LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

Report of Capt. C. J. Allen, Corps of Engineers, giving an account of the construction of a sluiceway at the Falls of Saint Anthony, Minn., and urging the importance of immediate repairs to the apron built by the Government of the United States for the preservation of the Falls.

JANUARY 12, 1880.—Referred to the Committee on Commerce, and ordered to be printed with accompanying documents.

WAR DEPARTMENT,
Washington City, January 9, 1880.

The Secretary of War has the honor to transmit to the United States Senate a letter from the Chief of Engineers, dated the 6th instant, and accompanying copy of report from Capt. C. J. Allen, Corps of Engineers, giving an account of the construction of the sluiceway at the Falls of Saint Anthony, provided for by the river and harbor act of March 3, 1879, and urging the importance of immediate repairs to the apron built by the United States for the preservation of the falls.

ALEX. RAMSEY,
Secretary of War.

THE PRESIDENT
Of the United States Senate.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., January 6, 1880.

Sir: Inviting attention to the subject of preserving the Falls of Saint Anthony, to which reference is made in my annual report for the last fiscal year, at pages 134 and 1159, and in connection therewith, I have now the honor to submit a copy of the report of Capt. C. J. Allen, Corps of Engineers, dated December 6, which gives an interesting account of the constrution of the sluiceway, provided for by the river and harbor act of March 3, 1879, and at the same time shows the necessity for immediate repairs to the apron built by the United States for the preservation of the falls, to which great injury has ensued from the action of the floods upon the soft sandstone bed of the river, and also from the passage of logs in large numbers over the falls during the recession of the waters.

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As the preservation of the falls is a question of vital importance to the large commercial and manufacturing interests centered at Minneapolis and vicinity, I deem it my duty to present the subject, with the suggestion that it be brought to the attention of Congress for consideration of the Committees on Commerce of the Senate and House of Repesentatives.

Very respectfully, your obedient servant,

H. G. WRIGHT,

Chief of Engineers, Brigadier and Brevet Major General U. S. A.

Hon. ALEXANDER RAMSEY,

Secretary of War.

PRESERVATION OF THE FALLS OF SAINT ANTHONY, MISSISSIPPI RIVER

ENGINEER OFFICE, U. S. ARMY,
Saint Paul, December 6, 1879.

GENERAL: I have the honor to report the following as the operations at the Falls of Saint Anthony for the past season:

Congress, by act approved March 3, 1879, appropriated the sum of $10,000 for the construction of a log sluice at the falls, in the following terms:

For sluiceway through public works at Saint Anthony's Falls, Minnesota, $10,000: *Provided,* That no part of said sum shall be expended for right of way, and that said improvement can be made without expense to the United States, further than the actual construction of said sluiceway.

This appropriation was, shortly afterwards, made available, but the commencement of the work was delayed from two causes, viz: 1st. The existence of high water; 2d. The delay consumed in acquiring releases to the United States from the owners of water-power at the falls for any water that might be drawn off from their canals or races in order to float logs through the sluice. These releases were all obtained by about the middle of June, 1879; the plan for the work was approved of by the Chief of Engineers; and the construction was begun as soon as the water lowered sufficiently. The sluice is located at the westerly end of the apron protection; is 451 feet in length, over all, having four different slopes or planes on the entire length, the total fall which generates the velocity being about 40 feet on 312 feet horizontal. The width is 6 feet in the clear throughout. The construction is of cribwork, from 4 feet to 8 feet in width, strongly put together, and the sluice lined on the sides with 3-inch plank, securely bolted to heavy timbers, all projecting points carefully chamfered with the adze, and the bottom protected at exposed points with layers of strap-iron. The entrance to the sluice proper is through a sort of tunnel through a large guard-crib at the westerly end of the apron, placed to protect the mills at that point from the impact of ice and floating bodies. It is 11 feet 6 inches in length and 6 feet in width, to be closed by a gate, worked by screws. The original intention was to make the entrance 8 feet 6 inches high and to use ordinary stop-plank in lieu of a gate, but the experience of the past season proving the disastrous effect upon the apron of running loose logs over it, at any stage of water, it was concluded to make the entrance sufficiently high in the clear to afford no excuse whatever for running logs over the falls, excepting through the sluiceway provided by law.

