

351-364

43D CONGRESS, } HOUSE OF REPRESENTATIVES. { Ex. Doc. 1,
2d Session. } Part 2.

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-THIRD CONGRESS.

VOLUME II.
PART II.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1874.

331-364

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

(CONTINUED.)

1 ENG

molding-sand, and stone; two cargoes of corn, amounting to 8,000 bushels; 18 cargoes of salt, amounting to 23,000 bushels.

Besides these there are sundry cargoes of wood, ashes, and other articles difficult to enumerate.

The great difficulty of entering the harbor and reaching the wharves necessitates the more expensive importation of lumber, iron, and corn by rail, the amount of the latter article reaching about 60,000 bushels the past year. It is difficult to estimate the advantage which would be derived from a channel 6 feet deep to the wharves at low-tide, but it is clear to all persons of any experience in navigation here that many obstacles would thus be removed which cause delay and expense in receiving and discharging cargoes, and that new inducements would exist for a large increase of our commerce. Plymouth is already a place of considerable importance as a manufacturing town, its products reaching the sum of \$3,000,000 per annum; its water-power and general facilities for a large increase of business promise the best results from the improvement of the harbor which is now contemplated.

I trust, sir, that the enterprise will not end with a mere survey, but that it may be carried on to a successful and speedy completion.

I am, with respect, your obedient servant,

THOMAS LORING,
Collector.

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

APPENDIX Z.

ANNUAL REPORT OF MAJOR N. MICHLER, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1874.

UNITED STATES ENGINEER OFFICE.
Portland, Oregon, July 24, 1874.

SIR: I have the honor to submit herewith my annual reports upon works of river and harbor improvements, and of surveys and examinations under my charge, for the fiscal year ending June 30, 1874.

In obedience to Special Orders, No. 179, War Department, Adjutant-General's Office, Washington, September 8, 1873, I relieved Major H. M. Robert, October 22, 1873, of all his duties, including that of Light-House Engineer of the Thirteenth Light-House District.

Very respectfully, your obedient servant,

N. MICHLER,
Major of Engineers, U. S. A.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

Z 1.

IMPROVEMENT OF THE LOWER WILLAMETTE AND COLUMBIA RIVERS FROM PORTLAND, OREGON, TO THE SEA.

LOWER WILLAMETTE RIVER, OREGON.

The following improvements were projected and executed during the fiscal year.

Mouth of Willamette Bar.

The building of the United States dredger was not completed and in readiness for action until the end of August, 1873. The delay was

caused by the great conflagration in Portland during that month. On the 1st of September the dredger, dump-scows, and wood-scow were towed to the mouth of the river by the steam-tug Ben Holliday, and the operation of dredging the bar commenced. Four cuts, each 30 feet in width, were made to the depth of 17 feet, opening a channel-way of 1,800 feet in length by 120 feet in width. The quantity of sand and mud removed amounted to 8,550 cubic yards. The work at this point was completed by the 19th of November.

Post-Office Bar.

The dredger was moved up to this locality from the mouth of the river, a distance of four miles, and soon after began to operate. The latter work was suspended December 11, in consequence of the great inclemency of the weather, ice forming to such an extent as to make it necessary. It was resumed in the following season on the 11th of March, and the cut was finished by the 31st of the same month. Red and black buoys, constructed for the purpose, were placed in position. The benchmarks were renewed. The total length of cut through this bar is 1,552 feet, with a width of 30. The total number of cubic yards removed is 5,100.

Percy's Slough.

The special report of the proposed improvement at this slough, dated February 28, 1874, is herewith appended as part of this report. The appropriation asked, for the fiscal year ending June 30, 1876, will be expended in keeping open the channel of the Lower Willamette and in the necessary repairs to works. A survey will also be made of Willamette Slough, connecting the Willamette at Post-Office Bar with the Columbia at St. Helen's.

Special report of proposed improvement.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, February 28, 1874.

GENERAL: By your direction a communication from Major Robert, United States Engineers, of November 6, 1873, in regard to the improvement of the bar at the mouth of the Willamette River by the closing of Percy's Slough, near the mouth of the river, was referred to me for revision of the plan of improvement therein suggested and for further information. After a careful study of the reasons assigned by him for the proposed plan of improvement, and upon a thorough personal examination of the locality in question, the following report is respectfully submitted for your information. The project in itself is very reasonable and perfectly practicable, but as to the location of the proposed dam for closing the slough, it appears not to be the proper one, for several reasons which will be enumerated. The inclosed tracing of the map of the junction of the Willamette with the Columbia, showing also the connection between the two rivers through Percy's Slough, will fully exhibit their relative positions. In this proposed improvement it must be borne in mind that the extreme stages or freshets in each of the two rivers occur at entirely different seasons of the year, the interval between the two extremes of water being from four to five months. The last examination made by myself was on the 12th of this month, (February,) at about the average stage of usual high-water in the Willamette, and the tug-boat aboard which the inspection was made was unable to ascend the slough to what may be termed its head, as indicated by the line C D on the sketch. Above that line was an extensive bed of gravel and sand, through which the water could only percolate, if pass at all. Immediately below it was a deep pocket or basin, the soundings showing a depth of water averaging from 7 to 21 feet. This gravel-bar alone, without any additional aid, contains material enough, when set in motion by a strong current, during one of the freshets of

