

EXECUTIVE DOCUMENTS

PRINTED BY ORDER OF THE

HOUSE OF REPRESENTATIVES

DURING THE

SECOND SESSION OF THE FORTY-FIRST CONGRESS.

1869-'70.

IN THIRTEEN VOLUMES.

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*Not printed; copy returned.

WASHINGTON.
GOVERNMENT PRINTING OFFICE.
1870.

REPORT

OF

THE SECRETARY OF WAR,

BEING PART OF THE

MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE SECOND SESSION OF THE FORTY-FIRST CONGRESS.

VOLUME II.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1869.

Fort at Fort Point, entrance to San Francisco Harbor, California, in charge of Major George H. Elliot.—The sea-wall, six hundred feet long, designed to protect the proposed eastern barbette battery, was completed during the last winter. The ground in rear of this wall has been filled flush with the coping, and a pavement of dry stones has been laid for a distance of thirty feet in rear of the wall. The pile wharf, the roadways, the quarters, stables, and storehouses, have been kept in repair. The iron work of the embrasures, the railings and stairways have been scraped clean of rust and have been painted. A thorough repair of quarters for officers and men has been undertaken and will be finished early in the present fiscal year. An apron of masses of rock, from ten to fifteen tons weight, has been commenced in front of the channel sides of the fort to prevent the wearing of the beach. A series of experiments with the cements and limes obtainable on the Pacific coast, and with the building sands obtained in San Francisco Harbor, has been commenced.

Appropriation asked for the next fiscal year, \$200,000.

Fort at Lime Point, San Francisco Harbor, California, in charge of Major George H. Mendell, brevet colonel United States Army.—During the fiscal year two large blasts have been exploded at Lime Point. The first took place on the 24th October, 1868, and contained nearly twenty four thousand pounds of mortar and cannon powder. The second, of sixteen thousand five hundred pounds of powder, in three charges, was exploded on the 17th April. The gross effect of these two explosions was the removal of about ninety thousand cubic yards of rock. A tunnel with two chambers, of capacity of six thousand pounds each, is ready for loading. Seventy-five thousand cubic yards of rock have been removed from the site during the year; to an average distance of eighty feet. Operations were suspended during four months out of the twelve. The fence, three miles in length, separating the public land from that adjoining, which was commenced in the previous fiscal year, was finished in July. During the next year it is proposed to continue the rock excavation, construct a battery on Point Cavallo, and emplacements for guns and mortars on the hills above Lime Point, with the necessary roads.

Appropriation asked for the next fiscal year, \$200,000.

Fortifications at Alcatraz Island, San Francisco Harbor, California, in charge of Major George H. Elliot, brevet colonel United States Army.—Operations during the past year have consisted in excavating the rocky slopes in rear of batteries 2 and 3; in repairing public property; painting the magazine roofs, the schooner, and the office, and in other miscellaneous work. About four thousand yards of rock have been excavated and thrown over the scarp walls. The earthy product of the excavation is saved for future use. It is proposed to remove the ridge of the island, leveling it to a plane; give the necessary increase of thickness to the parapets, and introduce additional traverses with magazines and bomb-proofs.

Appropriation asked for the next fiscal year, \$100,000.

Defenses at the mouth of the Columbia River, Oregon, in charge of Major George H. Mendell, brevet colonel United States Army.—During the year extensive repairs were made on Fort Stevens. The scarp revetment, which was much decayed, was removed, and the exterior slope of the parapet extended to the bottom of the ditch. It was faced with plank to protect the lower part of the slope from washing where it is reached by the water of the ditch. A covered way with parapet arranged for infantry fire was constructed along the counterscarp. The wooden

magazines at Cape Disappointment exhibit signs of decay. Arrangements have been made to construct a fire-proof powder-house for storage of powder. The condition of the works both at Fort Stevens and Cape Disappointment is good.

No appropriation asked for the next fiscal year.

BATTALION OF ENGINEERS AND DEPOTS.

Battalion of engineers, commanded by Major Henry L. Abbot, brevet brigadier general United States Army, headquarters Willet's Point, New York Harbor.—The strength of the five companies constituting the battalion of engineers, on the 30th of June, 1869, was 23 officers and 634 enlisted men. 116 recruits were needed to complete the organization. The companies of the battalion were stationed and commanded as follows: At Willet's Point, New York Harbor, company A, Captain A. Mackenzie; company B, Captain A. H. Burnham, brevet major United States Army; company C, Captain O. H. Ernst. At Yerba Buena Island, California, company D. Captain S. M. Mansfield, brevet lieutenant colonel United States Army. At Jefferson Barracks, Missouri, company E, Captain P. C. Hains, brevet lieutenant colonel United States Army.

A detachment from companies A, B, C, and E, under the command of First Lieutenant C. B. Sears, served at the United States Military Academy for the purpose of aiding in the instruction in practical engineering. A detachment of 38 men, under the command of First Lieutenant Thomas Turtle, were engaged from April, 1869, upon the survey of the battle field of Gettysburg; and small detachments were made from time to time from the post in the west for other duties.

