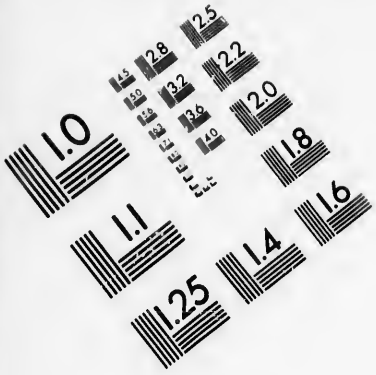

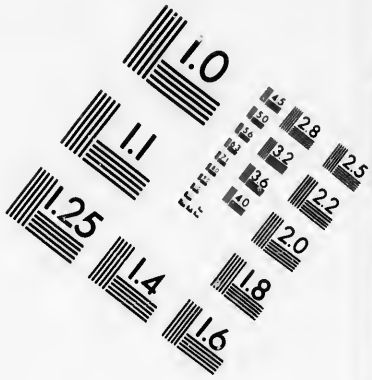

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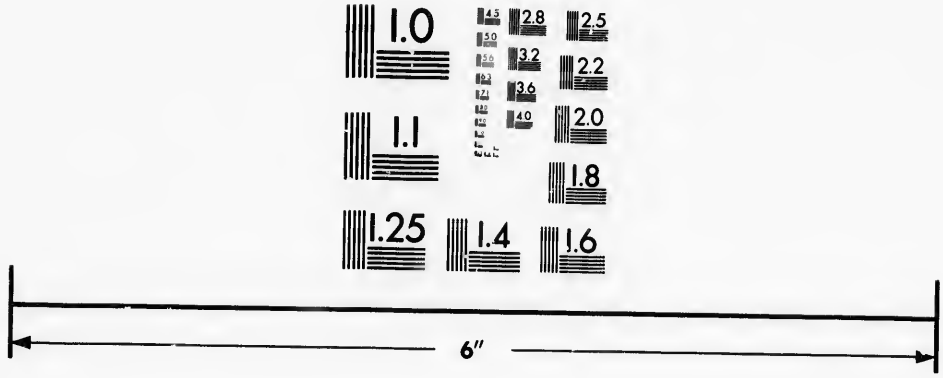

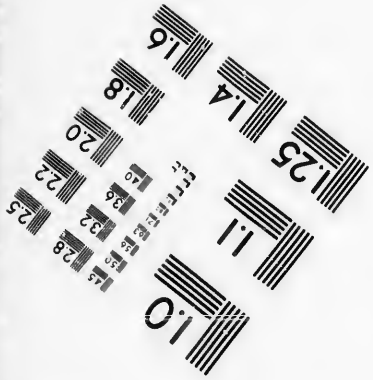

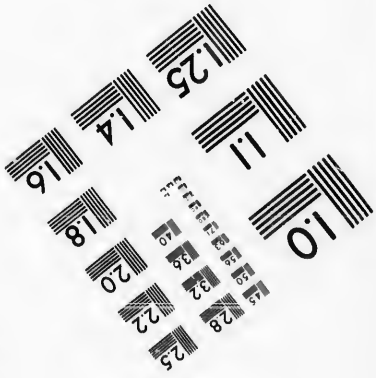

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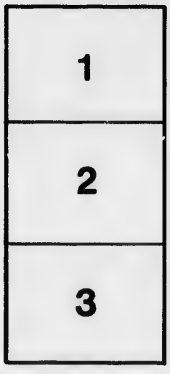

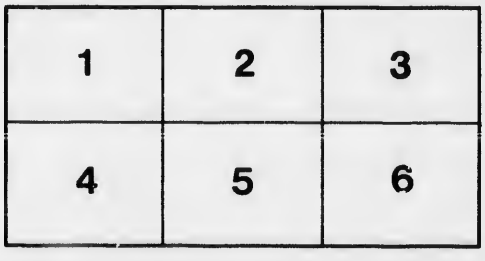

REPORT

OF

W. H. TALCOTT, ESQ.

ON

THE WORKS, ETC.

