

tion, but present a depth of $4\frac{1}{2}$ feet through the rocks, and the velocity rarely exceeds 5 or 6 miles an hour, so that steamers can navigate them.

The principal obstructions to navigation were found at the following localities:

Steamboat Riffle, 37 miles above mouth of Clearwater.
Saddle Bag Rapid, $36\frac{1}{2}$ miles above mouth of Clearwater.
Harper's Bend, 34 miles above mouth of Clearwater.
Big Eddy, 29 miles above mouth of Clearwater.
Ten-Pow-wee Rapid, $24\frac{1}{2}$ miles above mouth of Clearwater.
Kent's Chute, $16\frac{1}{2}$ miles above mouth of Clearwater.
Island Rapid, $13\frac{1}{2}$ miles above mouth of Clearwater.
Reuben's Rapid, $4\frac{1}{2}$ miles above mouth of Clearwater.
Upper Lewiston Shoal, $1\frac{1}{2}$ miles above mouth of Clearwater.
Lower Lewiston Shoal, near mouth of Clearwater.

Mr. Eastwick has given a careful description of each of these rapids in his report.

It is estimated that a depth of $4\frac{1}{2}$ feet at low-water can be maintained in this section by removing rocks and cobblestones, as follows:

Locality.	Rock in position.		Cobblestones.
	Loose rock.		
Saddle-Bag Rapids	Cubicyards.	Cubicyards.	Cubicyards.
Shoal $\frac{1}{2}$ mile below Saddle-Bag	15		
Shoal above Harper's Bend	4		1,000
Rocky Bar	4	200	700
Big Eddy	26		
Ten-pow-wee Rapid			600
Kent's Chute			500
Island Rapid			200
Reuben's Rapid	80		
Upper Lewiston Shoal			3,000
Middle Lewiston Shoal			800
Lower Lewiston Shoal			3,000
Minor obstructions throughout the section	42	45	8,400

FRESHETS.

The Clearwater River is generally at its lowest stage in September; in October and November there is a slight freshet of about 2 feet from the autumn rains, but this soon falls, and the river again reaches its lowest level in December and maintains it until the following March; the melting snow in the mountains then causes it to commence rising again, and this continues with various fluctuations until June, when the maximum level, from 8 to 12 feet above low-water, is reached; this is maintained but a short time, the river gradually falling until the lowest stage is again reached in September. It will thus be seen that the low-water period continues for about 7 months of the year, the river being in a far better condition for navigation between the months of March and September, during which period many of the obstacles met with during the low-water season are not encountered.

ESTIMATE FOR IMPROVEMENT.

The following is an approximate estimate of the cost of the work necessary to obtain a depth of $4\frac{1}{2}$ feet at low-water from the mouth of the river to the North Fork, and of 3 feet from the mouth of the North to the mouth of the South Fork:

379 cubic yards of solid rock, at \$25	\$9,425 00
335 cubic yards of loose rock, at \$2	670 00
21,200 cubic yards of cobblestone, at \$1	21,200 00
Contingencies, 10 per cent	3,129 00
Total	34,424 00

ADJACENT COUNTRY.

The river from the mouth of the South Fork to within 6 miles of Lewiston passes through the limits of the Nez Percé Indian Reservation, the east and north boundary lines being from 1 to 6 miles distant; beyond this limit along the entire distance is an excellent country, in which the land is open to settlement; on the south and west side, the Indian Reservation extends back from 10 to 20 miles, but beyond that is said to be a very large amount of the best grain-growing lands in the vicinity of any of the branches of the Columbia.

Between the South and Middle Forks the land is said to be excellent for wheat. I am told that along the banks of the Middle and South Forks are large bodies of the finest white cedar and pine, which can be utilized in case the river is improved.

