Its approaches are unsurpassed, having on the east of the harbor a prominent sugar-loaf mountain of 1,800 feet altitude, laved by the waters of the bay, and four miles east of this mountain another, with an altitude of 2,300 feet, thus presenting to the navigator landmarks that cannot be mistaken in approaching the shore. The country in the interior is undoubtedly as rich in resources as any other portion of our coast, with inexhaustible deposits of coal, iron, copper, silver, and gold, extensive bodies of timber, and fertile valleys, all teeming with nature's riches, but, like the major portion of our iron-bound coast, destitute of a place of shipment.

At the same time, important as are these internal resources, they should be considered but secondary to the great commercial demand for a port of refuge for the safety of the lives and property engaged in our coast traffic. We have only to refer to the sad detail of the sacrifice of life and property during the last winter, to raise our voice in prayer to the government to look to our safety. All shipmasters on this coast, those commanding our magnificent steamers as well as sailing-vessels, unite in recommending Port Orford as the place adapted for an improvement of this kind.

A chart of Port Orford, showing proposed breakwater and the direction of the heaviest seas and currents, is transmitted.

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

JOHN M. WILSON,
Major of Engineers, Brevet Colonel, U. S. A.

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

KK 9.

SURVEY OF COQUILLE RIVER, OREGON.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., September 30, 1878.

GENERAL: I have the honor to transmit herewith a chart of Coquille River, Oregon, together with the report of Assistant Engineer C. M. Bolton, and to submit the following report of a survey made under my direction, in accordance with the act of Congress approved June 18, 1878.

OBJECT OF THE SURVEY.

The act of June 18, 1878, provides for an examination or survey of "Coquille River, Oregon," and an estimate of the cost "of improvements proper to be made."

After careful examination and inquiry it was found that the object in view was to make such an examination as would show the necessity of improving the mouth of the river and to prepare plans and estimates for the necessary work.

THE COQUILLE RIVER.

The Coquille River is formed by the union of the north, south, and middle forks, which, rising in the Rogue River Mountains, Oregon, after very circuitous courses, unite about 45 miles from its mouth; the river empties into the Pacific Ocean half way between Coos Bay and Port Orford, about 15 miles south of Cape Arago, in latitude 43° 07′ N., longitude 124° 24′ west.

From the petition to Congress of the residents in the vicinity of Coquille River, dated December 30, 1875, I quote the following:

> The Coquille River will average 150 yards wide for 30 miles from its mouth, and is navigable for that distance by vessels drawing 14 feet water, and by light-draught steamers 20 miles more.

I presume the above refers to high tide, as Captain Parker, the pilot at the mouth of the river, informed Assistant Engineer Bolton "that the river was navigable for vessels of 10 feet draught at low-water up to Coquille City, 15 miles from its mouth, and that the tidal influence was noticed with a rise and fall of 1½ feet at a point 44 miles upstream."

Throughout this distance the river is described as presenting the features of a natural canal, its banks steep, its channel free from rocks, shoals, or rapids, and obstructed only by a few snags, easily to be removed.

THE ENTRANCE TO COQUILLE RIVER.

The south side of the entrance to the river is a bold, rocky headland, while the north side is a low, sandy spit, the entrance being only about 200 feet wide, with a depth of not more than 5 feet at low-water in the channel. On the bar outside the least depth is 9 feet at low-water.

In addition to these troubles there are many dangerous rocks in the immediate vicinity of the present entrance.

The great difficulty arises from the shifting sands and the rocks. From Captain Parker, the bar pilot, we learn—

> That the sands shift so rapidly that he cannot rely on information gained one day for the next, but has to make a thorough examination of the channel before each trip.

He also states that the channel frequently cuts through the sand spit near the ledge of rocks about 200 feet north of its present position, and that in December, 1877, a schooner and tug passed through at that locality.

The difficulty seems to be that the sand driven along by the strong northwest winds in summer rapidly prolongs this north spit, and that the current on the ebb, in the dry season, is spread over too great an area to give it sufficient scouring force to carry these sands out to deep water; the channel is therefore pushed down through the rocks until it occupies its present position.

