey was completed early in September.

From the head of the bay to Squam river there is a distance of about two miles across a country very slightly elevated above the level of the bay waters. Along one line of this intervening space two or more ponds occur, constituting almost a natural communication between the waters of the bay and Squam river. The construction across this tract of intervening land, of a canal deep enough for the coasters navigating Barnegat bay, would be by no means an expensive undertaking, and the work could very readily be rendered permanent. It is quite possible that the additional receptacle for the tidal water through Squam inlet, thus opened, must induce a greater flow through it, and permanently improve its condition. In this improvement all the country bordering on Squam river is deeply interested, not only as regards trade, but the health of the country depends on it. At certain seasons, Squam river and the tide through the inlet are not sufficiently powerful to keep the inlet open. The waters of the river are dammed up, stagnate in its bed, and generate disease over all the adjacent country.

Among divers projects that may present themselves for the improvement of the navigation of Barnegat bay, I see no one that promises so well as that of this proposed canal uniting this bay with Squam river; I see no one that promises to become permanent at so little cost; I see no one supported by so large a number of persons, or opposed by so few. I consequently respectfully recommend it to the favorable consideration of the chief engineer.

I enclose a copy of the petition of the inhabitants of Sims' river village to Congress. It makes known their views upon this question. I attach other statistical information bearing upon it:

"The number of vessels trading out of Barnegat inlet is fifty-five, of from forty to one hundred tons, exclusive of a large number of vessels of larger size, owned by the inhabitants of the country adjacent to Barnegat bay, and trading to southern ports, and frequently entering Barnegat inlet for a harbor—all, together, employing about eight hundred seamen.

"The amount of tonnage in small vessels belonging to Squam river is 1,638 tons, and the annual value of the trade between Squam and New York city is estimated at about six hundred thousand dollars, ($600,000.")

The range of tide in Barnegat bay, in its upper reaches, is about eight inches. In Squam inlet it is about four feet six inches. There is a bar near the mouth of Squam river which requires dredging; this being done, it will facilitate the entrance of the tide up the river, and increase the power of the ebb and improve the condition of the inlet.

There are shoal places in Barnegat bay which require dredging, and the channel would be very much improved by being straightened. I have not yet had time to get the information I desire regarding the range of tides at Barnegat inlet, and the action of the meeting of the currents of flood entering by two different inlets. I shall hope to do so in a few days, in accordance with the sanction of the department, and will transmit it as early as possible.

I attach a problematical estimate for executing the work suggested in the above report.

I am, very respectfully, your obedient servant,

M. HARRISON,
Lieut. of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

Engineer Office,
New York, November 6, 1853.

Estimate of funds required for the improvement of the navigation of Barnegat bay, New Jersey.

For dredging the shoals in Barnegat bay, and straightening its channel.......... $20,000

Constructing a canal from the head waters of Barnegat bay to Squam river	$20,000
For dredging in Squam river	10,000
Total	50,000

M. HARRISON,
Lieut. of Engineers.

APPENDIX Y.

FORT DELAWARE,
December 13, 1852.

SIR: Accompanied by Lieutenant Casey, I have just returned from a visit to Little Egg harbor, New Jersey, made in obedience to your instructions of the 6th of November, with the view of examining the present condition of that harbor in reference to the public works, and to navigation, &c. I shall now proceed to submit the result of my examination.

Ever since I received your instructions placing me in charge of the repairs of the public works at Little Egg harbor, New Jersey, it has been my aim to discover what works had at any time been constructed by the United States at that point. I succeeded in picking up orally some knowledge on this head from various individuals and reliable sources, but I have derived most of my information from a report of Lieutenant A. P. Allen, topographical engineers, made to Major Bache, of the same corps, and dated November 11, 1839—a copy of which was furnished me by Major Bache.

It appears that Major John L. Smith, of the corps of engineers, in 1837, or thereabouts, built four jettees of small piles, brush, sand, and sod, perpendicularly to the shore of Tucker's island, which at the time covered the harbor seaward, with a view "to prevent the rapid wasting of the beach by the abrasion of the surf." Three of these jettees were immediately carried away, leaving only one in existence at the date of Lieutenant Allen's report, and of this some vestiges are yet to be seen. "In 1838 and 1839 there was constructed 7,859 lineal feet of brush fence, running in parallel lines lengthwise the island, and conforming as nearly as possible to the direction of the surf—one line situated near high-water mark, and the other occupying a line almost central of the island." The object of these fences, as stated in the original report recommending their erection, was "to serve as a receptacle for the drifting sand, and become the nucleus of a more permanent protection." Lieutenant Allen made a survey of Tucker's island, which, on comparison with a map to which he refers of a survey made under the direction of Major Bache ten years before in 1829, showed that the island during that period lost on an average 400 feet along the seashore. Lieutenant Allen states "that these fences do not guard against the principal danger, which, as has often been suggested, lies in the gradual undermining of the beach by the surf—a process of destruction which must continue to go on in spite of all works founded above high-water mark." I have seen neither of the maps referred to by Lieutenant Allen; but the coast survey chart doubtless gives a correct delineation of the shore lines, as well as those of the channel, in 1840, only a year subsequent to his survey. I cannot learn that any other public works were ever constructed at or near this harbor by the United States than those described in Lieutenant Allen's report. The harbor at this point prior to 1850 was an inner bay, protected seaward by Tucker's island, or Short beach, having its egress by channels to the southward of the island called the "New inlet." The object of all the public improvements was to preserve the island, thus forming a natural breakwater, from the destruction with which it was threatened by the rapid encroachments of the sea. In 1850 the sea broke across the island, and by October, 1851, had cut a new channel, called the "Little inlet," affording not less than eight feet water through it from the harbor to the sea.

In company with Mr. Thompson, collector of the port; Mr. Farrar, a citizen of Tuckerton, largely interested in the coasting trade; the light-house keeper, and an intelligent fisherman by the name of Horner, who was in the employment of the coast survey party at the time of their survey, I visited Short beach, or Tucker's island, on Wednesday, the 8th instant. The accompanying sketch, made by Lieutenant Casey on a tracing from the coast survey chart, gives a fair description of the condition of the island and the site of the old harbor as we found them.

The changes undergone have been so thorough and radical, it is quite clear to my mind that it is no longer practicable to repair or reconstruct the public works heretofore made with the sole view of protecting Tucker's island from the sea. The island itself has been cut in two, and there is a deep inlet running across the very site of the line of works erected for its preservation, and which this appropriation seems to have been intended to repair. These changes appear to be still going on, not having settled into that degree of stability which the harbors and inlets on this coast often assume for a term of years. I observed a continuous line of breakers across the entrance into the "Sod channel," whilst there was a wide and smooth opening across the bar of the "Little inlet." The south channel, formerly the main inlet, has been abandoned for several years. It is indeed quite possible that all the inlets to the south of the old island will fill up, and that the inlet which has been opened across the island, called the "Little inlet," will eventually become the principal channel. Whilst this island is undergoing such a rapid process of destruction at both ends and through its middle, the beaches to the north of it are making southward, and those to the south of it are wasting on their northern ends.

A correct and full survey, furnishing a new chart, buoys to mark the channel of the "Little inlet," and beacons on the shore—works appropropriately devolving on the Coast Survey and Light-house board—would prove most useful, and are indeed actually called for by vessels frequenting or running into Little Egg harbor; but I must say that any such works as may properly be termed harbor improvements, would, as far as I am competent to judge, prove to be futile and worthless, and their construction only result in a wasteful expenditure of public money.

The site of the present light-house must inevitably follow the fate of the island; but it is moreover threatened by some sudden encroachment of the sea through a breach in the sand, which timely and vigilant care would effectually guard against, by closing these breaches as they are formed with a few cords of brush, pinned down with short piles. The light-house keeper, under the direction of the collector of the port, could, with the expenditure of a small sum in every quarter, do everything, short of the expenditure of a sum which I shall not pretend to estimate, that it is possible to effect towards the preservation of the site of a structure which did not originally cost over $5,000.

I shall require fifty dollars of the appropriation for the repairs of the public works at Little Egg harbor, to cover the expenses of my late examination.

Respectfully submitted.

JOHN SANDERS,
Brevet Major of Engineers.

Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX Y—1.

Office of Delaware Breakwater,
Philadelphia, April 30, 1853.

Sir: In conformity to your instructions, I last week visited Little Egg harbor, to examine its present condition in reference to the public works and to navigation, and to form an opinion as to the manner of applying the recent appropriation for "repairing the public works" at that place.

For an account of those works and their present condition, I would refer you to the report of Major Sanders, of December 13, 1852.

No material change in the general outline and character of the harbor appears to have taken place since the date of his report, and I have therefore adopted his sketch; but, to represent more fully the actual condition of things, I have prepared the accompanying sketch, on which the rapidly forming spit from the extremity of Long beach is approximately laid down, and the outline of the harbor, from the coast survey chart, is sketched in red.

A reference to this sketch will show the breach which has been formed through Tucker's island, and the new channel thus created into the harbor.

It will also show that the "Sod channel," mostly used at the date of the coast survey, has filled up; that the east channel remained as good as ever, and is now principally used, (and its character is said to have been unchangeable since first known,) and that the south channel is still good, though not much used. The position of the sand-spit or shoal, formed in connexion with the new channel through the island, is also exhibited, and the southern extension of Long beach laid down approximately.

The appropriation made is for "repairing of public works at Little Egg harbor;" and to judge how or where to apply it, it must be observed—

1. That the event which these public works were designed to prevent has actually and irremediably occurred.

2. That the "public works" themselves have been mostly swept away—a few detached portions of the brush fence only remaining.

3. That the harbor has *as yet* suffered no injury whatever, either as a harbor or in the facility of ingress and egress; nor does the present aspect of things threaten any deterioration in either of these particulars.

4. That in the past few years very considerable changes have occurred, which have deranged the old regimen of the harbor, and the new one has not yet fully developed itself; hence we cannot intelligently design any considerable system of works, (if otherwise desirable,) for we know not which way nature is working. Moreover, the wording of the law making the appropriation is such that it does not appear to me applicable to any new system of works.

I concur, therefore, fully with Major Sanders in the conclusions he arrives at in his report.

The observations of the last twelve or fifteen years have gone to show that the beach of Tucker's island had receded several hundred feet before the breach through the island actually occurred; and as the northern extremity of the island at the same time was carried away rapidly, it has been assumed that the whole island was in process of being destroyed.

I have no experience as to the action of the sea upon this coast, but I am not aware that the sea is encroaching upon it. The mere action of the waves of the sea, however violent, will not (after having cut it down to the proper slope) destroy a sand coast unless aided by lateral currents. Every inlet produces local currents, which modify the action at its particular locality. Such local currents, of much complexity, must have always existed at Little Egg harbor, as the various directions of its numerous channels or outlets and that of "Old inlet" will show, by mere inspection of a chart. Without a knowledge of these currents it is impossible to form any system of protection; and parallel lines of works can have no effect unless they go very deep and are constantly watched.

Why the shore line of Tucker's island has been rapidly abraded, while that of Long beach has remained comparatively permanent, it is not worth while to conjecture; but the abrasion of the northern extremity of the island seems to me to be sufficiently accounted for by the current which has been thrown upon it from the inner bay, by the elongation of the southern extremity of Long beach, aided by the waves of the ocean and of the bay from the northward. This latter evil seems now to be correcting itself. Old inlet is now almost completely obstructed. The spit from Long beach reaches within a little over a mile of Tucker's island, and connects itself with the island by a wide bar, without channel, on which breakers form in smooth weather. The waters which once flowed through this pass find their vent through Little inlet and the southern channels; and my impression is, that the northern portion of Tucker's island will soon connect itself permanently with Long beach, and be maintained by the same law which now maintains and extends Long beach. Hence I conclude that there will always be land where the light-house now stands, though I do not mean to convey the idea thereby that the building is perfectly secure. I know not the depth of its foundations, (and they are probably superficial,) and the surface of the island where it stands, may be yet carried away. According to the statement of the light-house keeper, some 75 or 100 feet of high bank has been eaten away in the last eighteen months, and as much more abrasion will bring the sea to the foundations of the light-house.

There are also "swashes" cut through the high part of the island near the light-house, and an easterly or southerly storm of long duration might make a clean passage, and perhaps endanger the structure from this quarter.

The application of a small sum to restoring the brush fence in the vicinity of the light house, and (if the thing is practicable) to protecting the shore in front of the building, might be expedient; though this latter object does not come within the scope of the law.

The light is said to be of little or no use where it is; and if so, its loss would not be a subject of regret.

In conclusion, I would say that a resurvey of the harbor, and providing sufficient buoys or beacons for marking the entrances, is what, in the present state of things, is most required.

To devise works which must protect the light-house seaward, would require a further examination, which I will make should you direct it.

I am, very respectfully, your obedient servant,

J. G. BARNARD,
Brev. Major of Engineers.

Gen. Jos. G. Totten,
Chief Engineer, &c., Washington, D. C.

APPENDIX Z.

Philadelphia, *February* 15, 1853.

Sir: I have to submit, for consideration of the board of engineers, the following report and project for the "continuation of the Delaware breakwater."

The present condition of the work may be briefly stated as follows:

Commencing at the west end of the breakwater proper, and following its length eastward, 985 feet are completed to full dimensions of 15 feet above low water; thence 321 feet are raised within an average of 6 feet of full height; thence 217 feet are completed to full height; thence 427 feet are raised 8 feet above low water; thence 267 feet are completed; thence 345 feet are raised from 8 to 9 feet above low water. At either end of the above limits there is an irregular slope to low-water line: on the west, of 18 feet; on the east, of 25 to 30 feet base. The actual length, therefore, of what may be called superstructure of existing work, is 2,562 feet, or 854 yards. (The dimensions of work are stated with slight variations in different reports, but the above are from recent measurement; the same remark being applicable to the dimensions, which will be given, of the ice-breaker.)

The number of cubic yards required, therefore, to complete this portion of the breakwater to 15 feet above low water, would be 2,140 cubic yards for the first unfinished portion, 4,128 for the second, and 3,978 for the third; or, in all, 10,246 cubic yards.

I find, in the records of the work, no data by which to estimate the number of tons of stone actually required per cubic yard of volume.

Major Bache estimates the quantity of stone for the above work at 17,587 tons, which is very nearly $1\frac{3}{4}$ (1.716) tons per cubic yard, and (estimating the specific gravity of the stone at $2\frac{1}{2}$) very nearly equal to the absolute weight of a cubic yard volume of stone, making but very small allowance for the interstices in the mass.

Taking this estimate, however, as an ample one, it requires 3,674 tons of stone for the first section, (unfinished,) 7,090 tons for the second, and 6,826 tons for the 3d section, in the order above mentioned.

The superstructure of the ice-breaker is in the following condition: Commencing at the west end, there are 219 feet from 10 15 feet above low water; 475 feet, about 9 feet above low water; 63 feet, 15 feet above low water; 413 feet, 7 feet above low water; 195 feet, 11 feet above low water; 45 feet, 15 feet above low water; and irregular slopes down to low water at each end—at the west end, of 22 feet; and at the east, of 33 feet in length. The actual length of the superstructure, exclusive of these slopes, is 1,410 feet, or 470 yards.

The height to be given to the ice-breaker appears to be still an unsettled point. When the work was originally planned, 9 feet was the highest tide known to the commissioners; and upon that they fixed the height, both of the breakwater proper and ice-breaker, at 12 feet. During the progress of the work, however, the tide was known to rise as high as 12 feet above low water. This induced a change of profile, and three feet height were added, giving a total height of 15 feet; no doubt, so far as the breakwater proper was concerned, an important and necessary change. But there seems to have been some fluctuation of opinion, among the different officers who have had charge of the work, as to the necessity of applying this increased height to the ice-breaker, and even as to the necessity of raising it higher than 10 feet.

On the profiles of 1836, this increased height is sketched on the original profile; and, as has been seen above, some portions of the work have actually been carried to this height But it would appear also, from the letter-book, that the necessity of it has not been generally concurred in.

In describing a severe storm of the 15th, 16th, and 17th of March, 1843, Major Bache uses the following language:

"It will be seen, from the foregoing statements, that, although the winds which prevailed during the gale were from the quadrant included between northwest and northeast, the winds of all others to which the ice-breaker is most exposed, the stone on that work, as far as the examinations could determine, had not in any case been displaced. The attention of the bureau is called to this fact, as confirmatory of the opinion expressed, in the last annual report, of the breakwater, that the elevation of the ice-breaker should be limited to 10 feet above low water, instead of 15, as originally proposed."

And his estimates are founded upon that height down to 1849, when he modifies the item for the ice-breaker, so as to provide for a height of 12 feet. But, although he describes several storms since the one above mentioned, he does not, so far as I can discover, give anywhere the grounds for this change, which is in opposition to his strongly reiterated opinion that 10 feet was sufficient. The decision of the question is not important in reference to the present appropriation, as it is quite inadequate to finish the more important work on the breakwater proper.

Assuming the intended height to be 12 feet, I estimate the number of cubic yards of stone, required for completion, to be 5,015. Major Bache estimates at 9,054 tons the quantity of stone necessary for that object, which would allow $1\frac{4}{5}$ tons per cubic yard.

The quantities of stone above given for completion of the superstructure must be made up entirely of large stone, weighing two tons and upwards—the standard which has always been adopted.

Besides the above, there are some deficiencies in profile, below low-water line, of no great amount, and which I cannot estimate; which will require a certain quantity of small stone. There are also three or four holes, of considerable extent, cut in the bottom by the action of the currents, which it is considered important eventually to fill up; and the quantity required therefor, as estimated by Major Bache, is 15,827 tons.

For completing the work, therefore, on the present bases, to 15 and 12 feet heights, requires 42,468 tons of large and small stone; and the estimate for procuring and depositing the same, with all contingencies, is communicated to you, as taken from Major Bache, by letter of the 5th instant.

The amount is stated at	$137,910
Of which there is now appropriated	30,000
Requiring to be appropriated	107,910

Although having no immediate bearing upon the manner of applying the present appropriation, it is thought proper to make some allusion to the changes which have taken place in the bottom.

As early as 1834, the formation of a considerable shoal caused the War Department to order a board of survey, and, upon their recommendation, all further extension of the longitudinal dimensions of the structure was suspended, and the operations thereafter were confined to completing the parts commenced up to their intended height. The present structure is, in consequence, unequal in extent to the work originally designed, the breakwater proper lacking 346 yards and the ice-breaker some 30 yards of their projected lengths.

I cannot ascertain exactly where these deficiencies are, as compared with the original design; but am inclined to believe, that that of the breakwater is on the western end towards the cape. On this supposition, however, it is necessary to suppose that the ice-breaker is some 100 yards westward of its intended position; for Major Bache states the gap between the two works to be 457 yards, while by original plan it should have been 350. Lane's survey, however, gives this gap about 400; and Smith's map of the shoals, in 1834, gives it exactly 350 yards. I presume, however, Major Bache's statement is correct, as I believe it is taken from measurement. This would make the breakwater want 100 yards on its eastern and 246 yards on its western extremity, to bring it up to the original design. But this idea is no longer entertained; and the change of location, if there has been one, is beneficial, as vessels are still shy of the entrance between the breakwater and the cape, (though now without cause,) and the gap is considered none to wide for an entrance.

The progress of the shoal was quite rapid till about 1834 or 1835, and was even perceptible as late as 1842, though becoming firmer in its character, as if the new regimen of the harbor was permanently established. Since the latter date I cannot find any evidence that any material change has taken place; and the opinion of those who have been connected with the work, and of the inhabitants of Lewis, is that there has been none.

As soon as I have the means at my disposal, I propose to make a survey, by which the changes since 1842 can be known. The matter has, however, no important bearing upon the application of the present means.

My project for the application of the $30,000 now in hand will be governed by the following considerations. The greatest degree of efficiency to the harbor should be obtained that the means will admit. The breakwater proper, furnishing the principal protection, should be raised to its full height through as great an extent as possible. This requires nothing but large blocks, though some small stones might be used with advantage, I should think, in fitting the interstices.

The only other application for small stone is, for filling out some deficiencies in the profile, and for filling the holes in the bottom, at the end of the structures. To do this completely, would require, according to Major Bache, 15,827 tons of stone; more than the present appropriation would procure. From the best information I could get, these holes have not changed materially for many years, and it is not believed that they endanger the structure. As it is, however, necessary to receive a certain portion of small stone with the large blocks, I have included a proportion of one-sixth the whole amount to be applied around the ends of the breakwater, and as before stated. The estimated application of the appropriation will, therefore, be as follows:

6,000 tons of stone in blocks of two tons and upwards, at $3	$18,000
1,200 tons in pieces less than ¼ ton, at $2 50	3,000
Machinery—2 cranes, at $600	1,200
2 capstones, at $40	80
6 mooring buoys, at $20	120
3 boats	360
chains, ropes, blocks, and other machinery	500
instruments	200

Services—	1 overseer, per month at $100	$100	
	2 crane masters and inspectors of stone	120	
	1 rigger	45	
	2 inspectors at quarries	120	
	1 clerk and draughtsman	75	
	40 men	1,000	
	For one month	1,460	
	For 2½ months		$3,650
Contingencies			890
Reserved from appropriation			2,000
			30,000

By using two cranes and a double gang, I find it more economical than one crane with a single gang of men. It is probable that the estimated quantity of stone could be deposited in two months; but I have thought best to make a large allowance and also a large reservation from the appropriation, in order to be sure not to involve myself in contracts beyond the means available.

The quantity of large blocks estimated for will complete the first and about one-third the second unfinished section of the breakwater proper.

In estimating for a clerk and draughtsman, I have contemplated one who would be able to assist me in the surveys and drawings of the harbor, and rated his service accordingly.

I will forward specifications for stone contracts in a day or two. If there is a prospect of another appropriation, it would be best not to call for proposals until it is made, as the larger amount would procure more favorable terms.

I am, very respectfully, your most obedient servant,

J. G. BARNARD,
Brevet Major of Engineers.

Gen. Joseph G. Totten,
Chief Engineer, &c., Washington, D. C.

APPENDIX Z—1.

Engineer Department,
Washington, March 28, 1853.

Sir: The board of engineers of river and harbor improvements have considered the report of Major Barnard, corps of engineers, on the continuation of the Delaware breakwater, and approve of his suggestions relative to the application of the existing appropriation to the work.

Major Barnard proposes to raise the breakwater proper (which furnishes the principal protection) to its full height through as great an extent as the present means will allow; thus obtaining the greatest degree of efficiency to the harbor that the limited appropriation will afford.

The breakwater has now a height above low water, varying irregularly from eight to fifteen feet; the low places should be filled up with large stones, so as to make the crest of a regular and uniform height. Some small stones will be used to fill interstices and holes in the bottom.

I concur in Major Barnard's views, and have the honor to propose, with your approbation, to instruct him to proceed to the execution of the work accordingly—the first step to be the issue of an advertisement from this office, with the view of procuring tenders for furnishing the stone, and depositing it at suitable places on the breakwater.

The report of Major Barnard, and that of the board of engineers, are submitted herewith.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brevet Brigadier General and Colonel of Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved:

JEFFERSON DAVIS,
Secretary of War.

WAR DEPARTMENT, *March* 29, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX A A.

ENGINEER OFFICE, FORT DELAWARE, AND
UNITED STATES HARBOR IMPROVEMENT,
Philadelphia, February 7, 1853.

SIR: In obedience to instructions from the Engineer department, dated the 6th of November last, placing me in charge of the construction of a harbor on the east side of Reedy island, for which Congress has lately appropriated the sum of $51,090, I now proceed to submit the following as my report, and shall accompany it with a map and the necessary drawings, to explain the plan or method of construction recommended:

The amount appropriated being for the construction of a new and complete harbor, I do not feel at liberty to project it on a scale to which the means available would prove incommensurate. A permanent structure and small outlay are incompatible in works of such unavoidable magnitude. Cheapness, as well as strength, is an indispensable element in any plan which can now be resorted to for the construction of this harbor. It therefore gives but little range of choice in the selection of the materials to be used, and I think excludes, for the present, all consideration of the hollow cast-iron pile with which Major Bache has most ingeniously proposed to make the piers for forming the barriers to protect the harbor from ice. In this case, I feel satisfied that wood must necessarily be resorted to, and mainly relied upon, as the material out of which the necessary structures should be formed. But as it is a perishable material, where exposed to atmospheric action, it should be used in such form, or in such combination with other materials, that the parts which decay can be renewed without the necessity of rebuilding the whole work; or, which would still be better, replaced at a future time, when the means should be less restricted, by a more permanent material, and thereby converting the work into an enduring structure. A question as to the choice of site for the harbor, which is to be constructed on the east side of Reedy island, does not seem to arise. I submit a map of a minute and detailed survey of the part of the Delaware where the channel most closely approaches to the shore of the island. The harbor of Reedy island is neither called for nor projected with the view of affording a place for lading or unlading vessels, but solely to offer and furnish ample shelter, readily accessible, to vessels when stopped or endangered in their passage up and down the river by fields of running ice. Such a harbor requires no intimate connexion with the shore of the island, or that of the main land. The island itself would therefore only be brought so far into the system of improvement as it may indirectly serve to protect the harbor from unnecessary exposure on a side which would otherwise be uncovered. According to the continuance, as well as to the intensity of the cold in winter, ice forms and lodges on the shores, extending out at times even into twelve feet water. No artificial structure to protect a harbor would seem to be required within the line of this fast or shore ice. No position, if it could be exactly fixed, would indeed give the precise starting point for the line of structures or artificial obstacles which are to serve for stopping or deflecting the running ice. The only arrangement, which it seems at all possible to adopt, for protecting a harbor from running ice, is to construct on either side—that is, above and below it—lines of obstructions which will keep off the ice. These lines have heretofore universally been made, without even a suggestion to the contrary, parallel to each other, and perpendicular to the shore, or at right angles to the current. These structures, usually detached piers, being placed close enough together to jam the ice by preventing the large fields from passing between them, and also strong and massive enough to sustain, not only the ice thus lodged immediately against them, but also to resist the shock or pressure of the floating fields continually striking against that already lodged. The outer edge of the fast ice, lodged against the piers, offers a deflecting line to the floating fields running in the river. It fairly seems that it would not be unreasonable to assume that this line would afford the most natural and best position for the site of the structures intended to turn the ice from the harbor. It would moreover seem, that the nearer we approach to the position of this natural line, the less massive and strong will the obstructions have to be to effect the object of deflecting the ice. The mud, carried in suspension by the waters of the Delaware, is so thick that it settles with wonderful rapidity wherever the current is at all checked. The obstructions placed in the water for the purpose of stopping or turning the ice, cannot be made to offer too little impediment to the free passage of the water in its currents of ebb and flood; for, in fact, if a space were included between two continuous piers, jutting out from the shore, its bottom would rise above the surface of low tide in a very short time. Wharves and landings on the Delaware are made by building and sinking crib piers, made of logs, and filled with earth and stone. This kind of structure has, as yet, alone been resorted to in constructing ice harbors in the Delaware. The piers built at New Castle, for the protection of its harbor, which are eighty feet long, up and down the river, by forty feet wide, have afforded sufficient evidence of their stability in withstanding the shock and pressure of the floating ice of the Delaware, to furnish a limit of stability as great as it may be necessary to approach with any other structure intended for a similar purpose. Such piers as referred to never cease settling until they arrive at a solid and firm bottom. To reach such a bed where our harbor is to be built, would require cribs or piers with an extreme height of fifty feet. A single wooden pier, substantially built and properly filled, and settled to the eastward of Reedy island, in twenty feet of water, would not cost less than $10,000. It would take four such piers to cover any space at all, and another pair of them for every additional hundred feet given to the width of the harbor. Four piers would cover a space about one hundred and fifty feet wide, measured across the current. If the inner piers are placed near the line of shore ice, the harbor of four piers would not embrace a space affording a sufficient depth of water for any large vessel. This harbor must extend out to the twenty-one foot low-water curve, as it will then admit, at half-tide, the largest ship navigating the Delaware. They are at times loaded to twenty-four feet water. The depth of soft and penetrable mud, in the bed of the river where the harbor has to be located, is from thirteen to sixteen feet. Certainly no vessel, left on such a bed by the falling of the tide, could suffer any injury. A steam-tug, with a tow of ships, requires a certain width of entrance to get into a harbor. Doubtless any width over five hundred feet would suffice. I fix the width of the entrance of the harbor which I have projected at nine hundred feet, not only to secure a more ample interior space, but also, if it should become necessary at some future period, to allow the extension of the lines forming the harbor further out into the river, without changing their direction, and so as still to preserve a sufficient opening for a free and easy entrance into the harbor. The bed of the Delaware undergoes changes which we can neither foresee nor prevent. Those familiar with it will not hesitate to admit, that a harbor might be filled up independent of any cause arising from changes in the currents, fairly attributable to works which may be placed in the water. Such a contingency, when it happens, would put all plans on an equal footing by rendering the best worthless. The possibility of its occurrence only adds to the uncertainty of the result to be attained, without, in the least degree, dispensing with the necessity of attempting to provide an adequate shelter on this part of the Delaware for vessels put in jeopardy or danger by river ice. Attention is naturally drawn to the structures which have heretofore been used and tested, solid piers of wood and stone; but such piers, independent of their first cost, will require rebuilding above half-tide every twelve or fifteen years. They present no advantage on the score of permanency over those which I am going to propose. To be sure, these cribs can also be made to furnish a good and durable foundation from low water for a superstructure of stone masonry. I would substitute a simpler and cheaper method of constructing the piers, by which we can increase the number for the same expenditure of money, thereby extending the width of the space covered to five hundred and sixty-five feet, and making a harbor from the twelve-foot to the twenty-one foot curve at low water. The new pier will have the further advantage of only offering one-fourth of the obstruction to the passage of the water of that presented by the solid pier. I shall now proceed to describe the plan which I submit for the construction and arrangement of the piers. The piers are to be so arranged and placed, that the space covered for a harbor shall extend fifteen hundred feet up and down the river, on the island side, and gradually narrowing to nine hundred feet, opening on the channel side, giving a width protected (as measured across the current, from the twelve-foot to the twenty-one foot curve at low-water) of five hundred and sixty-five feet; its entire area exceeding fifteen acres. The average size of the piers to be about twenty-nine feet wide by about forty-six feet long. The medium side pier will consist of eight parallel rows of piles driven in the line of the current, and about three feet in the clear from one another. The rows of piles made up of long and short piles; the heads of the latter not rising much above low water, but those of the former left well above the level of the highest tides. The short piles, for the present, are solely made to perform the function of adding strength and stiffness to the row, and of furnishing the means of connecting all the rows with one another, so as to form them into one united structure. But the plan looks eventually to the time when the long and short piles can be cut off at the level of low water, and the whole capped and covered with a platform for sustaining a stone superstructure, which would thereby convert the piers into a permanent work. The long piles, having their heads exposed and subject to decay, must be selected from the most durable woods. I propose to get white oak and Georgia pine logs. The short piles, which are to be twice as numerous as the long ones, being kept below the influence of atmospheric action, are exposed to no decay; for experience and observation show, that the worm does not attack timber as high up the Delaware as Reedy island. Hemlock, Chesapeake pine, or any other sound and strong wood, will answer for the short piles. The string pieces connecting the piles of a row, and the cap logs connecting the rows with one another, can be made of white pine. The cap logs running across the heads of the high piles, will tend to preserve them from decay. To prevent any injury to the iron from rust, it can all be galvanized at a cost of a few cents a pound, which will doubtless prove sufficient protection, as the water to which it will be exposed is but slightly brackish. The position given the piers being such as to tend to deflect the floating ice from one to the other, there will be a constant rubbing of the ice against the outer piles; and unless their faces are protected by some hard material, the ice will cut into the wood and destroy the pile. But it is well known that no friction of running ice will affect the thinnest sheet of iron. Strapping the exposed faces of the outer piles with bar iron, will prove an ample protection against any cutting from the ice. If the pile pier thus constructed only has sufficient stiffness to give it stability, it will serve every desirable purpose. I have implicit confidence that it will present the requisite stiffness and stability; but know of no process of reasoning, short of the evidence arising from an actual trial, by which to prove that such must be the result. I can only rely upon a similar conviction to that which I entertain arising in the minds of others, from examining the plan which shows the combination of the piles, ties, and braces. The method I propose following, in constructing the harbor, is to prepare a steam-engine and pile-driver, with all the necessary equipment and apparatus for driving piles for each line of piers. The steam-engine to be placed near the shore on a solid platform, where it will remain stationary; while the pile-driver itself will be moved out on a platform, sustained on trestles, or temporary piles driven for that purpose, and extending from position of steam-engine to first pier, and then from that to the next, and so until all the piles in the whole series of piers are driven. The system of administration will be hired labor, superintended by one of my assistants; an overseer or practical pile-driver, at three dollars a day, with other mechanics and laborers—making a total force of about fifty men. Five thousand dollars will be sufficient to procure the steam-engines and pile-drivers. The cost of the long piles will be from twelve to fifteen dollars apiece, and that of the short piles not over five dollars apiece, delivered. The receiving, handling, pointing, and driving the piles, will not exceed, exclusive of first cost of machinery, two and a half dollars a pile. The white pine, used for caps, braces, and ties, will not cost over fifteen cents a cubic foot. The screw bolts, and other iron required, if all galvanized, will not cost over thirteen cents a pound. The rates just specified will make the average cost of the piers less than three thousand dollars. Twelve piers, thus arranged in two lines of six piers each, will certainly furnish a harbor that will meet all the present exigencies of the case. If the unforeseen expenses which, to the disappointment and mortification of engineers, so often arise in carrying out new and untried plans, do not greatly overrun any amount which I can at all anticipate, the harbor afforded by this number of piers can, by the exercise of great economy, be constructed within the means which are already available for this object. But after deducting the amount estimated for their cost and that of the steam pile-drivers, platforms, and other machinery used in their construction, there will be left but the small balance of a little over three thousand dollars to cover the ordinary and unavoidable contingencies caused to such works. However, in case the amount available should not prove sufficient to finish the whole twelve piers, those which may be completed with it can be so arranged, by omitting the one found least necessary, as to make it a very useful harbor.

It is not out of place, before closing my remarks, to say something on the subject of converting these piers into permanent structures. To do so, I should propose cutting off all the piles to the common level of low water, and capping them with logs so as to form a solid grillage platform, on which I should build a masonry superstructure—the face of cut granite blocks, laid in regular courses, dowelled and clamped together with composition bolts, and the interior space filled in with concrete. I believe it to be a fair and ample estimate to allow an average cost of nine thousand dollars a pier for such a change. I shall therefore hazard the statement that one hundred thousand dollars, granted in a single appropriation, at any time within ten years after the work is finished as now proposed, will suffice for accomplishing this desirable object.

I shall now proceed to submit a detailed estimate of the cost of the works as herein projected:

Estimate of medium size pier.

56 long piles, at $13 per pile	$728 00	
96 short piles, at $5 per pile	480 00	
19 cap logs, 30 feet long, 15 cents per running foot	85 50	
32 string pieces, 46 feet long, 15 cents per running foot	220 80	
48 braces, 15 feet long, 15 cents per running foot	108 00	
16 pieces, 46 feet, 12 by 6 inches, at $16 per thousand	70 50	
152 treenails, at 5 cents apiece	7 60	
Total cost of wood		$1,700 40
2,795 lbs. screw bolts, at 13 cents per lb	363 41	
640 lbs. bars, 8 feet, 3 inches by ½, at 13 cents per lb	83 20	
Total cost of iron		446 61
Driving 152 piles, at $2 50 per pile	380 00	
Laying, bolting, and fastening 3,500 running feet of ties, braces, and caps, at 10 cents per foot	350 00	
Total cost of construction		730 00
Total cost of medium size pier		2,877 00

Estimate of platform for steam-engine.

60 piles, 16 feet long, at $2 per pile	$120 00	
10 cap logs, 36 feet long, at 10 cents per running foot	36 00	
4,000 feet 3-inch plank, at $16 per thousand	64 00	
60 treenails, at 5 cents apiece	3 00	
200 lbs. of spikes, at 5 cents per lb	10 00	
Total cost of materials		$233 00
Laying platform	27 00	
Driving 60 piles by hand, at $4 per pile	240 00	
		267 00
Total cost of platform for steam-engine		500 00

Estimate of platform for pile-driver.

32	piles	38	feet long, is	1,216	running feet of timber	for piles.
32	do	36	do	1,152	do	do.
32	do	35	do	1,120	do	do.
32	do	34	do	1,088	do	do.
36	do	30	do	1,080	do	do.
90	do	23	do	2,070	do	do.
254				7,726		

254 piles, 7,726 running feet of timber for piles, at 10 cents per foot	$772 60	
71 cap logs, 20 feet long, 1,420 running feet, at 15 cents per foot	213 00	
1,368 running feet string pieces for platform, at 15 cents per foot	205 20	
254 treenails, at 5 cents apiece	12 70	
42,000 feet 3-inch plank for platforms, at $16 per thousand	672 00	
15,000 feet 3-inch plank for bracing, at $16 per thousand	240 00	
1,020 lbs. of ½ lb. spikes, at 5 cents per pound	51 00	
Total cost of materials		$2,166 50
Driving 254 piles, at $2 per pile	508 00	
Laying 2,788 running feet of caps and strings, 5 cents per foot	139 40	
Laying and spiking floors and braces	186 10	
Total for workmanship		833 50
Total cost of platform		3,000 00

Estimate for steam-engine and pile-driver.

Steam-engine	$1,000 00	
Pile-driver	500 00	
5 turned cast-iron drums, 14 inches diameter, and 12 inches long, placed in strong oak frames, at $20 apiece	100 00	
80 three-inch rollers and frames, at $1 50 apiece	120 00	
2 pieces of 9-inch Manilla rope, 4,500 lbs., at 14 cents per lb	630 00	
		$2,350 00

RECAPITULATION.

12 piers, at $3,000 each	$36,000 00
2 platforms for steam-engine, $500 each	1,000 00
2 platforms for pile-driver, $3,000 each	6,000 00

2 steam-engines and pile-driver, $2,500	$5,000 00	
Contingencies..........................	3,090 00	
Total..........................		$51,090 00

Respectfully submitted.

JOHN SANDERS,
Brevet Major of Engineers.

General JOSEPH G. TOTTEN,
Chief Engineer, Washington, D C.

APPENDIX A A—1.

ENGINEER DEPARTMENT,
Washington, April 4, 1853.

SIR: Brevet Major J. Sanders, corps of engineers, in charge of the construction of a harbor on the east side of Reedy island, Port Penn, Delaware, has submitted his project for the work. It is as follows, viz:

To enclose an area, between the lines of twelve feet water and twenty-one feet water, of fifteen acres; the enclosure to be formed by twelve piers of an average size of twenty-nine feet wide by forty-six feet long; the piers to be composed of piles driven into the bottom, and substantially fastened together. The space enclosed will have for its length, on the twelve-foot line, (which is the base or land side,) fifteen hundred feet; and its opening on the twenty-one foot line will be nine hundred feet; its width will be five hundred and sixty-five feet between these two depths. The outside of the piers to be protected from the ice by metallic bars.

The board of river and harbor improvements approve the general outline of this ice harbor, and its extent; but prefer one unbroken series of piles to detached piers.

One member of the board, differing from the majority in their opinion, above stated, thinks that Major Sanders' plan is a good one.

Major Sanders' project provides for eventually cutting down the timber work to near low-water mark, and placing a masonry structure on top for the sake of permanence. The existing means are not sufficient to do this now.

As Major Sanders' station in the Delaware has enabled him to observe the effects of the moving ice, and to appreciate its power, and as the repairs of two such harbors are intrusted to his charge, I think the details of his project (which are the result of his study of the whole subject, and of his local knowledge) are probably the best adapted to the purpose; and I therefore concur in his views, and have the honor to present them for your approbation.

Should you give it, he will be instructed to proceed at once with the execution of the work, by day's work or by contract, as shall prove to be the most advantageous.

Some observation of the effect of large fields of ice when driven upon piers or wharves, leads me to suggest, as an improvement of Major Sanders's project, to frame the end of the pier against which the ice will impinge, as an inclined plane; this will cause the cakes of ice to rise upon the top of the pier. By such means, I have seen the ice piled twenty feet high on a pier that would, but for this construction, have been swept away like a cobweb. This detail I have caused to be sketched in red on one of the drawings.

The following papers accompany this communication, viz:

1. Report of Major Sanders and drawings.
2. Report of board of river and harbor improvements, with sketches and estimate.
3. Report of the minority of the board.

I have the honor to be, very respectfully, sir, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Recommendation of Chief Engineer approved.

JEFFN. DAVIS,
Secretary of War.

W. D., *April* 6, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX B B.

ENGINEER OFFICE U. S. HARBOR IMP'TS, DELAWARE RIVER,
Philadelphia, March 26, 1853.

SIR: My project for the improvement of the harbor of Newcastle, which was placed under my charge by department letter of the 29th of September last, has only been matured within a few days. I shall now briefly proceed to submit it for the consideration of the board of engineers.

The position of the old works at Newcastle, intended to form a harbor, was selected with a different view from that which would now guide an engineer looking to the existing wants of navigation and commerce on the Delaware. The harbor, at the best, was very contracted, and but indifferently protected from running ice. At present it is without a landing or wharf at which any vessel drawing ten feet water can either take in or discharge a cargo. The harbor, as a refuge from ice, was originally designed and its limits fixed in the early part of this century, chiefly covering a space which, through subsequent neglect and the injudicious closing of some sluice-ways, has become a mere mud-bank, so that what was then the mouth or entrance of the harbor, should now form the limit of the solid shore-wharfing. We are consequently forced to seek the requisite space for affording shelter and cover to vessels, by projecting additional works which will run out into deep water. The last improvements attempted at this harbor, under the auspices of the federal government, were planned and partly executed nearly twenty years ago. But they were also made at too early a date to give full and due weight to those changes affecting the port of Newcastle, which are now so clearly in operation, and which have been chiefly brought about by the connexion lately established, through a branch railroad, with the cities of Wilmington and Philadelphia. Should we hereafter be subject to frequent returns of as severe and rigid winters as that of 1851–'2, gorging and jamming with ice the narrower and shallower bars and passes of the river above Newcastle, the passengers and cargo of a vessel stopped by the ice could readily be debarked at the projected extension of the railroad wharf, and carried thence in a couple of hours into the heart of the city of Philadelphia; whilst the ship itself, detained by no unnecessary delay, could, through the same means, be at once refreighted and sent directly out to sea on another voyage. The Newcastle and Frenchtown Railroad Company, subsequent to the last works executed by the United States at Newcastle, have established a wharf, without and below the site of the old harbor, for the landing of passengers. The present energetic president of the company proposes, within the ensuing year, to extend their wharf or landing into deep water, so that any size vessel can approach and lie alongside of it.

The configuration of the western shore of the river naturally designates the railroad company's wharf as the starting point for the lower line of piers or obstructions, intended to protect the harbor above it from the flood-ice.

The more I reflect on this subject, the more decided is my conviction that the relation of the railroad to this harbor is one of the most important features to be regarded in any new project for its improvement. The only thing which withheld me from at once acting on this conclusion, is the position of the lower hexagonal pier, sunk some twenty years ago by Major Delafield, for the improvement and enlargement at that time of the harbor. But with the view I now take, this pier, in its present position, not only becomes a useless work, but also a serious obstacle in the harbor. The considerations, however, which guide and direct my plan, did not exist when his was adopted. It is, therefore, no reflection on the fitness and propriety of his plans for the time, to say that they do not now meet the unforeseen changes and developments which are taking place in the commerce of the port of Newcastle. The accompanying drawings present a correct map of the harbor of Newcastle as it now is, showing the actual site of the old and existing works, and also exhibiting the position proposed for the projected improvements. It is an indispensable element in any permanent system, for the harbor of a commercial port to fix on a limit for the extension of shore-wharfing; otherwise the harbor space, intended for the moving of vessels, might soon be filled up and permanently occupied with piers, run out by the enterprise and competition of private citizens. Nothing has ever been done to establish such a line for regulating the wharfing at Newcastle. The injudicious closing of the old sluices, before referred to, has caused so large a deposite of mud, that it has now become absolutely necessary to extend out the wharves, so that vessels can reach them. I propose that the line of the front of the United States pier B, shall be fixed on as a limitation for the extension of solid wharfing. But as that will barely reach the line of low water, I propose that a further extension may be allowed on piles which will only partially obstruct the water-way, and that the line of the front of the United States pier C, which cuts the *two-fathom* curve, may be fixed on as the limitation of this open wharfing. I propose to leave the small open space between Jefferson's wharf and the railroad company's wharf as a harbor for small craft. I do not think it either necessary or advisable for the United States to construct the line of shore-wharfing, and therefore only propose to have its limits fixed and designated by some recognised and acknowledged authority, leaving the establishment and construction of the wharves to private enterprise. The lower hexagonal pier has never been finished, but merely sunk in its place and loaded with blocks of stone intended for its superstructure. When this weight is taken off, and the ballast used in sinking it removed, as the pier rests on a hard bottom, and had to go but a slight depth in the mud, it may be possible to raise it and float the pier to another position. I propose, if it can be done, to remove it to the position marked A, which is on the extremity of the upper line of piers intended to protect the harbor below from the ice floated down on the ebb-tide. If the transportation of the pier to the new position should prove impracticable, then it would be necessary to tear it to pieces, and remove all the materials out of which it is constructed, so as to free the harbor from the obstruction which it would constitute. It will, in that case, be necessary to construct and establish a new pier in the position marked A, to complete the upper of the two lines of piers which are required to form the harbor. As these piers are obviously intended to jam or deflect the ice, and not to split it, so as to allow the smaller pieces to pass between them and sweep the harbor, their ends should be square instead of sharp. I therefore propose making all new ones rectangular.

The position of the upper line of piers seems to have been well selected for the purpose of an ice harbor. Its general direction would not be improved by any change. I offer no other modification to it than to extend the line further out into the river, by adding another pier, placed on its prolongation. This addition will afford something like an adequate space for a harbor, if the other line of piers is established at a proper and suitable distance below it. Less than nine hundred feet between the lines would scarcely afford ample room for all the vessels which might have to seek shelter in this harbor. A width of that extent is also very convenient for a tug getting in with its tow. The position I have selected for the lower line, starting from the railroad company's wharf, will afford a clear space of 930 feet between the lines of piers forming the harbor, with an inner width of 233 feet from entrance of harbor to proposed limit of open wharfing, giving an area of $5\frac{7}{10}$ acres sheltered from the large fields of floating ice. I propose to construct this lower line by establishing two piers, in the respective positions marked D and E; but as each of these piers will cost over $10,000, the inner one alone can be built with the means now available. This new pier to be a wooden one, filled with earth and stone, built crib-fashion in the most substantial manner, with high steamboat fenders and boiler-iron on the corners; this pier to be ninety feet by forty-five, with its longer face parallel to the current, and its lower inner corner two hundred feet out from the lower corner of the railroad company's wharf, as it now stands, giving room for the company to extend their wharf out a hundred feet, and still leave a hundred feet clear water-way between it and the new pier, D. This class of piers can be converted into permanent structures whenever there are sufficient funds granted to replace the upper wood-work with cut-stone masonry; but with the present limited means that cannot be attempted. There are some repairs required on the upper hexagonal pier. Its coping and a few other stone have been displaced by the ice or vessels running against the pier; and the top of the pier also needs covering or flagging. I propose confining the expenditure of the appropriation now available to the making of these few repairs, and the building of the new pier, D. Adding the necessary contingencies of the cost of the work specified, would leave a balance of about $2,500 on hand. I shall submit the following estimate of funds for which an additional appropriation will be required to complete the improvements of this harbor:

Estimate.

Upper line of piers:	
New pier A, with granite superstructure	$18,000
Removing obstructions in harbor, tearing lower hexagonal pier to pieces and removing materials	6,000
Lower line of piers:	
Granite superstructure, pier D	9,000
New pier E, with granite superstructure	18,000
	51,000
Contingencies	8,000
	59,000
Deduct estimated unexpended balance of present appropriation	2,500
	56,500

The plan of operations and system of administration which I would submit for conducting this work is, to execute the repairs of the hexagonal pier with hired labor, and to let out by contract, to some competent wharf builder, the construction of the new pier, D, of the lower line; the work to be done under the general supervision of myself and assistants, with an inspector, at three dollars a day, kept constantly on the work whilst the contract is in the course of execution.

Respectfully submitted.

JOHN SANDERS,
Brevet Major Engineers.

Gen. Jos. G. Totten,
Chief Engineer, Washington City.

APPENDIX B B—1.

ENGINEER DEPARTMENT,
Washington, June 28, 1853.

SIR: I have the honor to submit herewith the report of Major John Sanders, corps of engineers, with a project "for repairing the piers and for improving the harbor at Newcastle, Delaware." Also, the reports on this project of the board of river and harbor improvements, and of the minority member of the board.

The importance of the harbor of Newcastle has been much increased by the growth of the commerce of Philadelphia, and by the connexion of the two places by railroad; in consequence of which, ships ascending the Delaware in winter, can, when the narrow river above is choked with ice, discharge their passengers and cargoes at Newcastle, and receive their return freights at that point, without incurring delay. Thus Newcastle becomes a winter port to Philadelphia.

To attain and preserve an area of suitable magnitude for the shelter of this commerce, with proper depth of water, Major Sanders proposes, 1st, that the shore-line of solid embankment be limited by a fixed boundary, corresponding to the present low water; 2d, that from that limit the construction of open pile wharves be allowed, out to the depth of twelve feet water: these limits to be in the care of the proper authorities—the United States to incur no expense about them; 3d, the existing piers to be finished, and one, now occupying an unsuitable position for the improved harbor, to be moved to a better place; after which, two additional piers to be put down at the lower end of the harbor, to complete it. To do this, and make the superstructure of the piers permanent, will require an addition to the present appropriation, of the sum of $56,500.

The board of river and harbor improvements approve of Major Sanders's project.

The minority member of the board regards the law as limiting the application of the means to the deepening of the area now enclosed, and therefore proposes to expend the appropriation in reopening old and forming new sluices, dredging, and repairing the existing piers.

The law provides for two objects, viz: "*Repairing the piers, and for improving the harbor at Newcastle.*"

Under the first clause, I think that such of the present piers as should be retained for the improved harbor, may be restored where they have been injured, and put in the best condition for use hereafter; and I propose that this be done.

The second clause seems to me to provide for any work which may increase the efficiency of the existing harbor.

I propose that, in the first place, the remains of the upper pier, built by Major Babcock, be removed, as far as practicable. The water-lines on the sketch of the harbor which accompanies this report, indicate that these remains are acting as a dam, turning the flow of the current from the shore, and causing the accumulation of mud in the dead space below.

If the lower pier, built by Major Babcock, be also removed, there will be no obstacle to the flow of the current inshore; and it may be expected that a deepening of the water will ensue from the natural scour of the bottom. Should this not take place, however, dredging of this space near the shore-line can then be resorted to, and the accumulated mud be thus removed. It is obvious that the greatest security will be afforded to vessels by enabling them to lie as close inshore as possible. The space thus reclaimed will be an important portion of the present harbor, and not less important of the harbor under any future enlargement.

Supposing—these things being accomplished—that there shall remain an adequate balance of the present appropriation, I would recommend the construction of the new pier marked D. As this pier, while it will materially enlarge the harbor, will render useless the old pier, built by Major Delafield, opposite Jefferson's wharf, this latter should be removed. Whether, in reference to facility of access to the harbor, this removal should not precede the construction of pier D, may best be left to the judgment of the constructing officer. When removed, it should, if possible, be transferred to the position marked A, according to the suggestion of Major Sanders.

Confirming the approval given by the board of river and harbor improvements to the project of Major Sanders, in recommending that the means necessary for the completion of that project be solicited from Congress, the substance of my present proposition is, that the present means be applied as indicated, in order to improve the harbor as it now stands, to the utmost, in a way which shall contribute to the execution of the entire project.

I am, very respectfully, sir, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Endorsement.

The appropriation is "for repairing the piers and for improving the harbor of Newcastle, Delaware." The plan submitted by the Chief Engineer contemplates the removal of the existing piers and the construction of new ones in other places, with the view both of improving the harbor and of enlarging its dimensions; and this plan, for its execution, will require nearly five times the amount appropriated.

The proposed enlargement of the harbor might be warranted under the general direction "for improving" it, if there were no other special provision upon the subject; but it is connected with a provision for "repairing the piers," which must be understood to mean the principal piers as they now stand, determining the limits of the harbor. And, in view of this, and of the fact that the present appropriation is entirely inadequate to the undertaking, so that the expenditure of the money, according to the plan proposed, might either sacrifice the appropriation or present to Congress the alternative of making an additional grant, I do not think the department would be justified in adopting the plan.

The appropriation, in my opinion, must be applied to the repairs of such of the existing piers as are necessary to the preservation of the present harbor, and to such further improvement of the same as may be practicable, including, of course, the removal of such piers as are prejudicial to it; but no structure which is now of service to the harbor should be removed with the view of constructing another, which may be of more service, out of an appropriation to be hereafter obtained from Congress. The principal end of the plan to be pursued must be, to make the greatest improvement which the present appropriation will effect.

The papers are returned, in order that the plan may be revised in accordance with these views.

JEFFN. DAVIS,
Secretary of War.

War Department, *July* 7, 1853.

The officer was instructed to carry the project, as modified, into execution accordingly.

APPENDIX C C.

Extract from the report of Brevet Major John Sanders, corps of engineers, in reference to repairs of piers at the harbor of Chester, Pennsylvania, dated Fort Delaware, October 4, 1852.

Sir: * * * * * * *

I propose visiting Chester on Thursday next. I have already a pretty clear idea of the work to be done there. It is, the repairs of the old wooden wharves, piers, and bridges—exactly similar work to that which I had to do on first coming here. It is of the ordinary class of log wharfing. These repairs will require the removal of the old wood-work as far as decayed, possibly as far down as low water, and also the excavation and temporary removal of the earth filling as low down as the wood-work is taken away. It will then be re-built with hemlock in the lower courses, and finished off with white pine, and the interior space again filled up with earth; the sides of the wharf protected with oak fenders closely fitted and bolted on, and all exposed corners of wharves or piers sheathed with bent boiler-iron. Five thousand dollars is a very small sum for the work required.

Wharf work, if I buy the materials and hire the labor, will cost between sixteen and twenty cents for every superficial foot of face-work: fenders, iron sheathing, and earth filling, extra. If the work at Chester is to benefit the navigation of the Delaware during the present winter, it must be commenced immediately, to secure its completion before the ice may be running in the river. I believe, if authorized to do so, that I can undertake to have all the repairs done by Christmas. I would suggest that I may at once be authorized to contract with some suitable and competent party for the entire completion of those repairs, so that the cost will not exceed the amount of the appropriation after deducting a small sum for contingencies. I would then propose to employ a suitable person for inspector, whose duty it would be to witness the proper laying and bolting of every log and tie, and to see that the work through its stages is executed strictly according to the contract. As his services would only be required for about twelve weeks, I would place his pay at three dollars a day, Sundays included. I can dispense with the services of the chief overseer at this work (Fort Delaware) when those of an inspector would be required at Chester; I will therefore name to you Mr. McElroy as a suitable person for such inspector. He is perfectly competent to discharge the duties, and on my speaking to him on the subject he expresses himself as most anxious to obtain the situation.

* * * * * * * *

Very respectfully, &c.,

JOHN SANDERS,
Brevet Major of Engineers.

Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

The foregoing received the verbal approval of the Secretary of War.

APPENDIX C C—1.

Engineer Department,
Washington, October 11, 1853.

Sir: Your letter of the 4th inst., relative to your proposed operations at Newcastle and Chester, is received.

* * * * * * * *

From such information as has been obtained, it appears to the department that the plan you propose with reference to the harbor of Chester, viz: the repairs of the existing wharves, piers, and bridges, is the proper course to be pursued; and as you state that the work should be commenced immediately, (in order that it may be finished in time to be of service the coming winter) your proposition has been submitted to the honorable Secretary of War, and is approved by him. You will therefore endeavor to form a contract at once for the thorough repair of the existing works by a competent person—the work to be completed, if practicable, by Christmas—and to be under the constant inspection of a suitable agent on the part of the United States. The employment of Mr. McElroy, and on the terms you propose, is approved; as also that of Mr. Hay, if you have satisfied yourself of his suitableness and reliability.

Should your further examinations at Chester suggest an additional work as needful for that harbor, you will please prepare a project and estimate accordingly, to be submitted to the board of engineers for river and harbor improvements.

Very respectfully, your most obedient,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. of Engineers.

Bt. Major John Sanders,
Corps of Engineers, Delaware City, Del.

APPENDIX D D.

BALTIMORE, MD., *April* 15, 1853.

SIR: I have the honor to submit a project for the "improvement of the Patapsco river, from Fort McHenry to the mouth of the river."

By a comparison of the hydrography of the Patapsco, as exhibited on the chart of that river made by the United States Coast Survey in 1845, with that given on the map published in the year 1819, by Mr. F. Lucas of Baltimore, from the survey of Brantz, it would seem that little, if any, changes have taken place in the bed of the river in a period of upwards of a quarter of a century, indicating that there are no disturbing causes at work operating to produce any material change in the regimen of the river. Indeed, this might be inferred from the topography of the country in the vicinity of, and bordering on the river, and from the small rise of water, which, as shown by the tidal observations of the United States Coast Survey, is only about one foot between mean low and mean high water.

The only stream emptying into the Patapsco, from which apprehensions might be entertained of alluvial deposites, is that of Jones's Falls, which takes its rise about fifteen miles above the city; and being of rapid descent and passing through a clay district, its waters become very turbid during a sudden and heavy fall of rain; but its sedimentary matter, as well as the washings of the streets of Baltimore, are chiefly deposited in the upper harbor, from which they are annually removed by dredging machines belonging to the corporation of the city.

It would appear, then, that if a depth of water is given to the channel by artificial means, such as dredging, sufficient for the wants of commerce of Baltimore, this depth will not be liable to be disturbed. There is some difference of opinion among those most interested in the commerce of this city, as to what depth is required; some proposing as great a depth as 25 feet at low water, whilst others think 22 feet will satisfy the requirements of trade. I have adopted the latter depth, estimated from mean low water, as that which can be attained within a reasonable limit of expense; with a width of channel-way of 150 feet, which the pilots sailing out of this port deem sufficient to allow two of the largest class ships to pass each other in towing. The present depth of water, at the stage referred to, between the mouth of the river and Fort Carroll, is from 16 to 18 feet, and upwards; and between Fort Carroll and Fort McHenry, the least depth of water is 18 feet—the general depth being above the maximum required (22 feet). One of the largest ships now belonging to and sailing out of this port is the Flora McDonald, of 840 tons burden, and drawing, when loaded, about 19 feet water at stern. On the return of this vessel from Europe in February last, her draught was 19 feet aft and 17 feet forward. She was towed up to the city from the mouth of the river by a steamer at a very favorable period, the wind blowing from the south east, with a full tide. The time occupied in towing was from three to four hours.

The position of the proposed channel-way is shown in full red lines on the two charts of the United States Coast Survey, herewith; one sheet being a chart of the Patapsco river, and the other a chart of that portion of Chesapeake bay near the mouth of the river. Between Fort

Carroll and Fort McHenry two lines are laid down—one a direct line, the other represented by dotted red lines, diverging from it towards the east shore, where the best water is found after leaving Fort Carroll, in approaching the city. An estimate of the number of cubic yards to be excavated on each line does not, in my opinion, show difference enough in quantity, to justify a departure from the more direct course—the excess of excavation, by following the latter line, being little more than 17,000 cubic yards, as compared with the quantity to be removed on the longer line; the number of cubic yards for each being, respectively, 77,377.77 and 60,093.89. The great bulk of the excavation will be between the mouth of the river and Fort Carroll, and amounts to 1,114,580.55 cubic yards, which added to the quantity 77,377.77 cubic yards to be removed between the two forts, makes 1,191,958.32 cubic yards of matter to be excavated; which at 30 cents per cubic yard for dredging and removing the same, by means of trap-door lighters, to the opposite shore, is

lighters, to the opposite shore, is	$357,587 50
Add for superintendence and contingencies	32,412 50
Total	390,000 00

The above estimate is based upon the supposition that the work is executed by contract. If dredges and steam-tugs are provided by the government for the purpose, it is believed the work can be done for about three-fourths of this amount, including the cost of machinery, &c.

It is intended to employ the steam-dredge recently contracted to be built for the waters of the Chesapeake bay, in the improvement of the Patapsco river; but as the amount now available for this object is entirely inadequate to carry out the improvement as designed, I propose co-operating with the steam-dredge now being built by the corporation of Baltimore for the purpose, in removing such knolls as at present obstruct the navigation of the river between its mouth and Fort Carroll.

I have to request that the charts forwarded with this report may be returned to me, when no longer required by the department.

All which is very respectfully submitted.

HENRY BREWERTON,
Captain Corps of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX D D—1.

Engineer Department,
Washington, May 23, 1853.

Sir: The board of engineers of river and harbor improvements have considered the project of Captain Henry Brewerton, corps of engineers, for the improvement of the Patapsco river from Fort McHenry to the mouth of said river, and give it their approval.

This project embraces the eventual excavation of a good, deep channel, (should sufficient means be obtained for the purpose,) wherever needed within the limits specified; but the present grants being small, the proposition of Captain Brewerton is to apply this to removing such knolls as at present obstruct the navigation of the river between its mouth and Fort Carroll; employing for the purpose the steam-dredge authorized by law for the waters of Chesapeake bay, &c., and in co-operation with a dredge now preparing by the corporation of Baltimore for the purpose.

I have the honor to propose that you approve Captain Brewerton's project, and that I be authorized to instruct him to carry his last proposition into effect at once, as far as existing means will allow; the work to be done by contract or by day's work, as shall appear to be most to the advantage of the government.

The report of Captain Brewerton (with two maps,) and that of the board, are submitted herewith.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Colonel Engineers.

Hon. Jefferson Davis,
Secretary of War.

Endorsement.

Approved, with the limitation that there shall be no connexion with' or responsibility for, the city appropriation.

JEFFN. DAVIS,
Secretary of War.

War Department, *May* 31, 1853.

The officer was instructed to carry the project, as modified, into execution accordingly.

APPENDIX E E.

Baltimore, Md., *February* 22, 1853.

Sir: In compliance with the instructions of the department of the first of October last, I have the honor to present a project and estimate for "removing obstructions at the mouth of the Susquehanna river, near Havre de Grace."

1. As to the nature, character, and extent of the obstructions.

They consist of two shoals, composed of mud and sand, situated between the light-house at Havre de Grace and Spesutie island. The first or upper shoal, called Devil's island, begins about half a mile below the light-house, and extends in a southerly direction from 2,000 to 3,030 yards, depending upon the depth of water to be attained. The second or lower shoal commences from 900 to 1,250 yards above Donohoe's battery, and extends from 1,230 to 1,300 yards below the same, making the whole length of this shoal from 2,130 to 2,550 yards, its southern extremity being within 560 yards of Spesutie island, between which and the shoal the greatest depth of water, at mean low water, is 22 feet. The minimum depth of water on the upper shoal is 6 feet, and on the lower one 5 feet, at the same stage of water.

2. As to the present state and future wants of commerce.

The trade of Havre de Grace is now carried on by vessels drawing from 7½ to 9 feet water; but it is supposed that if the depth of water over the shoals is increased, so as to give 12 feet at mean low water, eastern vessels of a larger class will be induced to visit the port of Havre de Grace for the purpose of participating in the coal trade.

3. As to the extent of the improvement proposed.

In order to accommodate the present trade, so that vessels may pass freely, at all stages of water, from the mouth of the river to Havre de Grace, it will be necessary to obtain a depth of not less than 10 feet of water over the shoals at mean low water; and to effect this, it is proposed to excavate to that depth a channel 100 feet wide, nearly straight, its general course conforming to that of the deepest water.

The position, direction, and extent of the proposed channel, is shown by the full red lines on the chart of the United States Coast Survey of the Susquehanna river, herewith; and has been laid down so as to connect the deep water above and below the shoals by the shortest line compatible with a due regard to a minimum amount of excavation. To provide for an expansion of the trade to the probable wants of commerce, it is proposed to deepen this artificial channel two feet, making the depth at mean low water 12 feet. This will increase the length of the proposed channel on the upper shoal 1,030 yards, and on the lower shoal 420 yards, as shown by the dotted red lines on the chart.