The Clearwater River is in the collection-district of the Willamette; the nearest port of entry is at Portland, Oreg.; the amount of revenue collected at Portland during the last fiscal year was \$131,352.35. The amount of navigation to be improved will be 56 miles; as yet there is no commerce on the river; the nearest light-houses and the works of defense are at the mouth of the Columbia.

I respectfully invite attention to the interesting report of Mr. P. G. Eastwick, assistant engineer, transmitted herewith. Mr. Eastwick has described the river very clearly; in the examination he had many difficulties to contend with, and he deserves great credit for the faithful manner in which he has discharged the duties assigned to him.

A chart showing the Clearwater River is transmitted herewith.

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

JOHN M. WILSON,

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

Brig. Gen. A. A. HUMPHREYS,

Chief of Engineers, U. S. A.

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

PORTLAND, OREG., October 12, 1878.

DEAR SIR: In compliance with instructions contained in your letter of instructions of 16th ultimo, directing me to make an examination of the Clearwater River from a point near Mount Idaho to its mouth, with a view to determine the obstacles to its navigation for boats of 4 feet draft and to prepare an estimate of the cost of their removal, I left this city on the 18th of September, reached Mount Idaho on the 25th, and the following day commenced the descent of the Clearwater River at a point on the South Fork of that river known as Jackson's Bridge. From Jackson's Bridge I followed down the South Fork a distance of 15 miles to its junction with the Middle Fork of the Clearwater, the South and Middle Forks at this point forming the Upper Clearwater. From this junction I followed down the Upper Clearwater a distance of 29 miles to what is known as the Lower Forks, a point where the North Fork of the Clearwater River joins the main body of the stream. From the Lower Forks I descended the Lower Clearwater 40 miles to its mouth at Lewiston, where it empties into the Snake River.

The water in the river at the time of this examination was at its lowest stage, lower, in fact, than it has been known to be for many years past. At the headwaters of the South Fork are located the Placer and Hydraulic gold-mines of Elk City and Warren's. The work at these mines makes the waters of the South Fork very muddy, and this again contaminates the waters of both the Upper and Lower Clearwater to its junction with the Snake River, and interferes very much with an examination of the channel of the river.

THE SOUTH FORK OF THE CLEARWATER.

Jackson's Bridge, the starting-point on this examination, is situated about 5 or 6 miles below the cañon where the river passes through the spur of the Bitterroot

Mountains known as Mount Idaho. From this point to the junction with the Middle Fork the river has the character of a mountain stream, very crooked in its course, inclosed in steep granite slopes and bluffs, with narrow bottom lands at their bases only in a few cases. It is rapid in its descent, the average fall being 30 to 40 feet per mile over the 15 miles of distance passed over; it has very few and short levels of slack-water and a great many rapids and bars. At some of the rapids the fall of water is as high as 2 feet in 100. The depth of water on this fork is from 6 to 12 inches. The bed of the river over 9 miles below Jackson's Bridge is rocky, with many large masses of detached rock. The balance of the distance to the Middle Fork has a bed of large water-worn stones.

The volume of water passing down at the present low stage I estimate from numerous observations, to be 13,000 cubic feet per minute.

The general course of the South Fork from the bridge to its mouth is from south to north.

This portion of the river is not susceptible of improvement by the usual manner of removing obstructions or deepening the channel.

THE UPPER CLEARWATER.

From the South Fork to the North Fork.

The general course of this portion of the river is N. 28° W., and its distance about 29 miles. This course is generally maintained with few and slight variations throughout its entire distance. The average width of the stream at low-water is from 250 to 300 feet, widening in some places to 500 or 600 feet at the shoals, and narrowing to less dimensions at a few other points. The ruling depth of water is 3 feet. This depth is maintained with much uniformity over numerous long levels of slackwater. In some places a depth exceeding 10 feet was found, but this was exceptional and of short extent. The bottom is generally of water-worn cobblestones. In some cases, however, bowlders of 1 cubic foot dimensions and upwards occupy the channel, and in a few cases, hereafter specially noted, the channel is obstructed by rock in places.