As soon as the southwest gales commence in the winter the formation of the spit ceases, and the current of the river, greatly increased by freshets from heavy rains, strikes it almost directly a short distance below the rocky ledge and forces a channel through it, thus entirely avoiding the rocks below, near the present entrance.

THE TIDES.

The mean rise and fall of the tides is 5 feet.

THE VALLEY OF THE COQUILLE.

The Coquille River drains a section of country of about 900 square miles, consisting of valleys and low rolling mountains, which are covered with magnificent timber, including maple, ash, live-oak, fir, &c.; the mountains are said to be rich in coal, iron, gold, and other minerals, while the valleys are well suited to agriculture, all kinds of cereals growing luxuriantly, and fruits and vegetables in abundance.

PROPOSED IMPROVEMENT.

The best plan for improving the mouth of this river would seem to be by assisting nature in its efforts to keep open a channel through the spit near the rocky ledge about 2,000 feet above the present entrance.

For this purpose the people of the county have commenced the construction of a dam about 600 feet below the mouth of the creek indicated on the chart; this dam is built so as to receive the current nearly at right angles; its location is not deemed to be well selected, for the waters of a tidal stream, in order to improve it, should be gently led in the new direction, not suddenly turned, as in this case; the dam is of crib-work, filled with stone, but for want of funds work has been temporarily suspended.

It is now proposed to start a training wall from the point near the mouth of the creek, as indicated on the chart, and to carry it across the spit in a direction nearly west out to the depth of 12 feet at low-water, that being the depth desired to be gained in the channel. Starting from the rocky ledge on the spit and running nearly parallel with the training wall already mentioned will be another, the two approaching near their outer ends, so as to present a width of channel about equal to that at the present entrance. These walls should be carried up to a height of 3 feet above low-water, so as to obtain the full influence of the ebb tide; the outer ends should be carried to high-water mark, and have upon them cement-masonry bulkheads, carried to a height of 15 feet above high-water mark.

It is hoped that the increase of velocity due to the contraction of the channel will give sufficient scouring force to keep open a channel with a depth of 12 feet, as desired; as the current will naturally set along the lower wall, it is possible that the upper one will not be required.

As the fresh water in the Coquille River prevents the action of the "limnoria" and "teredo," that portion of the lower wall out to the spit can be constructed of crib-work filled with stone; beyond the spit, in the ocean proper, where the fresh water will not be materially felt, the wall should be of ordinary rubble-stone to the height of 8 feet below low-water, and of large blocks from 1 to 4 tons from that to low-water, the top and sides protected by pieces weighing from 5 to 20 tons.

The estimated cost of this work is approximately as follows:

Lower training-wall, 3,400 feet, at $26 per foot	$88,400
Upper training-wall, 2,000 feet, at $26 per foot	52,000
Two masonry abutments, at $8,000	16,000
Contingencies, 5 per cent	7,800
Total	164,200

In case the upper training-wall is not needed, the estimated cost of the work will be about $100,000.

Of this amount $50,000 can be profitably expended during the next fiscal year.

It is proposed to so regulate the direction of these walls that vessels entering during southwest gales, which are the most dangerous, will not be obliged to come broadside to the wind.

Stone for the construction of the work can be obtained near at hand, in Coquille River.

COMMERCIAL STATISTICS.

There is no port of entry on the Coquille River.

From Mr. W. A. Furman, notary public, at Randolph, Coquille River, I learn the following:

The coastwise imports consist of every kind of merchandise, and amounted to about 7,000 tons during the last fiscal year. The exports consist of white-cedar lumber, wool, hides, wax, wheat, potatoes, and eggs. There have been 3 schooners and 1 steamer running to the river.

These vessels draw about 7 feet, and sail in over the bar; they are towed out by a tug which is employed in the river; they carry about 90,000 feet, board-measure, of lumber, valued at $3,000.

The salmon-fishery business is growing rapidly on the river, three firms being now engaged in it.

