

The observations were made on June 16, 17, and 18, when the river was slowly rising, and when the mean surface-reading above the rapids was 116.9 feet, or 22.5 feet below the flood of 1876.

Unusually low water occurred last winter. The upper gauge read to 0.5 foot of extreme low-water reference. It is understood that the river has not been so low for at least ten years. The Oregon Steam Navigation Company had waited that period for a very low river to extend their incline track at the Upper Cascades. Two plates of water-curves are transmitted herewith. Previous to the time of placing the lower gauge, the records of the office show that a single reading by leveling of the water-surface in that locality was made on January 18. This reading was 74.2. On the same date the guard-gate gauge read 96.5; its record had a range from the preceding to the following day of 0.2. It is reported to me that the reading by leveling was made carefully, and with a full knowledge that it gave a water surface lower than that which had been taken as extreme low-water in fixing the canal references. The plotting of this single reading on the plate of corresponding readings of upper and lower gauges indicated that (73.4) is the reference of the water surface at the lower gate when the guard-gate gauge reads 96.0, or extreme low water; 75.5 had been previously taken as extreme low-water reference at the lower gate, and resulted from a reduction of level readings obtained during the survey of 1876-'77, and when the river was at or a little above mean low-water. The survey note-books show the following levels of water surface:

February 3, 1877, Station 3, line B.....	100.56
February 3, 1877, Station 33, line B.....	79.86
February 3, 1877, Station 63, line B.....	76.03
February 4, 1877, Station 3, line B.....	101.30
February 4, 1877, Station 33, line B.....	80.50
February 22, 1877, Station 3, line B.....	100.00
February 22, 1877, [Station 33, line B.....	79.0]
February 22, 1877, Station 42, line B.....	79.3
February 22, 1877, Station 64, line B.....	75.0
February 22, 1877, Station 75, line B.....	73.4

Station 3 is near guard-gate gauge, Station 33 near lower gate gauge, and Station 75 near end of breakwater. From plate 3 with upper gauge readings, as arguments, of 100.5, 101.3, and 100.0, the lower gauge readings would be respectively 79.7, 80.5, and 78.8; their agreement with the survey observations is a test of the level reading of January 18. Readings plotted on plate 2 show that during ordinary high stages there is a difference of about 6 feet in the elevations of water surfaces at the head and foot of the breakwater. The survey notes make this difference, as observed during a mean low stage, very nearly the same. It appears to be constant for different river stages, and, if so, the extreme low-water reference for the foot of the breakwater becomes (67.5.) It had previously been taken as (70.0.) The detailed statement of the reasons for making changes in low-water readings is given on account of their importance in determining canal references.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
First Lieutenant Engineers.

Maj. G. L. GILLESPIE,
Corps of Engineers.

K K 17.

IMPROVEMENT OF THE MOUTH OF COLUMBIA RIVER, OREGON.

A survey of the bar at the mouth of the Columbia River was made by Lieut. A. H. Payson, Corps of Engineers, August–November, 1878, under direction of Maj. J. M. Wilson, Corps of Engineers, to comply with as much of the river and harbor act of June 18, 1878, appropriating \$5,000 for the purpose, as required a thorough survey of the bar at the mouth of said river, and the preparation of a plan and estimates for its permanent improvement. Lieutenant Payson finished his survey in October, and after preparing his chart submitted a report to me (Major Wilson having in the mean time been relieved), dated November 16, 1878, which was forwarded with my report to the Chief of Engineers, dated December 18, 1878. They were subsequently printed in Senate Ex. Doc., No. 50, Forty-fifth Congress, third session.

I shall not be able to prepare a plan and estimates for the improvement contemplated in the act approved June 18, 1878, until the investigation of the conditions which affect the character of the harbor shall have been more extended. In studying the changes which had lately taken place in the harbor, and in preparing the comparative chart which accompanied my report to the Chief of Engineers of December 18, 1878, I received great assistance from the detailed and careful chart of the harbor made from the survey by Captain Jessen, under Major Wilson's direction, in 1876.