The principal obstructions to navigation are found at the following places:

Upper Division:

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.

Middle Division:

Carlton's Rapid.....	17½	miles above North Fork.
Cañon Rapid.....	16½	miles above North Fork.
Sixteen-Mile Rapid.....	16	miles above North Fork.

Lower Division:

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 the mouth of North Fork.		

At two of the points named, to wit, *Miner's Rapid* and *Sixteen-Mile Rapid*, the rapids in each case have a length of 1,000 feet, with a fall in that distance of 15 feet. The river at these two points can be made navigable only by the introduction of a system of slackwater navigation, thus dividing the Upper Clearwater into three navigable divisions.

At *Miner's Rapid* the water runs with great velocity in a straight course over a very rocky channel of granite rock in place. The length of this rapid I estimated at 1,000 feet, and the fall in that distance is 15 feet. Rock reefs extend across the channel at the head, middle, and foot of the rapid. The river, narrow at the head, widens in the middle, and again contracts to 50 feet at the foot.

At *Sixteen-Mile Rapid* the river is narrow and rapid with rock bottom, and with but three rocks in the channel to impede navigation. Owing, however, to the rapid descent of 15 feet in the 1,000 feet length of the rapid, the ascent of the river at this point will be impracticable.

The other points named are susceptible of such improvement that will afford a navigable channel having a depth of 3 feet.

UPPER DIVISION.

Indian Billy's Rapid extends over a length of ¼ a mile, and has a fall in that distance of 14 feet. The bed of the river throughout this distance is of granite rock in place. The channel at present is quite tortuous, and to straighten and deepen it will require the removal of 300 cubic yards of rock.

Reuben's Rapid is a short rapid 500 feet long with a fall of 3 feet. Its channel is impeded by rock in place and bowlders. One hundred cubic yards removed will clear the channel to 3 feet depth.

MIDDLE DIVISION.

Carlton's Rapid is 350 feet long and 350 feet wide at the head, narrowing gradually until the whole mass of the water of the river pours with great velocity through a gorge 75 feet wide, falling 2 feet in the last 100 feet. On the left of the gorge is a rock of 30 cubic yards, and to the left of this rock an extensive bar of small bowlders, bare at low-water.

By the removal of this rock and some of the bowlders the channel will be widened and the fall distributed over a greater length of the rapid. The estimated quantity of rock to be removed here is 90 cubic yards.

Cañon Rapid is situated at the head of a close granite cañon. This rapid is 500 feet long and has a current of 6 to 7 miles per hour. The removal of 75 to 100 cubic yards of granite rock exposed at low-water will be necessary to admit of its navigation by steamer at any stage of water.

LOWER DIVISION.

Granite Rapid is 350 feet long with swift water in a straight channel, having a cobble-stone bottom and numerous small bowlders, with one mass of rock of 4 cubic yards in the channel. The estimated quantity of rock to be removed is 25 cubic yards. The minimum depth on the cobble-stone bottom is 4 feet.

Grier's Rapid is 700 feet long with a fall of 3 feet in the 700. It flows over cobble-stones, with numerous rock bowlders. It is estimated that the removal of 75 cubic yards of these bowlders will be necessary to clear the channel.

Ford's Rapid is 400 feet long and falls 3 feet in 400. The bottom is of broken basaltic rock, of which 15 cubic yards will have to be removed to clear the channel and afford a depth of 4 feet of water.

At the head of *Slew Gundy Rapid* the river is 350 feet wide, narrowing rapidly to 75 feet at its foot. On the left, at the foot of the rapid, it is confined by a cobble-stone bar, the head of which extends across the river, and shoals the river at the head of the rapid to 2 feet at low-water. At the head of the rapid it will be necessary to deepen the channel by scraping or dredging, and at the narrows at the foot of the rapid the removal of a part of the gravel-bar from the left will be necessary to widen the channel, that the force of the current may be lessened at this point. The removal of 20 cubic yards of rock bowlders from the channel will be necessary.