The sluice was ready for use by the latter part of September and logs

were run through it successfully; but the construction of the gate was deferred, as the entire force of laborers was necessarily diverted to the repairs upon the apron, to be referred to further on. The work is a thorough success; logs run through the sluice with great rapidity and no interruption to their passage can possibly occur, unless the channel at the foot of the chute is clogged with mill refuse. The gate will be mounted during the present month.

Early in the summer it became apparent that the toe of the apron was suffering considerable damage from the action of the floods upon the soft sandstone bed of the stream. As the stage of water receded, the logs, which were passing over the falls in large numbers, contributed to aggravate the damage. The managers and owners of the logs were requested to discontinue running them over the apron, and were assured that the sluice would soon be ready for use.

No action being taken by them to stop the logs, the matter was brought, through the Engineer Department, before the Department of Justice, and the United States district attorney at Saint Paul having received the necessary instructions, an injunction was obtained from the United States court for this district, restraining the running of logs over the apron. There will be, after this season, no possible excuse for not running the logs through the sluice provided; and the Minneapolis Mill Company will, as their agent gave assurance last June, provide for the passage of logs through their works above the sluice. A boom should be placed, by the log-owners, in the pool between the upper and lower rolling dams, so as to sheer the logs into the sluice built by the United States Government, and refuse the apron.

As soon as the water subsided sufficiently, a careful examination and survey was made of the toe of the apron and the channel below; two large gaps were found in the timber work, viz, one about the middle of the lower edge or toe, and one in the angle near Farnham & Lovejoy's mill-pond. The break in the middle was the first observable; the other not becoming apparent until later. The bowlder protection placed below the apron in the winter of 1877 and 1878 had, nearly all, been swept away by the flow of water, and much of the stone filling in the crib foundation of the apron had also moved out, allowing the timber to float and lift up the apron planking for a width of about 200 feet, and a depth, measured upstream, of 20 to 30 feet.

It became apparent that prompt measures should be taken to restore the work, as nearly as possible, to as good condition as it was in when completed in 1877. The preservation of the log-sluice also depended largely upon that of the apron itself. The balance of funds available was totally insufficient for repairs. The Minneapolis Mill Company, recognizing that their interest hinged upon the preservation of the works, donated sufficient timber for temporary repair, and this was worked into place by the government force of laborers. The repairs consisted mainly in the substitution of water-tight cribs for the open-work cribs where the greatest damage had occurred. If the United States Government is to retain charge of the preservation of the falls, at least $25,000 should be available at once to perfect the work. A footing of loose bowlders might afford protection to the toe for some time to come, and cost much less than crib-work, but such protection is precarious, owing to the action of the floods and ice in carrying the bowlders away, in addition to the small resistance offered by the soft sandstone of the river bed, the stone seeming to yield to the action of the water, and the bowlders spreading out over it for a considerable distance. The toe of the apron should be protected by tight crib-work below it

and extending across the width of the stream, the top of the planking to the crib-work to be about 8 feet below the surface of low water, the crib-work to act both as a protection to the bed of the stream and to prevent action of the eddies, boils, &c., upon the foundation of the apron. The greater part of the proposed work can be done this winter and early in the spring, before the highest water sets in, if funds are available at an early date.

The injury to the work in the angle at the easterly end of the apron seems to have been aggravated somewhat by the injudicious placing of flush-boards by the owners of the mill-privilege at that end of the apron, a fact that was not discovered until the flush-boards had been in position for some time.

The rest of the work at the falls is in good condition.

The report of Mr. J. P. Frizell, assistant engineer, herewith inclosed, gives the details of the work accomplished.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

REPORT OF MR. JOSEPH P. FRIZELL, ASSISTANT ENGINEER.

ENGINEER OFFICE, U. S. ARMY,
Saint Paul, December 1, 1879.