By act approved March 3, 1879, \$5,000 were appropriated to continue the current observations commenced last season, and when the money becomes available the survey will be placed under the charge of a competent assistant.

The following statistics required by act June 23, 1866, are respectfully submitted. The appropriations for this work have been as follows:

Act of June 18, 1878.....	\$5,000
Act of March 3, 1879.....	5,000
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	10,000

The harbor is in the collection-district of Oregon. Astoria, 12 miles above the mouth of the Columbia, is the nearest port of entry. There are one light-house and one work of defense on either side of the entrance.

Amount of revenue collected at Astoria during the 11 months ending	
June 1, 1879, was.....	\$21,071 31
Value of imports.....	565 00
Value of exports.....	1,953,033 00
Vessels entered, 234; aggregate tonnage.....	399,663
Vessels cleared, 269; aggregate tonnage.....	435,063

It is impossible to give an estimate of the extent to which commerce will be benefited by this improvement. Should an improvement be adopted for the harbor which will give an increased depth of water over the bar and enable vessels drawing 22 to 23 feet of water to cross without danger at all stages of the tide, the commerce of the whole of the north-west will be increased beyond the capabilities of any one to estimate at the present time.

Money statement.

July 1, 1878, amount available.....	\$5,000
Amount appropriated by act approved March 3, 1879.....	5,000
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	\$10,000
July 1, 1879, amount expended during fiscal year.....	5,000
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	5,000
July 1, 1879, amount available.....	5,000
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Amount that can be profitably expended in fiscal year ending June 30, 1881.	Unknown.

K K 18.

IMPROVEMENT OF ENTRANCE TO AND HARBOR OF COOS BAY, OREGON.

In accordance with the river and harbor act of June 18, 1878, a survey of the entrance to Coos Bay was made in August, 1878, under the direction of Maj. J. M. Wilson, Corps of Engineers, by C. M. Bolton, assistant engineer, and a report dated September 30, 1878, was submitted to the Chief of Engineers.

This report was transmitted by the honorable the Secretary of War to the United States Senate, Forty-fifth Congress, third session, December 14, 1878, and published in Senate Ex. Doc. No. 14 of that session.

In reference to the proposed improvement, Major Wilson says in his report:

In any improvement of the entrance to this bay three objects must be kept in view: First, the tidal flow in the bay proper must not be decreased, but must be made as great as possible; second, the flow of the ebb from the bay must be so directed as to prevent it from meeting directly that coming from the South Slough; and, third, steps must be taken, if possible, to prevent the drift sands from moving the sand spit into the channel.

To accomplish these results it was proposed to confine the new channel between two training-walls, starting at or near Fossil Point and running almost due west across the north sand spit out to deep water.

The estimated cost of the two training-walls was \$972,000. Should it be decided that the training-wall on the north side will not be required, the estimated cost of the other wall was \$600,000. By act of Congress approved March 3, 1879, the sum of \$40,000 was appropriated for "improving the entrance to and harbor of Coos Bay, Oregon."

The plan of the improvement of the harbor has been submitted to the Board of Engineers for the Pacific coast for consideration, and no steps will be taken for the expenditure of the appropriation until their report shall have been made to and approved by the Chief of Engineers.

In advance of this report I cannot make at this time any recommendation relative to a future appropriation.

The following information required by the act of Congress of June 23, 1866, is respectfully submitted.

The first appropriation for this work was act March 3, 1879, \$40,000.

Coos Bay is in the collection-district of Southern Oregon; Empire City, on the bay, is a port of entry. The nearest works of defense are at the mouth of the Columbia River, about 100 miles north. The nearest light-house is at Cape Arago, on the south side of entrance to Coos Bay; it is of the fourth order—fixed, varied by white flashes.

Imports from foreign ports for the year ending June 1, 1879, none.

Exports to foreign ports for the year ending June 1, 1879, none.

Revenue collected during the year, none.

There were in the year 210 arrivals, and the same number of departures, of coastwise vessels at the port of Coos Bay, nearly all from and to San Francisco, carrying lumber and coal to that point.