OF

The Inland Navigation Company,

AND

EXTRACTS FROM LAST REPORT

OF

C. W. FAIRBANKS, ESQ.

HALIFAX, N. S.
PRINTED BY JAMES BOWES AND SONS,
1856.

Louis P Fairbanks
June 1st 1856

1807

REPORT

OF

W. H. TALCOTT, ESQ.

To the Shareholders of the Inland Navigation Company of Nova Scotia:

Gentlemen,—

At the request of the President and Directors of your Company, I have examined the line of your proposed Inland Navigation, for connecting the waters of the Harbor of Halifax with the waters of the Basin of Minas, for the purpose of ascertaining, as near as possible, the cost of completing the said Navigation, upon a scale which will accomplish the objects intended to be accomplished by the making of such a work.

The general plan of your works, as recommended by your Chief Engineer, Mr. Fairbanks, and approved by your President and Directors, is as follows:

I. An inclined plane at Dartmouth, with 55 feet lift above medium high tide, connecting the Harbor with a small artificial lake at the head of this plane.

II. A lift lock, of cut stone masonry, laid in full cement mortar, with 11 feet lift, connecting the said artificial lake with Dartmouth Lake.

III. A canal, 669 feet long, bringing the waters of Dartmouth Lake to the foot of lock No. 2, which is called Port Wallace.

IV. Lock No. 2, which is a lock of 13 feet lift. This is an old lock, now standing, originally faced with cut stone and laid up with lime mortar. It is proposed to let all the walls of this lock stand, except what extends above the upper lock gates, and to line the chamber of the lock with timber and plank, and fill the space between the plank and walls with concrete, making what is called a "composite lock," constructed partly of stone and partly of wood.

V. A canal, 1,000 feet long, extending from the head of lock No. 2 to the foot of lock No. 3.

VI. Lock No. 3, which is to be reconstructed upon the site of the old lock, at the west end of the summit level. It is to be a "composite lock" of 13 feet lift.

VII. A canal, 2,640 feet, being the summit level of the proposed navigation, and bringing the waters of Lake Charles to the head of lock No. 3, including also a stop gate at the entrance into the lake.

VIII. Porto Bello inclined plane, with a lift of 33 feet, connecting Lake Charles with Lake Thomas.

IX. Lock No. 4, with 9 feet lift, connecting Lake Thomas with Lake Fletcher. This is a cut stone masonry lock, laid in cement mortar, and nearly completed, At this lock there is a dam and large overfall or weir, with gates to discharge the surplus waters.

X. Lock No. 5, with 10½ feet lift, connecting Lake Fletcher with the Grand or Shubenacadie Lake. This is also a cut stone masonry lock, laid in cement mortar, and so nearly completed as to admit of locking boats through it. At this lock there is also a large dam and a very extensive weir, completed, with gates to discharge the surplus waters.

XI. Lock No. 6, with 6 feet lift, including river dam No. 1, and a short canal of 700 feet, reaching from the dam to the lock. This lock is situated about 1½ miles below the natural outlet of Grand Lake. It is to be a "composite lock." The dam is built with crib work of timber and stone, having suitable openings to discharge the surplus waters.

XII. Lock No. 7, with 7 feet lift, situated at a place called Rocky Falls, about two miles below lock No. 6. This includes, also, river dam No. 2, which is to be constructed similar in plan to river dam No. 1; also, a canal, 500 feet long, reaching from the dam to the lock.

XIII. A drawbridge at Scott's cross road, near the lower end of Lake William. Also, a drawbridge, or a bridge suitable to be used without a draw, at the lower end of Lake Thomas. Also, a bridge, and raised road way, across the lower end of Lake Fletcher.

XIV. The clearing out and improving the Shubenacadie River, from the outlet of Grand Lake to Nelson's Bridge.

XV. Some further improvements of the river, from Nelson's Bridge to its mouth. This item is not intended to be done at present, as the river may be conveniently navigated, in its present state, until the trade shall require further improvement—at which time the earnings of the Company will provide the means of making it.

It is proposed to make these works in such manner as will secure, generally, at least 5 feet depth of water throughout, and as will allow boats navigating the same, to be loaded to 4 feet depth of water, and the boats to be of the following dimensions, to wit:

Extreme length of boat, . . .	66 feet,
Do. width	16½ feet,

and to use wind or steam power for propelling the boats, taking advantage of the flow and ebb of the tide so far as that extends.