It is thought that if the mouth of this river was once properly improved a large amount of capital and a number of vessels would be immediately employed in securing and carrying to market productions of this rich valley.

The Coquille River is in the collection-district of Southern Oregon. The nearest port of entry is at Empire City, Coos Bay. No revenue was collected from foreign imports at Empire City during the last fiscal year.

The nearest light-house is at Cape Arago, 15 miles distant. The nearest works of defense are at the mouth of the Columbia River, 195 miles distant.

The report of Mr. C. M. Bolton, assistant engineer, is transmitted herewith.

Respectfully submitted.

JOHN M. WILSON,
Major of Engineers, Bvevet Colonel, U. S. A.

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

REPORT OF MR. CHANNING M. BOLTON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, September 27, 1878.

COLONEL: On completing the survey of Coos Bay, I proceeded on the 26th of August, as directed by you, to the Coquille River, to make the required examination there. Although the mouth of the Coquille is only about 16 miles along the coast, south of the entrance to Coos Bay, the only line of communication is by steamboat from Empire City via the bay and Isthmus Slough to Utter, 18 miles; thence by railroad 5 miles to Coaledo, head of Beaver Slough; thence by rowboat down Beaver Slough 5 miles to Coquille River, 22 miles from its mouth.

I learned that the river was navigable for 10 feet draught as high up as Coquille City, about 15 miles from its mouth, and that the tide affects it 44 miles, where it rises and falls 1½ feet. The valley of the river is quite fertile and in good state of cultivation, and abounds in fine cedar and fir timber. Salmon-fishing is also carried on to a limited extent. I was shown specimens of gold quartz and coal of good quality, and was informed that they were to be found in large quantities on the upper river. Arriving at the mouth of the Coquille on the 27th of August, I at once organized a party and made the survey as shown on the chart. In consequence of the small amount of money available and the limited time at my disposal, the survey was extended only about three-fourths of a mile up the river.

The difficulty here, as at Coos Bay, seems to be the shifting sands and crooked channel, together with the addition of a much narrower entrance, and that obstructed by many dangerous rocks. Captain Parker, owner of the tug and pilot at the mouth of the river, informed me that the sands are so shifting that he cannot rely on information gained one day for the next, but has to make a thorough examination of the channel before each trip. He also told me that the channel is frequently as far north as "Ledge of Rock" on sand-spit and that as late as last December a schooner and tug passed out through that channel.

The citizens of the country, under the advice of Captain Parker, have commenced to build a training-wall of timber filled with stone, as shown on the chart, but for want of means work has been temporarily suspended. No well-defined bar exists at the mouth of the river, but a regularly-sloping beach with a narrow channel-way into the river. I learned that during the southwest winds of the winter it was impossible to run into the river with its present channel, but during the northwest winds vessels frequently run in under sail. I saw the schooner Mose, drawing 9 feet, run in under a very stiff northwest wind and anchor safely in the deep water just inside of the mouth.

To improve the mouth of the river, I would propose a training-wall to be built as indicated on the chart. That portion of the wall from the up-river end to the sand-

spit might be built of timber filled with stone, as the river furnishes enough fresh water to prevent the sea insects from injuring the timber, but from the sand-spit seaward stone will be required. The entire wall should be carried up to about 3 feet above low-water, and at the sea end an abutment of about 20 feet square run up to above high-water. After the completion of this wall, it may be found necessary to build an additional training-wall, as indicated by the broken lines, in order to protect the new channels from the drifting sands of the northwest winds which prevail during the summer. This wall should be built of the same dimensions as the first.

The following is the approximate estimated cost of the proposed improvement:

Southern wall, 3,400 feet long, at $26 per foot	$88,400
Northern wall, 2,000 feet long, at $26 per foot	52,000
Two sea-end abutments, at $8,000 each	16,000
	156,400
Contingencies, 5 per cent	7,800
Total	164,200

Very respectfully,

CHANNING M. BOLTON,
Assistant Engineer.

Col. JOHN M. WILSON,
Major Corps of Engineers, U. S. A.