the Columbia, to be able to more than fill the channel at the mouth of the Willamette, when carried into it, held there, and deposited by the opposing currents of the waters of the two rivers. As reported, some 8,000 cubic yards of material accumulate during the freshet of each year, forming the bar at the mouth, and which must be annually removed by dredging, at an expense of \$4,000, in order to obtain sufficient depth of water to enable sea-going vessels to ascend to Portland.

Your attention, general, is called to the amount of shipments of wheat and flour alone, and the tonnage of vessels, foreign and home bottoms, to the annexed statement from July, 1870, up to and including January, 1874, as compiled by Mr. Bernard Natoop, of the firm of Roger, Meyer & Co., at my request, and to whom my thanks are justly due for the pains and accuracy with which it has been done. While, according to these figures, each yearly expenditure is more than justified, still more reasonable would it be to apply a few thousand dollars at once for perfecting what may prove to be a permanent improvement; the first-cost of any such work will be saved in the course of a year or two from the amount now required annually to be expended upon keeping a sufficient depth of water upon the bar by dredging. The bar at the mouth of the Willamette will not only be improved, but a good and lasting effect will be had upon what is called Post-Office Bar in the same river; the locality is about four miles above that at the mouth, and its formation is from similar causes. At a high stage of the Columbia River its waters are forced up the Willamette to a short distance above that bar, the counter-currents meeting at that point, and are then discharged back into their original bed through what is termed the Willamette Slough, entering again at St. Helen's, eighteen miles below. A survey of the slough is also recommended with reference to straightening it and removing some ledges of dangerous rocks and snags. A survey of it will be made during the summer, if authorized. Frequently, when the mouth of the Willamette is blocked with ice, the slough can be made available.

The plan proposed for damming Percy's Slough is simply to drive a line of piles of large dimensions across it, to cap them by heavy timber, and to strongly brace them from below; also to cut and throw in, above the row of piles, cuttings from the willow-trees, which can be had on the spot; these will sprout up and grow, thereby forming, in time, a strong obstacle in themselves to the current of the Columbia. The estimated cost of the entire work will be \$5,210.26. The location of the dam, as selected by Major Robert, is represented by the lines A B; its length is about 300 yards. The ends of the dam at this point terminate on both sides of the slough in low banks, and, in consequence, a strong current may, during the high-waters of the Columbia, wash them away and form new channels. The location of the dam which in my judgment is the best is the one represented by the line C D; length, about 300 yards. In this position both ends of the dam would abut against high bluff banks on either side of the slough, the most elevated portions of the two islands, (Percy's and Bybee's.) Both these islands would have to be flooded entirely before the water could pass over the dam; an event which is not likely to take place, no incident of the kind being on record. A dam built along C D would not interfere with the boat-landing now used by the planters in the neighborhood, being, as before stated, really at the head of the slough.

The following is the estimated cost of building the pile-dam:

Length, 857 feet; diameter of piles, 15 inches.	
686 piles, 15 feet long = 10,290 linear feet, at 6 cents.....	\$617 40
Driving 686 piles, at \$2.....	1,372 00
857 feet capping, 12 by 12 inches, at 12 cents.....	102 84
Sawing off top of piles and fastening caps, at \$1 each.....	857 00
12,348 pounds strap-iron and spikes, at 14 cents.....	1,728 72
86 piles for bracing, 20 feet long = 1,720 linear feet, at 6 cents.....	103 20
Driving and fastening 86 piles, at \$5.....	430 00
Total.....	5,211 16

Very respectfully, your obedient servant,

N. MICHLER,
Major of Engineers, U. S. A.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

Statement of exports direct to Europe from Portland, Oreg., from July, 1870, up to and including January, 1874.