4. As to the means to be employed in effecting this improvement.

As the velocity of the current in the Susquehanna river near its mouth is ordinarily small—the mean rise and fall of the tide being only about two feet—it would seem that the only practicable method of deepening the channel over the shoals at present obstructing the navigation, is by means of dredging. The machines to be employed for this purpose should be worked by steam, and the excavated matter removed, by dumping or trap-door lighters, to deep water near the west shore, and there deposited. This locality, as will be perceived by reference to the chart, will afford abundant accommodation for all the dredged matter, without detriment to the navigation. As the distance the lighters will have to be transported from the dredge to the place of deposite, and back again to the machine, is from two to three miles, it follows that the most economical method of moving them will be by steam; a small steam-tug will consequently be required for this purpose.

5. As to the cost of the proposed improvement.

For a channel 10 feet deep and 100 feet wide, there will require to be excavated—

On the upper shoal	49,345	cubic yards.
On the lower shoal	64,311	"
Total	113,656	cubic yards

of matter, which, at 30 cents per cubic yard for dredging and removing the same to deep water, is........................ $34,960 80

Add for superintendence and contingencies for one year and a half	$2,039 20
Total	37,000 00

For a channel 12 feet deep and 100 feet wide, there will require to be excavated—

On the upper shoal	105,900	cubic yards.
On the lower shoal	117,688	"
Total	223,588	cubic yards

of matter, which, at 25 cents per cubic yard for dredging and removing the same to deep water, is $55,897 00

Add for superintendence and contingencies for two years and a half	3,103 00
Total	59,000 00

The cost of the dredging, &c., per cubic yard, is estimated on the supposition that the work is to be done by contract. If a dredge is built by the government for this object, or can be hired at a reasonable expense, it is believed the work can be executed for about one half what has been estimated above, or, including the entire cost of a dredge, for three-fourths the price the improvement can be effected by contract. These calculations are based upon actual results, as deduced from the whole quantity of excavation done at the Overslaugh bars in the improvement of the navigation of the Hudson river during the years 1836, 1837, and 1838. The average cost of the dredging proper—that is to say, the expense of excavating, raising, and depositing the dredged matter into lighters ready for removal—was a little less than six cents per cubic yard; during the year 1838, the average cost was only .04022 per cubic yard.

There will be required a competent and trustworthy person to superintend the work during its progress, whose compensation should be about $100 per month.

It will be perceived that the appropriation at present available for this improvement is entirely inadequate for the purpose. It is therefore doubtful whether any beneficial result can be accomplished with the small means at our disposal, especially if the work has to be executed by contract.

This report has been delayed to this late day in consequence of my not having received the tracings of the maps of the Susquehanna until the 27th of December last, and from the state of my health since that time.

I beg leave to request that the chart forwarded with this report may be returned to me when no longer required, as I have no other copy.

All which is very respectfully submitted.

HENRY BREWERTON,
Captain Corps of Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX E E—1.

ENGINEER DEPARTMENT,
Washington, April 23, 1853.

SIR: Captain H. Brewerton, corps of engineers, has submitted a project for removing obstructions at the mouth of the Susquehanna river, near Havre de Grace, Maryland, in which he proposes to open a channel, by dredging, 100 feet wide, with a depth of 10 feet at low water over the shoals; the channel to be nearly straight, its general course conforming to that of the deepest water.

The board of river and harbor improvements approve of Capt. Brewerton's project, and of the location of the lower part of the channel line, but prefer for the upper part a cut to the eastward, as having the advantages of being shorter, as they think, and conveying more of the current, than that proposed by Captain Brewerton. The board also suggest that the steam-dredge, equipment, and discharging-scows "*for the waters of the Chesapeake bay and the Atlantic coast*," provided for at the first session of the 32d Congress, may be used in connexion with this improvement.

In an additional communication, Captain Brewerton proposes to adopt the suggestion of the board as to the location of the upper part of the cut, from motives of economy; but states that the abrupt change of direction, which a vessel must make on entering it, will make it difficult of navigation, and it will be liable to fill up from being athwart the current. The line selected by him conforms as nearly as practicable with the usual track of vessels.

The Chesapeake bay dredge, mentioned above, he contemplates employing at present in the improvement of the navigation of the Patapsco, and does not think it advisable to defer the work at the Susquehanna until the dredge can be spared from that object.

In order to attain the greatest depth that the present means will furnish, Captain Brewerton is willing that the width of the cut be reduced to 66 feet. With this width, a depth of 8 feet may (I am verbally informed by him) be obtained at low water, within the existing means and on the direct line.

I have the honor, therefore, to propose to you that I be authorized to instruct Captain Brewerton to enter into contract, if favorable terms can be had, for dredging a channel on the direct line, to have not less than 8 feet depth at low water, with a width of 66 feet.

The improvement thus begun will be efficient and serviceable, and may be expected to be lasting; and will occupy the proper position to receive increased dimensions whenever the means of giving them shall be procured.

Accompanying this communication are the two letters of Captain Brewerton, the report of the board, and a map of the locality.

I have the honor to be, very respectfully, your obedient servant,

JOSEPH G. TOTTEN,
Bt. Brig. General, and Col. Engineers,

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved.—WAR DEPARTMENT, *April* 28, 1853.

JEFFN. DAVIS,
Secretary of War.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX F F.

BALTIMORE, MD., *December* 13, 1852.

SIR: In compliance with so much of the department's instructions of the 1st of October last as relates to the construction of a steam dredging machine, &c., for the waters of the Chesapeake bay and Atlantic coast, I have the honor to report that I have been in correspondence with several officers of the corps of engineers, and with other persons, as to the most approved plan for a steam-dredge for digging in deep water and in exposed situations; and have also made a personal examination of some of these machines, and witnessed their operation.

In this investigation several dredges have come under my notice. They are—

1st. The inclined-plane dredge, manufactured by H. R. Dunham & Co., Archimedes Works, New York, the hull of which consists of twin-boats, fifty feet in length—one fourteen feet, and the other ten feet in width, and seven and a half feet in depth, having an interval of six feet between them, and strongly connected together by beams and bottom timbers. The open space between the boats is occupied by an inclined plane or carriage, four feet wide, and of sufficient length to enable the machine to dig in twenty-six feet water. One extremity of this inclined plane is suspended by a fixed axle at one end of the dredge, in such a manner as to allow the other extremity to be raised or lowered at pleasure. A series of iron buckets, or excavators, eight in number, containing nine cubic feet each, placed twelve feet apart, and connected by an endless chain, revolve around this carriage, digging at one end of the dredge and delivering the excavated matter at the other into scows or lighters. The working power of this machine is a steam-engine of twenty horses power, and it is represented that this dredge is capable of raising, in ordinary mud and sand digging, from 650 to 700 tons per day, of twelve hours. The cost of a dredge complete of this description, is $16,000—for the machinery alone $7,000—and to fit it for locomotion would involve an additional expense of $2,500. These machines are much used in the city of New York for deepening the docks. This same principle has been applied to a single boat, with a series of buckets on one or both sides. A dredge of the latter kind, belonging to the corporation of the city of Baltimore, is used in the harbor for excavating in the neighborhood of the wharves. It is a very complicated and expensive machine, and is said to have cost, with the improvements, about $70,000. If kept constantly at work, it is stated this dredge is capable of raising about 750 cubic yards of mud and sand per day; although, upon an average, not more than half that quantity is raised by it in that time. The first application of this principle is considered the best, as it brings the buckets in the centre of motion, and therefore in the most favorable position in a sea-way, or exposed situation.

2d. A dredge, the hull of which is forty feet in length by thirty feet in width, and about six feet in depth, of a box-form, having a series of iron buckets on each side, connected by an endless chain, and moving over two drums, having their axes in the same vertical plane—the upper drum being fixed, whilst the lower one, by means of an upright frame-work, can be raised or lowered at pleasure. The steam-engine of a dredge of this description now in use at the Atlantic dock, Brooklyn, New York, is of twenty-five horses power, and it is represented the machine is able to excavate, in a depth of twenty feet water, of soft, stiff soil, 1,000 cubic yards per day, and to be capable of digging in thirty feet water. In hard, strong soil, it is said not to work well. This machine may be made to feed in an exterior detached frame of about two and a half times the length of the dredge; and with this arrangement is the same description of machine as those used in the improvement of the Hudson river between the years 1835 and 1840. These latter had engines of about twenty horses power. One of these dredges, in a working day of twelve hours, excavated 1,200 cubic yards of coarse sand, in a depth of six to ten feet of water. I have no doubt that, for digging in ordinary soil and in moderate depths of water, a machine of this kind is capable of doing more work than any other. The cost of one of these dredges complete, it is supposed, would be from $8,000 to $10,000; although those built for the government on the Hudson river cost much more than that.

3d. The single-bucket or long-leaved dredge, of Carmichael and Osgood's patent, (a plan of which is furnished herewith,) is a box-boat, about fifty feet in length, by twenty-five or thirty feet in width, and four feet in depth. The dredging apparatus consists of a single iron bucket, containing about a cubic yard, having its open end, or mouth, shaped like a scoop; whilst its bottom, from which the excavated matter is delivered, is movable about a hinge, and is confined by a strong latch, so arranged as to cause the lid to close of itself during the descent of the bucket into the water, and only to be opened through the agency of the dipper-tender, by means of a cord fastened to the latch. The bucket is attached to one extremity of a long wooden lever, which, by an arrangement of wheels and rollers, is allowed to slide freely in a crane placed in the middle of one end of the boat. Connected with this crane is a turn-table, by means of which it is capable of making the sweep of a semi-circle, and thus conducting the lower extremity of the lever, and with it the bucket, to every part of the space embraced within the scope of the crane, and even beyond it, as the bucket may be made to descend under the boat itself. The lever is manœuvred by an upper and a lower chain, which pass over drums connected with the engine. The engine is of twelve horses power, which is said to be sufficient for the most difficult digging. One of these machines is employed at the navy yard at Washington; but I am informed the boat is of smaller dimensions, and the engine of less power, than some others on this principle. Another of these dredges is in use at the Philadelphia navy yard, excavating for the sectional dry-dock. It digs in upwards of thirty feet water, and, I am told, performs well. It was not in operation when I saw it. I witnessed, however, the working of one of these machines (belonging to J. B. Cooley, of Philadelphia,) at Camden, New Jersey. Its performance was very satisfactory. At the Atlantic dock, Brooklyn, New York, I saw another of these dredges in operation; its hull is forty feet in length, by thirty feet in width, and has two engines of sixteen horses power each. This machine is not considered a fair specimen of its kind, as it was a partial failure, and had to be altered and improved; and, I believe, was the first boat built by Mr. Carmichael upon his principle. It is said, however, this dredge is capable of excavating 600 cubic yards per day, and digging in thirty feet water, and of raising about as much matter in hard as in soft digging. When I saw this machine at work, it was dredging hard-pan, at about twenty feet water. It occupied, upon an average, 2¼ minutes to raise one dipper full containing a cubic yard or more, the bucket being heaped.

4th. The Archimedes screw-dredge, patented by Montgomery, one of which is now being built by Dunham & Co., at the Archimedes Works, New York, and which will probably be ready to operate in the course of a month. This is nothing more than the screw-pump adapted to dredging. It consists of twin-boats, of about the same dimensions as those of the inclined-plane dredge, and arranged in a similar manner, the open space between the boats being occupied by an Archimedes screw, six feet in diameter and twenty-five feet in length, made of boiler-iron; the barrel of the screw, at its lower extremity, having a cutter, in order to facilitate its penetration into the soil. The screw is worked by steam-power. The proprietors of the dredge now building (Messrs. P. A. Kane & Co., of No. 80, Beaver street, New York) are quite sanguine of its success, and say that it will do six and a half times the work of any other machine in use. Its cost is not stated. I apprehend the resistance the screw will have to overcome in digging, together with the weight of the excavated matter in the screw, will be much greater than the projectors of this machine anticipate.

There seems to be an objection to the inclined-plane dredge when working in a sea-way, from the fact that the upper extremity of the carriage is fixed, which would cause the lower extremity to surge against the bottom of the river, and thus prevent the operation of digging. The screw-dredge would be liable to this objection in a greater degree.

After a careful examination of the qualities of each of the dredges named, with reference to the character of some of the obstructions to be removed from the Patapsco river, (detached knolls, consisting of hard concretions of small stones and oyster-shells,) and the exposed situation in which the machine will have to operate, I have come to the conclusion that the single-bucket dredge, with some modifications in the hull of the boat to fit it for the particular service required, will be best adapted to this locality. I am informed by Captain Dutton, of the corps of engineers, that Mr. Osgood has just completed a drawing of a dredge upon this plan, to work two cranes and scoops at the same time, having two pairs; that is, four cylinders of six horses power each. The hull of the machine to be 60 feet in length by 40 feet in width, with apartments on deck, such as captain's office, dining and cook-room, lodging-rooms, coal storage, and smith's shop, with a set of small paddles to propel the boat. Mr. Osgood says that this dredge is so arranged as to work when any machine can, and that it will be capable of excavating 100 cubic yards per hour. The dredge, complete, will cost $15,000. The price of the single-bucket machine is $6,250; and with the improvements necessary to fit it for the service, its cost would probably be $8,000. About six dumping scows would be required with this dredge, at a cost of about $500 each, and a deck lighter for coal and wood, the cost of which would not exceed $250. There would also be required a small steamboat for towing the dumpers into shoal water, where the excavated matter is to be deposited. A second-hand steamer would answer the purpose, which it is supposed might be purchased for about $4,000.

As the building of the dredge ought to be commenced at once, in order to have the machine ready for operation as early in the spring as practicable, it is important that an early decision should be had in the matter.

All which is respectfully submitted.

HENRY BREWERTON,
Captain Corps Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX F F—1.

Engineer Department,
Washington, December 28, 1852.

Sir: In reference to the item in the river and harbor law of August 30, 1852, providing for the "*Construction of a steam-dredge, equipment, and discharging-scows, for the waters of the Chesapeake bay and Atlantic coast,*" Capt. Brewerton, of the corps of engineers, having been industriously employed in collecting information, has lately submitted a report, (herewith laid before you) in which, after describing briefly the several kinds of dredge that have come under his notice, he states his preference to be fixed, for the particular use designed to be made of the steam-dredge provided for in the law, "on the single-bucket dredge, with some modifications in the hull of the boat to fit it for the particular service required."

This report of Captain Brewerton's was submitted to the board of engineers. They do not think they have information enough before them to form an opinion, favorable or otherwise, as to the machine Capt. Brewerton prefers. They, however, are of opinion that the construction or purchase of a steam-tug, as proposed by Capt. Brewerton, to be used in connexion with the dredge, is not provided for in the law.

Under the circumstances, I recommend that Capt. Brewerton be authorized to procure a "steam-dredge, equipment, and discharging-scows," such as, on thorough examination, he shall be satisfied are best calculated to carry out the purposes of the law; that he be directed to take the measures necessary to secure, by proper inspections and guarantees, all the qualities proper and necessary in such vessels, boats, and machinery, including durability, strength, power, accommodation, and fitness in all respects; that he be authorized to give to the dredge-boat, whether a single boat or a twin-boat, such dimensions and form as he shall find best adapted to the situation in which it is to work, giving it, if necessary, the power of locomotion, at the same time that he be cautioned against changes in machinery already well tried and approved, and also against new devices therein, the amount of the appropriation not authorizing nor justifying any such experiments; that should he think any of the vessels or boats, or machinery, can be most cheaply procured by contract, he be directed to call for proposals therefor, circulating his advertisements freely wherever he may expect competition; and if led thereby to propose one or more contracts, that he prepare the same for approval here, sending at the same time all the tenders he may have received.

Captain Brewerton should be desired to report whether some cheaper mode may not be resorted to for moving the scows, than a separate steam-tug, as proposed in his report.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Hon. C. M. Conrad,
Secretary of War.

Approved; the proposals, in case of advertising for contracts, to issue from the department.

C. M. CONRAD,
Secretary of War.

December 28, 1852.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX G G.

James river—Report of the Commission on its improvement, November 26, 1852.

Washington, D. C., *November* 26, 1852.

Sir: In pursuance of the instructions contained in your letter of October 1, the commission named therein have the honor to submit the following preliminary report in relation to the improvement of the James river.

The commission, accompanied by a committee of the council of the city of Richmond, personally examined the river as far as Harrison's bar, eight miles below its junction with the Appomattox river, and diligently sought information from pilots and the gentlemen interested in the improvement of the river. The river was surveyed by Captain

Stansbury in 1836, and his report, with two charts—one of Harrison's bar, the other of the portion of the river included between the city and Warwick bar—was placed at their disposal. The Superintendent of the Coast Survey also placed at the disposal of the commission the survey of Harrison's bar made under his direction in 1852, by Lieut. R. Wainwright, U. S. Navy.

The banks of the river between Richmond and City Point are generally high on one or both sides, and few extensive mud-flats exist. There is apparently no necessity for jettees or other works to confine the river to its bed. The river flows in a channel not requiring expensive works to prevent it from spreading in the ordinary stages of water. The improvement of its bed is, therefore, comparatively a simple operation, and the permanence of the improvement the only point upon which there may be doubt.

The principal obstructions in the James river are, the Goose Hill flats below Jamestown, and half way between City Point and Hampton roads; Harrison's bar; Cox's bar, on Mill Rock reach, 20 miles; Warwick bar, 5 miles; and Richmond bar, 2½ miles, below Richmond (Rocketts.) The two latter bars (Warwick and Richmond) mark, rather, points where a permanent shoaling in the depth of water occurs in the river, its bed forming terraces, interrupted only by occasional holes.

At the Goose Hill flats, according to the statement of Capt. T. Skinner, an experienced pilot on the James river, there are two channels. The south channel has, from one to one and a half mile, only 16 feet clear at ordinary high water; but in consequence of its bottom being of very soft mud, vessels drawing 18 feet can be dragged through by tow-boats. The north channel is an 18-foot channel, with lumps of hard sand, admitting only of the passage of vessels drawing 16 feet.

At Harrison's bar there are two channels. The main channel passes along the northern shore of the river, and has 16½ feet at ordinary high water. At spring tides, vessels drawing 17 feet of water can pass over it.

At all the other points of the river below City Point, the pilots state that there is at least 19 feet of water at high water.

Above City Point, Stansbury's survey and the pilots differ as to the depth of water on the several bars. At Cox's bar, Stansbury's report indicates 15 feet at ordinary high water. The pilots variously report 12 and 13½ feet, though they are of opinion that the water has shoaled since his survey. At Warwick bar, Stansbury gives 14 feet; the pilots 13½ to 15; at Richmond bar, Stansbury 10 feet, the pilots 10½ to 11 feet; and at the Rocketts, one mile below the falls, and where are the wharves of the city, and for a mile further down, Stansbury reports at least 12 feet, the pilots 11½ to 12 feet—all at ordinary high water. At Warwick and Richmond bars, the pilots are of opinion that the water has deepened some 8 to 10 inches, in consequence of the current carrying away the bottom loosened by the keels of vessels. To this same cause the pilots attribute the keeping up of the former depth of water at Cox's bar, when vessels drawing 15 feet of water passed up to the old town of Warwick and discharged their cargoes, till, by the introduction of tow-boats, the lightering was all done at City Point, or at Bermuda Hundred, opposite. No vessel passed that bar which could not get up to Richmond. The bottom was no longer stirred up by the keels of vessels, and the depth has since gradually diminished to 13½ feet or 12 feet, as before stated. If Cox's bar were deepened to 16 feet, that depth could be kept up to Warwick.

The bottom at Richmond and Warwick bars is of sand, and at Cox's bar is said to be of mud. There is no appearance of rock in the river, except at the Rocketts, where it is visible in detached masses, and probably in some places forms part of the river-bed. The amount of excavation required in any scheme of improvement can only be determined by a minute examination, with suitable borings.

Between Warwick bar and City Point, there are two remarkable bends in the channel; the first is Mill Rock Reach, where the channel, after a course of 8 miles, returns to within 130 yards of its starting point. This narrow pass is called the "Dutchman's Gap," and the highest point is about 30 feet above low-water mark. In this Reach is Cox's bar. The second bend is just above the junction of the James and Appomattox rivers, where only about half a mile is gained after a course of some 9 miles. In any plan of improvement, the commission are of opinion that the question should be considered, whether the river should not be straightened by cutting through these passes? As regards the Dutchman's Gap, it might be more economical, as well as more effective, than to dredge out Cox's bar, which is said to be two-thirds of a mile in length.

At Harrison's bar, the information at the disposal of the commission, resulting from the surveys of Captain Stansbury and the Coast Survey, was very complete, and sufficient to determine the general character of the improvements required. Besides the main channel already referred to, there is a swash channel on the southern side of the river, having also 16½ feet at ordinary high water. The swash channel is the more narrow and circuitous one, and the northern channel is best adapted to navigation, and most generally used by vessels. This channel is gradually improving in the depth of its water, and the river is now forcing out a better channel. This was predicted in 1826 by C. Crozet, esq. Captain Stansbury did not concur in this opinion, though he was of opinion that if a channel were once dredged out, it would maintain its depth. A comparison, however, of Captain Stansbury's survey with that made by the Coast Survey in 1852, shows conclusively that the channel has very much improved. In 1836 the bar between the 18-feet low-water lines was one mile in length. In 1852 it was reduced to half a mile. In 1836 there was an extensive middle ground on this bar, dividing it into two channels, with 16 feet at average high water in each. In 1852 this middle ground had essentially disappeared, there being simply occasional lumps of 10½, 11½, and 12½ feet; the two channels had become one, and the depth at ordinary high water had increased to 16½ feet. The bottom has been ascertained, by boring, to consist for the most part at the surface, and for six feet below, of a hard pavement of pebbles, mixed with shells and gray sand, below which mud and yellow sand occur. The current has within the last fifteen years greatly improved this bar, notwithstanding the rigid character of the bottom, and the commission are satisfied that it would maintain a considerably increased depth if it were dredged out. Should subsequent examinations confirm the truth of the statement of the pilots, that, with the exception of Goose Hill flats and Harrison's bar, 19 feet of water at high water can be carried all the way up to City Point, and should the Goose Hill flats admit of a similar improvement, the commission are of opinion that at least this depth could be permanently secured for Harrison's bar. They cannot, however, submit a definite plan for Harrison's bar, till what is practicable to be attained at the Goose Hill flats, to be determined only by a survey, has been ascertained.

While the commission are of opinion that a survey of the whole river is essential to determine the character of the improvements that are required, they propose, at present, simply to survey the Goose Hill flats and the river between the city of Richmond and Harrison's bar. From a full conference with the corporate authorities of Richmond, it is believed that this will furnish the necessary data for any improvements which can be undertaken at present. When an additional appropriation is made, the survey can be completed, and the commission will then be able to prepare a complete plan for the improvement of the whole river, with suggestions for the necessary aids to navigation. Besides buoys, &c., pointed out by Captain Stansbury as required in certain localities, and which may be needed in others, he recommends strongly the necessity of a light-house at Point of Shoals, and his reasons are conclusive. This light has not been built.

At the request of the commission, the Superintendent of the Coast Survey will immediately commence the survey of the river from Richmond to Harrison's bar, and of the Goose Hill flats, including the topography of the two bends, to determine in either case whether the river shall be straightened by digging through the narrow passes, and accompanied by the necessary tidal and current observations. The importance of tidal observations is apparent from the fact that, according to the observations of Captain Stansbury, the tide rises one and a half foot more at Richmond than at City Point. The pilots are of opinion that this increased rise is maintained both at the Richmond and Warwick bars, and for 10 miles further down the river. The phenomenon is entirely different from what is known of the Appomattox river, where by observation it has been found that there is nearly the same rise (3½ feet) at City Point and at Petersburg.

It is believed that the survey from Richmond, to include Warwick bar, can be completed in two months, with a reconnoissance of Cox's bar, and that a supplementary report can be made before the close of the approaching session of Congress.

The commission are, however, of opinion that the improvements in this river will mainly consist in dredging, and they therefore recommend that it be commenced at the earliest practicable moment.

We would further recommend that an additional appropriation of $45,000 for this river be asked for, for the ensuing fiscal year.

The commission cannot close their report without acknowledging their obligations to the city council of Richmond for the hospitalities extended to them, and for supplying them with a steamboat to examine the river as far as City Point, in which they were materially aided by a committee of the council, and several citizens of Richmond who accompanied them.

JOS. K. F. MANSFIELD,
Capt. Corps of Engineers, and Brevet Colonel.
A. D. BACHE,
Superintendent U. S. Coast Survey.
ISAAC I. STEVENS,
Lieut. Engineers and Brevet Major,
Ass't U. S. Coast Survey.

Bvt. Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington City, D. C.

APPENDIX G G—1.

Engineer Department,
Washington, December 21, 1852.

Sir: A joint commission, consisting of Professor A. D. Bache, Superintendent of the Coast Survey, Brevet Colonel Mansfield and Brevet Major Stevens, of the corps of engineers, have, under instructions from this office, made an examination of James river, in reference to improvements provided for in the river and harbor law of the last session of Congress.

The report of this commission is very encouraging, as to advantages to be derived from contemplated improvements in the obstructed portions of the river, which lie between the city of Richmond and Harrison's bar, eight miles below the junction of the Appomattox.

These improvements will consist of dredging chiefly, if not wholly; but there must be made a good survey of the particular portions needing improvement, in order to determine, in the several cases, the exact extent and the nature of the work. This survey is in progress, and may be finished in about two months.

But though the survey is indispensable to a complete project, there are certain dredging operations as to which there is now a concurrence of opinion; and as these would afford material relief, independent of other operations, I recommend that Colonel Mansfield—who was one of the commission, and will have local charge—be authorized to advertise for proposals for executing any such dredging operations by contract, being instructed, at the same time, should he be satisfied with the terms offered, to submit, for the approval of the department, the contracts he may propose to have executed.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Chief Engineer.

Hon. C. M. Conrad,
Secretary of War, Washington.

Approved:

C. M. CONRAD,
Secretary of War.

War Department, *December* 22, 1852.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX H H.

Appomattox river—Report of the Commission on its improvement.

WASHINGTON, *November* 26, 1852.

SIR: The commission named in your letter of October 1st met at Washington, and proceeded, according to your instructions, to examine the Appomattox in reference to its improvement, to consider and discuss the results of the survey of the river, and to collect information from various sources within reach. They have now the honor to submit the following report, with the necessary plans and estimates:

The Appomattox is eleven and three-eighths miles in length from Rowlett's wharf, in the city of Petersburg, to City Point, where the river enters the James river. The distance from Petersburg to City Point, in a straight line, is eight miles and seven-eighths, or three miles and a half less than the distance by the course of the stream. The tide flows to the falls, a short distance above Petersburg. At City Point, and sixty yards from its wharf, the river is twenty feet deep at low water, and eighteen and a half feet can be carried to Broadway, three miles and one-eighth above City Point, being eight miles and a half below Petersburg. At the Point of Rocks, three-quarters of a mile above Broadway, the river divides into two channels, on the northern one of which, a mile and one-eighth above the Point of Rocks, is Port Walthall, connected by railroad with Richmond, and to which eighteen and a half feet of water can be carried. Above this the channel rapidly shoals, dividing into two arms, which unite again at the mouth of Swift creek, taking a southward course for a few hundred yards, and then joining the main channel. At the distance of a mile and a quarter above the Point of Rocks the southern or main channel divides into two arms, of which the northern is the principal. The southern, having been closed in Mr. Stein's improvement of the river, is still quite shallow. It passes close to the foot of the southern high bank of the river-basin, and is separated from the main channel by low islands, covered in part by wood, and extends two miles and an eighth up stream before rejoining the main channel. The main channel is irregular in depth; twelve and a half feet, however, can be carried to a point nearly opposite to Port Walthall, and seven and a half to the junction with the Port Walthall channel, both at ordinary high water. The distance from the Point of Rocks to this junction by the main channel is two miles and one-third, and by the Port Walthall channel it is three miles. There are several small slues connecting these different channels. The main channel makes an abrupt bend before uniting with the Port Walthall channel. From their intersection to Hare's bar, opposite the head of the southern channel, is about a mile, and up to this a depth of seven and a half feet can also be carried, and over the bar seven feet at ordinary high water. From Hare's bar to Covington, about a mile, the same depth can be carried. Here begins Stein's lower cut through a low marshy island, and which is now the main channel of the river. The former channels along the foot of the northern and southern banks of the river-basin were closed, and remain partially so now. From the extremity of Stein's lower cut to Rowlett's bar, near the mouth of Oldtown run, is seven-eighths of a mile, and a depth of water of six feet can be carried to the bar, and five and a half feet, at ordinary high water, over it. From Rowlett's bar, through Stein's upper cut, to Rowlett's wharf, in the city of Petersburg, about two and one-third miles, six feet can be carried at ordinary high water, with the exception of Page's bar, about one mile above Rowlett's bar, which has only five and a half feet. Stein's upper cut is four hundred and fifty yards in length, and its narrowest part ninety feet in width. In its bottom are three separate beds of rock, having about seven and a half feet water over them at ordinary high water.

At the city wharves, there was, when the survey was made, a depth of 12½ feet at ordinary high water.

It is proper to observe that the depths were taken from mean low water, during the summer, and that they fall short of those generally referred to as the average of depths. The depth, too, has since been increased by the dredging operations prosecuting by the city, which at the time of our visit, at the close of October, had been made at the city and on Page's bar, and were extending to include Rowlett's bar.

The width of the river at Broadway is 150 yards, and at Petersburg 64 yards.

Below Hare's bar there are several small jettees of wood, for contracting the width of the river; also below and above Stein's lower cut. Between the mouth of Oldtown run and Page's bar, on both sides of the river, at intervals, are jettees for confining the river to its present bed. Above this, to Stein's upper cut, are others on the north side; and the old bed of the river, near Petersburg and opposite to Stein's upper cut, is closed by a stone dike. The only rocky bottom now known to exist is in Stein's upper cut.

The jettees were of stakes driven into the river-bottom, and closed by wattling, but are now in bad repair. They are usually crosswise to the direction of the river.

The cuts and jettees were made by a company, whose chartered rights are now held by the city of Petersburg.

The obstacles to the navigation of the Appomattox all lie above Broadway, and extend 7½ miles from the city of Petersburg.

The tides, as derived from observations at City Point, at Broadway, ⅜ mile below Covington's and below Stein's upper cut, and at the city, rise and fall about 3½ feet, with little difference between City Point and Petersburg.

The duration of the flood is about 5¼ hours, and of the ebb about 6¾ hours. Spring tides add about one-half foot to these depths, and neaps diminish them by about the same quantity. The time required for the tide-wave to propagate itself from City Point to Broadway (2¾ miles) is 20 minutes; from Broadway to the station below Covington's, (4¾ miles) is 24 minutes; thence to the city (3¼ miles) is 1 hour and 8 minutes.

The velocity of the current at flood and ebb, at Broadway, is 1 knot, at Covington's ½ a knot, per hour. The direction carries the water in mid-stream, or against one or other bank.

The slope of the river-bed from Petersburg to Covington's is at the rate of 4 inches per mile; from thence to Broadway, 3 inches per mile;

and thence to City Point, 3 inches; making an average from the city to City Point of $3\frac{1}{3}$ inches per mile. In the whole distance the slope is 2 feet $8\frac{1}{2}$ inches.

The surface of the bottom of Page's bar is coarse yellow sand and pebbles; of Rowlett's bar, coarse yellow sand; and of Hare's bar, coarse yellow sand and pebbles. Borings, 4 feet below the surface of Page's bar and 6 feet below that of Rowlett's bar, yielded similar materials to the foregoing; and at 6 feet below the surface of Hare's bar, yellow sand and blue clay. In Stein's upper cut there are three distinct beds of rock, entirely across the channel, at average depths, respectively, of about 6, 5, and 4 feet, at mean low water, and of about 60 yards in length.

The materials forming the deposites in the river-bed are brought down principally in freshets, which occur usually in the spring and autumn, though by no means invariably every season. The freshet of 1851 rose to about $6\frac{2}{3}$ feet above ordinary high water, and that of 1852 about 6 feet at the city wharves. The low islands in the stream and the lateral channels giving room for the water to spread, the rise is but little felt at Broadway. The Appomattox and its branches drain an area of about one thousand square miles. The amount of material deposited in any single freshet has not been ascertained.

Swift creek, draining the country on the north side of the Appomattox, is the only branch of consequence which it receives below Petersburg. Its width at the mouth, where it enters Port Walthall channel, is 100 yards, and its depth in the channel $8\frac{1}{4}$ feet. It is a rapid stream, as its name indicates, and inconsiderable in length, compared with the Appomattox. Its banks are high, and its waters rise rapidly after rains. The freshets in Swift creek are much more frequent than those in the Appomattox; and when its waters are high, it backs up those of the river. It is thus the chief cause of the shoalness of the water in the north channel, between a point above Port Walthall and the main channel, and of the direction of the main channel itself.

The Appomattox river was surveyed last summer by the Coast Survey, by direction of the Treasury Department, at the request of the city of Petersburg, and in part through means furnished by the councils; and a map has been made, showing the river and its banks, which has been placed at the disposal of the commission. The survey included the observations of tides, currents, and of the nature of the bottom of the stream generally; and borings were made below the surface of the different bars. Levels, connecting the different tide-gauges, were also run. There was no necessity for further surveys, but merely for personal examination by the commission, and for borings in Stein's upper cut, and in the old bed of the river near it, to determine the extent of the rock there below the surface of the bottom.

The commission was informed that a map existed, showing the river-bed after the completion of Mr. Stein's improvements; but they were not able to obtain this. A sketch, made in connexion with a project for a ship canal by Mr. Fisk, was placed at their disposal by the committee of the city councils on the improvement of the river. This referred, however, to a condition of the river which it was the object of Mr. Stein's improvements to alter, and which had in effect been much changed by them.

The commission are under great obligation to the committee for the facilities rendered in the execution of their duties, and for the various information furnished to them, and venture to express the opinion that to the foresight of the committee in obtaining an exact survey of the river is due the readiness with which the plans for its improvement have been made, and the absence of delay, which otherwise would have been unavoidable.

The importance of the improvement of the Appomattox river to the city of Petersburg needs no enforcing by argument; but the very thriving condition of the city itself, and its connexion with the trade of the South and Southwest, which renders the improvement a matter of concern to several States, may require illustration.

The statistics obtained from the collector of the port of Petersburg show an export trade for the year ending November 1, 1852, of $4,500,000, an import trade of $7,500,000, and an amount invested in manufactures of $1,772,750; making, in all, $13,772,750. This is annually increasing. During the last twelve months, the tonnage to and from foreign ports has amounted to 20,664 tons, and coastwise to 140,430 tons; making, together, 161,084 tons. The same authority gives the cost of corn and wheat manufactured within the year at Petersburg, at $400,500; of iron worked up in foundries, $55,000; of expenditures in tobacco factories, $775,250; and in cotton factories, $542,000. The number of operatives in the tobacco and cotton factories is 2,800; and nine thousand bales of cotton are worked up in the course of the year.

It is not alone the city of Petersburg, nor even the State of Virginia, which is interested in the improvement of the Appomattox. The various railroads already completed bring up to the wharves the produce of the adjacent country and States; and others in progress will add greatly to the demand for facilities in reaching a market.

The Petersburg railroad opens the valleys of the Roanoke and Cape Fear, and connects Petersburg with Raleigh, in North Carolina; whence the road making to Charlotte joins the South Carolina railroad. During the year ending September 30, 1852, 40,090 tons of merchandise and agricultural products (including 14,077 bales of cotton, 54,415 bushels of grain, and 10,893 hogsheads of tobacco, and 44,589 passengers) were carried over that road.

The Southside railroad, when completed, will bring in the produce of western Virginia, and will, through the Lynchburg and Tennessee railroad, connect with the great line now constructing through Tennessee, to Memphis. The Appomattox canal and boat navigation of the upper river extends between seventy and eighty miles through a good agricultural region. A plank road connects Petersburg with Boydtown, seventy-five miles to the southwest of the city.

After examining the data collected in reference to the Appomattox, the commission is of opinion that, by confining the water to one bed, rendered as nearly uniform in width as practicable, and by deepening artificially, this river may be greatly improved for purposes of navigation.

The rise and fall of the tides is nearly the same ($3\frac{1}{2}$ feet) at City

Point and at the wharves of Petersburg; it may nevertheless be desirable, at particular points, to straighten the bed.

The chief mode of confining the river effectually, and without too great expense, is by shutting off, and keeping permanently closed, the side channels and slues from one channel to another. The next is, by repairing the jettees generally with new wattling, and in some cases with additional stakes, contracting the bed at particular points.

This channel can be made without difficulty, and, by the assistance of the jettees and works closing the lateral natural channels, may be kept open in part. It is, however, certain that, in freshets, portions of the deposites from the wash of the river must remain in this part of the bed, and that new dredging will be required to remove it. The importance of the river is such as to justify such operations from time to time; and when the great development of the trade of Petersburg, which it is now supposed must take place, occurs, much more complete plans may be resorted to, lateral jettees being replaced by continuous linings of the channel.

It is obvious that there is a certain width of the channel at which the current will maintain the greatest depth, and reduce the permanent amount of dredging to a minimum. The engineer charged with the improvement should make this the subject of careful observation; so that when the importance of the commerce of the river shall authorize the expenditure, the present temporary arrangements can be replaced by permanent artificial banks.

To deepen the bed artificially, dredging and dragging may be resorted to; but we consider the former as especially applicable to the case, considering the small velocity of the current, except in freshets, and that for several miles the entire bed of the river must be deepened.

In reference to the draught of schooners and small brigs engaged in the coasting trade, it is desirable that at least twelve feet of water, at high tide, should be carried to the wharves of Petersburg.

The map of the Appomattox, which is herewith submitted, shows the river-bed, and the depths reduced to mean low water. The commission have marked upon the map by two parallel lines, including a blue tint, the channel which they would propose to form by deepening the bed of the river.

Referring to the several obstacles as they occur, in their order, from Petersburg towards Broadway, we would recommend the following operations; observing, however, that much latitude should be left to the engineer who will execute the work, and that his observations may change the relative importance of parts of the work. The projected works are indicated by red lines upon the map.

1. To open the old bed of the river at Stein's upper cut, as indicated on the map, by removing the dike at P, thereby turning the three beds of rock in that cut, which would otherwise involve an expenditure of $14,000 for their removal. This the commission recommend less reluctantly, as their observations, as far as they could be obtained, showed there would be no rock found in the old bed; and in the event of a resort to coffer-dams, the best mode of removing the rock in Stein's cut, it would still be necessary to pass off the water of the river through the old bed.

2. To place some additional short jettees below those on the north side of the river, above Page's bar, as indicated by the red lines on the map, so as to avoid the sudden enlargement of the bed there.

3. To stop the upper entrance of Oldtown run into the Appomattox, so as to bring the waters out below Covington's, nearly in the direction of the main stream of the river.

4. Effectually to close the southern passage, heading opposite to Covington's, by an obstacle near the position of the jettees and mounds marked on the map, and by placing in it the deposite removed from the river-bed by dredging, securing it in such a way that freshets will not carry it back into the river-bed.

5. To close up the south branch, near Hare's bar, by means similar to those just referred to, and as marked by red lines on the map.

6. The commission has discussed carefully the question connected with the improvement of the river at the head of the island separating the Port Walthall and main channels.

The idea was considered of making the Port Walthall channel the main one, by turning all the water into it, and cleaning out the shoal passage now existing between the main channel and the entrance to Swift creek; but the commission is of opinion that this would cause deposites in the deep water near Port Walthall which would injure that port. No injury could, the commission is of opinion, result to Port Walthall by closing this shoal passage; and the current of Swift creek would suffice to prevent the water from becoming so still as to deposite gradually the sediment brought in with the flood-tide water.

The effect of closing this passage would be very good on the main channel, tending to clear off the bar now forming near the upper end of the bend, and to increase the velocity of the ebb in and below it. A jettee properly placed just above this bend, would effect of itself much of this work. (See red lines.)

7. To close several small openings through which the water now passes from the main channel.

8. To dredge the channel of the river thus confined, so as to give twelve feet at mean high water up to Petersburg, on a width, at the bottom, of twenty yards.

The material of the bottom being sand of various degrees of coarseness, will be easily removed. It should be placed at points where it will assist in filling channels intended to be closed, whence it cannot be returned by freshets to the bed of the river. The filling up of the bed, except during the time of freshets, would be an extremely slow operation, and the expense of removing the materials which might accumulate in any one year could not be very great. At all events, it would repay itself to the citizens in the facilities afforded to the commerce of this growing place.

We submit the following approximate estimate for the cost of the improvement of the river:

The whole amount of dredging required to secure 12 feet of water at ordinary high water, will be, in round numbers, 350,000 cubic yards, which, at 20 cents per yard, the price now paid by the city of Petersburg for dredging, will amount to..	$70,000

The amount required for cut-offs, for repairs of old and the placing of new jettees, securing the same by deposites of the earth dredged out, by enrockments, and pavements of stone and pebbles, &c., may be estimated at	$20,000
Cost of dredging-boat and flats	20,000
Contingencies	5,000
	115,000

The commission would recommend that $22,500 of the appropriation for the James and Appomattox rivers be set apart for the latter object, and be applied, first; to constructing the cut-offs and jettees, which require a careful study of the river, and, involving modifications and even entire changes in the plans, must be done gradually; and, second, the dredging out the channel, and that Congress be asked to make, for the next fiscal year, an appropriation of $45,000.

The commission are not prepared to give a detailed estimate of the cost of the works which will be eventually required to give that permanent character to the improvement, to be obtained only by permanent artificial banks throughout its extent. The width of the channel cannot be now determined, nor can the exact character of the banks. The whole problem, in all its details, will be elucidated in the progress of the scheme of improvement recommended in this report.

It would be proper to leave the order in which the details of this work should be undertaken, and all other arrangements for its execution, to the engineer in charge.

JOS. K. F. MANSFIELD,
Captain Corps Engineers, and Brevet Colonel.
A. D. BACHE,
Sup't U. S. Coast Survey.
ISAAC I. STEVENS,
Lieut. Engineers and Bt. Major, Assist. U. S. Coast Survey.

Bt. Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington City, D. C.

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APPENDIX H H—1.

Engineer Department,
Washington, December 14, 1852.

Sir: I have the honor to lay before you, for your action, the report of a commission, consisting of Professor Bache, Superintendent of the Coast Survey, Colonel Mansfield and Major Stevens, of the corps of engineers, on the proposed "improvement of the Appomattox river below the city of Petersburg," provided for in the river and harbor bill of the last session. With this report there is a large map of a late survey of the river, showing the obstructions upon which it is designed to operate, the jettees and dikes it is proposed to erect, and the trace of the channel that it is thought should be opened by dredging.

This project has been under consideration by the board of engineers for river and harbor improvements, whose report thereon is also now laid before you.

The commission recommend that the sum of $22,500, being one-half of the sum of $45,000 granted by Congress for improving the two rivers, James and Appomattox, be set apart for the latter object. This is approved by the board of engineers, and recommended to the approval of the Secretary of War by the Chief Engineer.

The commission also recommend that this money be first applied to the construction of such dikes and jettees as a careful study of the river, by the constructing officer, shall show to be necessary, and next to dredging out the channel, as drawn in the plan. The board of engineers unanimously concur as to the dredging of the channel, but a majority advise that the construction of dikes be restricted to a single one at the junction of Swift creek, until progress in dredging shall show whether other dikes, jettees, &c., are necessary. The Chief Engineer is of opinion, that if the local engineer be instructed, in studying the details of the project in its application to the ground, to keep in mind the cautions, as to these dikes and jettees, of the commission, (of which he was a member,) as well as those of the board of engineers, the design of both will be attained; and, accordingly, the Chief Engineer recommends to the approval of the Secretary of War the design of dredging the channel according to the plan, and of making such dikes and jettees as shall be found to be necessary in the progress of dredging, and of further exact and minute examination of localities. One member of the board approves of dredging as proposed, but objects to all dikes and jettees.

Should the above recommendation of the Chief Engineer be approved, he will consider himself authorized to direct the immediate commencement of the work, and its prosecution with all the vigor that the means will allow.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Colonel Engineers.

Hon. C. M. Conrad,
Secretary of War.

Approved as recommended.

C. M. CONRAD,
Secretary of War.

December 14, 1852.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX I I.

Washington, D. C., *February* 21, 1853.

Sir: In compliance with your orders of October 4, 1852, I have the honor to submit a report and plan of operations for "reopening a communication between Albemarle sound and the Atlantic ocean, &c."

I have carefully read and studied the elaborate and able reports of—

Mr. Fulton, State engineer of North Carolina, September 15, 1820, Senate document 106, 2d session 20th Congress.

Captain Bache, Topographical Engineers, February 12, 1829, Senate document 106, 2d session 20th Congress.

Mr. Gwynn, State engineer, North Carolina, January 29, 1841, Senate document 132, 2d session 26th Congress.

These papers may be said to have exhausted the historical and general discussion of the subject. They are enclosed herewith, and such drawings and maps, calculated to throw light upon the subject, as I have been able to obtain, viz:

Wimble's chart of the coast of North Carolina, 1738.

Coast Survey sketch D, published in 1851.

Coast Survey sketch of Hatteras inlet, 1850.

Coast Survey hydrographic map of Albemarle sound, 1851, scale $\frac{1}{80000}$.*

Coast Survey hydrographic map of the junctions of Albemarle, Roanoke, and Croatan sounds, North Carolina, 1851, scale $\frac{1}{20000}$.

And a copy of Captain Bache's survey of Roanoke island and its vicinity, belonging to his report, but not published with it.

The place of Roanoke inlet, which it is proposed to reopen, was opposite Roanoke island, a little south of the sand-hill called "Nag's Head." The inlet existed from the time of the settlement of the country to the end of the last century, when it finally closed.

There are now two communications between Albemarle and Pamlico sounds: one west of Roanoke island, called Croaton sound, three miles over, and averaging eight feet deep, with a greatest depth of thirteen feet; the other east of Roanoke island, called Roanoke sound, with a principal channel one-half mile over, and averaging four feet deep; and several smaller channels about three-fourths of a mile over, and one foot deep. The distances and depths being taken in both cases along the sites of the proposed breakwaters or dams.

Along the lower part or southern end of Croatan sound, there are marshy islands, which, with the similar formations on both sides, are called the "Roanoke marshes." Here, at an early period, it is supposed, that sound was entirely closed; and then, Roanoke sound being always shallow, the waters of Albemarle, fed by several rivers, and draining a large area, found their way to the ocean through Roanoke and Currituck inlets, and kept these inlets open.

At some period channels opened through Roanoke marshes, gradually increased to a great width, let out the water of Albemarle into Pamlico sound, and thence into the ocean through several inlets, and allowed Roanoke and Currituck inlets to close up.

If, then, we restore the original topography of the country—that is, close the two outlets from Albemarle to Pamlico sound, and reopen Roanoke inlet by art—we shall bring the original causes into action, and may expect the inlet to be kept open by the penned up waters of

*A part of this map, including the locality of the proposed inlet, is printed at the end of this report.

Albemarle sound. In these general matters the three reports nearly agree.

I find nothing to show that Roanoke marshes have opened recently. Wimble's chart, published in 1738, gives to Roanoke and Croatan sounds very nearly their present relative widths, and lays down several wide channels through Roanoke marshes, and, what is remarkable, gives to that communication with Pamlico sound precisely its present least depth—nine feet. This must be regarded as much better authority than the tradition which makes the opening of that channel something recent—something in the memory of the last generation.

Neither is there anything to show that Roanoke inlet was ever used by any but small vessels. In 1738, according to Wimble's chart, vessels bound north would naturally pass out of Currituck, where the low-water depth was ten feet; and vessels bound south, out at Ocracoke through Croatan sound, where they could carry nine feet. The low-water depth of Roanoke was then only six feet.

Before presenting any remarks upon the plans proposed, it may be wel to give some additional description of the natural features of the country.

There is no perceptible tide in Albemarle sound; the level of its surface, and the currents in Croatan sound, are regulated by the winds. Southwesterly winds produce the greatest elevation in Albemarle sound, and northeasterly winds the greatest depression. Southwesterly winds produce a current through Croatan sound towards Albemarle, and northeasterly winds a current in the opposite direction.

The general level of Albemarle sound is about a mean between high and low water of the ocean; according to Fulton, 2½ feet above low water, and 2½ feet below high water, of neap tides. But as the water of the Roanoke, and other rivers which flow into the sound, cannot escape entirely by evaporation, and by percolation through the "banks" into the ocean, the general level of Albemarle must be a little above the mean level of the ocean, and the water flowing out through Croatan sound must somewhat exceed the quantity flowing back. Still the difference is so slight, that all observers speak of the currents through Croatan as being regulated entirely by the wind.

No long-extended observations have been made upon the ocean tides at Nag's Head. Fulton gives as the result of his observations, made between the middle of March and the beginning of May—rise and fall of neap tides, 5 feet; ditto spring tides, 7'.50.

Captain Bache gives 2' 6" as "the greatest oscillation of tide" from December 16, 1827, to January 15, 1828.

At Cape Hatteras, about 50 miles south, a Coast Survey sketch of 1850 gives—

"Greatest rise and fall of tides at Hatteras cove, 5' 3".

"Mean rise and fall of tides at Hatteras cove, 3' 3".

"Least rise and fall of tides at Hatteras cove, 2' 2"."

Another Coast Survey sketch, published in 1850, gives for Hatteras inlet, 13 miles west of Cape Hatteras—

"Greatest rise and fall of tides on the bar, 6 feet; mean, 3 feet; least, 2 feet.

"Greatest rise and fall at the anchorage between the inlet and the bulkhead, 3 feet; mean, 2 feet; least, 1½ foot.

Greatest rise and fall on the bulkhead, 2½ miles from the bar, and 1¾ inside the inlet, 1½ foot; mean, 1 foot."

The last series is highly significant, as showing how little the level of a large sound is affected by ocean tides, even in the immediate neighborhood of an inlet.

The water in the upper or western part of Albemarle sound is entirely fresh; in the lower part, it is brackish. In Roanoke sound, at Nag's Head, oysters are now growing; but there were none there prior to the storm of 1846, which opened several inlets in Pamlico sound, three of which are still open: Oregon inlet, ten miles from Nag's Head, nearly dry at low water; Hatteras inlet, thirteen miles below Cape Hatteras, with five feet at high water on the bulkhead; and one between Ocracoke and Cape Lookout, with four feet at low water on the bar, and no bulkhead. These depths may not be strictly correct, the source of information not being always very reliable.

The Roanoke marshes, and all the marshes which I saw on the main lands and islands, (I examined all those which lie in the way of the proposed breakwaters,) are very low—less than one foot above the water at the time; and I was told by many persons that the water stood near its ordinary level.

On the main land a marsh begins, say, one mile below Fleetwood Point; gradually widens to 1,200 yards (by estimate) at that point; and goes on enlarging to the lower end of Croatan sound, and beyond, forming a part of Roanoke marshes.

On Roanoke island a marsh, beginning a short distance below Pork Point, extends, I believe, over the greater part of the southern portion of the island.

The dam over Roanoke sound must pass over at least a mile of marsh on Roanoke island.

The pine trees on Roanoke island and the main everywhere indicate to the eye the border of the marsh, and the beginning of higher ground; but I have felt much in want of an accurate topographical map; and shall probably be able to obtain one soon from the Coast Survey office, the surveys having been completed.

The reports agree in recommending the same positions for the dams. At these places they are best protected from the winds and waves, and cross the sounds where the water sections are nearly the least.

The following section over Croatan sound will give some idea of the work required there. [Note.—Figure 1 on the plate presented at the end of this report, being a section over Croatan sound, along the line of the proposed breakwater, will give some idea of the work required there.]

The following section through Roanoke sound, reduced to the same scale with the preceding, is taken from Bache's map—that of the Coast Survey being incomplete at this locality. [Note.—Figure 2 in like manner illustrates the work required to construct a breakwater over Roanoke sound.]

Since the survey of Fulton, there seems to have been no sensible change in the soundings and water-lines of the two sections.

To show the dredging or scouring required to open an $8\frac{1}{2}$ or 12-feet channel from Albemarle sound to the Atlantic ocean, passing round the head of Roanoke island, down Roanoke sound, and through the proposed inlet, I give the following section. [NOTE.—Figure 3 is given to show the dredging or scouring required to open * * * * through the proposed inlet. The upper ground-line is that of the Coast Survey map, 1851; the lower line, that of Captain Bache's map, 1829.]

Horizontal scale to the vertical, as 222.22 to 1.

Fulton's first plan—stone.

[See sketch E, at the end of the volume.]

For Croatan sound, Fulton proposes an embankment, 15 feet wide at top, with a slope of 3 to 1 on the north side, and 2 to 1 on the south side; and rising 5 feet above the ordinary level of the water.

For Roanoke sound and the marshes, he proposes embankments of like height and width, but with steeper slopes.

The quantity of stone required for his embankments I find, by cal culation, to be—allowing one ton for 16 cubic feet—nearly 700,000 tons. This stone, delivered and put in place, will cost at least \$3 50 a ton, making \$2,450,000 for this item alone.

Suppose these embankments made: let us see how much the water will rise in Albemarle sound above the water on the other side of the breakwater. According to Fulton, the area drained is 17,000 square miles; and the quantity running into the sea, annually, through Croatan and Roanoke sounds, is equal to a sheet of water 12 inches deep covering that area. This gives 15,000 cubic feet per second. The water-sections along the proposed breakwaters amount to 140,000 square feet. The void spaces in the stone make up one-fifth of the volume; and the various little water-ways, running through, cannot be less than one-twentieth of the water sections.

This gives us, for all the outlets through the stone, 7,000 square feet. Now let the water rise on the Albemarle side, until it has attained the formidable head of seven-eighths of an inch. All the little streams will run through with the velocity due to that head, viz: $2\frac{1}{7}$ feet per second, nearly.

$7{,}000 \times 2\frac{1}{7} = 15{,}000$ cubic feet per second = the supply.

The difference of level, therefore, is less than an inch, and cannot be increased.

If we suppose so many small stones used in the breakwater as to reduce the voids for running-water to one twenty-eighth of the water sections, we shall be able to accumulate a head of $1\frac{2}{3}$ inch.

But one conclusion can be drawn from these calculations. Fulton's stone embankment would be utterly useless; its tendency to pen up the waters of Albemarle infinitely small.

Fulton's second plan—timber and earth.

[See sketch F, at the end of the volume.]

Two rows of piles, hewn or sawed on two parallel sides, driven, side by side, 20 feet apart; the interior space filled with mud and sand; and the piles protected from the worms "by a sloping bank of earth or sand, with an easy inclination," rising to "the ordinary surface of the water."

The piles above the ordinary surface of the water will rot and disappear in ten years. Suppose the work completed: the same winds which now produce a strong current through Croatan sound will then produce a difference of water-level on the opposite sides of the dam. The water standing on one side above the ordinary level will flow over with a velocity proportionate to the difference of level. It will loosen the sand and mud between the piles and carry it off. It will force the water through the seams between the piles in such a manner as to remove the external embankment to a considerable depth. Capt. Swift having run out from the shores of the Cape Fear, in 8 feet water, jettees of sheet-piling, driven close together, side by side, found, after a time, 20 feet water on both sides of the jettees, the water remaining, as before, a short distance off, 8 feet deep. Suppose this interior embankment perfectly protected: still the increasing water-fall will remove the external sand and mud, and expose the piles to the salt-water worm. Eighteen months after exposure the piles will disappear, and with them all which they supported. In this long line of embankment, without any help from the overflow, the *waves* could not fail to lay bare the piles in many places, and in some places for many feet in depth.

I have spoken only of ordinary weather—ordinary agents. Superadded to these, we know that every ten years the works will be visited by some great storm like that of 1846. Can any one doubt the result?

If we suppose the embankments to come up to the top of the piles, we only postpone the final result. In any strong wind, the waves, turned into formidable breakers upon those gentle slopes, will ride with great velocity over the crest, carrying over and dispersing the loosened sand and "soil."

Captain Bache's plan—a tide-lock.

The scouring power of all the water that can flow out of a tide-lock does not seem to me sufficient to keep the *outlet* open. Every flood tide, and the ebb also, until the gates are opened, will bring a great deal of sand along the beach and leave it in the channel. The overflowing water, if able at first to remove all the sand, will carry it out into deeper water, where a part will be carried away, and a part left to accumulate from day to day and form a *bar*, too distant to be removed by so small a cause—the small current from the lock losing its power by diffusion.

Plan of Mr. Gwynn.

[See sketch G, at the end of the volume.]

For the dam across Croatan sound, Mr. Gwynn proposes "cribs" 20 feet square, of round logs, with a row of cross-logs in the centre, and kept in position by five piles on each side. Sides and top of dam to be protected by stone.

The history of this embankment, I think, would be this: The incessant play of the waves between high and low water in every wind, and, during high winds, the violent action of the breakers, caused by the sloping sides, and extending from some distance below low water to the top of the embankment, would derange the stone revetment directly, and let it down in some places; in others, loosen and remove the mud beneath the revetment. The water, thrown at times with tremendous force into every opening, could not fail to have the latter effect in many places. The stone falling into the place of the mud removed, will leave the logs exposed to the air. The logs will then rot in a few years and disappear down to the ordinary level of the water. The overflow then comes and carries on the work of degradation with accelerated force.

I do not say that in the plan of Mr. Gwynn, and the second plan of Mr. Fulton, the works could not be carried so high as to postpone the final destruction for some years; but this would cause a vast increase of expense: it would expose the dams to the imminent if not certain danger of being turned at each of the proposed four ends, or, to avoid the latter evil, require new and vastly more expensive *sites.*

The timber in these works is of little use after the first construction. The dam must consist essentially of mud or sand; and the timber not protecting these materials from the waves and currents, can add but few years to its duration.

To secure the work against breaches in very severe storms, the nucleus or back-bone of the dam must be stone, and this must have all the voids filled with sand and mud; and this "soil" must be constantly maintained—say 5 feet above the ordinary level. But I could not recommend this modification of the plans proposed, because it is certain that a wall of concrete, laid in water, would be a great deal cheaper and far more certain to fulfil its object.

Let us suppose Roanoke inlet re-opened: What are the causes which tend to close it? How shall they be counteracted?

One most powerful cause, remarkable for its almost ceaseless activity, is, I believe, to be found in the translation of sand along the beach. This operation, always unnoticed by the ordinary observer, has been well known to engineers since the time of Smeaton. It is the prominent point of discussion in his own and many subsequent reports upon the harbor of Dover, England.

The remote cause may be the wind, or the tide, or the swell of the sea, caused by a distant wind; but the immediate agent is the *wave,* which, breaking on the beach, moves on in its own proper direction—almost always oblique—up the slope, carrying with it the sand and any other matter in suspension: there losing its onward impetus at the top of the slope; and retiring, under the law of gravity, by the line of greatest declivity, at right-angles to the shore, it takes back and transfers its load to the next wave, to be again carried up the slope, again to retire, and so on.

Moving in these zigzag lines, the whole surface of the beach is in a state of motion, travelling as near the direction of the wave as the direction of the shore will allow.

Referring to your own report of November 9, 1833, published in Ex. Doc. No. 1, 1st session 23d Congress, for the first explanation of this curious phenomenon, so simple and obvious when once understood, I remark, that on the seacoast this operation has hardly any period of repose. I have always observed on the beach, that the waves beat upon the shore with more or less violence even with an off-shore wind, and always with considerable violence on the flood-tide; and I have never yet seen the sea still along shore, even in a calm. The translation, however, is by far the greatest when the wind blows on shore, and increases with the violence of the wind, or rather with the size of the waves, and the distance from the shore at which they begin to break.

To illustrate what has been said—[see sketches H and I, at the end of the volume.]

When the wind, on any coast A B, blows in the quadrant A C d, towards land, the sand, light pebbles, &c., all along shore, will move towards B; they will cease to move when the waves come on at right-angles; they will move back towards A when the wind changes to the quadrant d C B. If the winds blow about equally in these two quadrants, the beach will remain always about the same, so far as this translation is concerned; but if there be anywhere on that coast an inlet, the sand thus beat along to it can no longer return with a change of wind. We shall then have a variable but continual stream of sand pouring into the inlet, narrow and small in light winds, wide and very great in gales and storms. When it stops coming on one side, it soon begins on the other. It is always coming—never returning.

What becomes of this endless supply of sand? There are but three possible dispositions of it.

1. A part of it is deposited at the points of land on each side of the inlet, taking the place of that which the previous flood or ebb has carried away. And here we see the reason why inlets do not increase to an indefinite width; the depositing power of the translated sand, or "shingle," is nearly constant, because its quantity is constant. When the inlet is well situated, narrow, and deep, the removing power of the flux and reflux tide is very great; it diminishes with the width, and when the two forces become equal, the width is fixed, though not the place of the inlet; the latter, from causes above intimated, sometimes moving, as it were, bodily, in the direction of the prevailing wind.

2. Another portion of this sand is taken up by the flood-tide and deposited on the inner shores, and shoals and bars. These inner bars—sometimes called bulkheads, sometimes swashes—are a characteristic of the inlets of Pamlico sound, and probably of all inlets in similar situations; the interior reservoir being probably a great deal too large. The flood-tide, after passing the inlet, not being constrained by land to

follow any particular channel, expands in all directions, lessens its velocity by diffusion, and leaves a deposite along a circular rim or line of shoals and ever-shifting channels.

3. The remaining portion of the transported sand is taken up by the ebb-tide and left upon the outer shoals and bars, or carried still farther out.

No one will deny that beach-sand thus finds its way to the inner and outer bars. But we cannot stop here. I have come to the conclusion that *the whole exterior formation of outer bars and shoals consists mainly of sand transported by the waves in zigzag lines along the beach to the inlet, and carried out by the ebb-tide.*

It is remarkable that this source of material has not been recognised in any explanation which I have seen or heard of, as having any agency whatever in the formation of our seacoast bars. At many inlets I believe it to be the principal agent, as it is well known to have been the sole cause of certain river-bars, or bulkheads, on Lake Erie and other northern lakes.

This connexion between the beach and the bar has been long observed at Dover and other harbors in England; but in those cases only, so far as I am informed, where the "shingle" had a decided motion in one direction. But I apprehend the connexion is equally close where the shingle is continually oscillating to and fro. It seems to me an obvious and necessary truth, that the total quantity of sand poured in from the beach to be got rid of by the inlet, and to be accounted for in our investigations, is precisely the same whether the wind blows always in one on-shore quadrant, or equally in both—the formations of land on both sides being the same.

Speaking now of the inlets on the coast of North Carolina, and all others of a similar character, to verify the statement underscored above, I remark:

I. The deposites on the outer bars and shoals are sand; therefore they do not come from the rivers, which bring down only mud and clay.

II. They do not, after the first opening of the inlet, come from the interior sounds and harbors, for these are almost everywhere more or less rapidly filling up.

III. They do not in any considerable degree, if at all, owe their existence to the direct action of the flood-tide, which, at the mouth of an inlet, differs little from a current; for the ebb-tide being superior to the flood, both in velocity and duration, is assisted by the natural tendency of sand to work down an inclined plane, and must carry out more than the flood brings in.

IV. The deposites cannot be left by the general flood along the line of no motion or change of direction between its waters and those which flow into a particular harbor; for that line, according to my observations, is far outside the line of bars and shoals. Moreover, in some situations, as at New inlet, on the Cape Fear, the general and local floods are in the same direction, and that line could not, in the nature of the case, be where the bar is. Moreover, bars are formed at the mouths of rivers which flow into lakes where there are no tides. This remark is applicable to III.

V. The winds and tides, and their currents, remove bars and shoals as soon as the inlet closes—witness Roanoke; and I am disposed to think that while they may occasionally co-operate in the formation of those obstacles, their general tendency is quite the reverse; that they tend to destroy, to abrade, to wash away into deep water, to scatter the material carried out by the ebb-tide. These scattered elements may find their way again to the beach, and repeat their former march to the inlet.