KK 10.

EXAMINATION OF ALSEA RIVER AND BAY, OREGON.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., September 23, 1878.

GENERAL: I have the honor to transmit herewith a chart of the Alsea River and Bay, Oregon, together with the report of Assistant Engineer R. A. Habersham, and to submit the following report of an examination made under my direction in accordance with the act of Congress approved June 18, 1878.

THE ALSEA RIVER.

The Alsea River rises in the Coast Range of Mountains in Benton County, Oregon, about 30 miles in a direct line from the sea, and flowing first south and then west, empties into the Pacific Ocean about 12 miles south of Yaquina Bay.

From its source to a point about 15 miles from its mouth it is described as a mountain stream full of rapids and bowlders, with abrupt falls at various points of from 3 to 5 feet, obstructed by rocks and with very little water. At this point the stream is 80 feet wide and from 3 to 6 feet deep at low-tide, and gradually widens and deepens until the mouth of Drift Creek, 9 miles below, is reached, where it is 300 feet wide; the depth in this section varies from 3 to 20 feet, with an uneven and occasionally rocky bottom; the river is inclosed on both sides by hills ranging from 300 to 600 feet high, covered with grass, fern, and young thickets. On the left bank the hills slope to the water's edge; on the right bank a strip of level bottom, several feet above high tide and from 200 to 600 feet wide, extends along the river, broken occasionally by projecting spurs from the ridge.

ALSEA BAY.

About 3½ miles from its mouth the river spreads out into Alsea Bay, which is from 2,000 to 7,000 feet wide at high tide, covered with mud

flats bare at low-water, and through which are numerous shallow channels.

For a mile inside the mouth there is a channel and a perfectly protected anchorage with a depth of from 12 to 20 feet; immediately inside the bar is a hole 2,000 feet long and 300 feet wide at which no bottom was found at 6 fathoms. Near its mouth the bay is separated from the ocean by a sand-spit about ⅔ of a mile long and ⅛ of a mile wide; this spit narrows at its outer end, the outer 100 feet being covered at high tide; the channel at the mouth of the bay is about 300 feet wide, with the depth as indicated in the deep hole described above.

THE BAR.

Immediately in front of the mouth of the river, extending about 2,000 feet into the ocean, is a sand-bar, over which the least depth found at low-water was 8 feet. The law did not call for an examination of this bar, but it nevertheless would have been carefully made could it have been done without danger to life; but heavy fogs, rough seas, and bad weather, and the absence of any tug or safe boat at the time the survey party was there prevented the examination. A line of soundings was afterward run on a calm day by some citizens, who reported that the distance across the bar was 1,800 feet, and the channel 1,200 feet wide, with 8 feet as the least depth.

TIDE.

The tide rises about 8 feet at the mouth, and there is a rise of about 6 feet 8 miles above, the tidal influence being felt up to the foot of a line of rapids 15 miles from the mouth.

THE ALSEA VALLEY.

The valley of the Upper Alsea is situated about 40 miles from the mouth, measured via the river, and covers an area of about 300 square miles; it is considered one of the finest portions of Oregon for agriculture, the flax and wheat being excellent. The wheat crop for the present year is estimated at 60,000 bushels; great difficulty is, however, experienced in getting these products to market. In case the bar at the mouth of the river is found to be such as to admit vessels, it is proposed to build a good road from the settlement to the head of navigation.

Just south of the Alsea River is the Alsea Indian Reservation.

OBJECT OF THE EXAMINATION.

In the summer of 1875 a survey of this river and bay was made under the direction of Maj. N. Michler, Corps of Engineers. I caused a careful examination of the river and bay to be made in August, 1878, by Assistant Engineer R. A. Habersham, whose report is transmitted herewith.

The act of June 18, 1878, directed an examination to be made of the "Alsea River and Bay, Oregon," and an estimate of the cost of improvements "proper to be made."

The result of the examination and of conversation with residents at the bay demonstrated the fact that no improvement of this river and bay was expected, and none is deemed "proper to be made."