Menth.	Name of vessel.	Tonnage of 2,240 pounds per ton.
July	Herm Doctor	503
September	Alpha	750
October	Choverd	660
November	Fordensskfold	612
December	Lyra	621
December	Mont'y Castle	1, 233
Total tons		4, 379
1871.		
January	Gungner	693
February	Rosedale	610
March	Tennax Proposeta	604
April	Prince of Wales	637
May	Envoy	782
June	Panama	1, 075
September	Skiddaw	1, 046
October	Doreby	1, 221
October	Niobe	1, 000
October	Bristolian	1, 000
November	Alice Graham	660
Total tons		9, 326

Month.	Name of vessel.	Total cargo. (tons of 2,240 pounds.)	Lightered, (tons of 2,000 pounds.)	Draught of vessel.
January	Barracoute	908	.....	17
Do	Harrington	815	200	18
February	Metis	870	100	17½
March	Chetah	831	150	18
Do	Coldstream	720	150	16
April	Sparkling Dew	457	150	15
July	A. M. Small	1, 350	300	18½
October	Electra	748	200	17½
Do	Navigator	730	200	17½
Do	Manilla	745	200	17½
Do	Loch Dee	1, 070	240	17½
November	Siam	951	306	18½
Do	Zouave	1, 530	1, 000	21½
Do	Ded Deer	983	306	18
Do	Grasmere	1, 169	600	20
December	Namorth	528	100	16½
Do	Channel Light	810	220	18
Total		15, 215	4, 122	
1873.				
January	Victoria Nyanza	1, 433	750	19½
Do	Whittington	1, 300	600	19
Do	Mendelssohn	1, 204	509	20
February	Barracoute	917	.....	17
Do	Roswell Sprague	1, 222	418	20
Do	Caribou	1, 082	243	18
Do	Sarah Scott	830	.....	17½
Do	Ilione	1, 000	350	19
Do	Victoria Cross	951	150	18
March	Penang	764	.....	17
Do	Northumbria	844	.....	17½
Do	Gemini	648	.....	16
April	Tamaya	790	.....	16½
July	Hermene	782	.....	17
August	Confidence	1, 052	360	19
Do	Middlesex	1, 454	662	21½
Do	Lieut. Maury	546	76	17
September	Otago	1, 322	718	20
Do	Privateer	1, 251	620	20
Do	Windermere	1, 050	466	19
October	Wetterhorn	951	346	18
Do	Theresa Behn	620	136	17
Do	Romeo	937	230	17
Do	Spirit of the Dawn	1, 044	385	18
Do	Flecherd	970	200	17½
November	Vesta	541	.....	15½
Do	Lord of the Isles	936	190	17

Month.	Name of vessel.	Total cargo. (tons of 2,240 pounds.)	Lightered. (tons of 2,000 pounds.)	Draught of vessel.
1873.				<i>Feet.</i>
November	Gunger.....	793	225	18
Do	Eskdale.....	1, 802	1, 105	20½
Do	Santa Rosa.....	730	200	17
Do	Pifeshire.....	1, 036	350	18
Do	City of Paris.....	1, 311	708	19
Do	Electra.....	792	200	17½
December	Cutwater.....	1, 280	800	20½
Do	Allon.....	994	449	18½
Do	Prof. Airy.....	612	.....	17
Do	Powhattan.....	539	.....	16
Do	Discow.....	1, 205	310	18½
Do	Sidlaw.....	721	.....	17
Total.....		38, 256	11, 756	

RECAPITULATION.

Year.	Number of ships.	Cargo in tons of 2,240 lbs., (wheat and flour only.)	Lighterage, (tons of 2,000 pounds.)	Cost of lighterage, (gold coin.)	Remarks.
1870.....	6	4, 379	January.
1871.....	11	9, 328	.....	.....
1872.....	17	15, 215	4, 122	\$6, 000	
1873.....	39	38, 256	11, 756	17, 500	
1874.....	14	11, 120	.....	.....
Total.....	87	78, 298	15, 878	23, 500	

Shipments by coasters and steamers at 25,000 tons per annum.

LOWER COLUMBIA RIVER, OREGON.

The operations for the fiscal year were confined to the examination and survey of that portion of the river known as the Hogback, lying between Tongue's Point and Woody Island; the observations of the direction and force of the currents; also to determine upon the most eligible plan for dredging a channel. These several works were placed under the charge of Assistant Engineer R. B. Randall, who performed the duties under my instructions. The dredging and buoying of the selected channel were prosecuted with the United States dredger, Mr. D. E. Buchanan in charge. A steam-tug of sufficient power was also employed as a tender to the dredger, and several scows employed in the work. A map of the survey was made, which delineates, as completely as possible, the intricacies of the several channels and the positions of the many shifting sand islands; also a map showing the locality and course of the channel finally determined upon and dredged out; and a map showing the direction and force of the currents. These are all appended as supplementary to this report, and to which reference must be made, as explanatory of the latter. The survey was commenced April 20, and completed by the end of June.