I am well aware that tidal and other currents are most powerful causes of change at the bottom of the sea and on the shore. For example: where the flood-tide comes on in a direction parallel or oblique to the shore, and retires perpendicularly, we might look for a continual motion of the lighter matter at the bottom in the general direction of the flood. In this, and many other ways, the bottom of the deep may be disturbed, and its particles transported gradually and systematically towards the land, and finally to the beach, there to be landed and taken up by the wind, or to join the column of kindred particles always moving to or fro under the mechanism of the last wave.

It is easy to conceive of a translation in deep water due to the tide, and a counter-translation along the shore due to the prevailing wind. The first may be the continual feeder of the second, and receive back a portion of its transferred load at the mouth of every inlet.

When the wind is very light, and then only, according to my limited observations, the direction of the waves at the beach is the general direction of the flood-tide for the time being.

The inner bars, bulkheads, and shoals owe their formation and increase mainly, I think, to the same cause—sand brought in from the beach and taken up by the flood-tide.

Another cause tending to close inlets, differing rather in degree than in kind, is the storm and tempest. Then the waves break in deep water, and the grand scene of translation goes on further out from the ordinary shore. But the effect is most remarkable at an inlet. Every sea, striking the shoals which lie on the windward border of the outer channel, becomes a breaker, takes off something from the surface of the shoal, and leaves it, when its motion is checked, in the channel. In this way, by this levelling operation, the channel is rapidly obstructed; and on the flood-tide, vast quantities of sand pass from the beach and the shoals, along the channel, into the inlet.

The best inlets in North Carolina are not exposed to storms. Old Topsail, at Beaufort, is sheltered by Cape Lookout, and Cape Fear inlet by Cape Fear.

Storms always commence in the northeast; pass round by east and south to southwest, expending their fury before they pass the south.

All inlets between Cape Hatteras and Cape Henry must be exposed to the full violence of all storms, in addition to those more ordinary obstacles common to all the inlets. For this reason, I suppose Roanoke and Currituck inlets filled up while Ocracoke remained open. But we may derive some encouragement from the fact that Roanoke was so long in filling up after all the present difficulties were in full force. Croatan sound was wide open in 1738; Roanoke closed up in 1800.

It would seem, therefore, that with some positive aid from art, it might be kept open indefinitely, and improved in its capacity.

Let us trace the course of a storm in North Carolina. It begins and blows a day or two in the northeast: the tide is immediately several feet higher than usual, and pours into Albemarle and Pamlico sounds through all the inlets. At the same time, the water of Albemarle is blown west and raised many feet at its western end, and the water of Pamlico is raised in like manner towards the northwest. The wind blows furiously from the east—the tides continue high; the wind passes rapidly through the southeast into the south and southwest. The ocean tides by this wind are made low; the waters of Albemarle and Pamlico, heaped up in the west and northwest, are blown back towards the ocean; then the level of the embayed waters, high before, is raised several feet above the "banks" in many places, and six or eight or ten feet above the ocean. New inlets are formed—old ones are scoured out. This is the history of every storm. An inspection of the map will show that the greatest head of water, under this southwest wind, must be at Roanoke island, where the two sounds are, as it were, blown together. To this accumulation, and its scouring action upon any existing inlet, I attribute the fact that "New inlet," a little below Roanoke island, has been always open since the date of Wimble's chart. Roanoke inlet also may have derived some benefit from its proximity to this accumulation. Roanoke marshes could never have been any obstacle to the union of the waters of the two sounds during a storm, for those marshes are then submerged several feet.

I give an outline of Roanoke inlet, as it appeared a few years before it finally closed, furnished by Mr. Etheredge, 76 years old—now living on Roanoke island. [See sketch J, at the end of the volume.]

He says that, when a young man, he was in the habit of fishing constantly at Roanoke inlet; that he was often compelled to wait for high water to cross the bar near the mouth; that the point of land P was continually making south; that the inlet was closed several times by gales of wind, and re-opened by ebb-tides; that the numerous islands opposite the old site were, in his opinion, caused by the inlet; he remembered when some of them were naked shoals.

Whether I am right or wrong in ascribing pre-eminence to a particular cause, it is certain that the amount of sand always moving along the beach and passing into every inlet is enormous. Whenever the wind in one seaward quadrant prevails, generally, over the wind in the other, the longest jettees afford only a temporary barrier to the moving sand. The windward angle fills up and the suspended matter passes round the head.

It is also perfectly certain, that so far as we can keep out this sand from the inlet, so far shall we diminish the material of the inner and outer bars and shoals, and assist the tide in keeping the inlet open.

The plan which I shall now recommend does not, by any means, exclude the dams. Should the piers, contrary to my expectation, prove ineffectual, we may then resort to the plan of the dams, of which the executed work will be, almost all, a part.

I propose, by excavation and dredging, to re-open the inlet about one hundred and fifty yards wide and six feet deep, at the ordinary stage of the water, and, at the proper time, to run out a jettee of large stones, or cubic masses of concrete, resting on grillages of pine logs, on each side of the opening—giving to them and the exposed points the necessary protection.

All that I could learn indicated a slight but positive prevalence of the wind in the northeast quadrant. For that reason the jettee C [see sketch K, at the end of the volume] must be commenced first, and made the longest. It must be extended slowly as the windward angle fills up; for while that angle is not full, the jettee is fulfilling its object; and by waiting until it is full, and begins to run over, we shall build the jettee in shallow water. Suppose we have in this manner extended this jettee one-half mile, to a line where the water is now 34 feet deep. The windward angle will be full as high as the jettee, and the accumulation will probaby extend two or three miles north. This body of sand, which the pier will have kept out of the inlet, would form a very respectable set of bars and shoals. But in another manner the pier will act, I think, to exclude the sand. When a northeast wind passes round to the southeast, the accumulation will begin to travel back towards the north, and be reduced to the dotted line A a C, and this reservoir will be partly empty, so that the wind may blow again a certain time from the northeast without transmitting any sand round the head. I infer, therefore, that this pier, properly extended, will exclude a large proportion of the sand which would otherwise come into the inlet from the north.

The jettee D will exclude a still larger proportion of sand from that direction, for the prevailing northeast wind will blow back, or south, the accumulations in the angle D E F, and not often allow it to be full.

As the piers are extended the exclusion of the sand will become more perfect, and the depth will, I think, increase of itself in some proportion to the extension. Moreover, by this extension the outer bar and shoals will be thrown out from the general shore-line into the way of the currents, which, on this straight coast, have considerable force.

The inlet must be allowed, as far as possible, to fix its own width. For this purpose the southern pier D must be delayed as long as possible. When we do commence that pier, we must remember that too great a width is less to be feared than too little; for the former evil will necessarily correct itself, while the latter may require large expenditures for the protection of the points.

The piers are almost sure to work well in all ordinary weather; and to this habitual action we may look for a removal of the obstructions caused by extraordinary weather—by great storms.

The stone should be as large as our means of transportation will admit—say from 500 pounds to four or five tons. I am disposed to think that cubic masses of concrete made of oyster-shells will be found a good and cheap material.

The place of this inlet is immediately north of Nag's Head hill, between it and the beginning of a range of hills extending some miles north. The hills are in places quite high; opposite the proposed inlet, probably 60 or 70 feet.

Nag's Head is directly in the way. It is, however, travelling south, so that we have less to fear from it than from the opposite range. Any place for the inlet south of Nag's Head would require a great deal additional dredging, and would be otherwise objectionable.

On the Coast Survey map A, I have drawn, in red, the outline of the proposed dredging and excavation, the two piers, and the final outline of the inlet. All but the first must be taken as mere conjectures, at least so far as the distances and proportions are concerned. I have supposed the piers, after some years of gradual extension, to have attained the respective lengths of half and quarter miles. These will require for their protection occasional rectangular offsets on the inside, and the points or shores of the inlet will probably require similar works.

Estimate for channel 150 *yards wide and six feet deep, &c.*

Excavation above water, 900 yards × 150 yards × 2 = 270,000 cubic yards; at 15 cents	$40,500 00	
Excavation under water, 422,000 cubic yards, at 25 cents	105,500 00	
		$146,000 00
North pier, 2,640 feet long, raised 4 feet above ordinary high water, averaging 12 feet high, 10 feet wide at top, sloping 45° on both sides—43,560 tons of stone, at $4 25	185,130 00	
South pier, of same height and width, and half the length	92,565 00	
Add for protection of piers and protection of points of inlet, ¼	69,423 75	
		347,118 75
Contingencies		6,881 25
		500,000 00

These operations, I believe, will give a harbor and channel of entrance for vessels drawing from 12 to 15 feet. There is, however, great probability of an inner bar or "swash" at the head of Roanoke island. With a good harbor this will be but a small evil.

The $50,000 already appropriated should be all applied, I think, to excavation above and below water, commencing in Roanoke sound.

I do not regard any other agent than an overseer as necessary. I have secured the services of a very good one.

I suppose it will be necessary for me to visit this work about once in six weeks.

The particular dimensions of the piers stated above I do not give as fixed, but as matters liable to be changed, both before and after the piers are commenced.

Very respectfully, your most obedient servant,

D. P. WOODBURY,
Lieutenant of Engineers.

Gen. JOSEPH G. TOTTEN,
Chief Engineer, Washington, D. C.

APPENDIX I I—1.

ENGINEER DEPARTMENT,
Washington, April 6, 1853.

SIR: On the 30th of August, 1852, the sum of $50,000 was appropriated for "re-opening a communication between Albemarle sound and the Atlantic ocean, by the construction of a breakwater across Croatan sound."

After a careful and thorough examination, it is believed that an inlet may be opened, and kept open, without "the construction of a breakwater across Croatan sound," and at an expense, perhaps, less by two millions of dollars than that of the breakwater plan.

The question arises, are we at liberty to apply the appropriation to anything else than the breakwater?

In 1820 Mr. Fulton, State engineer of North Carolina, presented an elaborate report, in which he recommended—

1. A breakwater across Croatan sound;
2. A breakwater across Roanoke sound;
3. An artificial opening of the inlet by dredging and excavation.

In 1829 Captain Bache, of the topographical engineers, and in 1841 Mr. Gwynn, State engineer of North Carolina, after full examination of the subject, expressed their opinions in favor of the same steps.

An inspection of the accompanying chart will show that "a breakwater across Croatan sound" cannot, by any possibility, without other measures, "re-open a communication between Albemarle sound and the Atlantic ocean."

It is a question, whether the law, taken literally, has any sense whatever. To give it meaning, it may be necessary to understand the "construction of a breakwater, &c.," as including the entire plan recommended by Fulton, Bache, and Gwynn, of which those words give only the first step.

That this was the idea of the framers of the law is not unlikely; because the plan of the two breakwaters or dams, and an artificial opening of the outlet, have been discussed in the neighborhood of Albemarle sound for several generations.

If we assume the words "construction of a breakwater, &c.," to mean the entire plan spoken of above—that being the only plan hitherto proposed—it would seem that we are at liberty to commence with another part of that plan, viz: opening the inlet directly by excavation and dredging.

Future legislation may relieve us of the necessity of even resorting to the breakwaters, unless the necessity therefor shall appear in the progress of operations.

Another view of the subject may be presented. Suppose the money already appropriated to be more than sufficient to construct the "breakwater across Croatan sound;" could not the balance, without further legislation, be applied to such other measures as were necessary to "re-open a communication, &c.?" Must not the re-opening of the communication be regarded as the great and sole object of the law? Shall the obvious great national object of the law be injuriously delayed for a technicality?

As persons in high standing, and who were mainly instrumental in carrying the appropriation through Congress, have expressed themselves as anxious for such a construction of the law as will allow us to apply the appropriation immediately to an artificial re-opening of the inlet by excavation and dredging, may I beg to suggest that you refer the question to the Attorney General.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

WASHINGTON, *April* 11, 1853.

SIR: I have your communication of the 8th instant, in regard to the construction of the provisions of the act of August 30, 1852, making an appropriation to re-open a communication between Albemarle sound and the Atlantic ocean.

The words of the statute are—"For re-opening a communication between Albemarle sound, North Carolina, and the Atlantic ocean, by the construction of a breakwater across Croatan sound, fifty thousand dollars."

As a general point of statute construction, I am of opinion that "the re-opening of a communication" is the principal, of which "a breakwater" is but the incident, or a means to an end. The plain sense of the statute is to accomplish the object. The indication of a breakwater, as a means, is not to have the effect of defeating the main object. Such specification is directory only, not mandatory, still less exclusive of the main object. Of course the appropriation is to be applied, primarily, to the re-opening of a communication, without necessarily including, or necessarily excluding, a breakwater across Croatan sound.

The particular points in the present case, from which it appears that, in the judgment of experts, the breakwater alone would not have the desired effect, but might, on the contrary, serve to exclude the direct means to the proposed end, may serve to illustrate, by way of example, the propriety of the conclusion of law here presented; but the conclusion itself is independent of the paruicular points, and rests on a logical analysis of the true legal intendment of the act of Congress.

I am, sir, very respectfully, your obedient servant,

C. CUSHING

Hon. JEFFERSON DAVIS,
Secretary of War.

Decision of the Secretary of War, endorsed on the foregoing opinion of the Attorney General.

Referred to the Chief Engineer. Congress having by law indicated the means by which the object is to be effected, as well as the object itself, I do not feel warranted in directing the plan thus laid down to be abandoned and another to be adopted.

JEFFN. DAVIS,
Secretary of War.

WAR DEPARTMENT, *April* 22, 1853.

APPENDIX K K.

WASHINGTON, N. C., *January* 29, 1853.

SIR: In compliance with that part of your letter of October 4, 1852, which relates to "completing the improvement of the harbor of Washington, North Carolina," I have the honor to submit the following report and plan of operations.

This town numbers about 3,500 inhabitants, and is rapidly growing. It is on Pamlico river, 75 miles from Ocracoke inlet, and at the head of navigation for sea-going vessels.

An appropriation of $5,000 was made for the harbor in 1836, and another of the same amount in 1838. Under the superintendence of Captain Swift, of the engineers, and subsequently of Captain McClellan, of the topographical engineers, these appropriations were applied to the removal of a shoal a little below the town, by steam dredge-boats borrowed from other appropriations. Through this shoal, 600 yards in length, a channel was made 50 yards wide and 8 feet deep. Seven feet was the depth of the shoal before dredging. Eight feet is all the depth required, for that is rather more than the high-water depth of the bulkhead or inner bar of Ocracoke inlet, the best outlet from Pamlico sound.

From the report of Captain McClellan of December 30, 1839, and from information furnished by well informed persons here, I infer that there is little now required but the removal of some logs and stumps from the channel of the river, below the shoal, and from a half to one and a half mile below the town.

The improvement seems to have been of a permanent character, and has proved, they say here, a very great benefit to the town.

I have been told, however, by persons very familiar with the locality, that when the wind blows strong from the northwest, vessels drawing seven and a half feet are still liable to ground upon the shoal, and that a little more dredging there is desirable. They agree, however, that this is secondary in importance to the removal of those logs and stumps which come within eight feet of the surface at the mean level of the water. These are exceedingly numerous below the level of eight feet; but out of fifty which I struck in floating once down the river, not more than one, I think, would have required removal. They occasionally break or unship a rudder, but I have not heard of their causing any serious losses.

I propose to remove all those logs and stumps which come within eight feet of the surface, for a width of fifty yards; and if the appropriation holds out, to extend this to one hundred yards, so as to give room for beating; and should anything then remain, to apply it to the removal of the shoal as far as it will go.

The logs can be removed, I think, by means of windlasses, working upon two flats or scows, firmly fastened to each other at a certain distance apart. The scows here are well adapted to the purpose, being quite large and strong. Moreover, they are frequently used in this manner in preparing ground for drag-nets. I am disposed to think, too, that the soft mud of the shoal may be removed by men standing in these scows, at an expense not exceeding sixty cents a cubic yard. At Wilmington they pay thirty cents a cubic yard for steam-dredging.

No survey was ever made of the shoal—at least, none transmitted to Washington; and the recent appropriation (five thousand dollars) being small, I do not think any elaborate preliminary survey advisable. The river is narrow, and it will be impossible to mistake the channel.

May, I am told, is the proper time to begin, the fisheries being then over, and many laborers then usually seeking employment.

A little before that, I should wish to find all the logs and stumps within eight feet of the surface, and for fifty yards in width; mark the place of each by a pole, securely planted in the mud, and numbered, and make a note of its position by estimated distances from other poles or by ranges; so that if any poles should be removed, the fact may be known and the evil remedied with ease and certainty.

These logs and stumps may perhaps be most easily found by suspending an iron rod horizontally, eight feet below the mean surface, to two boats, kept at an invariable distance apart, and causing the boats to pass slowly over all the ground; marking, by lines of frequent and temporary stakes, the path of the outer boat, and keeping up tidal observations on shore to regulate the level of the rod.

The water-level depends almost solely upon the wind, the lunar tide being hardly perceptible.

The work in my absence may be intrusted to an overseer or master-workman. I do not regard any special agent as necessary.

Washington is on the way from Smithville to Nag's Head. During the time of active operations, it will be necessary, I think, for me to visit these improvements once in every six weeks.

Please direct communications for me to Smithville, Brunswick county, North Carolina.

Very respectfully, your most obedient,

D. P. WOODBURY,
Lieutenant Engineers.

Gen. Jos. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX K K—1.

Engineer Department,
Washington, March 26, 1853.

Sir: The board of engineers for river and harbor improvements have had under consideration the project of Captain D. P. Woodbury, corps of engineers, for completing the improvement of the harbor of Washington, North Carolina, and give it their approval.

This project is to remove from the channel all the logs and stumps which came within eight feet of the surface of the water for a width of 50 yards; and if the appropriation holds out, to extend this to 100 yards, so as to give room for beating; and should any means then remain, to apply them to the removal of some irregularities in the depth of water on the shoal through which the channel passes.

I concur in this plan of making the improvement, and have the honor to submit it for your favorable action.

The report of Captain Woodbury and that of the board of engineers are herewith.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Colonel of Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved: JEFFERSON DAVIS,
Secretary af War.

WAR DEPARTMENT, *April* 6, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX L L.

WASHINGTON, D. C., *March* 30, 1853.

SIR: In obedience to orders from the War Department to examine and report plans for "improving Cape Fear river at and below Wilmington," we have examined in person the river and its two communications with the sea, with the aid of various reports, maps, and charts, of which a list is given in the Appendix, and of which copies are enclosed herewith, or references made to the originals in the Engineer department, or printed copies in the Congressional documents.

Anticipating, here, facts which will be stated in detail below, we find that a harbor which once afforded easy access to vessels drawing nineteen feet of water will now admit only those with less than thirteen; and we cannot but regard this deterioration as a great national misfortune, and the restoration of the inlet to its original state as a work demanded by the general interest of commerce, both in peace and war.

Beaufort harbor, ninety miles east of the Cape Fear, is the only harbor of refuge for vessels drawing over thirteen feet between the mouth of the Chesapeake and Charleston, along a coast exposed to frequent and violent easterly winds and storms. An inspection of any general map of the coast will show the importance to our shipping of a port of refuge, a place of repairs and supplies, at the Cape Fear, which may be regarded as the head or most retired part of the great bend, in which vessels frequently encounter easterly or southeasterly storms, and where, annually, many are wrecked, and more still dismasted and otherwise crippled. The immense trade carried on between points south of the Cape Fear, New Orleans, Mobile, Pensacola, Key West, Savannah, and Charleston, and the northern cities—Baltimore, Philadelphia, New York, Boston, &c.—and between the former cities and Europe, is maintained in vessels drawing about fifteen or eighteen feet water, and the larger part of it passes along the coast of North Carolina near the mouth of the Cape Fear. Can any one calculate the utility of this port as a port of refuge—a place of escape from the elements and the enemy—a place of supply and repairs when crippled—for vessels of that class, in time of war? Other nations, at enormous expense, have made artificial harbors on coasts not badly supplied with natural ones. Shall not we, at comparatively small expense, restore what nature once furnished? Are not the arguments which justify and require the erection of light-houses applicable to this improvement?

But these are not the only considerations which recommend the restoration of this inlet. The Cape Fear is the natural and actual outlet of the products of twenty-eight or more counties in North Carolina, and several counties in South Carolina, and the railroads and slack-water improvements now in progress and contemplation will greatly extend its trade with the interior. In one item of future exports other southern States are interested, and the whole country must be so in time of war. Coal in large quantities and of an excellent quality has been found upon the waters of the Cape Fear, about 120 miles from its mouth, and at no distant day, it is supposed, will become a regular article of export. We may therefore have—what must be regarded as a national benefit at all times, and in time of war as of very great importance—a depôt of coal upon the Cape Fear, independent of supply from the North, and beyond the reach of an enemy. But this depôt will, in a great measure, be lost to the country unless the Cape Fear shall be improved so as to admit our steamers-of-war.

To illustrate the business of Wilmington—the principal town on the Cape Fear, thirty miles from its mouth, and near the head of deep-water navigation—we give a statement of its trade, prepared by several highly intelligent gentlemen of the place with care, but which must be regarded as only approximate—probably too small.

Coastwise exports from Wilmington, from December 1, 1851, *to December* 1, 1852—*one year.*

Sawed timber	17,135,889	feet	$272,585 77
Pitch-pine timber	1,025,202	"	12,815 01
Spirits of turpentine	96,277	barrels	1,707,999 75
Rosin	320,219	"	560,383 25
Tar	17,522	"	35,044 00
Pitch	6,660	"	9,157 00
Turpentine, raw	63,071	"	220,748 50
Cotton	12,988	bales	454,580 00
Rice, clean	2,300	casks	37,375 00
Rice, rough	64,842	bushels	58,357 80
Peanuts	93,255	"	93,255 00
Corn, Indian	5,663	"	3,009 64
Staves	27,000		105 00

Cotton yarn	2,434 bales		$97,360 00
Sheetings	1,702 "		102,120 00
Flax seed	165 casks	}	6,052 25
Do	1,253 bags	}	
Sundries			320,613 86
Coastwise total			3,991,561 83
Foreign exports			549,107 74
Total coastwise and foreign			4,540,669 57

A few of the principal foreign exports are subjoined:

Lumber, feet	15,201,000
Timber, feet	2,383,814
Turpentine, barrels	33,596

For a more detailed statement see the enclosed number of the Wilmington Herald of December 29, 1852.

Still further to illustrate the trade of this town, and to show the capacity of the river and of its principal entrance, which are about the same, we give a list of the vessels in port November 29, 1852, and their several draughts.

Denomination and name of vessel.		Draught of water when loaded.	Tonnage.
Barque	White Cloud	12¼	284
Do	Mary R. Barney	12	280
Do	John A. Taylor	13	214
Do	Muskingum	12	248
Brig	John Dawson	12	237
Do	Buena Vista	11	188
Do	Rebecca and Francis	10	160
Do	Mary Jane	11	147
Do	Wm. T. Dugan	11	149
Do	Coral	11½	200
Do	Eliza W. Denton	11	196
Do	Annandale	10	184
Do	Helvellyn	9½	150
Do	Indian Queen	11½	186
Do	Tribune	11½	196
Do	Firth	12	280
Han. sch'r	Untervemineg	9	120
Galliot	Heinrich	9½	145
Schooner	Maine	11½	347
Do	Henry Nult	11½	240

LIST—Continued.

Denomination and name of vessel.	Draught of water when loaded.	Tonnage.
Schooner Mary F. Lutterlok	12	158
Do......Mary Ann Guest	7½	89
Do......Ann Elizabeth	9½	131
Do......Dart	10½	156
Do......D. L. Clinch	10	166
Do......Express	5	47
Do......Champion	5	37
Do......A. J. De Rosset	11½	197

In what precedes we have had in view to exhibit the magnitude of the question we have been called upon to treat. It would seem impossible to overstate it. It involves not only the prosperity of Wilmington, and the convenience of our coastwise trade in this quarter, but also, as has been stated, the prosperous development of the internal resources of the whole State of North Carolina; the introduction into the market of its coal; and the usefulness of those grand schemes of improvement which so honorably illustrate the enterprise and spirit of its inhabitants.

From these preliminary remarks we pass to a recital of the information concerning the past and present condition of the river and bars acquired in the course of our investigations.

Although we do not propose to apply any portion of the small appropriation recently made ($20,000) to the improvement of the river proper, still, having investigated the subject, we think it our duty to present a summary of the information we have gained, touching the history of its improvements, the capacity of the river before and after the commencement of the improvements, and to add some remarks upon their character; and we do this the more readily because a part of this information is not easily gleaned from the maps and reports, and because it could not be so easily or accurately obtained at any future day.

These works were commenced by the State of North Carolina, in 1823, in execution of a plan furnished by Mr. Fulton, State engineer, (see his report herewith.) The general government took charge of and continued the works in 1829. In the mean time the State had closed the channels west of Clarke's island and the channel west of Campbell's island, and in so doing had destroyed the best channel in both of those places. The best channel, running west of both of those islands, and between the two comparatively near the western shore, allowed the passage, at ordinary high water, of vessels drawing eleven or twelve feet; and this is very nearly the present capacity of the river.

Fulton's soundings give in that channel three shoals, viz:

The upper shoal, near the foot of Clarke's island, $3\frac{1}{2}$ miles below Wilmington.......................... 8 feet 6 inches.

The middle or Town Creek shoal, 7 miles below Wilmington.. 9 "

The lower shoal, near the foot of Campbell's island, 9 miles below Wilmington.......................... 9 " 6 "

Supposing the soundings to refer to mean low water, and the mean rise and fall of tide to be 3′ 6″ at Clarke's island, we have twelve feet as the draught at mean high water; and this agrees very well with the information we have gained from pilots, sea-captains, and merchants, with whom we have conversed, and who were familiar with the river at the time. They generally agree that the capacity of the river at that time, in this its shoalest part, was not greater than it is now; and most of them say that it was somewhat less; none make the difference more than one foot.

Unfortunately, Fulton's report gives no information as to the capacity of the river when he made the survey, and the soundings upon his map are too few to justify any satisfactory conclusion. The only shoal of which he mentions the depth—the "bulkhead" at the foot of Clarke's island—was one which vessels following the deepest channel did not pass over.

We wish here to express our decided opinion, that no river or harbor improvements should be commenced without first obtaining accurate surveys and full descriptions of the obstructing and other features. Two hundred thousand dollars have been expended upon the Cape Fear, and we are now without any certain means of knowing the extent, or even the fact, of improvement, without any proper data for studying the connexions between cause and effect; and, admitting an improvement of one foot in the capacity of the river, we think that a greater improvement might have been made, at comparatively small expense, by dredging the three shoals mentioned above. Their composition—mud and stiff mud—and their limited extent, promised good results from that mode of improvement.

In 1827, under the authority of Congress, a thorough survey of Cape Fear was conducted by Captain Bache, of the topographical engineers, and his map, with an elaborate report, sent to the Engineer department December 10, 1827. Copies of both are enclosed.

The river at that time was in a very bad condition. The upper shoal at the foot of Clarke's island, and another at the head of Campbell's island, had but seven feet at low water; and the river afforded "facilities to vessels drawing at most but nine feet water." This state of things continued for some years. (See memorial of the people of Wilmington presented to Congress in 1829.) The old channel being destroyed, it was the work of time to create a new one, which had to cut its way through shoals of considerable extent. To hasten this, a dredging-boat was employed at least two years. (See Captain Swift's annual report of 1836.) This long interruption of the navigation we regard as an inevitable consequence of Fulton's plan, and one that should have gone far towards causing its rejection. For some years all vessels drawing over nine feet water were compelled to anchor ten miles below Wilmington and send up and receive their cargoes in lighters.

This plan of Mr. Fulton's was, moreover, in violation of what we regard as an important principle in river improvements, and one which can be disregarded only in rare and peculiar cases. The executed work should be perfectly safe—should threaten no permanent or temporary harm, but effect at every step a direct and positive good. This principle, which forbids the destruction of the existing state of things in the hope of finally obtaining a better, can never be safely violated where works are carried on by the State or general government, and are liable at all times to suspension, or even abandonment.

And to this may be added the enumeration of another established principle in hydraulic engineering, to be observed in the improvement of rivers and harbors.

The tendency of deposites caused by irregularities in the established channel of a river is, to divert the main current into a new channel. This was actually the state of things in that part of the Cape Fear river on which Mr. Fulton operated. Now in such a case it is more safe and more easy to co-operate with and assist the action of natural causes than to oppose them. Again, on account of the effect of irregularities in creating deposites, it is desirable that the limits or boundary lines of river channels should be as direct and regular as possible; in this respect the new channels which Mr. Fulton stopped up were superior to the old ones, into which he has compelled the waters of the Cape Fear to return.

And, finally, the contraction of the water-passage, and the reduction of its lateral dimensions, is a well-known means of improving river channels for the purposes of navigation, by deepening them. The channels west of Clarke's and Campbell's islands possessed these advantages of narrowness and depth, which Mr. Fulton's plan of improvement sacrificed.

The subject of river and harbor improvement, especially on the southern coast, is one of such vital importance to the prosperity of this country, that we should not think ourselves justified in neglecting to point out Mr. Fulton's errors, and in stating distinctly the principles on which our censure rests.

Captain Bache disapproved of the most important feature of Fulton's plan—that of closing the channel west of Campbell's island; but new shoals had formed, which rendered it, in his opinion, unadvisable to reopen that channel. He projected eight jettees (two had been constructed by the State) to contract and direct the naw channel. These, with modifications, were executed from time to time, and by 1836 (see Captain Swift's annual report of that year) the river had attained nearly its present capacity.

The mode of constructing and protecting the jettees, as improved by observation and experience, is well given in Captain Swift's annual report, dated October 26, 1837. The jettees, in their actual position, are seen, in a general way, on Glynn's chart of 1839. Their tops are rugged and decayed, but under water they doubtless still fulfil, to a great extent, their intended purpose.

We do not propose any expenditure upon the river at the present time, because its capacity is equal to that of the bar—perhaps a little greater. But should the works of the engineer succeed, as we believe they will if means are furnished, in increasing permanently the capacity of the main inlet, the improvement of the river should then be resumed, and equal capacity, if practicable, should be given to it.

We regard a new survey of the river as a necessary preliminary to any future plans of improvement. This survey is now in progress as a part of the coast survey. It will extend above the town of Wilmington to the point where the Cape Fear divides into two branches, and where both Fulton and Bache have proposed a jettee to turn more of the water into the Wilmington branch.

This is in strict conformity with the principle which directs the union of the waters of a river (as far as it may be practicable, having regard to the wearing of banks, &c.) into one channel, and the cutting off the secondary and lateral channels which conduct the water away from the main channel, and destroy its power and usefulness by wasteful diffusion.

The two outlets of the Cape Fear.

The principal mouth of the Cape Fear is between Baldhead and Oak island—the width being about one and three-eighths of a mile. A middle ground occupies the chief part of this space; the river seeking its outlet through two channels—one, the main or eastern channel, hugging the bend of Baldhead, close to which it passes, and the other running near the land of Oak island. The western channel is closed on the inside by a bulkhead of variable extent, depth, and position. The depth is now seven feet, and the shortest distance across this bulkhead, between the nine-feet curves, is about 120 yards. As is usual with such channels, there is deep water on both sides of the bulkhead, and the channel widens gradually as it recedes, until, at the distance of about $1\frac{1}{3}$ mile from the bulkhead, it passes over its proper bar, on which there is about eight feet at mean low water.

This western channel, bending along the land of Oak island, delivers the water of ebb amost directly opposite to the general direction of the ebb-tide along the coast.

This is the correlative channel of Falsehook channel at Sandy Hook, N. J., and of Cape Henlopen channel at the entrance of Delaware bay, differing in the important particular of having a decided bar at its outer and broader extremity.

The eastern or main ship channel runs nearly south after turning the point of Baldhead, curving eastward towards the land. The distance measured along this channel between the nine-feet curves is about 800 yards, but within that distance there are several nine and ten feet soundings. The least water in this channel at mean low water is eight feet. The bar is about one mile and a quarter from Baldhead, and is much broader than the bulkhead which closes the western channel. The distance between the twelve-feet curves along this channel is about 1,200 yards.

The current of the main stream of ebb, deflected by the point of Oak island, passes over towards Baldhead, is there turned westward, and, being further thrown off by Baldhead Point, shows, by a slue, a tendency to break through the middle ground, where the distance between the nine-feet curves is about three-eighths of a mile. After crossing the main bar, three fathoms and three quarters are found inside up to near the "Horse-shoe," a little below New inlet.

The slue just referred to appears to be a part of the changeable regimen of the outlet, since it did not exist in 1839. It appears to be connected with the increase of the area, "dry at low water," which skirts the western side of the main channel, and with the decreased depth of the main bar. It indicates a tendency in natural causes, which it may be expedient hereafter to assist artificially in bringing about the desired results.

There is another mouth of the Cape Fear, called New inlet, about seven miles from Baldhead, in a northeasterly direction, with eight feet on the bar at low water, and a width between Federal Point and Zeek's island of about three-quarters of a mile. The outlet of the river is nearer the source than the main one, but the water from above, in escaping through it at ebb-tide, is turned back from its course more than 100 degrees.

In the opinion of pilots, there is rock underlying the bar of this inlet. Efforts have recently been made to settle this question by boring, but the roughness of the sea, common on this bar, and now greatly increased by the winter weather, has so far defeated them. We saw rock (pronounced by Professors Agassiz and Holmes, post pleiecine) in place upon the beach outside, two miles from Federal Point, and similar rock nearly opposite, on the river side. Rocky ledges have been found all around the outer rim of this outlet—(see sketch O)—and we think the opinion of the pilots may be correct.

This rock forms, without doubt, the nucleus of the later deposites, and its existence would alone suffice to forbid any attempt to improve this channel, exposed as it is, by artificial deepening.

Separated from New inlet by Zeek's island, there is a still newer and continually increasing opening, 400 yards over and 4 feet deep at low water; and near that a third outlet, about 200 yards over and 2 feet deep.

Referring to the maps mentioned in the Appendix, and to a statement of the pilots made in 1850, we subjoin a comparative statement of the depths at low water on the main bar, the bulkhead or shoalest part of the western channel, and on the bar of the New inlet, at various periods, reducing the high-water soundings of some of the maps, by subtracting five feet from each.

Depths on, in feet.

Name of author of map.	Date.	Main outlet. Main bar.	Main outlet. Bulkhead or shoalest part of western channel.	New inlet.
Edward Moseley	1733	14	9	Did not exist.
William Wimble	1738	16	4	do.
Joshua Potts	1797–8	15	3	6
Col. Kearney, Top. Engineers	1820	10½	3	6½
Capt. Glynn, U. S. N.	1839	9	9	10
Pilots, etc	1850	8	9½	7
Coast Survey	1851	8	7	8
Coast Survey	1852	7½	7	8

This table, and the maps from which the soundings have been taken do, in the opinion of the commission, after full and careful consideration and discussion, authorize the following conclusions:

1. The depth on the main bar of Cape Fear entrance has diminished, since the earliest records, at an irregular rate. In the last fifty years it has shoaled from fifteen feet to eight feet, so that, at the beginning of this century there was 2½ feet more water on the bar, at ordinary low water, than there is now at ordinary high water.

2. In general, a decrease of depth on the main bar has been attended, as might be expected—the middle ground remaining the same or rising—with an increase of depth in the western channel, and *vice versa.* The latter channel has, however, fluctuated rapidly and irregularly, while the decrease on the main bar has been constantly going on.

3. The deterioration of the main entrance is due mainly to the influence of New inlet, which opened, as nearly as we can learn, about 1780. This outlet diminishes by a vast amount the volume of water which otherwise would, and formerly did, pass in and out at the main entrance during every tide. And the evil has doubtless been accelerated latterly by two still newer openings, alluded to above, which are a little south of that inlet.

This influence is shown in a general way by the decrease of the sum of the depths on the main bar and bulkhead of the western channel, from 23 and 20 in 1733 and 1738, to 18 in 1797–8; 13½ in 1820; 18 in 1839; 17½ in 1850; 15 in 1851; and 14½ in 1852.

The sum of the two depths before the opening of New inlet, and the three since, has been, respectively, 23 and 20, and 24, 20, 28, 24½, 23, and 22½. The old maps do not furnish the necessary data for carrying out this comparison with the areas of the sections, and the velocities at the two inlets.

4. The comparative maps show a great wearing away of Smith's island, and particularly of Baldhead, amounting at the point to some half or three-quarters of a mile. The site of the old light-house represented on Potts's map of 1797–8, is now deep water. The remaining part of Baldhead Point, say for one-third of a mile back, which was formerly covered by high sand-banks, is now only a few feet above high water. That great body of sand, both in and above water, continually passing off into the channel, must have had a direct and considerable influence in obstructing the main bar. And the evil still exists; for that point and the adjacent shores are still washing away rapidly.

5. The practicability of protecting exposed points by jettees is demonstrated by the map of the site of Fort Caswell, on which the water-lines of various dates are laid down. The jettees for the protection of this site, which was rapidly washing away, have been run out at various periods from 1839 to 1850. They have most effectually accomplished the desired object, and, with occasional repairs, will doubtless preserve the site indefinitely. Their projecting ends are all within low-water line, and most of them within high-water line. This high-water line, though carried out in places more than 100 yards since 1839, is still several hundred feet within the high water of 1820, as determined by Colonel Kearney.

We are decidedly of opinion that these jettees have had no injurious effect upon the bulkhead bar of the western channel, which is about five-eighths of a mile from the longest jettee. The depths on that bar have always been very fluctuating, as shown by the table given above. Between 1820 and 1839 it deepened from 3 to 9 feet. It is now 7 feet. This last fluctuation has been complained of by many people on the river as an injury caused by the jettees.

6. The middle ground, between the main and western channel, is increased in extent and more shoal than formerly. The spots upon it "dry at low water" have increased in number and size, and both the channels have been shifted towards the land.

The foregoing facts clearly indicate the character of the operations which, with the best promise of success, and the most economical expenditure of money, will remove the present causes of deterioration, and restore the former condition of things, in which there was twenty feet of water on the main bar.

Without further explanation, we will now indicate the operations which we recommend as the most economical, and as promising the best results —operations which look to the restoration of the main bar to its original condition, 20 feet at high water, by a restoration, in the main, of the original state of things. Premising that these operations promise at every step a positive and increasing improvement, and that should they, contrary to all probability, fail to effect all that is contemplated, they must at least be beneficial to a certain extent; and furthermore, that we do not lay down the precise place, extent, or plan, of any particular work, because these must vary with ordinary local changes, and with those other changes of land shoals and soundings which, caused by the works themselves, must determine the order and character of each successive step. The details, to a great extent, must be necessarily left to the engineer, and we think it proper in this connexion to express our conviction that during the progress of this work, the all-important results of continued observation and experience should not be lost by frequent change of superintendence.

Enumerating the operations in the order in which they should be taken up, we recommend—

1. The protection of Baldhead from further abrasion, by jettees like those at Fort Caswell. The northwest shore being very near deep water, and exposed to the strong current of the ebb-tide, the first jettee should be located nearly at right-angles to that shore, about 100 feet from the point and should be run out in the first instance but little beyond low water. A wharf, supported by piles, about 100 yards inside of that jettee, may be made to play the part of the jettee by sinking and loading grillages between the piles. One or more jettees will be required for the protection of the outer shore; but as this shore is abraded mainly, as we conceive, by waves acting obliquely towards the inlet and deriving their direction from the tide of flood, and is separated by an extensive shoal from deep water, it is hoped that one jettee placed near the point will be sufficient for its protection. This jettee should unite with the first, and be extended according to circumstances. The two must have a common branch above high water, along the general direction of the point, to secure them from the degrading action of storms during high tides, by which they might otherwise be turned.

As the construction of one jettee sometimes shows that a pre-existing one might have been dispensed with, the engineer should, of course, take care not to hurry these works, but wait for each to produce its full effect before adding more.

While the jettees are under construction, something should be done to preserve the naked land above high water from further loss by the winds. By sand-grass, properly planted, and by wattled fences, it seems to us this might be done.

This low uncovered sand extends back about one-third of a mile from the point, and is there bounded by elevated hillocks and ridges of drifting sand, advancing upon and overwhelming a dense growth of live oak and cedar; and we saw that the beach was washing away outside, for at least a mile from the point. But we do not propose to extend protection at present to any such distance, thinking it better to wait until this abrasion has become actually dangerous.

Guided in a measure by the cost of the jettees at Fort Caswell, we estimate the expense of protecting Baldhead at $40,000. It may be much more, it may be less.

2. The next step, and one which should be taken, if the available means will permit, as soon as the works on Baldhead are fairly commenced, is the filling up of the two small openings near New inlet—one about 400 yards over, and four feet deep in the middle at low water; the other about 200 yards over, and two feet deep at low water. These openings are increasing in size, and we regret the necessity of any loss of time in closing them.

The smaller opening, which should be closed first, may, we believe, be stopped most economically by piles driven eight on ten feet apart, and sheet-piling filling the intermediate spaces. The piles should be hewed or sawed on two parallel sides, and two strong continuous caps secured to them, to receive the sheet-piling between them and keep their tops in place. The opening being closed in this manner, we look to the easterly winds and storms to fill up the gap on the outward side before the piling has been destroyed by worms; that is to say, in two years. The expense of this piling being probably not more than one-sixth that of stone and grillages, we are disposed to recommend it for the larger opening also. There is a probability of success; and in case of failure, the loss will be comparatively small.

Operations of this nature are liable to accidents, and the expense cannot be accurately estimated. We present, therefore, conjectural estimates as follows, for the two modes of construction, guided in some measure, as to the first, by Captain Swift's estimates, of October 26, 1837, for work of a similar character—(see his letter herewith.)

In case of piles and sheet piling—		
Smaller opening, 600 running feet, at $4		$2,400
Larger opening, 1,200 running feet, at $5		6,000
		8,400
In case of stone and grillage—		
Smaller opening, 3,600 tons granite put in place, at $3	$10,800	
Smaller opening, 600 running feet of grillages, at $3	1,800	
		$12,600
Larger opening, 10,800 tons of granite put in place, at $3	32,400	
Larger opening, 12,000 running feet of grillages, at $4	4,800	
		37,200
		49,800

In case of piles at the smaller opening, and stone at the other, the combined estimate will be $2,400 and $37,200—say $40,000.

3. A jettee from Zeek's island, to prevent New inlet from making south—costing say $20,000.

4. Closing up New inlet. The Coast Survey maps of 1851–'2 show a shoal, six feet deep and less, extending down about one mile from Federal Point, and lying between the channel of the river and the deep channel of New inlet, and contracting the latter channel to about 350 yards, opposite Zeek's island. We propose to take advantage of this shoal and commence a jettee upon it at Federal Point, and to continue it until it is thought best to diverge to Zeek's island.

We are aware that there will be great danger of the water deepening at the head of this jettee while in progress, and some danger of its being undermined by parallel currents on both sides. The first evil, should it occur, may, we believe, be remedied by thowing upon the shoal, in advance of the jettee, small stones brought for the purpose, sufficient in size and quantity to prevent the wearing of the bottom, and not large enough to interfere with the proper settlement of the grillages. The second evil, we believe, may be prevented by occasional projections from the jettee on both sides—they being made like the jettee itself. When the contraction of this inlet shall have lessened in a considerable degree, the volume of water flowing in and out, and the scouring action of the ebb-tide, we may, perhap s, expect some aidom nature—from the regular action of the sea, and particularly from the action of waves beating obliquely towards the inlet upon the adjacent shores, and from the litoral and general action of the flood-tide. The deposite and accumulations due to these, and other causes, we may then expect to go on increasing.

Horse-shoe shoal, now one of the worst in the river, will doubtless be removed by closing New inlet. The channel along Snow's island seems to be deepening and extending, and it is highly probable that its extension through to deep water, above and below, will result from a partial contraction of the inlet. In the subjoined estimate the jettee or breakwater is supposed to rise five feet above low water, to be ten feet wide at top, and to slope 45° on both sides; and the soundings are supposed to increase by one-fifth their low-water depths.

112,000 tons of granite put in place, at $3...........	$336,000
10,000 do do (lateral projections) at $3...........	30,000
5,500 running feet of grillage, at $6.................	33,000
Total (less $20,000 already estimated) for Zeek's island jettee, which should form a part..................	379,000

It has been proposed to force the entire water of the river through New inlet by a breakwater across the main channel, here two miles over. It has also been proposed to make an outlet through the narrow neck above Federal Point light-house, by running a breakwater over the river immediately below that place. Of these plans we do not approve, for several reasons. They require very large outlays—say $2,000,000 for either of them. They violate the cardinal principle, that no improvement should be attempted which, if it fails, can cause injurious results. The best inlets in North Carolina are at Beaufort and Cape Fear; both under cover of very salient capes and shoals, which protect them from easterly storms, and their bars in a great measure from the swell and deposites of the flood-tide.

Ocracoke is somewhat similarly situated, but is a poor inlet, its bar being variable in position and depth, and its place probably too far from Cape Hatteras to receive the necessary protection. Inlets frequently open between Capes Henlopen and Hatteras, and ordinarily soon close up again.

This sudden breaching of new inlets by violent storms, and their gradual closing again under the steady and invariable action of the laws of tidal and other deposites, or the gradual closing of previously existing inlets where new ones have opened, are characteristic features of the whole alluvial coast of the United States. In many parts of the coast of Georgia and the Carolinas, the rivers of the continent are discharged into lagoons, enclosed by those belts of sand which form the Ocean boundary; and the opening, which with us has received the distinguishing name of "inlet," is the passage by which the waters of the river are finally emptied into the sea. Across the mouths of these inlets lie bars of sand formed by the causes above mentioned. The depth of water on these bars, and the greater or less permanency and stability of the inlets themselves, depend to so great a degree on the strength and regularity of the tidal currents—that is, on the regular flux and reflux twice a day of a certain quantity of water—that it may be said, in general, that where the rise and fall of the tide are considerable, and the waters of the flood enter the lagoon, an inlet made by a violent storm will be kept permanently open, and will extend both in width and depth; and that on the other hand, where no such tide exists, the inlet is liable to be closed by the operation of the constant law of deposite. The latter case is illustrated by the examples of two inlets which opened in Body's island during the violent storm of 1846. One of them was closed in the course of a year; and the other was slowly, but surely, closing when last observed. There, while the rise and fall of the tide on the external seacoast is about four feet, the regular ebb and flow are not perceptible in the sound. The former case of the effect of a strong and regular tide in keeping open an inlet, and increasing its capacity, is exhibited in New inlet, Cape Fear. And it is on this account that we find it necessary to resort to artificial constructions to close this inlet, as the only means of obliging the waters of the river proper, together with the returning waters of the ebb-tide, to resume their former course through the main channel. When combined here, as they were eighty years since, their united power is no more than sufficient to maintain the depth of the water on the main bar required by the rapidly growing commerce of Wilmington, and the region of which it is, by its geographical position, the natural depot of trade and commerce.

The depth on New Inlet bar, Cape Fear, is now equal to that on the main bar; but the former is so very rough, in consequence of its direction and exposure, that vessels of deep draught seldom go there.

We are of opinion that, however desirable the result, any attempt to close the western bar of the main entrance, would have no other effect than to carry that channel out further from the present shore, and that a jettee, to effect any sensible good in this way, must be of great length, and should not be thought of at present.

We are also of opinion that no attempt should be made to improve the western channel, as the attempt would, in all probability, be unsuccessful, and success could only be partial, and would be at the expense of the main bar.

We have already spoken of this channel as corresponding to the False Hook channel, at Sandy Hook, and the Henlopen channel, at the capes of the Delaware; and the commissioners on the improvement of Charleston harbor pointed out a similar resemblance in Sullivan's Island channel. But the latter was selected as the most favorably conditioned for improvement. It may be worth while, therefore, to say that, although all the channels above mentioned are, in each case, similarly situated with regard to the main channel, and form a trait universally recognised at the mouths of the tide-harbors on the alluvial coast of the United States, yet they are not all equally adapted to the requirements of the engineer. In this especial instance there are these important differences between Sullivan's Island channel and the western channel at the main entrance of the Cape Fear: that the former has retained its position and general character unchanged, from the period of the earliest authentic survey, and is so situated as to be under protection; while, on the contrary, the latter has always been fluctuating, and is very much exposed.

The main bar, as deep as eight feet below the bottom, has been found, by boring, to consist of exceedingly fine sand; and the shoal from Federal Point, near the proposed place of the breakwater, has been found, in like manner, to consist of fine sand, as deep as eleven feet below the bottom.

It must be remarked that the long, narrow strip of sand stretching from the main body of Smith's island towards New inlet, is in danger of opening and affording new inlets, and that openings may be apprehended, at a later period, through the narrow neck at Federal Point light-house. Such openings are generally very shallow for some time, and may be easily closed if taken early. We do not apprehend any serious difficulty from this source.

In conclusion, we call especial attention to the fact, as we believe it to be, that every operation recommended above, and every successive part of each particular work, will tend to an improvement in the main bar, and that each particular expenditure is recommended by its own merits independently of the final results; so that, be the sums expended more or less, and whenever the operations are suspended, we may look with some confidence for a good and permanent effect.

Recapitulation of the estimates.

Protection of Baldhead Point	$40,000 00
Closing the two small outlets of the Cape Fear near New inlet with timber	8,400 00
Closing New inlet	379,000 00
Contingencies	31,200 00
	458,600 00

If the small outlets be closed with stone, the items will be	$40,000
	49,800
	379,000
	31,200
	500,000

A. D. BACHE,
Superintendent U. S. Coast Survey.
CHARLES HENRY DAVIS,
Lieut. U. S. Navy, Sup't Nautical Almanac.
D. P. WOODBURY,
Captain Engineers.
ISAAC I. STEVENS.

APPENDIX.

List of accompanying reports, maps, reports, &c.

Captain Hartman Bache's report of December 10, 1827, with a map of the river, and a detailed map of the shoals.

Mr. Fulton's report of 1821, with map—the latter borrowed from the office of topographical engineers.

Report of Mr. Johnston, chairman of the Committee on Commerce, February 2, 1827, relative to petition of the inhabitants of Wilmington for the removal of obstructions in the river.

Report of Lieutenants Mansfield and Winder, October 22, 1835.

Lieutenant Swift's annual report, of September 30, 1836.

Lieutenant Swift's annual report, of October 30, 1837.

Captain Swift's annual report, of October 20, 1838.

Extract from Captain McClellan's annual report of October, 1839.

Glynn's map of the Cape Fear, 5 sheets.

A. Copy from map of Edward Moseley, 1733, enlarged to scale $\frac{1}{100000}$.

A *bis*. Wimble's chart, of 1738.

B. Tracing from map of Joshua Potts, 1797–'8, enlarged to scale $\frac{1}{100000}$.

C. Tracing of reduction of survey of Cape Fear river, bar, and entrance, by Major Kearney, 1820, $\frac{1}{100000}$.

D. Comparison of Cape Fear entrance in 1839 and 1851, scale $\frac{1}{100000}$, from surveys of Lieutenant Commanding Glynn and Lieutenant Commanding Maffitt, U. S. Coast Survey.

D *bis*. Sketch showing the changes in the Cape Fear river, bar, and entrance, comparing Glynn's survey of 1839 and the Coast Survey of 1851, scale $\frac{1}{10000}$.

E. Map of the Cape Fear river and its vicinity, by Joshua Potts, 1797–'8, small scale, showing changes on land in red ink.

F. Sketch of Frying-pan shoals and Cape Fear river, by Lieutenants Commanding Jenkins and Maffitt, 1851, scale $\frac{1}{120000}$.

G. Entrance of Cape Fear river and New inlet, by U. S. Coast Survey, 1851.

H. Sketch of main inlet, with tidal observations and selected soundings, 1852.

I. Tracing on cloth of main inlet, from Captain Maffitt's survey of 1851, with red lines showing where sections are taken.

$1(^1)$, $1(^2)$, $1(^3)$ colored sections taken along lines indicated in I and K.

K. Tracing on cloth of New inlet, from Captain Maffitt's survey of 1851, with red lines showing where sections are taken.

Four sheets of sections furnished by Captain Maffitt, November, 1852, taken at New inlet.

M. Sketch furnished by Captain Maffitt, November, 1852, of the southern point of Smith's island, and a part of Frying-pan shoals.

Sketch of the site of Fort Caswell, 1851, in the Engineer office.

APPENDIX L L—1.

ENGINEER DEPARTMENT,
Washington, May 30, 1853.

SIR: The subject of the improvement of Cape Fear river, at and below Wilmington, N. C, has been examined and reported on by the commission constituted for that purpose.

The question has been elaborately examined and discussed by them. Their resulting propositions are as follows:

They do not propose to attempt any improvement of the river proper at present, as its navigation is now better than the bar at the mouth; to the improvement of which they recommend the following operations:

1. The protection of Baldhead from further abrasion by jettees.
2. The closing up of two small openings near New inlet.
3. A jettee from Zeek's island, to prevent New inlet from working south.
4. Closing up New inlet.

The board of river and harbor improvements have examined the report of the commission, and the accompanying documents.

They concur with the commission in the opinion that present efforts should be directed to the improval of the entrance exclusively.

They concur also in the opinion that the protection of Baldhead beach should be attended to without delay.

They concur also as to the importance of closing, without delay, the southernmost breach near New inlet.

They do not approve the propositions for the complete closing of New inlet; they think, however, the narrow beaches in the vicinity should be strengthened if necessary.

They propose to regulate the tidal currents at New inlet, by a wing-dam resting on the northern shore; and to modify and improve the channel at the main bar by another wing-dam, and by dredging if necessary.

The present grant of Congress, $20,000, is not sufficient for the execution of the works at Baldhead, if constructed of stone, as designed by the commission. The board think brush may be substituted with economy, and without impairing their efficiency.

I have, however, just been informed by one of the commissioners, Professor A. D Bache, that some of the citizens of Wilmington have made a subscription of $60,000 in furtherance of the proposed improvements; the money to be expended under direction of the United States officer having charge of them.

With this assistance all the works in which the commission and the board concur can probably be completed in a permanent manner. I have the honor, therefore, to propose that I be authorized to instruct the officer in charge of the work, Capt. D. P. Woodbury, corps of engineers, to proceed at once to the erection of these works, preferring stone structures where they are appropriate. He will be cautioned that the United States are not to become in any way liable for means beyond the extent of the present appropriation.

His presence and study of the influences which maintain the present state of things, and his observations on the modifying effects of the operations now proposed, will, it is believed, afford us the means of deciding on the questions concerning which there is a want of concurrence between the commission and the board, and the most suitable additional works will be executed accordingly, when the proper time arrives, should there be means at our disposal for the purpose.

With this are transmitted the report of the commission, and the accompanying documents and maps enumerated in the appendix thereto; the report of the board of engineers; and the letter of Professor Bache, with that of John Dawson, esq., referred to by him.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brevet Brigadier General.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved, with the restrictions heretofore directed to be made in all cases where officers receive aid from corporations or individuals in the execution of a work authorized by government.

JEFFERSON DAVIS,
Secretary of War.

WAR DEPARTMENT, *June* 9, 1853.

The officer was instructed to carry the project into execution, as modified, accordingly.

APPENDIX M M.

Report on the harbor of Charleston, by Professor A. D. Bache, superintendent coast survey; Lieutenants C. H. Davis, J. N. Maffitt, M. F. Maury, United States navy; J. D. Kurtz, United States engineers, to the chamber of commerce.

THE HARBOR OF CHARLESTON.

CHARLESTON, *March* 4, 1852.

GENTLEMEN: "The committee on the improvement of Charleston bar," appointed by the chamber of commerce of our city, have learned, with sincere gratification, your arrival among us, and avail themselves of an early opportunity to express to you the deep interest which they, and all whom they represent, feel in the purpose of your visit.

The improvement of the Charleston bar has long been a subject of great and earnest solicitude, not only to the people of our city, but of the whole State. This solicitude has only become the more intense now that the increasing connexion of Charleston, by railroads east, north, and west, is rendering her the outlet to a large portion of the exportable products of the surrounding States of North Carolina, Georgia, Alabama, Mississippi, Tennessee, and Kentucky.

The deepening of the channel of our bar, therefore, in which, but a short time back, this State was alone interested, has now become a matter of almost equal interest to the States already named—so that any improvement of our bar, however important to the future welfare and prosperity of Charleston, must now be regarded as a question of general rather than of local interest.

Impressed with the importance of this subject to our own, and to the great and growing interests of so wide a section of our country, the chamber of commerce, at the commencement of the operations of the coast survey in our harbor, appointed a committee to communicate with, and to tender its aid in any and every way that might be practicable, to the officers having it in charge, in the full hope that the scientific investigations of those engaged in this duty would point out the way to some feasible plan of improving and deepening the outlets to our harbor.

On the completion of the survey last spring, this committee lost no time in soliciting your early attention to the object of their wishes, and now would respectfully request of you a full, patient, and impartial examination of the question, to wit:

Is it practicable so to improve any one or more of the channels of our bar as to permit the ingress and egress of vessels drawing over sixteen to seventeen feet water; and, if so, at what expense?

We also respectfully request that you will make known to us any improvements within our harbor, or along our wharves, that may be suggested to you in the course of your investigations.

Profoundly and gratefully impressed, gentlemen, with the kind spirit which has prompted your present visit to us, and holding ourselves in readiness to furnish any further information which we may possess, and to make all necessary arrangements to facilitate your operations, and to promote the convenience of your meetings,

We are, with most respectful consideration, &c.,

A. O. ANDREWS,
HENRY GOURDIN,
HENRY W. CONNER,
JOHN HEART,
L. T. POTTER,
Committee.

To Prof. A. D. BACHE,
Lieut. C. H. DAVIS, *U. S. N.*
Lieut. M. F. MAURY, *U. S. N.*
Lieut. J. D. KURTZ, *U. S. E.*

Report.

At the request of the chamber of commerce of the city of Charleston, the undersigned have examined the question of the practicability of deepening the bar, and present, respectfully, the following report:

The channel ways to the sea, from all our seaport towns between the mouths of the Chesapeake bay and the Rio Grande, are more or less obstructed by bars. While the commercial wants of the country have called into existence new classes of ships, with improved models and deeper draught, which cannot cross them, the industry and enterprise of our fellow-citizens have, by railroads and other improvements, greatly increased the commercial resources of these very ports and harbors the entrances of which are thus obstructed.

The question, therefore, of increasing the draught which may be carried into these harbors, is one already of great importance; increasing daily in magnitude, it exercises more and more influence upon the business, not only of the railroads and canals south of the Potomac, but also upon the prosperity of the whole country, and especially upon those portions of it—the industrial pursuits—the commerce and navigation of which are suffering so much from these harbor obstructions.

The solicitude manifested on various occasions by the general government, within the last thirty years, to obtain somewhere along the Atlantic coast, to the south of the capes of Virginia, a good man-of-war harbor for the purposes of the common defence, is an indication not to be mistaken, as well of its views upon this subject, as of the interest with which the great statesmen of the country have never ceased to regard the question of deep water and easy access to one or more of our southern harbors.

The duty, therefore, of examining into and reporting upon the possibility of increasing the draught which ships may carry over the Charleston bar, has not failed deeply to impress us, by reason of its bearings upon so many and such great interests of State. Consequently, we have sought to acquaint ourselves, not only with the present, but also with the past condition of the bar and harbor of Charleston.

In this part of our duty we have been most kindly assisted by the committees, both of the State and of the chamber of commerce of this city, who have afforded us every facility. We are also under obligations for much valuable information to the surveys and reports which have from time to time, within the last thirty years, been made by officers of the army and navy, upon the subject of the harbor and its improvements. The charts of the coast survey and topographical engineers have afforded us standards of minute accuracy; and we have felt ourselves greatly indebted to the pilots and other citizens of Charleston for much useful information and very valuable suggestions.

Having thus informed ourselves, and having visited in person the proposed scene of operations, we proceeded to discuss the subject freely and fully among ourselves, and to give it the most attentive consideration.

It is proper to state, that we took up the question of increasing the draught of water for ships over Charleston bar with many misgivings, and not without fear lest any attempt to improve it might end only in making it worse. But the lights which we have received, from a close and thorough examination, have encouraged us. Impressed with the importance of proceeding cautiously with any plan that could be suggested, these lights have led us to recommend one which, if it do not succeed, can do no harm, and as to the success of which there seems to be a greater amount of probability than with regard to any other that has been proposed.

This plan, therefore, with a statement of the facts, principles, and reasons which have led us to recommend it, we beg leave to submit, as one in which we all concur, not only because it seems to us more promising of success on the one hand, but because, on the other, it is the least objectionable in the event of our expectations not being realized.

The spacious and commodious harbor of Charleston is formed by the union of the waters of the Cooper and Wando rivers with those of the Ashley, the former flowing on the east and the latter on the west side of the point of land on which stands the city.

The final place of meeting of these waters is in "Rebellion roads," which has been very appropriately called the grand reservoir of the harbor. It is a spacious basin, characterized by uniformity of depth and of bottom. From this basin the waters pass (on the ebb) through a comparatively narrow gorge into the ocean. And here we see repeated the phenomena common to every one of our alluvial tidal harbors. In the first place, the force generated by the compression of the water in the gorge has, in accordance with its uniform law of action, excavated a cavity deeper in spots than any other part of the harbor, occupying a limited space at the outer opening of the gorge, and bounded on the inside by the line of narrowest extent, and on the other by the deposits forming the bar.

In the second place, the water released from its confinement, and losing its velocity and movement by diffusion, passes on to the ocean through several drains and channels, more or less deep and regular.

The confinement of the water at the Narrows, in the harbor of New York, and its subsequent escape, together with the various channels leading to the sea, furnish an example in which the same causes and modes of action have produced precisely similar results.

These drains or channels may be more or less deep, depending on circumstances, an enumeration of which would lead to very minute explanations, and would be out of place here. We shall pass on to a special description of the bar and channels of Charleston harbor.

CHARLESTON BAR, ITS EXTENT, FORMATION, &C.

Charleston bar is in general a deposit of marine sand, varying in its degree of firmness, and mixed occasionally with shells. Examination of the quantity of solid matter (sand and the like) contained in the water near the bottom of the sea on the bar, during the flood and ebb tides, shows that it is greatest in amount during the first quarter of the flood. The sand then assumes the quality of quicksand, and the bar is expressively said by mariners to be "alive." The sand is precisely such as composes the beach of Long island to the eastward of Sullivan's island, and resembles the shore sand of the southern coast generally.

The back water of the inner harbor and its coves, and of the rivers, issuing with the ebb tide, tends to remove this sand by its scouring action. The relation between the depositing power of the flood and the scouring action of the ebb determines the position, extent, depth, and other general features of the bar. As the velocity and duration of the tidal currents of the ebb are both greater than the corresponding elements of the flood, it might seem that the scouring action should exceed the depositing; but the spread of the waters of the ebb over the larger area of the outer harbor, thus weakening its force, prevents this. The area of a section, taken along the curved line crest of the bar, is 47,408 square yards, while that between Cumming's point and Sullivan's island, across the entrance, is but 20,178 yards. If this water were confined to its original section, the present bar would certainly be removed, to be deposited elsewhere when the contraction should cease.

The solid matter brought down by the Ashley and Cooper rivers, by the ebb tide, is deposited on the flats and shoals of the inner harbor; never, as a general rule, reaching the bar, but being found sometimes in the deeper and more quiet portions of the channels.

The general direction of the tidal currents of the flood along the coast east of Charleston bar is nearly parallel to the shores of Long and Sullivan's islands. They set, therefore, directly into the mouth of the harbor, and bluff up against the shores of Morris' and part of Folly islands. When, by the ebbing of the tide, the water has fallen at the entrance of the harbor—that is, when the flood begins to make—the supply is received not only from the eastward but the southward, where also the general set of the tidal currents of flood is to the west. The water is thus forced to change its direction; and, when receiving a check to its velocity, it begins to deposit in particular places the silt which it contains.

Although the general condition of the deposit can be well made out, it is not so easy to anticipate its minute characteristics. The opinion has been advanced, that the existence of an escarpment of marl underlying the bar is the determining cause of its particular position, and of the depth of a portion of the channels. A careful and extended series of borings, such as has been ordered by the committees of the State of South Carolina and Charleston chamber of commerce, cannot fail to furnish the facts to determine this, with other important questions. A deposit once formed would increase, until the general play of the forces causing the deposit should produce a state of more or less permanent equilibrium. It is certain there would be irregular deposits without such a nucleus, from the action of the currents themselves.