SIR: I have the honor to present the following report of operations at the Falls of Saint Anthony during the past season, this work having been under my immediate supervision.

The act of Congress approved March 3, 1879, appropriated $10,000 for the construction of a sluiceway through the public works at the Falls of Saint Anthony. The amount was made available shortly after the passage of the act, but the high water did not abate sufficiently to admit of the commencement of the work before the first of August.

Before the commencement of the work, the precaution was taken to procure releases from the several owners of water-power at the falls, exonerating the government from any claim for damages by reason of the diversion of water from the mills and canals of the said owners by the operation of the sluice.

The sluice was located on the westerly side of the apron, commencing at a point about 130 feet above the crest of the lower rolling dam, which was built for the purpose of keeping the limestone flooded with water. It discharges into a channel separated from the main river by a bank of loose stone and gravel, being the channel which receives the water from several of the saw-mills. It was constructed of 12″ x 12″ square timber fastened with drift bolts. One side is formed by 3-inch longitudinal planking, fastened to upright timbers, which are bolted to the Minneapolis Mill Company's high dam and to the wall, partly natural and partly artificial, which forms the westerly side of the apron. The other wall of the sluice is of close crib-work, 4 feet to 8 feet wide, filled with stone. The side next the sluice is lined with 3-inch plank. The rolling dam was cut through, and the bottom of this part of the sluice, comprising a distance of about 63 feet, consists of 6-inch plank bolted to the lime rock. The sluice is 6 feet wide inside. For a distance of 79 feet from the foot of the roll-dam it takes the same slope as the apron, viz, about 1 perpendicular to 5 base, and in this part the floor is of 6-inch plank, bolted to the floor of the apron. Thence for a distance of 143 feet it takes a slope of about 7½ base to 1 perpendicular. Thence level to the end, a distance of 58 feet. In these two last portions its bottom consists of 12-inch timber. At the foot of the sluice the water is about 5 feet higher than the river, passing over a little cascade before reaching the latter. The bottom is protected at the parts most exposed to abrasion from logs, viz, a distance of about 180 feet, by 6 straps of wrought iron, ⅝ inch thick, and 3 inches wide, confined by 12-inch bolts with countersunk heads. The guard-crib at the westerly end of the rolling dam was taken away to make room for the sluice and rebuilt over the latter, leaving a clear opening 11 feet 6 inches high. The sluice, for a distance of some 69 feet, where the water from the saw-mills falls into it, is covered with 6-inch planking. The lower end is protected by a riprap of heavy stone.

The work was executed entirely by day labor, under the direction of Mr. A. H. Weeks as overseer. The materials have been purchased in open market, except the stone, which has been procured mainly in the immediate vicinity at the cost of quarrying and moving. About 219,000 feet of lumber and 30,000 lbs. of iron were used in addition to that contained in the old guard-crib. The greater part of the lumber was purchased for $7.97 per M; $10 and $11 was paid for small quantities of better grade. The iron cost 3 and 3½ cents per pound.

The sluice is now entirely completed, except the gate, which will be a plain, old-fashioned, up-and-down gate, worked by screws. The mechanism is now in course of construction.

The only accident which occurred during the construction of the sluice was the drowning of Geo. Boyd, a laborer. He was crossing the river in a boat just above the lower rolling dam while a violent storm was impending. The wind commenced to blow with great fury just after he started, and he was swept over the apron.

Many logs have been passed through the sluice, which fulfills its purpose perfectly.

THE APRON.

It became apparent during the continuance of high water that serious damage had been done to the apron. It gave evidence of being disturbed at the toe for a width of some two hundred feet, and two gaps of considerable width appeared. The Saint Paul Boom Company claimed the right, pending the construction of the sluice, of running logs over the apron, and actually did send over a large number, amounting to some millions of feet of lumber. The damage to the apron, though not wholly due to this cause, was obviously much extended and aggravated by it. Accordingly, through the Engineer Department at Washington, the matter was brought to the notice of the Department of Justice, and the district attorney at Saint Paul was instructed to act in the matter.