After making a number of soundings, the narrowest place across the Hogback was found to be opposite to the black buoy No. 13, anchored there by the United States Light-House Establishment, and having on it, at the shoalest place, 10½ feet, exactly the same depth as in the channel heretofore used between the upper channel buoy and red buoy No. 10. An examination was then made of what is known as the Johnson Channel. The distance across the Hogback at this place was greater than at the other one, but as the course is more direct, it was believed

that, eventually, it would prove to be the better one. Accordingly the dredger was placed at the west end of the proposed cut. After working four days, it was found that the dipper would not bring up more than one-half of its proper quantity. The cause ascribed for this is, that, in the first place, the compact nature of the sand at the bottom having a tough sedimentary coating, makes it difficult for the dipper to grapple into it; and, in the second place, although the sand was apparently so hard, still, when raised and forced into the dump-scows, would show its characteristic of quicksand by leaking or filtering through the crevices between the jam and gates at the bottom of the hopper. Under these circumstances it was apparent that the mode of dredging employed would have to be abandoned. It was first proposed to use a scraper, to be dragged forwards and backwards by the tug, until a sufficiently deep channel could be obtained. It was then suggested that a large curved hoe, with teeth for raking attached to its lower edge, to be used on ebb-tide, would prove more efficacious. It could be soon made, and at a small cost. When ready for use considerable time had been lost, and the balance of the appropriation available for this work not being large, a change of plan was determined upon. This was, to proceed to work at the original proposed cut, opposite buoy No. 10, this being the shorter of the two, and where scraping could be done to better advantage, with the probability of opening a channel in the least time. The dredger was accordingly moored at the head of this cut, and May 27th work was commenced. At that date the depth was ten and a half feet; by the 24th of June a channel had been scraped down to fourteen and a half feet, which enables a vessel drawing twenty-one feet to pass over the Hogback, at high-water, without risk of touching. The deep-water channel below the cut has been very little affected by the deposits from the scraping. It is believed that the opening now made will continue to widen and deepen through the active and strong pressure of the current passing down Gilman Channel until it again assumes the form shown by the United States Coast-Survey chart of 1870. The *modus operandi* for executing the work, although interesting, need not be here described. As the flood-tides were very weak, the work was carried on the ebb. Upon the completion of the cut an invitation was extended by the engineer of the dredger, on behalf of this office, to all the pilots, both steamer and sailing-vessel, to examine the channel; five accepted, two of the former, and three of the latter, who, after sounding with their own lead-lines, expressed their entire satisfaction in regard to the work; they requested that a beacon be placed upon the sand on the outer side, which would enable them to use the new channel immediately. An iron beacon was planted, which will last for some time, and will serve as a leading-mark. Temporary red and black spar-buoys were also placed, which will answer until the Light-House Establishment replace them by permanent ones.

During the working of the dredger current observations were commenced. These were only noted at the time of ebb-tides, as there is so little flood in the month of June, it cannot have any influence in the formation of shoals. Owing to the great width of the river at Hogback the freshets from the Upper Columbia have no appreciable influence upon the level of the water; the only effect produced by them is to increase the current on the ebb, and retard it on the flood. The tides have their regular rise and fall. The best time for observations of currents would be in October or November, when the upper rivers are low. It is at that period that bars and obstructions are formed, caused by strong flood-tides, and heavy winds with a ground-swell from the sea.

Then the sediment and sand, brought down during the summer and retained in deep channel, are carried back (the salt water having made the particles lighter) to form new obstructions.

The usual appliances were used in obtaining the rate and set of currents; both are fully represented on the map transmitted, and are indicated by figures and arrows. Many of these observations were made during high winds and rough water, for both of which an allowance was made, and, although the results may not be strictly accurate, still they are sufficiently so for the purpose of giving an idea of the action and effects of the currents toward forming the shoals.

From present data no well-devised plan of improvement can be planned; it will be a study of the future. Owing to the great breadth of water it would seem more advisable to let nature work out its own channels, and to then follow them up each year by an economical use of the dredger.

In concluding this report it may be stated that upon the termination of the work the engineer in charge started June 25 with the dredger and scows, in tow of the steam-tug Sedalia, for Portland. After proceeding as far as Kathlamette the current was found too strong to continue along with the entire tow. The dumping-scows were accordingly left there to await the return of the tug. Upon the dredger being moored safely at its old landing near the city, the scows were sent for, and on the way up from Kathlamette the Sedalia took fire and was burned to the water's edge. The scows were subsequently towed up and laid alongside of the dredger. The crew of the latter was discharged upon its arrival.

Financial statement.

Balance in Treasury of United States July 1, 1873 :		
Lower Willamette.....	\$10,793 36	
Obstructions.....	9,206 64	
	\$20,000 00	
Amount appropriated by act approved June 23, 1874.....	20,000 00	
Amount expended during the fiscal year ending June 30, 1874.....	14,678 15	
Amount available July 1, 1874*	5,321 85	
Amount required for the fiscal year ending June 30, 1876.....	20,000 00	

*Of the amount available July 1, 1874, must be deducted \$4,800 for building dam across Percy's Slough, which is not yet completed.