The bar is necessarily divided into shoals and channels. The action of currents of water and of currents of air is alike; and the inertia of both water and wind, by carrying the current beyond the point of equilibrium, establishes an intermittent action. A regimen of deep pools or drains, and dividing ridges, is the natural one for rivers. Such ridges and hills, in hillocks, are also the normal regimen of a sand area, acted upon by the wind. As an illustration of the effects of this mode of irregular action, we have annexed a profile view of the bar along its crest, (plate —,) which shows its irregular character laterally and the divisions into shoals and channels. The sections across it are of the same lumpy character. Over the shoals the water passes with a diminished, and through its channels with an increased, velocity, furnishing endless sources of change in the forms of the shoals and of the channels themselves.

The general effect of the conflict of currents in causing marine deposits will be modified very materially, upon a bar of the depth of that of Charleston harbor, by the direction of the prevailing winds, or by violent storms, and for these reasons: First. The tide rising at a mean of 5.19 feet, even the bottom of the deepest channels here must be much more than reached by the violence of the waves. Second. The prevailing winds, being from the northeast and southwest, set across the mouth of the harbor; the first broken by Rattlesnake shoal and the land of Long island and Sullivan's island, and the last by Folly and Morris' islands; nevertheless, the swell which they cause outside of the harbor is in the general direction of the bar itself, and must tend to disturb the channels and shoals very materially. Third. The southeast wind drives in its swell from the great Atlantic. This swell probably expends its violence more on the shore of Sullivan's island than on the bar. These winds also cause a general set of the current near the surface, which likewise tends to produce special changes in the shoaler parts of the bar. Easterly winds may also be included in the list of modifying causes which affect the deposits upon the bar, for they no doubt force the eddy current from the Gulf stream towards the mouth of the harbor.

The operations of the Coast Survey have led to the observation of new and important phenomena in relation to our ocean beaches. One of these, and one very necessary to be considered on the present occasion, is, that the wave of the sea breaks on the shore in a normal direction, coinciding with that of the flood tide; and this direction is most frequently (speaking of the alluvial coast from north to south) oblique to the trend of the land. Hence it follows that the motion of translation belonging to that form of wave, which finally breaks on the beach, is a progressive motion; and that all the matter held in suspension by the water, and left to its disposition by any cause whatever, is transported slowly but constantly in the prevailing direction in which the final wave of the sea breaks with respect to the line of the beach.

If these facts and this train of reasoning be, as we believe they are, correct, they leave us in no doubt as to certain channels which it would be very inexpedient, not to say unwise, either to attempt to open or improve. To these we shall have occasion again to refer.

CHANGES IN POSITION AND DEPTH OF CHANNELS.

To ascertain the changes which have taken place in the bar, the chart of 1780, in Des Barrés' Atlantic Neptune, that of Lieutenant Sherburne, U. S. N., (1821,) of the bar, and of Major Bache, U. S. topographical engineers, for the outer and inner harbor, in 1825, and that of the Coast Survey in 1851 and 1852, have been compared in the Coast Survey office. The annexed sketches show the six-foot and the twelve-foot curves of depth from these maps, (Plate No. 1.) There is some uncertainty as to the plane of reference of the oldest. Those of Major Bache and of the Coast Survey admit of exact comparison, the soundings in the former having referred to the lowest tide observed, and in the latter to mean low water; and the difference between the lowest tide observed, and the mean of all the low waters included in his series of observations, having been given by Major Bache. The comparative charts may be otherwise described as exhibiting within the colored spaces, one the depths less than six feet, the other the depths less than twelve feet. The red color refers to the survey prior to 1780, the blue to that of 1821 and 1825, and the black to that of 1851. The curves upon the earliest chart having been drawn from comparatively few soundings, are, of course, to be taken only as a very general view of the configuration of the bottom. It appears to have been the practice, in making these charts, to delineate the shoals with as great an extent as the soundings would allow, in order to throw all uncertainties on the safe side—a fact which should be remembered in examining them. It should further be recollected, that only a general expression of the curves is aimed at in the compilation of the sketches. An examination of these charts shows that, according to the earliest records, the bar of Charleston has varied comparatively but little in extent or direction, or in distance from the mouth of the harbor. The channels have varied in number from time to time; but some of them, as the Lawford channel, main ship channel, north channel, Sullivan's Island channel, (we have thus called the channel immediately under Sullivan's island, for the sake of distinguishing it from the other channels,) have always been traceable. The positions of these channels have shifted to the southward, and southward and westward respectively, about three-quarters and one-half of a mile, since Lieut. Sherburne's survey, and about two and a half miles, and one mile and a quarter, since the work on which Des Barrés' chart is founded was executed. Before 1780, the six-foot curve projected boldly to the eastward, on a parallel south of Light-house inlet, extending to where the main ship channel is at present. The Lawford channel of that day was a little to the eastward and northward of where the present main ship channel lies. The other channels, except the Sullivan's Island channel, have been variable in position, and their former positions may easily be confounded one with another. Their value is not such as to justify any detailed discussion at present in relation to them. The north channel is the least variable of them, and lies three-quarters of a mile to the south of its position prior to 1780, and less than half a mile south of that of 1821. The Overall channel is now closed towards the westward. The Sullivan's Island channel has but slightly changed in position since 1824. It is represented as a mere slue in Des Barrés' chart, probably for want of sufficient soundings to give it the true character. These facts, with others to be presently stated with regard to this channel, agree with the traditions and experience of the intelligent pilots who have freely communicated to us the interesting facts and observations recorded by them.

While the main ship channel and the Lawford channel have thus changed in position to the southward and westward, their depths have diminished. The main ship channel, which is given by Des Barrés as a thirteen-foot channel, has now less than eleven feet (10.6 feet) in it at mean low water; and the Lawford channel, which then had ten to eleven feet in it, has now but eight. Sherburne gives eleven feet in the main ship channel and ten feet in the Lawford. It thus appears that these channels, as they have changed their position, have also somewhat decreased in depth. We must, of course, allow something for the uncertainty of the tidal observations on which the oldest charts depend, which may probably amount to about a foot. The scouring action of the ebb tide acts with less advantage as the direction of the channel becomes oblique to the general direction of the current at ebb along the coast. It would not be difficult to trace the result, if this progress continues, until the main ship channel has moved so far to the westward as to present its mouth in a direction nearly opposite to that of the tidal current of the ebb. The motion of these channels to the southward and westward is no doubt mainly, if not exclusively, due to the general progress of the deposits in the direction of the flood tide along the coast; but whether this be so or not, the facts are firmly established, independent of the explanation.

The velocity of the current in the main ship channel decreases after passing Cumming's point, increasing again south of Light-house inlet, owing in a degree, perhaps, to the back water of the inlet, but more to the compression of the general current of the ebb south of Folly island setting the water out against the bar. This tends no doubt to assist in keeping open the main ship channel.

The north channel retains nearly the same depth as prior to 1780; it appears to be rather deeper now than when Major Bache's survey was made, probably from the effect of Bowman's jettee on Sullivan's island, and of Fort Sumter flat, in causing a more direct action of the current. It had full eight feet at mean low water in 1850, the date of the present coast survey chart.

The Sullivan's Island channel is one of a class presented by many harbors besides Charleston. It resembles, for example, the False Hook channel at Sandy Hook, New York, and the Henlopen channel at the capes of the Delaware. These are deep channels, closed by a narrow belt of sand, or bulkhead, on which the water is of less depth than in the channel, and connecting them with the cape or hook, where the change of direction in the current causes a deposit. The bulkhead widens out as it recedes from the cape, forming a shoal which separates the channel from the deep water. The channel itself widens as it deepens. Another of the phenomena of tidal harbors like Charleston, observed by the coast survey, is the uniform tendency of the channels of such harbors to assume, as one of their natural boundaries at the outlet, or place of discharge, one of the limiting capes or points; that is, the deepest water runs very near the shore.

It has also been observed that, under circumstances of frequent occurrence, the main channel is disposed to follow the course of the land; though this tendency is often interrupted by causes of deposit, such as in general can be easily traced. We have an exhibition of this tendency at Charleston.

The gain of the main ship channel towards the land takes place under the operation of a general law, which has been already stated. Such channels, from their position in regard to the land which gives a protection, are usually quite permanent. The existence of the bulkhead and its shoal shows that there is in such places a constant tendency to deposition, and when the material for deposit is fine sand, a channel of this class, if opened, would be certain to close immediately. The Sullivan's Island channel has now a depth of fourteen feet, and on the bulkhead six feet. Lieut. Sherburne's map shows nearly or exactly the same depth in it. The distance from the fourteen-foot curve on the east side of the bulkhead to the fourteen-foot curve on the west side is 280 yards, measured on the shortest line.

The tidal current of ebb passes more directly out of the north channel than of the Sullivan's Island channel, but after the first quarter of the ebb a strong derived current (2.4 miles per hour) sweeps through that channel. The tendency of the current of the ebb to transmit one of its divided streams through this channel, has been exhibited in a very remarkable manner. It is evident from the form of the curves, and the position of the bulkhead, on Major Bache's chart, that this stream formerly ran along the point of Sullivan's island in an easterly direction; Bowman's jettee was laid down directly in its path. The stream, however, still seeks to follow its original channel, and, though diverted in the beginning of its course, finds that channel by a circuitous route, and with an increased velocity. We regard this as being very favorable to the plan of improvement we shall subsequently present.

The deposit on the bulkhead and shoal, and in the channel, is, as far as can be judged in anticipation of the boring, of coarse sand, mixed with shells. Such deposits have been found to indicate a more permanent state of equilibrium than those where sand prevails; thus agreeing with the conclusion from the facts already stated in regard to the Sullivan's Island channel. This feature would be of great importance in relation to any project for making a cut through the bulkhead, both as to the dredging itself and to the probable rapidity of filling up.

Deposits like those forming the bottom of Sullivan's Island channel have been fully recognised, in the extended observations of the survey of the coast, as characteristic of a condition highly promising to purposes of harbor improvement. They indicate, in the first place, a bottom deep, relatively to the adjacent ground; and, in the second place, a state of *comparative* protection or rest. Such deposits, moreover, are more easily removed than the fine and compact sand of the bars and shoals, and they are also less rapidly renewed. Proceeding seaward from the bar, the same character of deposit begins to show itself as soon as the water deepens; that is, as soon as the bottom is more seldom disturbed by the action of the waves in storms. This is mentioned as confirming the view that this deposit is characteristic of a greater degree of rest and protection. But the above generalization is the result of observations made on other parts of our coast, where the instances are so constantly repeated as fully to establish its truth.

The channel under discussion is protected to the southeast by Drunken Dick shoal, and that causing the north breakers, from the violence of the southeasterly swell. We have the authority of one of the most intelligent pilots of the bar of Charleston for saying, that in all ordinary blows there is a smooth sea in the Sullivan's Island channel.

It has been questioned whether the jettees placed on Sullivan's island, to prevent the wearing away of the southwestern extremity, have affected injuriously this channel, and the question has been carefully examined by us. A comparative chart on a full scale has been made, showing the Sullivan's Island channel in its connexion with the shore, and with the shoal to the southward and westward of it, dividing it from deep water, before and after the construction of the jettee. There is a slight uncertainty as to the plane of reference of the chart made in 1841, before the construction of the jettee, which would affect a minute comparison with the coast survey chart; but the uncertainty does not materially influence the result which we have under discussion. The channel has been forced slightly further from the land, and the bulkhead has increased in width, but neither it nor the bulkhead has been affected in depth. An interesting feature in the survey of 1852 is the tendency of the deep water on the two sides of the shoal to approach each other, as shown by the deep pocket (20 feet) south by east of the head of the channel, which does not appear in the survey of 1841. Just at the head of the jettee the current has scooped out the bottom to the depth of sixty feet, having encroached upon the bed of eocene marl known to extend across the harbor from this point to Fort Sumter flats. The deposit of sand on both sides of the jettee has greatly modified the shore line; to which it has added, at a mean, more then one hundred yards. The tendency of the obstruction which this work presents to the ebb is undoubtedly to deflect the water more through the north channel, and it is one of the considerations going to show the stability of the Sullivan's Island channel, that it has not been more affected by the action of the jettee. No work of engineering could better have effected its purpose of protecting Sullivan's island from wear than this jettee. That there should have been a question of its effect on the important channel which is under discussion, shows the necessity of studying, in connexion, the whole of the problem which the harbor presents. It is worth while to observe here, very distinctly, that it is not safe to entertain any projects for special improvements or purposes in a tidal harbor, without a careful consideration of the incidental effects that may follow. The actual state of things can never be disturbed without leading to results that appear to be very remotely connected with the original cause, and indeed, to any but an habitual student of the motion of tidal currents, entirely independent of it. The British harbors are filled with melancholy examples of the injuries produced by constructions designed solely for special or individual benefit. We may profit by these examples, and still further by the present rule of action in the British parliament, of allowing nothing to be done in tidal harbors that can alter the established course of the currents, and consequently change the modes of deposit, without the consent and authority of respectable engineers.

ON THE IMPROVEMENT OF THE BAR.

The importance of an easier access to the inner harbor of Charleston has not failed to render the improvement of the bar and of its channels a subject of study with engineers and others taking deep interest in the commercial prosperity of the city. These suggestions have not been generally recorded in a permanent form, and indeed some of the most valuable have appeared anonymously; and the undersigned have not the knowledge of local history which would enable them to state these plans or projects in a way to give due credit to their authors.

They have not failed, however, to consider such suggestions as have been made, or as have occurred to them during their examinations of the charts and documents within their reach, and of the communications made to them. They are of opinion that any improvement of the bar must be tentative, and hence have decided upon a project safe in itself, not involving a very heavy expenditure, and which will be very beneficial if successful.

Any attempt to improve the bar with its present extent, by adding to the volume of water thrown into the inner harbor—that is, by increasing the reservoir—would, in their opinion, be unavailing. And if artificial works were made for limiting the outside area, now four times that of the entrance, the expense would be very great, and the bar might be removed from its present position to occupy some other without material change of depth upon it. We do not mean to say that such would necessarily be the case, but merely that, until the more feasible and less expensive plan of obtaining access through the Sullivan's Island channel is tried, no such effort should be made.

At the entrance to Mobile bay, in the same relative position as the main ship channel of Charleston after the turn at Cumming's point, several small sand islands exist, the increase of which has forced the water to retain its direct egress from the bay, has limited the spreading on one side, and has forced the bar further out into the Gulf, deepening it materially. The projects for arresting the southern motion of the channels, and their consequent decrease of depth; for preventing the access of the supply of the shifting material of the bar, by a jettee from Long island to Rattlesnake shoal; for dredging out the channels of the bar; for promoting deposits on the bar by permanent or temporary obstacles; for forcing the main ship channel from the shore by wattling; for thorough cuts across the land, to be used instead of the ordinary channels of access, all belong to the class which should be undoubtedly postponed until the direct, simple, and moderately expensive experiment which we propose in Sullivan's Island channel shall have been made.

This experiment is the dredging of a channel from the main ship channel of the inner harbor to the Sullivan's Island channel, of the depth of fourteen feet at low water and nineteen at high. A conjectural estimate of the cost of this operation has been made by one of us, and is annexed; it will be replaced by a detailed estimate, founded on more specific data, but is believed to be a sufficient approximation in regard to the means required for the action of your committees. The position and form of this cut is shown on the annexed chart. Advantage has been taken of the apparent tendency in the fourteen-foot curves to approach at this point to make the cut. The material, as far as is now ascertained, of the bulkhead, (coarse sand and broken shells,) encourages us to believe that the dredging may be made without great difficulty; but the estimate is founded on the removal of sand, and allowance is made for a comparatively large amount of material to be removed. It is not possible to say whether this channel will remain open, or will require to be dredged from time to time, and at what intervals, nor to what depth it may certainly be made. Should a mere depression in the bulkhead result, as would be very likely to be the case were the material fine sand, then the experiment would be a failure, and attention must necessarily be directed to some other remedy. But the probabilities appear to be that a cut may be opened, and may be kept open, without an unreasonable outlay of means—say at a cost of one hundred thousand dollars; and we do not hesitate to recommend the attempt. The nature of the work to be done, and of the locality where it is to be executed, require that careful preparation should be made beforehand. The dredging machine best adapted to remove the deposit—the nature of which the borings will fully show—should be selected, the form and construction of the steam-engine to work it be duly estimated, and experimental trials be made of the best form and construction of the buckets, and other parts of the machine for the work. Not until the best working machine is prepared, and preliminary experiments have shown how best to use it, and the appliances necessary, should the operations be regularly commenced.

This experiment in dredging will be made, at all events, under the best circumstances possible for the outer harbor, on account of its nearness to the cove and city, and the shallowness of the depth; and even if it fail directly to furnish a new channel, the experience thus obtained in dredging will be useful in the subsequent trials which must undoubtedly be made. In the course of the experiment it may be found that the best position has not been fixed upon for the cut, or the best form; and, by watching the action of the currents, the engineer in charge may be able to devise some plan better than that which can be now framed.

Should the experiment succeed, the channel is admirably placed from its directness, and other qualities already enumerated, to give access to the harbor during all prevailing winds. The portion where beating will be difficult will be small, and to vessels towing from or to sea it affords every desirable facility.

ON THE IMPROVEMENT OF THE INNER HARBOR.

This subject has been so ably handled by the officers of engineers who have been engaged in the erection of the works for the defence of the harbor, that it is merely necessary to refer to their reports, and to printed extracts from the more recent ones. The jettee work on Sullivan's island has been entirely successful for the purposes for which it was intended. There remains the improvement of stopping Hog Island channel, and of protecting the bank near Fort Johnson. Sumter flats appear to be filling up so rapidly, that it will be unnecessary to assist the action there, as a general thing. The stopping of Hog Island channel will throw the water of the Ashley over against the wharves, increasing its force and velocity. This may occasion some slight inconvenience to navigation, and may render it necessary to give some additional support to the wharves most exposed to its effects. We have no hesitation, however, in saying, that this measure is indispensable to the security and maintenance of the commercial accommodations of the city. The Sumter flats tend to throw the water towards the cut which we propose into the Sullivan's Island channel.

The effect of the breakwater on the cut, when made, should be observed with the greatest care and minuteness.

We have also appended a copy of a letter from the chamber of commerce of Charleston, requesting us to make the examinations referred to in this report; to do which, we were duly authorized by the departments of the government under which we are serving, respectively.

A. D. BACHE, *Superintendent Coast Survey.*
J. N. MAFFITT, *U. S. N.*
J. D. KURTZ, *U. S. A.*
M. F. MAURY, *U. S. N.*
CHARLES HENRY DAVIS, *U. S. N.*

A DESCRIPTIVE MEMOIR OF CHARLESTON HARBOR.

By Lieut. Maffitt, U. S. N., Assistant in the Coast Survey.

The deterioration of the main ship channel, and general unfavorable changes of the bar of Charleston, S. C., are such as not only to attact attention, but also to excite a reasonable alarm in the minds of her citizens for the safety of her foreign commerce.

By careful comparison with the oldest charts, and consulting with the most experienced and intelligent pilots, it is made manifest, that all the channels have not only decreased in depth, but have changed unfavorably in position.

An investigation of Des Barrés' chart of 1780 will show that more than 13 feet water could be brought in, over the main entrance, at low tide. In 1817, the mean depth on the bar, by Sherburne's chart, was 12.5; and in 1851, only 10.7 is to be found on the main bar at mean low water.

This information, which is corroborated by other evidence, imparts no hope for an improvement by the action of nature; and the demands of commerce call for artificial means to be adopted, even though the effort should result in but temporary benefit; for it may be many years ere such authentic information can be accumulated as will enable the scientific community to ascertain satisfactorily the law which governs the action of nature, and produces the alarming changes on the shore and in the channel-ways.

Charleston bar extends from Sullivan's island, in a southerly direction, (and somewhat parallel to Morris' island,) with a gradual westwardly curve, eleven miles, until it connects with Folly island, three miles south of Light-house inlet.

The *average* breadth of the bar, from the interior to the exterior two-fathoms curve, is one and three-quarters of a mile; the greatest breadth, due east of Fort Sumter, is three and a half miles; the least breadth, east from the light-house, is half a mile. There is much irregularity in the breadth as well as in the configuration of the shoals.

Numerous channels intersect the bar nearly at right angles, and the shoals generally have a broken surface. But *two* of the channels are *now* available—the *north and main ship;* the former is E. by S. from

Fort Sumter, and through it all the northern coasting trade passes. It is narrow, with dangerous shoals on the north and south. Three buoys designate the passage, but the absence of lights prevents its use at night.

Two beacons were erected at Morris' island, to give a range in, through the Overall channel, south of the north. In 1817 ten feet was the mean low water, but in 1851 important changes are shown to have occurred; a six-foot shoal now blocking up the west mouth of this channel, which has rendered it useless to navigation.

The most important, and through which all the foreign trade of Charleston passes, is the *main ship channel*, located three miles north from the southern extremity of the bar, and S. E. from the light-house. This channel is the best and most narrow of all the passages, out or in.

Three buoys designate the locality of the deepest water, and a beacon is erected which, with the Charleston light, gives a range that enables the navigator to cross the bar at night with safety; when inside, the beacon-lights back of Fort Moultrie mark out the channel up to Cumming's point.

The improvements of lights, beacons, and buoys, as suggested by the "Board on Light-houses," &c., for the advantage of Charleston horbor and bar, are necessary, and would materially tend to the benefit of navigation.

The water from the Cooper river rushes in a southeastwardly direction, until checked by a shoal projecting from the main land called Oyster point; deflected from thence, it impinges on the Charleston side, cutting out a narrow but deep passage, called Town creek, between Drum island and the main land. The water which does not pass through this channel shoots to the northward of Drum island, and speedily mingles in a southeastwardly course with that of the Wando.

At the southern extremity of Drum island all the waters of the Cooper and Wando are united, and pass together towards the city. It is probable that the extension of the northern wharves, as well as the current from the Wando, deflects a portion of this water from its regular course through a channel north of Folly island, called Hog Island channel.

By a comparison with the maps of Des Barrés, of 1780, Major Bache, 1825, and United States Coast Survey, 1851, it is made evident that this channel is rapidly increasing in breadth and depth, which circumstance has created a feeling of anxiety for other parts of the inner harbor; as the loss of so large a volume of water from its natural egress by the city, and westward of Castle Pinckney, may cause a diminution of depth abreast of the wharves, and an increase of the Middle Ground.

The union of the waters of the Cooper, Wando, and Ashley, occurs at the west end of the Middle Ground, where they pass on under different influences to the *grand reservoir* of the *harbor—Rebellion roads.*

The separation of the tidal current at White point has caused a deposit of considerable extent, which projects out eight hundred feet from the bath-house. The deep water of the Ashley river, with an average of four and a half fathoms, inclines along the city wharves, (the alluvial deposit being great, and spreading out in extensive flats on either shore;) thence glancing off to the southward and eastward, with the direct action of a portion of the ebb from Cooper river, it touches on James' island, with a wasting influence on that beach, from whence it is again deflected, east northwardly, to Rebellion roads.

The convergence of the Ashley and Cooper has no doubt caused the formation of that troublesome shoal, in the centre of the inner harbor, called the "Middle Ground," which extends three-quarters of a mile west and east, and one-third of a mile north and south—having *at present* more depth than in 1825; the least water *now* is eight feet at mean low water, and six at spring tides. The water from Hog Island channel, after passing round by Mount Pleasant in a circuitous direction, unites with that from Sullivan's cove, and empties into Rebellion roads, where the union of all the waters of Charleston is perfected.

The large body of water compressed in Rebellion roads finds its egress oceanward, between Forts Sumter and Moultrie, with so strong and scouring a force, that it has carved out the bottom here to the depth of thirteen and fourteen fathoms, finding a foundation of rocks or marl mixed with shells; beyond this point the current spreads over a greater surface, with the strongest tendency through the Sullivan and north channels. The velocity around and by Cumming's point is weakened, in its southern progress, from a gradual diffusion, at right angles, over the bar. In passing through the main ship channel the ebb is somewhat reinvigorated, probably by the current out of Light-house inlet, though its strength is not sufficient to contend successfully with the deleterious action of the ocean current and hammering waves forced in by the northeasterly gales.

A portion of the ebb rejects the main ship channel, and, passing on to the southward and westward of the south breakers, makes its exit through the Lawford, which in 1817 was a twelve-foot, but *now* a seven-foot, channel. The flood to the eastward of the bar (in calm weather) sets about east by north—the ebb generally west southwest. The currents are much influenced, though not controlled, by the prevailing wind. The *average* force of the flood on the bar is 1.2 miles per hour, with a duration of 5h. 40m. The velocity of the ebb is 1.55 miles per hour, with a duration of six hours; *inside* of the bar, and particularly *in the channel-ways*, the current velocity is much greater than *on it;* and *outside* the velocity is much less.

In the Cooper river, the bottom is generally mud and sand, the average depth being from five to eight and nine fathoms. Abreast of Market street wharf the bottom is slaty, consequently the anchorage bad; proceeding further south the mud increases, and, in the Ashley muddy bottom prevails.

Between Folly and James' island, mud and sand characterize the deep water, but fine sand the shoal.

In Rebellion roads, mud and gray sand predominate. A short distance south by west of Fort Moultrie, in a line with Cumming's point, there is a bed of calcareous or limestone rock, which is supposed to extend eastward further than the limits of the bar. If this prove true, the proposition for dredging out the channel will be more attractive, from the increased probability of the experiment being successful.

The bar of Charleston is composed of fine gray sand, mixed with black specks, with occasional layers of coarse sand and broken shells. To the eastward of the bar, in deep water, coarse sand and gravel, with broken shells, (and mud occasionally,) constitute the general character of the bottom, except on the Rattlesnake shoal; that is formed of fine white sand and black specks, corresponding to the deposits on Drunken Dick.

The east three-fathom curve of the bar is uniform and nearly parallel with the coast, but the inside curves are broken and irregular, particularly from abreast of the Overall beacons to the westward, which originates from the dredging effects of the ebb tide, exhibiting greater strength *here* than further south.

The extensive shoals that caused the south breakers are strung together in the most singular and irregular manner, strongly exhibiting the influence of ocean wave and current action; fine gray sand, with occasional beds of broken shells, denote the character of the bottom.

Along the beach of Sullivan's island is a channel with fourteen and fifteen feet of water at low tide, except at its inner or western entrance, by the long jettee south of Fort Moultrie, where is deposited a belt of broken shells and fine sand, with but seven feet upon it.

Adjacent to this belt, to the westward, the depth of water is very great, starting from twenty feet abruptly down to sixty. The ebb tide in this locality runs with great force, its average velocity being 2.4 miles per hour; and over the jettee it is very rapid until half ebb, when the exposure of the rocks, by the falling of the water, produces an eddy current favorable to the deposit which the flood tide has already made, increasing the east beach to some considerable extent.

The unfortunate condition of the bar, and manifest anxiety for its benefit on the part of the citizens, has naturally urged upon me (independent of my duty) a close inspection, and considerable reflection, as to the proper locality that might be susceptible of improvement.

My investigation has resulted in the settled conviction that no feasible or reasonable plan can be adopted for the benefit of any one channel south of Sullivan's Island channel.

All the rest are alike exposed to the revolutionary action of easterly gales, which cause an ocean current, that conveys and deposits at the mouth of all the channels (except Sullivan's island) a "bulkhead" of fine sand, which the ebb tide has not sufficient power to disperse; besides this, it will be made manifest that these channels are not only shoalened by marine deposit, but that, under the same ocean influence, they are working further to the southward.

Due east of Fort Sumter, and three and a half miles from Breach inlet, is located a dangerous and important shoal, unconnected with the bar; it trends nearly N. E. and S. W., and is two and a half miles in length, with a breadth of one-eighth of a mile. At spring tides there is but five feet water upon it in several places; it is formed of fine gray sand, with black specks, and has four fathoms close in with it on either side, the bottom changing to coarse sand and broken shells.

This shoal, being in the track of all the northern coasting vessels, is dangerous to navigation, and should be buoyed; yet undoubtedly it is beneficial to Sullivan's Island channel, acting as a *breakwater* in easterly gales, and protecting it from the injurious influence of the sea.

The trending out to the eastward of Long island, and the shoal spit from "Dewees' inlet," must afford material protection to the above-mentioned channel; while "Drunken Dick," and the bar generally, protects it from the southeastwardly and southwestwardly gales.

Thus nature affords a shield to the Sullivan's Island channel, which, in my opinion, warrants a *reasonable expenditure* in the shape of experiment, the prospect of advantage being not altogether hypothetical. There is one certainty well worthy of consideration—that, if the experiment *here fails*, the other channels cannot be injured by the effort to obtain a better channel-way at this point of the bar.

My observation goes to prove that all passages over a sandy formation have a natural tendency to follow the shore, as is the case with the Sullivan's Island channel.

In the inner barrier, which now renders it unavailable, consists in many places of coarse sand and broken shells; in others, gray and black sand, with a large quantity of mica; under this layer, sand and shells. The distance to be dredged will not be more than one thousand five hundred feet in length, and the quantity necessary to displace, for the obtainment of a fourteen-foot channel, would not much exceed five million cubic feet of the bottom.

The ebb tide has at present a decided inclination to force a good outlet here; for, since the building of Fort Sumter, between that fort and Fort Johnson the flats have accumulated, and the sand "uphove" to such an extent as to form a natural jettee, deflecting the ebb towards Sullivan's island.

I am strongly impressed with the idea that if this belt, E. S. E. from "Bowman jettee," be dredged to a sufficient depth, the accumulated force of the ebb (from the deep basin alluded to before) will be powerful enough to keep the channel clear; but even with the conviction that in time a redeposit would occur, I would not be deterred from the *experiment;* for, possessing the "dredging machine," which, when unemployed on the bar, could be hired to the owners of wharves to dredge the docks with, the continuous facility for cleansing would always be on hand, and the passage kept open at a comparatively small expense.

The next channel to notice is the north, which is in a direct line and due E. S. E. of the mouth of "Rebellion roads," apparently open to the full influence of the ebb, or cleansing current, which would seem to warrant its possessing greater depth than any other channel on the bar. This, however, is not the case; for, being exposed to the influences before mentioned, it is injured by a "bulkhead" of fine sand athwart its eastern mouth, with but eight feet water at mean low tides, and six at spring.

One-half a mile south of the north, and parallel, is the Swash channel, which possesses all the characteristics of direction, bottom, depth, and formation, as the former.

The next channel is the "Overall." In 1817 this channel was more available than the north, the beacons in range leading into nothing less than ten feet at low water; but at present a narrow crest of fine sand, with only six feet at mean low water, has formed across the inner mouth, to the almost total uselessness of the passage.

Adjacent to the "Overall" is the "Coast Survey channel," called the "New Middle." It was discovered by the hydrographical party under my command in 1850, and eleven feet at mean low water could be carried through without difficulty. The character of the bottom, and lumpy spots in many places, rendered its permanency doubtful; and orders were wisely issued for repeated examination (as the opportunity offered) ere a final report of its character should be made.

In January, 1851, when re-examined, no material change was obvious; but in February, 1851, a small vessel was wrecked a few hundred yards north of the west entrance. She bilged and drifted into this channel, sinking in eleven feet water Ere she broke up and drifted away a six-foot shoal formed around her; and by the recent resurvey of January, 1852, a narrow belt of sand was found to have banked up athwart the east entrance, making a six-foot shoal, where, in 1850, eleven feet at mean low water existed. These changes were not altogether unexpected, from the loose nature of the sand composing the bottom, and particularly as the location of the channel was unfavorable for the scouring action of the ebb tide. It is but proper here to mention circumstances of considerable interest that were made manifest while obtaining the set and velocity of the currents in this channel. Finding that the anchor did not hold on the flood, the moorings were doubled, and the bottom sounded with a pike. The sand seemed all alive, and appeared to travel in with the tide; when the ebb made, the bottom at once hardened down, and no impression could be made with the pike. Specimens of the water, at different stages of the tide, were, in consequence, bottled. Those that I personally examined gave evidence that on the flood the water was impregnated with fine sand, which was not the case on the ebb. This is but a collateral evidence that all changes on the bar are produced by the flood; and microscopic examination of the specimens of the bottom proves the deposit to be marine.

From the New Middle channel south the bar narrows, and when about east from the light a ten-foot channel exists now, called "New S. E. channel," which on Des Barrés' chart of 1780 appears to have been the main ship channel. But the present main ship channel is one mile south of this, tending W. N. W. and E. S. E. Like the others, it is exposed, and manifests the destructive influence of the ocean, having a narrow belt of fine sand at the outer mouth, with but 10.6 feet at mean low water, and 8.7 at spring tides. The channel is full of lumps, which no doubt originated from the repeated loss of buoy moorings, that became the nucleus of small and troublesome shoals. This channel continues to work to the southward, as is clearly proved from the following circumstance: In 1831 the range beacon for crossing the bar was three hundred and twenty yards to the northward of its position in 1850. In January, 1852, it was again moved twenty-six yards further south, in order to range with the light for crossing the bar in the best water.

The knowledge of the migratory character of the channel might have suggested the propriety of a portable beacon in place of the brick one just erected.

Southwest from and bordering on the main ship channel there exists extensive and dangerous shoals; and between them lies the last swash or channel on Charleston bar: this is called the "Lawford." Two years ago it was buoyed and constantly used by the Savannah steamers; the changes in it have been so injurious, in the last eighteen months, by the increase of shoal ground, that the steamers have abandoned it, and now use entirely the main.

In May, 1849, I erected a signal on Folly island, on a bluff some twenty yards from high-water mark. In December, of the same year, I found that it had been washed away; the bluff was submerged, and no trace of the signal left.

In conclusion, I would state that I do not think there is any danger to be apprehended from the action of the ocean on Sullivan's island, as the jettees now standing have had the desired effect of preserving the beach from the sea encroachment. Should there be a doubt on this subject, I would suggest the placing of small jettees along the beach, to extend but a few feet below low-water mark, as at Beaufort, N. C., where small stone jettees had the desired effect, under circumstances precisely similar to the beach in question at this place; and the washing of the shore, which was at one time rapid, has been checked by the numerous small jettees erected for its preservation. A few years of observation would show whether these additions are necessary or not. The elongation of the present jettee does not appear desirable.

In the event of a recommendation being made for the dredging of the Sullivan's Island channel, I would suggest a re-examination and more elaborate survey, on a large scale, for the guidance of the persons who may have the direction and control of a work which is so vital to the commercial prosperity of the city of Charleston.

All of which is respectfully submitted by

Your obedient servant,

J. N. MAFFITT,

Lieutenant Commanding United States Navy.

ABSTRACT OF THE REPORT OF CAPT. A. H. BOWMAN, CORPS OF ENGINEERS, U. S.

On the improvement of Charleston harbor, October 11, 1839.

SIR: The principal work now in progress in Charleston harbor is that designed to protect the site of Fort Moultrie, and to prevent the farther encroachments of the sea upon Sullivan's island. In the success of this work Charleston has a deep interest. The destruction of Sullivan's island would render this harbor little better than an open roadstead. with no protection against the violent northeast gales so common in this latitude, especially about the time of the equinoxes. Storms from this quarter are directly opposed to the Gulf stream, and cause the water to rise to an unusual height, rolling a heavy sea into those harbors that are unprotected. During the gales of 1699, 1728, and 1752, and others at a more recent period, the water rose ten feet above the ordinary high tide, covering the city of Charleston, and compelling the inhabitants to retreat to the second stories of their houses, destroying the wharves and shipping to a ruinous extent. On these occasions the force of the sea was broken by this island; to the protection thus afforded, the town owed its preservation from still more extensive injury.

The present fort, erected in 1806, is the third which has occupied the southwest end of the island. The two first, more perishable than the honors acquired in their defence, have been swept away; not a vestige of either now remains above the waters by which they were destroyed. It is not possible to ascertain, with any degree of certainty, the extent of beach that has been washed away. It is, however, probable that some two hundred and fifty yards of the southwest point of the island has been destroyed; of this a portion was marsh, but the greater part light sand, mixed with small particles of mica. Colonel Moultrie, in his report of the defence of the fort, says, "there was a morass in the midst of the fort that swallowed the shells as fast as they fell." The existence of cypress knees and stumps on the point of the beach, at a recent period, shows that the marsh extended even beyond the limits of the fort. This is an important fact connected with the preservation of the island. The encroachments of the sea may be arrested where we have mud bottom to build upon. The abrasion occasioned by the waves above low-water mark was readily prevented by the system of jettees and crib-work commenced in 1830. It was evident, however, if the deep water of the channel continued to approach the shore, that both the crib work and the fort it was designed to protect must be involved in one common fate, so soon as it should reach them. Before the commencement of the system of jettees the sea had reached the present fort, and had thrown down portions of two faces of the work. To prevent, if possible, the nearer approach of the deep water, it was resolved to construct grillages, running perpendicular to the direction of the current, and extending from the crib-work on shore towards the channel; these grillages to be loaded with rough stone, rising as near to the surface of the water as should be found necessary to cause a deflection of the current from the shore.

It has been stated that the great moving power of the sand was the flood tide; the largest accumulation of sand has consequently been on the sea side of these grillages. On the opposite side the increment was comparatively small. The first gale, above referred to, brought the sea with great force upon the mass of sand accumulated on the sea side of the grillage. By the combined action of the waves and current, a large amount of this sand was washed over the grillage, forming, on the harbor side, a bank equal to that on the sea side.

After the gale abated, the accumulation of sand on the sea side of the grillage soon attained its former magnitude, the beach on the opposite side having been increased in breadth about seventy feet; similar results were produced by the second gale.

In compliance with the instructions of the department to that effect, my attention during the summer has been directed to the proposed breakwater over Drunken Dick shoal. The protection of Sullivan's island cannot be regarded as complete until this work shall be constructed. The grillages, when finished, it is believed, will render the west end of the island secure; but well-grounded apprehensions are entertained that the sea will make a breach through the island at a low and narrow place called the "Curlew Ground," directly north of Drunken Dick shoal.

The proposed work would at once remove all grounds for such apprehensions, besides securing important advantages to the port of Charleston.

It will cause the extension of Sullivan's island to the south, and, in a corresponding degree, diminish the force of the sea in the harbor. It will concentrate the water upon the bar of the north channel, and increase the depth. This channel is straight, and would, by these means, be rendered the safest and most accessible entrance.

In his report of October 17, 1839.

Referring to your letter of August 31st, I find instructions to report "on the present state of the channel between Shute's folly and Hog island," &c.

The passage between Shute's folly and Hog island, at the point of separation from Cooper river, is broad and deep, but gradually contracts in its course towards the lower harbor to five hundred yards in width; it then expands, and in its course to the bay passes over extensive shoal, intersected by two channels.

There are forty-five feet water in this channel, at low tide, from Cooper river to the gorge above mentioned; below this point the depth gradually diminishes as the breadth increases. There is, however, water enough to admit any vessel that can enter the harbor. The marsh through which it passes is alluvial, and yields readily to the action of water. The city wharves, which project into Cooper river about the point of separation, and the current from Town creek, which enters diagonally from the opposite side, act conjointly in deflecting the water towards Hog Island channel, and have, without doubt, caused the enlargement of its dimensions. There is reason to apprehend that, if measures are not taken to prevent it, this channel will become larger than that which passes the city; and that deposits of sand and mud, in front of the wharves, will follow as a necessary consequence.

The most respectable authority establishes, beyond dispute, that Hog Island channel-pass has been gradually increasing for many years past. The causes which are supposed to have produced the enlargement of Hog Island channel still exist; it cannot reasonably be expected, therefore, that their effects should cease, but rather continue to augment, until the worst fears of those interested are realized.

If these views are correct, delay will increase the expense of a work which must ultimately be constructed.

In forming an opinion of the probable effects of partially or entirely closing Hog Island pass, it will be useful to inquire what was the situation of the interior harbor at a period when the channel was small, and received but little of the water of Cooper river. From the best information I have been able to procure, it appears that the depth of water opposite the city was then greater than it now is, and that the change has been effected by deposits of sand and mud.

The quantity of water flowing through Hog Island channel has undoubtedly greatly increased, while that which passes the city has diminished, and the power of its current diminished in proportion. Each channel will adapt itself to the volume of water it is required to discharge; the one by wearing away the enclosing banks; the other, by its inability to remove them, will be obstructed by deposits.

It would seem to follow, that the closing of Hog Island channel, by restoring to the channel opposite the city its original volume of water, will give it also its former dimensions.

From the effects already produced, and those that may be anticipated from the enlargement of Hog Island channel, I am clearly of the opinion that it should be effectually closed.

In addition to those works already recommended for the improvement of Charleston harbor, I beg leave to call the attention of the department to another which appears worthy of consideration. It is the construction of a breakwater from Cumming's point to Fort Sumter. This work, in connexion with the proposed breakwater over Drunken Dick shoal, will add essentially to the security of the exterior harbor; will effectually protect the east side of James' island, and supersede the necessity of the work recommended for that purpose. Its location should be upon the shoal which extends from the point to the site of Fort Sumter.

In his report of January 21, 1842.

The preliminary survey of Drunken Dick shoal being completed, I have the honor to submit herewith, for the consideration of the department, plans and estimates of the proposed dike.

The objects to be attained are—

1st. Additional security to Sullivan's island and the site of Fort Moultrie.

2d. Protection to the harbor of Charleston from the effects of northeast gales.

The first well-authenticated account of the encroachment of the sea upon Sullivan's island which I have been able to find, relating to the period subsequent to that above referred to, viz. 1776, is that of Von Hoff. Upon the authority of this writer, it appears that, during the three years ending 1786, the sea carried away one-quarter of a mile of the beach. From that time forward, till 1830, when it reached and destroyed a portion of the walls of the present fort, its progress was more or less rapid in proportion as the storms by which its destruction was chiefly effected were more or less severe.

The works commenced during the year last mentioned, for the protection of the site of Fort Moultrie, seem to have arrested the advance of the sea, and have since caused an increase of the beach.

The entire destruction of Sullivan's island would leave the harbor of Charleston exposed to the unbroken violence of the sea. The great interest manifested by the inhabitants in its preservation, has led to the investigation of the causes which have exercised a prejudicial influence upon it.

Amongst the most prominent assigned may be mentioned the wharves of Charleston, the enlargement of Hog Island channel, and the foundation of Fort Sumter.

It appears, however, that the tide from the "Cove," striking that from Hog island nearly at right angles, forces it off the shore. Observation has further shown that the destruction of beach is greatest during flood tide, which of course is independent of any influence from wharves and channels four miles above the point of greatest decrement.

After a careful examination of the subject, I am unable to discover that the foundation of Fort Sumter has produced any perceptible effect.

But while doubting the agency of the supposed causes above referred to, it is with less confidence that I proceed to state what appears to me the true source of the degradation of the shores of this island. It has already been stated that it is during flood tide, with the wind on shore, that most injury is done to the beach; it is therefore to the ocean, and not to the harbor, we are to look for the source of mischief.

In general, the stability of a particular point on the seashore depends more upon the contour of coast, and the direction of the prevailing winds and currents, than upon the nature of the materials of which the coast is composed.

The wind from northeast, acting against the Gulf stream, causes a high rise in the tide, and is always accompanied by a heavy sea and a southwest current. The south and southwest winds, which frequently blow as violently as those from northeast, throw in a heavy sea on the beach at the point where the greatest injury has been done, has assumed the form it might be expected to take from the action of the waves during the southwest gales, viz: a straight line of coast, nearly perpendicular to the direction of the winds. It is reasonable to suppose that the bar, which encircles the entrance to this harbor in the form of a crescent, arrests the sub-current, and that none but that which flows unbroken over the bar does any injury to the beach. This accords with my observation. I have not been able to satisfy myself that the shores of the island are wearing away to any great extent below this level.

Assuming, then, that the direction of prevailing winds and currents and the contour of coast (all other things being equal) determine their stability, I proceed next to the consideration of the best means of counteracting the influence of those winds and currents which are believed to have caused the destruction of a portion of this island.

Two plans of the proposed work are herewith submitted, differing in nothing but position.

The first to consist of a grillage of palmetto logs, loaded with rough granite, having the inner end resting on the shore and extending along the crest of the shoal. The second to consist of a similar grillage, loaded in like manner, extending from the shoal perpendicularly to the rock which forms the bottom of the channel.

The first-proposed work would break the force of the waves, which roll in upon the shore with great violence during storms.

From its position, however, it will be liable to all the fluctuations of the bar upon which it is placed, and may be washed away by some slight change in the direction of the currents by which that bar was formed, (a change that in all probability may be effected by the breakwater,) and would have less influence in arresting the sea which flows into the harbor during storms, than one located along the ground line.

The second plan, the adoption of which is respectfully recommended, it is believed will ultimately afford equal protection to the Curlew Ground, by causing the space between Drunken Dick shoal and the shore to fill up, and will possess the advantage of greater security, having one end resting upon the works on shore, at the point where the sand is rapidly accumulating, and the other upon a rock bottom.

The direction of the work, according to this plan, will vary slightly from a north and south line, and will, therefore, be nearly perpendicular to the direction of the prevailing winds and currents. It will, consequently, be less liable to be undermined; while its position, with respect to the prevailing currents, will cause the greatest accumulation of sand.

Report of Lieut. Kurtz, corps of engineers, on the cost of dredging the channel through the bulkhead across the Sullivan's Island channel.

The following data are assumed as the basis of this estimate:

1. The deepening to be attempted by dredging machines, without the aid of artificial walls to contract the channel-way.
2. The indications of the bottom render it probable that such an excavation will be kept open by the current.
3. From the caving of the sides, and the flow of the tides, it is probable that twice as much material will have to be removed as now occupies the space to be cleared.
4. From the exposure of the position, the machines cannot probably be kept at work more than half the time.

ESTIMATE.

Cost of dredging 621,600 tons raised to an average height of twenty feet	$24,864
Cost of maintaining vessels and crews while not at work	30,246
Cost of mud-scows	1,800
Cost of cordage for hawsers	600
Cost of crews of scows	10,800
Cost of dredge-boats	18,000
Superintendent's wages	2,400
Clerks' wages	1,200
Office hire, fuel, stationery, and postage	475
Unforeseen expenses	9,038
	99,428

The cost of dredging a channel following the line C D will exceed the above by twenty-five per centum.

Letter of Professor Holmes, of Charleston college, in relation to the geographical formations underlying Charleston harbor.

CHARLESTON COLLEGE, *March* 11, 1852.

DEAR SIR: I beg herewith to submit for your examination a geological map of the State of South Carolina, taken from a recent survey made by Professor Tuomey; and also, for your perusal, a few notes descriptive of the geology of Charleston and the surrounding country, which I published a year or two ago. Especially would I claim your attention to the diagram annexed to the map, of a geological section extending from tide level at Charleston to the Saluda gap, as from it, and some recent discoveries made in the marine beds, we hope to throw some light upon the structure of the "bars" at the entrance of Charleston harbor.

From actual surveys it has been ascertained that the great bed of marl so extensively developed in South Carolina, and known to geologists as belonging to the eocene formation, underlies the city of Charleston at the depth of about sixty feet, and out-crops, or comes to the surface, nine miles northwest, near Ashley ferry. About seven miles north of east, in a nearly opposite direction, the superimposed beds, called Post Pliocene, are exposed upon or near the surface; thus placing Charleston a little to the east of the central axis of a small *basin* about sixteen miles wide. We say a basin, because in addition to the out-crop and exposure of the marl, and its accompanying rocks inland, we frequently obtain from fishermen fine specimens of marl rock, dredged from the bar and the harbor, and often off the coast in twelve to fifteen fathoms, all of which specimens are quite characteristic of the eocene marl; and as it is well known that the "Northern," or "Sullivan's Island channel," suddenly shoals from ten fathoms or sixty feet on the west, to one and a half fathoms or nine feet, and with a current at half ebb of say four knots, for the space of two hundred yards, when it as suddenly deepens to twenty-five feet, it seems reasonable to infer hence that these obstructions are not caused by sand bars, but are submarine escarpments of the marl rock, the representative of the eastern ridge of the basin partially removed by the denuding action of the waves of the ocean.

I am, dear sir, most respectfully, your obedient servant,

FRANCIS S. HOLMES.

Professor A. D. BACHE.

Letters from Captain Peck, of the steamer William Seabrook, and of Mr. Adkins, pilot of the mail-steamer Marion.

CHARLESTON, S. C., *March* 17, 1852.

Since 1840 I have had continual experience in and about Charleston harbor and bar. I have made the following observations, viz:

That the shoal ground between Fort Sumter and Fort Johnson has increased, forming a high bank exposed at half ebb. This bank has thrown the body of the ebb towards Sullivan's island.

The force of ebb and flood is much weakened when to the southward and westward of Cumming's Point buoy. I have observed that the main force of the tide in and out of Charleston harbor is through the north and Sullivan's Island channels; through the latter, on the ebb, most forcibly, until Bowman's jettee is exposed.

I have examined the coast survey chart of Charleston harbor and bar, and find it full and complete in every respect. The proposed opening of Sullivan's Island channel I approve of highly, and think it the only spot on the bar where an experiment can be attempted with a prospect of success. My reasons are as follows, viz:

1st. All the channels south of Sullivan's island are exposed to the ocean, and consequently are shifted more or less at every heavy blow. Moreover, the ebb is so dispersed that it has not the power to keep open the channels.

2d. The Sullivan's Island channel is protected from the N. E. by the trending out of Long island and Dewees' Inlet shoal; from the eastward by the Rattlesnake. In heavy N. E. blows, I have particularly observed that Sullivan's Island channel was never affected by breakers, as is the case in the other channels. This is the only protected channel on the bar from easterly and northeasterly gales, and the Drunken Dick protects it in part from a S. E. blow.

In anything like a swell, fourteen feet in the Sullivan's Island channel would be better than sixteen on the main bar. I have anchored off the bar; the flood sets direct to the breakers, the ebb from them.

It is my impression, that if the belt which separates the inner curve of deep water from the outer curve of deep water is opened, the action of the ebb will be sufficient to keep it open; for, if the belt or bulkhead be removed, the ebb will flow through, whereas now it is bluffed off on the last quarter of the ebb.

FENN PECK,
Commanding steamer William Seabrook.

To Prof. A. D. Bache, and the Gentlemen of the Board.

Charleston, *March* 13, 1852.

I have examined the coast survey chart, and with pleasure attest to its perfect accuracy.

The proposition for dredging out the Sullivan's Island channel is, to my mind, a good one. *I know of no other part of the bar* where an improvement can be attempted with prospects of success. In all ordinary blows there is a smooth sea in the Sullivan's Island channel.

SIMPSON ADKINS,
Pilot of mail-steamer Marion.

To the Gentlemen of the Board for the improvement of Charleston bar.

DRAWINGS AND DOCUMENTS ACCOMPANYING THE REPORT.

With this report the following named drawings and documents were submitted:

1. The Coast Survey chart of Charleston harbor and its approaches, from the survey of 1850–'51, scale $\frac{1}{10000}$, prepared by request, for the use of the chamber of commerce of Charleston.

2. General Coast Survey chart, showing the approach to Charleston harbor.

3. Charts of the Tidal Currents of ebb and flood in Charleston harbor, showing their direction and velocity.

4. Detailed chart of Sullivan's Island channel by the Coast Survey, 1851–'52, scale $\frac{1}{10000}$.

5. Comparative chart of Sullivan's Island channel before the construction of Bowman's jettee, and in 1851–'52.

6. Comparative charts, showing the curves of 6 and 12 feet depth, from the charts of 1780, (Des Barrés',) Lieut. Sherburne and Maj. Bache.

APPENDIX M M—1.

CHARLESTON, S. C., *January* 29, 1853.

SIR: After a careful study of the report and project of the commissioners on the improvement of the harbor of Charleston, S. C., and an attentive examination of the accompanying charts, I am clearly of opinion that the plan proposed, and the point selected, by the commissioners for the improvement, offer more to encourage a hope of success than any other.

The execution of the work, however, even here, will be attended with numerous and formidable difficulties. The exposed situation, the nature of the materials forming the "bulkhead," the immense amount of fine sand held in suspension by the flood tide ready to be deposited by a moderate retardation of the velocity of the current, the strong tendency of the ebb tide to take the north channel and pass by the mouth of the proposed cut—all these will present themselves during the progress of the operations, in various ways and degrees, to injure or retard the work. The effects to be apprehended from these causes are so manifest, that it will be out of place here to do more than barely mention them.

1st. The exposed position will frequently cause the entire interruption of the operations of the dredge-boats; more frequently retard them and render their working imperfect; will increase the difficulty and expense of removing the dredged material; will render it necessary to receive this material in scows so far detached from the dredge as to prevent their collision during rough weather; will render a powerful tug-boat necessary to manage the scows in strong tideways, and occasionally to lend assistance to the dredge to escape to harbor; will increase the expense for moorings, anchors, &c., &c.

2d. The nature of the material forming the "bulkhead." This material appears, from the borings, to be sand, and sand and shells mixed. Upon the proportions of shells in this mixture, and the coarseness of the silicious particles, will materially depend the difficulty of making a permanent impression upon the "bulkhead." If fine sand and other matter of different specific gravities predominate to the extent necessary to render it "quick," this will form a great, if not absolute, insuperable difficulty.

3d. The sand held in suspension by the flood tide and liable to be deposited when the velocity of the current is checked. This will increase the expense in proportion to the amount of sand transported and deposited by the flood tide during the continuance of the work, or until the channel is so far opened by dredging as to invite a sufficient volume of water on the ebb to remove the silt deposited by the flood tide.

I shall endeavor to show, before concluding, that the "bulkhead and Sullivan's Island channel" are both due to the flood tide, and that the "bulkhead" is a deposition of the sand daily brought in by the flood tide, which will continue to accumulate, and must be removed by inviting a stronger ebb current through the excavated channel.

4th. The strong tendency of the ebb tide to take the north channel and pass the mouth of the proposed cut. It will be seen, by reference to the accompanying current chart, that a large portion of the ebb tide is deflected towards the north channel by the point of Sullivan's island and the dike; and while there has been a manifest effort of the ebb to escape into the Sullivan's Island channel, at a point some distance to the east of the dike, it is quite apparent that something like an equilibrium exists between the depositing power of the flood and the scour of the ebb; the effects of which are, to maintain the bar and to prevent the ebb from breaking through at this point. Upon the efficacy of the means used to reverse the relative power of the flood and ebb tides at this point, will mainly depend the success and permanence of the undertaking.

I have thus briefly referred to the difficulties that may reasonably be anticipated, and the manner in which they are likely to act. I will now endeavor to point out the advantages which the position of the proposed cut presents over any other that could be undertaken, with any probability of success.

An examination of the accompanying chart will show the Sullivan's Island channel as it now exists, and is known to have existed for nearly a century. It is a long, trumpet-shaped channel, presenting its open or longer end to the east, as inviting the silt, which is moving along the coast in great quantities, to enter and close it; and yet it has, in shape and dimensions, remained nearly unchanged from the date of the earliest charts to the present day, and this, too, in despite of its change of position.

The dike to Drunken Dick closed the smaller end of this channel, and added (near Fort Moultrie) between one and two hundred yards of beach above ordinary high-water mark; the effect of which was, not as would have been expected, to narrow this channel, but to move it bodily to the south. What was taken from its breadth on the shore side by the increment of the beach, was restored by its encroachments on the shoal of Drunken Dick. This persistence in the Sullivan's Island channel to maintain its dimensions and position relatively to the shore for so great a length of time, cannot be the result of accident; and it would be unphilosophical to ascribe it to the accidental concurrence of currents and winds that are daily giving new forms to the outline of our coast. The wind and tide, acting together for even a short period, might excavate from the light sandy material of this coast a channel like the one under consideration; but the chances would be equal that, under some new combination of these powerful agents, its place might be occupied by a sand bar before the end of the season. We are therefore compelled to ascribe the position and permanence of the Sullivan's Island channel to causes comparatively constant in degree and direction.

It would scarcely be worth while to inquire what these causes are which result in a permanent channel most favorably situated for the proposed improvement, but from the fear that in disturbing the present régime we may counteract them, and destroy or injure the channel.

It is stated, in the very able report of the commissioners which accompanies this, "That the wave of the sea breaks on the shore in a normal direction, coinciding with the flood tide; and this direction is, most frequently, (speaking of the alluvial coast from north to south,) oblique to the trend of the land. Hence it follows that the motion of translation—belonging to the form of wave which finally breaks on the beach—is a progressive motion, and that all the matter held in suspension by the water, and left to its disposition, by any cause whatever, is transported slowly but constantly in the direction in which the final wave of the sea breaks, with respect to the line of the beach."

My acquaintance with this locality for the last twelve years enables me to attest the correctness of the above cited general principle in its application to the case in question, and also to the remark, that the flood tide sets nearly parallel to the shore of Sullivan's island. To these conjoint causes may be attributed the existence and permanence of the Sullivan's Island channel. The waves break in a direction coinciding with the flood tide, and this direction being slightly oblique to the trend of the land, the result must be—first, great disturbance of the sand by the breaking of the wave; and, secondly, the transportation of the suspended matter in the direction of the flood. It may be asked, why this action does not open the shore channel entirely through the "bulkhead," thus giving a fair way channel, quite into the harbor, of the general depth of the Sullivan Island channel.

To understand the cause of the obstruction to this channel called the "bulkhead," (which is laid down in every chart to which I have had access,) it will be necessary again to refer to the accompanying chart, where it will be seen that the comparatively small volume of flood tide which comes through the Sullivan's Island channel is met by the immense volume flowing through the north and main ship channel, almost at right angles, and is compelled suddenly to change its direction to the north and west. This causes a very considerable retardation of its velocity, and a subsidence of the suspended silt is the consequence; this silt forms the "bulkhead" in question. The ebb tide, as before stated, is deflected by the southwest point of Sullivan's island and the dike, and during the last half (by far the most effective in scouring) by the shoal of Drunken Dick, into the north channel, and is consequently inoperative in removing the sand which the flood tide has deposited; the result is a formation of a permanent bar, separating the shore channel from the main ship channel, at the precise point where it might be expected to occur from the operation of the causes referred to.

To control, as far as possible, the direction of the ebb tide, becomes therefore an object of the greatest importance, as upon its agency will depend the permanence of any improvement effected. This object, it is hoped, will be attained by opening with the dredge a cut through the bar which separates the main ship channel from the Sullivan's Island channel, which will give to the ebbing waters the most uniform and greatest depth, and, with the exception of the curve at the bulkhead, the straightest and shortest track to the open sea; all of which conditions are admitted to be essential to maintain the most efficient scour of the ebb tide. The position proposed for the cut is at the point where the waters deflected by the dike seek to return to the shore channel. This tendency of the ebb to force its way into the Sullivan Island channel, is shown by the deep excavation of the bottom at the point where it is proposed to commence the dredging. In selecting this point, therefore, the commissioners have not attempted to mark out a new route for the receding waters, but have wisely decided to adopt that which the ebb tide is endeavoring to open for itself; by the assistance of the dredge it is hoped this may be effected.

We have here two permanent channels, viz: the main ship and the Sullivan's Island channel, separated only by 280 yards of a bank composed of coarse sand and shells. If any portion of this bank should, as the excavation advances, prove to be quicksand, it will probably be found impracticable to remove it, except at an enormous expense. As nothing of the kind, however, is indicated by the borings, we may entertain a well-grounded hope that the dredge, assisted by the ebb tide, will ultimately prevail; and even if there should be a disposition to silt up, the importance of the commercial interests of Charleston, annually increasing as its railroads extend into the interior, would fully justify the inconsiderable expense of a dredge from time to time to keep it clear.

The present depth of the best channel that enters this harbor is 10 feet 6 inches at mean low water, (see commissioners' report;) if 14 feet can be obtained, (and at a very small outlay if it can be done at all,) the advantages to the commerce of Charleston can hardly be overestimated. This would give, at spring tides, 20 feet water on the bar. To show how far this increase of depth would accommodate a large portion of sea-going vessels, I beg to refer to Lloyd's list for the year 1833. It is there stated that there are only 33 vessels, out of 10,430, that draw *more* than the depth proposed, (20 feet.)

The following is a list of these 33 vessels, showing their burden and draught:

Vessels,	5 are	600	tons burden and	draw 20 feet.
Do	14 are	700	do	do.
Do	6 are	800	do	do.
Do	1 is	900	do	do.
Do	2 are	1,000	do	do.
Do	4 are	700	do	21 feet.
Do	1 is	800	do	22 feet.

Although the models of vessels since 1833 have undergone great changes, by which, in most instances, their draught has been increased without a corresponding increase of burden, yet the increase of depth expected to be obtained in the new channel will be equally important to vessels of the new as of the old models.

In concluding this part of the subject, I beg to state, that although the result of this attempt to open the new channel is by no means to be calculated upon with certainty, the probabilities are decidedly in its favor. This is certain: no other plan for the improvement of Charleston bar could be undertaken for a like sum with anything like equal chances of success.

Plan of administration.

I propose to purchase one dredge-boat, one tug-boat, and four scows, at the commencement. If these latter should be found insufficient after the work is begun, two more will be added.

I propose to carry on the work by hired labor; this will not only be the most certain mode of doing it well, but with the advantage of selecting good laborers from those trained in the public works in this harbor, and accustomed to habits of subordination, industry, and rigid discipline, will, I doubt not, be the most economical, and will save much difficulty which could not fail to arise under a contract by the cubic yard, from occasional filling up of the channel during storms or heavy seas.

I do not anticipate that it will be necessary to employ any one, above the rank of the captains of the two boats, to take particular charge, in subordination to my own supervision. Should it, however, be found necessary to do so, my decided opinion is, that a subaltern of the corps of engineers should be assigned to that duty. Apart from other considerations which favor this view, I think a sufficient reason is, that it would be a good school (in which most of us are yet scholars) to acquire a knowledge of a most important class of works now devolved upon the corps.

PROBABLE COST OF THE WORK.

One dredge-boat and machinery complete, with duplicates of all the parts of the machinery liable to be broken, coppered and copper fastened, ground tackle, cordage, &c., &c., complete	$25,000 00
One tug-boat, coppered and copper fastened, with all necessary fixtures complete.	15,000 00
Four scows, zinced, with all ground tackle, moorings, &c., complete..	6,000 00

Monthly cost of working dredge.

Pay of 1 captain	$40 00	
2 engineers (1 for each engine)	80 00	
2 firemen (1 for each engine).	36 00	
1 cook	16 00	
6 hands, at $15 per month.	90 00	
Provisions and lights for 12 hands	144 00	
Repairs of machinery, at 1 per cent. per month	250 00	
Fuel for 15 days, 5 tons per day, 75 tons, at $8 per ton	600 00	
Total monthly cost of dredge.		$1,256 00

Monthly cost of working tug-boat.

Pay of 1 captain	$40 00	
1 engineer	40 00	
1 fireman	18 00	
1 cook	16 00	
4 deck-hands, at $15 per month	60 00	
Provisions, lights, &c., for 8 hands	96 00	
Repairs of machinery, at 1 per cent. per month	150 00	
Fuel, 3 tons daily for 15 days, 45 tons, at $8 per ton	360 00	
Total monthly cost of tug		$780 00

Monthly cost of working scows.

Pay for 8 men for scows, at $15 per month	120 00	
Provisions and lights for do	96 00	
Total monthly cost for scows		216 00

Cost of mechanics.

1 blacksmith	45 00	
1 carpenter	50 00	
1 boat-builder	50 00	
Total monthly cost of mechanics		145 00

Contingencies.

Cordage, anchors, and ship-chandlery generally	100 00
Fuel for smith's shop	5 00
Lumber for repairs of dredge-boat, tug, and scow	30 00
Clerk hire, office rent, fuel for office, stationery, &c.	325 00
Unforeseen expenses	343 00
Total monthly cost of dredging	3,200 00

Assuming the capacity of the dredge to be 1,000 cubic yards per day, and estimating 15 working days to the month, we shall have 15,000 cubic yards monthly, at a cost of $3,200, or 21 33-100 cents per yard—say 22 cents.