The troops at the several posts have been carefully instructed in the infantry tactics, both practically and theoretically, and in the drills peculiar to their special arm of the service, and have accomplished a large amount of work in the construction of the buildings and preparation of the grounds at the depots established for them. Theoretical instruction for the men, as directed in General Orders No. 56, of 1866, has been continued, with considerable interest manifested, and encouraging progress made; and the original intention of making the service with the battalion a school of practice for the officers on duty with it has been kept steadily in view in the methods of instruction marked out. With the sanction of the Secretary of War the duty of experimentally developing a torpedo system as an accessory of the permanent sea-coast defenses was devolved upon the battalion of engineers, under the direction of the board of engineers for fortifications, by instructions from this office in May last.

I would again recommend that two principal musicians should be allowed to the non-commissioned staff of the battalion; that the seventh section of the act of July 13, 1866, taking from engineer soldiers the per diem paid to other soldiers, when engaged on continuous labor, should be repealed; because the effect of this law is to make the pay of engineer soldiers much less than that given to other troops when engaged on extra duty, works an injustice to the men, and excludes a class of recruits from their ranks which the interests of this special arm of the service requires should be enlisted. With this law repealed, the engineer soldier will be replaced upon the same footing as the other troops of the service. I would also renew my recommendation that an appropriation of \$1,000 be made to purchase the stock out of which siege and trench materials are fabricated for the instruction of the troops at Willet's Point.

it at high water. For the improvement of navigation at this place, the engineer in charge recommends—

1. Boiler Rock to be removed to a depth of twelve feet, requiring seventy cubic yards of blasting, which, at \$50 per cubic yard, would cost.....	\$3,500 00
2. The point of ledge contracting the channel at Upper Hell Gate to be blasted off, requiring about 1,500 cubic yards, at \$4.....	6,000 00
3. Deepening the bar about midway between Upper Hell Gate and Arrowsic bridge, so as to afford a channel one hundred feet wide and ten feet deep at mean low water, requiring 11,000 cubic yards of dredging, which, at fifty cents per cubic yard, would cost.....	5,500 00
Add ten per cent. for contingencies.....	1,500 00
Total required for the proposed improvement.....	<u>16,500 00</u>

All of which could be profitably expended during the fiscal year ending June 30, 1871. (See Appendix U.)

7. *Survey and improvement of the Penobscot River, Maine.*—This survey has been completed. Very extensive and accurate soundings and borings made in the river show that from Crosby's Narrows up to Bangor, a distance of some three and a half miles, the bed of the river is seriously obstructed with slabs, edgings, and sawdust, to an average depth of ten feet, and in some localities more than eighteen feet; and that the harbor of Bangor is also obstructed with several large sunken rocks. To restore the channel to the original river bed would require an excavation of more than 5,000,000 cubic yards of its accumulations. But a passable channel could be made at a cost estimated at from \$100,000 to \$500,000, according to its width and depth. (See Appendix U.)

8. *Improvement of Union River, Maine.*—A careful examination of this river, from its mouth to Ellsworth, has been made. The engineer in charge estimates that for the improvement of the navigation between these points, by clearing it of slabs, edgings, and sawdust, removing boulders and sunken rocks, and erecting five stone beacons, there will be required an appropriation of \$40,000, which, in view of the large lumber trade, he recommends to be made. (See Appendix U.)

RIVERS AND HARBORS ON THE PACIFIC COAST.

Officer in charge, Brevet Lieutenant Colonel R. S. Williamson, major corps of engineers, assisted by first Lieutenant Wm. H. Heuer, corps of engineers.

1. *Improvement of the Willamette River, below Portland, Oregon.*—The operations on this river during the past fiscal year have been confined to dredging on Swan Island Bar, and the bar at the mouth of the river, and to removing snags at each of these localities. Surveys were made of the Willamette slough and of the mouth of the river. Many difficulties were encountered causing delays in the prosecution of the work. In December, 1868, when the dredging was temporarily suspended, a channel had been cut over Swan Island Bar, admitting vessels drawing fifteen feet, during the low water stage. The total length of channel excavated since the commencement of the work in 1867, at this locality,

is 3,200 feet. The estimate of the cost of deepening Swan Island Bar to eighteen feet was based on the supposition that the cost of dredging at a depth between fifteen and eighteen feet would not vary materially from the cost of the previous dredging.

From a report received from the officer in charge, it appears that the dredging at this place has been greatly retarded during the summer by numbers of large, sunken trees imbedded in the bar, the removal of which has been found to consume much time, besides causing frequent breaks in the machinery. For these reasons he deems it advisable to increase his estimate of the amount required for the fiscal year ending June 30, 1871, as follows:

For Swan Island Bar.....	\$25,000 00
For keeping open the channel at the mouth of the Willamette River.....	6,000 00
<hr/>	
Total.....	31,000 00

which he believes will complete the work on the Swan Island Bar, and keep open the channel at the mouth of the river up to that date.

Amount of appropriation and allotments for the improvement of Willamette River.....	\$79,500 00
Amount available July 1, 1869.....	26,923 74
Amount required to be appropriated.....	31,000 00

which can be profitably expended during the fiscal year ending June 30, 1871. (See Appendices V V 1 and V 1, a.)

2. *Removal of Blossom Rock in the harbor of San Francisco.*—After the allotment of \$50,000 had been made from the general appropriation of 1868 for rivers and harbors for the removal of this rock, the work was advertised and proposals invited. Only one proposal was made, and that being unsatisfactory was rejected. A plan for the removal of this rock was submitted to the officer in charge, accompanied by an offer to remove it to a depth of twenty-four feet at mean low water for \$75,000, no payment to be made until the satisfactory completion of the work.