After a careful inspection of the whole line of these works, I am able to say that this general plan is admirably adapted to, and in union with, the prominent and very remarkable features of the country through which your work passes. And I can with truth say, further, that this general plan, and also the detailed plans for carrying it out, evince a careful study of, a thorough acquaintance with, and readiness to apply, the great laws which govern the natural means which have been so profusely placed within the reach of man, to accomplish this work. And I may also add, that these natural means and advantages

exceed anything of the kind that has ever before fallen under my observation, clustered within so short a space.

It will be observed that the plan adopted for overcoming the elevations, includes the construction of two inclined planes. Inasmuch as this is not the usual method of overcoming elevations in water communications, it may be expected that particular reference should be made to this part of your works.

There is always, and wisely so, a hesitation on the part of capital, in adopting any novel plan, or embarking in untried experiments. Although there is something unusual in this plan, still it cannot now be said to be either *novel*, or an *experiment*. Such planes have been in successful use for several years in England, and for more than twenty-five years in the United States. At this present time the undersigned has charge of the Morris Canal, in the State of New Jersey, which is 102 miles long, and overcomes an elevation of nearly 1,700 feet of rise and fall by means of 23 inclined planes and 24 lift locks, and has a trade at this time of about 600,000 tons per annum.

The greatest elevation overcome by any one plane is one hundred feet, and the time required to pass a boat over this plane is less than five minutes, making the rate of speed while passing the plane greater than the ordinary speed of the boats on the level canal.

Those planes are all operated by water power, which is the same power as is proposed for your planes, and the plan and machinery for your planes is to be the same as that now in use on the Morris canal. There need not, therefore, be any doubt or fear about the success of the inclined planes on your work; and I do not hesitate to give a very decided preference to planes over locks at the two points where planes have been adopted.

In estimating the cost of the planes, it becomes necessary to ascertain the weight of the ropes to be used. In doing this I must refer again to the dimensions of the boat in order to ascertain the weight of the load on the rope. The total length of the boat is to be 66 feet, and the width $16\frac{1}{2}$ feet, and the draught of water 4 feet.

Making the proper allowance for the rounding of the ends of the boat, it will displace $(56\times16-6\times4,)$ 3,630 cubic feet of water, which is equal to $(3{,}630\times62\frac{1}{2}$ lbs.,) about 100 gross tons.

The boat may be estimated at $\frac{1}{4}$ or 25 tons, and the cargo at 75 tons.

The car for carrying the boat over the plane is estimated to weigh 27 tons, making the total weight to be moved 127 tons.

The Dartmouth plane is to have an inclination of 1 in 22, and the Porto Bello plane an inclination of 1 in 16.

The preponderance of the trade will be up the Porto Bello plane and down the Dartmouth plane. It will therefore be necessary to provide the ropes of sufficient strength for the Porto Bello plane. The duty required of the rope may be stated as follows :

I.	The gravity of 127 tons on an incline of 1 in 16, a weight of 17,780 lbs., . .	17,780 lbs.
II.	The friction of the car may be estimated at 15 lbs. per ton, which equals . .	1,905 "
III.	The friction of the carrying sheaves and back rope is estimated at	1,275 "
		20,960 lbs.

Good wire will break at a strain equal to 90,000 lbs. per square inch of cross section.

This will give $(\frac{20960}{90000}) = 0, \frac{233}{1000}$ of a square inch of metal as equal in strength to the weight of this load.

It is recommended that there should be at least five times the area of equilibrium given to the rope — this would be equal to $1\frac{165}{1000}$ square inches of solid metal.

The weight of English ropes $1\frac{3}{4}$ inches diameter is 23 lbs. per fathom, which is equal to 1 lb. for every $3\frac{13}{100}$ inches length of rope, and this is equal to an area of $1\frac{23}{100}$ square inches of solid metal, providing the rope was all metal; about $\frac{1}{7}$ of the rope is hemp; if $\frac{1}{7}$ be deducted, it leaves an area of $1\frac{10}{100}$ square inches of solid metal, and there is very considerable strength in the hemp parts of the rope. It may therefore be considered safe to adopt ropes of $1\frac{3}{4}$ inches diameter.

