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Report of Col. William Boardman, Engineer of the Kennebec Locks and Canals Company

William Boardman

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REPORT

Alex. W. Longfellow
of
1840

COL. WILLIAM BOARDMAN,

ENGINEER OF THE

KENNEBEC LOCKS AND CANALS COMPANY.

NOVEMBER 1, 1837.

AUGUSTA:

PRINTED BY LUTHER SEVERANCE.
1837.

R E P O R T .

TO THE PRESIDENT AND DIRECTORS OF THE KENNEBEC LOCKS AND CANALS
COMPANY

GENTLEMEN :—The important work upon which I have been engaged for the last two years, under your direction, having been brought to a successful termination, it will not be thought improper for me to take a review of the ground passed over, from its commencement to its completion, describing its character, and embracing estimates of the extent and value of the real estate belonging to the Corporation, that you may be enabled to form an estimate of its general character, and of the value of the stock.

In the month of February, 1835, having been employed to make an examination of the Kennebec River at Augusta, with a view to the location of the Dam and Canals, I proceeded thoroughly to examine the bed of the river, and fixed upon the present location as combining the most advantages, and affording a site in every respect eligible for the purpose.

The original plan (with the exception of substituting one chamber in the Lock, for two first contemplated, and an important alteration in the lower section of the ground floor of the Dam, which has been formed by placing timbers from 50 to 60 feet in length, compactly together, in a direction parallel with the stream, and so fastened with bolts and trenails as to make it certain that the ballast cannot from any cause escape) has been rigidly adhered to, and every part of the work has been executed in a thorough and substantial manner. The plans of the River, Dam, Lock, Canals, and adjoining lands in your possession, will give you an accurate and clear conception of the whole character of the work.

The length of the Dam, exclusive of the stone abutments and Lock, is 584 feet—the base, 127 feet—the height, fifteen feet above ordinary high water mark. It is built with cribs of timber, bolted and trenailed strongly together, and is filled with ballast, to the very top. The upper slope is covered with five inch pine plank, jointed and perfectly tight; the lower with five and three inch hemlock plank. The crest, terminating at the sluice near the middle of the overfall, is level, and covered entirely with stone eight feet in length, and strongly secured with iron straps and bolts. The sluice, sixty feet in length, corresponding with the provisions of the charter, is covered in the same manner, and is about twenty inches lower than the wings. The walls of the Lock are 170 feet in length, its chamber 101 feet by $28\frac{1}{2}$ feet in the clear, with a single lift; the west wall serves as the eastern abutment of the Dam—it is 28 feet thick at the base, graduated to 25 at the top. The head and east walls are of corresponding strength. Both are built wholly of granite. The face courses hammered, bed and joint, rabbitted, and laid in cement, and the rabbit filled with cement. The floor of the Lock is constructed of timber fifteen inches deep, and covered with five inch pine plank, tongued and grooved, with an additional flooring of five inch hard wood plank, commencing at the head of the Lock and extending fourteen feet. The main gates of the Lock, and guard gates of the Canals, are of white oak from the Chesapeake, and the wicket gates of cast iron. The large stone piers above the Dam, for the protection of the Lock and abutments, are each 30 feet square on the base, graduated to 25 feet on the top, and about 34 feet high, and built of granite, clamped and strapped with iron. There are also ten triangular piers (the sides of which are about 30 feet) parallel to the east bank of the river, on a continuous line with the main pier and Lock wall, distant from each other about 100 feet. They are built of square timber, filled with ballast, and raised to within two feet of the top of the Dam. They are intended for a guide to the entrance of the Lock; the tops are designed to be of stone, and may be finished at any future period, at the pleasure of the Company.

The Canals on each side of the river are 50 feet wide in the clear, carrying 10 feet water from the level of the top of the Dam. The walls are 22 feet high, $7\frac{1}{2}$ feet thick at the base, and 5 feet at the top. They are finished as far as, and including, the guard gates; and that on the west side is excavated for several hundred feet below, at the termination of which has been excavated a basin 90 feet wide, and about 300 feet long, calculated for the use and accommodation of 12

Saw Mills, the foundations for which have been already commenced, and about 2000 perches of stone laid. They are perfectly guarded against any accident, by a double barrier; a stop-gate of timber, 12 inches thick, connected with stone and sheet-piling, being placed immediately above the guard-gates. The gates are of great strength, built of heavy oak timber, and in the most substantial manner, revolving in stone coirs, with which stone and sheet-piling is connected, extending across and 25 feet into each bank, and driven 10 feet below the bottom of the Canals.