This offer has been accepted, and the officer directed to enter into contract in accordance with the foregoing terms.

Amount allotted from appropriation of 1868.....	\$50,000 00
Amount allotted from appropriation of 1869.....	25,000 00
<hr/>	
	75,000 00
	<hr/>

(See Appendices V and V 3.)

SURVEYS AND EXAMINATIONS ON THE PACIFIC COAST.

1. *Survey of the Upper Columbia River, Oregon.*—Portions of the Upper Columbia River, Homly Rapids, and Rock Creek Rapids, have been examined with a view to ascertaining the position and dimensions of certain rocks, and to preparing estimates of the probable cost of removal of these obstructions. (See Appendix V.)

2. *Harbor of San Pedro, (Wilmington,) California.*—An examination of this locality has been made with a view to preparing a project for the improvement of the harbor. The report of the officer in charge, with estimate of the probable cost of improvement, is transmitted herewith. (See Appendices V and V 2.)

prevented by sickness, with confinement to my bed and home for more than two weeks past.

I am, very respectfully, your obedient servant,

GEO. THOM,

Lieut. Col. of Engineers, Bvt. Brig. Gen. U. S. A.

Maj. Gen. A. A. HUMPHREYS,

Chief of Engineers United States Army,

Headquarters Corps of Engineers, Washington, D. C.

BOSTON, *February 24, 1869.*

SIR: I have received estimates for building all machinery, elevators, and buckets for one of my patent dredges with one elevator.

I could furnish a double fourteen-inch cylinder engine with boiler and smoke-stack, donkey engine, two eight-inch cylinder engines and gears for hoisting elevator, the elevator with buckets, chain, all the shafting and gears to dive the buckets, elevator, hauling chain, hand-hoisting, &c., in fact, all the machinery and iron work required to set up in working order a complete machine for dredging, except the hull or vessel for the dredge, all this work warranted to be of the best material and workmanship, for the sum of twenty thousand dollars, and the use of the patent for the United States government for the State of Maine for the sum of five thousand dollars. Or the government may build the machine at their own expense, and pay the five thousand dollars for the use of the patent for said State.

I am ready to enter into any contract you may see fit to make, to purchase the machine and scows you may build under my patent right at the expiration of a reasonable time, for a sum we may agree upon, as I am going to build myself, in the course of a few years, several of the single elevator machines for work laid out in Boston Harbor.

Most respectfully,

A. BOSCHKE.

Gen. GEO. THOM, U. S. A.,
Portland, Maine.

APPENDIX V.

SAN FRANCISCO, CAL., *July 31, 1869.*

GENERAL: I have the honor to submit the following report of my official operations during the fiscal year ending June 30, 1869:

The operations have been conducted under the following appropriations:

Surveys of military defenses.

Purchase and repairs of instruments.

Removing obstructions in Willamette River.

Surveys and examinations on Pacific Coast.

Repair, preservation, extension, and completion of certain public works of river and harbor improvements.

River and harbor improvements for the year ending June 30, 1869, and for the year ending June 30, 1870.

The amount of the two last-mentioned appropriations, though having different names, are applied to the same improvements. In addition, I

am the engineer of the twelfth and thirteenth light-house districts and a member of the board of engineers for the Pacific Coast.

The operations under the above-named appropriations will be described in the order named.

SURVEY OF MILITARY DEFENSES.

Instructions having been received from the Chief of Engineers to cease disbursements under this appropriation, and to deposit the amount on hand to its credit with the assistant treasurer at this place, the amount on hand was so deposited and the account closed. The previous expenditures had been principally for collecting meteorological data, and a considerable amount had been collected which had not been reduced.

Upon representations made by me to the Chief of Engineers of the importance of the work being completed, I was given a small amount for that purpose. Nearly all the observers, however, agree to continue the observations, except those taken hourly, without compensation, and the work has continued with the expense of only about \$150 per month. The results are valuable and increase in value as the series of observations become longer.

The following are the amounts received and expended during the fiscal year ending June 30, 1869:

Cash on hand July 1, 1869	\$1,662 28
Deposited with the assistant treasurer at San Francisco, California, July 10, 1869	1,662 28
On hand July 10, 1869
Received during the year	\$1,720 00
Expended during the year	1,690 60
On hand June 30, 1869	29 40

PURCHASE AND REPAIR OF INSTRUMENTS.

By the direction of the Chief of Engineers the amount on hand from this appropriation at the end of the first quarter of 1869 was deposited by me to its credit with the assistant treasurer at San Francisco, California, and the accounts under it thus closed.

The following are the amounts received and expended under it:

On hand July 1, 1868	\$651 75
Expended during the year	105 08
Balance on hand March 31, 1869	546 67
Deposited with assistant treasurer at San Francisco, Cali- fornia, March 31, 1869	546 67
On hand April 1, 1869

REMOVING OBSTRUCTIONS TO NAVIGATION IN WILLAMETTE RIVER, OREGON.

This work has been under the immediate charge of my assistant, Lieutenant W. H. Heuer, United States Engineers.