The bar at the mouth of the North Fork extends entirely across the channel of the Upper Clearwater, which at this point is 600 feet wide. The depth of water on the bar varies from a few inches to 1½ feet at the present low stage of water. The middle of the bar in the direction of the current does not exceed 200 feet at the deepest part.

The intervals between the principal rapids named may be generally described as long stretches of slackwater, with frequent short and slow-running rapids and short bars, upon which the water may be deepened by dredging or scraping. Over a large part of the distance occupied by slackwater the ruling depth at low-water is 3 feet. Owing to the very coarse nature of the material of the bottom at the bars and rapids, which throughout consists of cobble-stones of from 4 to 8 inches in diameter, and more or less flattened, it is doubtful whether it can be moved by increasing the rate of current by the introduction of wing-dams without so far increasing it as to render the ascent of the river impracticable for steamers. It is a question to be decided by further investigation whether the removal of this coarse material may not be best effected, and, to a certain extent, in a permanent manner, by dredging or scraping, thereby loosening it in such a manner that it can, with the assistance of the current, be carried down to the deeper parts of the river.

The volume of water passing down the Upper Clearwater at its lowest stage I have estimated, from a number of observations, at from 150,000 to 175,000 cubic feet per minute.

The Upper Clearwater passes through 22 miles of a granite country in its upper portion, and the remainder of the distance through a basaltic formation. Where the river passes through the granite the side-hills are very steep and rocky, and in some cases the rock bluffs adjoin the river, forming cañons of greater or less extent. Where it passes through the basalt the hills are less steep, and have frequently at their bases arable bottom and beach lands, generally quite narrow. The hills throughout rise abruptly to a height of 1,200 feet and upwards to the high rolling table-land, which is characteristic of the country.

THE LOWER CLEARWATER.

From the mouth of the North Fork to the Snake River.

Over this distance of 40 miles the river runs westerly to Snake River at Lewiston. On the first 17 miles the general course is a little north of west. Turning then to the

southwest it flows for 9 miles, and from thence follows nearly west to its confluence with Snake River.

This part of the river varies greatly in width in different parts. In some places a width of 300 to 400 feet is maintained for long distances. It, however, widens to 1,000 feet in some places, and narrows to 60 feet at Kent's Chute.

The ruling depth over a number of the long slackwater levels is from 4 to 5 feet. Deeper water is frequently found, and on the bars the river shoals generally to 3 feet, except in a few cases where the depth does not exceed 2 feet, and in one instance (at Hog Island, 8½ miles above Lewiston) the depth at low water is but 18 inches, but only for a short distance of 100 feet in the length of the channel.

The bed of the river, with but little exception, is of the same general character as that of the Upper Clearwater, heretofore described; that is, of cobble-stones, generally flattened and well water-worn. The material, however, is somewhat smaller at the approach to the mouth of the river.

Shoals and bars are numerous on this part of the river, occurring at points where the river is widest. The shoals, short at first, increase in extent as the mouth of the river is approached, reaching a maximum of ¼ a mile in length, with 3 to 4 feet of water at the present low stage in the case of two bars near the mouth of the river at Lewiston.

Material impediment to the navigation of the river at low-water by light-draught steamers is to be met with at but few of the rapids, on the river, and to these points reference is more specially made below.

Many minor rapids, which by the river-men are designated by the name of "riffles," are met with on the river. They are generally short, and the current over them, though sometimes swift, cannot be called rapid, seldom exceeding 5 to 6 miles per hour. Channels of 50 feet and upwards in width with a depth of 4½ feet at low-water can generally be found upon them.