It is impossible to state the extent to which commerce will be benefited by this improvement.

There are 14 saw-mills in operation along the bay, and 5 coal mines have been opened. These and all other interests of the bay and harbor are still in their infancy, and require further development before any accurate statistics can be given or predicted. It is one of the most important harbors on the southern coast of Oregon, and is the outlet for an extensive and growing district lying to the eastward.

Money statement.

Amount appropriated by act approved March 3, 1879.....	\$40,000 00
July 1, 1879, amount available.....	40,000 00
Amount (estimated) required for completion of existing project.....	932,000 00

Amount that can be profitably expended in fiscal year ending June 30, 1881, cannot be given in advance of the report of the Board of Engineers for the Pacific coast.

K K 19.

IMPROVEMENT OF LOWER CLEARWATER RIVER, IDAHO.

In accordance with the river and harbor act of June 18, 1878, an examination was made of the Clearwater River, Idaho, under the direction of Maj. J. M. Wilson, September to October, 1878, by Assistant Engineer P. G. Eastwick, and a report submitted to the Chief of Engineers October 16, 1878.

The examination extended from Jackson Bridge, on the South Fork, near Mount Idaho, to the mouth of the Clearwater at Lewiston, a distance of about 84 miles. It was found impracticable to improve the South Fork, as it was but a mountain stream choked with rocky reefs. The Middle Fork or main Clearwater River was, in the report of Major Wilson, considered under the two heads of Upper and Lower Clearwater. The former, which extends from the mouth of the South Fork to the middle of the North Fork, a distance of 29 miles, was found full of rapids, with rocky and gravelly reefs, and at two points impracticable of improvement except by slackwater navigation.

The latter extend from the mouth of the North Fork to Lewiston, a distance of 40 miles. In this latter section many rapids and shoals were likewise found, and it was estimated that a depth of 4½ feet at low-water could be maintained throughout the section by the removal of 379 cubic yards of solid rock, 335 cubic yards of loose rock, and 21,200 cubic yards of cobblestone, at an aggregate expense of \$34,424.

By act of Congress approved March 3, 1879, the sum of \$5,000 was appropriated for improving the Lower Clearwater River, and this sum will be applied, it is expected, in removing solid and loose rock at the shoals where improvement is needed, commencing with Ruben's Rapid, 4½ miles from Lewiston, and it is probable navigation at medium stage may be extended to the mouth of Lapwai Creek, a distance of 12 miles.

There is a large section of very fine land open to settlement on the upper waters of this river, and many mines have been opened which yield a fair return to the miner. The timber on the Middle and South Forks is also said to be excellent and in large quantities, and is brought out by rafting, for which the river furnishes every facility. At this time, when the country is sparsely settled, and there is no commerce on the river of any kind, it is not thought proper to recommend any money for further improvements. The head of navigation in this direction is Lewiston, and all the persons with whom I have conversed who live in the country, or have any extended interest along any of the water-courses in southeast part of Washington Territory, say that they would much prefer to have the assistance the government is willing to extend them applied in the improvement of Snake River below Lewiston, and of the Upper Columbia below the mouth of the Snake. My visit to that section last spring confirms their views.

I would recommend that the moneys intended for the further improvement of this river be included in the appropriation under the existing

head for the improvement of the Upper Columbia and Snake Rivers, and that the improvements take place in the Clearwater only after the rapids in the lower water-courses have reached such a state of perfection as will justify or warrant the extending of the head of navigation beyond Lewiston. In this way the section of country drained by these rivers will reap the benefits of the improvements in proportion to their necessities, and no money will be frittered away in the improvement of a mountain stream where there is no commerce, and which cannot be reached when improved from the sections of the lower navigable rivers.

In compliance with act of Congress of June 23, 1866, I respectfully state that the first appropriation for this work was act of March 3, 1879, \$5,000.

The Clearwater is in the collection-district of the Willamette. The nearest port of entry is Portland, Oreg., at which the revenue collected for the year ending June 1, 1879, was \$139,149.40.