The operations on this river during the past fiscal year have been

confined to dredging on Swan Island Bar, and the bar at the mouth of the Willamette River, as well as removing snags at each of the above-mentioned localities. Surveys of the Willamette Slough and of the mouth of the Willamette River were also made. The Willamette River being sufficiently low during August, 1868, to commence dredging, a crew was hired and work resumed August 1, 1868, and continued until December 12, 1868, when work was suspended on account of high water. During this time 18,515 cubic yards of material were removed. The season had been very unfavorable for work; owing to the dense smoke from the woods which were on fire, we were unable to see more than fifty yards from the dredge. The Willamette is also so low during the summer that vessels of much draught must, in passing up and down, occupy the channel in which the dredging is done, and consequently every time a vessel passed we were compelled to stop work, haul out of position, allow them to pass, then get back into position and resume work, all of which caused much delay. While digging we also came into contact with numerous snags imbedded in the sand, whose presence would only be made known by the breaking of some part of the machinery of the dredger owing to the increased strain to which certain parts would be subjected. In December last, when dredging was temporarily suspended, we had cut a channel over Swan Island Bar which carried fifteen feet of water during low-water stages.

Steamers found no difficulty in keeping in the cut, which was well defined by buoys placed at its entrances and angles. The total length of channel cut since the commencement of the work in 1867 at this place has been 3,200 linear feet.

On the 25th of February, 1869, the Willamette River was again low enough to resume dredging. We therefore commenced excavating a channel at the mouth of the river, and continued dredging until May 8, 1869, when high water caused a suspension of operations. During this period of work we excavated 12,425 cubic yards of material. The channel cut was 841 feet in length by 100 feet in width by an average of 4 feet in depth, giving a channel carrying 17 feet of water during low-water stage.

There yet remains to be dredged at this place about 300 linear feet, averaging 2 feet in depth, which will probably be completed in August, at an estimated cost of \$2,700.

Besides dredging, we removed 31 snags which were imbedded in the sand, the largest of which measured 30 feet in length by 9 feet in circumference. The quantity of material removed during the year was 30,940 cubic yards at a cost of \$26,414 28, being an average of 85.4 cents per yard. This amount included the repairs of the dredger, the removal of snags, and the surveys of the Willamette Slough and River, which cost \$4,861 77.

During the latter part of 1868 a survey of the Willamette Slough was made by F. H. West, (one of my assistants,) with a view of ascertaining its adaptability as a ship channel. The survey showed that the slough was not adapted for that purpose on account of its numerous rocky reefs. Maps of the slough, together with a map of the mouth of the river, were sent to the Engineer Department last February. A current chart was also prepared during the early part of 1869, showing the velocity and direction of the current during the winter freshet of 1868-'9 at the mouth of the river. This chart, also a map giving the latest survey of the mouth of the river, by Mr. F. H. West, accompany this report.

It was thought that the freshet in the river during January, 1869, would produce certain changes in the bed of the river at its mouth.

This actually occurred, and by comparing the last survey (accompanying this report) with those previously made in 1867 and 1868, it will be seen that the current washed out the sand so as to make a channel carrying 12 feet of water in places which previous surveys showed to be almost bare. The June rise of the Willamette River (occasioned by high water in the Columbia) seems to act injuriously to the channel at the mouth of the Willamette, causing a considerable deposit of sand which is only partially removed by the current of the Willamette, after the subsidence of the freshet. The accompanying current chart was made in January of 1869, when the Willamette was only about 10 feet higher than the ordinary low-water stage. This was the greatest height attained during the winter, and was 11 feet lower than the river was during the freshet of December, 1867. The current chart shows that the rate of the current during January, 1869, freshet averaged between two and a half and three miles per hour, which during a heavy freshet would probably be accelerated 33 per cent., the general direction of the current remaining the same.

In the June freshets the direction of the current is materially changed. The current then seems to come down the Columbia, passing between Percy's Island and Nigger Tom, as well as between Nigger Tom and Coon Islands, thence passing back into the Columbia through the slough B between Coon and Laurie's Islands. During this time the Columbia Slough also carries a considerable volume of water, the current of which passes in a northwesterly direction toward Gillingham Point, then separating, a portion passing through the slough B, the other portion takes a southwesterly direction, passing through the Willamette Slough back into the Columbia. The Columbia Slough was formerly used by steamboats in running to Vancouver, but it is now nearly blocked up.

I am directed to report on the following eleven points:

1. A survey of Swan Island Bar was made during the year, also of the bar at the mouth of the Willamette River and Willamette Slough. The plan adopted was to dredge Swan Island Bar so as to have 15 feet of water in the channel during the low-water season. Finished the work to that depth. At the mouth of the river we intended to dredge to 17 feet of water over the bar. That work is about three-quarters completed.

Items of expense during the year have been as follows:

Dredging at Swan Island Bar.....	\$11,387 31
Dredging at mouth of Willamette.....	10,165 20
Repairs to dredger and surveys.....	4,861 77
	<hr/>
Total expended during the year.....	26,414 28
	<hr/>

2. It is estimated that the amount that will be required to complete the work at the mouth of the river will be \$2,700. To deepen the channel at Swan Island bar to 18 feet of water will probably cost \$31,200. It will also probably require a small annual appropriation to keep the channel open to 18 feet of water.

3. The amount that can profitably be expended upon the work during the next fiscal year is \$26,500.

4. The collection district is Astoria, Oregon.

5. Portland, Oregon, is the nearest town.

6. The amount of revenue collected is unknown to this office.

7. The amount of commerce to be benefited by the completion of this work is very great. Steamers measuring two thousand tons leave San

Francisco weekly for Portland. A large number of sailing vessels also ply between these two ports.