Aside from the cobble-stone bars and the "riffles" here referred to, the obstructions to navigation are found at the following points:

Steamboat Rifle, 37 miles above Snake River.
Saddle-Bag Rapid, 36½ miles above Snake River.
Harper's Bend, 34 miles above Snake River.
Big Eddy, 29 miles above Snake River.
Ten-pow-wee Rapid, 24½ miles above Snake River.
Kent's Chute, 16½ miles above Snake River.
Island Rapid, 13½ miles above Snake River.
Reuben's Rapid, 4½ miles above Snake River.
Upper Lewiston Shoal, 1½ miles above Snake River.
Lower Lewiston Shoal, near the mouth of the river.

Steamboat Rifle, extending over 800 feet of the course of the river, is 250 feet wide at the head and 200 feet wide at the base, and has a channel 5 feet depth at low water. The steamer Colonel Wright passed up over this rifle in early days though at a stage of water somewhat higher than the lowest stage.

Saddle Bag Rapid, named from the principal rock obstructing the channel, is on a gentle curve of the river. Its length is about 400 feet. The bed of the river is rocky, but by the removal of three rocks containing 15 cubic yards a direct and unobstructed channel is obtained, with from 5 to 6 feet of water at any point.

Harper's Bend, an abrupt bend of nearly 90° to the right, offers no obstruction to navigation. The river is wide above and at the bend, and the water deep and of slow current at low-water. From those who have rafted on the river I learn that there are no dangerous eddies formed at this point at any stage of the water.

Big Eddy.—At this point the river turns within a distance of 600 feet fully 90 degrees to the right. Above the bend is a rapid 400 feet long, the base of which is contracted between rock bluffs on the right and a cobble-stone bar on the left to 125 feet in width. At the bend below the rapid an extensive and deep excavation has been made by the waters during the time of floods, and at the higher stages of water this area is occupied by two whirlpools and their bordering eddies. These whirlpools are generally located on opposite sides of the river with the main body of the water running rapidly between them, though I learn that they frequently abate their violence and then suddenly appear in an unaccountable manner in other parts of the area at the bend. At the low stage of water this pool is very quiet, and offers no impediment to navigation. The water passes over the rapids above the pool with a depth of 4 feet and a 6-mile current at low-water. From this rapid three small bowlders, containing 6 cubic yards, will have to be removed. In the pool at the bend is located a large rock, always submerged, 20 cubic yards of which it will be requisite to remove, as it occupies a position on the curve which would be traversed by steamers navigating the river. It is located in the channel of the swiftest current, and its removal would materially reduce the intensity of the whirls which form on each side of it at high-water by admitting a free and unobstructed passage of the water which emerges as from a funnel from the narrows at the base of the rapid above.

The eddy is considered by river men who run rafts and drive logs down from the timbered country above as the most dangerous part of the Lower Clearwater River. At the high stages of water rafts are frequently drawn to the whirlpools and logs drawn out of sight temporarily and coming to the surface again in a distant part of the pool. As the unwieldy rafts have no steerage-way, but are shifted from side to side, as occasion requires, by bow and stern oars, they are less quickly managed than would be a steamer having sufficient steerage-way to give a quick answer to the movement of the wheel, and it is with difficulty that they are kept from the whirlpools at the side of the channel.

Ten-pow-wee Rapid is 1,100 feet long, and has in its shoalest part but 2 feet of water in the channel over a short part of this distance. The bottom, though generally of cobble stones, has many small detached basalt bowlders. I estimate that 600 cubic yards of the material of the bottom will have to be removed to obtain a depth of 4½ feet at low-water.

At Kent's Chute the largest part of the river passes very abruptly from a wide and deep slackwater level above through a channel 60 feet between two bars exposed at low-water. The chute is not over 50 feet long, and in that distance the water falls 2 feet. By the removal of 500 cubic yards from the head of the bar on the right of the chute the intensity of the current will be decreased and the fall of 2 feet distributed over a greater length. At the present low stage of water and in its present condition the ascent of this chute by a steamer is impossible except by the assistance of ropes attached to the trees on the shore above the chute, a number of which are to be found in the line of direction of the chute and a short distance above.