Z 2.

IMPROVEMENT OF THE WILLAMETTE RIVER ABOVE OREGON CITY,
OREGON.

The report for the fiscal year ending June 30, 1874, for this improvement is respectfully submitted. The operations consisted in the removal of snags and other obstructions, the work continuing until November 8, 1873, at which time the snag-boat was laid up, the appropriation being exhausted.

Commencing at Horseshoe Bend, June 16, 1873, there were removed some large cotton-wood trees, which obstructed the channel very much; thence down the river many serious obstacles were encountered until Bowers's Bar was reached, where several snags were removed and placed in the wing-dam, which had been broken by floating trees and snags the previous winter. At Luckamutte, the renowned "big pine," with its fifty associates, had to be removed. A long time was consumed at this locality on account of these trees being deeply imbedded in the

gravel. Giant-powder was indispensable at this point, as well as at other places. Two hundred and eighty snags were removed during the working-season. Last year the snag-boat failed to remove many snags and stumps, which were removed during the present working-season.

The master reported that the boat did not fail in a single instance to remove every snag, tree, and stump of which it took hold. Many very serious obstacles to the navigation of the river have been removed; many still remain. It is recommended, in addition to the continued removal of snags during the ensuing fiscal year, that certain improvements pertaining to the building of wing-dams be made at the following-named points, should no other process be adopted, together with the removal of rocks at several of them:

LIST.

Polally Bar.	Rocky Rapids.	Magoogalon.
Yamhill Bar.	Long's Crossing.	Half-moon Bend.
Union Bar.	Buena Vista.	Bowers's Slough.
Five Islands Bar.	Wells.	Eola Slough.
Biterman's Bend.	Luckamutte.	Eola Slough Rocks.
Beaver Rapids.	Ferrier's Bar.	Rocky Rapids.
McClosky's Shute.	Fickel's Bars, (upper and lower.)	Humphrey's Rocks.

The average number of feet of wing-dams will be about 6,000. These obstructions extend from Oregon City to Bowers's Slough, a distance of about one hundred and nine miles.

Financial statement.

Balance in Treasury of United States July 1, 1873.....	\$1,500 00
Amount appropriated by act approved June 23, 1874.....	7,500 00
Amount expended during the fiscal year ending June 30, 1874.....	1,500 09
Amount required for the fiscal year ending June 30, 1876.....	25,000 00

Z 3.

IMPROVEMENT OF THE UPPER COLUMBIA RIVER, OREGON.

The appropriation for the improvement of the rapids in the Upper Columbia was exhausted during the working-season of the fiscal year. The following detailed *résumé* of the nature of the obstructions which have been overcome is respectfully submitted. Propositions in regard to the continuance of the work of improvement are also suggested. A personal inspection before and after the completion of the several works, together with valuable information obtained from the river-pilots and the engineer assistant in charge, furnish the data upon which this report is based. The work was done under contract with Mr. J. B. Montgomery, and was superintended by Mr. R. B. Randall, the duly authorized agent of the Government.

Under the direction of my predecessor, Maj. H. M. Robert, the removal of the whole of John Day Rock at the rapids of the same name was accomplished during portions of the months of January, February, and March of the year 1873; also the rocks at the Upper Umatilla Rapids, designated by the letters "Z," "Y," "W," and "X" on the maps previously submitted, were blasted, but the *débris* was not raked off and removed. At the Lower Umatilla Rapid work was commenced during the same period on the rock "E," but it was only partially removed in conse-

quence of the commencement of the annual rise in the river, which necessitated the suspension of all operations for the season. It should be here stated that it is only during the winter-months work can be successfully executed, as at that period the river falls to the very lowest stage, so that many rocks then become exposed above the surface of the water, and the latter becomes clear, thereby enabling the workmen to operate to greater advantage, and thus expedite their labors. Work at that time is somewhat impeded, and often temporarily discontinued, in consequence of floating ice. During the extreme cold weather, however, the thermometer ranging as low as 14° below zero, the river becomes frozen over in a solid mass above and below the rapids, and no interruption then occurs. The laborers soon become habituated to the extreme severity of the temperature, as the weather remains perfectly clear during the greater part of the winter.