Total number of cubic yards to be excavated, (making proper allowance for sloughing of sides and probable silt brought in by flood tide,) 672,000, at 22 cents per yard	$147,840 00
Total cost	193,840 00

By reference to the above estimate, it will be perceived, that to remove from the proposed channel 672,000 cubic yards, with a machine of 15,000 cubic yards capacity per month, will require 44.8 months, say four years, to complete the work.

It will probably be found advisable (if a single dredge makes a permanent impression on the bulkhead) to put two dredges with the necessary scows to work. This would materially lessen the cost per yard, and reduce the time of completion one-half. The advantages of the increase of depth will thus be secured to commerce two years earlier, and the time during which the work, in its unfinished state, will be exposed to the casualties of storms, &c., will be diminished by an equal amount. When completed, the unobstructed flow of the ebb and flood tides, it is supposed, will remove any partial deposits made during storms; such deposits, occurring before the new channel is opened entirely through the bank, would have to be removed by the dredges.

All of which is respectfully submitted.

Your obedient servant,

A. H. BOWMAN,
Captain of Engineers.

Gen. J. G. TOTTEN,
Chief Engineer.

APPENDIX M M—2.

ENGINEER DEPARTMENT,
Washington, March 9, 1853.

The question of the improvement of Charleston harbor, South Carolina, has been examined by a special board constituted for that purpose.

The officer in charge of the improvement of the harbor of Charleston, South Carolina, as provided for by the act of August 30, 1852, (p. 56, Statutes at Large, 1851–'52,) has given the report of the above-mentioned board careful study, and is clearly of the opinion that their design offers more hope of success than any other.

The board of river and harbor improvement also approve of the project for improving the harbor, and I have the honor to recommend it for your sanction.

The plan proposed is, to dredge through a bar of sand which separates the waters of the harbor proper from those of the ocean; the point selected is the extreme northwestern end of the bar, and is comparatively sheltered by neighboring land and shoals; the cut to be made of a width of about 700 feet, and to have a depth at low water of 14 feet.

A dredge of suitable power, to be procured with its appurtenances by contract, and to be worked, under the immediate direction of the officer in charge, by day's work.

The exposed nature of the position, which is open to the ocean, (and with a powerful current running,) forbids any expectation of the work being undertaken by contractors at a reasonable price.

As the existing appropriation is not sufficient for the execution of this improvement, either by contract or by day's work, and as the cost of the dredge, and other vessels and apparatus, will require the expenditure of nearly the whole of it, I propose, with your approbation, to instruct the officer in charge of the work, Captain A. H. Bowman, corps of engineers, to enter into contract at once for providing the requisite vessels, boats, and machinery, looking to the means for the completion of the work being obtained hereafter.

Herewith are transmitted the following papers, viz:

Report of the commission, printed.

Report of Captain Bowman, with a letter.

Report of river and harbor improvements.
Two traced maps.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General and Colonel Engineers.

Hon. JEFFERSON DAVIS,
Secretary of War.

Approved:

JEFFN. DAVIS,
Secretary of War.

WAR DEPARTMENT, *March* 29, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX N N.

Report of the commission appointed to examine Savannah river and harbor.

SIR: The commission organized under the War Department, on the application of the chamber of commerce, and commissioners of pilotage of Savannah, Georgia, for the purpose of examining the Savannah river, and reporting a project for the improvement, contemplated by an appropriation approved August 30, 1852, and composed of the following members, viz: Prof. A. D. Bache, superintendent of the United States coast survey; Captain A. H. Bowman, corps of engineers; and First Lieutenant J. F. Gilmer, corps of engineers, have, after a careful study of the charts previously prepared, and the soundings recently made by Lieutenant Gilmer, together with accompanying reports and personal examinations of the river, devised a project "for the removal of obstructions in the Savannah river at a place called the Wrecks, and the improvement of the navigation of said river," and they have the honor to submit the following report:

1. The Savannah river has its sources in the northeastern part of the State of Georgia and the northwestern counties of South Carolina, near the southern boundary of North Carolina, and in latitude 35°, about, and in longitude 6° to 6° 30′ west of Washington city. The river is formed by the junction of Tugalo and Keowee rivers, having their sources in a mountainous region of primitive formation, and its general course is southward, inclining from 35° to 38° to the east, but the channel is a very winding one, and at some points the river flows in a direction north of east, or north of west. The length of its channel from source to mouth is not less than 450 miles, whereas the direct distance is only about 250 miles. The mouth of the Savannah is in latitude 32°, about, and in longitude 4° and a few minutes west of Washington city

Many small tributaries empty into the Savannah at points not far below the junction of the Tugalo and Keowee, having their sources in a semi-mountainous country; but the first tributary of magnitude is the Broad river, which rises in Hall and Habersham counties, Georgia, and after flowing through a tolerably fertile region of country for a distance of about 90 to 100 miles, unites with the Savannah some 50 to 55 miles below the junction of the two head branches. Between the mouth of the Broad and the city of Augusta there are several tributaries, the principal of which are the Little river and Stephen's creek, flowing from the interior of South Carolina, and the Little river from the interior of Georgia. Below the city of Augusta, the water-courses of largest size which flow in are Butler's creek, Spirit creek, McBeau's creek, Upper Three runs, Lower Three runs, Brier creek, and Black creek.

The Savannah and its tributaries drain an extent of country equal to about 8,200 square miles, and all the branches which flow in above the city of Augusta have their rise in mountainous or hilly sections of country, and have considerable velocity of current, with rapids and falls at different points; in some degree, such is also the character of the main river towards its source. Passing to the south of Augusta, the features of the bordering country change, becoming comparatively level and flat, and the currents in the river, as a consequence, are less rapid. In this lower portion of the river the channel is more crooked; the distance from Augusta to Savannah, by water, being about 230 miles, whereas the direct distance is about 115 miles.

The currents in the upper part of the Savannah river and its tributaries being more rapid than they are when the river approaches the ocean, considerable quantities of earth are washed from the bottom and banks as it passes through the hilly country, and carried in suspension to the more sluggish portions, forming bars and shoals. Some of the obstructions, even so far down as the city of Savannah, are probably formed in this way, and these bars are generally composed of a silicious gravel and sand, with a small proportion of alumina and lighter earths.

The products of the country bordering on the river above Augusta are principally corn, wheat, rye, potatoes, cotton, timber, hogs, sheep, oxen, mules, and horses; the main productions of the middle and southern sections are corn, potatoes, cotton, rice, and timber.

The river above the city of Savannah is subject to freshets, which often overflow its banks, doing much injury to the bordering plantations of corn, cotton, and rice. The losses from overflow, however, are confined to localities above the city, the plantations below being but little exposed to injury from like causes.

The Savannah river, near the mouth, becomes a tidal stream, and the flood tides, in ordinary stages of the river, ascend to a point about 45 miles from the ocean, or 28 miles above the city of Savannah

The downward current in the tidal portion of the river has the greatest influence upon the bed of the stream at all times, and more especially when freshets occur; its duration and velocity being considerably greater than the flood. This difference diminishes as we approach the ocean; but opposite the city of Savannah, in ordinary stages of the river, the duration of the flood is to the duration of the ebb about as 5 is to 7. When freshets occur this difference becomes greater. The greatest velocities of the flood and ebb currents at the same place bear about the proportion of 1.3 to 1.5. The ebb and flow of the tides in the lower part of the river are also affected by the winds. When the winds continue to blow for some time from the east and northeast the tides rise considerably above the mean height, and the ebb does not descend to the level of mean low water. With prevailing north and northwest winds the effects are the reverse.

II. The city of Savannah is the principal seaport town in the State of Georgia, and much the largest portion of the commerce of the State is concentrated at this city. It is built upon the first high bluff or plateau met with in ascending the river, and at a distance of about 18 miles from the sea; the banks below, being rice lands or salt marsh, furnish no good site nearer the ocean for a commercial town.

The population of the city of Savannah at this time is about 20,500. The following statement will show the population as early as 1810, and for successive periods up to 1848:

Population in 1810	5,195
Population in 1820	7,523
Population in 1830	7,773
Population in 1840	11,214
Population in 1848	13,573

Showing an increase in 38 years of 8,378, equal to 161 per cent. The increase during the four years since 1848 has been about 6,927, equal to 133 per cent. if compared with the census of 1810, or to 51 per cent. if compared with the population in 1848.

The commerce of the city has become one of considerable magnitude, and its growth for the last few years has been more rapid than previously. The developments that are now making of the resources of Georgia, together with the increased facilities for transporting the products of the interior to this one seaport, must insure a more rapid increase of business for the future than has occurred during any period of the past. So far as the trade of Savannah is connected immediately with foreign countries, it consists almost exclusively of exports, the imports from abroad being small in comparison. In addition to the foreign commerce, the city has a very large coastwise trade connected with northern home ports, and in this part of her trade the imports probably exceed the exports, and the amount of exports sent coastwise for many years has generally been greater than the foreign exports.

The principal exports are cotton, rice, and lumber; a large part of each (one-half or more) is shipped annually to home ports. The following tabular statement will show the amount of these products exported during the years ending 1st of September, 1841 and 1842; and for the two years ending 1st of September, 1851 and 1852, ten years later, viz:

	Cotton, bales.	Rice, casks.	Lumber, feet.
Shipped from Savannah, 1841...	147,280	23,587	14,295,200
Shipped from Savannah, 1842...	222,254	22,065	8,390,400
For two years, 1841–'42......	369,534	45,652	22,685,600
Shipped from Savannah, 1851...	317,434	35,606	17,764,300
Shipped from Savannah, 1852...	353,068	39,929	25,508,500
For two years, 1851–'52......	670,502	75,535	43,272,800

By an inspection of the foregoing table, and comparing the exports of cotton, rice, and lumber, for the two years 1841 and 1842 with the same for the two years just passed, it will be seen that the cotton has increased in this period of 10 years 81½ per cent., the rice 65½ per cent., and the lumber 90⅔ per cent. It will be seen, also, that the increase of the lumber trade for the year 1852 has been unusually great; and the demand for this material is such now as to insure a continued increase of exports.

These principal articles of export are brought to the city of Savannah by the river, on the various railroads of the State, along the coast, and in wagons from the interior counties. The railroads which converge to the city, with the great extensions that are now being made, and others in contemplation, will soon connect her with a large part of the best cotton-growing region of the south, and increase very largely the shipments from the port.

The railroads which transport cotton and other products intended for the Savannah market are the following, viz:

	Miles
1. The Central railroad of Georgia, connecting Macon and Savannah—length	192
2. Waynesboro' and Augusta road, connecting Augusta with the Central road and Savannah	53
3. The Milledgeville and Eatonton road, connecting these towns with the Central road and Savannah	39
4. The Southwestern road of Georgia, connecting the southwestern counties of the State with the Central road and Savannah	50
5. The Columbus and Fort Valley roads, connecting the city of Columbus and the rich valleys of the Chattahoochee and Flint rivers with Savannah, *via* Macon and the Central road	71
6. The Macon and Western railroad, connecting Atlanta and the middle counties with the Central road and Savannah.	101

7. The Western and Atlantic railroad, connecting Chattanooga, and a considerable portion of Alabama, Tennessee, and northern Georgia, with Savannah, *via* Macon or Augusta..	140
8. The Georgia railroad, connecting Atlanta and the middle counties of Georgia with Savannah, *via* Augusta, Waynesboro' and the Central railroad, or *via* the Savannah river..	171
9. The Athens branch of the Georgia road..................	40
10. The Washington branch of the Georgia road..............	17
11. The Atlanta and La Grange road......................	80
12. The Rome branch of the Western and Atlantic road......	17
13. The East Tennessee railroad, connecting eastern Tennessee with Savannah..................................	82
Total length..................................	1,053

With the exceptions of Nos. 2, 5, 10, 11 and 13, the railroads enumerated above have been completed and are now in operation. The five under construction will be finished in a few months. The completion of No. 5 will cause an immediate increase in the receipts of cotton at Savannah to the extent of 90,000 or 100,000 bales. The completion of Nos. 2, 10, 11 and 13, will also give an increase of business, but perhaps less in amount.

In addition to the roads already mentioned, companies have been formed for the construction of a road to connect Savannah directly with the southwestern part of the State, to be afterwards extended to some point on the Gulf of Mexico, and for the extension of the Southwestern road. These roads, when completed, must add much to the business of the city, increasing largely her imports and exports.

The following are the total receipts of cotton by the railroads, the river, and from other sources, for the past nine years:

Received in Savannah in—	Railroad.	River and from other sources.	Total.
	Bales.	*Bales.*	*Bales.*
1842	....	....	299,173
1843	....	....	243,324
1844	77,437	227,579	305,016
1845	114,641	74,435	189,076
1846	96,539	139,497	236,029
1847	87,524	157,972	245,496
1848	168,718	238,188	406,906
1849	203,725	136,300	340,025
1850	176,031	136,263	312,294
1851	150,866	200,700	351,566
1852	231,210	121,858	353,068

The value of the entire exports from Savannah to foreign and home markets is given in the following statement for the years 1849, 1850, 1851, and for the first nine months of 1852. The value of the exports abroad were obtained from the records of the custom-house, and the values of the coastwise trade were calculated from the best data that could be found in the prices current and other records of the business of the city:

Value of exports, foreign and coastwise, for the years 1849, 1850, 1851, *and nine months of* 1852.

1849.—Exports to foreign ports	$7,163,294
Exports to home ports	6,793,088
Total for the year	13,956,382
1850.—Exports to foreign ports	8,726,763
Exports to home ports	9,774,889
Total for the year	18,501,652
1851.—Exports to foreign ports	6,211,671
Exports to home ports	9,531,633
Total for the year	15,743,604
1852.—Exports to foreign ports	5,003,811
Exports to home ports	7,005,770
Total for nine months	12,009,581

The imports from abroad are small compared with foreign exports, and consist principally of railroad and other iron, salt, coal, hardware, sugar, coffee, and cigars.

For the years 1849, 1850, 1851, and nine months of 1852, the value of the imports from abroad was as follows:

Foreign imports in 1849	$587,722
Do........1850	555,095
Do........1851	605,353
Do........1852, (nine months)	357,689

The Savannah river furnishes the only outlet for this extensive and valuable trade; any defect, therefore, in its channel must affect most injuriously the interests and future prosperity of both the city and the entire State.

A large part of the products destined to foreign ports is shipped in vessels having a draught, when freighted, of 16 to 17½ feet. Owing to the obstructions at Garden bank and the Wrecks, vessels drawing more than 14 to 14½ feet cannot, in the ordinary stages of the river, go to sea from the city wharves. After receiving a part of their cargoes, therefore, they have to drop down to Venus point, an anchorage about $7\frac{1}{2}$ miles below, and receive the remainder from lighters. Freighting vessels in this way involves both delay and expense, which would be avoided if the obstructions near the city were so far removed as to give a few feet increase in the depth of channel.

The large coastwise trade of the city is carried in smaller vessels, of 200 to 600 tons, drawing 10 to 13 feet when loaded.

By a careful examination of the tonnage and draught of the vessels which entered and cleared from the port during the nine months terminating December 1, 1852, it was found that the average draught for a vessel of 200 tons was 10 feet, and for one of 600 tons it was 13 feet. Vessels of the class now engaged in the coasting trade can, therefore, receive their entire cargoes at the city, and pass out of the river at ordinary high tide. With the growth of the city business, however, the amount of freight coastwise must be vastly increased, when it will probably be advantageous to employ a larger class of vessels. This will depend upon future developments as to the wants of the Savannah trade.

It has been stated that the average draught for 600 tons is 13 feet. This is true for the vessels that entered the Savannah river for the period of nine months examined; but it cannot be taken as an average for all vessels of 600 tons, for there are some of this tonnage that draw as much as 20 feet.

The varieties in model are so great that it is doubtful whether any positive relation can be established between the tonnage and draught. (For diagram and table relating to tonnage and draught of vessels that entered the Savannah for the nine months preceding December, 1852, see Appendix No. 1.)

The vessels engaged in the Havana trade are about the same class as those in the coastwise. Their outward freights are usually lumber, coal, rice, and cotton; returning, they bring cargoes of sugar, coffee, cigars, fruit, &c.

Vessels drawing $17\frac{1}{2}$ feet can pass out of the river from the anchorage at Venus point in the ordinary stages of the tide; during the spring tides the river below will float vessels having a little greater draught.

The following statement exhibits the amount of tonnage of American and foreign vessels entered and cleared at the Savannah custom-house for foreign and home ports during the years 1849, 1850, 1851, and the first three quarters of 1852, viz:

	Home ports.	*Foreign ports.*	*Total.*
Tonnage for 1849	213,791	150,497	364,288
" " 1850	196,899	120,110	317,009
" " 1851	269,229	106,599	375,828
Three quarters of 1852	190,539	96,857	287,396

By adding proportionally for the tonnage of the last quarter of 1852, to the tonnage of the first three quarters as given in the above statement, it will make the amount for the year 383,194 tons; but as the shipments during the last quarter of each year are always more than an average compared with the preceding ones, the probable tonnage of the year 1852 will not be less than 400,000. (For number of vessels entered and cleared, see Appendix, No. 2.*)

The amount expended annually for lighterage from the city wharves to Venus point has not been ascertained with accuracy; but when the elements of expenditure are considered, viz. shipment, transshipment, delay and inconvenience, the amount must be such as to impose a considerable tax on the business of the city. The charges made by the owners of lighters at this time are as follows: Cotton, 15 cents per bale; iron, $1 per ton; salt, 5 cents per bag.

III. The great results which have been obtained by engineers in their efforts to improve the channels of rivers in other countries, and even in our own, fully demonstrate that such improvements are practicable, and that in most cases, where the works of improvement were skilfully planned, the question of success became simply a question of money. One of the most striking instances of river improvement is that of the river Clyde, Scotland, from Port Glasgow, near the mouth of the river, to the city of Glasgow, 18½ miles above.

In 1755 vessels of no greater draught than 3 feet 6 inches could pass up to the city, but in 1845 the river had been so vastly improved by dredging, straightening the channel, changing the form of the cross section, and removing all obstructions which tended to retard and lessen the flow of the tides, that the Clyde could float vessels drawing 18 feet water; and this result was obtained, says William Bald, the engineer in charge, notwithstanding many errors of engineers. It is believed a greater depth has been obtained since 1845. As the Clyde is a tidal stream, the leading principle observed, in all the operations undertaken for its improvement, was to facilitate the flow of the flood tides by giving uniformity of depth and width, and straightening the channel as far as practicable. And experience has now convinced the ablest engineers who have had charge of the improvements made in many other rivers of England and Scotland, that this principle must never be overlooked. By encouraging the flow of a large volume of the flood to the upper parts of a river, the velocity and power of the ebb currents are greatly increased, tending to scour out more effectually the bottom and give greater depth of channel.

One of the engineers of most experience in England or Scotland (William Cubitt, civil engineer for 40 years) states the chief obstructions to the propagation of the tide to be "crookedness of channel, unevenness of depth, and varieties of composition of bottom and sides," and that they retard the flow "by causing eddies, sand and mud banks, and deposits, with a continual tendency to increase the evils."

"Such obstructions can be removed by groining, wharfing, embanking, dredging, scouring, &c. The scouring power and depths of rivers, as far as neap tides ascend, are due chiefly to the tides, above that point principally to freshes."

Experience has shown that, as a general principle, the tidal flow should not be obstructed, but in particular cases a *small* amount may be excluded with advantage, when it is desired to straighten the chan-

* This table includes the tonnage of the vessels only that *entered* and *cleared* at the Savannah custom-house. There are many additional vessels engaged along the coast, that trade under what is called coasting license.

nel, and give it a better direction. Such operations have even quickened the tide, as in the Tay, Scotland. The tide reaches the town of Perth, on the Tay, 30½ miles up the river, about 55 minutes sooner since the improvements were made than it did before. It does not rise higher, but the channel has been deepened, and the propagation of the tidal wave from Newberg, seven or eight miles below, is now at the rate of 5.13 miles per hour, whereas it was only at the rate of 3.42 miles per hour previous to the improvements.

The propagation of the tidal wave is influenced much also by the mean depths of the channel, the greater velocities being due to the greater depths. Observations were made in England for ten years by John Scott Russell, civil engineer, on artificial and natural channels, to determine the progress of the tidal wave, and the results obtained were as follows:

For a depth of ten feet the progress of the tidal wave was 12 miles per hour; for 20 feet, 16 miles; for 30 feet, 20 miles; for 50 feet, 26 miles; for 70 feet, 32 miles; for 100 feet, 34 miles per hour.

From these observations and others, it has been discovered that the progress of the tidal wave is nearly as the square roots of the depths.

Previous to the commencement of the work of improvement in the Clyde, the rise of the tide just below the city of Glasgow was only one foot nine inches; but in 1845, after a greatly-increased depth had been obtained by dredging and by skilfully-constructed works, the mean rise of the neap tides was six feet three inches, and of spring tides eight feet four inches. This great increase in the rise of the tides demonstrates in a forcible manner how much greater is the volume of flood that ascends to Glasgow now than formerly. The mean duration of the flood current at the city, in 1845, was five hours fourteen minutes; of the ebb, seven hours sixteen minutes; and the mean velocity of the flood was 771 yards per hour, and of the ebb, 1,576 yards. These are the results of observations made at that date; the greater depth of channel obtained since has no doubt increased the rise and duration of flood tide, and as a consequence added to the velocity and scouring power of the ebb current. (For a comparison of tides and currents in the Clyde and Savannah rivers, see appendix Nos. 3 and 4.)

The improvements of the river Tay were commenced in 1834, when only nine feet six inches could be carried to the city of Perth at high spring tides; in 1845 vessels drawing fifteen feet could ascend to the city, showing an increased depth of five feet six inches. The operations on this river have been prosecuted since, giving a still greater depth of channel. These results were obtained by dredging the shoals and bars, straightening the channel, and removing all obstructions along the banks. The improvements were succeeded immediately by an increase of commerce.

In 1815 the total revenue of the port of Perth was £4,096.

In 1844, ten years after commencing the improvements, it was £23,985; and the tonnage had increased to 272,239 tons.

The increase in the commerce of the city of Glasgow, induced by the greater depth of channel in the Clyde, has been even more wonderful than that of Perth, as is shown by the following statement of the port dues and custom-house duties collected at different periods, viz:

From 1755 to 1770, the Clyde river dues were............	£174
In 1835 ....do............do.................	31,900
In 1836 ....do............do.................	35,000
In 1837 ....do............do.................	39,000
In 1841 ....do............do.................	50,292
In 1812 the custom-house duties were..................	3,124
In 1824 ....do..........do........................	29,926
In 1836 ....do..........do........................	314,701
In 1837 ....do..........do........................	389,702

In 1844 the total number of arrivals at the city of Glasgow was 13,919 vessels of all classes, having a tonnage of 1,101,949 tons. There belonged to the port 60 steam-vessels; and the sailings and arrivals of traders amounted to 940—not one of which could get nearer than 12 miles of the city prior to the improvements.

The population in 1846 was 330,000, the city debt £320,006, and the gross income for the year £46,865. The total receipts of river and harbor dues amounted to £800,000, a large part of which has been expended from year to year on the improvement of the Clyde.

IV. The bar at the entrance of the Savannah is one of the best along the southern coast of the United States, and has a depth 19 feet 6 inches at mean low water; and as the mean rise of the tide is about 8 feet, the depth at high water becomes 27 feet 6 inches. At all stages of the tides, vessels drawing 18 and 19 feet can enter and pass inside of Tybee island to a good anchorage, where they are beyond the influence of the swells of the ocean. This is an important fact connected with the entrance; for vessels arriving at the bar, even at the hour of low tide, can enter without delay, thus freeing them from the danger of standing off and on the coast, in stormy weather, waiting for high water. The outer obstruction, or sea-bar, requires no improvement; and the first obstruction in the channel of the Savannah is two and a half miles above Tybee point. By the removal of this obstruction, vessels drawing 20 to 22 feet could ascend the river to Venus point, six and a half miles further up. The river would then become a good harbor of refuge for vessels of war, as well as merchantmen. The entrance to the river is between Tybee island on the south, and Hilton Head island on the north, distant from each other about five miles and a quarter; but the channel of deep water passes near the northern point of Tybee. Going inside this point and ascending the river, it divides into two channels, the main or *north channel* and the *south channel*, separated by a succession of islands, the principal of which are Cockspur, Long, York, and Elba islands. At the upper end of the last-named island, about four miles below the city of Savannah, the north and south channels unite; from this point there is but one channel, until we ascend to the foot of Fig and Hutchinson's islands, where another division occurs; the branch on the north is known as *Back river*, the one between the islands as *Fig Island channel*, and the one to the south as the *Front river*. The islands and channels above mentioned will be seen by an inspection of the accompanying maps. The banks of the river and the islands are low, being either salt marsh or rice lands, until we ascend the Front river to the high bank or plateau on which stands the city. Passing above, the banks become low again, until we ascend to King's island, where the southern bank is elevated a few feet above the level of the rice fields on King's and Hutchinson's islands. The banks of the Back river are cultivated in rice for several miles above the city, and these rice fields can be flooded from the river at high tides. Passing above the head of Hutchinson's island, the river has three channels, known as *Front*, *Middle*, and *Back* rivers, and the islands making these divisions are Argyle, Onslow, and Isla islands. The Middle and Back channels are united at the head of Argyle island, and, following the common channel around the head of Isla island, we enter the channel of the Front river through Mackay's cut. This cut is dry at low tide, so that the great volume of fresh water descending the river flows through the Front channel to the foot of Isla island, where it divides; the greater volume passing down the Middle river, which unites with the Front again at the foot of Onslow island. The current of the Middle river, at the point of entrance to the Front, flows in a direction nearly at right angles to the current of the latter, and has the greatest influence in giving direction to the combined currents below, causing the bank towards the main to wash away, and a sand bar to form along the shore of Argyle island. The effects of these will be discussed in after parts of this report.

Taking the direction of the greatest current, which is also the line of the best water generally, and again along the centre line of the river, the following were found to be the distances of different places above Tybee point. It will be seen that they are greater in the direction of the current than along the centre of the river.

Distance from Tybee point in miles.

In direction of the greatest current: To Knoll 2½ miles, to off Fort Pulaski 3, to Mud flats 12.8, to Four-mile point 17.6, to Wrecks 21.2, to Exchange 24.1, to King's island and cross tides 31.03, to J. Potter's 35.3, to Judge Berrien's 40.8.

Along centre of the river: To Knoll 2½ miles, to off Fort Pulaski 3, to Mud flats 9.5, to Four-mile point 12.6, to Wrecks 14.94, to Exchange 16.97, to King's island and cross tides 21.05, to J. Potter's 24.5, to Judge Berrien's 29.07.

The above distances were taken along the north channel from Cockspur to Four-mile point, and along the Front river from the Wrecks to Judge Berrien's.

Measuring the centre lines of the Front and Back rivers from the points where the currents separate, above King's island, to Fort Jackson, below Hutchinson's island, the distance by the Front river is 7.556ths miles, and by the Back river 7.642ths miles, the former being .086ths of a mile the shorter. Measuring the two rivers in the direction of the greatest currents, the difference in lengths becomes greater—the Back river being 7.955ths miles, the Front 7.824ths miles; difference, 131ths of a mile.

The distances from the centre of the cross tides, at the head of Hutchinson's island, to Fort Jackson, are—

By the centre of Front river	7.727ths miles.
By the centre of Back river	6.829ths
Difference	.898ths
By the line of deepest water, Front river	7.972ths miles.
By the line of deepest water, Back river	7.056ths
Difference	.916ths

The mean rise of the tide in the Savannah river opposite Fort Pulaski is 7.956 feet, at the city 6.354, and at the cross tides 5.77. (For the observed and computed rise at other points, see Appendix No. 7.)

The duration of the flood at Fort Pulaski is	5h. 43m.,	at city 5h. 20m. 44s.
The duration of the ebb	6h. 44m. 10s.	do. 7h. 10m.

V. By comparing the tides in the Savannah river with the tides in the river Clyde, it is found that the duration of the flood at Glasgow, which is 18½ miles above Port Glasgow, is 5h. 14m.; and at the Wrecks, the same distance up the Savannah, the duration of flood is 5h. 26m., showing twelve minutes in favor of the latter. The duration of the ebb at Glasgow is 7h. 16m., and at the Wrecks it is not more than 7h. 6m., giving ten minutes in favor of the rapidity of fall in the Savannah over that of the Clyde.

Comparing the currents in the two rivers, it is found also that the mean velocity of the flood, six miles below the city of Savannah, is 0.8 mile per hour, and the same distance below Glasgow only 0.4 mile. The mean velocity of the ebb at the same distance is one mile per hour in the Savannah river, and 0.9 mile in the Clyde.

The duration of the rise and fall of the tides, and the velocities of the tidal currents, are therefore, other things equal, more favorable in the Savannah than in the Clyde for scouring out the bottom of the channel and keeping it open when dredged. (For comparison of tides, see Appendix Nos. 3 and 4.)

By comparing a series of seventy-nine soundings by Lieut. Smith in 1849, in Front and Back rivers, and the Savannah below the junction, with one hundred and fifty-two soundings on the same lines, by the coast survey in 1852, it appears that the plane of reference of the last survey is .5 of a foot lower than that of the first. The comparison of the mean depths in Front and Back rivers, on the section referred to in Lieut. Smith's report at the period of his survey, and in 1852, confirms this deduction, the difference being .6 of a foot in the same direction. For purposes of comparison, it will be proper, therefore, to add half a foot to the coast survey soundings, or to deduct the same from those of Lieut. Smith's map. This depends no doubt upon the rise of the river as influenced by freshets, and shows the importance of referring the zero of tide-gauges to permanent beach-marks, in order to facilitate comparisons in future.

According to Lieut. Smith's survey, 1849, and the coast survey, 1852, the mean depths, the mean of deepest water, and the mean widths of Front and Back rivers, were as follows, viz:

	Front river.	By whom surveyed, and date.	Back river.	By whom surveyed, and date.
Mean depth, feet	7.1	Lieut. Smith, 1849	11.5	Lieut. Smith, 1849
Mean depth, feet	7.4	Coast Survey, 1852	11.1	Coast Survey, 1852
Mean of best water, feet	11.9	Lieut. Smith, 1849	22.9	Lieut. Smith, 1849
Mean of best water, feet	11.5	Coast Survey, 1852	21.9	Coast Survey, 1852
Mean widths	1,017	Lieut. Smith, 1849	1,678	Lieut. Smith, 1849
Mean widths	983	Coast Survey, 1852	1,500	Coast Survey, 1852

By this comparison it is seen:

1. That the mean depth of water in the Front river has increased .3 of a foot between 1849 and 1852, and a small decrease of .4 of a foot in Back river.

2. The mean depth of the Back river is still greater than that of the Front. The difference in 1849 was 4.4 feet, and is now 3.7 feet.

The mean depth of the cross tides in 1849 was 12.3 feet, and in 1852, 12.5 feet. (For details of the comparison, see Appendix Nos. 5 and 6.)

The mean depth of Front river being only 7.4 feet, while that of the Back river is 11.1 feet, the propagation of the tidal wave of high water is more rapid up the Back than up the Front river, in the proportion of 112 to 100, and the tidal wave of low water in the ratio of 123 to 100.

The cross section of Front river at section 1.2 (see map) is equal to 5,850 feet, and of Fig Island channel at 3.4 is 2,280 feet; the mean velocity of currents at (1.2) is 0.8 mile per hour, and at (3.4) 0.6 mile per hour. Hence the quantities of discharged water are as (5,850 by 8.10) to (2,280 by 6.10) or as 1 to 0.29. The mean velocity may be taken as two-thirds the maximum.

In the Front river a maximum velocity of 1.5 miles per hour nearly corresponds to a depth of 12 feet at low water. If one-half of the water from north side of Fig island be turned to the Front river, the velocity at section (1.2) will become 1.20 miles per hour; if two-thirds, it will be 1.26; and if the whole, it will give 1.39 miles per hour.

VI. By an examination of extracts taken from the minutes of the commissioners of pilotage of the city of Savannah, it was found that in 1816 the depth of water over the Wrecks at low tide was reported to be 6½ feet; and this least depth was stated to be "on the middle bar, about 70 yards long." The commissioners of pilotage expressed the opinion that, as long as the Fig Island channel remained open, bars would continue to form at the same place, and that it ought to be closed. Efforts were made to close it by sinking wrecks, driving piles, &c., but for the want of means it was not accomplished.

In 1820 they expressed again the opinion that it ought to be closed, and represented the channel of Front river as in a deplorable condition. In 1823 the commissioners recommended the employment of a "*mud machine*" at the Wrecks, stating it could be so employed with much advantage.

An appropriation having been made for the improvement of the Savannah river by Congress in 1828, a dredge-boat was worked at the Wrecks, and continued until near the close of 1829. A dam across Fig Island channel was also partially constructed, under the direction of an agent of the United States.

In May, 1830, a commission was appointed, under the United States Treasury Department, to examine the work which had been done by the agent, and the effects upon the channel. A careful examination was made by this commission, and much testimony taken as to the navigation of the river before and after the works were commenced. Nearly all the witnesses agreed in the statement, that vessels drawing 13 feet 10 inches to 14 feet could go to sea from the city at that date, (1830)—ordinary high water; and at high spring tides there was a still greater depth. It was further stated that from 1820 to 1823 the pilots limited the draught of vessels going over the Wrecks to 13 feet.

The records of the commissioners of pilotage report the depth of water over the Wrecks in 1830 to be 7 to 7½ feet at low tide, and 13 feet 11 inches at high tide. The same records, as has been stated, gave the depth as 6½ feet in 1816, low water.

From all the information obtained as to the depth over the Wrecks, at the different dates above mentioned, it is probable that the channel was deeper in 1830 than previously, and that the increase of depth was from six inches to one foot.

This most probably resulted from the use of the dredge-boat, and the partial construction of works closing the Fig Island channel.

During the years 1835, 1836, and 1837, a deeper channel was dredged across the Wrecks, under the direction of Lieutenant J. K. F. Mansfield, of the engineers; but since the last date the position of the channel has changed, and it now passes more to the north.

VII. At this time the first obstruction met with in ascending the Savannah river is the "*Knoll*," two and a half miles above Tybee light, consisting of oyster-shells, sand, and mud; it has a depth of water over it of ten feet at ordinary low tide; it is of small extent in the direction of the channel. (See Appendix No. 8.) Passing above the Knoll, the channel has a depth of 12 feet and upwards, until the "*Mud flats*" are reached, 6.5 miles higher up, over which vessels drawing more than ten feet cannot pass at ordinary low water. They are composed of sand and mud, and extend for a distance of three-fourths of a mile.

The larger class of vessels visiting the port anchor at Venus point, below the Mud flats, and discharge a portion of their cargoes by lighters.

Ascending the river, the next obstruction met with is "*Four-mile Point bar*," composed of sand and mud; the depth of the channel here is also 10 feet at low tide. Above Four-mile point the channel is deep until we come to the "*Wrecks*," 15 miles above Tybee and 2 miles below the City Exchange. They form the most serious impediments to the navigation of the lower river, reducing the channel to a depth of about 8 feet at mean low tide. The wrecks at this point were sunk during the revolution, (1779,) by direction of the commander of the English forces, then in possession of Savannah, to block the entrance to the Front river as a protection against the approach of the French and American fleets. So far as can be ascertained, the vessels sunk were the following: "His majesty's ship *Rose*, the *Savannah Armed Ship*, purchased into the king's service sometime before, and *four transports*," which blocked up the channel.

The place selected for sinking these vessels being just at the point where the Front river widens in connecting itself with the Back river, as a consequence loses a part of its velocity of current. A bar of sand and mud was formed by the ebb currents around them; this bar has increased so much as to fill up the original channel and force the water of the Front river to seek an outlet more to the north, thus making the channel crooked and irregular. The sunken wrecks probably caused the flood tide also to *silt* up the channel below. This would the more certainly take place during strong northeasterly or easterly winds, which force the currents over to the southern shore.

Above the Wrecks, the next and last obstruction is "*Garden Bank*" just below, and opposite the eastern wharves of the city. This bank is composed principally of a coarse silicious sand deposited by the ebb, and extends from a point near the foot to the head of Fig island, where the waters flowing down Front river divide, a part passing through Fig Island channel. The artificial obstructions at the entrance to Front river have, no doubt, caused additional deposits to be made on Garden bank; first, by retarding the flow of the flood into the south channel, and secondly, by checking the velocity of the ebb, and forcing a considerably increased volume of water to pass down Fig Island channel and the Back river. The amount of flood which passed by the city and to the upper part of Front river was no doubt more before the sinking of the wrecks than it has been since; and on its return to the ocean this diminished volume has been still further reduced by the additional quantity forced, as has been said, by the same obstructions, to seek an outlet north of Fig island. The velocity as well as the volume of the tide ebbing through the south channel was thus much diminished, and as a consequence lost much of its scouring power.

In this connexion it may be stated that the flow of the tides in Front river has been, and is now, much retarded by other artificial means, viz: rafts of floating timber; two or three vessels anchored abreast in the narrower portions of the channel; the floating dry dock; wrecks lodged along the banks; sunken pieces of green timber cut from the rafts; piles driven along shore, and in many cases by the wharves, both on the side of the city and on Hutchinson's island.

The wharves are built of timber, and the usual plan of construction has been to advance the bulkheads far enough beyond low-water mark to get the requisite depth for vessels to lay alongside; thus diminishing, to a considerable extent, the cross section of the river.

Had they been built so that the front lines would have fallen between high and low-water marks, and then the bank in advance dredged out, to give the requisite depth, great advantages would have resulted to the river, instead of injuring, as under the existing state of things. If the proprietors of wharf lots, below the city and elsewhere, would adopt the method of building just suggested in all future construction, many benefits would accrue to themselves and the city. This is a matter of so much importance, that the commission would ask for it the particular consideration of all citizens of Savannah.

So far as possible, rafts should be kept out of Front river, and especially should care be taken that none of the ties fall into the channel, when cut loose from the rafts; for, being of green timber, they often sink to the bottom, causing a permanent injury. The piles driven along shore, and the wrecks lodged against the banks, should be removed as far as possible, as well as all other obstructions to the flow of the tides.

It has occurred to the commission that a part of the shipping which now anchors in the narrow part of Front river, causing a retardation in the flow of tides, might be removed, as also the dry dock, if a basin of sufficient depth were excavated at some point above the city—say at or near the present entrance to the Ogeechee canal, and extending up to the depot of the Central railroad. It is probable that such a basin, having depth and capacity to float many of the larger merchantmen engaged in the Savannah trade, will soon become a necessity for the accommodation of the future increase in the business of the port.

If the locality named were selected, much of the present expense for drayage on cotton to the lower wharves could be saved; and if the necessary cotton-presses were built in connexion, bales of cotton could be transferred immediately from the railroad depot to the vessels in the basin.

The cost of drayage on cotton brought by the Central road is about $12\frac{1}{2}$ cents per bale; hence the expense for 231,210 bales (the number brought on the road during the year just past) would be $28,900. The drayage from the river to the depot amounts, probably, to nearly an equal sum.

The basin would afford greater facilities also for loading ships with heavy rafted timber than are now found in the river itself. Ships and rafts would be removed entirely from the influence of the rapid ebb and flood currents, to which they are now exposed, whereby much delay and inconvenience in receiving cargoes could be avoided.

The shipping and rafts transferred to the basin would free the channel of the river to a considerable extent, and tend to its improvement.

VIII. In the river, the influence of the downward current upon the banks and bottom is the greater, and the shoals and bars are generally formed by it. In most cases, therefore, works designed for the improvement of the channel must be planned with a view to control and give proper direction to the *descending* current.

The shoals which offer the greatest impediment to the navigation, show a down-stream action; such is the character of Garden Bank, the Wrecks, Four-mile Point bar, and probably the shoals lower down.

The current map of the Coast Survey shows that the currents over the Wrecks, and other obstructions, are of less velocity than in deeper portions of the channel; this tends to greater accumulations, and indicates the cause of original formation.

From what has been said of the obstructions in the Savannah river, it will be seen that 10 feet *at low water* can be carried over all points below the Wrecks, where the depth becomes only 8 feet. In devising a plan, therefore, for its improvement, the commission are of opinion that the object first to be obtained is *uniformity of depth;* that is, give a depth of 10 feet at low water over the Wrecks and Garden Bank, thus enabling the larger class of vessels, which now load and unload, in part, at Venus Point, to come up to the city wharves. This would seem also to be the order of improvement contemplated by the appropriation law, which is in the following words: "For the removal of obstructions in the Savannah river, at a place called the Wrecks, and the improvement of the navigation of said river, $40,000."

The engineering operations necessary to the improvement at the Wrecks and Garden Bank, involve nothing of a complicated character; it is only a question of time and means. The Front river appears now to take a permanence of 8 feet at low tide, and this can be increased, 1st, by dredging a deeper channel; and, 2d, by giving water enough to keep it open.

Great facilities are found in the river above the Wrecks for forcing an additional volume of water down Front river, giving it sufficient velocity and scouring power to preserve the depth attained by dredging. The requisite deflecting works can be so planned and located as not to infringe upon any rights secured by the treaty of Beaufort.

Above the head of Hutchinson's island (see map) the current of Middle river, at entrance to Front river, has such a direction as to throw the body of the stream against the opposite bank below, from which it is deflected, so as to turn the larger volume of the river through the cross-tides. This current of the Middle river causes also the formation of a large sand-bank, running down nearly parallel to the opposite shore, and terminating in the channel of the cross-tides; a deflecting work can be placed on this bank extending to the edge of the main channel, which will turn a large amount of water to the south of King's island, giving as much volume and velocity to Front river as may be necessary to preserve, with the waters of Fig Island channel, a greater depth over Garden Bank and the Wrecks than now exists.

IX. For the accomplishment of this object of first importance, the following operations are recommended: Widen and deepen the channel at the Wrecks, and over Garden Bank, by dredging; straightening it, at the same time, so far as to give uniformity of curvature: close the upper end of Fig Island channel, turning the water south of the island; construct a jettee starting from foot of Fig island and extending far enough in a northeasterly direction to deflect a considerable portion of the flood from the Back to the Front river; build a deflecting work just above King's island, with a view to throw an increased volume of water into Front river: if found necessary, deepen the channel north of King's island, and at the foot of Marsh island. The flow of water in the city channel can be increased also, if found necessary, by making a *cut* across the lower point of Isla island, and enlarging the existing cut across Drakie's Point, or by making a *cut* across Hutchinson's island from the Back to the Front river, entering the latter just above Marsh island.

(The estimates in the report show that the approximate cost of these works would be ....$190,927)

The object of next importance in the improvement of the Savannah river, is, in the opinion of the commission, to give an increased depth to the channel over the *knoll* off Cockspur island, so as to enable vessels of a larger class to come up to the anchorage at Venus Point. For this purpose it is proposed to dredge the channel over the Knoll 2 feet 2 inches, which will give 20 feet ordinary high tide at all points of the channel below. Vessels of greater draught than have heretofore entered the port could then reach the anchorage, and as the approach to Venus Point is well guarded by the guns of Fort Pulaski, the Savannah river would also become a safer harbor of refuge.

Large amounts of lumber—heavy ranging timber as well as sawed—are shipped annually from Savannah, and this trade would be much benefited if vessels of 18 to 20 feet draught could come to Venus Point. As most of the ranging timber exported is taken from the rafts in the river, it could be shipped at that point with nearly the same economy and convenience as in front of the city. The proposed increase of depth in the channel below will offer increased facilities to other parts of the Savannah trade, as there will be less restriction as to tonnage and draught of the shipping that can engage in it.

Amount to be dredged from Knoll is about 51,600 cubic yards	$10,500
Approximate cost of works indicated	$201,427

By judicious expenditure of the above amounts, it is the opinion of the commission that a channel of at least 10 feet in depth at ordinary low water can be obtained from the entrance of the river up to the city wharves, and a depth of 12 feet as high up as the anchorage at Venus Point. The depth at ordinary high water to the anchorage would then be 20 feet, and up to the city 16 feet 4 inches. At spring tides, these depths would be increased about 1 foot.

During the progress of the work, continuous and elaborate observations should be made of the effects especially upon the tides, currents and depths. Permanent bench-marks should be established for the zero of each tide-gauge, to facilitate future reference.

It is recommended that the existing appropriation be expended—

1st. In procuring a good dredge-boat and the scows necessary to remove the materials dredged from the channel. For towing the scows from the machine to the place selected for depositing their loads, a tug-boat suitable for the purpose may be hired for the first season.

2. The dredge should be worked first upon the bank formed at the Wrecks, beginning at its lower edge. This should be continued until a channel 10 feet deep at low tide, and 100 feet wide, is obtained. The dredging should be commenced along the edge of Garden Bank, giving the same depth and width as below. These operations should be carried on alternately.

3. If a suitable dredge-boat can be obtained for $10,000 or $12,000, the present appropriation will probably furnish means to collect the materials required for closing the upper end of Fig Island channel. Such should be the application of any available balance. It may be

even found necessary, in the progress of the work, to close this channel, before giving the full width and depth proposed to the South channel, in order to get the requisite velocity, and scouring power, to keep it open. A considerable sum must be applied to this work before all the dredging below is executed.

If further improvements of the Savannah be undertaken at a future day, it would probably be most advisable to give the same depth of channel above Venus Point, that there will be below when the Knoll has been dredged to the depth previously recommended. To effect this, the Mud Flats, the Four-mile Point bar, the Wrecks, and Garden Bank, must be so far removed as to give an additional depth of 3 to 3½ feet. Uniformity of channel would then be attained, and all vessels drawing 20 feet and less could come up to the city. Afterwards the Knoll could be dredged to a greater depth, admitting vessels drawing more water to Venus Point, should the business of the place demand it.

It is probable that the depth of water over the shoals above could be increased three or four feet by *dredging alone*. If the deeper channels over the different obstructions were cut so as to straighten the line of best water, the flow of the tides would be accelerated, and this would give more scouring power to the returning ebb—sufficient, perhaps, to preserve the increased depth: if it should prove insufficient, however, a dredge could be worked from time to time, to aid in keeping open the requisite depth of channel. If 20 feet water were once gained from the entrance to the city, the advantages to the trade of the port would fully justify any expenditure that would be necessary to give permanence.

The maps used by the commission in studying a project for the improvement of the Savannah river, were:

1. A map made from the survey of Lieut. M. L. Smith, corps of Topographical Engineers, 1849.
2. Maps of the U. S. Coast Survey, 1851–'52.
3. Current map U. S. Coast Survey, 1852.
4. A map by Lieut. J. F. Gilmer, U. S. Engineers, 1852.

The maps and drawings sent herewith are the following:

1. A map of the Savannah river from the entrance to the head of Argyle island, on which are shown the depth of channel, the direction of currents, and the works recommended for its improvement. This map is in three sheets, Nos. 1, 2 and 3.
2. Map of the Wrecks and cross-tides, on a double scale.
3. Detailed drawings of the deflecting works recommended.

J. F. GILMER,
First Lieut. of Engineers, and Reporter.
A. H. BOWMAN,
Captain Engineers.
A. D. BACHE,
Superintendent U. S. Coast Survey.
} *Commissioners.*

WASHINGTON CITY, *February* 11, 1853.

APPENDIX N N—1.

ENGINEER DEPARTMENT,
Washington, February 24, 1853.

SIR: The commission on the improvement of the Savannah river having furnished an elaborate report on the subject, that report has been laid before the board of river and harbor improvement; and the majority of the board, having carefully examined and considered the subject, coincide, in all respects, with the views and recommendations of the commission.

One member of the board, while concurring in the project of the commission as regards its general features, proposes slight modifications, to obviate objections which he states in his report.

The project of the commission is, to widen, deepen, and straighten the channel at the Wrecks, and over Garden Bank, by dredging; close the upper end of Fig Island channel, turning the water south of the island; construct a jettee to deflect a considerable portion of the flood from the Back to the Front river, at the foot of Fig island; build a deflecting work above King's island; and the execution of other works, in case they are found necessary.

In specifying, in still further detail, the order of succession of the different operations, the commission recommend that this order be subject to such modifications as the progress of the work may suggest, and as may meet the sanction of the Engineer department.

I have the honor to propose, that I be authorized to instruct the officer in charge of the work to carry into execution the project of the commission, in measure, as funds may be provided for the purpose by Congress; and his attention will be specially called to the point of detail, in regard to which there is a want of unanimity in the views of the board of river and harbor improvements. The present grant to be applied to opening a channel one hundred feet wide, and ten feet deep at low water, at the Wrecks and at Garden Bank, either by contract or by the purchase of a dredge-boat, &c., and by working the machinery by days' labor or by contract, as may be found most economical.

Any surplus of means that may remain will be used in the further improvement of the navigation of the river, as provided for by the law, and in accordance with the project herein presented for your approval.

The following papers are transmitted with this report:

1. Report of the commission, with the accompanying maps and drawings.
2. Journal of proceedings of the commission.
3. Appendix to the report.
4. Report of the board of river and harbor improvements.
5. Report of the minority of that board.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Hon. C. M. CONRAD,
Secretary of War.

Approved February 26, 1853.

C. M. CONRAD, *Secretary of War.*

The officer was instructed to carry the project, as approved, into execution accordingly.

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APPENDIX N N—2.

Report of operations for removal of obstructions in the Savannah river, at a place called the Wrecks, and the improvement of the navigation of said river, for the year ending 30th September, 1853.

By letter from the Engineer department, bearing date 29th September, 1852, and received by me the 4th of the following month, I was informed that an appropriation of $40,000, approved August 30, 1852, had been made for the improvement of the Savannah river, and that the work was thereby assigned to my charge. Immediately on the receipt of the department letter, I commenced the requisite preliminary surveys and examinations of the river preparatory to the study of plans for the works contemplated. I was occupied with these labors from the early part of October until the first week in December, 1852, when the commission appointed, under the War Department, to devise a *project* for the improvement of this river, convened in the city of Savannah. The joint labors of this commission, of which I was a member, were not closed until February last, when the report, together with full maps of the river, and detailed plans for the contemplated works of improvement, were presented to the department.

As soon as the project of the commission received the sanction of the Secretary of War, advertisements were issued from the Engineer department, and published in the public papers in different sections of the country, calling for proposals to build such boats, dredging-machinery, and scows, as were required for the prosecution of the work; or, for proposals to dredge the channel by the cubic yard. Offers were received from various parts of the country in answer to the call which had been made; and a contract was entered into the 13th day of May last, for dredging and removing materials of all kinds from the bed and bottom of the Savannah river, at a stipulated price per cubic yard—the work of dredging to commence the 1st day of July, 1853. At that date the contractor had procured the requisite boats, scows, and machinery, and he has been engaged since in the prosecution of the work. The dredging has not progressed at the rate required by the terms of the contract, owing to a deficiency of power in the machine first set to work; but the contractor has made arrangements for a second machine, which is to be employed in the river early next month. The daily labor of the two will probably amount to six or seven hundred yards.

In the course of the summer a substantial flat was built, to be used in the construction of the closing and deflecting works, which form a part of the plan of improvement; and arrangements were made for building a steam pile-driver, with the other machinery required. Measures were also taken to procure the materials for building these works, and to have them delivered at the points where they will be required.

To insure successful results from the construction of the works designed, and the dredging now commenced, I think it very desirable that they should be carried on to completion as rapidly as possible. This would result in great economy—diminishing much what would be the entire cost if operations were delayed and protracted for several years for the want of means.

Respectfully submitted.

J. F. GILMER,
Captain of Engineers.

APPENDIX O O.

Report of operations in the examination and survey of the river Savannah from the city of Savannah as high as the city of Augusta, for the year ending 30th September, 1853.

The charge of this examination and survey was assigned to me as early as the first of October, 1852, but more pressing duties, connected with other works committed to me, absorbed all my time and attention until the beginning of last spring. By the first of March I had made my preliminary arrangements and organized a party to aid me in conducting the field operations. We reached Augusta the first week in that month, and commenced work with fair promise of good weather; but the spring rains set in a few days afterwards, causing high freshets in the river—making it impossible to conduct the work in a reliable manner. Nearly the whole of the month was lost—at least so far as the labors of the field party were concerned. During the continuance of the rains I collected all the maps of the Savannah river that could be found, and, aided by my assistant, Mr. Welter, compiled such facts from them as would be useful to us in the labor we were about entering upon.

About the end of the month the river had fallen enough to justify the commencement of the survey; and it was pressed forward with all possible despatch. We had many rains, however, during the progress of the survey, causing considerable rises in the river, and thus preventing as satisfactory examinations of some of the bars as I desired. The field operations were brought to a close about the middle of May last; since which time the general map of the river from Augusta to the city of Savannah, and the charts of the divisions where the bars occur, on a larger scale, have been in preparation. As soon as they can be completed and copied they will be sent to the department.

The principal obstructions to the navigation of the river were found to be *sand-bars*—occurring where the width was greater than the average, or at the abrupt bends of the river; *snags and rafts of logs and brushwood* lodged against the concave banks in the sudden curves, or "bites," as they are called by the river captains, and the *rapidity of currents.*

Some of the sand-bars in the upper part of the river—the first twenty-five miles below the city of Augusta—are impassable for boats drawing more than two and a half to three feet water during the lowest stages of the river—and not more than four feet can be relied upon throughout any summer; and the channel giving this depth is frequently narrow and crooked, so that boats of the smallest draught are liable to get aground.

In many cases (perhaps in all cases) where they occur in straight sections of the river, these bars may be deepened by building deflecting works—projecting alternately from the right and left banks of the stream—confining a greater volume of the water to the centre of the channel. In other instances, dredging from time to time might prove most advantageous.

The bars at Hershman's lake may be avoided by improving the channel of King's creek for a part of its length, (by removing the snags and logs,) then connecting the creek with the main river again by means of a *cut*. The snags and rafts may be removed by employing a boat of small draught, provided with machinery for cutting and raising the logs and brushwood from the channel; and the same motive power used for propelling this machinery could be employed in working a dredger. It often happens that the timber lodged in the "bites," or abrupt bends, crowds the boats out of the best water, forcing them up on the sandbars projecting from the opposite bank of the river. The navigation of this river would be vastly improved if these accumulations of timber alone were removed from time to time.

The bars which offer the most serious obstructions to the navigation, and have not more than from three to four feet water over them in the low stages of the river, are—1. Gardiner's bar, in front of the city of Augusta. 2. Course's bar, 1¼ mile below Augusta, by way of the river. 3. Blue House bar, 4¾ miles below Augusta. 4. Canoe Cut bar, 6¾ miles below. 5. Rifle Cut, Bugg's, and Alder Patch bars, about 7 miles below. 6. Twiggs' bar, 12 miles below. 7. Silver Bluff bar, 24½ miles below. 8. Buzzard's bar, 31 miles below. 9. Prescott's Reach bar, 73 miles below. 10. Burton's Ferry bar, 86½ miles below; and, 11. Hershman's Lake bars, about 91 miles below Augusta, with others; but those enumerated are of the most serious nature.

The Upper Savannah river is subject to very sudden and high *freshets*, the water rising *twenty*, *thirty*, and even as much as *thirty-seven* feet above the level of low water, midsummer. It will probably be best, therefore, that the proposed deflecting works should not be raised higher than the level of low water in the river, so that the water may flow freely over them in cases of freshets.

Should the improvement of the Upper Savannah be undertaken by the government, I would offer the following as a proper estimate of funds to be applied for the fiscal year ending 30th of June, 1855, viz:

For boat of light draught, furnished with machinery for cutting and removing rafts, snags, &c., and for dredging........	$20,000
For fuel for boat one year, 720 cords at $3................	2,160
For hire of 1 captain, 1 assistant, and 6 hands, one year....	3,000
For subsistence for 8 men one year....................	600

For construction of deflecting works..........................	$25,000
For contingent and unforeseen expenses.......................	4,240
Total for fiscal year ending 30th June, 1855..........	55,000

Which is respectfully submitted.

J. F. GILMER,
Captain of Engineers

SEPTEMBER 30, 1853.

CHASEFIELD, NEAR PENSACOLA, *July* 4, 1853.

SIR: I was directed by your letter of the 13th April last to complete the "examination and survey of the Flint river up to Albany," and the "Chattahoochee up to Columbus," provided for by the river and harbor law of August 30, 1852, for each of which operations the sum of $2,500 was assigned by the War Department. My duties as a member of the board of officers appointed by the Secretary of the Navy, detained me at the navy yard near Pensacola until the 20th of May. My duties in relation to the improvement of the harbor of Mobile detained me at Mobile and New Orleans until the 25th May, when I immediately proceeded to Columbus in Georgia, where I arrived on the 29th of May. I was detained in that city until 3d June, before I could obtain a suitable conveyance down the Chattahoochee river to its junction with the Flint river. It was necessary to supply some information by general observation and a few detailed examinations, additional to that furnished by the notes of Captain Scarritt, U. S. E., in order to arrive at a proper understanding of the matter which I have been instructed to investigate.

My movements, labors, and their results, from the time of my departure from Columbus to that of my return thereto, have been fully explained in my letter to the department of the 12th June. I have since been employed with my industrious and competent draughtsman in preparing the maps and sketches necessary to illustrate the reports and estimates called for by your instructions.

I returned to this station on the 27th June, and required a day or two of rest to recover from indisposition, the consequence of exposure and fatigue.

I have now the honor to submit the following:

APPENDIX P P.

I.—REPORT ON THE CHATTAHOOCHEE.

(1) This river's sources are all in the county of Habersham, Georgia. "The Chattahoochee range" divides the waters from those of the Tugula river, which is a branch of the Savannah river. On the north a mountainous region separates the sources of the Savannah and Chattahoochee rivers from those of the streams flowing into the Tennessee river.

The principal source of the Chattahoochee, as represented on the most recent map of Georgia, lies in 34° 45′ north latitude, and in 83° 48′ west longitude from Greenwich. The general course of the river to latitude 33° 15′, in Heard county, Georgia, is nearly southwest, and thence to its junction with the Flint river, in latitude 30° 42′ 41″ and longitude 84° 53′ 15″, it is nearly due south. The Chattahoochee forms, with the Flint, the Appalachicola river.

The Chattahoochee receives throughout its course no tributary stream of any size or of importance; the Chestatee being the only one dignified with the name of river. This branch interlocks with the Etowah, which is a branch of the Coosa river, a tributary of the river Alabama. The Chestatee has its source in Habersham county, near those of the present stream.

The Chattahoochee passes for the most part through a rich and interesting country, which lies principally within the State of Georgia. From West Point to the Florida line its west bank forms the boundary between Alabama and Georgia. The sovereignty of Georgia extends to high-water mark, on the western bank of the river, thus giving to that State the entire ownership of the stream adjoining Alabama. The line between Florida and Georgia passes down the middle of the river.

The Chattahoochee is said to be impeded in its course down to the great rapids at Columbus, by rocky shoals and sand-bars, with intervals of navigation for small boats. It is also said that there is a good clear navigation for two hundred miles above West Point, for small boats, following a very winding course.

The rapids or falls at Columbus fix the limits of navigation from the Gulf of Mexico. These rapids extend almost without interruption back to West Point in a direct line about twenty-eight miles, and, it is said, rise to an elevation above the surface of the river at low water at Columbus of nearly four hundred feet.

The river below these rapids is navigable for steamers of considerable size, except in the low stage of water. Smaller streams are employed during the low stage, and are not entirely impeded in their movements until the water falls below the twenty-four inches mark.

The impediments to the navigation in a low and medium stage of the water, consist of rocks, snags, sand-bars, and trees overhanging the river's banks.

The formation of the banks of the river below Columbus is derived from diluvial deposites resting on a base of marl and limestone. The alluvial washings of the banks form sand-bars in the bed of the river, and extensive shoals at the mouth of the river Appalachicola, which, in time, uniting with the main land, exhibit a constant encroachment upon the waters of the Gulf of Mexico.

These alluvial washings are increased as the banks are cleared and cultivated. The bars are composed of silicious gravel and sand, with mixture of aluminous and other earths.

Trees undermined by the currents of the river during floods, falling into the stream, sink to the bottom by reason of the weight of earth adhering to the roots. These form snags, and occupying the channels and shoals, present very dangerous obstacles in the navigation.

The rocky impediments are generally detached, and are either fixed or movable. Marl rocks occupy some portions of the bed of the river, through which the waters have worn narrow channels.

The currents, considered as an impediment to the upward navigation, are rapid in proportion to the rise of the river between its banks.

When there are seven feet of water in the channels and rising to the highest floods, a facile and safe navigation is afforded to steamers; but when the water subsides below the seven-feet gauge to its lowest stage, the navigation becomes devious, difficult and dangerous. At the lowest stage in summer, the navigation is impracticable except ior bateaux, the quantity of water not being sufficient to fill the channel.

The Chattahoochee is subject to freshets, which rise with extraordinary rapidity, and overflow at many points along its banks. Sand is frequently deposited, by the floods, on plantations, and sometimes to a ruinous extent.

(2.) The country above Columbus produces all the cereals, besides Indian corn, potatoes, cotton, upland rice, lumber, horses, mules, oxen, &c., &c. The productions of the country below are cotton, rice, tobacco, Indian corn, tar, p'tch, turpentine and lumber.

It is difficult to estimate what the product of cotton is, within the dependent country, respectively, of the Flint and Chattahoochee rivers. The exports from the port of Appalachicola rivers afford no data for calculation, for they are furnished from the whole system of rivers formed by the Appalachicola, Chattahoochee and Flint. 150,000 bales of cotton are estimated to be the amount exported from Appalachicola during the year 1853. Appalachicola is the third cotton exporting place, in point of quantity, in the Gulf of Mexico.*

The Chattahoochee possesses not only commercial but military advantages, and both will pertain to it in a considerable degree, even when railways shall cross its banks and direct a portion of its trade to the Atlantic coast.

Columbus possesses natural advantages for an interior commercial and manufacturing town. These advantages are principally derived from the immediate water-power afforded by the falls of the river in the neighborhood; from the salubrity of its climate; and from its location in the heart of a rich and productive country. To which may be added the advantages which art is imparting to it, by the construction of railways leading to the Gulf of Mexico; to the Mississippi river; to the valley of the Tennessee; to the northeastern parts of Georgia; and to the Atlantic coast. These advantages are beginning to be availed of: already four or five extensive cotton and woolen factories have been erected in Columbus and its immediate vicinity. Many handicrafts are also carried on; most of which being attended by good success, encourages the application of capital and the enlargement of the division of labor; so that in connexion with the general increase of the population, property, and power of the country, it may be reasonably

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* A letter received from Georgia since this report was written, affords the following information:

Shipments from Columbus to Appalachicola	53,000	bales of cotton.
" The Landings between Columbus and the town of Chattahoochee	73,000	"
" The Landings on the Appalachicola river	4,000	"
" The Flint river	16,000	"
Total at Appalachicola	146,000	"

claimed that Columbus is destined to become a place of trade and manufactures equal to the most favored place of the kind on the continent.

Viewing the country from Baton Rouge to the Atlantic ocean, no one position appears to offer as great advantages as does Columbus for the site of a national armory, arsenal, or foundry.

In a few years' time, arms and implements of war could be distributed with almost equal facility to the valley of the Mississippi, to the Gulf of Mexico, and to the Atlantic coast.

The improvement of the navigation of the Chattahoochee river may be considered, then, as one of national importance, for it has been shown that it would promote the extension of commerce and assist the national defence.

(3.) The impediments to the navigation of the Chattahoochee at its medium and low stages of water may be in some instances entirely removed, and in others only reduced in power.

The impediments in points of importance may be classed as follows:

1. The tree-snags lying in channel and on the shoals.
2. The rocks in and near the channel.
3. Sand-bars and narrow channels through marl beds.
4. Trees overhanging the banks.

The snags are represented, by veteran and experienced navigators of the river, to be the most formidable and dangerous impediment, and are those that should be first removed. Unlike the rock, marl formations and sand-bars, they occupy every variety of position, and are not confined to particular localities. The rocks, marl beds, and sand-bars are few in number, fixed in position, and once known, can, by skilful pilotage, be avoided: the overhanging trees do injury only to chimneys and guards of steamers; but old snags change their positions, and new ones are planted so rapidly as often to deceive the most skilful pilot, especially when the river is at its medium stage.