About the middle of September an injunction was issued by the United States district court at this place restraining the owners of logs from turning them into the river to find their way over the apron. No further trouble has been had from this cause, though it is proper to add that no logs could have been run in the low stage of water which has prevailed since the date of the injunction.

The small amount of money available for the Falls of Saint Anthony did not appear to warrant the commencement of the extended repairs required by the apron. The execution of this work, however, was so important to the owners of water-power, especially to the Minneapolis Mill Company, that this company offered to donate the lumber required for the repairs. This put the government in a position to undertake the work, and about the first of October it was commenced. The greatest damage occurred near the easterly angle, where the water comes down two slopes, which form a valley. The bottom at this part had been protected in the winter of 1877–'78 by a rip-rap of heavy bowlders, reaching nearly to the surface of the water. On commencing operations this season, a depth of 28 feet was found. The damage to the apron appears to have been largely due to the reflex action of the water in undermining the crib-work and taking out the stone, the cribs having been sunk with open bottoms, as is customary in harbor work. The cribs, deprived of their ballast, floated and raised the apron at the toe. This action must have been much aggravated by logs, which, on reaching the bottom of the apron, do not always proceed on their way, but take part in the rolling and whirling action of the water and remain pounding against the crib-work. In proof of this, logs were found under the floor of the apron, where the crib-work was broken through.

In executing the repairs, the floor, what remained of it, was removed as far as the disturbance had extended, viz, for a width of some 200 feet, and 20 to 30 feet up and down stream. All unsound timber-work was removed, and even sound work as far as necessary, to get depth for sufficient ballasting of the cribs. Dynamite was freely used for detaching the timber. The work below water consisted of cribs of 12″ x 12″ square timber laid close with lock joints. They measured 16 feet in width, and 20 feet up and down stream. They were generally built highest at the down-stream end, the water being deepest there. The lower timbers were fastened together with 36-inch screw-bolts; the rest with drift bolts and oak treenails. All the cribs had tight bottoms, *i. e.*, tight enough to hold stone. In the deep cribs the bottom was laid on the lower cross-ties. In the shallowest, the planking was below the ties, confined thereto by screw-bolts, an arrangement giving more room for ballast. On the cribs were laid and bolted the cross-ties which support the flooring of the apron. This consists of two thicknesses; the first of 8-inch timber, the second of 4-inch plank. The flooring is fastened wholly with oak pins or treenails; the 8-inch timber by 16-inch round pins 2 inches diameter; the 4-inch plank by square pins 1¼ inch diameter, 10 inches long. This work was also done by day labor. It was finished in the latter part of November; 157,000 feet new lumber, about 7,500 pounds iron, and some 10,000 treenails were used.

The chief danger to this structure is in the undermining action of the water at the

toe. If the government is to be charged hereafter with the maintenance of this work, some defense against this action must be adopted. The readiness with which the heaviest bowlders are washed out inspires doubts as to the efficiency of any loose stone protection, especially in the line of the junction of the two slopes, where the action of the water is most violent. A protection of brush and stone has been suggested, but probably could not be made strong enough to resist the action of ice. Crib-work appears best suited to the purpose, but would be attended here with peculiar difficulties, as the problem would be to sink cribs with 6, 8, or 10 feet of water over them and leave them filled with stone with a strong deck or platform over the top; since it is obvious that cribs open at the top would be deprived of their ballast by the action of the water and floated away. The only method of constructing and placing such cribs that I can conceive of would be to make them water-tight. After loading them to the water's edge, add a curb or bulkhead around the top, giving them sufficient buoyancy to float full of stone. Then fill and cover them, protecting the top with iron plates, straps, or old railroad bars if necessary. Float them into position and sink them by cutting through the curb. The latter being of light material could be detached or left to be destroyed by the water. $20,000 would be judiciously expended in a protection of this kind. In other respects the works for the preservation of the falls are in excellent condition. The concrete dike, so far as can be observed, fulfills its purpose well.

Very respectfully, your obedient servant,

JOS. P. FRIZELL,
Assistant Engineer

Capt. CHAS. J. ALLEN,
Corps of Engineers, U. S. A.