Operations on the rapids were not resumed until the 1st of November, 1873, the river by that time having fallen to a suitable depth. The working-scows were then dropped down the river from Umatilla, at which place they had been moored during the summer, to Devil's Bend, a short distance below. At this point a channel was opened 100 feet in width and 600 feet in length; this was done by removing all bowlders or rocks from the gravel-bar above the bend, which lay within $5\frac{1}{2}$ feet of the surface of the water, at which stage it corresponded with the zero-point on the gauge at Umatilla. The boats now employed in running on the Columbia above the Dalles to Wallula, and during the highest stages of the water ascending the Snake River as high as Lewiston, are generally loaded to a depth of between $3\frac{1}{2}$ and 4 feet. As the bowlders are covered with little water, and being scattered promiscuously on the bottom of the river, which at this point spreads out to a great width, nearly 3,000 feet between the lines of low-water mark, they were always more troublesome and dangerous than the rocks below; the latter have comparatively deep water around them, and, their positions being well defined, can be easily avoided.

The operation consisted in anchoring the scows immediately over the rock to be displaced, and the drilling of the necessary holes to receive the tin cartridges filled with giant-powder; the latter were fired by a fuse protected by and fastened to the cylinder containing the powder by a wooden stick. The charge was from three to eight pounds, the cases being about three inches in diameter; the holes were drilled to a suitable size to receive them. Upon the completion of that portion of the work, December 2, there occurred for more than a month a severe freezing spell which caused much floating ice; work was consequently suspended during that time, and the boats moored in a safe cove opposite Umatilla. On the 8th of January of the present year the scows were warped up to the Umatilla Lower Rapid, and operations were resumed on the following day. At this locality only four rocks were removed, a sufficient number to open a channel large enough for the boats now plying on the river; they are designated on the sketch by the letters C, C', C'', and D. It was deemed advisable not to continue work on the rock E, which had been partially removed during the previous spring, as it seemed probable that by further lowering the water at that point other rocks might become exposed and made dangerous which otherwise are not so at present. Between the point of the reef and the gravel-bank the current has a velocity of twelve miles per hour. The work at the lower rapid was finally completed and accepted by January 28. Within a few days after this date operations were resumed in the high-water channel at the Umatilla Upper Rapid. By reference

to the map it will be seen that what has always been known as the low-water channel, and which has been used up to the present time, is a very long and circuitous one bounded on both sides by reefs and shoal-water.

Experienced pilots can alone navigate it. The one called the "High-water Channel," which hitherto has been used during the season of high-water, and which can now be safely run during the lowest stages of the river in which boats can pass over the rapids between Wallula and the Dalles, has been made a direct and short one. At this rapid such rocks were selected for removal as would most benefit navigation, as only a limited quantity could be displaced in order not to exceed the amount of the appropriation. Its width at the narrowest point is scarcely 40 feet; this, for several reasons, is by no means sufficient, and it is recommended that an increased width be given to it as soon as the necessary funds become available. It is stated, notwithstanding the unevenness of the bottom on the outside of the channel from which the rocks have been removed, that boats ascending with a draught of 4 or even 5 feet of water would experience no danger, but that in descending there would be considerable risk on account of the swiftness of the current, there being danger of a sudden sheer-off and the boats not being perfectly manageable. At the head of the rapid it has a velocity of twelve miles an hour. During a high stage of water the pilots will continue to use it as formerly, and as the river falls will learn by experience whether it is an improvement upon the "Low-water Channel," that on the Washington Territory shore.

To make the high-water channel perfectly safe at every stage of water, it is estimated that it would require the removal of about 100 cubic yards of rock on the south side of the head of the rapid, a like amount from the edge of the reef (at the narrowest point) on the south side of the channel, and a similar quantity, as contained in four rocks, on the north side. This work accomplished, a width of 75 feet would be obtained throughout its entire length; by then using it, steamboats coming downstream against the strong summer-winds would avoid the trouble and risk often experienced in running the other channel. By February 25 the work was completed so far as the nearly exhausted funds would admit, and its execution by the contractor accepted.

It may not be uninteresting to state the method adopted by the superintendent of the work for sounding the very swift current over the rapids. The scows, four in number, were fastened end to end, and firmly anchored from above the rapids; the entire length thus obtained was equal to 185 feet. A series of soundings, commencing at the head of the channel, was then taken, a long iron rod, graduated to feet and inches, being used; this was plunged well forward in the current so as to obtain as near as practicable a perpendicular position upon striking the bottom of the river. This was done once on each side and along the entire length of the united scows. The latter were then hauled by their boat-lines distances of 18 feet, and new sets of soundings taken until the entire width of the channel was passed over. The scows were then allowed to drop down their own length, and the foregoing operations repeated; this was continuously done until the whole length and breadth of the channel had been accurately sounded. By this method an area of 900 feet by 75 feet was examined. Angles were taken with a sextant at each shift of the boats upon some principal stations, those designated on the map by the letters C, D, and N; these were marked by iron rods set in holes drilled into the rocks for the purpose. These stations were established by triangulation from a base-line of

2,150 feet laid out and carefully measured on the Oregon shore. After the removal of the several rocks and the completion of the work upon those blasted the previous year, a second examination was made of the channel, commencing from its foot. Timbers 6 inches by 6 inches were rigged across the bow of the scows and planked; these projected over the sides so as to present a frontage of 40 feet. The iron rod was then used as before to obtain soundings at intervals of 5 feet, and an accurate section of the channel thus obtained. The boat was then heaved ahead by the hawser a distance of 5 feet, measured upon the latter, and a similar set of soundings obtained; this was continued until the head of the channel was reached. Angles to certain established points were taken with the sextant to locate each successive position of the scow. The top of the rock marked C was adopted by agreement as the level for the low-water mark, and the zero of the water-gauge at Umatilla was made to correspond with the same point.