The amount of navigation which it is practicable to improve is about 50 miles. At present there is no commerce on the river, and no commercial boat has ever gone higher than the mouth of Lapwai Creek, 12 miles from Lewiston, for purposes of trade.

The nearest light-houses and works of defense are at the mouth of the Columbia River, about 500 miles.

Money statement.

Amount appropriated by act approved March 3, 1879	\$5,000 00
July 1, 1879, amount available.....	5,000 00
Amount (estimated) required for completion of existing project	29,424 00

KK 20.

EXAMINATION OF ROGUE RIVER, OREGON.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., January 21, 1879.

GENERAL: I have the honor to submit herewith my report on the examination of Rogue River, Oregon, made in compliance with the river and harbor act approved June 18, 1878.

The act calls for a *survey*, but by reason of its inaccurate phraseology in placing Scottsburgh upon the Rogue River, this office could not determine whether it referred to the Rogue or to the Umpqua River.

In view of the doubt created by the language of the act, the honorable the Secretary of War, under date of September 20, 1878, directed that no survey be made, and that a report be prepared on Rogue River from the facts already known relative to the river.

This office possessed no information about the river, and could gain none in this vicinity, excepting the passing notice of the harbor, given in the records of the coast survey of the Oregon coast. Many letters were addressed to influential men throughout the State, requesting information, but no reply was elicited. In order, then, to meet the intent of Congress, and to carry out the subsequent instructions of the honorable the Secretary of War, I deemed it incumbent upon me to send a competent engineer to the river to make a hasty examination, and to collect such data as would assist me in reporting upon the general character of the stream and the agricultural and mining resources of the country traversed by it.

The gentleman selected was Mr. Philip G. Eastwick, assistant engineer, whose ability and previous service in various departments under the general government, dating as far back as 1862, highly recommended him to my attention. The examination was made during a very inclement season of the year, and the difficulties everywhere encountered along the river by reason of its numerous rapids and falls, together with the poverty of the country in furnishing any ready facilities for passing them, made the task one of no usual experience and hardship. Mr. Eastwick deserves great credit for the zeal, energy, and ability displayed in executing the instructions given him. I submit herewith his report. It is so descriptive of the river and the adjacent areas drained by it, that I feel it unnecessary to do anything more than summarize the principal features of the examination, and to embody my views as to the results.

In explanation of the length of the river examined, I have to say that it was impracticable at this season to reach the mouth of the river by sea without taking up more time than I could allow for the examination, and accordingly Mr. Eastwick was directed to go overland to the river by the nearest and most practicable route, and to follow it thence to its mouth by any means he could either hire or readily construct.

Rogue River is approximately 300 miles long; it rises in Crater Lake, in the Cascade Range, runs generally in a southwesterly direction; drains with its various tributaries the three counties located in the southwestern corner of Oregon, adjoining the California line, and finally reaches the ocean near latitude 42° 25' north, and longitude 124° 21' west. From Rocky Point, the initial point of the examination, for the first 26 miles the river was found to be a passably good stream 100 to 180 feet wide, and draining a narrow but somewhat rich valley; many small rocky rapids occur, which might possibly admit of slight improvement if the river had a better outlet. For the next 70 miles the river possesses all the features of a mountain stream, steep slopes, swift in its currents, and filled with rapids and falls, choked with detached masses of rocks and bowlders, which discourage any attempts at improvement. In the outer reach of this section the river breaks through the Coast Range of mountains in a deep, narrow, and rugged cañon about 25 miles long, extending to Big Bend, about 10 miles above the confluence with the waters of the Illinois River, a southern tributary. In this particular part the rapids occur in rapid succession, and in one place the fall is as great as 60 to 80 feet to the mile, the average throughout the section being 15 to 20 feet per mile. From Big Bend to the mouth of the river the channel is from 200 to 400 feet wide, the bends are very abrupt, and the connecting straight reaches short and cut up into frequent shoals and swifts, making navigation impossible for vessels having any commercial importance. Along this portion hydraulic mining has been carried on rather extensively, and the miners have used the river as a dumping ground for their mining *debris*, thereby filling the bed and shortening the tide-way, which extends to about 4 miles from the mouth. The river is practicably navigable only 2 miles from its mouth, and for the smallest grade of vessels, drawing not to exceed 6 feet of water. Its improvement will not therefore be considered as worthy of any thought or attention.