What the people of the Alsea Valley want and what I respectfully recommend is that an accurate survey may be made of their harbor and the bar in front of it, proper charts prepared for distribution to mariners, and the bar properly buoyed.

There is no port of entry at the Alsea River; as far as I can learn, only one vessel has ever crossed the bar, and that was built in the bay.

The nearest port of entry is at Newport, Yaquina Bay, Oregon, 12 miles north of the Alsea. No revenue was collected at Newport during the last fiscal year; there were no foreign imports or exports. There were 2 sailing-vessels of about 100 tons burden engaged in coastwise trade, which bring in about 600 tons of assorted merchandise annually. The exports coastwise are lumber and oysters.

The nearest light-house is on Cape Foulweather, about 15 miles distant, and the nearest works of defense are at the mouth of the Columbia River, about 125 miles distant.

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

JOHN M. WILSON,
Major of Engineers, Brevet Colonel, U. S. A.

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

REPORT OF MR. ROBERT A. HABERSHAM, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., September 18, 1878.

COLONEL: After completing the survey at Cape Foulweather, I proceeded to make he examination of Alsea River and Bay, as directed by your letter of instructions.

The Alsea enters into the sea 12 miles south of the mouth of the Yaquina. The road connecting the two points lies along the sea-beach, except for a distance of 1½ miles opposite Seal Rock, where the coast line is rocky, rising vertically out of the sea, at low-tide line.

The river rises in the Coast Range, 30 miles in a direct line from the ocean. Its general course is westward.

The principal tributaries are Fall Creek and Fire Rivers, the former entering from the north, 28 miles by river from the sea, the latter 6 miles lower. Drift Creek, which flows into Alsea Bay at its head, is a tidal slough or lagoon navigable for small boats for 4 miles. It does not contribute to the volume of the river proper, although it is included in the same general drainage basin, which covers an area of 300 square miles.

The tide extends 12 miles, from the head of the bay to the foot of the line of rapids, where my personal examination ended. Here the stream is 80 feet wide and from 3 to 6 feet deep at low tide. Above it is a mountain stream navigated only by Indian canoes, with a swift current and rocky bed. Below it is a tidal channel with no perceptible river current, widening gradually down to the mouth of Drift Creek, where it is 300 feet across. The depths along this section at low tide vary from 4 to 20 feet, the bottom being very uneven, and in some places rocky.

The bay is 3½ miles long and from 2,000 to 7,000 feet across at high tide. At low tide a large extent of mud flats is left bare, forming islands, between which the channels are so shallow as to admit only small boats and scows.

For a mile inside of the bar there is good anchorage, with a depth of from 12 to 20 feet at low-water, constituting a harbor of about 80 acres area, sheltered on all sides. Immediately inside of the bar is a deep hole 2,000 feet long and 300 wide, at the curve of 18 feet depth, in which no bottom was found at 36 feet.

The above data concerning the bay were obtained from the chart of the survey made in 1875 under the direction of your predecessor, Maj. N. Michler. At the head of the bay in the principal channel there is a bar half a mile long, on which I found only 3 feet at low-water. This point is not included in the limits of the survey.

Between the mouth of Drift Creek and the head of the tide-water, 12 miles, the river is inclosed on both sides by hills ranging from 300 to 600 feet in height, thickly covered with salal grass, fern, and young thicket. On the left bank the slopes of the hills reach generally to the water's edge. On the right bank a strip of level bottom, several feet above high-tide level and from 200 to 600 feet wide, extends throughout this section, broken at points by projecting spurs from the ridge. This strip is all taken up under the homestead and pre-emption laws, and a portion is under cultivation. It is all

alluvial soil, producing excellent corn, vegetables, and fruit, and wheat equal to any that I have seen in Oregon.

The river is the northern boundary of the Alsea Indian Reservation.

For 30 miles from the coast inland, the greater portion of the large timber in the valley has been destroyed by fire.