8. No proposals were invited during the year, as the work is not being done by contract, but by the United States, by means of hired labor.

9 and 10. Hence no contracts were made.

11. The following are the amounts of money received and expended on account of the Willamette River work:

Cash on hand June 30, 1868.....	\$8, 914 99
Received during the year from appropriation for removing obstacles to navigation in Willamette River.....	9, 500 00
For preservation, completion, &c., of rivers and harbors..	9, 000 00
Total on hand and received.....	27, 414 99
Expended during the year.....	26, 414 28
On hand June 30, 1869.....	<u>1, 000 71</u>
The total amount of money appropriated which could be made available for improving the Willamette River was. \$79, 500 00	
Total expended to June 30, 1869.....	52, 576 26
Amount available to complete the work.....	<u>26, 923 74</u>

SURVEYS AND EXAMINATIONS ON PACIFIC COAST.

During this fiscal year the only work done under this appropriation was a survey, by Lieutenant W. H. Heuer, United States Engineers, of portions of the Upper Columbia River, known as Homly Rapids and Rock Creek Rapids, with a view of ascertaining the size and position of dangerous sunken rocks on these rapids, with a view to their removal. A few experiments in blasting were made on a submerged rock at John Day Rapids, for the purpose of ascertaining the cost of removal of the numerous rocks in the various rapids of this river.

For maps and detail, see reports of my assistant, Lieutenant W. H. Heuer, United States Engineers, forwarded to Engineer Department, November 20, 1868.

Cash on hand June 30, 1868.....	\$10, 165 16
Received during the year.....	-----
Expended during the year.....	4, 781 91
On hand June 30, 1869.....	<u>5, 383 25</u>

BLOSSOM ROCK, SAN FRANCISCO, CALIFORNIA.

During the year an allotment of \$50,000 was made for the removal of this obstruction. Advertisements were made and proposals invited. Only one proposal was received, which was from Mr. Townsend, of Boston, Massachusetts, and that, proving unsatisfactory, was rejected. Subsequently two allotments, amounting in all to \$25,000, were added, making the total amount available for the work \$75,000. Mr. A. W. Von Schmidt, a civil engineer, submitted a plan for the removal of the rock, and offered to remove it to a depth of twenty-four feet, mean low water, for \$75,000; no money being paid out by the government until

the satisfactory completion of the work. Mr. Townsend also presented another proposition. These propositions were submitted to the Chief of Engineers for his decision. At the end of this fiscal year no decision had been made in the matter.

PACIFIC RAILROAD.

In October, 1868, the Secretary of the Interior appointed me one of the special commissioners to examine and report upon the Central Pacific railroad, and, upon the completion of our report, I was immediately appointed on another commission to examine the Central and Union Pacific railroads, from Sacramento to Omaha. On my arrival at Sacramento, on my way back to my station at San Francisco, I was met by an order to examine at once the Western Pacific railroad, between Sacramento and San José, California. These duties have occupied me during a large portion of the fiscal year, and during the remaining portion much time has been consumed in duty as engineer of the twelfth and thirteenth light-house districts, (Pacific coast.)

Respectfully submitted.

R. S. WILLIAMSON,

Bvt. Lieut. Col. U. S. A., Major of Engineers.

Maj. Gen. A. A. HUMPHREYS,

Chief of Engineers U. S. A., Washington, D. C.

Synopsis of contents of annual report for year ending June 30, 1869.

SURVEYS OF MILITARY DEFENSES.

The only disbursements under this appropriation have been about \$150 per month.

The following amounts were received and expended during the fiscal year ending June 30, 1869:

On hand July 1, 1868.....	\$1,662 28
Deposited with assistant treasurer at San Francisco, California, July 10, 1868.....	1,662 28
On hand July 10, 1868.....	
Received during the year.....	1,720 00
Expended during the year.....	1,690 60
On hand June 30, 1869.....	29 40

PURCHASE AND REPAIRS OF INSTRUMENTS.

This account was closed, by order of the Chief of Engineers, at the end of the first quarter of 1869. It stood as follows:

On hand July 1, 1868.....	\$651 75
Expended during the year.....	105 08
Balance on hand March 31, 1869.....	546 67

which was deposited with the assistant treasurer at San Francisco, California.

REMOVING OBSTRUCTIONS TO NAVIGATION IN WILLAMETTE RIVER.

During the year surveys were made of the Willamette Slough and of the mouth of the Willamette River. Dredging was done at Swan Island

Bar, and a channel 3,200 feet long, carrying 15 feet of water at the lowest stage of the river, was completed during this year. This year it is expected to nearly complete Swan Island Bar, excavated to 18 feet of water, at an estimated cost of \$31,200. A channel at the mouth of the river was also excavated 841 feet long by 100 feet wide by 4 feet in depth. There yet remains to be dredged at this place about 200 linear feet, which will be completed this year, at an estimated cost of \$2,700.

Total amount of appropriation for removing obstructions to navigation in Willamette River was.....	\$45,000 00
From the appropriation for repairs, preservation, extension, and completion of public works on rivers and harbors, there has been allotted for the Willamette River.....	21,000 00
From appropriation for rivers and harbors for fiscal year ending June 30, 1869, and June 30, 1870, there has been allotted for the Willamette River.....	13,500 00
Total amount appropriated and allotted for this work.....	79,500 00
Total expended on work to June 30, 1869.....	52,576 26
Amount available to complete the work.....	26,923 74

SURVEYS AND EXAMINATIONS ON PACIFIC COAST.