These snags can be easily removed, and, in comparison with the resulting good, at a reasonable expense. The means to be applied involve no complexities; consisting, as they would, of a large flat, furnished with a boom-derrick, ropes, falls and tackle, boats, axes, saws, &c.

Most of the snags would be drawn out by purchases attached to the trees on the banks of the river, and then cut up and placed in position, when the next floods would carry them off. Those lying in the channel way would be extracted by the boom-derrick and carried ashore to be cut up. Many of these snags are deeply imbedded in sand, and in some instances are fastened in the clefts of rocks.

A working party was employed in the summer of 1852, by the owners of steamboats, to remove some of the snags in the river. It consisted of two directors and twenty men: they worked twenty-two days, and removed some one hundred and fifty snags, at a cost of $900.

The intelligent pilots Brockway and Wingate represent the number of snags to be removed as seven hundred and forty. These occupy the channels and shoals. Those in the channels are particularly dangerous in low water—those on the shoals are dangerous in a minimum stage of water. It is desirable that every snag should be removed, for if they are not immediately an obstruction to navigation, they serve as lodging places for new snags, which in time become dangerous.

The estimates marked A are founded upon these data.

The rocks in and near the channel, requiring to be removed, are exhibited at a few positions, viz:

At the Betton shoals.

At Snake shoals, (only one rock in mid-channel necessary to be removed.)

At Roanoke island, marl, (necessity of removal doubtful.)

At Handridge's shoals.

At Widow Brown's Landing.

At King's rocks, or shoals.

At Rock island.

All the rocks in these positions require to be blasted and scattered over the bottom in deep water. An estimate for this work is contained in the general estimate marked A.

The sand-bars over which the channel requires to be deepened are only two in number, viz:

1st. At Woolfork's bar and island.

2d. At the Race Paths upper bar.

When the water-mark at Columbus indicates four feet six inches, there are only three feet over Woolfork's bar, and only four feet over the Race Path bar; whilst over the other bars of the river there are from five feet to seven feet water.

The construction of a wing-dam at Woolfork's bar, some years ago, deepened the channel to the depth of water that can be obtained at Columbus Landing at low tide. This was all that was desired, seeing that no more water could be obtained in the river opposite the landing. There being six inches less over the Race Path bar than there is at Columbus landing, requires that this bar should be deepened at least six inches.

The depth of water at Columbus is assumed to regulate the required depth at low water throughout the river; and, consequently, when a depth in channel is equal to or greater than that of the initial depth at Columbus, there exists no necessity for improvement.

The depth over Woolfork's and Race Path bars being less than the initial depth, requires to be increased. The plan for deepening the channel over these bars consists in the construction of "wing-dams," by which the current is compressed over the shallow places, and the impediment thereby removed to a certain extent.

The success attending a similar construction at this point indicates the proper remedy. The old wing-dam, being composed of small rocks, was in part destroyed by floods in the river. It is proposed to repair the entire length of the dam—to extend and strengthen it by forming it of heavy rock obtained from the neighboring quarries.

The Race Path bar will receive a similar improvement. The positions of these improvements are exhibited in the sketches Nos. 3 and 8; and estimates for cost are embraced in the general estimate marked A.

Some of the channels pass through marl beds along the river, and are narrow and deep, but all boats navigating the river have room to pass through in safety, under skilful pilotage. The general opinion among intelligent owners, captains, and pilots of steamers is, that these channels do not require to be widened for low-water navigation.

An estimate for cutting away the trees overhanging the banks is embraced in general estimate marked A.

All the information that I could obtain from persons interested in the navigation of the Chattahoochee river goes to confirm my own opinion, that its improvement only requires that the snags should be thoroughly removed, that the rocks in and near the channel should be blasted, and that the trees overhanging the river's bank should be cut away. My recommendations as to scale and cost of improvement of the river are accordingly limited to these objects.

It is proper to remark, that the navigation intervening the particular impediments stated, may be considered as facile and safe in any stage of water; but an exception to this is exhibited at Francis's bend. The floods of the river bring down and deposite sands which lodge on the shoals, and which are gradually washed away as the river falls to its low stage, and the channel assumes its usual depth. There is a "cut-off," increasing in depth, at this point; but whether it will become the principal channel and remain so, or not, it is impossible to say, as the river here is constantly changing its form. By removing all the snags now lying in this bend, and those that may hereafter be lodged there, promptly, this part of the river will receive all the improvement that it is possible to afford.

As regards the order of time in which the works of improvement should follow each other, it would be desirable that they should all be carried on about the same and in the shortest possible time. With adequate appropriations the work should be performed in a single season, when the water was at a low stage. Should these appropriations be obtained as early as May, 1854, it is recommended that separate parties should be set to work to clear out and cut up the snags, to construct the wing-dams, to remove the rocks and the marl beds, and to cut away the overhanging trees, as early as June, or as soon after the appropriation could be made available as possible.

(4.) The elements for constructing the maps and sketches accompanying this report are as follows:

1. A map of the river Chattahoochee, extending from Columbus to the Appalachicola river, compiled from the land surveys of Alabama and Georgia, by Captain Scarritt, U. S. E., with additions by Major Chase, U. S. E.

2. A map of the State of Georgia.

3. Actual surveys, by Captain Scarritt, of Woolfork's shoals and island, Abercrombie's shoals, the Uchee shoals, Upper Race Path shoals, Roanoke island, and Francis's bend.

4. A general reconnoissance of the river, with particular examinations of Francis's bend, Handridge's shoals, Wood shoals, Widow Brown's rocks, King's rocks, and Rock island, by Major Chase, U. S. E.

5. Notes taken from pilots, as regards positions of certain shoals, bars, &c., by Major Chase and Captain Scarritt.

Extreme accuracy in the maps and sketches, except in the instances of actual survey by Captain Scarritt, is not claimed, for the disposable means would not allow of its attainment; but an approximation to the truth of things has been obtained by actual survey in the instances mentioned by Captain Scarritt, by personal observation by Captain

Scarritt and Major Chase, and from information of a reliable nature, obtained from experienced captains and pilots of the river, by which the policy, plan, and pecuniary means for the proposed improvements may be safely assumed and recommended to be adopted.

The maps and sketches accompanying this report, and illustrative of it, and attached estimates, are:

A map of a part of Georgia, embracing the Flint and Chattahoochee rivers, extending from their junction up to the towns of Columbus and Albany, respectively. (See sheet No. 1.)

Map of the Chattahoochee river from Columbus down to its mouth. (See sheet No. 2.)

A sketch of Woolfork's island and shoal. (See sheet No. 3.)
Abercrombie's shoals. (No. 4.)
Little Uchee shoals. (No. 5.)
Old Head Uchee shoals. (No. 6.)
Uchee shoals. (No. 7.)
Upper Race Path shoals. (No. 8.)
Roanoke Island shoals. (No. 9.)
Francis's Bend shoals. (No. 10.)
Betton's Rocks shoals.
Handridge's Rocks shoals.
Wood's Rocks shoals.
Widow Brown's Rocks shoals.
King's Rocks shoals.
Rock Island shoals.
(No. 11.)

(5.) The estimates for the respective works proposed are contained in the paper marked A, and entitled "General estimate for the improvement of the Chattahoochee river."

A.

General estimate for the improvement of Chattahoochee river, in the State of Georgia.

1. The removal of nine hundred snags lying in the channel, on the shoals, and near and on the banks throughout the river, from Columbus to the Appalachicola, and which are particularly indicated as follows:

	Snags and trees.
Head of Woolfork's island	6
Between the island and Abercrombie's bar	15
About Abercrombie's bar	6
Between the bar and Woolfork's shoal and lower island	6
Through Woolfork's shoals	25
Between Woolfork's and Fort Mitchell	12
Head of Uchee shoal to foot	3
Foot of Uchee shoal to Uchee island	18
Uchee island to Betton's rocks	6
Betton's rocks to Chimney bluff	20

Chimney bluff to Race Path	20
Through Race Path	12
To Crupper island	6
To Snake shoal	20
Through Snake shoal	12
To Everitt's shoals	25
Through Everitt's shoals	25
Everitt's to Oak Log shoals	12
In Oak Log shoals	25
To Florence	25
To Roanoke island	15
To Fanny's bar	20
To Fish Point and Coagge bar	25
To Pennyman's shoal	30
In Francis's bend	10
To Francis's bend	15
To Eufala	8
Eufala to Barber's shoals	40
To Hightown shoal	11
To Magan's shoals	20
To Handridge's shoals	25
To Fort Gaines	5
To Gilman's shoal	10
To Wood's shoal	12
To Abbua creek	20
To Columbia	25
To Saffola's bar	30
To Donalson's bar	6
To Hardie's bar	20
To Bryant's bar	15
In Bryant's and Owen's bars	15
To King's rocks	18
To mouth of river	40
	734
Add for those lying near and on the banks	166
Making this number	900

It is assumed that three men will, on an average, remove and cut up one snag per day. This, for 900 snags, would require 2,700 working days for one man, and 40 men would perform the work in 67.5 days. Add for Sundays (11) and for wet days, (11½,) and make the whole number of days 90 for the duration of the work.

The work should be performed by two parties of 20 men each, under the direction of one superintendent, with an overseer to each party. Each party would require for its work, one large flat, 60 feet long by 20 feet wide, decked over, and supplied with a boom-derrick, with windlass, anchors, cables, &c.; also with a cabin and caboose-house for the accommodation of workmen, &c.

One small covered flat, 25 feet long and 9 feet broad, for the accommodation of the overseer and for a place for stores, &c.

Two yawl boats, ropes, falls and tackle, chains, &c.

Twenty axes, ten shovels, five crosscut saws, cooking utensils, &c.

Each working party would then cost as follows:

One large flat, with cabin, caboose-house, anchors, cables, boom-derrick, and windlass, complete	$1,000 00
One small covered flat	150 00
Two yawl boats	150 00
Saws, axes, shovels, ropes, chains, fall and tackle, cooking utensils, &c	300 00
One overseer, who should be a river pilot, at $4 per day, 90 days	360 00
Twenty men at $1 25 per day, (without deducting wet days—only Sundays) 79 days	1,975 00
One cook, at $1 25 per day, 90 days	112 50
Provisions for 22 persons 90 days, at 30 cents	594 00
	4,641 50
Add for contingencies	358 50
Cost of one party	5,000 00
For two parties	10,000 00
If the superintendent of the work was an officer of engineers, a provision must be made for office expenses, commutation of fuel and quarters, transportation, &c	500 00
Total estimate of cost to remove snags	10,500 00

2. It is difficult to estimate the cost of cutting off overhanging trees, &c.; but as the snag party might do this work as it passed along, it is thought that it might be done for	$1,000 00

3. To estimate for blasting the rocks in the several shoals is very difficult. The estimate made by Captain Scarritt in his communication to the Engineer department, is entirely too high. All these rocks require to be cut down below the surface of low water, as indicated when the water-mark at Columbus stands at three feet. It would be well that the depth to be attained over these rocks should be four feet at low water. In blasting these rocks they would be scattered over the bottom in most places deeper than four feet.

Admitting that these rocks have not only to be blasted, but that their fragments should be taken up and carried off to the banks of the river, it is thought that $150 for each rock would cover the whole expense. That sum is assumed for the average cost of all the rocks.

In the upper Betton rocks there are seven rocks which should be removed, which at $150 would be	$1,050
There is a single rock in mid-channel at the foot of Snake shoals, that requires removing	150

The necessity of cutting off the top of the marl bed at Roanoke island is doubtful. It can be cut or chiselled off for	$100
At Handridge's shoals two rocks require to be blasted and removed, at $150 each	300
And the point of reef at A should be cut off six feet	150
At Wood's shoal three rocks should be blasted and removed, at $150 each	450
At widow Brown's landing, one rock at A to be removed, at $150	150
At King's rocks, Nos. 1, 2 and 3 require to be blasted and removed, at $150 each	450
And the old wreck of the Appalachicola steamer to be blown up and removed	150
At Rock island, rock above the island to be removed	150
Total estimate of cost of removing rocks	3,100
Cost of superintendence	300
	3,400

An experienced man in blasting rocks should be employed, and the number and kind of boats, and number of workmen to be employed, should be left to the officer in charge of the improvement.

4. *Construction of wing-dams.*—Stone, either of granite or limestone, can be obtained in abundance for this work. Granite is obtained at the Columbus falls; it is preferred to limestone on account of its blasting out in large pieces. Limestone crumbles in blasting; 150 pounds are assumed as the weight of a cubic foot. The stone should be placed as compactly as possible in the dam. The dams at Woolfork's island and shoals are, together, 1,215 feet in length, 3 feet high, and 6 feet (average) wide; making 21,870 cubic feet, which multiplied by 150, gives 3,280,500 pounds, or about 1,460 tons.

No quarries are worked at Columbus, and no prices for the delivery of stone could be obtained; but $4 per ton would certainly procure the quantity required. This price per ton is assumed.

We then have 1,460 tons, at $4 per ton	$5,840
Cost of superintendence, &c	160
Total estimate of cost of Woolfork's dam	6,000

The wing-dams at the Race Path shoals are 860 feet in length, 4 feet high, and 7½ feet (average) wide; making 26,040 cubic feet, which multiplied by 150, gives 3,906,000 pounds, or about 1,740 tons; which, at $4 per ton, gives	$6,960
Cost of superintendence, &c	240
Total estimate of cost of Race Path dams	7,200

Recapitulation of estimates.

Removing of snags	$10,500
To cut away trees. &c	1,000
Blasting and removing rocks, &c	3,400
Wing-dams at Woolfork's shoals	6,000
Wing-dams at Race Path shoals	7,200
	28,100
Add for general contingencies	1,900
Resulting cost for the improvement of the Chattahoochee river from Columbus to its junction with Flint river	30,000

APPENDIX Q Q.

II.—REPORT ON THE FLINT RIVER, GEORGIA.

(1.) This river takes its rise in the counties of Coweta and Franklin, in the State of Georgia, in latitude 33° 37½″ north, in the hills which separate its waters from those of the Chattahoochee river. Its course on a straight line is nearly due south for fifty-three miles, when it turns to the southeast and runs thirty-five miles; it then resumes its course to the south for sixty-seven miles, when it changes to a southwesterly direction, which it keeps to its junction with the Chattahoochee river. It receives no rivers, but many large creeks, in its course. Some of the best lands of Georgia are watered by the Flint river and its tributaries. The productions of these lands will be greatly increased when the net-work of railways shall be completed in Georgia, by which facile communications with the interior and sea-board market shall be established.

The head of navigation for steamers is fixed for the present at Albany. It is said that small steamers might ascend to Danville, if the rocks in the channel, over some eleven shoals, were removed. The navigation of the river in stages of water not less than six feet, and up to the highest floods, is easy and safe—there not being a snag, save one, or overhanging trees, near the channel in its whole course from Albany to the mouth. When the river falls below six feet, and to the lowest stage, the navigation is impeded by a series of detached shoals and islands formed principally by boulders of flint-rocks mixed with sand, whose aggregation appears to have been effected by the force of the current rolling the rocks to the points of limerock rising from the bottom, and offering obstructions to their progress. The sizes of the boulders are various—of eight or nine inches up to those of four or five feet in diameter, but generally the size does not exceed one foot.

These boulders form the islands and reefs, and the ledges projecting from the banks of the river. In a few instances a smooth limerock forms the bottom of the channel, which is unobstructed by any loose boulders. The water in its low stage passes with great rapidity over these natural dams. In the intervals, the current is retained to a gentle current in deep water. The bottom along these intervals is composed of limestone, which, except in a few instances, is covered with sand, mixed occasionally with a flint boulder. In these intervals sand is deposited during the floods of the river, whilst the aluminous matter is held in suspense by the water, and carried down to the sea. As the river comes down to its low stage, portions of the sand are washed over and through the rock, and are slowly carried off into the Appalachicola river and to the Mexican gulf. There are no sand-bars in this river, with the exception of one at its mouth, and which is common to the Chattahoochee river, and one opposite Spring creek. There is but one snag in the river.

The river from Albany to its mouth has excavated its channel through a diluvial formation, based upon eocene limestone, and it is said that the same formation and peculiarity of channel is maintained to the source of the river. The rise and fall of this river are exceedingly rapid.

This being the general character of the Flint river and of its obstructions, it would appear that the solution of the problem of improvement is an easy one.

(2.) The improvement of the river, twice assayed by Georgia, is a matter of considerable interest to that State; but it possesses in no degree any national characteristics, being entirely embraced within the limits of Georgia. It appears to be excluded from that class of works that may be denominated national; and although its improvement would in some degree afford facilities to general commerce, yet as its ownership strictly pertains to Georgia, that State could develop its value by its own means, and have the right to remunerate itself by the imposition of tolls upon the navigation. In this respect the Flint differs from the Chattahoochee. The latter river flows through the three depending States of Georgia, Alabama and Florida, and is necessary to the commerce of the same. No one of these States would have the right to improve the navigation of the river with a view to remunerative tolls.

The productions of the northern portion of the country washed by the Flint and its tributaries, are similar to those of the Chattahoochee. Cotton, Indian corn, and cattle, are the chief productions of the country lying below Albany. Not over 20,000 bales of cotton at present go out of the river to Appalachicola; but the country has been newly opened, and is found to possess lands of unrivalled excellence for the production of the great staple. Rice, tobacco, and sugar, can, and will in time, be successfully cultivated.

(3.) It is ascertained that there are thirty inches of water, at the lowest stage of the river, over the shoal at Spring creek; and at that time there are about fifteen inches of water in the shoalest channels over the rock shoals.

As the deep parts of the river contain an abundance of water, it is thought that if the channel over each dam or shoal were widened to forty feet, with a depth of thirty inches, the supply of water would be sufficient to maintain the depth of water from Albany to the mouth of the river.

The owners and pilots of steamers and other boats would be con tented if this depth of water could be permanently maintained, by which an uninterrupted navigation for light-draught steamers would be afforded during the summer months, when the trade is of limited extent, consisting, principally, of supplies brought up from Appalachicola.

The depth of thirty inches is assumed, then, as the initial depth, upon which the project of improvement and the estimates of cost are based.

The improvement would consist simply in removing the loose rocks, and cutting through the limestone in a few places in the channel, so as to widen it to forty feet, and to deepen it to thirty inches at low water. To effect this, laborers would be employed to pick up such loose stones lying in the channel as they could conveniently handle, and place them on the right and left of it. For the removal of the heaviest stones it would be necessary to provide "twin-boats," which should be decked over, leaving an opening in the centre. By means of a derrick the rocks would be raised through this opening, and placed on deck. When a load was obtained, the boat, attached by lines to both banks of the river, would be let down by the current over the shoal, and its cargo discharged into the deep water below; and thence be hauled up to its first position. A plan of one of these twin-boats, and its position whilst at work, is shown in sheet No. 2.

The number and name of each shoal requiring improvement, and a general estimate of cost of the same, are subjoined.

Number and name of each shoal, and number of rocks to be removed.

1. Albany island. Nothing required.
2. Long's island. Eight rocks at the upper end to be removed.
3. Blue spring. Limestone rock to be blasted; reef between it and the shore, also of limestone, requires to be cut fifteen inches deeper on a line of 150 feet.
4. Arline rock. Fixed flint-rock; six loose boulders to be removed from channel.
5. Cane-brake shoal. Rocks to be blasted, and four or five small rocks to be removed.
6. Nigger-head. Twelve boulders to be removed from channel.
7. Goat island. About twenty boulders to be removed from channel.
8. Touch-and-go. One rock to be blasted, and a few boulders to be removed from point of shoal—say six.
9. Miller's island. Five rocks from head of island.
10. Mingo island. Two rocks on shore to be removed; and limestone reef, putting out from island, to be cut off.
11. Red Bluff island. Rock No. 1 to be blasted.
12. Emmeline island. One small rock near the channel, above the island, to be removed.
13. Ward's shoal. About twenty boulders to be removed from western channel.
14. Ten-cup shoal. Fifty-six boulders to be removed throughout the shoals.
15. Lucky shoals. Limestone reef, to be cut fifteen inches deep on a

line of about twenty feet, and forty feet wide, and twenty boulders in the channel to be removed.

16. Louisa shoal. Four or five rocks to be removed from point of reef, two of them to be blasted.

[*Note.*—Between Cass eddy and Ferguson's shoals, one hundred boulders to be removed from the channel.]

17. Ferguson's island and shoals. Fifty boulders at the head of island; fifty do. at the foot of island; ten do. just below the island; twenty do. 600 feet below. Limestone reef at A, twenty feet long and ten wide, to be cut away.

18. Atkinson's island. Three rocks to be removed.

19. Tinsley's bend. Three rocks to be removed.

20. Chimney shoal. One large rock to be blasted, and four or five small ones to be removed.

21. All-day shoal. Twenty boulders to be removed from channel.

22. Newton shoals. Fifteen do. do. do.

23. Newton island. Rocks Nos. 1 and 2 to be blasted.

24. Three Sisters. Twelve boulders at head of island No. 1; twenty do. between island and shore No. 1; twenty do. at head of island No. 3; one large rock to be blasted near channel; thirty boulders at foot of island No. 3.

[*Note.*—About half-way between Newton island and the Three Sisters there are six boulders in channel that should be removed.]

25. Forest shoals. Fifty boulders to be removed from channel, and a large flint-rock to be blasted.

26. Sangamon islands and shoals. At island No. 1, a projection of rock at upper end to be trimmed; a large rock above water, and four more under water, to be blasted; twelve boulders, 600 feet lower down, to be removed.

27. Flat shoal. About four hundred small boulders to be removed.

28. Red Bluff shoals Thirty boulders to be removed; small projection below wants trimming.

29. Deep-step shoals. Rock in channel to be blasted.

30. Dry-bread shoal. One hundred small rocks to be removed.

31. Ropewalk shoal. Point at A, of loose rocks, to be removed, fifteen in number, in order to change the channel to west side; twelve rocks to be removed on west shore, opposite lower shoal.

32. Bull's Slough island. Fifty boulders to be removed from channel.

33. Knight's shoal. One hundred boulders to be removed.

34. Hopkins's shoal. Three hundred rocks to be removed.

35. Johnson's island. No. 1, three rocks, No. 2, twenty-five rocks, No. 3, fifteen rocks, to be removed.

36 Henry's shoals. Twenty-five rocks to be removed.

37. Musgrove shoals. Two hundred and fifty rocks to be removed.

38. Griffin's Pocker shoals. One hundred rocks to be removed from ledge just below; three large limestone rocks to be blasted.

39. Keaton's shoals and island. One hundred rocks, lying between the fixed rock and west shore, to be removed, in order to turn the channel that way; shoal No. 2, thirty rocks to be removed; one hundred and fifty rocks to be removed near the island.

40. Ichnanotchnee island. Twelve rocks above, and twelve opposite the island, to be removed.

41. Maple's island. Stop up the cut-off, and throw the current more forcibly around the bend, to wash the sand out; a few loose rocks to be removed.

42. Sycamore shoals. One hundred and fifty rocks to be removed.

43. Hell Gate. One hundred and twelve rocks to be removed at the island.

44. Bull-pen shoal. One hundred and fifty rocks, between upper and lower island; twenty-five feet of loose rock to be removed from ledge below.

45. Take-in shoal. Nothing required.

46. Reed island. Sixty rocks to be removed.

47. Winding shoal. Fifty rocks from channel.

48. Hand reach. Thirty-five rocks to be removed.

49. Pat's shoals. One hundred and fifty rocks to be removed, and one large one blasted.

50. Anderman's shoals. Blast the rock, and remove three small ones.

51. Mrs. Williams's shoals. Rocks 1 and 2 to be blasted, and three rocks below to be removed.

52. Yuter's shoal. Two rocks to be removed—fixed.

53. Sweet Gum shoal. Twelve rocks loose.

54. Oak Log. Twelve rocks loose.

[*Note.* Neat's reach. One hundred and fifty rocks to be removed.]

55. Belcher's shoals. Eight rocks to be removed.

56. Fodder stacks. One rock to be blasted; one rock removed.

57. Crosse's chute. Twelve rocks to be removed.

58. Tinsley's shoal. Fifty rocks to be removed.

59. Glover's rocks. One rock to be blasted; one large rock to be removed; one oak-log snag to be removed.

60. Cypress Point shoals. Twenty rocks to be removed.

In the reach below, three miles long, 150 rocks to be removed.

61. Versailles reach. No obstructions.

62. Cherry chute. Remove one rock.

63. Little Horse-shoe. No obstruction.

64. Rocks and sand-bar. Nothing required.

65. Big Horse-shoe. Point to be cut off, and rocks removed in bend.

66. Broad Axe rock. A fixed rock to be blasted and cut down.

67. Bob's rock. A fixed rock to be blasted and cut down.

68. King's rock. A rock in mid-channel to be blasted.

69. Rock island. Nothing required.

70. Spring Creek shoal. Does not require improvement; there are thirty inches on it at low water, and that is as much as can be obtained elsewhere.

Recapitulation of the above.

1st. 29 fixed rocks to be blasted.

2d. 3,344 loose rocks or boulders to be removed from channel.

3d. Limestone rock to be cut through at		Blue Spring shoal.
Do.	do	Ming's Island "
Do.	do	Lucky "
Do.	do	Ferguson's "
Projection of limestone to be cut off at		Sangamon "

Ledge to be removed twenty feet at Johnson's Island shoal.
Rocks on each shore of Big Horse-shoe to be removed.

B.

Estimate for the improvement of Flint river.

1. Machinery. One twin-boat, 65 feet long, supplied with cabin, caboose-house, one derrick, an anchor, cables, chains, grappling irons, crowbars, complete	$1,500 00	
1 yawl boat	90 00	
1 large tent and cooking utensils	60 00	
		$1,650 00
2. There are twenty-nine apparently fixed rocks to be blasted, say at an average cost of $100 each		2,900 00
3. At Blue spring the channel requires to be cut 150 feet long and 40 feet wide, 15 inches deep, through a soft limestone rock. The number of cubic feet is 7,500, say at five cents per cubic foot	375 00	
At Ming's island, about 1,350 cubic feet of soft limestone to be removed, at five cents	67 50	
At Lucky shoal about 800 cubic feet of soft limestone to be removed, at five cents	40 00	
At Ferguson's shoals about 900 cubic feet of soft limestone to be removed, at five cents	45 00	
At Sangamon shoals, a projection of rocks to be trimmed	20 00	
At Johnson's island, a point of the ledge below requires to be cut off twenty feet	100 00	
At Big Horse-shoe, rocks on each shore require to be cut away	300 00	
		947 50

4. There are 3,544 boulders or loose rocks to be removed from the channel of the Flint river. An experienced river man thinks these boulders would not exceed $1\frac{1}{2}$ cubic foot in size. 3,600 are assumed for the number of rocks to be removed, and three cubic feet as the average size for each. This would give 10,800 cubic feet of rock, which being multiplied by 150, gives 1,620,000 lbs., or about 800 tons. This amount of rock could be

quarried from the bank of the river, and placed on board of vessels for \$3 per ton. It would be easier to raise these boulders from the shallow channel, and remove a short distance to the adjoining shoal, or into deep water. \$3 per ton is therefore assumed as the cost to remove these impediments from channel. 800 tons, at \$3, exclusive of the cost of machinery	\$2,400 00
5. One large oak snag to be cut up and removed	2 50
6. Cost of superintendence	1,100 00
Resulting estimate of cost of the improvement of the Flint river	9,000 00
Perhaps it would be well, considering the low estimate herein resulted, to add \$3,000 to meet errors in estimates, casualties, and greater difficulties to encounter than have been calculated upon	3,000 00
	12,000 00

The elements relied on for the construction of the maps and sketches of the Flint river were—

1st. Map of the land surveys of Georgia, obtained from the surveyor general's office.

2d. A map of Georgia.

3d. Sketches made by Major Chase from the oral description of Mr. Saucer, a pilot of the Flint river, of the various islands, shoals, and channels, and from notes of Captain Scarritt, made of conversations held by him with Messrs. Griffin and Saucer, pilots.

The maps accompanying the report on the Flint river, and in illustration of it, and of the accompanying estimates of cost of its improvement, are—

1st, A map of the Flint river, extending from Albany to its mouth; see sheet No. 1.

2d. Sketches of shoals and islands, numbered from 1 to 70; see sheet No. 2.

The undersigned respectfully submits, for the favorable consideration of the department, the results of his labors.

It would have been more satisfactory to him to have commanded sufficient means by which an exacter survey might have been obtained.

The information obtained by himself, as well as that obtained by Captain Scarritt, is from the most reliable sources, and has enabled him to make reports, plans for improvement, and estimates, exhibiting the character, condition, and practicability of improvement of the Chattahoochee and Flint rivers, with much greater accuracy than he at first looked for.

WILLIAM H. CHASE, *Major of Engineers.*

Gen. J. G. Totten,

Chief Engineer U. S., Washington.

APPENDIX R R.

MAYPORT MILLS, FLORIDA, *April* 1, 1853.

SIR: I have the honor to inform the department that I have been to St. Augustine to endeavor to obtain some reasonable and reliable offer for filling in behind the sea-wall by contract, but without success. There is a general indisposition, on the part of the citizens who would be likely to engage in such a work, to undertake it; and, indeed, I am not satisfied it would be the best way of doing the work, as the wall itself needs repairs in many places to insure its safety, which should, in my opinion, be made before the filling at these points is done.

On passing along the line of the wall, it is clearly seen that the filling near the back has settled considerably at many points since my visit there in December last; and on examining the wall itself, I found many places where the foundation was separated from the wall, leaving crevices varying in height from a mere crack to six inches, and in length, along the face of the wall, as great in one instance as fifteen feet, thus leaving the superstructure at these points without adequate support, and allowing the filling on the back to wash out. I am not sure whether these cracks are due to the settling of the foundation, or to the washing out of the mortar and chippings of stone with which the top surface of the foundations may have been levelled up, though the latter supposition seems the most probable. But whatever the cause of these defects, they exist to an extent sufficient to endanger the safety of the structure; and as it is much easier to repair the wall now than to rebuild it, I think it will be best to undertake it at once, in connexion with the filling. One place in the wall has been rebuilt by one of my predecessors, it having fallen down from this cause. The foundation also needs protection at a few points where it is slightly undermined.

As regards the filling, I am unable to see any advantages that would result from executing it to the extent proposed by the department. The street in rear of the wall is above the ordinary tides, and is generally dry, no water reaching it except at storm-tides, and then it runs off as fast as the culverts through the basin walls will discharge it. A little grading would certainly improve it by filling up a few low places; but whether the general government or the city ought to do it, is for the department to decide. The mean height of the lowest line of the street between the two basins, is 4′ 11″, the ref of the top of the wall being taken at 9′ 4″. With the exception of this grading, I would recommend no other filling except immediately on the back of the wall, where it might be raised to within 18 inches of the top and sloped off towards the street at an angle of $\frac{1}{6}$. This would tend to throw the water that breaks over the wall in storms towards the centre of the street and out of the culverts, instead of allowing it to run down the back of the wall and out under the foundation.

The filling, according to this plan, might doubtless be given out to contract on terms within the appropriation; but should the department decide to have the wall repaired, then it would be better to have the filling done in connexion with it by day labor.

Very respectfully, your most obedient,

H. G. WRIGHT,
Lieut. of Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX S S.

Washington, D. C., *May* 24, 1853.

Sir: I have the honor to submit herewith a map of the survey of the entrance to the St. John's river and Fort George inlet, made by parties of the Coast Survey under an arrangement entered into with the superintendent, Professor A. D. Bache. I have also to submit the following report in relation to the improvement of the bar, contemplated by Congress in the appropriation made for that object.

The river St. John's has its outlet in latitude 30° 20½′, runs in a westerly direction, or nearly perpendicular to the coast line, to Jacksonville, an estimated distance by the windings of the channel of 25 miles, where it turns to the southward and runs nearly parallel to the coast for the remainder of its extent. Opposite to Jacksonville it is comparatively narrow and very deep; through the rest of its course from near its mouth to as high up as Palatka, and even somewhat above, an estimated distance of over 100 miles, it is broad and generally shallow, with the exception of the channel. After passing the bar a depth of from 12 to 15 feet may be carried to Jacksonville, and from 10 to 12 feet to Palatka. Unlike most rivers of the same magnitude, it is seldom subject to heavy freshets in the rainy season, and its currents are principally the result of the tide. It is in fact rather a succession of lakes than a river, and may more properly be considered as an extensive lagoon, like Indian river. A little above Jacksonville its width is said to be about five miles.

Its importance to the development of the resources of the eastern section of the peninsula can hardly be over-rated, penetrating as it does the heart of the country through several degrees of latitude, and furnishing a ready means of transporting its productions to a market. The country in its vicinity is being gradually settled up, and its agricultural products are every year increasing. These all find their way to some point on the river, from which they are shipped either to Savannah or Charleston. The lumber business is also increasing with surprising rapidity, and is now become an important branch of industry—the lumber being shipped to our northern ports and the West Indies by brigs and schooners of as great draught as can be carried over the bar. Nearly all the mills in East Florida are situated on this river. The contemplated ship canal across the peninsula, the survey for which was provided for by Congress at the same time with the appropriation for the improvement of this river, must probably have its eastern terminus on the St. John's, and will most likely be found impracticable for want of a suitable outlet, unless means can be devised for deepening its bar sufficiently to admit vessels of a large class. On the success of its improvement, too, rests the project for a railroad across the peninsula, terminating at Jacksonville, a charter for which was granted at the last session of the State legislature.

The importance of the river to the prosperity of East Florida, and the advantages thus imperfectly set forth which would be derived from an increased depth of water on its bar, so as to permit vessels of a large class to engage in its commerce, have for some time attracted the attention of persons interested in the advancement of their section of the State, and examinations were made with the view of devising some means of improving the navigation. One of these schemes, originating with Dr. Baldwin, has met with the most favor, and has been submitted by him to the department, and on his estimate the present appropriation is understood to have been made. As his plan embraced the inlet lying a little to the north of the mouth of the river, the survey on which the map now submitted was founded includes it within its limits.

I have given to the subject of this improvement the greater part of my attention during the past winter, and have studied it carefully, both as a matter of duty and from a feeling of interest in the success of any attempt to improve this the great river of Florida. The results of these investigations are contained on the map of the survey and in the following remarks:

The obstruction to navigation at the mouth of the St. John's is the bar at its entrance shown on the map, on which there is, at this time, only seven feet of water at mean low tide. Bars are found at the entrances of all rivers, harbors, inlets, &c., with which I am acquainted, except those in the coral formations, and this one may, it is presumed, be fairly attributed to the same cause as similar bars at the entrances of rivers, &c., on our sandy coast, but not to the same as those at the mouths of rivers which, like the Mississippi, bring down large amounts of sediment from the interior of the country, which is deposited where the current of the river meets resistance enough from the great body of the exterior waters to deaden its velocity. The bar of the St. John's is of hard sand; is disposed in a ridge which slopes off each way, and is, as may be expected, at the point where the current of the river is nearly deadened by the waters of the ocean. The water that flows in and out of the river is very free from sediment a short distance up the stream, and does not, I am sure, bring anything down in suspension that is deposited on the bar. What little is brought down in this way is deposited along the banks, in the channel, which has soft bottom in places, and perhaps outside the bar, where the soundings indicate soft bottom in spots.

What, then, is the source from which the bar is derived, and what the force that brings it into position? The answer seems plain. It is due to the ocean waters, and not to the waters of the river, and is placed in its present position by the combined action of the sea and the current of the river. Along the shore of this part of the State, and, I believe, through the whole extent of our sandy coast, the water for some distance from the shore-line is shallow, often leaving banks of pure, fine silicious sand bare, or nearly bare, at low water. This shoal water extends out about the same distance from the shore at different points of the coast where the circumstances of exposure to the ocean, and other disturbing causes, are the same. Applying this to the coast both above and below the entrance of the St. John's, and we have a line of flats extending along the shore which, when acted upon by the current of the river, would undoubtedly be forced seaward to some extent, thus making a bend outward in the line. We therefore see, where the river empties its waters into the ocean, the outer edge of the shoal curves outward, being further from the coast than either above or below. Over this bank, or shoal, the waters of the river pass, not in one direct line, but spreading out over its whole extent, as soon as it loses the confinement of its banks. The whole volume is not spread out equally over the shoal, but a portion of it retains its direction, and continues on to the outer edge, where the *bar proper* is found, and where the depth is greater than at any other point.

As the bar is a shifting one, it seemed necessary to ascertain, if possible, all the facts connected with these changes; and, after many inquiries of pilots and others supposed to be best informed in the matter, I have come to the conclusion that the prime cause of every decided change is a heavy storm, which, by the heave of the sea and the temporary derangement of the current, destroys the existing relations between the usual forces, and establishes new relations among them, causing the waters to make their way out in a new direction, where the force opposing their egress is less than in the old one. It does not seem that this new direction is a permanent one, or rather the one it must necessarily keep till another storm occurs, but only a general course, from which it may change from day to day within slight limits. For instance, the present channel was found more than two years ago, and has been subject, during the interval, only to slight variations. At present it is working very slowly to the southward, a direction that seems more natural than its present one. Nor should it be understood that when a new channel is found it is completely formed—that any storm makes one where none was found before. The storm only causes such changes in the form of the shoals, depth of water, &c., as to make the commencement only, perhaps, of what will become the true channel, most subject to change; and the one referred to above as liable to shift, is that outside of the inner buoy.

I have thus far spoken only of the shifting of the channel in direction, and not of any changes of depth on the bar. A variation of depth is liable to occur at any time, and does not, by any means, necessitate a change of direction or position of the bar, and is caused entirely by the direction and force of the wind. When the wind is off the land, and blows with violence for a considerable time, the rapidity and duration of the ebb current is much increased, and a deepening of the bar is the result. It is said, under such circumstances, to run out at least 18 hours in the 24. On the return of the wind to a direction on or obliquely on shore, the bar soon fills up again to its usual depth. I shall have occasion to refer to this again when speaking of principles which must, in my opinion, govern in any improvement attempted.

The sand-hills and banks of the river near the mouth being of fine sand, are easily moved by the water and wind, and are very prone to change in form and position when the wind is at all strong, a portion being carried into the river and thrown up in other places without affecting the depth on the bar. These sands seem confined to the river itself in their effects, changing the depth of water at various points not in the channel way. For instance, the bank on the south side is rapidly progressing in past the light-house, having increased both in extent and height since I first arrived at the mouth of the river, and indeed since the survey of this part was made; and this sand is derived, in part at least, from these banks and sand-hills. The shoals that extend out to the bar, as well as the bar itself, are also of this character of sand, easily moved by the current or heave of the sea, and but for the equilibrium established between the various forces tending to its motion, the shoals it forms would be sensibly changed from day to day. As it is, they are nearly stable, preserving generally the same shape and depth of water; and the same may be said of the bar itself.

The direction and force of the currents are distinctly shown on the map of the survey for the various points at which they were taken. In addition to these, which were obtained with great care by Captain Craven, with a float made for the purpose, he observed the direction and estimated the force of the current whilst making the soundings over the shoals on both sides of the outlet; the directions being determined by the way the boat tended when anchored for the purpose of taking the angles of position. The general directions of these were all seaward on the ebb tide—the natural course they would take when spreading out, from being no longer confined by banks—and their velocity at no time exceeded half a knot, in his judgment. On the change of the tide the directions were reversed. Like all large estuaries, the directions of the current and tide do not change simultaneously, the ebb *current* here running from one to two hours after the flood-tide has commenced, and in strong westerly winds much longer. The same is true for the flood current and tide. It is not found, however, that there are any decided counter currents along the banks during this interval; so this rise must be accounted for by the swelling of the waters of the ocean meeting and raising the level of the water of the river, which, from its inertia of motion, continues to run for a time in spite of the force opposed to it.

Taking one of the tides—the ebb, for instance—and following the current within the limits of the channel, it may be distinctly traced out over the bar proper; but on approaching the edge of the channel below the sand point on the north bank, the current is there found to feather out over the shoals, and is dispersed into the waters of the ocean. Thus a considerable part of the water of the river is delivered, not over the bar, but over the wide extent of this shoal, and its effect in deepening the bar consequently lost. The same may be said, to a less extent, of the currents over the breakers on the south side of the river.

Tidal observations were taken both on the river and on Fort George inlet, which show a general concurrence in the times of high and low water in the two streams. This is not true of the current, which in the river continues to run, as has been before remarked, for from one to two hours, and in heavy winds still longer, after the tide has changed, whilst in the inlet the changes of tide and current are nearly simultaneous. The current and tidal observations also show, that whilst the current in the river channel continues to run after the tide has changed, that through the swashes changes nearly at the same time with the tide, and of course at the same time with that in the inlet. Taking the last of ebb, for instance, the current of the river runs out, spreading itself over the shoals till low tide; but on the commencement of the flood, the ebb current is mostly confined to the channel and out over the bar, whilst over the shoals and through the swashes, what current there is is in towards the river—that is a flood current. The velocity of the current over the shoals and through the swashes, is small in comparison with that in the main channel of the river. No current has been detected running from the bar to the inlet, or the reverse; and Captain Craven's observations discover no other current off shore than that produced by the wind. Along the outer edge of the shoal, the flood sets to the southward and the ebb to the northward, the velocity not exceeding half a knot in moderate weather, but much influenced by the wind. There can be no question, I think, that in all the currents over the shoals, through the swashes or rudimental channels, and those exterior to the shoals, the direction and force of the wind exercise much influence over the direction and velocity of the currents—that what is true at one time and in one kind of weather, may be found untrue at another—though I believe the above results are in conformity to the general law, and any departures from them will be found to be exceptions.

Having stated all the facts collected which seem important to the consideration of the subject, I will now give what seem to me the principles which must govern in any attempted improvement of the bar. It is seen that, under the same circumstances, the depth of water on the bar remains about the same; that when undisturbed by extraneous influences, no change takes place; but when this condition of equilibrium is disturbed, the depth of water at the principal outlet, and often its position, are changed; that westerly winds, which increase both the duration and velocity of the ebb current, always tend to increase the depth at the bar, whilst winds on shore soon bring it again to its former condition. Merely deepening the bar, then, will be of no avail; it must soon fill up again, unless some means can be devised to prevent it. To gain this greater depth and retain it, a greater volume of water must be made to pass over the bar, requiring a greater space for its discharge, or what will be equivalent to increase of volume or greater velocity, or both combined. Of this there can be no two opinions. The effect of an increased volume would doubtless be to increase both width and depth of the outlet; but would it increase its depth in proportion to the width? It seems to me not, if the width of the outlet over the bank is not restricted; for is it not a well established fact, that on these bars, after a certain depth is obtained, an increased velocity or volume increases width rather than depth? that sand is much easier moved near the surface by currents than at greater depths?

Whilst I feel satisfied as to the principles that must govern in any attempted improvement, I am not so confident as to the means by which these principles should be carried out. Indeed, I am free to confess that I see no plan which I would be willing to submit, as promising any certainty of success. In an undertaking of this kind the judgment of more than one person is desirable, as promising more reliable results from their united experience and skill, and in commanding the confidence of the public in the correctness of their decis on. I would therefore suggest to the department the propriety of sending a commission to examine the river and submit a project, before any action is taken.

As the instructions of the department, however, require me to submit a plan, it may be expected that one, however unsatisfactory, will be offered. It seems to me that the only project that can be at all reliable, is to confine to the channel the waters of the river that pass over the north shoal, by a breakwater running nearly parallel to the channel, and extending from the shore to as near the present bar as it can be carried, thus securing a much greater volume of water, and consequently a greater depth over the bar. That this would improve the bar, so long as the channel retains its present direction and position, there can be, I think, no question. What the result would be if the channel were to shift to the southward, cannot be so easily foretold. The influences, too, might, and probably would, be only temporary, from the sand gradually working out behind and beyond the extremity of the breakwater, and finally producing a bar further seaward; though it does not seem that this danger is so great here as in the case of rivers whose bars are produced from deposites brought down in suspension by their currents.

Whilst giving this, as what appears to me the most apparent as well as the only project promising success, I am far from saying the plan is a practicable one. The sea breaks heavily over this bank a large portion of the time: the bank itself is of fine sand, easily moved by the water; and it would seem almost impossible to overcome all such obstacles as the heave of the sea and the excavating power of the currents, and construct anything upon it which would resist the violence of the storms—at least at such cost as would be considered admissible. I may over-estimate the difficulties of such an undertaking, but I think not. They will of course increase with the extent of the work from the shore, being greatest at the outer extremity.

Near the shore, say to the first shoal, the work would be comparatively easy of construction; and indeed the desired effect might be obtained by sinking a line of wrecks, against which the sand would be likely to accumulate sufficiently to form a barrier to resist the storms. It is not possible to foresee what action the water would produce on the sandy bottom along and particularly at the end of such a breakwater as is proposed; it might accumulate the sand, or it might cut it away, leaving a deep channel. Nor is it possible to say how much effect should be expected from a short breakwater in deepening the bar, though some benefit to it must result, if the foregoing reasoning be correct.

I have not given any details of construction for such a work as is proposed, or any estimates of cost, as I have not had time to make one since the survey was finished. Nor would such details and estimates be of any service, if, as I hope may be the case, the department should determine to refer the subject to a commission.

The only other project that has been at all studied is the one proposed by Dr. Baldwin, and which I return herewith, with the request that it be considered when the subject is examined. Dr. Baldwin has taken great interest in the question of the improvement of the bar; has examined the locality personally, and has come to the conclusions set forth in his report. His project is certainly a very ingenious one; the means required for its accomplishment very small; and his confidence in its success most sanguine. I am sorry I cannot agree with him, but my own convictions constrain me to differ entirely in opinion as to the promised success of his plan, which ought, and I hope will, be attentively considered by the department and board when the subject is investigated. I believe he intends to draw up another report which shall embrace other facts, and place his theory in a shape more satisfactory to himself than in his original paper, and which he will forward to the department as soon as prepared.

A breakwater on the north shoal, only, is spoken of in the foregoing report, though one on the shoal on the south is required to carry out the project fully; but as the first is by far the most necessary in my opinion, and should be the first tried, the other is not recommended at this time.

It was at first supposed that the protection of the light-house and the improvement of the river might both be effected by the same means, and authority was given to combine the two appropriations towards attaining the common object. As my report to the Light-house Board proposes a project of operations entirely distinct from that recommended for the improvement of the river, the two appropriations ought to be hereafter separated.

Respectfully submitted.

H. G. WRIGHT,
Lieutenant of Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

Notes to the foregoing report.

I have been struck by the fact that the mouths of the only rivers and inlets I have seen on this coast seem to be gradually working to the southward—a coincidence that may be entirely accidental, or it may be the result of a general law. I have seen this in the case of Mosquito inlet, from the sketch of Capt. Rogers's survey; afterwards at St. Augustine; then at St. John's and Fort George inlet; and I understand the same is true for St. Mary's, or rather the entrance to Cumberland sound.

The north bank of the St. John's is marshy for several miles up, except the mere sand-bank just at the mouth, whilst the south is bordered by a range of sand-hills as far up as the mill. Along this southern shore, between high and low water, the marsh mud is found, in which the roots and stubs of the grass are still quite perfect; and this mud is also found underlying the sand-hills wherever wells have been dug, showing its connexion with the marsh in rear. These sand-hills themselves are unquestionably gradually travelling to the southward, as is shown not only by this mud, but by the palmetto trees which are still growing out of the tops of the hills, but whose trunks are entirely buried up. Many of these trees are just being uncovered by the washing away of the face of the hills, their trunks being now exposed down to the roots, showing that they grew on ground but little above the high-water mark—that is, in rear of the sand-hills as they then existed.

As the great storms that affect the coast are mostly from the northeast, may not this gradual movement of the mouths of these rivers and the sand-hills on their banks be fairly attributed to their agency? It would seem to be a cause sufficiently powerful to produce such an effect, and is, moreover, the only apparent one. Storms from a direction off the land are often severe, but their influence in producing changes of this kind are small in comparison with the northeasters, which have a wide sweep over the ocean, and whose power is not diminished by the obstacles that are constantly opposed to the wind off the land. These last winds only serve to retard the effects that would be caused by the storms from the ocean—not to annul them.

If this supposition be true, may not the material of the bar of the river be derived from the sand along shore, which is thus driven to the southward by these storms into the current of the river, and deposited, in part, on the bar and shoals, and which constantly tends to move the bar further out? If so, will not a breakwater on the north shoal serve to arrest these sands and secure permanency to any improvement in depth produced by the contraction of the outlet?

I am inclined to think the shifting of the bar of this river to be less in amount than is generally asserted. If we look at the map, we see over the north shoal, near the entrance, two very distinct swashes, through which there is but about two feet less water than over the bar. Any storm from the southward, and perhaps any direction on shore, might act upon the present bar enough to incline the current through either of these, and produce in it a greater depth than through the present outlet. This current, when once established, would retain its direction till changed by another storm, or till gradually filled up as the old one opened. The same may be said of the south side, where there is full as much water as on the north side, though no swash channels. When an old channel becomes very bad—that is, should the pilots seek for better water and a new channel is proclaimed, they observe these changes only so far as they apply to their own business, taking little if any notice of others, however interesting or necessary to persons investigating the subject with a view to devising projects of improvement.

Once the channel ran out to the southward in a position not easy to define, but probably along, or perhaps over, the edge of the southern bank, but did not continue there long. It grew gradually worse, according to the testimony of Mr. Palna, an intelligent citizen of the vicinity, at that time engaged in the live-oak business, when a channel was found nearly or quite in the position of the present one. The current being divided between the two, neither possessed sufficient depth for the vessels he had engaged in freighting his timber, and he had it in contemplation to try to get an appropriation for sinking some old wrecks in the southern one to stop it up. Fortunately the straight one soon improved, and the other filled up of itself.

Should any attempt to improve the bar be successful, it would be necessary to make some improvement in the river between the mouth and Jacksonville in order that it may be available. Just below what is called Davis's Point—about ten miles above the bar—the channel becomes very narrow, and as shallow as twelve feet, furnishing a depth at high water of say fourteen to fifteen feet; a greater depth than this could be commanded to Jacksonville only by improvements at this point. Above Jacksonville the channel becomes shallow again, giving no greater available depth than twelve feet to Picolata, and ten feet to Pilatka—so say the pilots. Rise of tide above Jacksonville, according to the same authorities, does not exceed one foot.

H. G. W.

APPENDIX T T.

JACKSONVILLE, FLA., *January* 6, 1853.

SIR: I have just returned to this place from a visit to the "Haulover," and have the honor to submit the following report of my examination, with a proposed plan for forming the contemplated channel between the two lagoons.

The Haulover is a strip of land about 2,150 feet wide at its narrowest part, separating the waters of the Indian river and Mosquito lagoon, and is the point at which the boats traversing those two bodies of water are carried over. In 1845 a survey was made of it by Lieut. Blake, of the topographical engineers, under the direction of General Worth, with the view, as is understood, of opening a passage through it for boats, in order to facilitate the transmission of supplies for the troops then stationed at several points along the coast; the labor to be performed principally by the troops themselves. Two lines of levels were run across the Haulover, which are shown on the tracing herewith, and which I have assumed to be accurate. As the high winds and rains during the two days I was there would not allow of the levels being taken, I concluded to rely on those given by him, particularly as they seemed to correspond with the form of the ground as it now appears.

In regard to the character of the ground, the examination satisfied me that the rock extends further than he imagined, as I found it within twenty feet of the Indian river side, and about four hundred feet further on the other than the last well in which rock is shown. At this point, its depth was five feet below the surface. Until the rock dips off towards the Mosquito side, its average distance below the surface may be taken at 2′ 6″; the upper surface being quite uneven.

The sand is generally interlaced with the roots of the several kinds of growth with which the Haulover is covered, containing some matter that looks like clay, and stands at a very steep angle. The pits dug by Lieutenant Blake still remain, with sides nearly vertical, thus showing the tenacity of the earth. One hole which I had dug in the sand to the depth of five feet was made with vertical sides, and showed no disposition to cave in. The rock resembles the coquina of St. Augustine, but is, I think, rather harder. Like that of the keys of the reef, it has an upper layer about three feet thick, which is much more compact and tenacious than that below. Indeed, Lieutenant Blake calls the underlying mass "shell," though it is hard enough to require the use of a pick in the excavation, and will, I believe, stand vertically when excavated and subjected to the action of the water, though liable, of course, to some abrasion in time.

In fixing upon the width and depth of the canal, both the character of the boats likely to use it and the amount of the appropriation should be considered. As far as I can learn from the persons who have been up and down the lagoon frequently, and profess to be pilots, there cannot be carried more than two feet at the Mosquito to the Haulover. The boy who piloted our boat up, and is said to understand the channels well, carried us through what he said was the best water, and he grounded us several times. Two feet water would therefore seem to be depth enough for the canal, and will float any boat now used on either lagoon. Eight feet width at the bottom would also seem to be ample for the wants of such boats.

I would therefore propose a channel eight feet wide at bottom, with sides vertical wherever the rock occurs, and with slopes of not more than 45° from the horizontal wherever the excavation is in sand. This is as much, it seems to me, as can be done with the present appropriation; but should an additional one be made as requested, and the proposed width or slopes to be found insufficient on trial, they can be modified.

Since I have been here I have heard of several persons who have some idea of offering for the work if it is let out on contract; and one of them accompanied me on my visit of examination. As the persons referred to are both reliable and responsible, and as, from the means at their command, they can do it for a much less sum than it can be done by the government, I would recommend that authority be given me to enter into contract for its completion at the lowest responsible offer below the amount appropriated. As it seems to me the best mode of executing the work, I have determined, whilst awaiting the decision of the department, to invite proposals by advertisements, in order to save as much time as possible. Six months will be fixed for its completion, though it is doubtful whether men can work there after June on account of the mosquitos, which are said to be unbearable during the summer months; indeed they were almost so during the lulls of the wind when I was there, on the 29th and 30th of December.

My estimate of the amount of excavation, according to the dimensions proposed above, is as follows:

Rock and "shell"	2,840	cubic yards.
Sand	3,168	"
Total	6,008	"

This continues the channel 300 feet into each lagoon beyond the shore-lines.

The sum of $5,000 would seem large for the excavation when the number of cubic yards is considered; but when all other expenses are taken into consideration, such as the collection and transportation of a force to the spot, the cost of provisions, shelters for the men, boats, tools, and implements, and the necessary supervision, it does not appear to me to be exorbitant, nor do I think it can be done for that sum unless it be by a person having a force of his own, with other facilities for doing the work.

I would respectfully request that the department give me instructions in this matter at as early a day as convenient, as it is very desirable that the work be undertaken without delay.

Very respectfully, your most obedient,

H. G. WRIGHT,
Lieutenant of Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

P. S.—I have not time to complete the sketch referred to, but will send it by next mail.

H. G. W.

APPENDIX T T—1.

Jacksonville, Fla., *January* 10, 1853.

Sir: I have the honor to send herewith the sketch of Lieutenant Blake's survey of the "Haulover" mentioned in my letter of the 6th instant, and, on the same tracing, the cross-sections of the canal, as proposed by me.

On looking over my letter to the department of the 6th instant, it occurred to me that my views in relation to the sufficiency of the slope proposed for the sides of the canal might be misunderstood, and I would therefore say that I am far from satisfied that the earth at that angle will stand for any great length of time when subjected to the action of water. Twice the slope for the part exposed to the water would not probably be too great; but such an amount of excavation as this would require, would, in my opinion, far exceed what can be done with the funds now available, and therefore I endeavored to adopt a section of such form as could possibly be completed for $5,000.

It is impossible to say with any certainty what the minimum slope should be, without trial, and, furthermore, what the action will be on the sides and bottom when subjected to a current. There is little if any regular tide in the lagoons; but all the persons acquainted with the locality, with whom I conversed on the subject, agree in saying that tides are created by the winds, which blowing up one lagoon, raise the water on that side and diminish it on the other. This is probably true for the Indian river side, which is narrow and funnel-shaped at the Haulover, but is not so certain on the other, where the Mosquito lagoon is several miles wide. There was a strong northwesterly wind blowing directly up that lagoon during our stay, which did not affect the depth of water sensibly. If, then, the water is raised at all on the Indian river side during such high winds, a current will of course be established through the canal, which may be strong enough to keep open and even deepen the portion through the sand, and preserve it in a condition to be useful to such boats as are now used on the lagoons.

I would still request that the additional $5,000 estimated for by me in my letter of November be asked from Congress, in order to secure a proper and permanent channel in case the first attempt fails of success.

Very respectfully, your most obedient,

H. G. WRIGHT,
Lieutenant of Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX T T—2.

Engineer Department,
Washington, January 31, 1853.

Sir: Lieutenant H. G. Wright, corps of engineers, has submitted a project for connecting the waters of the Indian river and Mosquito lagoon, at the Haulover, Florida.

He proposes to apply the existing appropriation to the construction of a canal, in a straight line at the Haulover, from the Indian river to the Mosquito lagoon; the canal to have a width at the bottom of eight feet, and a depth of water of two feet. Where the excavation is through sand, the sides of the canal will be sloped at an angle of 45 degrees; and where it passes through shell-rock, they will be vertical. Lieutenant Wright considers the above dimensions to be as great as the appropriation will admit of, and also sufficient for the wants of the boats that are likely to use the canal. He proposes to execute the work by contract, considering that there are persons in the neighborhood who, from the means at their command, can do it for a much less sum than the government can.

The board of engineers have had this project under consideration, and approve it.

They suggest that a berm, to prevent the washings of the slopes from getting into the canal, and a gutter to lead off the drainage, be provided if the appropriation will admit of it. Lieutenant Wright also proposes, should an additional appropriation, which he urges, be obtained, to make the slopes more gentle, and to increase the width of the canal, so as to secure a proper and permanent channel in case the first attempt fails of success.

With your approbation, Lieutenant Wright will be instructed to carry out his project as stated above; and in the event of there being means for the purpose afterwards, to apply them to the preservation and improvement of the work, in such ways as experience and observation may indicate to be most appropriate.

As advantageous propositions for the execution of the work cannot be looked for from a distance, I propose to direct Lieutenant Wright to circulate his advertisements in the vicinity instead of issuing them here.

The report of Lieutenant Wright and that of the board of engineers, together with a map, are submitted herewith.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bvt. Brig. General, Col. of Engineers.

Hon. C. M. Conrad,
Secretary of War.

Approved:

C. M. CONRAD,
Secretary of War.

February 1, 1853.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX U U.

Mobile, *November* 25, 1852.

Sir: Although I have not completed the duties demanding my attention at New Orleans, as directed by the Secretary of War, I have availed myself of a few days' leisure to come over here and proceed with the duties assigned to me at this place.

I am now prepared to report on the improvement of the harbor of Mobile, "at Dog river and at the Choctaw Pass," under an appropriation made at the last session of Congress; and I have the honor to submit "a project, estimates, and plan of administration for carrying out the intentions of the appropriation."

It is proper to state that I have been abundantly supplied with extracts from the work of the Coast Survey, showing accurately the condition of the above-mentioned points at a period as late as 1850; and that, in consequence of this important assistance, I have found it only necessary to make a personal examination, by sounding the channel through Choctaw Pass and over the Dog River bar, down to the anchorage of the "Upper Fleet." The examination resulted satisfactorily, in showing that no material alteration had occurred in the course of the channels, or in the general character of the same, since the hydrographic surveys of Lieuts. Patterson and Alden, of the Coast Survey service. I am thus enabled to form a project, make estimates, and arrange a plan of administration, with facility and accuracy, at a cost, up to this time, of only ten dollars, thereby saving a considerable expenditure of money and time that otherwise would have been necessary. It is due to the distinguished Superintendent of the Coast Survey to state these things, and to acknowledge the promptness with which he has placed at the disposal of the Engineer department the valuable information at his command.

It appears that the improvement of the Choctaw Pass in 1839 exhibited a channel 12 feet deep, and 120 feet wide, throughout its extent;

and that only three sections of the proposed channel over Dog River bar were dredged. No further appropriations being made for this object, no further work was done, within my knowledge or that of the Engineer department.

That the improvement proved very beneficial to the navigation of the Choctaw Pass, there is no doubt; for vessels drawing $11\frac{1}{2}$ feet can now, at high water, pass easily up to the city. As the work was suspended before a thorough channel had been dug through the Dog River bar, the channel of that bar remains unchanged in its natural condition, and we cannot, therefore, speak with the same confidence as to the probable result of dredging this bar on the score of permanence; but we have reason to believe that the results would not materially differ from those produced at the Choctaw channel. It is supposed by pilots that the constant passing of vessels, many of them of a draught of water something greater than the depth of the channel, would contribute to the maintenance of deep water.

If 12 feet in depth through the Choctaw channel were excavated in 1839, then I find that the channel has filled up about one foot in 13 years, or a little over one inch per year. Assuming this to be the case, we are able to estimate the annual expenditure necessary to keep open the new channels proposed to be dredged. The amount is so small, in proportion to the great advantages to be afforded to the commerce of Mobile, that we are greatly encouraged to persist in the system of dredging for the proposed improvement.

Besides dredging, there are two other methods suggested for deepening these channels: that of harrowing the bottom, and exposing the material thereof to be carried off by the ebb tidal current; and that of jettees, to be extended from Pinto's island on one side, and from Choctaw Point on the other side, following the present channel through Choctaw Pass and over Dog River bar, down to the 12'.5 curve in Mobile bay.

The harrowing operation would not answer here, though it may prove successful in alluvial rivers, or shorter lines, and where there is a current of four or five miles per hour; but the ebb tidal current out of these channels would not be strong enough to carry off the material harrowed, even if the line of operations were a shorter one.

The construction of jettees on a line extending down to the 12'.5 curve involves a large expenditure of money, affording no adequate assurance of permanent benefit. Deposites of alluvium would soon be formed around the mouth of the jettee in a much shorter time than the advocates of the scheme imagine. Besides, it is doubtful if the channel within the jettee would become deeper very rapidly, for the flood tidal current would move back in some degree the material moved forward by the ebb current. In the mean time the river is constantly supplying matter, assisting to replace what the ebb current had carried beyond the mouth of the jettee, in excess of that brought back by the flood tidal current. An equilibrium would be established between the depositing and ebb and flood tidal forces in this case, as in others relating to alluvial rivers. But the matter is too complex to be discussed here; few or no facts have been collected illustrative of it. A great deal of observation and study must be had before it may be profitably discussed; nor is it necessary in this case to discuss the matter, since we have at hand cheap and available means for improving this harbor, with assurance of good results, and their future maintenance at a small annual expense.

Dredging, then, is assumed to be the best means to be applied at present to the proposed improvement.

The accompanying sketch exhibits the projected course and extent of the dredging operation.

The operation is carried through the Choctaw Pass—12′.5 deep at low water—into the natural channel terminated at A. It is resumed at this point and carried S. 10 E., 600 yards to A′ B, where it joins the channel of Spanish river. It thence proceeds, following the present track of ships S. 19.30 W., to the "lower stake," and thence S. 16 W. to B′, on a line of 3,260 yards. From B′ it is carried to D C′ S. 2 E., 1,150 yards; and thence to D′ in 12′.5 water, S. 30 E., 6,750 yards. The line from Choctaw channel to B′ follows the present channel or track for ships. From this point to its terminus at D′, the line follows the best water to the 12′.5 curve.

Collateral means may be adopted to increase the volume of water passing down the Mobile river, by deflecting a portion of the current now passing through the Spanish river at its junction with the Mobile river, and by closing the branch of the Mobile river at the head of Pinto's island. The latter might be done at once at a cost of $2,000. But the former should be carefully considered; and, if adopted, the means gradually applied, so as to avoid any violent change in the character of the Mobile river, as regards width and depth. Perhaps, as the experiment proceeded, it might be found beneficial to close up the Spanish river altogether. There is no doubt that either the whole or a part of the volume of water now passing down Spanish river, if turned into the Mobile river, would deepen the river in its shoal places opposite the city. The increased current would likewise act favorably upon the outer dredged channels.