Forty miles from the bay, measured along the river, is the valley of Upper Alsea, covering an area of 300 square miles, in which some 50 families are settled. Its principal products are wheat, flax, oats, and cattle. The wheat crop of the present year is estimated at 60,000 bushels. A wagon-road is now being opened to connect with tide-water. At present there is no outlet from the upper valley save by a wagon-trail, almost intransitable in summer and quite so in winter, across the Coast Range to Corvallis in the Willamette Valley. Last year only about one-third of the wheat crop could be gotten to market before the trail was made impassable by the winter rains.

The principal value of the Alsea country is in its forests of fir and cedar, which cover the country above the burnt district, the timber being of the best quality and of large size.

Salmon visit the river in large numbers. The season commences between the 20th and 30th of August and lasts two months.

The information concerning the Upper Alsea country was furnished by Mr. Thomas Russell, an old resident and postmaster at Tidewater on the Lower Alsea.

It was not possible to make a personal examination of Alsea Bar, owing to the prevalence of heavy fog, rough seas, and bad weather generally, and the want of a suitable boat. I, however, engaged two of the residents of the vicinity to go out on the bar the first calm day and run a line of soundings across out to deep water. From them the following information has since been received: Least depth on bar in channel at low tide, 8 feet; width of entrance, 1,200 feet; distance across the bar, 1,800 feet.

No survey has ever been made of this bar, nor has any project for its improvement been suggested. All that the parties interested request from the government is that the depth of water be officially declared and the entrance buoyed, owners of steamers in San Francisco having assured them that when this is done they will send light-draught steamers to carry off the products of the valley.

Up to the present time only one vessel, a small schooner built in Alsea Bay, has crossed the bar.

Respectfully submitted.

ROBERT A. HABERSHAM,
Assistant Engineer.

Col. JOHN M. WILSON,
Major Corps of Engineers, U. S. A.

KK 11.

EXAMINATION OF CLEARWATER RIVER, IDAHO.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., October 16, 1878.

GENERAL: I have the honor to transmit herewith the report of Mr. P. G. Eastwick, assistant engineer, upon an examination of the Clearwater River, Idaho, made under my direction in September and October, 1878, and to submit the following report.

OBJECT OF THE EXAMINATION.

The act of Congress approved June 18, 1878, provides for an examination of the Clearwater River, Idaho, and the preparation of estimates for "improvements proper to be made."

After correspondence with the Hon. S. S. Fenn, Congressional Delegate from Idaho, I learned from him that it was desired that an examination of the river should be made from the mouth of the South Fork near Mount Idaho, Idaho Territory, to the mouth of the Clearwater at Lewiston, Idaho, a distance of about 69 miles.

No steamer has ever ascended the Clearwater higher than 30 miles from its mouth, but rafts have been brought down from the junction of the South and Middle Forks. As there was no rowboat in the vicinity, I had one made and hauled about 6 miles and launched in the south fork of the river at a point known as Jackson's Bridge, about 15 miles from its mouth.

About the middle of September I directed Assistant Engineer Eastwick to proceed to Mount Idaho, and to descend the river to its mouth, and to make a careful examination of its condition and the impediments to navigation, in order to determine what was required to improve it so as to make it navigable for the light-draft steamers now navigating the Snake River.

Mr. Eastwick proceeded to Wallula, Wash., by steamer, 240 miles; thence to Walla Walla by rail, 30 miles; thence to Lewiston by stage, 90 miles; thence to Mount Idaho by stage, 70 miles; a total distance of 430 miles. At Lewiston he organized his party, being fortunate in obtaining the services of gentlemen who had rafted on the river for several years.

DESCRIPTION OF THE RIVER.

The Clearwater River is formed by the junction of the Middle and South Forks, the former rising in the Bitter Root and the latter in the Salmon River Mountains, and after very circuitous courses uniting about 69 miles from the mouth of the river. The North Fork, which rises in the Bitter Root Range, unites with the stream 29 miles farther down, and the river then flowing west for a distance of about 40 miles empties into the Snake at Lewiston, Idaho, about 150 miles above the mouth of the latter stream and about 500 miles above the mouth of the Columbia. The bed of the river is of gravel, cobblestones, and bowlders, with here and there a reef of rocks extending into the channel.