The following recommendations are made in regard to future operations on the Upper Columbia at the several dangerous rapids which render navigation dangerous. In addition to the improvements previously suggested in regard to the "High-water Channel" of the Umatilla Upper Rapid, the captain and pilot of the steamboat Tenino, Captain Coe, recommends the removal of all the rocks on the north side. To this officer my thanks are justly due for much valuable information concerning the river and the nature of the difficulties to be overcome. He also states that if a channel was made with a uniform depth of 6 feet, and having only one rock left in it with but 5 feet on it, a boat in passing over it will have her headway deadened, the boat seeming to draw towards it; and from this cause arises the great difficulty of steering where there are many of them.

Howly Rapid is similar to the upper part of Devil's Bend. Large bowlders, which have been borne down on drifting ice, are deposited on the bar, and will have to be removed by the same method as was adopted at the last-named locality.

At Squally Hook the rocks marked A and B should be removed. In descending, a boat has to sheer so much across the current to avoid them that her stern is in danger of striking the latter. There is also a small one immediately in the channel, over which boats pass, excepting at the lowest stage of water.

At the Owyhee Rapid the river is both wide and shoal; the bottom is gravel, covered with bowlders. The steamer Yakima struck one of them, and while in a sinking condition was run on a bar below, her deck remaining just above the surface of the water. The improvements suggested for this locality are the establishment of leading-marks on the shores and the removal of all bowlders within 50 feet of the line on each side.

At the foot of Rock Creek Rapid there is a large rock, which should be blasted. In ascending, boats put close to its south side; in descending, owing to the swiftness of the current, they hug close the Washington Territory shore, making quite an elbow to avoid it, and incurring great risk at the same time of running upon others.

Between the Cascades and the Dalles, the shoalest place at the lowest stage of the river had seven feet of water upon it; there are other shoal places, but none are dangerous.

The amount of the appropriation for the current fiscal year, \$20,000, will be applied as far as possible toward the improvements above enumerated, so as to make the river from the Dalles to the crossing of the North Pacific Railroad (near the mouth of Snake River) in the same

navigable condition as at the several rapids, John Day, Umatilla, and Devil's Bend.

The quantity of rock removed was 1,425 cubic yards.

Financial statement.

Balance in Treasury of United States July 1, 1873.....	\$9,000 00
Amount in hands of officer and subject to his check.....	19,183 76
Amount appropriated by act approved June 23, 1874.....	20,000 00
Amount expended during the fiscal year ending June 30, 1874.....	28,085 11
Amount available July 1, 1874.....	98 65
Amount required for the fiscal year ending June 30, 1876.....	40,000 00

APPENDIX Z 4.

ANNUAL REPORT OF MAJOR HENRY M. ROBERT, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1874.

MILWAUKEE, Wis., August 28, 1874.

SIR: I have the honor to submit the following as my annual report on the works of river-improvement in Oregon for part of the fiscal year ending June 30, 1874.

By Special Order 179, War Department, Adjutant-General's Office, dated September 8, 1873, I was ordered to be relieved from this duty by Maj. N. Michler, who took charge of these works on October 22, 1873. Up to that date the work done was as follows:

IMPROVEMENT OF THE LOWER WILLAMETTE AND COLUMBIA RIVERS FROM PORTLAND, OREGON, TO THE SEA.

At the commencement of the fiscal year the steam-dredger (Morris and Cummings's patent $1\frac{1}{2}$ -yard bucket) was nearly finished, its completion having been very much delayed by its machinery being detained in San Francisco for payment of full freight-charges.

The great fire of August 2 in Portland, destroying over twenty blocks, caused another delay by the destruction of the foundry in which the steam-capstan for the dredger was being built. She was recalcked, as also were the dumping-scows, in August, and was finally finished two or three weeks after the commencement of the long low-water season. She was towed down river September 1 to the mouth of the Willamette, on which bar she began work, dredging a channel 80 feet wide and holding 15 feet at low-water. The work was done under many disadvantages, the engineer and men being new to her pattern, and the bottom very hard till broken; then consisting of fine quicksand, a large portion of which would float away before the bucket reached the scow. Notwithstanding these disadvantages, she removed in 18 working-days of September $36\frac{1}{2}$ scows of 100 cubic yards each.