The present and prospective commerce of Mobile demands greater facilities than it now possesses, in the way of access to the city of vessels drawing more than 11½ feet at high water. It has been suggested that, in order to afford these facilities, a channel should be excavated at a depth of sixteen feet at mean low water; extending down the Mobile bay to what is called the "Lower Fleet;" but it is not in place here to consider the suggestion, as the appropriation by Congress, and the instructions of the Engineer department, direct attention solely to the improvement of the "*harbor of Mobile, at the Dog River bar, and at Choctaw Pass.*"

The term Dog River bar is not well defined, and is not properly applied. The obstruction to the navigation which it is meant to represent consists of an extended shoal or mud flat, formed evidently by deposites, the material for which is discharged from the great Alabama and Tombeckbee rivers, through their several branches—the Tensaw, Spanish, and Mobile—into Mobile bay. I take for granted that the small stream called Dog river has very little agency in supplying material for forming this shoal or flat. The commencement of it may be placed at the curve 12′ 6″, where the water, in passing upward, exhibits regular though gradual diminishing depths to the junction of the Mobile and Spanish and Tensaw channels. Below this curve the 12′ 6″ depth is preserved for several miles, thus establishing the curve above alluded to as the limit of what is called Dog River bar. Assuming this to be the case, I find myself not beyond my instructions in considering the improvement of the Dog River bar as properly extending to the 12′ 6″ curve.

To effect this improvement, and produce a depth of 12′ 6″ at mean low water, referring to the tide-mark of the coast survey, with a width of 100 yards—which dimensions are deemed not more than sufficient for facile navigation—there must be excavated 868,929 cubic yards of mud, as follows:

	Yards.			Average depth in feet.	Cubic yards.
In the Choctaw Pass	940 by	100	by	2.8	87,733
Pass A A′	600	100		1.1	22,000
" B B′	3,260	100		3.34	362,946
" C C′	1,150	100		3	115,000
" D D′	6,750	100		1.25	281,250
Cubic yards					868,929

Estimate.

To perform this work by dredging, there would be required—

1 dredging machine and hull, capable of discharging 3,800 cubic yards of earth per day, complete in all its parts, with steam-engine, cabin, anchors, cables, boats, &c	$16,000
5 mud-hoppers or tenders, to hold 100 cubic yards each, with everything complete, at $1,500	7,500
Contingencies, say	500
	24,000

To excavate 868,929 cubic yards, at the rate of 3,800 yards per day, would require, working days	229
Allowing for Sundays	52
And for casualties of bad weather, &c	84
We have, as the probable duration of the work	365

To support the dredge, and tenders in full operation, it would be necessary to provide—

Fuel.	2 cords per day, at $3 50	$7 00
Crew.	1 superintendent, at (per day)	3 00
	1 mate ....do	2 00
	1 engineer ....do	3 00
	1 assistant engineer and blacksmith	2 50
	6 deck hands, at $1 25	7 50
	2 firemen........do	2 50
	1 servant or attendant	1 25

Crew for hoppers. 4 mates, at $1 50 each	$6 00	
12 men, at $1 25	15 00	
Contingencies of barge crew, repairs, oil, &c.	10 25	
Total cost of working the machine in full operation	60 00	
365 days, at $60 per day, is		$21,900
In case it should be necessary to employ a local superintendent, his pay would be $3 per day for 365 days	1,095	
A clerk, at $1 per day	365	
Contingent expenses	240	
		1,700
		47,600
Balance of appropriation		2,400
Amount of appropriation		50,000

I have received specific offers to build the dredging machine for $16,000, under a guarantee of perfect efficiency. The person offering to perform the work is Mr. A. C. Jones, of New Orleans, an intelligent machinist, well acquainted with dredging machines and the practical working of them. He is in full possession of all the improvements up to the present time. Mr. Jones was formerly employed in the dredging operation at the mouths of the Mississippi, by Captain Talcott.

The amount of work estimated to be performed by this machine is certainly very large in comparison with the resulting cost; but I have no doubt, with the ample margin allowed for non-working days, arising from Sundays and bad weather and casualties in the year, that a machine can be constructed, as proposed by Mr. Jones, that will perform the work in the time and for the money estimated. But in order to insure the opening of the channel throughout with a depth of 12.5, I would recommend that one-half of the work should be executed first—that is, that the channel should be excavated throughout with a width of 150 feet, after which it should be increased to 300 feet. Perhaps, also, it would be well to ask for another appropriation of $25,000, which would certainly insure the completion of the dredging, and close up the Spanish river and the pass at Pinto's island, if these latter works were deemed necessary to be done.

The use of Carmichael's and Osgood's under-water excavator has been suggested as powerful and cheap means for dredging. One of these machines can be procured at Troy, New York, and delivered at Mobile for $4,300. The cost of the float or hull, built here, would be about $1,500 in addition; contingencies, say $200, making the whole cost

cost	$6,000
Two scows, or mud-hoppers, would cost $1,500 each	3,000
Cost of machine and tenders	9,000

To support the excavator and tenders in full operation, it would be necessary to provide for—

Fuel.	$1\frac{1}{2}$ cord of pine wood per day, at $3 50	$5 25
Crew.	1 engineer, per day	3 00
	1 blacksmith and assistant engineer, per day	2 00
	1 brakeman, per day	2 00
	1 foreman....do	1 25
	1 laborer.....do	1 25
	8 men to mud-hoppers, per day	10 00
Contingencies of boats, repairs, oil, &c., per day		5 25
Total cost of working the excavator		30 00

Which is said to excavate 1,000 cubic yards per day.

To excavate 3,800 cubic yards per day, we should require—

3.8 machines and tenders, which, at $9,000 for each machine, would amount to	$34,000
The cost of working these machines would be, for 365 days, ($365 \times 3.8 \times 30$)	41,610
	75,610

exhibiting an excess over dredger and its work of $29,710, and over the appropriation of $25,610.

It will require four months to build and deliver at Mobile the dredger, mud-hoppers, &c., complete; and it will require about three months to procure the excavators from Troy. The hull and mud-scows would be built in Mobile.

I would recommend the construction of the dredger proposed by Mr. Jones, because its size and power would be better adapted to the bay of Mobile than the smaller excavators. Besides, a more vigilant and less expensive supervision could be maintained over the operations than could be done if three or four excavators were employed.

There is an excavator recently received here, in private hands, which I can employ for four months at $400 per month. It is one of Carmichael's and Osgood's, and it is stated to be able to discharge 1,000 cubic yards per day. I would recommend that the machine should be hired from the owners and employed in the Choctaw Pass, from which some 80,000 cubic yards could be taken by these means during the winter.

It was heretofore stated that the deposites in Choctaw Pass have been about one inch per annum. If this should prove to be the average deposites hereafter, in the channels excavated, then we shall have:

12,700 yards whole length of channel $\times$ 100 yards $\times$ 1″ = 35,277 cubic yards to be annually removed.

This would involve a very inconsiderable expense per annum in keeping the channel open. But it may prove that the tendency to fill up is greatest the first year after the excavation is made, and that it is gradually diminished each year until the equilibrium is established. In this case no estimate can be made of the annual cost of maintaining the channel until results are fully exhibited.

The dredger and mud-hoppers, when not employed, can be laid up in some place above the city of Mobile, under cover from the weather and preserved from injury, at a small annual expense, involving the pay of a faithful and intelligent keeper.

The channel thus proposed to be opened affording 12′.5 at low water, and about fourteen feet at high water, would give to commerce great advantages, by admitting the passage of large ships up to the city of Mobile, where they would receive full cargoes of the rich, and (in time) varied products of Alabama, Mississippi and the western States.

And whilst commerce is thus supported, the national defence is directly assisted by the proposed improvement, for thereby an entrance is afforded into the harbor to war-steamers and other vessels of considerable size, seeking supplies, repairs, or refuge.

In order, then, to effect this improvement and secure the attendant advantages, I would recommend that my project and estimates for the same be adopted; and that the sum of $25,000, in addition to the present appropriation, should be embraced in the estimates to be laid before Congress.

Respectfully submitted by your obedient servant,

WM. H. CHASE, *Major of Engineers.*

Gen. J. G. Totten,

Chief Engineer U. S., Washington.

APPENDIX U U 1.

Engineer Department,
Washington, December 27, 1852.

Sir: Major Chase, of the corps of engineers, under a provision of the act of Congress approved August 30, 1852, for the "*improvement of the harbor of Mobile, at Dog River bar and the Choctaw Pass,*" has reported a project for said improvement; which has been approved by the board of engineers for harbor and river improvement, so far as concerns the great operation of dredging contemplated by him.

My own opinion coincides with that of the board; and I accordingly recommend that I be authorized to instruct Major Chase to proceed immediately with the steps preliminary to said improvements.

As it is quite probable that enterprising and responsible persons may be glad to undertake the work, in whole or in part, by contract, the interests of the United States require, as one of the first of these steps, that the attention of such persons shall be drawn to the subject by advertisements, freely circulated in those sections of the country where competitors are likely to be found.

The nature of these proposals may vary. They may comprise, 1st. The clearing out of one or both of the channels for the entire length and depth—or separate portions thereof—including all cost and expenses of vessels, boats, machinery, and labor, at a price per cubic yard; or,

2d. They may restrict themselves to furnishing vessels, machinery, &c., ready for work; or,

3d. To working the vessels and machinery at a price per cubic yard, keeping everything in repair; or, 4th. The last two propositions may be included in one, in which case the machinery, vessels, &c., would remain the property of the United States, with which to repeat annually, if necessary, the process of clearing out the channels.

Care should be taken not to bind the United States to accept any of the propositions.

Major Chase should be instructed to give in detail the plan of operations that seems to him best calculated, in prosecuting the improvement, to subserve the interest of the government, in consideration of all the proposals received, and of such other information as he may have been able to collect; and should he find the contract system most promising, to submit for approval such contracts as he may desire to have executed, accompanied by all the offers made in answer to his call.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Brev. Brig. General, and Col. of Engineers.

Approved:

C. M. CONRAD,
Secretary of War.

December 28, 1852.

The proposals ought to issue from the Engineer bureau.—C. M. C.

The officer was instructed to carry the project, as approved, into execution accordingly.

APPENDIX V V.

New Orleans, *October* 30, 1852.

Sir: In pursuance of your instructions, contained in your letter of the 22d September last, we have "taken into consideration the subject provided for in the appropriations lately made by Congress in the following words: 'For the construction of a harbor on Lake Pontchartrain, near the city of New Orleans, twenty-five thousand dollars,'" and we have now the honor to report in the premises, and to submit projects and estimates for the necessary works.

1. For the construction of such a harbor as the present available means will admit of.

2. For the construction of such works as will afford protection to vessels navigating Lake Pontchartrain, and, incidentally, to the jettees of the respective canals and railways debouching on the lake in the vicinity of New Orleans.

These latter works are the results of private enterprise, and are considered now as insufficient to meet the demands of commerce on the lake. But a new railway is now under construction, and nearly completed; it is well adapted to afford much additional aid to the greatly increased trade.

The existing structures are as follows:

The bayou St. John, and the canal connecting it with New Orleans;

The New canal;

The Pontchartrain railway;

The Jefferson and Pontchartrain railway, (now nearly completed.)

These several works are laid down on the sketch accompanying this report.

The jettees of the railways afford good harbors against all winds save the north. The jettees of the canals form of themselves harbors for vessels entering them respectively; but in low water produced by northerly winds, and during heavy gales, vessels cannot enter these canal harbors with safety; hence the necessity of an outer harbor for vessels trading with the several small harbors above mentioned.

The present appropriation of $25,000 is inadequate for the construction of such a harbor. We have, however, formed a plan and estimate for a breakwater that may be built in the lake, unconnected with the jettees, under the available money means.

We have also made a plan and estimate for a breakwater that will, in connexion with the neighboring shore, afford a complete harbor and give to all the jettees of the canals and railways full protection against northerly winds, and considerable additional protection against the northeast and northwest winds.

At the position (A) on the sketch, the figure of a breakwater is drawn in black lines. This is evidently the only figure that will give the greatest surface barrier against the waves, under the application of the present appropriation; but still its extent is insufficient for the purposes designed.

The accompanying estimate (No. 1) provides for its construction at a cost not exceeding $25,000.

The red lines B C, D E, and F G, exhibit the positions and extents of the breakwaters designed to form, in connexion with the shore, a harbor affording everything that can be desired on that score.

A close harbor is embraced within the points a a′ a″ a‴, and it serves also as protection to all the jettees against the north winds; protection to the W Z Y jettees against the northeast winds; and protection to the jettees X Y Z against the northwest winds. Little or no sea is produced by the east and west winds.

The sketch exhibits fully the advantages of this harbor, and the estimate (No. 2) provides amply for its construction.

The board are unanimous in recommending its plan to be adopted; and that a portion of it, marked a b, on section B C, be constructed under the existing appropriation of $25,000; and that an appropriation be asked, to complete the remainder of the structures in one year.

The portion of B C being constructed, will afford protection to all the vessels that lie under it from the north wind, and partially from the northeast and northwest winds within the triangles indicated by dotted lines.

The plan of all the breakwaters proposed is the same. It consists of four rows of piles, supported and braced by girders, beams, and four-inch plank, bolted, spiked, and trenailed together. (A vertical section of it on the sketch exhibits the mode of construction.) It rises above the surface of the water four feet, and descends with an inclination, carrying the upper surface of the structure five feet under water.

The wave-line of the lake is ascertained to rise three feet eight inches above the level, and to descend about three feet below it.

The surface wave will be thus received on the inclined plane, and arrested sufficiently on its ascent to prevent rough water within the breakwater. The passage of the ground wave under the inclined plane and between the piles, tends to prevent the accumulation of deposites around the work, at the same time it does not disturb the surface of the water within the harbor.

The worm does not bite in the lake water; hence all the wood-work below the line p p′ may be considered free from deterioration; but the small prism above the line p p′ will decay, and require renewal in ten or fifteen years. When this becomes necessary, the wooden prism should be cut off above the line p p′, and a new one mortised and bolted to the under structures.

The plan commends itself for its simpleness and effectiveness.

We will add, that the trade now seeking the lake entrance to the city of New Orleans comes from the States bordering on the Mississippi, also from Texas, Florida, Alabama, Mississippi, and Louisiana, lying toward the sea, and from the West Indies and Mexico.

The prospective increase of this trade must be in proportion to the great development of prosperous elements in the condition of New Orleans, and, as such, demands that preparation, not running into extravagance, should be made, not only for present, but future good harbor facilities.

We enclose, herewith, a sketch of the shore of Lake Pontchartrain in the vicinity of New Orleans, exhibiting everything that we have referred to in this report; also, estimates Nos. 1 and 2.

Respectfully submitted:

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engineers.
J. G. BARNARD,
Capt. and Bvt. Maj. U. S. Engineers.
G. T. BEAUREGARD,
Bvt. Maj. and Lieut. Engineers.

Gen. J. G. Totten,
Chief Engineer United States, Washington.

No. 1.

Estimate of cost of construction of breakwater forming a harbor on Lake Pontchartrain, near the city of New Orleans.

One section of 8 feet in length will require:

1	pile, 12 inches by	12 inches,	23 feet long,	at 10 cts.	per foot,	$2 30
1	do	do	25	do	do	2 50
1	do	do	28	do	do	2 80
1	do	do	30	do	do	3 00

Driving 4 piles, at $1 per pile	$4 00
1 beam 27 feet long, 12 by 12 inches, at 10 cents	2 70
2 girders, each 11 feet = 22 feet, 12 by 12 inches, at 10 cents	2 20
1 top brace, 12 feet long, 12 by 12 inches, at 10 cents	1 20
18 planks, 12 by 4 inches, 11 feet long = 792 feet board measure, at $10 per thousand	7 92
13 iron bolts, at 40 cents each	5 20
18 iron spikes	10
18 locust treenails	8
Workmanship in bolting and handling 1 beam, 2 girders, and 1 brace, and spiking and treenailing 792 square feet of planking	6 00
Total cost of 1 section, of 8 feet	40 00
One foot will cost	5 00
3,000 running feet of breakwater, at $5	15,000 00

Machinery, &c.

1 steam pile-driver	$2,500 00	
1 old hulk for accommodation of workmen	1,000 00	
2 row-boats	200 00	
Sundry chains, anchors, &c	300 00	
1 clerk of the works	600 00	
1 superintendent	600 00	
4 men as boat's crew	730 00	
Sundry office expenses, &c	300 00	
	6,230 00	
General contingencies for errors in estimates, casualties, &c., any balance from these being applied to the extension of the works in hand	3,770 00	
		10,000 00
Total amount of estimate		25,000 00

Respectfully submitted:

W. K. LATIMER,
Captain U. S. Navy.

WM. H. CHASE,
Major U. S. Engs.

J. G. BARNARD,
Captain and Bt. Major U. S. Engs.

G. T. BEAUREGARD,
Bt. Major and Lieut. Engs.

New Orleans, *October* 30, 1852.

No. 2.

Estimate of cost of construction of a harbor on Lake Pontchartrain, near the city of New Orleans, necessary to the present and prospective wants of commerce.

One section of 8 feet will cost per foot, as shown in estimate No. 1, $5.

20,000 feet in length of breakwater, proposed, at $5 per foot		$100,000 00
Machinery, &c., necessary to construct the whole work within one year, will require the following:		
3 steam pile-drivers, at $2,500	$7,500 00	
1 old hulk for the accommodation of workmen	2,500 00	
4 row-boats	400 00	
1 small tug-boat for towing piles and other materials	4,500 00	
Sundry chains, anchors, &c.	1,000 00	
1 clerk of the works, per annum	1,200 00	
1 general superintendent	1,200 00	
4 men as boat's crew	1,460 00	
Sundry office expenses, travelling, &c.	1,240 00	
	21,000 00	
General contingencies for errors in estimates, casualties arising from storms, &c., any balance from these being applied to repairs, &c.	29,000 00	
		50,000 00
Total amount of estimate		150,000 00

Respectfully submitted:

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engs.
J. G. BARNARD,
Captain, and Bt. Major U. S. Engs.
G. T. BEAUREGARD,
Bt. Major and Lieut. Engs.

NEW ORLEANS, *October* 30, 1852.

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APPENDIX V V 1.

ENGINEER DEPARTMENT,
Washington, December 10, 1852.

SIR: With this letter I lay before you the papers—including reports, plans and estimates—relating to the "construction of a harbor on Lake

Pontchartrain, near the city of New Orleans;" this being an improvement provided for by the late river and harbor law.

A special board, consisting of Capt. Latimer, of the navy, and Majors Chase, Barnard, and Beauregard, of the corps of engineers, instituted to examine this subject, have submitted two projects, namely:

1. A project delineated in blue on the sketch herewith, and further indicated by the letter A.

This project provides a small sheltered anchorage, at the distance of about one mile, in a northerly direction from the mouth of the bayou St. John. It consists of two wings, or branches, each about 2,000 feet long, extending, severally, in a northwest and northeast direction from their origin, at a point salient towards the south.

The special board prefer to this project another, to be mentioned directly.

The board of engineers for harbor and river improvements having considered the subject, do not sanction this project. And the Chief Engineer, on account of the position chosen, the arrangement of the parts of the project, and the partial benefit to be afforded by any such figure in that position, is also unable to approve this design.

2. The special board also present another project, delineated in red lines and figures, on the same sketch. This project, when entirely finished, will extend from B to G, a distance of 24,000 feet. Deducting one open interval of 1,500 feet in that length, and another of 2,500 feet, the total length of breakwater is designed to be 20,000 feet, or nearly four miles. This line of breakwater is to run east and west, at the distance of a little more than one mile from the shore, and will cover the termini of the Pontchartrain railroad, bayou St. John, and the new canal.

This project is unanimously recommended by the special board, who advise that the sum granted by Congress be applied to the construction of a portion 3,000 feet long, directly north of the terminus of the Pontchartrain railroad. They further advise that Congress be asked for the further sum of $125,000, in order to complete the whole breakwater in one year.

The board of river and harbor improvements having had this project also under consideration, a majority thereof approve of the plan and estimate as regards the kind of structure, its extent, and position, with this exception, that they think the breakwater should be strengthened by a counter-fort on the inside every 250 feet. The third member of that board, though agreeing with the majority as to the general design, prefers for its construction the details shown on another sheet, (also herewith,) that has been prepared to exhibit his views.

The Chief Engineer concurs with these two boards in recommending this second project to the government. He thinks the condition embraced in this project, of being capable of extension to cover all the existing or probable landing places connected with New Orleans on that side of the lake, is a fundamental one; that an extension to cover the three existing harbors should be accomplished as soon as practicable; and therefore that Congress should be called on for liberal grants in addition to that now in hand; that, in the mean time, the money now applicable should be used in the construction of a portion of this breakwater immediately north of the terminus of the Pontchartrain railroad, it being an important feature in this project that separate portions, while contributing to a great general result, may, from the first, be made to afford good local protection. He thinks, moreover, that the distance from the shore of this breakwater (about one mile) is well chosen.

There are, however, some points in the details as to which he must express himself less approvingly—at any rate less confidently. He thinks that the cross-section of the breakwater, as recommended by the special board, may need strengthening as a framework, even with the addition of the counter-forts proposed by the board of engineers; that there will be great difficulty in attaching strongly the immersed parts of the platform to each other and to the piles; that the lifting power of the waves upon this platform will be so great at times that it may be indispensable to make the platform (or sloping surface) a sort of grillage, of the nature of that shown in Col. Smith's sketch, (herewith,) with considerable openings—instead, as proposed by the special board, of placing the covering planks in contact, or nearly so. Some of the difficulties in the details of execution are, as he thinks, so great that he cannot recommend them as they now stand; but he thinks the modifications which on that account may be found necessary, may be left to be devised by the constructing officer, under the approval of the department; and he also thinks that the additions, if any, to the projects of the special board, that may be required to give proper strength to the framework, may be ascertained by constructing a small portion according to their design, and making thereto the additions that exposure for some time shall show to be necessary. On these conditions he thinks the project of the special board may be approved by the Secretary of War; and, if approved, he recommends that he be authorized to direct the constructing officer to commence, without delay, under instructions from this office, the portion of the breakwater opposite the terminus of the Pontchartrain railroad, keeping himself, in his expenditures and engagements, within the means now applicable.

Respectfully submitted.

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Hon. C. M. Conrad, *Secretary of War.*

Approved:

C. M. CONRAD,
Secretary of War.

War Department, *December* 17, 1852.

The project, with such modifications as were found necessary, is in process of execution accordingly.

APPENDIX W W.

New Orleans, *October* 29, 1852.

Sir: The board convened, by your order of the 18th of September, to make an examination of the mouths of the Mississippi river, with a view to determine the most convenient pass leading into the Gulf of Mexico, through which a ship channel, of sufficient capacity to accommodate the wants of commerce, can be opened, have the honor to lay before the department their report on the subject, with estimates and plans submitted by them.

I have the honor to be, very respectfully, your obedient servant,

W. K. LATIMER,
Captain U. S. Navy.

Hon. C. M. Conrad,
Secretary of War, Washington.

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New Orleans, *October*, 28, 1852.

Sir: The board convened by your order of the 18th ultimo, for the objects therein specified, respectfully inform you that, having visited and examined the passes of the Mississippi, and having, by collecting and comparing the results of former surveys and investigations, by personal inquiry, and by all other means in their power, obtained all possible information bearing upon these objects, they submit the following report:

The necessity and feasibility of deepening one or more of the passes of the Mississippi is not a new subject: it is one almost coeval with the settlement of the country itself. Yet it is only of late years that projects to accomplish this object have been seriously entertained.

By reference to ancient charts, it would appear that the Northeast Pass, for a period of at least seventy years, maintained a depth of twelve feet on its bar. This depth was found more and more inadequate as commerce rapidly increased, after the transfer of the country to the United States; and about the year 1835, public attention was strongly attracted to the necessity of increasing the depth in this and other passes.

With a view to this object, a preliminary survey was made, under the direction of Captain W. H. Chase, corps of engineers, who based thereon certain projects and estimates for increasing the depth of water, by closing several of the passes, and dredging the channel through the northeast and southwest bars.

Congress appropriated for these objects the sum of $250,000; but the subject was deemed so important by the War Department, that it was referred to a special board of engineers, who, simultaneously with the experiment of dredging, ordered a new and very thorough survey of the delta, with a view of obtaining more extensive and accurate data on which to base a project, and also to furnish a standard to which engineers could in future refer, in investigating the changes which are continually taking place in the channels and at the mouths of the passes.

The survey was executed with all desirable precision and scientific skill; a powerful dredging-boat and tenders were procured, and the experiment of dredging commenced. Unfortunately, the survey and the building of dredging machinery nearly exhausted the sum appropriated, and Congress having failed to make further appropriations, the experiment was necessarily abandoned before it had progressed sufficiently to test its efficacy. Thus the operations of this period failed to cast any light upon this important question now before the board, viz: "What is the proper method of securing a depth of water over the bars adequate to the wants of commerce?"

As the Northeast Pass became more and more unnavigable, it was found that the Southwest, which had heretofore been little used, answered sufficiently well the existing wants, and it has continued to answer them, without material inconvenience, till a recent date.

During the past year, however, public attention has again been attracted to this subject. Vessels carrying large and valuable cargoes have been detained for weeks and even months on the bar, and it has been stated that the Southwest Pass has, in its turn, commenced shoaling, while the Pass à l'Outre has commenced deepening.

The board do not find evidence to confirm the opinion that any deterioration has taken place at the southwest bar. The survey recently made by officers of the coast survey, exhibits fully as much water as existed at the time of Talcott's survey, and the personal examinations of the board give the same result; and if at any period in this interval there has been reported to be more water than now exists, the board believe the fact may be accounted for by extraneous and not natural causes.

The tonnage and draught of ships visiting this port has for years past been constantly increasing; and they believe that the circumstances which have recently excited public attention, are owing rather to an accidental accumulation of large vessels, than to any gradual shoaling of the bar.

The board, in their inquiries, found no reason to believe that this pass has, since anything has been known of it, changed materially its character or its depth, and they think they find reasons for this permanence of character, which will be stated hereafter.

But the board, though having little fear of a sensible or rapid deterioration of this pass, are nevertheless of opinion that it is not adequate to the existing and prospective wants of commerce; and it is this inadequacy, and not its deterioration, which has now made it necessary to look for some efficient means of deepening this or other passes.

The board, while they feel the immense importance of the task imposed on them, are yet more conscious of the extreme difficulty of the problem submitted to their consideration. They find, in the various and conflicting theories and projects put forward by eminent engineers; in the exceptional character of the subject itself; in the want of analogy to anything heretofore undertaken, and consequent want of precedent; and in the extreme uncertainty attending analogous operations on a much smaller scale, great cause to distrust any opinion they may form themselves, and equal cause to distrust the projects of theorists, who have made all their observations and facts subservient to a preconceived opinion. They have examined attentively, however, the various projects which have been submitted to the public, and they have sought information wherever it was to be found. They have themselves adopted no theory as to the formation of these bars, or as a basis of projects for their removal, for they believe the subject too difficult, and the facts collected too few, to justify any theory; nor have they attempted to confute the projects and theories of others.

In visiting the passes, the board proposed to themselves no extensive investigations or minute study, for these would occupy time they could not spare, but simply, by personal observation, to fix the existing state of things in their minds, and to inform themselves as to some few important facts, to which the labors of others had not been directed. The recent Coast Survey maps rendered additional surveys unnecessary.

The board spent eight days at the passes, during which they visited each one, and occupied themselves mainly in studying the changes which had taken place between Talcott's and Sands's surveys, the nature of the formations exhibited, the character of the bottom, particularly of the Southwest Pass and Pass à l'Outre, and the general slope of the bottom of the Gulf seaward for several miles from the passes.

These operations will be found more fully detailed in the journal, and illustrated by the accompanying sketch of the passes.

Some observations were made on the current; but to these they attach no further importance than as exhibiting the fact that, at all stages of the tide, they found inside the bar, and over the bar, an outward current at the bottom—less, indeed, than at the surface, but still very considerable.

They made but one observation at much distance (say at seven fathoms) outside, and this when the outward current was sensibly checked by the young flood-tide; and here they found the outward current confined to six or seven feet of the surface—all below that being salt water and motionless, or having little sensible motion. This is but a single observation, and at the dead low-water stage of the river.

The slope of the bottom outwards to a distance of three miles, and to a depth of twenty-five fathoms, was found extremely gradual and uniform, being scarcely forty feet to the mile.

Some description of the passes themselves, with their physical peculiarities, may seem necessary. Notwithstanding the number of passes enumerated and the complicated figure presented by a map, the true and essential division of the river may be considered as only into two great passes—the Northeast and Southwest—for the South Pass, originating at the same point, is now quite insignificant. The Southwest Pass takes from its origin a course of southwest by south, and pursues it with little deflection to its bar. Though throwing off several small bayous, it exhibits no tendency to divide; and to this uniformity in its course, and maintenance of its volume, the board are disposed to attribute the permanence of depth upon its bar; for the pass presents no evidence of having ever carried more or less water than at present through its channel; and there is no evidence on record to induce them to believe that as far back as the discovery of the country there was less water on its bar than now. That it was not noticed nor used prior to having the aid of steam for ascending the river, may be attributed to the superior facilities of ingress and egress from the eastward offered by the Northeast Pass, and by the fact that the prevailing winds from north round to southeast are adverse in this pass, while they are mostly favorable in the other.

By the experiments of Prof. Foshey, it would appear that the Southwest Pass discharges about one-third of the entire volume of the river; the remaining two-thirds being discharged by the other passes and bayous, and by the "Jump."

In addition to volume of water and permanence of depth offered by the Southwest Pass, it has great width of channel, and a fine anchorage and harbor, both inside and outside of the bar, and in this respect has greatly the advantage of Pass à l'Outre.

A single glance at the chart will show that vessels lying outside, awaiting opportunity to cross, are well protected from the violent winds from northwest, north, round to east, while a simple shifting of position of a few miles will give them shelter from the southeasters—though, with the latter winds and consequent rise of tide, they can always cross the bar.

The Northeast Pass takes, at its origin, a direction north of east, but it soon divides—its main branch flowing to the south of east and forming the Northeast and Southeast Passes, while a smaller branch continues nearly the original direction, constituting the Pass à l'Outre. But the tendency to subdivision exhibits itself in all the derivations of this pass: the main stem, besides throwing off large bayous, divides with the Northeast and Southeast Passes.

The Pass à l'Outre throws off near its origin the large bayou called Pass à Cheval, which again subdivides into numerous smaller bayous; and the Pass à l'Outre itself now exhibits in the division of its mouth, which has fully developed itself since Talcott's survey, the same tendency. A phenomenon so constant in its exhibitions, contrasted with the reverse character of the Southwest Pass, seems to indicate some assignable cause. The board think they have found such a cause in the prevailing winds, which, from north around to southeast, set either directly or obliquely into the mouths of these eastern passes, forcing the discharging current first to one side, then the other, causing the formation of middle grounds and consequent division. The effects of prevailing winds may also be traced in the configuration of the promontories at the mouths of each pass.

The board deems it needless to speak particularly of the Northeast and Southeast Passes; they have become unnavigable—their bars having but seven or eight feet of water, and the main stem from its separation from Pass à l'Outre having decreased in depth and width. A shoal, out of water, now connects the island and this point with the western bank, and trees are growing where ships passed a few years since.

As the Northeast Pass has shoaled, the south channel of Pass à l'Outre has increased in depth, and probably at the expense of the former. Sands's chart exhibits over thirteen feet water—nearly as much as on the southwest bar; and were it not for its extreme narrowness, it is probable it would now be as much frequented as the Southwest; but the width of this thirteen-foot channel scarcely exceeds, by the chart, fifty yards for about a mile, and there is two and a half or three miles of shoal to be passed over before a depth of eighteen feet is obtained. The north channel of Pass à l'Outre has, by Sands's chart, over nine feet of water; but it is wider, and it would appear to discharge a volume equal, or nearly so, to that of the south channel. The bottom of these passes is extremely soft, a single man being able to force a pole down ten or fifteen feet into the bottom with little exertion.

This pass is becoming now much frequented; being to the eastward and to the windward, it offers advantages to vessels going to or coming from the eastward, and in this respect has the advantage over the Southwest; but it is quite deficient in the harbor advantages possessed by the Southwest, being exposed on the outside to winds from northwest around to southeast, or all the prevailing winds, while inside it possesses little width for anchorage or for passing. While the balance of advantages are in favor of the Southwest Pass, the board deem it very important that both of these passes should be open.

Natural causes have thus far worked to deepen Pass à l'Outre. The board believe that nature may be aided by simple constructions, which they will allude to hereafter.

A few words are necessary concerning the new outlet called the "Jump," or Wilder's bayou. This outlet, about ten miles above the head of the passes, on the right bank, originated in 1840 from the rivers overflowing and breaking through the narrow strip of land confining it; and in the course of a few years it became an outlet of near a quarter of a mile in width at its mouth, and sixty feet in depth; and owing to its rapid descent to the Gulf, it drew through it a large volume of water at high stages of the river. So rapid was its current, that passing vessels were in some instances drawn into it, and it was for a time considered an object of danger. But the Gulf outside being extremely shoal, mud flats formed in every direction, which soon became islands, obstructing the flow and confining the water to narrow channels or bayous, which, though having considerable depth, finally discharge themselves into the Gulf over flats having no more than six or eight inches of water on them.

At present, in looking through the "Jump," the eye meets with an unbroken expanse of dense willow growth, extending for miles in every direction, and where but a few years ago the equally unbroken expanse of the Gulf presented itself. The flow through the "Jump" is now diminishing, and will probably soon become insignificant.

There is no evidence nor probability that its existence affected any one of the passes more than another, and none that the Southwest Pass has been injured by it. The latter pass was never better than when the "Jump" was in its full activity.

The South Pass, not before noticed, has never been accessible to sea-going vessels. The water on its bar has diminished from Talcott's survey to Sands's, from eight to six feet. The volume of water discharged has been diminished; an island and extensive shoal has formed at its origin, and little labor would be required to stop it altogether.

Before closing this description of the passes, the board think proper briefly to refer to the very remarkable agency at work at their mouths, and which appears to play an important part in accelerating the projection of these passes seaward. They allude to the upheaval of land by some subterraneous power. This upheaval exhibits itself on each side and generally in advance of the bars, and sometimes in deep water in the main channel over them.

All the islands projected beyond the points of main land, present indisputable marks of this upheaval. They are entirely distinct in character from the marsh formation constituting the main land; are usually from six to ten feet high, and sometimes as high as fourteen feet above ordinary tides. In many of them springs of salt water are found, through which bubbles of gas escape. These springs, in overflowing, deposite a sediment of fine clay, by which a cone of considerable elevation and base is formed. These islands, in progress of time, are apparently undermined by the sea, or washed down by rains; a marsh formation succeeds, which connects itself with the main land. The board refer to others for theories of this agency, but merely mention its undeniable existence, and their belief that this upheaval hastens the formation of land and consequent projection of the passes seaward.

The board have deemed these remarks indispensable to a just understanding of the opinions they have formed, and of the recommendations they are about to make. The Secretary has proposed a series of questions which they have found impossible to answer categorically, simply because they believe they do not, in the nature of things, admit of such answer; and they would remark, that the experimental system of operations they propose is based upon the trial of well known and plausible projects, or upon a few indisputable and universally admitted facts.

To the first question, "which of the passes is, in your opinion, the most convenient, or offers the greatest facilities to vessels entering and going out of the river, and your reasons for this opinion," they answer, that if compelled to the choice of a single one, they would select the Southwest; but they state that there are weighty reasons for keeping open both this pass and the Pass à l'Outre, and that these reasons are stated in their foregoing accounts of the advantages and disadvantages of these passes. If the experiment for improvement is to be confined to a single one, they recommend the Southwest for its application.

Second question: "Which can be opened and kept open with the least difficulty and cost, and the probable cost of each?" The board refer to the foregoing and following answers. They have selected the Southwest for experiment in the first instance, and nature would suggest a somewhat different system of operations at Pass à l'Outre, from that recommended at the Southwest. Their views on these points will, therefore, be best understood after answering the following question.

Third question: "The breadth and depth which should be given to the proposed channel, so that it will be of sufficient capacity to accommodate the wants of commerce; the same to be clearly indicated on a map of the pass." The board consider 18 feet in depth and 300 feet in width the least allowable. Such a channel is indicated on sketch, herewith, of Southwest Pass; but they strongly recommend, if found practicable, a depth of 20 feet.

Fourth question: "What process is recommended for the execution of the work? To what extent, and how, may the present means (deducting a portion to meet contingent expenses) be made to test the chances of success? and as the law requires that the trial shall be made under a contract, state all the points deemed indispensable to insist on in said contract; to this end present the rough draught of the instrument."

This question involves the real difficulties of the case. The following projects are well known, and have appeared to merit the consideration of the board:

1. Stirring up the mud at the bottom by suitable machinery, throwing it into the current, whereby it is to be swept off.

2. Dredging.

3. Jettees projected from the shores, to contract the current over the bar.

4. Closing the useless passes.

The first has had its advocates among eminent engineers, and they are now supported in their opinions by individuals who base their belief in its success upon their long experience in towing vessels to and fro over the bar.

While the members of the board differ in their individual opinions on this subject, they consider it a measure which can be tried most readily, and at least expense; and an opportunity is offered by the proposals of the Towboat Association to test it, without expense to the United States in case of its failure. They therefore unanimously recommend the trial by the opportunity thus offered, and by which the *present means* may be applied with tolerable chances of success, and in no other way. But they feel that they would not discharge their duty in limiting themselves to this. They believe that nothing but experiment can prove whether or not any project will be efficacious, and they believe the importance of the subject demands that no experiment should be left untried.

The board, therefore, recommend that an appropriation be asked adequate to continue the same process, if successful, to producing a channel of 20 feet depth, or, if unsuccessful, to be applied to other processes.

This makes it necessary to allude to other projects in order enumerated.

The operation of dredging is believed to have much in common with the process just recommended. The causes of failure for the first may be the same as for the latter. This is a point, however, which would best be determined by the officer in charge of the works. So far as we are able to ascertain, the opinions of those who had charge of the experiment in 1839 were favorable.

An estimate herewith, marked A, carefully made, gives $99,700 for the cost of cutting an 18-foot channel in ten months. To cut the same in five months would require additional machinery, swelling the amount to $150,000. To keep the channel open the balance of the year is provided for in the above estimate.

This operation being much less costly than the construction of jettees, the board, though, as before, differing in their individual opinions as to the probability of success, unanimously recommended that an appropriation of $150,000 be asked for, to be applied—

1st. To the continuance of the process *first recommended*, if found successful—to increasing the depth of the Southwest Pass to 20 feet.

2d. To dredging an 18-foot channel through the same pass, if the first process (stirring up the bottom) fails, and if the causes of failure, as observed by the engineer, are not such as to create a strong probability *that the same causes will operate in the same manner upon the operation of dredging.*

3d. In case of failure of the Towboat Association to perform their contract, and it should not be thought expedient to resort to dredging, the above sum, together with the available existing appropriation, to be applied to the construction of jettees, as the Secretary of War may direct.

The project of jettees is based upon the simple fact that, by confining the water which now escapes uselessly in lateral directions to a narrow channel over the bar, the depth of this narrow channel must be increased—in other words, the existing bar must be cut away.

A new bar will form beyond the jettees; how soon we do not pretend to estimate.

But all experience at these passes has shown that the depth on any one bar is greater as the volume of water discharged by the pass is increased. The contraction of the same volume to a narrow channel is analogous to throwing a greater volume into the same channel. Hence it is reasonable to believe that the new bar would have considerable more water than the old; and that this increased depth would continue for a considerable period of time.

The rate of annual expenditure for extension of these jettees the board are unable to estimate. The board recommend the trial of the project in case all efforts of stirring up the bottom or dredging fail.

Estimates for jettees at the Southwest Pass and Pass à l'Outre—the former amounting to $315,000, the latter to $95,000—are presented herewith in papers marked B and D.

The fourth plan of closing passes cannot be applied to any extent for improvement of the Southwest Pass, since, without stopping the main trunk of the Northeast Pass (which is not recommended) no considerable additional volume can be thrown down the Southwest Pass; (this plan may, however, be applied to Pass à l'Outre, as will be seen hereafter.)

The closing of the "Jump" may, indeed, be thought expedient hereafter, but the board have not considered it.

In relation to that part of the fourth question, referring to form and conditions of contract, &c., the board state that they have recommended a contract for approval of the Secretary; and if that is not approved, they see no probability of making another likely to produce any result, *with existing means*, and therefore they recommend no other.

Fifth question: "What is the opinion of the board as to the permanence of the contemplated improvement, supposing it once finished; and if liable to deterioration, what shall be the means of prevention, and what the annual cost thereof?"

The board offer no opinion as to permanence or cost of maintenance of the works they recommended, merely stating that if the operations are not found successful enough to be maintained at a reasonable cost, they may be considered as failures and should be abandoned. Experience and observation will alone answer this question.

The board have answered the Secretary's questions as categorically as possible, but they consider it their duty to go somewhat further.

They have stated the advantages of Pass à l'Outre, and the importance of having a ship channel there.

Natural causes have increased considerably the depth of water through this pass. These causes may continue to operate, but the board cannot entertain a very sanguine hope that a greater depth than now exists will be *speedily* attained by natural causes alone.

The quantity of water discharged through the main pass is not adequate to the maintenance of a great ship channel.

Stirring up the bottom, dredging, or jetteeing, if successful elsewhere, may succeed here; but the board still think that the useless water voided by the South Pass, by Pass à Cheval, by the north channel of à l'Outre, and, to a certain extent, by the Northeast Pass, should be applied here. They therefore recommend the gradual and successive closing of the north channel of Pass à l'Outre, of Pass à Cheval, of the South Pass, and a partial deflection of the Northeast Pass.

They consider it necessary that these operations should be successive and gradual, that the main stem may have time to accommodate itself to the increased volume.

An estimate for these objects is herewith submitted. Its amount of $30,000 is not great, and the board recommend that a special appropriation should be asked, to be applied immediately to these objects. (See paper C.)

And they also recommend that whatever process should hereafter be found successful at the Southwest Pass, should also be applied to Pass à l'Outre.

The above projects comprise all that seems to the board to offer any chance of success; and they believe that the importance of the subject demands that all should, if necessary, be tried.

If they all fail, the board have no fear that the passes will be in any worse condition than they are now: if they succeed, the object will be gained.

But, in case of failure, the board believe there is yet a plan to fall back upon, viz: a ship canal. The board do not allude to it with the view that the project should now be entertained, but merely to express their belief in the practicability, and to recommend that the engineer charged with these works should be directed to employ such time as he can spare to investigation of the subject, having reference to the possibility of a future recurrence to this project.

And the board further state that reasonable conclusions, as to the success of any one of the projects here presented, can only be derived from the constant presence and study of the engineer, and they therefore recommend that he should be directed to devote his whole time to this work alone, with regard not merely to the work actually under execution, but to the succession and propriety of ultimate projects.

The board herewith transmit the following papers and drawings, illustrating their report and operations:

Estimate for dredging Southwest Pass, marked A.

Estimate for constructing jettees at Southwest Pass, marked B.

Estimate for constructing auxiliary works at Pass à l'Outre, marked C.

An estimate of the cost of jettees at the mouth of Pass à l'Outre, marked D.

A sketch of the passes of the Mississippi, exhibiting the line of proposed dredging in the Southwest Pass; the positions of jettees at the same pass. Also the position of the auxiliary works proposed for the Northeast Pass, and its branch à l'Outre, and the position of jettees at the mouth of Pass à l'Outre.

Respectfully submitted:

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engs.
J. G. BARNARD,
Capt. and Bt. Major Engs.
G. T. BEAUREGARD,
Bt. Major and Lieut. of Engs.

Hon. C. M. Conrad, *Secretary of War.*

A.

Estimate of the cost of dredging a channel 4,000 *yards long,* 100 *yards wide, and* 6 *yards deep, at the Southwest Pass of the Mississippi.*

Machinery.

1 dredge-boat, complete, (steam)	$25,000 00
1 tug-boat do do	10,000 00
4 discharging scows, complete	5,000 00
	40,000 00

Officers and crew of boat.

1 captain, per day	$3 00		
1 mate	1 50		
1 engineer	3 00		
1 blacksmith as assistant	2 00		
1 steersman	1 50		
1 steward	1 00		
1 cook	1 00		
3 firemen	3 00		
6 deck-hands	6 00		
		$22 00	
Provisions for 16 persons, at 50 cents		8 00	
Steam, ten hours per day—8 barrels of coal per hour, at 50 cents per barrel—10 × 8 × ½		40 00	
Repairs of boat and machinery, per day		30 00	
			$100 00

Officers and crew of tug-boat and lighters.

1 captain	$2 00	
1 mate	1 50	
1 engineer	3 00	
1 assistant	1 50	
1 steersman	1 50	
1 steward	1 00	
1 cook	1 00	
3 firemen	3 00	
4 deck-hands	4 00	
16 men in lighter	16 00	
		34 50
Provisions for 30 persons, at 50 cents		15 00

Steam, ten hours—6 barrels of coal per hour, at 50 cents, $10 \times 6 \times \frac{1}{2}$	$30 00	
Repairs of boats and machinery per day	10 00	
Contingencies of all kinds	10 50	
		$100 00
Total cost of operations per day		200 00

The capacity of the dredge is estimated at 2,000 cubic yards per day.

The length of channel to be excavated is 4,000 yards, width 100 yards, and the average depth of mud 2 feet or $\frac{2}{3}$ yards.

Then $4,000 \times 100 \times \frac{2}{3}$	266,667	cubic yards.
Add 50 per cent. for filling in from lateral pressure and other causes	133,333	do.
	400,000	do.

400,000 cubic yards, at 10 cents	$40,000 00		
Add cost of machinery	40,000 00		
		$80,000 00	
Cost of dredging in 200 days			$80,000 00
There should be added for the cost of casualties, errors in estimates, &c., &c., say 60 days, at $200			12,000 00
400,000 cubic yards, at 23 cents			92,000 00

After the channel is excavated, the boats and machinery must be kept in readiness the remainder of the year to remove deposites, should they occur in the channel.

Say 35 days in full operation, at $200 per day		$7,000 00	
And 70 days lying still, with—			
1 captain	$3 00		
1 engineer	3 00		
1 cook	1 00		
3 hands	3 00		
70 days, at	10 00	700 00	
			7,700 00
Total cost of 400,000 cubic yards in 200 days			99,700 00

To perform the same amount of work in 100 days:

The 100 days, at $200 per day	$20,000 00	
Cost of first set of boats and machinery	40,000 00	
Add cost of another set of boats and machinery	40,000 00	
100 days' work of the same, at $200 per day	20,000 00	
		$120,000 00
Cost of casualties, bad weather, &c., 35 days, at $200		7,000 00

After the channel is excavated, one set of boats and machinery must be kept in readiness the remainder of the year to remove deposites in channel—

Say 60 days of dredge in operation, at $200	$12,000 00	
And 160 days lying still, at $10 per day	1,600 00	
		13,600 00
Clerk of the works, boats' crew, boats, stationery, and contingent expenses of the resident engineer		2,400 00
Add for errors in estimate, &c., &c		7,000 00
Total cost of dredging a channel		150,000 00

Supposing that, in the second year and subsequent years, deposites in the channel would require 200,000 cubic yards to be removed, one dredging machine would perform the work in 200 days.

Add 30 days for casualties—130 days, at $200 per day	$26,000 00

And keeping one machine in readiness the remainder of the year would be 235 days, at $10 per day	$2,350 00
Contingencies	1,650 00
Total cost of keeping the channel for the second year and each succeeding year	30,000 00

Respectfully submitted:

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engineers.
J. G. BARNARD,
Captain and Bvt. Major U. S. E.
G. T. BEAUREGARD,
Bvt. Major and Lieut. of Eng'rs.

NEW ORLEANS, *October* 28, 1852.

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B.

Estimate for the construction of jettees, five miles in length, at the mouth of the Southwest Pass.

These jettees are to average about 14½ feet in width, and to be made of two, three, or four rows of 40-foot piles, (mean length,) 1 foot in diameter, and driven from 20 to 25 feet into the soil, placing them 3 feet apart. from centre to centre, in each row, as per sketch.

For 26,400 piles, at $200 per M		$52,800 00
For driving 26,400 piles, at 80 cents		21,120 00
For longitudinal pieces, 712,800 feet board measure, 9 inches by 12 inches, at $16		11,404 80
Cross-ties and braces, 1,584,000 feet board measure, 9 inches by 12 inches, at $16		25,344 00
String-pieces to railroad, 475,000 feet board measure, 9 inches by 12 inches, at $16		7,603 20
Railroad iron, at $3,000 per mile		15,000 00
For iron bolts, bands, &c., for jettees		30,000 00
For carpentry, &c., at $1 per pile		26,440 00
For filling with sand-bags 50,000 cubic yards, at $1 20 per yard		60,000 00
For filling facines, brush, &c., at 15 cents per cubic yard		7,500 00
For contingencies and unforeseen expenses		52,555 75
		309,727 75
Or, at $61,945 55 per mile for jettees		309,727 75
For closing 2,100 feet of bayous on left shore of pass near the mouth of river, on the same plan as those at Pass à l'Outre, at $2 27¼ per foot	4,772 25	
For contingencies and unforeseen expenses	500 00	
		5,272 25
Grand total		315,000 00

Respectfully submitted:

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engineers.
J. G. BARNARD,
Captain and Bvt. Major Engineers.
G. T. BEAUREGARD,
Bvt. Major and Lieut. of Engineers.

C.

Estimate for closing the north branch of Pass à l'Outre, 5,280 feet in length, with two rows of piles 30 feet long and 1 foot diameter, placed 6 feet apart in each row, from centre to centre, and the rows 6 inches apart, to receive 5-inch planks slipped down between them, as per sketch.

For 1,760 piles, 30 feet long, 1 foot diameter, at $2	$3,520 00	
For 158,400 feet, board measure, 3-inch plank, at $16 per M	2,534 40	
For 95,040 feet, board measure, at $16, for string and cap pieces	1,520 00	
For 1,760 iron bolts and bands	704 00	
For workmanship, carpentry, and labor	1,760 00	
For contingencies and unforeseen expenses	1,961 60	
		$12,000 00
Or at $2 27¼ per running foot		12,000 00
For closing the bayous at the mouth of the pass on the right bank, 1,800 feet in length, at the same rate as above, at $2 27¼ per running foot	4,090 50	
For closing up Pass à Cheval, 500 feet in length, at $2 27¼ per running foot	1,136 25	
For a deflection, 2,500 feet, at the head of Northeast pass, at $2 27¼ per running foot	5,681 25	
For closing South pass, 2,500 feet, at $2 27¼ per running foot	5,681 25	
For contingencies and unforeseen expenses	1,410 75	
		18,000 00
Grand total		30,000 00

Respectfully submitted.

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engineers.
J. G. BARNARD,
Captain and Brevet Major Engineers.
G. T. BEAUREGARD,
Brevet Major and Lieutenant of Engineers.

D.

Estimate for the construction of 1½ miles of jettees at the mouth of Pass à l'Outre on the same plan as the Southwest pass, at $61,945 55	$92,918 32
For contingencies and unforeseen expenses	2,081 68
Grand total	95,000 00

Respectfully submitted.

W. K. LATIMER,
Captain U. S. Navy.
WM. H. CHASE,
Major U. S. Engineers.
J. G. BARNARD,
Captain and Brevet Major Engineers.
G. T. BEAUREGARD,
Brevet Major and Lieut. of Engineers.

APPENDIX W W—1.

ENGINEER DEPARTMENT, *November* 1, 1852.

The proposition made by the New Orleans Towboat Association, as communicated in the within papers, and recommended to the Secretary of War by the special board of officers, is to the following effect, namely:

The said association will open a channel at the southwest pass of the Mississippi river of the width of 300 feet, and depth at low tide of 18 feet, for the sum of $75,000—no portion of said sum to be paid until the work shall have been completed to the satisfaction of the officer appointed by the government to supervise the same.

In consideration of the observations made by the special board on this proposition; their recommendation of it; the fact stated by them that the Southwest pass has not changed its depth of water over the bar since Talcott's survey in 1838; their unanimous opinion that the interests of commerce demand that this pass, as well as the Pass à l'Outre, should be improved, I respectfully advise that this proposition, involving the government in no expense unless successfully carried out, be accepted; and that Major Barnard be instructed by telegraph so to inform the association, in order that they may proceed at once with the undertaking. A written contract, embracing the conditions mentioned in the proposition, and such others not inconsistent therewith as may be necessary to protect the interests of the government, to be forthwith prepared and sent to the same officer for execution.

Respectfully,

JOS. G. TOTTEN,
Bt. Brig. Gen. and Col. Engs.

A contract for the excavation of the channel, as proposed herein, was accordingly entered into by the War Department with two of the New Orleans towboat companies, who have completed their engagement.

APPENDIX X X.

NEW ORLEANS, LA., *February* 12, 1853.

SIR: Your orders of the 2d of October placing me in charge of the following surveys, viz:

1. A survey of East Pascagoula river;
2. A survey in reference to removal of obstructions to navigation of Bayou La Fourche;
3. A survey of the harbor of Sabine;
4. A survey of the river Sabine;

and instructions with regard to the execution of these surveys, did not reach me until the 29th of that month. As soon after as practicable, I proceeded to Bayou La Fourche, and made such an examination as the limited time which could be allotted to this work would admit, and such as the nature of the required improvement seemed to demand.

In compliance with your instructions, I availed myself of all the information I could obtain from the most intelligent persons residing on, or acquainted with, the bayou.

I found the obstructions to the navigation of the Bayou La Fourche to consist of great numbers of snags, which project above low water, and, for the distance of eighteen miles, almost entirely prohibit the passage of steamboats during the summer and fall months.

These obstructions are about sixty miles below the upper end of the bayou, and in the vicinity of the intersection of the "La Fourche and Barataria canal" with the La Fourche.

It is needless to say that the lands along the bayou are exceedingly fertile—having a fine climate, a rich and an inexhaustible soil. Such lands must increase in value, and they must more and more be brought into the culture of the peculiar productions of Louisiana, until this shall have become one of the most wealthy and important localities in the south.

The parishes of Louisiana interested in the navigation of Bayou La Fourche are "Ascension," "Assumption," "La Fourche Interior," and "Terre Bonne."

The population of	"La Fourche Interior" is estimated at		12,500
Do	"Assumption"	do	15,000
Do	"Ascension on La Fourche"	do	2,500
Do	"Terre Bonne"	do	10,000
Total			40,000

ANNUAL PRODUCTS.

Name of parish.	Sugar, hhds.	Molasses bbls.	Corn, bushels.	Rice, lbs.	Estim'd value of property.
La Fourche	9,000	15,000	75,000	500,000	$8,000,000
Assumption	10,000	16,000	90,000	500,000	9,000,000
Terre Bonne	8,000	14,000	50,000	300,000	6,500,000
Ascension on La Fourche	3,000	5,000	20,000	100,000	500,000
Total	30,000	50,000	235,000	1,400,000	24,000,000

To the above may be added sweet potatoes, Irish potatoes, hay, oats, &c., in large quantities.

To remove the snags and sunken logs to the depth of five feet below low water would probably require the service of a good snag-boat during two working seasons, occupying each year from July 1st to December 1st, a period of five months.

I estimate the cost as follows:

One strong, well-built snag-boat, complete (the Louisiana State boats cost $15,000)	$14,000 00
To work the boat with a good crew two seasons, of five months each	15,000 00
Care of boat and salary of captain, during seven months not working	700 00

Hire of clerk two years, at $500 per year	$1,000 00
Office rent two years, at $10 per month	240 00
Travelling expenses, stationery, and unforeseen expenses	560 00
Total of estimate for two working seasons	31,500 00

The amount required to be appropriated this session of Congress is made up as follows:

Cost of boat	$14,000 00
Cost of working the boat one season of five months, at $50 per day	7,500 00
Care of boat when not employed, seven months	700 00
Of clerk hire	500 00
Office rent one year, at $10 per month	120 00
Travelling expenses, stationery, &c., &c.	180 00
Total required to be appropriated this session of Congress,	23,000 00

I may here remark, that the boat will still remain good, as the property of the government, to be applied to service elsewhere.

I will here add, that there is an incidental advantage which the planters on Bayou La Fourche hope to derive from the "removal of obstructions to navigation."

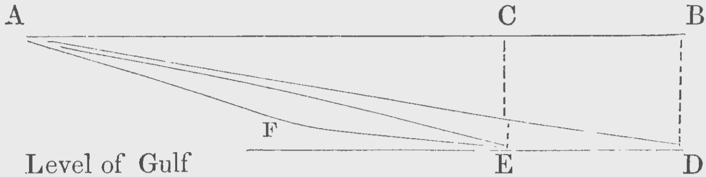
The levees which have to be constructed, particularly those low down the bayou, are very high—from twelve to fifteen feet—and it is the general opinion that the waters rise higher each year than the previous one. The causes assigned are two—first, that the constant passage of boats along the upper end of the bayou is gradually enlarging the water-way; and second, that the mass of interlocked logs and branches of trees intercepts the passage of sediment and sunken materials, and thus by contracting the water-way a yearly rise is the necessary consequence.

It is supposed that by removing the larger obstructions the smaller ones would not accumulate; and thus the planters would be relieved at once (to a degree) of the fearful head of water which yearly presses against their levees, and threatens to engulf them, and also of that yearly increased rise, which becomes yearly more difficult to guard against.

It has been suggested to me, by a gentleman of scientific attainments, that his hasty survey would seem to establish the fact, (not however conclusively,) that the tops of the levees in the vicinity of the obstructions which have been mentioned are below the plane of direct descent from the river Mississippi to the Gulf, at the mouth of Bayou La Fourche. In accordance, therefore, with the supposed law governing the regimen of rivers, "that their beds have a tendency to rise to the plane of common descent," it is questionable whether the bed of the Bayou La Fourche, at the point specified, will not rise yearly until it has attained the limit fixed by the regulating law.

To render the objection valid, or to refute it, would require extensive surveys and careful observation for a length of time. As this objection has no force against the "removal of obstructions to navigation," and as that is the real question which I have been directed to decide upon, I do not consider it as at all necessary to discuss this objection respecting the incidental advantages to be derived from this "improvement of the navigation."

I will remark that the laws which regulate the regimen of the Mississippi river will not apply, without modification, to a *shorter* branch leading to the sea. As Bayou La Fourche is much shorter than the river to the Gulf, so the current must be much more rapid. The particles of matter held in suspension by the river water on account of its motion will not be deposited in any part of the bayou where a stronger current sweeps it forward.



Let A B represent the length of the river from Donaldsonville to the passes.

Let A C represent the distance through the bayou to the Gulf. A D will be descent of river. A E will represent the descent of the bayou.

Let us suppose F E parallel to A D, then the current from A to F would be very strong, and there could be no deposit. From F to E we might expect a very slight rise, as the current would be like that of the Mississippi, and hence a slight deposit might be made Suppose F so low that the current from F to E would be *less* than in the Mississippi, then I suppose a deposit would take place at F *at once*, and raise the point F so high as would give a descent *as great as in the Mississippi river*.

If this reasoning is correct, there is now no part of Bayou La Fourche where the descent is not *as great* as in the river; so that the yearly rise in the bed of even this portion should not be greater than in the Mississippi.

I am of opinion that the portion of the bayou having a *more* rapid current than the river, extends below very nearly all the plantations; so that no cause can be seen why there should not be a yearly rise of the bed after the present obstructions shall have been removed. I advance this only as a crude theory.

All who are interested in the removal of these obstructions, on any account, consider that they have a special claim upon the United States government for an appropriation to remove obstructions from the bayou, besides the general one, of "an improvement of the navigation," since obstructions were placed in the *bayou* by order of Gen. Andrew Jackson, as agent for the government, as a defensive measure in conducting operations in this quarter during the late war between Great Britain and the United States.

All the inquiries which I could make with regard to this supposed fact served to confirm it.

A gentleman of intelligence writing from Thibodaux says: "In 1846, 1847, several citizens of our locality obtained written affidavits which substantiated the fact beyond a doubt, and placed the same in the hands of our representative, then the Hon. B. G. Thibodaux. On his arrival he made application to Congress for an appropriation, which motion was referred to the Committee on Internal Improvements, and by said committee no action was ever taken, even up to the present time."

It is my intention, as soon as low water will permit, to examine the bar at the outlet of the Mississippi, to ascertain whether it is practicable to keep a channel open during the season of low water, and what would be the cost each season.

I am, sir, very respectfully, your obedient servant,

HENRY L. SMITH,
Lieutenant Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX Y Y.

New Orleans, Louisiana, *February* 15, 1853.

Sir: Upon my return from the survey of Bayou La Fourche, having supplied myself with a large light skiff and the necessary camp equipage, I proceeded to the Sabine river by ascending Red river in a steamboat as far as Shreveport, and crossing over the country to Pulaski, Panola county, Texas, and from thence descending to its mouth, a distance of about 523 miles.

I obtained a very correct knowledge of the river above Pulaski to Belgord, in Smith county, Texas, the head of navigation, by conversing with persons acquainted with this portion of the river, and by the written statements of those who have been employed by the inhabitants to improve the river, and who have run steamboats thus far up. I made such surveys in the harbor of Sabine as were necessary for me to estimate the cost of the required improvements, and returned by way of Galveston, Texas, to New Orleans, and submit the following report of the result of my observations:

Sabine river.—The whole length of the river from the head of navigation, at Belgord, Smith county, Texas, to the Gulf of Mexico, is about 738 miles; of which, 285 miles are entirely in Texas, and the remaining portion is the boundary line between Louisiana and Texas.

The bottom lands, most of them quite low, and all of them subject to overflow during the season of high water, extend in width from one-half a mile to three miles back from the bank of the river to the high lands. These high lands frequently extend to the river, and are called "bluffs." Occasionally these bluffs are on both sides of the river at the same point; thus affording a good location for a ferry, and for a small town or depôt for country produce, and for the return supply of goods for country consumption.

The rise and fall of the river at Logansport, about 453 miles from the Gulf, is thirty feet. At points nearer the Gulf the rise and fall becomes less. The rise and fall of the water is sometimes very rapid. From the middle of January to the last of June is considered as being the season of high water, but a partial rise may be expected much earlier.

The current is not very strong, except over the shoals, or in narrow portions of the river, as at what is called the "Raft" or in the "Narrows."

The width varies from 100 feet to 200 feet, to the foot of the Narrows; below which it varies from 300 to 500 feet.

At the time of the lowest water there is only sufficient depth for a skiff at points in the river above Logansport, and below there are rocky shoals and sand bars, which render an attempt to procure a low-water navigation above Belgrade inexpedient, if not impracticable. The country abounds with wild game, such as ducks, geese, wild turkeys, deer, and bears.

The soil generally is good, and produces fine crops of cotton, corn, potatoes, &c.

The climate is said to be healthy, and on that account this region is to be preferred to some other portions of Texas which can boast a richer soil.

The tide of emigration from the older States of the Union has of late been setting towards the counties of Texas contiguous to and bordering on the Sabine river. The only product of the soil which at present will bear the cost of transportation is cotton, which is principally carted to shipping points on Red river, a distance of 50 or 120 miles; and the return trade is mostly through the same channel.

The planters, anxious to get their cotton to a market, aware of the difficulties attending the navigation of the river with all its present obstructions, and of the consequent exceeding high rate of insurance, and the uncertainty of the arrival of a steamboat, prefer to adopt the more tedious, but more certain, route to Red river, when the state of the roads does not render them absolutely impassable. On the other hand, those interested in steamboats cannot afford to run up the river where the risk is great—where the wear and tear is serious under the most favorable circumstances, where only a small boat carrying a small load is able to run at all, and where even a small boat can only run in the day time—without knowing *certainly* that a load will be in readiness upon their arrival at the principal depôts on the river.

It is evident that the first step towards affording increased facilities to the inhabitants of this portion of our country is to remove, thoroughly and permanently, those obstructions which now render the navigation of the river difficult and dangerous.

These obstructions consist of leaning trees upon the banks, of occasional rafts which gather from floating timber, of snags in the bed of the river, and of large logs which have gathered and sunk, particularly at the bends, where they are caught and mingled with the trees which have fallen from the caving banks There are points where the turns are very quick, which could in some cases be avoided by making a short cut off, at less expense than the cost of clearing around.

I would propose the following improvements:

Let all trees be cut on the sloping banks which could in any way interfere with a boat touching the shore with 10 or 12 feet rise of water. Their stumps should be cut smooth with the ground, so they could not injure the hull of a boat running over them. These trees must be cut up into 12 feet lengths, so they may float off without forming rafts.