At Island Rapid the entire volume of the water passes through a width of 125 feet. This rapid is but 100 feet long, and falls but 8 inches in that distance. It has a depth of 5 feet and over, and is very turbulent. This is due to the sudden contraction of the width of the river at the head of the rapid. By the removal of 200 cubic yards from the bar on the right, the intensity of the current on the rapid will be diminished.

At Reuben's Rapid 80 cubic yards of rock removed from a submerged reef crossing the channel will give a width of 60 feet with a depth of 5 feet.

As in the Upper Clearwater, the intervals between the rapids named are occupied by long slackwater levels with intervening minor rapids or "riffles," as they are termed by the river men of the locality.

The volume of water in the Lower Clearwater at the low stage may be estimated at about double that of the Upper Clearwater, the North Fork bringing into the lower river a volume of water about equal to that of the upper river. This volume may, therefore, be estimated from 300,000 to 350,000 cubic feet per minute.

The lower river passes through a basalt-lined valley, the hillsides of which are very steep, frequently terminating abruptly at their bases in perpendicular bluffs bordering the river, and in other cases terminating at the edge of arable bottom-land and low beach-land generally narrow.

The valley through which the lower river flows has the same general characteristics as that of the lower part of the Upper Clearwater, excepting that the summits of the hills are uniformly higher than in the latter-named case, the high table-land being situated from 1,500 to 2,200 feet above the river.

The main tributaries of the Clearwater River are the North Fork, emptying 40 miles above Lewiston, and the Middle and South Forks forming a junction at the head of the Upper Clearwater, 69 miles above Lewiston.

The North and Middle Forks have their origin high up in the Bitter Root Mountains, a high mountain range running north and south and lying to the east of the river, and supply to the main river the largest part of the water of the latter stream.

The South Fork is a minor stream and has its origin in the Salmon River Mountains, a spur of the Bitter Root Range running from east to west and lying in a more southern latitude.

The periods of freshet and of low-water in the North and Middle Forks are nearly coincident; these streams taking their origin in approximately the same latitude, being affected by similar conditions of climate.

These rivers, and consequently the Upper and Lower Clearwater, are generally at their lowest stage in September. In October they experience a rise from the effects of the fall rains, reaching a maximum average of about 2 feet above low-water in November and falling again suddenly upon the advent of cold weather to the lowest stage, which is generally reached early in December. During the winter and until the middle of March the water remains low. A rise then begins and continues with frequent fluctuations until the early part of June, when the maximum height is attained. This varies from 8 to 12 feet above the low-water level, the water frequently rising 4 feet in a few hours and as rapidly subsiding. The maximum height generally continues but a short time. By the middle of June the water commences to fall and continues to do so, at first rapidly and then at a decreasing rate, until September, when the lowest stage is again reached.

The extreme low stage, it will be perceived, continues for the six months from September to March, with the exception of the short period of rise in October. During the remaining six months of the year the water is high.

During the prevalence of high-water the condition of the water on the rapids is very different from that found at low-water. Most of the low-water rapids disappear as the water in the river rises, and the stream presents a more uniformly distributed current. Many of the obstacles to navigation, therefore, which are found at low-water are not encountered at higher stages.

The ruling depth of the water has been stated as follows:

	Feet.
On the Upper Clearwater, at.....	3
On the Lower Clearwater, at.....	4½

Excepting at Miner's Rapid and Sixteen-Mile Rapid, on the Upper Clearwater, the river throughout can be cleared so as to afford a channel at low-water of the depths stated and of a width not less than 60 feet. To secure a deeper channel at low-water will necessitate a resort to slackwater navigation.

Sixteen-Mile Rapid on the Upper Clearwater, barring the ascent of steamers at all times unless by the aid of slackwater navigation, I have included in the annexed estimate only the cost of improving that part of the river below this point.