Under this appropriation Homly and Rock Creek Rapids of the Upper Columbia River were surveyed, and some experimental blasts made on a submerged rock in John Day Rapids, with a view of estimating the cost of removal of dangerous rocks in the various rapids of this river.

Cash on hand June 30, 1868.....	\$10,165 16
Received during the year.....
Expended during the year.....	4,781 91
On hand June 30, 1869.....	5,383 25
Total amount of this appropriation was.....	\$50,000 00
Total amount expended to June 30, 1869, is.....	19,616 75
Unexpended balance of this appropriation is	30,383 25

BLOSSOM ROCK, SAN FRANCISCO HARBOR, CALIFORNIA.

No special appropriation has been made for the removal of this rock, but there has been allotted for its removal the following amounts:

From the appropriation for the repair, preservation, extension, and completion of public works on rivers and harbors	\$50,000 00
From the appropriation for rivers and harbors for fiscal year ending June 30, 1869, and June 30, 1870, there has been allotted.....	25,000 00
Total amount allotted for the work.....	75,000 00

Mr. A. W. Von Schmidt has made an offer to remove Blossom Rock, to the depth of 24 feet below mean low water, for \$75,000; which proposal was submitted to the Chief of Engineers for decision, but at the end of the fiscal year the matter was undecided.

V 1.

SAN FRANCISCO, CAL., *November 7, 1868.*

COLONEL: I have the honor to report that, in accordance with your instructions, I sailed from this place for Oregon on July 24, 1868, for the purpose of organizing parties for the continuance of work in the Willamette and Upper Columbia Rivers.

Parties were organized immediately after my arrival at Portland, Oregon, and the dredging apparatus was soon set at work at Swan Island Bar, in the Willamette River.

As the surveying schooner for the survey of the Upper Columbia River needed extensive repairs, those repairs were not completed until August 21. The succeeding day we sailed up the river and arrived at Homly Rapids on August 26, and began the survey next day at

HOMLY RAPIDS.

This rapid is in the Upper Columbia River, about one hundred and thirty miles above the Dalles, and about five miles below the mouth of Snake River. The nearest town is Wallula, (old Fort Walla-Walla,) Washington Territory, which is about four miles below the rapid. The river at Homly Rapids is three thousand three hundred feet wide, and contains numerous gravel bars. The current is rapid and varies with the stage of water in the river, being very much stronger in high than in low water. While we were at this rapid the rate of the current was six miles per hour, but during high-water season I am informed that it will average at least ten miles an hour; but during the lowest water the rate will probably not exceed five miles an hour. The soundings on the map indicate the depth of water at low-water stage, expressed in feet. The only part of the rapid where very careful soundings were made was between the two gravel bars, (see map,) as this was the only place in the rapid where there was much hope of being able to improve the navigation. The whole rapid was examined by me in a small boat, but with the exception of the place just mentioned, where the soundings show for themselves, the water was so shoal and rocks so plentiful that it was almost useless to devote much time to its survey; these shoals are indicated on the map by dotted lines. The whole of the river at this place is shoal, its bed is comparatively flat, covered with boulders, varying in size from an inch to several feet in diameter, and occasionally a portion of the bed rock (basalt) crops out and is visible under the water. The obstructions to be removed are ledges or portions of reefs of basaltic rock. Formerly there were large boulders in the river here, that interfered with steamboat navigation, but they were removed by private enterprise. The ledges which would require removal here are indicated on the map by dotted red lines, and measure one thousand one hundred and ninety-two cubic yards. One of the advantages that would result from improving this rapid would be that boats would be enabled to reach Lewiston, Idaho, on Snake River, a few weeks earlier in the season than at present. (See letter of J. C. Ainsworth, in Report of Chief

of Engineers for 1867, page 509.) According to that letter it would also enable boats to reach Priest's Rapids, in the Columbia; but, as there is no settlement at or near Priest's Rapids, I see no necessity of boats going there.

ROCK CREEK RAPIDS.

The next rapid surveyed is known as Rock Creek Rapids, situated in the Upper Columbia River, about forty-two miles above the Dalles. The shores on both sides of the river are rocky, and, within a mile of the river bank, the hills rise to a height of over a thousand feet. One thousand and eighty-two soundings were made in and near the channel of this rapid, and although many rocks were found, there were none that offered any serious obstacle to navigation. There are, therefore, no rocks recommended for removal in this rapid. The rapid is three-quarters of a mile in length, and in this distance has a fall of 8.34 feet; its current varies from five to ten miles an hour; during an ordinary stage of the river the current will not exceed six miles an hour, while immediately above and below the rapid, the current runs at the rate of one mile an hour.

BLASTING EXPERIMENTS.