On that portion of the sloping banks which would be above the line of 10 or 12 feet above low water, let such trees as have branches and tops to interfere with any of the upper works of a steamboat be cut off with a very high stump, and thrown back into the woods, with the trunk still strongly attached to the stump, to prevent its being carried away by the current and becoming a new obstruction. These stumps, so standing, will serve as guards to prevent the boat from running accidentally, or being carried by the current, so near the shore as to injure her upper works by the branches.

Where there are caving banks, let such trees as would be likely to fall in the course of two years be cut down, and let others be girdled or "deadened," so they may float when they fall, and perhaps break in pieces; or, at least, break off all the tops and branches, so they be less likely to catch in their descent to the Gulf.

The felling these trees on the caving banks, and the girdling of others further back, will not have a tendency, as some might suppose, to render the bank more subject to fall by the removal of the roots which helped to bind the soil; but a thick undergrowth would spring up, the more innumerable roots of which would serve the same or a better purpose.

At the lowest stage of the water the snags should all be cut even with the surface. All sunken trees with one end projecting upon the bank should be cut off and allowed to sink, if the water should be of sufficient depth, and if not, these logs should be hauled out upon the bank, or removed to some deeper point of the river and sunk.

With such a disposition of the snags and logs, a boat could safely ascend over them whenever a rise of four feet would make the rocks, shoals, and sand bars passable; and with the trees removed from the banks in the manner I have indicated, and with judicious regard to the greater or less extent of clearing which the particular locality should require, there would no longer be the serious detention of laying up at night; there would be no extra risk in running this river; there would be no extraordinary wear and tear; much larger and more profitable boats could be employed; and the uncertainty and high rate of insurance, which at present embarrass the planter and the boat owner, would be removed.

As it is practicable at no great cost, and would be highly advantageous, to remove the obstructions to *low-water* navigation as high as Belgrade, which is 178 miles from the Gulf, I have estimated the cost of the improvement of this portion of the river with reference to that project.

With such low-water navigation established, the double purpose would be served of giving employment to the steamboats in low water; thus encouraging the upper navigation of the river during *high water*, and of opening a convenient channel of trade with an extensive region of country north and west of that point, at a season too when the trade *via* Red river is cut off.

At the head of the Narrows a large body of water passes off by the old channel. By turning all of the water into the present channel, it would, no doubt, in connexion with the clearing of the banks, give increased width to this contracted portion of the river.

Below the Narrows the river is wide and deep, and the navigation is at present perfect.

The Sabine river enters into Sabine bay by four passes. The pass marked B on the sketch is most used, as it affords the best water by about eight inches on the bar. The depth, at ordinary low water, may be stated at three and a half feet for the distance across, of about three-fourths of a mile. All of the bars are composed alike of a hard crust of clay, sand, and a few shells combined with semi-fluid marsh mud underneath. For the distance of 150 yards this crust is perhaps one foot and a half thick, and for the remaining portion of the bar the average thickness may be set down at six inches.

The main river above all the passes is 709 feet wide, has a greatest depth of 24 feet, and a cross section equal to 10,420 square feet.

The first pass on the left descending has a width of 410 feet, a greatest depth of 24 feet, and a cross section equal to 4,790 square feet. The first pass on the right, or West pass, is 94 feet wide, is 13 feet deep at most, and has a section of 100 square feet. The pass in present use, marked B, is 150 feet wide; it has a greatest depth of 18 feet, and a cross section of 1,710 square feet. The middle and main pass is 417 feet wide, has a depth of 24 feet, and a cross section of 6,740 square feet.

To obtain a greater depth of water on the bar, say five feet at low water, I would propose the use of a dredging machine to remove the crust of which I have spoken, to the amount of about 30,000 cubic yards; and I would close the two smaller passes, marked A and B, in order to produce a quickened action on the bar of the main channel, thereby sweeping out the soft semi-fluid mud, which would then be exposed to the action of the current by the removal of the crust. Should these means fail to give a depth of five feet on the bar, (a failure I should not anticipate,) the additional expedient of confining the water to a comparatively narrow channel, until after its passage across the bar, would, no doubt, produce the desired effect These jettees could be cheaply constructed by conveying to the spot the large timber of the river above, (which sinks, owing to its great specific gravity,) and securing it in its proper position.

The depth of water across the bay is about seven feet at low water. I will here state that I was informed that much of the lumber for the supply of a large part of Texas was brought down this river. It is with difficulty that these rafts can now descend, on account of the obstructions.

Estimated cost of improving the navigation of the Sabine river in a thorough and permanent manner, including a navigation at all seasons as high as Belgrade, Texas—one hundred and seventy-eight miles from the Gulf.

Distance in miles from the Gulf of Mexico.	Extent of miles of the improvement.	River width in feet.	Part of the river to which the expenditure is to be applied.	Cost.	
32	......	......	To stop two passes	$1,500	
			Half cost of dredging machine to remove bar, complete, with scows, chains, anchors, &c. The other "*half cost*" is for *harbor*	4,500	
			To remove 30,000 cubic yards, or two months' work.	1,800	
			Contingent expenses for this portion of the improvement	200	
					$8,000
70	38	400	From the bay to the foot of the Narrows—38 miles—is good	....	
178	8	200	Eight miles above the foot of the Narrows no clearing is required	....	
93	15	100	To the head of the Narrows, clearing the banks, at $200 per mile	3,000	
			To remove logs for same, for low-water navigation, at $250 per mile	3,750	
108	15	180	To clear the banks of leaning timber, at $100 per mile	1,500	
			To remove snags and sunken logs, six feet below low water	2,250	
178	70	200	To Belgrade, Texas: clearing the banks, at $100 per mile	7,000	
			Cost of removing sunken logs, at $150 per mile	10,500	
			Cost of a good snag-boat fit for other service when done with this	14,000	
			Cost of stopping up old channel at head of the Narrows	1,000	
			Clerk hire during two years, while making these improvements	1,000	
			Unforeseen expenses, office rent, travelling expenses, &c.	1,000	
					45,000
193	15	140	Through the "Raft" there are many logs above low water—cost $350 per mile	5,250	
258	65	200	The whole cost per mile would average $250	16,250	
					22,500
			The above is to Burr's ferry, formerly Hickman's ferry.		
338	80	170	To Gaines's ferry, or *Pendleton*. This is about ten miles above Sabine town; the cost per mile would be $250	....	20,000
453	115	140	To Logansport, Louisiana; cost per mile $250	....	28,750
638	185	120	To Fredonia, Texas. The river being narrow, it is not probable that any extent of clearing would enable a boat to run at night. On this account, and on account of the more favorable banks which are less liable to wash, together with the less importance of the river and the probability of its being less navigated, at least for years to come, than the river below, I am induced to estimate the cost of suitable clearing at $100 per mile, making from Logansport to Fredonia	....	18,500
738	100	100	To Belgord, Smith county, Texas, at 100 per mile	....	10,000
			Total estimated cost of improving the whole river	....	152,750

I am aware that some persons would estimate the entire cost at much less, but I am satisfied that the advantages derived from a less thorough improvement would be purchased at a greater relative cost than the more decided advantages to be derived from the greater expenditure.

If the amount required is large, the quantity of work to be done is also great, and the end to be accomplished is great. A river 738 miles in length, now almost useless, is to be rendered navigable during seven months in the year, and for the distance of 178 miles there is to be a navigation at all seasons.

The thousands of our fellow-citizens from the older States who have sought cheaper lands and a more fertile soil in these regions, so difficult of access, will be rejoiced and greatly benefited by this expenditure; and not these only, but all of those who will gladly seek here a home when these increased advantages are given, and convert these wilds into fruitful fields. All these are interested, and in the prosperity of these our fellow-citizens, and in the conversion everywhere of wild lands into cultivated fields, our government is interested.

I have made as low an estimate as I believed consistent with the interest of the government and of all parties interested. Of course a very much smaller sum would be of advantage to the river, as it would remove the *worst* of the leaning trees, which it is now almost impossible for a steamboat to avoid.

Should it be determined not to include in the improvement the low-water navigation at Belgord, the sum of $25,000 may be deducted from the total amount required.

Perhaps it is well to remark that, if the present improvements are made without regard to this low-water navigation, the future cost of establishing it would be greater, because the logs now cut off and sunk would then have to be gotten up and removed.

With regard to the manner of conducting operations, I would propose as follows: Upon the supposition that but a partial appropriation will be made at this session of Congress, let a body of one hundred good wood-choppers be directed to rendezvous at Pendleton or at Sabine town; or let these men be gathered at New Orleans, and taken to one of those points. Let the party be divided into gangs of about ten each. Let several small flat-boats be procured suitable for the transportation of baggage. There should be at least two larger flat-boats, with suitable fixtures, so that a log could be lifted, either with one, or, when necessary, with two boats combined, and transported to any distance required.

Two or more parties with these larger flats should take advantage of the lowest water to remove logs projecting above low water, and to cut off snags to the surface of the water. The parties on the shore should be governed by the stage of water; if *very* low, they should all hasten on and cut only at the water's edge, leaving the timber higher on the bank to be removed at a more unfavorable stage of the water.

Besides being governed by the stage of the water, the superintending officer should endeavor to make a progress of at least two miles a day, in order to arrive at the end of the obstruction in about one hundred and thirty days, the time of continuance of low water. In the meantime the snag-boat should be at work with a laboring force of fifteen men on that portion which is to be made navigable at low water.

Should an appropriation be given to remove the bar at the mouth, or should the chief engineer decide to apply any of the appropriation for the river to that purpose, the dredging could be in progress at the same time; or it would not be interfered with by the high water if this work should be done at another season of the year.

With a larger appropriation the work could be commenced higher up, and if sufficient, it could be *completed* as the party proceeded.

To employ a gang of best wood-choppers one working season	$30,000 00
Required for purchase of snag-boat, &c., &c	14,000 00
Required for working the boat with a large force	11,000 00
Required for deepening the channel across the bar at the mouth of the river	8,000 00
Total required for Sabine river this season	63,000 00

I send a copy of a map which I procured from the Louisiana State Engineer department, made by the commissioners who established the boundary line between the United States and the republic of Texas. I also transmit a hasty sketch of the passes of the Sabine river:

Sabine harbor.

When I had ascertained that the desired improvement of the harbor consisted in the opening of a new and more direct channel, I made such surveys as were required to enable me to estimate the cost of such a work. The old channel is crooked, and cannot be navigated by a stranger.

Vessels coming into harbor with a northeast wind, if bound up to the city, are detained until a change, as it is impossible to get through the narrow reach when the wind is ahead and the current is strong.

With the proposed new channel opened, it will only be necessary to follow the shore as a guide up to Sabine city, and the same wind which will permit the entrance of the harbor will carry a vessel to the wharf.

The sketch sent herewith will convey a good idea of the old channel and of the new one proposed.

In making this improvement it would be necessary to remove about 25,000 cubic yards of clay, sand, and shells intermixed. The new channel would be cut nine feet deep.

The cost may be estimated as follows:

The half-cost of a dredging machine complete, (the other half being charged to the deepening of the bar at the mouth of the river.)	$4,500 00
Cost of working the machine two months	1,800 00
Clerk hire, stationery, travelling expenses, &c	700 00
Total cost of improvement of the harbor	7,000 00

The dredging machine would remain in the hands of the government, to be applied to service elsewhere.

It is felt by those interested in Sabine harbor, and by those navigating the portion of the Gulf of Mexico in its vicinity, to be of the greatest importance to have a light-house established on what is called "Louisiana point," or at some other site which may be selected at the mouth of the harbor. I assured all who urged this matter that their claim would be thoroughly considered by the intelligent officer having the superintendence of this light-house district, and by the Light-house board.

Although the charts represent the bar as having but a little over five feet at low water, yet, on account of the softness of the mud, a steamship can readily pass drawing ten feet. In case of a southeast blow, it would be safe to venture over with a draught of ten feet. It is asserted that a vessel drawing twelve feet of water has crossed the bar in a blow.

Vessels loading for this port may depend upon having but little, if any, detention. An unfavorable state of the wind might reduce the depth of the water, but with such a wind a vessel could hardly enter against the current, even if there were sufficient water on the bar.

Nothing seems necessary to be done to improve the bar at the entrance of this harbor.

I am, sir, very respectfully, your obedient servant,

HENRY L. SMITH,
Lieut. Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX Z Z.

Indianola, Texas, *September* 30, 1853.

Sir: I have the honor to submit the following report of my examination of Galveston bar:

This bar is so far from the shore, and the currents so dependent upon winds and tides, that nothing can be done to improve it, save some additional facilities in the way of beacons and ranges, to enable vessels to cross at night and in foggy weather.

It is rather difficult finding the bar in thick weather or dark nights. A reference to the sketch will show that a vessel "feeling" her way down the coast runs some risk of getting ashore; but were a beacon placed at the point marked "B," near the outer buoy, this could be always made at night or in a fog; having there the light-ship moored at or near the point marked on the map, there would be obtaining a good range with the light-house on Bolivar point. A tall pile or beacon placed at the point "A," between N. and S. buoys, would give a good range from the light-ship, and the ranges to run from "A" are kept up by the pilots. Were these facilities afforded, no difficulty would be met with in crossing, at any hour or any weather.

The channel between Pelican shoal and the east end of Galveston island is filling up. Where thirty feet was found in 1841 there is now but twelve. This filling up seems to be due to the cutting away of the east end of the island by the southeasters; the point once extended to the south buoy.

The only preventive to this difficulty—and a very serious one for Galveston if it continues shoaling—would be to throw a breakwater from east end, as indicated on the sketch by red lines; this would intercept the breakers from the southeast, and force the current which cuts across the end of the island into the channel, and thence into the Bolivar channel.

The current runs strongly after southerly blows; and the probability is, that such a breakwater would effect a change for the better, at least prevent any more shoaling.

To estimate for this work understandingly, and locate it to the best advantage, we should have careful observations, for at least six months, on the tides, currents, and winds, by a person of intelligence; and I would, therefore, recommend an appropriation for that purpose.

Respectfully submitted.

W. H. STEVENS.
Lieutenant U. S. Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington city.

APPENDIX A B.

Indianola, Texas, *April* 18, 1853.

Sir: I have the honor to submit for your consideration the following report of the result of the surveys on this coast, as far as they have been completed up to the present time, committed to my charge by the department letter of September 28, 1852:

I.—*Bars.*

The bars on the coast of Texas from Paso Cavallo to the mouth of the Rio Grande being of the same nature, acted upon by the same causes, and subject to the same changes, I have determined to describe them generally, and give the conclusions at which I have arrived as to their improvement, before taking up the subject of the harbors to which they belong. In this last connexion will be found the depth of water, &c., on each bar.

In my letter of January 13 I stated what I then supposed to be their general nature; a subsequent close examination of all has fully confirmed my impressions.

The bottom of the Gulf along the whole coast deepens very gradually, and is of sand until you reach a depth of about 7½ fathoms, when blue clay is found.

Not extending directly across the mouths of their outlets, but from points of the shore above and below, in a curved form, out to sea, these bars are so situated as to be entirely exposed to the action of heavy storms, and great changes are usually found to have occurred during their prevalence. Important changes in their position have also arisen from the constant cutting away and filling up of the shores. From the best information I can obtain, it appears that the depth of water on the bars has been gradually decreasing since they first became well known to our navigators. They are all of a quicksand formation, hard as rock to the touch of the sounding pole, but acted upon with extraordinary facility by the water.

On some of them, especially the Brazos Santiago bar, it is impossible to maintain buoys for any length of time in the same position, their anchors soon working their way through the sand and dragging them down.

It is difficult to imagine anything more changeable than are all these bars; the channels over them are, literally, constantly shifting, and cannot be depended on from day to day, Neither does the position of the channel appear to have any connexion with the outward current; that is to say, it is as often in a position where, judging from the conformation of the shores within, the action of the outward current is most indirect, circuitous, and weak, as when it is most direct and strong.

The positions, &c., of the bars and their channels appear to depend entirely upon the action of storms and prevailing winds, and not upon any current arising from the rivers emptying into the interior bays; for instance, the next best bar to Paso Cavallo (with regard to depth of water) is that at Brazos Santiago, at the outlet of a bay that has no stream emptying into it; while the worst is at the mouth of the Rio Grande. In fact, the rivers are so small, and the bays so large, that it is usually difficult to perceive any effect arising from the current alluded to.

From these facts, and the repeated occasions I have had to experience the extreme roughness of the water on these bars, I regard it as impossible to improve any of them by dredging, scraping, or any similar means; for, supposing that means may be formed to overcome the difficulty of working under such circumstances, and that the channel were actually deepened to the required extent, it is certain that the same causes which now operate in so constantly shifting the position of the channel, would almost immediately fill up any new one made by artificial means. It now remains to be considered whether it is possible to improve the bars by contracting or changing the direction of the channel, by means of dikes, jettees, &c., &c.

The passes at the mouth of the Rio Grande, Brazos Santiago, Corpus Christi, and Aranzas, have each but a single outlet, all exceedingly narrow, and none admitting any further decrease in width.

The only possible application of dikes, in these cases, would be to prolong the walls of the outlet until they reached a point very near the present position of the bar, in order to concentrate upon one spot the whole action of whatever outward current there might be. The ultimate effect of this would undoubtedly be the formation of a new bar outside that too, at no distant period. The immediate effect would, by no means, certainly be favorable, and the new outlet would be liable to be closed up by heavy storms, (subject to breaking out again,) as is now frequently the case with small inlets on the coast of Florida. With regard to the project for improving Paso Cavallo, by closing the Pelican Island channel, to which my attention has been called by the department, I have, since my letter of January 13, given it an attentive consideration. Were the proposed dike constructed, the situation of affairs would be analogous to that now existing at the other passes; and I see no reason for believing that the strength of the new current would be much, if at all, greater than that at Aranzas or at Corpus Christi pass. Were the strength of the current increased, it would exert itself in cutting away more rapidly the point of Matagorda island, where the light-house now stands, and thus enable itself to spread out still more than it now does before reaching the bar.

So far as it is possible to foresee the effect of so uncertain an operation, and judging principally from what I have observed at the passes in general, I think that, were any appreciable effect produced by closing the opening in question, it would be lateral rather than vertical.

As far as regards the "twenty-foot" channel expected to be obtained, one of one hundred feet might be looked for with equal confidence.

I therefore give it as my opinion, that it is not advisable to attempt any improvement of the bars mentioned in this report, as such attempts would, in all probability, result in a very great waste of money and of time, without any reasonable prospect of effecting any improvement.

I will close this subject by stating that, in every instance, the foundation of any structure attempted would be in quicksand, and that the difficulties of construction would be very great. Were anything attempted at Paso Cavallo, beyond closing the Pelican Island channel, it would involve the revetement of about four miles of shore, and the construction of more than five miles of dike.

II.—*Harbor of Brazos Santiago.*

The bar of this harbor is probably the roughest on the coast of Texas. During the fall, winter, and spring, it may be depended on for a depth of eight feet, it being seldom necessary for vessels of this draught to wait outside more than twenty-four hours, except on account of the roughness of the bar. During the summer the water is sometimes as low as six and a half to seven feet. The anchorage outside is excellent in seven and a half to eight fathoms; the bottom of blue clay; the best anchorage is in this depth, with the beacon on Padre island bearing west. In less than seven and a half fathoms the bottom is of quicksand. A steam-tug can usually be had to tow vessels over the bar. The harbor within is quite small, but is amply large for all the trade now carried on through it. The greatest depth of water in the harbor is twenty-two feet. There is no obstacle in the way of vessels between the bar and the inside anchorage.

As well as I can learn—and my own recollection leads me to the same conclusion—the harbor is gradually filling up, so that it may be necessary at some future day to improve it by dredging; but this period will be so remote that it is unnecessary to make provision for it at present. The channel from Brazos to Point Isabel can be depended upon for three and a half feet—there is usually more. It is ample for the lighters running between the two places, and there exists no necessity for any improvement at present. The bar at the mouth of the Rio Grande is, as has been already stated, of the same formation as the others. It averages about four feet. When there, I found three and a half feet, and was informed by the pilots that it is often still lower. On one or two occasions there have been seven and a half feet after violent storms; but it almost at once resumed its usual depth. This bar shifts even more than that at Brazos Santiago.

III.—*The harbor of Corpus Christi.*

The bay of Corpus Christi is the most open and unobstructed of any on the coast of Texas. The depth of water varies from fourteen feet to seventeen and a half feet. The difficulty consists in entering it. There are two entrances—one through Corpus Christi Pass, the other through Corpus Christi bayou from Aranzas bay. It is the latter entrance that is used. Both are obstructed by extensive mud-flats.

The bar at Corpus Christi Pass is too shallow for vessels navigating the Gulf, varying from five feet to six and a half feet. The pass is too narrow to allow a vessel of any size to beat through it. The bar is exceedingly broad and very rough. Having once passed the bar, there is an abundance of water for about four miles, when the mud-flat separating the pass from Corpus Christi bay is reached. Three feet six inches, and more, can generally be carried over this flat. This is deep enough for all present and future purposes, unless the bar should undergo an entire change for the better. With regard to the entrance through Corpus Christi bayou, the case is different. In the bayou itself there is no place less than seven feet, and generally from ten feet to eleven feet. Both ends of the bayou are obstructed; that towards Aranzas bay by a shell reef, on which there is three feet six inches at very low water; and that towards Corpus Christi bay by a very extensive mud-flat. The bayou itself is very winding. In the channel over the mud-flat there is at least a depth of five feet, except between the bayou and the Sister islands; at this place there is but a depth of two feet six inches for a short distance. As there is always a strong current running in one direction, or the opposite, through this bayou, any channel made through the mud-flats and the reef would probably remain open for a long time.

In the communication from Corpus Christi to Aranzas, great difficulty is now experienced from these obstacles, and I recommend that the channel be deepened to five feet. The excavation necessary to give such a channel, sixty feet wide, over the mud-flat, will be 15,000 cubic yards. To form a similar channel over the shell reef, the excavation will be 1,500 cubic yards.

IV.—*Aranzas harbor.*

It is through this pass that the trade between New Orleans and Corpus Christi passes. The depth of water on the bar varies from five to eight feet: seven feet is as much as can be depended upon, and to cross with that draught, vessels have often to wait outside a number of days. The channel is at present circuitous, and is at all times variable. The bar is very rough and dangerous. The anchorage outside is pretty good in about eight fathoms. The harbor inside is small and bad, the holding-ground being very poor.

Although there are numerous shoals between this pass and Corpus Christi bayou, still there is no real obstacle to navigation, the channels being sufficiently well marked, and being much more than deep enough for any vessel that can cross the bar. Twelve feet can be carried to Live Oak Point, opposite Lamar. I do not consider any improvement practicable or requisite for this harbor.

V.—*The inland channel from Matagorda bay to Aranzas bay.*

The only obstacles to navigating this channel with three feet at extreme low water, are found at the points known as the Oyster Reef Dugout, Ayres's Dugout, the Steamboat Dugout, and the Devil's Elbow—the last at the mouth of the Saluria bayou. The reefs are of hard sand and shells; the obstruction at the Devil's Elbow is a mud-flat. As there is generally a strong current running up or down at the points mentioned, there will probably be no difficulty in keeping the excavation open. This channel is now of much importance, and will have a greatly increased value as the country becomes more thickly settled. I recommend that it be opened to the depth of three feet at low water, with a width of forty-two feet. The quantity of excavation will be as follows:

Oyster Reef Dugout	2,000	cubic yards.
Ayres's do	2,000	do.
Steamboat do	3,000	do.
Devil's Elbow	2,000	do.
Total	9,000	do.

This work at the same time opens the channel from Matagorda bay as far as the mud-flat at the mouth of the Guadaloupe. While on the subject of this inland channel, I will state that the Laguna del Madre (between Brazos and Corpus Christi) is entirely closed by a sand-flat some miles in width, and that, from the best information I can obtain, it would be a work of far more expense and difficulty to open it than the necessity of the case will ever warrant.

VI.—*The harbor of Pass Cavallo.*

The bar at the mouth of this harbor is, next to Galveston, the best on the coast. It varies from 7 to 10 feet; 8½ feet can generally be found by waiting a few hours. The bar is less rough than those south of it, and the channel quite straight; it is very changeable, as is also the system of shoals and islands from Decrow's Point to the channel. In the month of January, at a very low stage of water, I found 7 feet on the bar between Pelican island and Decrow's Point. This passage is so extremely changeable that no reliance can be placed on it. There is a good anchorage inside the bar, under the lee of Pelican island, and in that vicinity; there is a still better one after passing Decrow's Point, between the middle ground and West shoal.

As these are good channels for anything that can cross the bar leading to the anchorages off Powderhorn and Sand Point, I do not consider any improvement necessary for this harbor.

Above the anchorages I have mentioned, the bay becomes obstructed by numerous reefs and shoals. Attempts are now being made by a private company to cut a channel through them to Lavaca. If the object can be accomplished, it will be effected without the aid of government. I do not see, in any event, that it is a case calling for the expenditure of money on the part of the general government. The ultimate point of deposite for freight must clearly be at least as low down as Powderhorn; and the communication from the bar to that point being at all times easy and safe, I do not consider it advisable to attempt any change above. The efforts now being made are merely to subserve local interests, and are not called forth by the general interests of the country; neither is it by any means clear that the end in view will be satisfactorily accomplished. I therefore recommend that nothing be attempted for the improvement of this harbor.

As to the estimate, in my letter of January 13, for a channel through the bar at the mouth of Saluria bayou, I do not recommend that it be asked for at present, but will repeat it here, in order that the data may be at hand should the improvement become necessary in future—it will require one month's work, or the sum of $500.

I have thus disposed of all the works committed to my charge, with the exception of the San Antonio river. I shall give to Lieutenant Stevens all the information I have collected in reference to it.

I will now give an estimate of the cost of the improvements recommended. There is at present one of Carmichael and Osgood's dredges in operation in this bay. From what I have seen of its working, and the information I have received from other officers of the corps, it seems admirably adapted to the purpose in view; and I will base my estimates on the supposition that it will be employed. There is no necessity for the employment of scows to remove the excavation at any other point than the Corpus Christi mud-flats; and at that place the necessity will be obviated by doubling the proposed width of the channel. This will *triple* the expense of the excavation, but the additional expense will be less than the cost of the scows, leaving entirely out of consideration the cost of the men required to manage them. I will then *triple* the excavation before given as the amount required for the Corpus Christi mud-flats. I find that 500 cubic yards per day can be taken as the average work of one of these machines of the largest class; and that a crew of six men is sufficient.

Estimate.

Excavator, complete, set up in working order in this bay.. $7,500

Cost of dredging, $470 per month, thus:

1 captain and engineer	$100
1 assistant and smith	60

4 men, at $25 per month	$100
Subsistence, at $5	30
Steam, at $6 per day	180
Total per month	470

Work at Corpus Christi mud-flats, 45,000 cubic yards, 3 months	$1,410
At the points mentioned, 10,500 cubic yards, 21 days	329
Hire of steam tow-boat	800
Row-boats, &c	200
Repairs and contingencies, (including loss of time in moving, &c.,)	1,000
Office, clerk-hire, &c	500
Total estimate	11,739

Should circumstances ever render it advisable to excavate an 8-foot channel over the bar and flats between Aranzas and Corpus Christi bays, the sum of $7,500 will be necessary for the *labor*, exclusive of machinery. The channel I have recommended will certainly be ample for all the wants of the place for years to come. Should the work on this channel be delayed for any number of years—four, for example—it would be advisable to increase the estimate for labor by from one-third to one-half—especially for the Corpus Christi mud-flats.

It should be mentioned that the company who are using the excavator now employed in this bay, have the patent right for all the waters between this place and Corpus Christi: how much will be required to extinguish their right I am unable to say.

It is also possible that they may be willing to do the work recommended by contract. I will request Lieutenant Stevens to procure information on these points and transmit it to the department.

I am, sir, very respectfully, your obedient servant,

GEO. B. McCLELLAN,
Lieutenant Engineers and Brevet Captain.

Brev. Brig. Gen. J. G. Totten,
Chief Engineer U. S. A.

APPENDIX A C.

Indianola, Texas, *September* 30, 1853.

Sir: I have the honor to submit the following report of my examination of the bar at Velasco, Texas:

This bar is formed at the mouth of the Brazos river. The river empties directly into the Gulf, and, unlike most rivers flowing through a flat country, has no delta, but breaks through the sandy beach into the sea.

The bar is, like all the bars on this coast, due more to the action of the sea than of the river it obstructs. It is of hard sand, shifting in position and form somewhat, as the stage of water in the river changes; the channel through it always changes after a hard blow. Pilots are obliged invariably to sound for the channel before taking a vessel over after a strong wind.

Freshets prevail in the Brazos during six months of the year, giving a current varying from three to six miles per hour. These rises occur during the winter, when the wind is mostly off-shore, giving better water on the bar than during the summer.

The bottom, one mile from the bar, is blue clay mingled with sand; inside the bar is blue clay, mud, and sand, the deposite from the river. The anchorage, so far as holding-ground is concerned, is good, both inside and beyond the bar.

I see no way of improving permanently; the constantly recurring changes would soon restore everything to the present state.

The pilots propose harrowing or ploughing through the channel, but this would require to be constantly kept up—one heavy blow of twenty-four hours' duration would neutralize the labor of weeks. The result of the experiment at the mouth of the Mississippi, will give a fair test of the success of such measures.

My opinion is against such an operation. The bar is formed at its particular location, because the current at the bottom becomes too weak to carry sand any further; then, if you loosen the sand by harrowing, you only place it where it was the instant before it was deposited; and why will it go out now, when it did not before? The same cause is acting as when the deposite took place, and the same results should follow. Alter other conditions, and there may be different results. By producing the bed of the river to the summit of the bar by dyking, it would be cut away immediately by the current, but a new bar would form, perhaps worse than this one, perhaps better; what its character would be, is entirely conjectural.

It is therefore my opinion that the nature of the case, as presented above, would prevent any improvement being of sufficient duration to warrant the expense.

Respectfully submitted.

W. H. C. WHITING,
Lieut. U. S. Engineers.

Brig. Gen. Jos. G. Totten,
Chief Engineer, Washington City.

APPENDIX A D.

Galveston, *April* 27, 1853.

General: I have completed a reconnaissance of the Colorado from Austin to its mouth.

It is a fine, rapid stream, susceptible of navigation, with a little improvement, to La Grange, for boats drawing from two feet to thirty inches, at almost all stages of water. La Grange is distant 190 miles from the mouth of the river. The head of high-water navigation is Austin, 130 miles above La Grange. Between these two places the river is very difficult; shoals of bad character, narrow and tortuous channels, render the navigation, even at most favorable stages of water, very troublesome. Regarding La Grange as the head of general navigation, I would not recommend much expenditure on the river above, further than to cut off the overhanging trees.

The river is broad, generally from 100 to 250 yards in width, and flows through a country unrivalled even in this fertile State for all productions of soil grown in temperate latitudes. It is surpassed by no part of the States, so far as I have seen; and the river, the natural outlet for rapidly increasing and prosperous settlements demanding a market, seems eminently deserving of a portion of the public expenditure. Snags, generally small and readily removable; boulders in two places, and two shoals which require improvement, between La Grange and the raft, are the up-river obstacles. Other shoals occur, but are not difficult; and as they serve to hold the water in pools, and to lessen above and below them the rapidity of the current, I would not recommend them to be removed.

By reference to the exceedingly minute and accurate sketch of Lieutenant Wm. F. Smith, topographical engineers, herewith returned, the general character of the stream and of its obstructions may be readily seen.

In my letter of December 9, 1852, I gave a conjectural estimate of $8,000 for the expense of clearing the upper river. My examination causes no change in this particular.

The great feature of work for the improvement of the river is the raft, and I would recommend that all the funds at command of the government for this purpose be applied to procure an outlet for navigation, either by its removal or by turning the channel of the river.

The present condition of the raft is very different to what it was when surveyed by Lieutenant Smith. This difference is in part owing to high rises changing its position, and in part to the successful labors of the intelligent and indefatigable Mr. Ward, in removing much of the lower raft, and preparing the river below.

It now occupies the bend of the river above Cane island, as indicated in the accompanying sketch, and consists of four detached portions, making an aggregate of about 3,000 yards. Since the survey of 1850 nearly a half mile of floating raft has been added by the annual freshets. The most difficult to clear is the lower or sunken raft, consisting mostly of huge logs of sycamore, cottonwood, cypress, pecan, and ash, sunk and imbedded together. It is upon that the greatest portion of labor is to be expended. Its removal requires a favorable season for work, and a good snag-boat, with the requisite machinery for raising heavy timber. The most favorable time is in the summer and fall, the water being generally lowest at those seasons, and also warm enough to allow the men to work in it.

It is easily seen that detailed plans for labor of this kind cannot be given—so much depends upon contingencies, so much upon the good judgment and efficiency of the overseers, the activity of their crews, and the happy accidents of high and low water occurring at the proper times.

The general outline of operations is to labor at low water with the snag-boat at the sunken raft, and at the same time to have parties of smart axemen engaged in cutting up and preparing the floating raft, clearing off the points of the river and the overhanging timber, and otherwise making ready to take advantage of the rise to convey the drift away. The floating raft does not present much difficulty; judiciously managed, it often happens that many hundred yards are dislodged in a single day. Much depends on the practical skill of the overseer. If the difficulties are not greater than have been heretofore met, I am inclined to think that six months of zealous labors would be sufficient to clear the raft. Certainty of course cannot be predicated in the premises. The estimate for six months' work, presented in a previous letter, may be assumed as a basis, here given with slight alteration.

One engineer, with assistant, carpenter, nine men, and cook, at $570 per month, general and sub-overseer, clerk, thirty laborers, cook, and subsistence for same, at $1,416 per month, will give for six months' work	$11,916
Add for contingencies	4,000
Axes, tools, tackle, &c	1,000
Purchase and repairs of Kate Ward snag-boat	5,500
Total	22,416

It is possible that I have underrated the difficulties in the way of clearing the raft and the expense of labor. I would like to make an examination at lowest water, in order to arrive at greater accuracy. As yet, I have not had an opportunity. The water during the present reconnaissance has been at two feet above lowest water mark. I have availed myself of the information and experience of Mr. Ward, and employed him as an assistant for a few days in my examination of the raft and its vicinity. His services have been indispensable to me. The amount of work accomplished by Mr. Ward, and the manner in which the river has been cleared from Cane island to its mouth, is a sufficient recommendation. From his great experience, practical character, and successful labor, I urge that he be employed as overseer and in charge of the snag-boat. The Kate Ward was built by him. He is by trade an engineer and steamboat builder; and I recommend, as a first step towards work, that, should the Colorado Navigation Company agree to sell the steamer, he should immediately commence her repairs. It is almost unnecessary to say that every year of delay naturally increases the difficulty and expense of removing the raft. If the summer is allowed to pass without labor, the season is entirely lost, for it is found almost impossible to work to advantage during the winter and late in the fall, on account of the cold.

Should the Colorado Company refuse their boat on the terms offered in the circular addressed to the directors, (of which a copy is herewith submitted,) it will be necessary to provide a snag-boat otherwise. A new one should be built. Probably, for economy, Louisville would be the best point to build at.

The cost of a snag-boat suitable to the Colorado, and brought out here, would not be less than $10,000. In this contingency, then, $5,000 should be added to the estimate above submitted.

I have another project to present, which has been the subject of much study and labor. It is, to turn the channel of the river by a cut-off, which will avoid the raft. By reference to the accompanying sketch, it will be seen that near the left bank of the river, in the vicinity of the raft, is a series of small lakes. They are due to the backings-up of the river by the timber, and the falling away of the level of the land from the river-bank towards the prairie. Numerous little shoots from the river at high water supply these lakes, and a strong current runs through them, finding its way back below the raft. At the present stage of water, the average depth of the channel-way of the lakes is five feet: during very low water they become nearly dry. The tendency of the current through them is to form them into a river, by raising banks and contracting their width. In two places on the proposed route a growth of willows extends nearly across the lake, the depth of water where they grow remaining generally the same. Two steamboats have already been taken around the raft by this route: one out of the river to the bay, and the other from the bay to the upper river. The proposed cut-off should commence at the point marked in the sketch—a short distance above the Kate Ward bayou, and below the upper portion of the raft. This portion, which is floating and of light character, can readily be deposited below.

In forming an estimate for this work it is difficult to be precise, especially as to time. The circumstance of a favorable season enters largely into the calculation. Low water of considerable duration is what is required, followed by a high rise.

I can only indicate, as before, a general plan of operations. Taking low water, work should be commenced at the lower shoot, marked as Lawrence's bayou. This bayou is quite narrow at present, but daily increasing, and running with great rapidity of current through a stiff, black loam. The trees should be cleared off its banks to a distance of fifty yards on either side. The roots of the willows should be grubbed up, and two or more small trenches should be dug parallel to the shoot, to assist the action of the water. The length of this bayou is one mile, including in this distance the "Little lake," 500 yards long, needing no preparation. The difference of level between the lake and the river at the mouth of the bayou is 15′ 1¼″. Little difficulty occurs in the lake itself. In two places it is necessary to clear away a scattering growth of willows. It is always necessary to get entirely rid of this tree when it is in the way. Its roots invariably prevent the washing power of the water, and it grows quite as well in the river as out of it. No force of water appears able to tear it up by the roots. At the point where it is proposed to let the river into the lake, the distance across is 139 feet. Very little labor is required to make the channel. It should be the last part of the work, and as large an opening should be cut as possible, and at the time of high water. It is thought that the river would complete the work for itself. A line of level was run from the water above the raft to the river below, at Cane island, and the difference of level found to be nearly 20 feet. The action of the current will tend to narrow the lake, and to form naturally levees or banks. Economical and rigid execution of this project will greatly depend, even with most zealous and able agents, upon a happy combination of the circumstances of the river.

The proposed cut-off is, in my judgment, practicable, and will result in a navigable outlet. It presents the advantages of getting rid of the immense amount of drift involved in the clearing of the raft. It is a work of less expense and shorter time. But the new river will not, I think, be so good as the main stream with the obstructions removed. I incline to the opinion that the straightening of rivers in alluvial countries by cutting off the bends is injudicious, as a general thing. This plan is only recommended from the peculiar condition of the stream, and to secure a cheaper mode of effecting an outlet. It might be adopted in case of very limited means at the disposal of government. A snag-boat is equally necessary, whatever be the plan. The estimate for this project is as follows:

Purchase and repairs of snag-boat	$5,500
Labor in preparing channel-way	6,000
Add for contingencies	3,000
Total	14,500

It is presumed that three months' work, at a favorable time, will be ample.

The greatest difficulty I foresee in the execution of any project for improvement in this section of the country is want of labor. At present I see no way out of this. Planters are unwilling their slaves should leave their cotton and sugar. There is difficulty not only in high prices charged, but in the precarious nature of the supply. White labor, even where it can be had, is objectionable here. It can neither be controlled nor supported as well as slave labor. The executive officer depending on white hands is constantly liable to be left at any critical period of his operations.

In the event of the appropriation by the State of Texas for internal improvements being confirmed by the people this fall, I think it will be possible to effect a kind of union of the two appropriations, by their being disbursed by an officer of the engineers. I intended to propose to the proper officers of the State that $20,000 of their appropriation should be at once invested, after the example of Louisiana, in the purchase of State negroes. The balance of the united funds, amounting to $37,000, would abundantly suffice to clear the whole river. The plan is the cheapest possible, and gives the agent the best control of his labor; and at the conclusion, if necessary, the labor thus purchased would command its own price. Permit me to suggest that correspondence be opened on this head between the department and the proper authority of the State.

With regard to the future action of the Colorado Navigation Company, I have as yet obtained no information. A copy of a circular which I have addressed to the directors is herewith submitted.

It is needless to say that steps should be taken at once. The longer this work is postponed, the greater will be the difficulty and expense.

I am, General, your most obedient servant,

WM. H. C. WHITING,
Lieutenant of Engineers.

Gen. J. G. Totten,
Chief Engineer, Washington.

APPENDIX A D—1.

Engineer Department,
Washington, March 12, 1853.

Sir: The board of engineers of river and harbor improvements have examined the project of Lieut. W. H. C. Whiting, corps of engineers, for the improvement of the navigation of the Colorado river, Texas, and approve of his preference for that mode of continuing the improvement which his project sets forth.

A company was incorporated by the State of Texas in 1850 for the purpose of improving this river; and this company, as appears by Lieut. Whiting's report, prosecuted the improvement with great success as long as their means lasted. His project, accordingly—and I have the honor to recommend it for your sanction—is, to procure the machinery belonging to this company, which is very suitable, and may be had at a low rate, and then to continue the work of removing the raft, which is the principal cause of the interruption of navigation, to the extent of the available means.

The work should not be undertaken until the stage of water becomes very low; and the probability is, that the existing appropriation will suffice for opening a good channel entirely through this obstacle.

A printed copy of the act incorporating the Colorado Navigation Company accompanies this report, in order that the proper legal authority may decide what steps, if any, are requisite to be taken in respect to their rights under this charter.

The raft of the Colorado is seven miles in length, and is about twenty-five miles from the mouth of the river. The difficulties in the way of the navigation of the upper part of the river are understood to be less serious; they are now under examination by Lieut. Whiting.

The report of Lieut. Whiting, and that of the board of engineers, accompany this communication.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engs.

Hon. Jefferson Davis,
Secretary of War.

[The project of Lieut. Whiting, in accordance with the foregoing recommendation, was approved by the Secretary of War, March 29, with the proviso that the Colorado Navigation Company interpose no obstacles to the prosecution of the work authorized by Congress.]

APPENDIX A E.

GALVESTON, *January* 23, 1853.

GENERAL: I have the honor to report upon the Trinity river, as follows:

For the purposes of navigation this stream is practicable during the time of high water for about 600 miles; during low water, *at present*, for 100; passing through very rich cotton, wheat, corn, and sugar lands. The season of high water is generally from about the first of January to the last of June; the river, however, has been known to remain "up" for 18 months. The transition from high to low water is not, as in most of the Texas rivers, sudden. The great length and depth of the stream retain the waters for a long time. The chief obstacles are—the overhanging timber; the snags which occur at various intervals; and the bar at its mouth. Transportation up and down its course can be improved very materially at no very great expense. Its importance to this growing country will be considerable. The cotton crop alone on the river, at present upwards of 20,000 bags, rapidly increases every year, owing to the immense immigration of planters, with their hands, upon its rich lands.

I propose to state the difficulties briefly, and in order.

Between White Rock shoals, a point distant 310 miles from the mouth, and Magnolia, the head of high-water navigation, the chief obstacle is the overhanging timber, which, from the rapid current in high rises, is very dangerous to boats; the difficulty occurs, for the most part, in the concave bends, and is found to interfere rather with the descent than the ascent of the stream. The timber consists of cottonwood, willow, and ash, and, in the course of the river, from 75 to 100 miles only requires trimming; of course upon that side of the river alone upon which the channel runs. This difficulty does not obtain below White Rock shoals, nor is it calculated to interfere to any extent with low-water navigation.

An estimate for its removal will be found appended.

There are numerous snags at various intervals to be found between Liberty, 60 miles from the mouth, and the head of navigation. With regard to this obstacle, I would state that at high stages of water it presents but little difficulty at most points, from the fact that the depth of water is there so great that snags may readily be avoided. In some places, however, they require removal wholly or in part; and this improvement will easily extend the low-water navigation, for boats drawing three feet, to Patrick, distant about 300 miles from the mouth. By removal in part, I mean the simple raising of the snag on end, cutting it off, letting the lower part sink; an operation of no great difficulty. I have carefully examined about 600 miles of the river at a most favorable time for observing the obstacles in the way of the up-river navigation. The estimates for removal of snags and overhanging timber are included in a general estimate for improvement of the Trinity from its bar to the head of steamboat navigation.

The river empties into Galveston bay by three main passes, forming a delta about two miles in length. There are also six other mouths, which are very small, and through which but little water flows, except at seasons of very high rises. The nature of the soil of the Trinity bottom, and the rapidity of the current, cause a large amount of sediment to be brought down with every rise. This has formed a bar of sand, overlying clay and mud, surrounding the delta, and of a general average width (*i. e.* distance from deep water to deep water) of seven hundred and fifty yards.

This bar is the great obstacle to the navigation of the Trinity and to the trade of this section of Texas. The depth of water in the deepest channels through it rarely reaches 3′ 6″, and the average depth over its extent is not more than 1′ 6″. Steamboats have often been obliged to wait for as long a period as three weeks in order to pass, even without a cargo—a great expense, when to loss of time is added the heavy charge of fifteen cents per barrel for lighterage over the bar.

The deepening of the channel of one of the passes is the main feature of improvement to be kept in view, both in making estimates and applying money; all others are secondary.

The subject is one of considerable difficulty. The analogy *on a small scale* as to nature of the banks, character of alluvions, force of current, great depth of stream, extent and shoalness of bar, and form of delta between this and the Mississippi, is almost perfect. A strong ebb and flow of tide sweeps by the mouths; great quantities of timber, drift, and sediment are annually brought down and deposited in every direction over the bar, serving to prolong the delta, and causing frequent shifting of the narrow channel-ways. The depth of water in the three passes known as Main Pass, Middle Pass, and Brown's or Anderson's Pass, is about the same, and reaches the extent of ten or twelve feet to the extremities of the delta. The current during the rises of the river is very strong, being three and three-quarter miles per hour at the mouth; in low stages of water, on the contrary, it is scarcely perceptible. High tides in the bay of Galveston produce the highest water on the bar. The depth of the channel-ways is but little affected by the rise of the river.

I present the following considerations with great diffidence. The subject is delicate, and the time which, under the circumstances, I have been able to devote to it, limited.

The closing of the secondary passes and of two of the main mouths, thereby concentrating the force of the current upon a single pass, might deepen the channel-way by the increased velocity of the flow. The volume of water, however, will increase more rapidly than the height; and I am convinced, from the great quantity of drift and alluvions brought down, that the confining the waters in an invariable channel would not only materially interfere with the discharge of floods, but also rapidly tend to produce obstacles of a worse character than exist at present at its embouchure. I would prefer, therefore, to maintain, as far as possible, the conditions which nature has laid down for the discharge of the waters, and propose for the deepening of the channel-way this project:

I would select the pass known as "Anderson's Pass" as the one to be improved, on account of its sheltered position. A glance at the accompanying sketch will sufficiently show this fact, there being no wind, or sea-way depending on winds, which can affect it. Commencing at the point marked A and A′ on the sketch, I would build two parallel lines of 4-inch sheet piling, securely braced, 60 feet apart, and 700 yards in length. The object of these is to form a revetment or defence for the improved channel-way. I would then apply the dredge, and deepen this way to 5 feet—an ample amount of water for the purposes of the river navigation. The structure should not be connected with the main land at all, and should interfere as little as possible with the discharge of the floods. It should be carried to a height of but 2′ 6″ above low-water mark. It is thought that, while it is probably as economical a device as can be applied, it will afford the greatest permanent depth and protection to the channel-way. The continued passage of boats through the pass contributes materially to keep it free from silting up; the worm does not affect it; it is exposed to no action of storms, and requires no great strength, while, at the same time, it offers little or no impediment to the discharge of drift and alluvions from the river. Its course is very nearly coincident with the present channel-way.

The following estimate is presented as a basis of appropriation:

For improving the bar of Trinity river:

Carmichael & Osgood's excavator	$6,200
Scows	1,200
One month's dredging	1,092
Job boat	1,000
Repairs, workmanship, &c	2,000
Office	1,200
84,000 feet 4-inch plank, at $22 per M	1,848
400 piles, at $1 per pile	400
4,000 feet of 6-inch plank, at $22 per M	88
Steam pile-drivers	2,500
Contingencies	1,200
	18,728

For improving Trinity river, as follows:

20 hands, at $1 per day	$20 00	6 months' low-	
Overseers	6 00	water work, at	
Engineer	3 00	$54½ per day,	
Assistant	2 00	say 180 d'ys . $9,810	
Carpenter	2 50	Add ⅓ for office,	
Cook	1 00	tools, repairs,	13,080
6 hands, at $1	6 00	contingencies,	
Pilot	3 00	&c. 3,270	
Steam	3 00		
Subsistence	8 00	13,080	

Total estimate for Trinity river and bar	31,808

It is to be remarked that this estimate implies that a snag-boat is already purchased for this coast, otherwise the amount should be increased by $10,000.

I remark, again, the improvement of the upper river is entirely secondary to that of the bar; and this is best shown by the fact that there are at this time seven steamboats engaged upon the river in spite of the difficulties; three of them are now on their return from a point 650 miles from the mouth. The Trinity is the deepest and least-obstructed river in the State of Texas. Its size, length, and depth, and the section of country through which it flows, entitle it to consideration. I have endeavored to accommodate my estimates to the prices of labor and materials. Judicious economy and great energy are required in the expenditure and application of the means appropriated.

I have the honor to be, General, your most obedient servant,

WM. H. C. WHITING,
Lieutenant of Engineers.

Gen. J. G. TOTTEN,
Chief Engineer U. S., Washington.

APPENDIX A' F.

INDIANOLA, TEXAS, *August* 31, 1853.

SIR: I have the honor to submit the following report of the result of my examinations of the San Antonio river, Texas.

The San Antonio river rises about four miles above the city of San Antonio. The Olmis, or Alemis, falls into it a short distance below the source, but furnishes an inconsiderable amount of water. The springs about the head maintain a constant supply of water, giving the river, even at its lowest stages, a current of three to four miles per hour.

The Medina, Cibolo, and Menanhilla, are its largest branches, and the only ones of much size.

The bed of the river between the city of San Antonio and Goliad is quite diverse in its character, sometimes quite uniform, and of coarse sand; at the shoals, which are very numerous, of coarse gravel; at the falls, of which there are many, beds of soft limestone, extending across the bed of the river. Between the points above mentioned the difference of level is 480 feet, and the frequency of shoals and falls would render any improvement perfectly useless, unless the system of slack-water navigation were adopted. To this there are many grave objections. First, it is not desired by the people; and, secondly, the great rapidity of the current, the extreme narrowness of the streams—seldom as much as eighty feet wide—the numerous and sharp turns, the sudden rises to which it is subject, the Medina and Cibola frequently rising in a few hours from twenty to forty feet, would involve an immense outlay of time and money not at all commensurate with the advantages to be derived. Were locks built, the excavations necessary to permit waste-weirs to be constructed, together with those necessary to permit the passage of a boat around the points, would give the work a character more resembling the construction of a canal than improving the navigation of a river.

It is therefore my opinion that it would be unadvisable to attempt improving between San Antonio and Goliad.

From Goliad to the sea the river has quite another character. The bed is of coarse sand, and extremely uniform in width and depth. It passes through a level prairie, which comes to the very brink of the stream, until, after passing Fagan's island, you find characteristic river "bottom" land. One peculiarity of the bed is worthy of notice, viz: that on points where you would naturally look for bars or shoals, none appear, the bank sloping 1–1, and the same depth of water at the point as in the bed. The width ranges between one hundred and one hundred and fifty feet; the soundings from twelve feet to three, the latter depth at only a few places. The bends are sufficiently gentle to permit a boat of eighty feet in length to round the points without difficulty.

The principal obstructions to the navigation at present are, a fall two miles below the town of Goliad, a raft at the head of Fagan's island, one at the fork of the two mouths, and overhanging timber; there are no snags or sawyers of any account, the coarse sandy bottom not retaining them as the muddy or clayey bottoms of rivers generally do.

The fall of Goliad is two feet, over a distance of about fifty yards; a bed of soft limestone crossing the river, makes the fall. To enable boats to go into the town of Goliad, this would have to be removed. The basin above has sufficient depth to permit it, and as it is composed of soft limestone, easily cut with an axe, a channel of three feet in depth could be cut through. Ten men could perform the labor in one month at a proper stage of the water; but knowing the trouble of working in the water, unforeseen delays, &c., I put the whole expense at $1,000. A slight rise in the river overcomes the fall, so that it appears to be only a rapid. I found the fall, by level, to be one foot five inches, but the river was up a few inches at the time.

The raft at Fagan's island is three hundred yards long, fifty of which is solidly wedged against the upper end of the island; this I do not consider as presenting, at present, any great difficulty in removing. As there has been no accumulation of earth upon or in it, the moment the few tie-logs are cut and removed, the whole mass is afloat.

In removing it I would leave the left-hand channel closed, tha the concentration of water in the other might widen it.

The raft near the mouth is about three hundred yards long, entirely afloat, and presents no difficulty whatever in removing.

The overhanging timber is abundant; but as no necessity exists for going any distance from the brink in clearing, the banks not caving, all that is required is to cut such trees as overhang. Such as are likely to fall should be trimmed and girdled; whenever they fall they will be dry or rotten, and will float away.

At the mouth is an extensive mud-flat, over which there is seldom over three feet, sometimes much less; but the mud being very soft, by staking out a channel permanently and running it with a steamer, there would always be enough water for such a class of boats as could navigate the river.

Estimate for improving to Goliad.

Snag-boat and machinery		$10,000

The Colorado snag-boat would probably, at the expiration of her services in the Colorado raft, answer very well: if, therefore, she could be used, this item could be reduced one half.

Three months' work with snag-boat—		
Captain	$100	
Running engines	200	
Fuel	300	
Eight deck hands	240	
Contingencies	160	
	1,000 =	3,000
Cutting channel through falls at Goliad		1,000
Clearing overhanging timber, 60 miles, $80 per mile		4,800
Contingencies		500
Total		19,300

Respectfully submitted:

W. H. STEVENS, *Lieut. U. S. Eng's.*

Brig. Gen. Joseph G. Totten,
Chief Engineer, Washington, D. C.

APPENDIX A G.

Supply of water to the cities of Washington and Georgetown.

The report of Capt. Meigs for supplying the cities of Washington and Georgetown with an unfailing and abundant supply of water was presented on the 12th of February 1853, and printed by order of the Senate, in Executive Document No. 48, 32d Congress, 2d session.

The *Great Falls* project was approved as follows, viz:

Engineer Department, *June* 28, 1853.

The project for an aqueduct from the Great Falls of the Potomac, here delineated, and as explained in the report of Capt. Meigs, dated February 12, 1853, with such deviations from the trace here given as local circumstances may, on more minute examination, demand, is approved, and is respectfully recommended to the President of the United States for adoption.

I moreover particularly recommend the adoption of the conduit of nine feet diameter, suggested by Capt. Meigs, in pages 25 and 34 of his report.

JOS. G. TOTTEN,
Bt. Brig. General, and Col. Engineers.

Recommended as above, to the President, for his approval.

JEFFN. DAVIS, *Secretary of War.*

June 28, 1853.

June 28, 1853.—Approved:

FRANKLIN PIERCE.

Report of operations in regard to the Washington Aqueduct, during the year ending September 30, 1853.

Congress having made an appropriation of five thousand dollars for the purpose of determining the best means of affording the cities of Washington and Georgetown an unfailing and abundant supply of good and wholesome water, this duty, in consequence of the death of Capt. F. A. Smith, of the corps of engineers, was assigned to me by your orders of the 3d November, 1852.

I proceeded at once to make the necessary examinations and surveys; and had the honor to make, on the 12th February following, to Brig. Gen. J. G. Totten, Chief Engineer, a report, in which I examined and estimated these several projects, and recommended, as the only suitable and unfailing source, the Great Falls of the Potomac.

This report was printed by order of the Senate, and an appropriation of $100,000 was made for commencing the work upon such plan, and from such source, as the President of the United States might approve; and providing that if the water should be drawn from any source within the limits of the State of Maryland, the consent of that State should first be obtained.

Application was immediately made to the State of Maryland, which by its law of 3d May, 1853, granted the desired consent, and also made provision for the appraisal and condemnation of land needed for the use of the aqueduct, and ceded jurisdiction over all lands to be acquired for this work.

This law was to take effect upon the United States agreeing to such conditions as the Chesapeake and Ohio Canal Company might consider necessary to secure the canal from injury in carrying into effect any plan that might be adopted by the United States.

The Chesapeake and Ohio Canal Company, at the annual meeting of their stockholders, approved of the arrangements made between the United States agents and their board of directors, and upon the 28th June, 1853, the President of the United States decided to adopt the Great Falls of the Potomac, and the larger size of the aqueduct, recommended in my report.

A party had been in the field for some time making examinations along the line, with a view to obtaining by purchase the right of way; but I found that there was no prospect of agreement with the land owners as to the amount of compensation to which they would be justly entitled, and I requested the counsel of the United States to make arrangements for appraising and condemning. This course I understood, too, would be generally acceptable to the land owners, who were willing to commit their interests to a jury sworn to do justice to both parties.

Considerable delay was caused by there being no legally qualified sheriff in the county of Montgomery.

After some time this obstacle was removed by the resignation of the incumbent, and the issue, by the governor, of a new commission. The necessary notices were issued immediately, and the first jury assembled upon the lands of Burgess Willet, esq., on the 10th September, at the expiration of the ten days' notice required by law, and appraisedthe value of the tract of land which will serve for the northern abutment of the dam, and the commencement of the aqueduct, at $400. This sum has been paid, and the land is the property of the government.

A second jury met upon the lands of J. W. Anderson, esq., and appraised the portion required for the aqueduct line, at $625. Two other small tracts for quarries were valued at $625 each.

These two condemnations give us the necessary right of way for about 1¾ mile, at a cost of $1,025.

The delays occasioned by the procuring of these laws, and the want of a sheriff qualified to issue the necessary legal notices, prevented our obtaining title to any land before the sickly season set in. All those employed on the surveys were attacked, so that the party was at one time entirely disabled, and withdrawn from the field.

I considered that it was most advisable, therefore, not to attempt to collect any considerable force until the approach of cold weather should remove all apprehension of sickness. Preparations have been made in Washingon and Georgetown, by preparing tools and machinery, for a vigorous prosecution of the work as soon as the sickly season is over, which will be about the beginning of November. Quarters for the large force to be employed on the dam and in the vicinity of the falls, were framed and prepared in Georgetown. The iron work for derricks and the necessary masonry and quarry tools were partly prepared in the machine-shops of Washington, and partly by the smiths employed in Washington for the aqueduct. The frames of the quarters, lime-houses, &c., have been sent up to the falls; and though the carpenters employed there have suffered from sickness, they will be ready by the time it will be safe to collect a force there.

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Respectfully submitted:

M. C. MEIGS,
Captain of Engineers, in charge of Washington Aqueduct and Extension U. S. Capitol.

COMPENDIUM OF THE REPORT OF THE COLONEL OF ENGINEERS.

1. *System of permanent fortifications.*

The grants made at the last session of Congress are all in the course of application by the officers respectively in charge—the operations having been vigorously pressed, where not delayed or prevented by prevailing sickness.. Five officers of engineers were sent to California, to unite with a sixth, already there, in commencing and prosecuting the defence of San Francisco. They have lost no time in making the surveys indispensable to a proper location of the fortifications, in putting up the temporary buildings necessary for the accommodation of workmen, levelling sites to receive masonry, &c. The chief engineer there has sacrificed his life to his efforts to urge forth these works. A successor has been ordered to the spot; and, in the mean time, the officers present will do the utmost to lessen the consequent delay.

The fortifications provided for at the last session of Congress are all of them important works, not only greatly needing the grant then made, but also those solicited in the estimates now sent up; but there are other defences, upon vital points of seacoast and interior frontiers, which equally demand further support from Congress. And the report presents, as briefly as may be, considerations for urging forward all the defences now under construction or repair, on the grounds that all the interests thus to be protected are of great value; that the proposed means are adequate; that they will be ready, reliable, and by far the cheapest; and that nothing in the growth of the country,—in the application of steam to naval uses,—in the use of the telegraph, of railroads, of improved implements of war,—will lessen the necessity of such fortifications as enter into our system, or change or modify their nature or form; but that, on the other hand, it is undoubtedly true, as shown by the great addition recently made to their seacoast defence by nations long practised in maritime warfare, that these inventions and improvements have greatly increased the necessity for those defences, and enhanced their importance.

It is earnestly hoped that Congress will not withhold the appropriations asked for in the estimates, based as they are on the supposition of a merely moderate progress. Whenever political events shall indicate that war may be pending, or probable at no distant day, it will be indispensable greatly to augment several of the items.

2. *Military Academy.*

The report of the Board of Visitors exhibits the opinions of a number of well-informed men, assembled from various parts of the country, on the condition and requirements of the academy.

The importance of extending the course of instruction to five years has heretofore been set forth by the Board of Visitors, and in the annual reports of this department. I desire again to add my conviction of the resulting advantages, to the favorable opinion of the present board, and to express the hope that the extension will be consummated.

3. *Corps of Engineers.*

The deficiency in the number of engineer officers heretofore set forth in my annual reports is more sensibly felt every day. It can only be safely remedied by gradual additions to their number, and this requires a prompt and immediate commencement. The high and varied qualifications of an engineer officer, though based upon his education and training at West Point, are only perfected in the practical school of active duty, on which he enters as soon as he leaves the academy, and in which he continues incessantly occupied thereafter. Practice in constructing, control and organization of men, application of theoretical knowledge, with continual new acquirements, knowledge of prices and materials, purchases and contracts, large disbursements, prompt and exact accounts, all are essential, and necessitate time and labor for their acquisition. Only from the source and through the channel specified can these qualifications be had.

Of the forty-three officers now commissioned in the corps, fifteen are employed in the Engineer department, at the Military Academy, in the Coast Survey, and in constructing public buildings: six of the younger graduates are without much experience. Six officers are employed in California on the Oregon route and the Texas frontier; leaving on this side of the continent but sixteen to conduct operations on more than forty fortifications, upwards of thirty works of river and harbor improvement, to serve as inspectors or constructors of light-houses, and members of two boards of engineers. It is evident from this that an addition to the strength of the corps is indispensable.

Your attention is also invited to the advantage of increasing the number of sappers and miners. Of the present company, one detachment is in the field on the Texas frontier; another is engaged on the Pacific railway exploration; and a third is on duty with the Coast Survey. The remainder of the company at West Point only suffices for the instruction of the cadets in practical field engineering, and for the preservation of the engineer train in store there. An additional company will afford the means of furnishing a few engineer soldiers at each of the fortifications, whose duty it will be at all times to exercise professional care over the work; and will also enable us to have a detachment prepared to accompany the engineer and ponton train to the field, in the event of a requisition for its immediate services being made.

4. *Harbors and rivers.*

The execution of that portion of the works and surveys for river and harbor improvements provided for in the act of 30th August, 1852, which lies on the Atlantic and Gulf coasts, was assigned to this department.

The duties were accordingly distributed among the officers of the corps—having regard to their occupations then in hand—with a view to their efficient and prompt prosecution.

In some cases, it has been found that the phraseology of the law must be altered before the grant can be applied to the object designed;

while in others, a careful examination of the locality has led to doubts whether the improvement is necessary or practicable; others have been hindered and retarded by the sickness of the country, the great demand for machinery, or the unreasonable pretensions of contractors. The deficiency of officers, compared with the varied and wide-spread duties intrusted to them, has been an increasing embarrassment. Most of the works, however, are in active progress: some of the most important are completed to the extent of our means, and others are approaching completion.

Many of the surveys directed have been executed; and the results, including projects for improvement where these were found advisable, are received, and are available for the future action of Congress.

5. *Ponton-bridge train.*

Reference is made in the engineer report to the necessity of an appropriation for making repairs and supplying deficiencies in the ponton-bridge train now stored at West Point, so that there may always be on hand a bridge in condition for immediate use. This can be done at a moderate expense, the engineer company being charged with its preservation.

6. *Supply of water to the cities of Washington and Georgetown.*

Surveys have been made and plans adopted by the President of the United States for bringing water from the Great Falls of the Potomac. Right of way to a part of the route has been secured, and preparations have been made for vigorous operations as soon as the sickly season—which has delayed them—shall have passed away. All circumstances are reported favorable to the execution of this important work, and to a rapid completion of it.

The engineer officer in charge considers that during the next year he could apply, with great advantage, $1,000,000, provided one-half of that sum could be made applicable to the last half of the fiscal year ending June 30, 1854, and the other half to the year ending June 30, 1855.