The river, from the junction of the South and Middle Forks to within 6 miles of Lewiston, lies wholly within the limits of the Nez Percé Indian Reservation; the east and north boundary lines of that reservation lying approximately parallel to the river, and from 1 to 6 miles distant.

The country which will in time be tributary to this river is that of the high, rolling plateau which extends from the summits of the steep slopes forming the sides of the river valley. The extent and value of this country can be but approximately stated with the meager information which my hurried trip would allow me to collect. This plateau extends on the right of the Upper Clearwater eastward to the foot-hills of the Bitter Root Mountains, a distance estimated at from 20 to 30 miles. As seen from the rising ground south of Mount Idaho, it has the appearance of an extensive rolling plain, principally prairie land, with frequent areas covered with a light growth of open evergreen timber. This extends from the Mount Idaho spurs on the south to a spur of the Bitter Root Mountains, dividing the North Fork and the Upper Clearwater, a distance estimated at from 35 to 40 miles. But few settlers at present occupy this country.

To the left of both the upper and lower river and of the South Fork lies a very extensive area of excellent agricultural land. This is, in the main, prairie land, though as an exception it may be stated that it contains many extensive belts of open pine timber. Most of this land lies within the Indian reservation. To the south of the reservation, and extending to the Mount Idaho spur lies the large rolling area known as "Big Camas" prairie. The general level of this prairie is somewhat lower than that of the surrounding country. It is 20 miles wide from north to south, and 25 to 30 miles long between the South Fork on the east and Salmon River on the west. The government surveys have been extended over a part of this prairie, and from 50 to 75 settlers have entered lands and made permanent improvements thereon. The country is best adapted to the raising of grain on an extensive scale.

The settlers on this prairie and the country immediately adjacent, and the miners of Elk City, Warren's and Florence, who at present receive their supplies through the town of Mount Idaho, are the only ones to be immediately benefited by the improvement of the Clearwater River. The immediate benefit would be felt only by a reduction in the cost of transporting up-bound freight from Lewiston, as nearly all the products of the soil find a ready sale for consumption on the spot or for transportation to the miners in the interior at figures higher than can be realized for the same products at Lewiston, the nearest market in the opposite direction.

With an increasing population and consequent increase in the productions of the country a market for the surplus products would have to be sought in the direction of the seaboard. Until then the advantages offered by the opening of navigation on the Clearwater River would not be commensurate with the outlay involved in making the necessary improvements to make the river navigable.

The following detailed estimate of the cost of the work is submitted:

ESTIMATE OF QUANTITIES OF ROCK IN PLACE.

Loose rock, boulders, and cobble-stone to be removed in the improvement of the Clearwater River, from Sixteen-Mile Rapid to the mouth of the river at Lewiston, to obtain a depth of 3 feet in the upper section and 4½ feet in the lower section at low-water.

Locality.	Rock in place.	Loose rock.	Cobble-stone.
	Cubic yards.	Cubic yards.	Cubic yards.
Granite Rapid.....	25		
Grier's Rapid.....	50	50	
Ford's Rapid.....	5	10	
Head of Ford's Island.....	10		
Foot of Ford's Island.....	8		
Slew Gandy Rapid.....	20		
Bar at mouth of North Fork.....			2,200
Minor obstructions on the Upper Clearwater.....	90	30	800
Saddle-Bag Rapid.....	15		
Shoal ¼ mile below Saddle-Bag.....	4		1,000
Shoal above Harper's Bend.....	4		700
Rocky Bar—detached rocks.....		200	
Big Eddy.....	26		
Ten-Pow-wee Rapid.....			600
Kent's Chute.....			500
Island Rapid.....			200
Reuben's Rapid.....	80		
Upper Lewiston Shoal.....			3,000
Middle Lewiston Shoal.....			800
Lower Lewiston Shoal.....			3,000
Minor obstructions on the Lower Clearwater.....	42	45	8,400
Total.....	379	335	21,200

ESTIMATE OF COST.