Mr. Eastwick commenced the descent of the river at Jackson's Bridge on the South Fork of the Clearwater and made a careful examination of it as far as Lewiston, a distance of about 84 miles.

THE SOUTH FORK.

From Jackson's Bridge to its junction with the Middle Fork this branch of the river is simply a mountain stream, very crooked, with steep bluffs on each side except at a few points. The average fall is from 30 to 40 feet to the mile, with a great many rapids and bars and a depth of from 6 to 12 inches.

No improvements are deemed "proper to be made" on this fork.

For the discussion of the remainder of the river it is deemed best to divide it into two sections, called the Upper and Lower Clearwater.

1. THE UPPER CLEARWATER.

The Upper Clearwater consists of that portion between the mouths of the South and North Forks, a distance of about 29 miles.

For 22 miles it passes through a granite country, the remainder of the distance through a basaltic formation. In the granite section the sidehills are steep and rocky, the bluffs at times close to the water's edge forming cañons; in the basaltic section the hills are less steep and have frequently at their bases narrow pieces of arable land. Within

this stretch of the river Mr. Eastwick found the following impediments to navigation:

Indian Billy's Rapid, 27 miles above North Fork.
Reuben's Rapid, 23 miles above North Fork.
Miner's Rapid, 19 miles above North Fork.
Carlton's Rapid, 17½ miles above North Fork.
Cañon Rapid, 16½ miles above North Fork.
Sixten Mile Rapid, 16 miles above North Fork.
Granite Rapid, 15 miles above North Fork.
Grier's Rapid, 10 miles above North Fork.
Ford's Rapid, 7 miles above North Fork.
Slew Gundy Rapid, 1½ miles above North Fork.
Cobblestone Bar, at mouth of North Fork.

At two of these rapids, Miner's and Sixteen Mile Rapids, the fall of the river is about 15 feet in 1,000 feet; the river at these localities cannot be improved so that boats can pass at low-water except by a system of slackwater navigation. The examination was not made sufficiently in detail to determine the cost of placing locks and dams at these points; but even if it had been, I do not think the country sufficiently settled yet to call for so great an expenditure of money to gain only 11 miles additional navigation. Beyond Granite Rapid, 15 miles above the mouth of the North Fork, at present I do not deem any improvement "proper to be made"; after the river is opened up to that point the subject of further improvement can be considered.

Mr. Eastwick estimates that a channel with a depth of 3 feet at low-water can be maintained in this section up to Sixteen Mile Rapid by removing rock and cobblestones, as follows:

Locality.	Rock in position.	Loose rock.	Cobble-stones.
	Cubic yards.	*Cubic yards.*	*Cubic yards.*
At Granite Rapid	25		
At Grier's Rapid	50	50	
At Ford's Rapid	5	10	
At head of Ford's Island	10		
At foot of Ford's Island	8		
At Slew Gundy Rapid	20		
At various minor obstructions along this section	90	30	800
At bar at mouth of North Fork			2,200

These cobblestones must be removed by scraping and dredging, as it is believed that but little advantage can be gained by wing-dams, as the material is so coarse that if the channel were contracted so as to gain sufficient velocity to move them, steamboats would have great difficulty in ascending.

2. THE LOWER CLEARWATER.

The Lower Clearwater embraces that portion of the river between its mouth and the mouth of the North Fork, a distance of about 40 miles. It passes through a basalt formation, the side hills very steep, frequently terminating in perpendicular bluffs bordering the river, and again having strips of arable land at their bases.

Throughout this section the river varies greatly in width, widening out to 1,000 feet in some places and again narrowing to 60 feet, as at Kent's Chute. The ruling depth is from 4 to 5 feet. The bed of the river is of gravel and flattened cobble stones with rocky reefs occasionally extending into the channel; shoals and bars are numerous, occurring, as is usually the case, at localities where the river widens.

Many minor rapids known as "riffles" are found within this sec-