Several large ships laden with grain, as well as the regular ocean-steamers, passed through the cut during this month, and, the dredging being in progress, necessarily some detention occurred until it had advanced sufficiently to give a temporary channel. The cut was made 40 feet wide across the whole bar, (350 feet,) then a second cut 40 feet wide was made alongside this, and a third cut, 2 feet deeper, in the center of these two, was being made when I turned over the work.

Five spar-buoys, 40 feet long, with sinkers and shackles weighing

over 2,000 pounds each, were placed in position on Swan Island Bar, in place of the old buoys, reported by the pilots as too small to be seen at night.

An examination of Columbia Slough was made by me, and my views as to the stopping of this slough by a pile-dam placed at the *widest* and *shallowest* part were transmitted to the Chief of Engineers in a report dated November 7, 1873, to which I would refer.

Examinations with the lead-line and sextant were made by my assistant over the various bars on the two rivers in advance of the dredger's work, to determine the best line for her to work on. These examinations were made at Swan Island Bar, where no material filling was found, only 4 to 5 inches, and of no great extent, after seven and a half months' intermission of dredging; also at the mouth of the Willamette River, where but 10 feet of water was found, and but 12 feet for a linear distance of 500 feet.

Also at Post-Office Bar, which had but 15½ feet of water on it, and at St. Helen's on the Columbia, where the average water on the line of cut was but 15 feet. The maps and results of these surveys were duly transferred to Major Michler.

A survey and chart was also made, by my assistant, of the "Hog's Back" Bar, in the Columbia River, near Astoria. The result was communicated to the Chief of Engineers in a special report dated November 7, to which I beg to refer.

The amount received and expended by me for this improvement is as follows:

On hand July 1, 1873	\$5,118 08
Received since, (of which \$5,000 was from the new appropriation for this fiscal year).....	7,406 64
Expended:	
New dredger	3,763 10
Stores and supplies.....	170 81
Watching property	29 41
Repairs	739 03
Dredging	966 20
Towing	800 00
Buoys	1,378 62
Office-expenses, salaries, &c.....	406 70
Surveys.....	646 86
Total	8,900 73
Balance transferred to Maj. N. Michler.....	3,623 99

IMPROVEMENT OF THE UPPER WILLAMETTE RIVER, OREGON.

One hundred and ninety-one snags were removed from the river-bed up to September 30, and the snag-boat crew built 360 feet of dam at Union Bar. Giant powder had to be used on several snags to loosen them and break them up.

Eight small buoys were placed in the river at Tualatin Rocks and Rock Island.

I visited the bars at Union and Yamhill, and found the wing-dams built there last year in good preservation, and answering the purpose they were intended for.

There have been received and expended for this work by me the following sums:

On hand July 1, 1873	\$12 21
Received since	3,000 00

Expended:	
Snagging.....	\$1,469 15
Towing.....	61 77
Repairs.....	36 84
Stores and supplies.....	175 64
Buoys.....	67 75
Superintendence, &c.....	178 71
Office-expenses, salaries, &c.....	245 57
Total.....	2,235 43
Balance transferred to Maj. N. Michler.....	776 78

IMPROVEMENT OF THE UPPER COLUMBIA RIVER, OREGON.

No operations in the field; waiting for low-water.

Amount on hand July 1, 1873, (of which \$15,157.50 was due the contractor, but retained till the completion of the entire work) \$19,214 33

Expended:	
Office-expenses.....	30 57
Balance transferred to Maj. N. Michler.....	\$19,183 76

SURVEYS FOR IMPROVEMENTS OF RIVERS AND HARBORS.—YAMHILL RIVER, OREGON.

I made an examination of this stream in September, to ascertain the nature of any improvement which might be undertaken, and to fix on such parts as would require an instrumental survey.

Expecting the arrival of my successor very soon, it seemed but proper for me to leave for him the responsibility of the survey and report upon this new enterprise, so I took no further steps, except, at his request, to make, on the day I left Oregon, (November 7,) a report to the Chief of Engineers upon the examination I had made.

The amount expended by me on this examination and the preliminary arrangements for the survey was \$122.31.

I was also charged with an examination of the mouth of the Coquille River, which was made by Major Michler.

Respectfully submitted.

HENRY M. ROBERT,
Major of Engineers, U. S. A.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers.

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COQUILLE RIVER, OREGON.

Report of Major N. Michler, Corps of Engineers.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., March 12, 1874.

SIR: The following report in regard to the proposed canal to connect the waters of the Coquille River with those of Coos Bay, State of Oregon, is respectfully submitted, in compliance with your instructions. Maps of the line of the lake survey, made under my direction, and of the