The Dartmouth plane might be operated with a rope only $1\frac{6}{10}$ inches in diameter, but the convenience of having all the ropes of the same diameter, allowing all the machinery to be of the same form and pattern, will more than compensate for any saving in the first cost of the smaller ropes for this plane.

And besides this, the duty of the rope at the Porto Bello plane being much the greatest, it is evident that the ropes at that plane will fail first. If the machinery and fixtures of both

planes shall be of the same dimensions, the ropes of the Porto Bello plane may be transferred to the Dartmouth plane whenever they show signs of being too weak for the duty required at that plane; and in that way more service can be obtained from the ropes, than could be expected if both planes had been made with the same inclination.

It is therefore evident that the present arrangement of the planes is judicious, and that it is best to have all the ropes of the same diameter.

It is more than eight years since the first introduction of wire ropes on the planes of the Morris Canal, and the experience of their use up to this time, indicates, that with proper care the ropes will last at least seven years.

The form of the rail used on the Morris Canal was adopted after long experience, and it is believed to be the best form you can have for your works. It is 3 inches broad on the bearing surface, and weighs 76 lbs. per yard. The estimates for the planes have been based upon the adoption of ropes $1\frac{3}{4}$ inches in diameter, and a rail of 76 lbs. per yard, and the use of the same kind of a water wheel as that which is used on the Morris Canal, called "a Scotch Motor."

Also, on the use of the same form and general dimensions of machinery as that which is used on said canal.

The aggregate estimated cost of completing all your works, I make as follows:

I.	Dartmouth plane, . .	$21,945 79	£5,486 9 0
II.	Lift Lock No. 1, . .	1,293 80	323 9 0
III.	Canal at foot of Lock No. 2 done, ...	0 00	0 0 0
IV.	Lift Lock No. 2, . .	1,200 00	300 0 0
V.	Canal from Lock No. 2 to Lock No. 3 done, .	0 00	0 0 0
VI.	Lift Lock No. 3, . .	2,787 40	696 15 0
VII.	Canal from Lock No. 3 to Lake Charles, . .	526 62	131 13 1
VIII.	Porto Bello plane, . .	18,150 00	4,537 15 0
IX.	Lock No. 4, . . .	490 00	122 10 0
X.	Lock No. 5, ...	240 00	60 0 0
XI.	Lock No. 6 and river dam No. 1, ...	2,500 50	625 2 6
XII.	Lock No. 7 and river dam No. 2, ...	4,745 91	1,186 09 6

XIII.	Drawbridges and other bridges, ...	$1,200 00	£300 0 0
XIV.	Clearing out the Shubenacadie river from outlet of Grand Lake to Nelson's Bridge, . . .	5,274 33	1,318 10 8
XV.	Improving the river below Nelson's Bridge at present,	0 00	0 0 0
		$60,354 35	£15,088 11 9
	Contingencies, Superintendence, &c., . . .	8,645 65	2,161 8 3
	Making a total of .	$69,000 00	£17,250 0 0

It is known to many of the Shareholders that the time which I have been able to bestow upon these estimates has been somewhat limited beyond what could have been desired. Consequently it can hardly be expected that the results will prove that the cost of each structure has been accurately arrived at.

It is proper therefore to state, that as a general thing (such being my rule always,) I have in all cases of uncertainty leaned towards an over estimate, rather than an under estimate. I shall not, therefore, be much disappointed if the works of the Company should be completed for a less sum than the total amount of my estimate, but I should be *greatly disappointed* if the work should cost more than the sum stated above.

As individual enterprize will hardly be willing to provide the first steam tug, at so early a day as it will be desirable to have such boat provided, it may be necessary for your Company to procure such a boat, which will cost from $2,000 to $3,000, or from £500 to £750.

Should the work be completed for the sum estimated, it will make the total cost of your works about £33,000; thereby giving to you the benefit of a navigation about 60 miles in length, with one end resting on the *Harbor of Halifax*, and the other on the *Minas Basin*, for that sum, which is only £550 per mile.