The walls on the banks of the river, above and below the Dam, extending about 500 feet, are of the same height as the Canal walls, and 8 feet thick at the base. On the upper side of the Dam is a sheet of timber-piling, tongued and grooved, and either resting on the bare ledge, or driven as far as they could be made to penetrate into the solid bed which covers a portion of its surface, and is connected with the piling which passes under and across the Lock into the east bank, and also with that which is driven in the west bank of the river. Above this, and extending to the top of the Dam, so as to cover the entire planking of the upper slope, is a mass of gravel from 20 to 30 feet deep.

2,500,000 feet of timber and about 25 tons of iron have been used in constructing the Dam, and about 75,000 tons of ballast have been deposited in it.

At the foot of the lower slope (which is 93 feet long) heavy stone flagging has been placed, to protect the bottom, in those parts which have not been laid bare by the freshet of May last (a space of about 200 feet.)

The Lock, Piers, River and Mill walls, with the Canal walls, extending to and including the guard gates, contain about 800,000 cubic feet of stone.

The expenditures have considerably exceeded the original estimates for the construction of your works. Those estimates included only the cost of the Dam, Lock and the two main piers, and were made in the spring of 1835, since which time the prices of labor and subsistence have advanced as much as 33 $\frac{1}{3}$ per cent upon an average. In addition to which eleven boom piers have been erected; fifteen thousand squares of earth have been excavated in the canals and mill sites; the guard gates, and their appurtenances, in the canals have been constructed; 452,000 cubic feet of stone have been laid in the canal and bank walls, and about 50,000 tons of ballast, over and above the 26,000 tons originally contemplated have been deposited in the Dam. This great quantity of ballast required was owing

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36000
76,000 tons

partly to the loss of stone washed out by the freshets which came during the progress of the work, and partly to the increased depth of water produced by the bed of the river having been swept to the ledge.

Five dwelling houses for the convenience of the workmen, an office, and several workshops have also been erected.

The personal property on hand, consisting of a steam engine, horses, oxen, carts, wagons, wheel-barrows, lumber, iron, steel, and tools of various kinds, may be estimated at from \$8,000 to \$10,000.

From the preceding statements, some idea of the magnitude of the work, and the immense amount of labor necessary to accomplish it, may be formed, and although the expense may also appear large in a corresponding degree, yet it may safely be said that no water power of this importance, and possessing the advantages of this, has ever been created in this country at double the cost, and I have no hesitation in saying that for extent, security, and facilities of operating, it is superior to any one in New England, within my knowledge.

Aware that the value of a water power used for manufacturing purposes depends in a great degree upon the certainty of an unfailing supply, I have given much attention to this point, and as the last and present seasons were both remarkable for the small quantity of water running in all the streams in this vicinity, as well as in the Merrimac and its tributaries, I think you may rely with perfect safety upon estimates then made. During the progress of the work, and especially while the course of the river was contracted to a space of 17 feet wide by 24 feet deep (a time peculiarly favorable for forming an estimate, and rarely offered in a stream of this magnitude) I repeatedly made observations upon the velocity of the current, and at no time found a less quantity than twenty-five hundred cubic feet per second. This may with perfect safety be relied upon as the *permanent* power. During the greater part of the year there will be surplus power almost inexhaustible.

I would here remark that the many rivers and streams emptying into the Kennebec above Augusta, with the immense natural reservoirs of lakes and ponds, as exhibited on the map of Maine, give to this river a character peculiarly favorable for the location of a valuable water power—the water retaining its height in dry seasons to an unusual degree. In this particular it has much advantage over the Merrimack and most other rivers in New England with which I am acquainted.

It may not be improper for me in this connexion to enumerate some

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of the advantages which should give a location at this place a preference over most others in New England.

The valley of the Kennebec is, in an agricultural point of view, very fertile. For many miles above Augusta, there is a well settled country, which already finds its principal market at this place, and gives assurance of abundant and cheap subsistence for a large manufacturing population.