As regards the harbor, it scarcely merits any better consideration. It is very small in capacity, possessing only 200 or 250 acres, with the greatest depth, in the center, of 15 feet at low-water. It has on the south side a long, low, and sandy shore, and on the north side a range of high hills, from which project to the southward a long, low, sand-spit,

confining the channel to a crooked course across the bar. During moderate winds from any point, the sea breaks heavily over the wide banks of shifting sand that cover the entrance, and the channel over the bar, under the most favorable circumstances, is too narrow for sailing-vessels to turn in, and has but 8 to 10 feet at low-water. The range of the tides is about 5 feet.

There is no settlement of any extent at the harbor, and there is nothing to invite commerce or trade. The eastern and western parts of the river, divided by the Coast Range, cannot be connected by any practicable improvement, and even if the western part were improved so that vessels could reach the western slopes of the Coast Range by an unobstructed navigation, there is no local interest which would encourage vessels to use it.

Rogue River Reef, a prominent group of inshore rocks, lies 4 miles to the northward of the entrance to the river, and makes this part of the coast dangerous of approach. The inside channel is never used by coasting steamers, as it is considered more dangerous than any other on the coast.

I invite attention to the report of Mr. Eastwick, and desire to say that I agree with him thoroughly in the conclusions he arrives at relative to the propriety and practicability of the improvement of the river, and will not make an estimate for any improvement of the harbor, since there is no commerce there to be benefited or encouraged, and it would never be selected as a suitable place for the construction of a harbor of refuge.

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

G. L. GILLESPIE,

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

CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. PHILIP G. EASTWICK, ASSISTANT ENGINEER.

PORTLAND, OREG., January 16, 1879.

SIR: In compliance with instructions contained in your communication of December 7, 1878, I proceeded from Portland, by railroad and stage, to Rogue River Valley, reaching that river at Rock Point on the 13th of December. Here I engaged two men to accompany me down the river to the sea. Being unable to find a boat on the river suitable for the work on hand, I was delayed at Woodville, a point on Rogue River, at the mouth of Evans's Creek, 6 miles below Rock Point, until the 18th, in building a boat, with the aid of which I descended the river to a point in the heart of the Coast Range of Mountains, 65 miles below Rock Point and 75 miles from the mouth of the river. Here, in lowering the boat over the rapids, it was carried away by the strong current, and wrecked on a rock in the river a short distance below, the entire contents of the boat being emptied into the river and soon carried out of sight.

After unsuccessful attempts to regain the wrecked boat from where it had lodged on the rocks, I abandoned it and proceeded afoot down the river to the mouth of Illinois River, a distance of 44 miles. Here I was fortunate enough to procure a small boat to take me to Ellensburg, at the mouth of Rogue River, a distance of 31 miles; from whence, after making the necessary examinations of the harbor, I returned to Portland.

Rogue River takes its rise in the Cascade Range of Mountains, its highest and principal source being Crater Lake, a lake sunk deep into the crest of the mountain, and occupying the place of an extinct crater. From its source, it flows in a general south-westerly direction down the western slope of the Cascade Mountains until it enters the agricultural basin known as "Rogue River Valley," at a point estimated to be by the meanderings of the river about 175 miles from the sea.

But little is known of the character of the upper part of the river, before it emerges from the mountains, beyond a general knowledge of its ruggedness.

After entering the agricultural district referred to, the river receives many large tributaries, principally from the south, which drain an extensive area of agricultural and grazing country centering around Jacksonville, Ashland, and Applegate, the three

principal business centers of the valley. This country is described as an extensive and heavily-undulating table-land, extending from the foot-hills of the Cascade Range on the east to those of the Coast Range on the west, and from the foot-hills of the Siskiyou Mountains on the south to Rogue River on the north, embracing an area of 600 to 800 square miles. Much of this country is prairie land, or land covered with a light growth of timber, and it is here that is collected the principal settlements of Rogue River Valley.