As a general thing, the canals now in use in the United States, with only 5 feet depth of water, have cost to the Proprietors at least $40,000, or £10,000 per mile, and $2,500 or £625 per foot lift for the elevations overcome.

The same rate of cost in this case would swell your work to the sum of £698,025.

Experience has shown that the cost of transportation in the States on a canal with 5 feet water is about 1 cent. per ton per mile, exclusive of the tolls; and that the cost of transportation on the rivers and lakes does not exceed ½c. per ton per mile.

As your navigation may be said to be entirely river and lake navigation, but subjected to the passing of 7 locks and 2 planes and a circumscribed channel in a portion of the river, it may be safe to calculate that the cost of transportation will be a half-penny per ton per mile for distances over 30 miles, and one cent per ton per mile for distances less than 30 miles; thus making the entire cost of transporting a ton from the Basin of Minas to Halifax Harbor, only two shillings and sixpence for the freight, and whatever the tolls may be in addition thereto, probably not to exceed, in all, three shillings and ninepence per ton.

In other words, for all practical purposes to Halifax, the Basin of Minas will be brought as near to it as is the farming country at ten miles distant from the town; and consequently a very large proportion of the trade of that large Inland sea would be secured to Halifax, a trade which must otherwise finally centre at St. John, New Brunswick.

I trust that it will not be considered improper, in closing this report, to refer to the large deposits of gypsum, limestone, brick, clay and sand on the banks of the Shubenacadie River, and the extensive quarries of granite and other good building stone on the lakes, and also to the forests that line the shores of the lakes and parts of the river and its tributaries, from which may be obtained almost an unlimited amount of timber, lumber and wood; and to the large water power on said tributaries, and along the Company's works, and also to the extensive and fertile agricultural regions on each side of the river, this side of the Bay of Minas, as evidence that a large trade will seek the advantages of the use of your water communication, almost as soon as it shall have been completed.

Very respectfully,

Your obedient servant,

W. H. TALCOTT, C. E.

HALIFAX, N. S., May 19, 1856.

EXTRACTS

FROM THE

REPORT OF C. W. FAIRBANKS, ESQ.

C. ENGINEER,

SUBMITTED TO THE SPECIAL MEETING OF THE COMPANY, HELD ON THE 6TH DAY OF FEBRUARY LAST.

THE work remaining to be done on the river will not cost over, at present prices, ... £2,500
To finish the locks at Fletcher's and the Grand Lakes, with three drawbridges and sluice, ... 350

Say to finish the canal to Marshall's, or to within six miles of Halifax Harbor, ... £2,850

If this part of the navigation be put into operation, the Company will derive some revenue, and it will also aid the railway.

If the Directors would accept of one of the offers made by JOHN F. WARD, of Jersey City, and Mr. GREIG, of Dartmouth, for the construction of the water wheel, pulleys, and other works connected with the planes at Dartmouth and Porto Bello, the two will cost £5,200
The flume wheel-house and other works on the Dartmouth plane will cost 1,000
The rails for one track at Dartmouth and Porto Bello planes, ... 700
Main and back wire ropes for the two planes, . . . 1,500
The flume wheel-house and other works at Porto Bello plane, ... 750
The Dartmouth and Port Wallace locks, ... 1,500
Brought forward, ... 2,850

£13,500

To which add for 4 drawbridges, station-houses and other expenses, ... 1,500

£15,000

The increased cost of value of labor, as compared with its cost previous to the commencement of the public works, is 35 per cent. for common laborers. I experienced much difficulty in procuring plank boards and timber for the locks, dams, and other works. The railroad contractors and their workmen required much more lumber than the mills could supply. I had therefore much trouble and expense to obtain the large quantity I required. In some cases thirteen dollars was freely given for hemlock lumber per thousand; every kind of material could only be got by paying more than one hundred per cent. over its former value. With all the additions to the cost of the canal, although much more than expected, it will not be an expensive public work.