Another very important advantage will be derived from the excellent quality and moderate price of building materials at this place. Upon the lands now owned by the Company, and within one hundred rods of the principal works, is the quarry from which the walls of the west Canal were obtained, which will afford an inexhaustible supply of the best material for all erections where strength and durability are required. Another quarry, also upon the land of the Company, and distant about two hundred rods, offers equal advantages. ~~As it has not been opened, I cannot speak with certainty of the~~ quality of the stone, but there are many indications that it will afford granite of good quality. Situated upon the declivity of a steep hill, and but slightly covered with earth, it may be quarried at trifling expense; and as it may be loaded into boats from the quarry without any expense for intermediate transportation, the cheapness of the material will be apparent.

In addition to the quarries owned by the company, there are many others on each side of the river, affording almost every variety of granite—some of them of the best quality, and all of them easily accessible from your works. Bricks are manufactured extensively here and at not over the average cost of three dollars fifty cents per M. As this place is now an extensive Lumber mart and when your mills are in operation, will probably be second to none, the facilities for procuring every description which may be wanted with the least delay and at the lowest price, will be unequalled.

In ascertaining the value of a manufacturing establishment, the facilities of transportation is a very important inquiry, and in this respect, few localities possess equal advantages with yours. As some of the grounds for this opinion, I would observe that the tide at Augusta flows from $3\frac{1}{2}$ to 6 feet, and vessels of 200 tons now ascend within $2\frac{1}{2}$ miles of your works, and those of 100 tons, almost to the foot of the Dam.

A thorough survey has been made the last season, between Gardiner and this place by the Engineers of the United States, preparatory to an appropriation for the purpose of deepening the channel. It is understood as the result of the survey, that no serious obstacles

exist, and that with a very moderate expenditure the channel may be so improved that vessels drawing 10 feet water can come up to the Wharves. As, from the location of the United States Arsenal, the Government are directly interested, there can be no reasonable doubt that this improvement will be speedily effected.

Cotton may now be shipped at New Orleans and not landed until it is placed in the Ware-houses on your premises, and at no greater expense than the cost of shipment to Boston. The rate of freight between Boston and this place is from one to two dollars per ton, varying according to the season and the articles shipped, and owing to the many vessels employed in the shipment of granite to New York and other Southern Cities, the rates from thence are even less.

Before the completion of the Dam, there was some anxiety and much speculation with regard to its effect in flowing lands and mills adjacent to the River. The result has been very gratifying; although the Pond extends in a broad sheet to the distance of about sixteen miles, but a single instance of damages from flowing has come to my knowledge, and in this case I understand arrangements have already been made by the Directors, by which, although it will require a present expenditure of \$2600—yet there is a good prospect of its eventual return—by reason of the increased value of the location and mill.

Upon the lands now owned by the Corporation, twenty Factories may be conveniently placed, reclaiming thereby about ten acres from the River, with facility and at a small expense.

After reserving all the lands which can be used for the location of mills and the necessary buildings connected therewith, there will remain 750 lots of the land conveyed and contracted to be conveyed to the Company (agreeably to the plans in possession of the Company upon which this estimate is based) containing upon an average about 5000 square feet, which may be occupied for the various purposes of a manufacturing community. Of this number, perhaps 250 may be needed for the operatives connected with the different manufacturing establishments, and to be sold to those only who purchase the power. From the remaining 500 lots, containing 2,500,000 square feet, if you deduct 20 per cent. for poor lots, making the streets, &c. (which will certainly be a liberal deduction) 2,000,000 feet will be left, which at 10 cents per square foot, will give you \$200,000. In addition to the above, you have the Western front on Water Street on the West side, and the two fronts on Canal Street, on the East side of the River, which have not been included; lying as they do upon the two principal Streets, they will undoubtedly be wanted for

Stores, Shops, &c. and are much more valuable than the other lots. The lots on Water Street, containing 87,000 square feet, I estimate at 50 cents per foot. On Canal Street, containing 320,000 feet, at 20 cents per foot.