Blasting experiments were made on a submerged rock in John Day Rapids, with a view of estimating the cost of removal of the various rocks in the river, but the results were unsatisfactory. A frame (see sketch of frame appended) was placed on "John Day Rock." It was thought advisable to put one or two drill holes in the rock, then insert some explosive compound, throw down as much rock as possible, by firing the blast, and thus make an estimate of the cost of removal of this rock. The drills used were of various shapes; some were plain, others curved like the letter S, while still others had a cross-section like this +, known as double bits or diamond drills; each of these drills was made so as to drill a three-inch hole, and were tried, but it was found that the plain bit would continually wedge in the hole; the curved bit (S) would chip off almost immediately after being inserted in the hole; therefore, the double bits or diamond drills were the only ones that could be used that promised any good results. With this bit we could drill a very round hole; it required three men to handle the drill, and the method adopted is called the churning process. The average depth of hole drilled per day, when work could actually be done, was twelve inches; each drill would require sharpening for every three inches of hole bored. The rock was so hard in places that the drill in striking against the rock would sometimes rebound three inches, and sound as though it were striking against an anvil. Considerable time was lost in preparing the drill-holes by not having a blacksmith on hand, but none could be obtained in that section of country; the drills had, therefore, to be sent to the Dalles (distant about thirty miles) to be dressed, and we were obliged to await their return. Eventually, after considerable trouble, we succeeded in getting the hole four feet deep, and placed in it a tin canister, containing four pounds of gunpowder, then endeavored to explode it by means of a Bickford fuse, but owing to some defect in the fuse, it failed to ignite the charge; the canister was jammed into the hole so tight that it could not be withdrawn. A cartridge was then prepared containing two pounds of giant powder and inserted in the hole (on top of the canister containing the ordinary powder) and exploded; the result was that 43.6 cubic feet of rock was removed.

As it would have taken many weeks more to have drilled another hole in the rock, we concluded to see what effect a surface blast would produce; a cartridge, containing five pounds of giant powder, was then placed under water, and under an overhanging shelf of the rock, in about six feet of water, and exploded, but without effect.

The experiments just made were of but little assistance in enabling me to make a fair estimate of the cost of removal of the rock. My impression is that the rocks can be removed by drilling holes in them, then inserting explosive material and firing the charge. I think, too, that that is the only practicable way of doing the work, but for such a hard rock a three-inch drill is too large; a drill one inch in diameter would be large enough, for with a one-inch drill a man ought to be able to drill two feet a day, whereas with a three-inch drill three men can only drill one foot per day; moreover, as the drill-holes will in no case be over seven feet in depth, a one-inch hole is better adapted to that depth than is a three-inch hole. I would also suggest that giant powder be used instead of ordinary blasting powder.

The following is the data obtained from the recent experiment on which to base estimates for the removal of the rock:

Expense of placing frame on rock.....	\$50 00
Drilling holes, 3 men, 4 days each	40 00
Sharpening 15 drills, at \$2	30 00
Powder and fuse	10 00
Total.....	130 00

Amount of rock removed; 43.6 cubic feet, cost per cubic yard, \$81 25.

Owing to my inexperience in blasting, the above cost per cubic yard was very great, and should not be considered as anything like a fair estimate of the cost per cubic yard for removing the various rocks in the river. The subjoined estimate I consider more nearly correct.

Putting frame on rock and shifting same.....	Gold.	\$100 00
Cost of drilling each hole, labor	\$10 00	
Sharpening drills for each hole	6 00	
Powder and fuse for each hole.....	2 00	
	<u>18 00</u>	
400 drill-holes, at \$18 each		7,200 00
1 blacksmith, for 3 months, at \$5 per day.....		450 00
1 assistant smith, for 3 months, at \$3 per day.....		270 00
Hire of boats, for 3 months.....		900 00
100 drills, at \$10 each.....		1,000 00
Removing frame from rock.....		50 00
Total in gold coin.....		9,970 00
Contingencies 10 per cent		997 00
Gold coin.....		10,967 00

\$10,967 in gold = \$15,667 14 currency, rating legal-tender notes at 70 cents; which would make the cost per cubic yard for removing the rock at John Day rapids = \$18 09; to which should be added \$10 per yard

for removing the debris, making a total of \$28 09 per cubic yard. The various rocks in the rapids to be removed will measure 5,934 cubic yards, which at a cost of \$28 09 per cubic yard would require \$166,686 06 to be appropriated for this purpose.

Very respectfully, your obedient servant,

W. H. HEUER,

Lieutenant of Engineers.

Lieut. Col. R. S. WILLIAMSON, U. S. A.,

Major of Engineers.

Description of frame for submarine blasting.

Each of the four legs is a cast-iron gas pipe four inches in diameter, into the bottom of which a conical piece of iron is fitted to prevent the legs from slipping. In each of the four angles of the wood-work of the frame is an iron cylinder through which the legs can slide freely; each leg is firmly held, (when in position,) by means of a set screw attached to the cylinder. The diagonal braces are ordinary one-inch gas pipes and are fastened in iron bands, which slide up and down each leg and which can also be clamped by set screws; each leg has two of these bands, and each brace runs from the bottom band of one leg to the top band of the adjacent leg.

The frame weighs about twelve hundred pounds, is stable and durable, offers but little resistance to the current, and the platform from which the drilling is done can always be levelled irrespective of the shape of the rock on which it may be placed. It was used this year in John Day rapid of the Columbia river, where the rate of the current was seven miles an hour, and was found to work very well.

Respectfully submitted.

W. H. HEUER,

Lieutenant of Engineers.

Bvt. Lieut. Col. R. S. WILLIAMSON,

Major of Engineers.