My examination of the river embraced that part of it lying between Rock Point to the mouth of the river, a distance estimated to be 140 miles. Twenty-six miles of this, immediately below Rock Point, lies in the western end of the basin heretofore described, the river flowing in a nearly direct westerly course to Green's Bend, having cut a channel throughout this distance deep into a bed of cement-gravel. The banks of the river rise to a height of from 30 to 50 feet above the present low stage of water, and are surmounted on both sides by level or slightly undulating table or bench land, generally of narrow width, but occasionally extending a mile or more back from the river. These tablelands skirt the bases of steep hills. On the tablelands frequent areas are found which have been denuded by floods and the rocky substratum exposed. As a rule, however, they are covered with a deep, rich loam, quite free from stone, to near the bases of the lining hills, where the surface is generally found to be covered with fragments of rock detached and fallen from the hillsides. The hillsides are covered with loose rock and frequently with rock in place. The banks of the river immediately adjoining the water are generally rocky, the rocks being frequently imbedded in the cement-gravel.

On the 26 miles of river from Rock Point to Green's Bend, I passed over 33 rapids, many of them, however, showing as such only at the low stage of water prevailing at the time of the examination. A remarkable feature of the river-bed is the entire absence of loose gravel or sand bars. This is no doubt due to the effect of the very strong current which prevails in the river at the time of the freshets, the volume of water and intensity of the current at such times being such as to carry before it all the gravel and sand as soon as it is detached from the cement, leaving the bottom and sides swept clean of all small, loose material, and frequently channeled out in the bed of the river in narrow and deep furrows running with the direction of the river.

At a number of the rapids the channel is obstructed by masses of detached rock irregularly scattered through the river. The average fall of this part of the river is from 8 to 10 feet per mile, the fall being generally concentrated at the rapids over short distances, where the water falls in many cases at the rate of 1 to 1½ feet in 100 feet, the intervals between the rapids having frequently very deep and slack water.

The width of the river throughout the distance here under consideration varies but little from 150 feet, except at a few of the rapids, where the width is frequently somewhat less.

From Green's Bend to Big Bend, a distance of 73 miles, the character of the river is that of a rapidly-falling mountain stream. It is with very few exceptions narrow, rarely exceeding 150 feet in width, and frequently narrowing down to a width of from 25 to 50 feet; the waters in the narrows pouring with great velocity and rapid fall through the gorges. The fall of the river is, as may be expected, very great, though occasional long and slackwater levels are met with, more especially in the close cañons, where, in some cases, the river being very deep, the current was scarcely perceptible. At one place, 58 miles below Rock Point and 82 miles from the sea, the fall of the river over a distance of a half a mile I estimate to be 30 to 40 feet. The average fall of these 73 miles of the river will, I think, be as great as 15 to 20 feet per mile.

This part of the river abounds in rapids and waterfalls, 72 of them occurring in the first 39 miles of this division. At a number of these the fall in a very short distance is as great as 10 feet.

Entering this division of the river at Green's Bend, the cement-gravel of the river bed rapidly disappears, occasional and extensive gravel-bars are met with, and these in turn disappear, the mountains closing in upon the river, forming an almost continuous cañon for the balance of the distance, the walls of the cañon being very frequently of barren rocks rising in places perpendicularly to a height of several hundred feet, their summits surmounted by the steep mountain slopes. More generally, however, a narrow beach very much obstructed by large masses of rock is found between the river and the foot of the bluffs.

The division of the river throughout its entire distance cuts through that part of the Coast Range of Mountains known as the Rogue River Mountains. From Green's Bend, the general course, at first north, deflects gradually to the west, until in passing through the heart of the mountains it has a generally westerly course. From here the direction is changed to southwest, which direction is maintained as far as Big Bend. The river throughout this entire distance is very crooked and has many very abrupt bends. As a consequence, the distance between the extremities of the division, which, on an air-line, is from 30 to 35 miles, is increased to 73 miles by the river.