379 cubic yards rock in place, at \$25.....	\$9,425
335 cubic yards loose rock, at \$2.....	670
21,200 cubic yards cobble-stone, at \$1.....	21,200
Total.....	31,295

Very respectfully, your obedient servant,

PHILIP G. EASTWICK,
Assistant Engineer.

Maj. JOHN M. WILSON,
Corps of Engineers, U. S. A.

K K 12.

EXAMINATION OF ROGUE RIVER, OREGON.

The act of Congress approved June 18, 1878, provided for a survey "of the Rogue River, Oregon, from Scottsburg to its mouth." Scottsburg is on the Umpqua River, about 100 miles north of the Rogue River, and I was consequently in doubt what action to take; the facts were submitted to the Chief of Engineers and by him to the honorable Secretary of War, who directed that no survey should be made, but that a report should be prepared from such facts as might be at hand or could be easily obtained bearing upon the question of practicability and necessity for improvement, &c. These instructions reached me on October 4, 1878.

The mouth of Rogue River is about 270 miles below the mouth of the Columbia; it can only be reached by going to Roseburg by railroad and thence by stage and horseback for three or four days across the mountains and down the coast. I made diligent inquiry in Portland, without

success, among merchants, bankers and shippers, to find some one interested in the river from whom I might learn its character. I then wrote to the member of the State legislature from that county; to the collector of customs at the mouth of Rogue River, and to the firm of Hume & Duncan, who have a salmon-cannery on the river, asking that they would give me such information in reference to the river as was in their power. These letters were written on October 5, but up to this date (October 22) no reply has been received.

I have, therefore, transferred the subject of a report on Rogue River to my successor, Maj. G. L. Gillespie, Corps of Engineers.

APPENDIX K K.—Continued.

ANNUAL REPORT OF MAJOR G. L. GILLESPIE, CORPS OF ENGINEERS, FOR PART OF THE FISCAL YEAR ENDING JUNE 30, 1879.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., June 30, 1879.

GENERAL: I have the honor to submit herewith my annual report upon works of river and harbor improvements and of surveys and examinations under my charge for the fiscal year ending June 30, 1879.

In obedience to paragraph 3 of Special Orders No. 193, Headquarters of the Army, Adjutant-General's Office, Washington, D. C., September 6, 1878, I relieved Maj. J. M. Wilson, Corps of Engineers, October 22, 1878, of all his duties, including that of light-house engineer of the thirteenth light-house district.

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

G. L. GILLESPIE,

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

Brig. Gen. H. G. WRIGHT,

Chief of Engineers, U. S. A.

K K 13.

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

This improvement has been the subject of investigation by the Board of Engineers for the Pacific Coast, and their recommendations, approved by the Chief of Engineers, are contained in their report dated April 9, 1877.

The project calls for special improvements at the principal bars and shoals obstructive to navigation from Portland to the sea, viz:

Swan Island, Willamette River, dike.

Willamette Slough, Willamette River, dike.

Mouth of Willamette River, dike and revetment.

Saint Helen's Bar, dikes.

The total cost of this project was estimated by the Board at \$298,974. The amount available for the improvement during the year being too small to effect any positive good by commencing any one special work, Major Wilson preferred to maintain the usual depths over the several bars by dredging, until an additional appropriation should provide means for undertaking the projected constructions.

On the 18th of July, 1878, the annual flood having fallen to 8.6 feet above low-water, the dredge commenced work on the bar at the mouth of the Willamette, and after cutting a channel 105 feet wide and 17 feet deep, by the excavation of 4,815 cubic yards of sand and drift, was removed on the 3d of August to Saint Helen's Bar, Columbia River. On the 8th of August dredging commenced on that bar and was actively prosecuted until September 18, during which interval 9,395 cubic yards of material were removed. The channel obtained was about 100 feet wide and 19 feet deep at low-water, and its range was indicated by