The value of the *permanent* power (which is fully sufficient to drive 200,000 cotton spindles) I hardly know how to appreciate. The lowest price at which sales have ever been made at Lowell, is, I believe, at the rate of two dollars fifty cents per spindle, including the Factory sites and lots for a sufficient number of boarding houses for the operatives. If this is fixed as the value of 20 mill-powers of 5000 spindles each, (and considering that the 250 reserved lots are to be divided between them it cannot be called high,) it will amount to \$250,000. The balance of the *permanent* power, may be estimated at the rate of \$1.25 per spindle, as the purchasers of the power must also purchase the sites for operating—this item will give \$125,000.

In addition to the application of the power above mentioned, upon the land of the Company, the *surplus* power, equal at least to the employment of 50 Saws, for eight months in the year, may be leased to be used upon land not owned by the Corporation. The income to be derived from this source cannot be estimated at less than \$400 per Saw, or an equivalent thereto in mechanical operations.

The last calculation is predicated upon the extension of the Canals over lands not now owned by the Company, at an expense of about \$20 per running foot, to be incurred by the Locks and Canals Company.

In this connexion it is proper to remark upon the striking value of your *surplus* power as compared with that of manufacturing establishments generally. It is usually the case that a water power used for manufacturing purposes is confined to that limit which will afford a supply at all seasons of the year—and that a surplus, however great and however long continued, is suffered to run almost wholly to waste.

From the vast amount of timber on the Kennebec and its tributaries, and from the peculiar advantages in manufacturing and shipping lumber from this place, it cannot be doubted that a very great proportion of the surplus power would be eagerly sought for, if offered at fair prices,—but it must be employed by an extension of the Canals upon lands not now owned by the Corporation, but which can, in my belief, be purchased at fair prices.

In making the estimates of the worth of the lands belonging to the Company, I have taken as a basis their intrinsic value, growing out

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of their nearness to the business part of a large and flourishing town situated at the head of vessel navigation on an important River, and adding thereto so much only as I am confident the price will be increased by the improvement of the water power.

Having for many years pursued the business of Civil Engineering, particularly in the location of manufacturing establishments and construction of Dams, Canals, &c. and having for the last twelve years been a resident in Nashua, a manufacturing town, situated on the Nashua and Merrimac Rivers in the vicinity of Lowell, I have had such opportunities of witnessing the effects produced in the rise of real estate, in the immediate neighborhood of a great water power, by its occupation for manufacturing purposes, that I have full confidence that the value which has been fixed to the lands belonging to the Corporation is *very* low, compared with the lands of other corporations with which I am acquainted.

The Canal on the West side of the River may be advantageously extended to the Kennebec Bridge (though the land below the Brook is not owned by the Company) the shore affording for nearly the whole distance a ledge for the foundation of Mills, after passing the Brook. On the Eastern side the Canal may pass for a distance of two or three miles over land generally favorable, crossing the grounds of the United States Arsenal, where the power may be used to advantage should it be required.

In addition to the above the Corporation own ten acres of land, with a booming privilege attached, within half a mile of the Dam. Also nine houses now producing an annual rent of \$1100, and the two quarries which have been before referred to. I am not aware of any other real estate owned by the Company.

A recapitulation of the different items of my estimate will show the following result:—

500 lots containing 2,000,000 square feet, at 10 cents,	\$200,000
The lots on Water Street fronting East, containing 87,000 square feet, at 50 cents,	43,500
Lots on Canal Street, containing 320,000 feet, at 20 cents,	64,000
20 Mill-Powers with Factory sites, and 250 lots to be divided between them, equivalent to 100,000 spindles at \$2,50	250,000
Balance of permanent power without land attached equivalent to 100,000 spindles, at \$1,25,	125,000
Surplus power for 50 Saws or other machinery equivalent, yearly rent at \$400 per saw, whole value to give 20 per cent. on investment,	100,000
Total	\$782,500

After a careful review of the above estimates and of the grounds upon which they are formed, and with an anxious wish not to over-rate in any particular, I do not hesitate to say that your Company possess a power with advantages which, when known, *cannot* be overlooked, and, when that time arrives, as it must speedily, it will be found that my estimates are much *under* the real value.

Yours Respectfully,

WILLIAM BOARDMAN.

AUGUSTA, NOVEMBER 1st, 1887.