SAN FRANCISCO, CAL., *November 20, 1868.*

GENERAL: I have the honor to forward herewith a report, with maps, of the survey made by Lieutenant Heuer, United States engineers, of Homly and Rock Creek rapids of the Upper Columbia River. These surveys complete the series contemplated in the act making appropriation for the survey and examination of that portion of the river. Some experimental blasts have also been made with a view to furnish data for an estimate for removing the obstructions. As the expense of such experiments is considerable, and as they are of no ultimate benefit unless an appropriation is made for actually removing the rocks, I did not consider it advisable to make further expenditures for that purpose. If the rocks are to be removed, the amount that can be profitably expended towards that object during the next fiscal year is estimated to be \$50,000.

As the work of surveying the obstructions on the Upper Columbia River is completed, and as, after this month, no further expenditures under that appropriation are anticipated, I respectfully submit the

following as the amount already received and expended since the first of July last:

On hand July 1, 1868	\$10,165 16
Received during the fiscal year
Total amount on hand and received	10,165 16
Expended and to be expended during the year	4,478 62
On hand December 1, 1868	5,686 54

Very respectfully, your obedient servant,

R. S. WILLIAMSON,

Bvt. Lieut. Col. U. S. A., Major of Engineers.

Gen. A. A. HUMPHREYS,

Chief of Engineers United States Army.

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SAN FRANCISCO, *October 16, 1869.*

GENERAL: I have the honor to transmit herewith a report of Lieutenant W. H. Heuer, who has recently returned from the Willamette River, by my order, in order that he may be available to conduct the proposed survey at San Diego Harbor, very important duties, as engineer of lights on the coast, preventing my conducting it in person. The views expressed in Lieutenant Heuer's report are approved by me, and I respectfully request that the sum of \$31,000 be appropriated for operations in the next fiscal year, which sum, it is supposed, will complete the work on Swan Island Bar, and keep open the one at the mouth of the river during that year.

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

R. S. WILLIAMSON,

Bvt. Lieut. Col. U. S. A., Maj. of Engineers.

Gen. A. A. HUMPHREYS,

Chief of Engineers U. S. A., Washington, D. C.

SAN FRANCISCO, CAL., *October 16, 1869.*

COLONEL: I have the honor to report that, in accordance with your instructions, I went to Portland, Oregon, on the steamer which sailed from here September 29, 1869. Having arrived at Portland I went on board the dredger which was busily engaged in dredging at the lower end of Swan Island Bar. Previous to recommencing work at this point this summer we had excavated a channel, which carried fifteen feet of water, entirely across the bar. In your annual report of operations of the Willamette River it was stated that "this year it is expected to nearly complete Swan Island Bar to eighteen feet of water, at an estimated cost of \$31,200." This estimate, both as to time and cost, was made on the supposition that the cost of dredging, at a depth between fifteen and eighteen feet, would not vary very materially from what the previous dredging had cost; but, upon resuming work at Swan Island, (since the annual report referred to was submitted,) we find that

the operation of dredging is greatly retarded by the presence of innumerable snags, one of which (recently excavated) measured six feet in diameter by forty feet in length. The time occupied in removing one of these snags would be sufficient to excavate upwards of one thousand cubic yards of sand; it also causes an additional expense by incurring numerous breaks in the machinery of the dredger, which, were it not for the snags, would probably not occur. From the fact that these snags are at the lower end of Swan Island Bar, and embedded at this depth, and also from the fact that some of them have copper attached, (probably from some vessel having scraped over them years ago,) I am inclined to think that the lodging of these snags at this locality was the cause of the formation of Swan Island Bar. It may be that as we progress with the excavation further up the river these snags will disappear; it is probable that such will be the case, but should it be otherwise, it will be nearly impossible to estimate, with any degree of correctness, what it will cost to excavate Swan Island Bar to eighteen feet of water. It is certain, however, that unless these snags soon disappear the work cannot be completed during this fiscal year, and an additional appropriation will be required. At this date, there is available to prosecute the work \$16,788 88, which will be sufficient to work for about five months longer, and allow us to attain a depth of seventeen feet of water over the bar, providing that portion of the bar between the references fifteen feet and seventeen feet be ordinary material, as sand and clay, but should this mass contain many snags, then the amount available will be insufficient to complete the work to that depth.

An annual appropriation is or will be required to keep the channel at the mouth of the Willamette River open. To open a channel, giving seventeen feet of water at the mouth, has cost the United States, in round numbers, \$13,000. It is probable that this channel will partially refill during the summer freshet, but in all probability two months dredging will again open it. This will cost about \$6,000. This amount annually appropriated would probably suffice to keep the channel at the mouth of the river open.

As it is proposed to dredge Swan Island Bar to eighteen feet of water, I think it would be advisable to request that an additional appropriation of \$25,000 be asked for; this, together with one of \$6,000 for the mouth of the river, would enable us to work until June 30, 1871, and would probably complete a channel of eighteen feet of water in the Willamette River from Portland, Oregon, to its mouth.

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

W. H. HEUER,

Lieut. of Engineers.

Bvt. Lieut. Col. R. S. WILLIAMSON, U. S. A.,

Major of Engineers.

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SAN FRANCISCO, *February 13, 1869.*

GENERAL: In compliance with orders from headquarters Corps of Engineers, dated at Washington, September 5, 1868, I proceeded to San Pedro or Wilmington, California, and made an examination of the harbor at that locality. Having been kindly furnished from the Coast Survey office at this place with a tracing of the Coast Survey chart, scale