A large part of the outlay is for new and valuable improvements, such as the lock sluices and the wire ropes, rails and water wheels, for the inclined planes. There is now no work to be done or executed of a dangerous or uncertain character. The greatest misfortune that can happen, such as the breaking of a dam or lock, cannot be very injurious. There is no part of the works on the river or lakes which cannot be made as perfect and as secure as can be desired.

No experiments are tried; the works are as near as possible copies of works now in use in England or the United States.

The deep cutting at Port Wallace is the most extensive and expensive work of art on the whole route, and it is, when compared with cuttings on other canals or railways, rather insignificant, but very important when it is remembered that it is the lowest passage from the harbor to the Basin of Minas: through it must flow the greatest portion of the trade of the Province; and if the rate of toll on the articles which may pass over the canal be as low as on any similar work, the revenue will exceed the working expenses and pay twelve per cent. on the outlay, and there will remain a large sum to make any required repairs or improvements, and, in time, the extension of the navigation eastward into other sections of the Province.

A small steamboat would be very useful and profitable on the Shubenacadie River and the Grand Lake; it would have plenty of work; and so soon as the locks arebuilt, a trade in plaister will at once begin. The steamboat could tow a train of boats containing five hundred tons of plaister, from the quarries which are nearest the market to Dartmouth, so as to prepare any quantity for shipment, in summer or winter: 1,000 tons each day for 200 days, at sixpence toll per ton, would give £5,000 for this one article alone.

If we put down but a small sum from the many other articles which we know will descend to the harbor, it is clear that a large revenue must be produced.

The working expenses on this canal will not be very large; it would be cheapest to employ only the best men that can be had, at the locks and railways. The repairs which may be required, will mostly result from the carelessness of the boatmen and the natural decay of all wood work in the gates and sluices. The mechanical structures on this canal will be less subject to injury than on most works of the same description. Plaister would perhaps bear one shilling toll, but it would not be prudent to charge it, if we desire to concentrate in Halifax Harbor the principal sources of the trade of the Province.

The lower the toll on every article is made, the greater will be the quantity used; thus marsh mud at sixpence per ton can come down, and pay the farmer who is within a short distance of the canal. Put it at threepence, and you will increase the demand perhaps fourfold. I cannot but believe that the revenue of the canal will much exceed all my former calculations. If we take the increase of trade on our canal to be something in proportion to the increase observed on the canals in the States, with much higher rates of toll than it is proposed to charge on our works, the profits will be very much beyond any statement yet made. The tolls received on the Morris Canal in 1845 was $18,997; in 1854, $246,429; the profits of the business $142,412 dollars. Now if these results are produced on a navigation, which I think is far inferior in every respect to our work, we may expect large returns.

The toll on the Morris canal is one cent per ton for a mile; our toll may be half a cent per ton. The tonnage on the Morris Canal in 1854 was 545,269 tons; our trade will exceed this quantity in ten years from its completion.

The work though, as a commercial speculation, affords every prospect of profit to those embarked in it. We may view it in the light of a public work of necessity, absolutely required to supply the wants of the citizens of Halifax and the people of the country. The port of Halifax wants an export trade besides that which the fisheries produce. The city wants cheap wood and coal, also building materials, stone, brick, timber, &c. The country wants a cheap mode of communication with the sea-coast, so that at all times the staple products of the Province may be exported in winter as well as in summer, and thus afford employment for that portion of our shipping now idle and use-

less during the winter months. The experience of other canals give us data from which we may, without any doubt, estimate the profits on our navigation.

Plaister, deals, timber, coals, and other articles, can be placed in very great quantities at the outlet of the canal in summer, so that a cargo may be procured at any time. No other work of art can produce these important advantages to the same extent or at so small a cost.

The canal will bring into use and value many acres of land now unproductive; it will cause numerous quarries to be opened, some of which only await the opening of the work; it will also turn the trade passing down the Shubenacadie River into the Harbor of Halifax, and produce many other valuable results now unnoticed or perhaps unknown.

Whatever good may be done by the navigation, when in operation, must be attributed to, not the works made by man, but to the great natural advantages and resources which it has pleased a wise Providence to place for our benefit and use, on or under the soil of our Province.

From the rapid increase in dimensions, and also the vast expansion of the trade on canals in the States within the last ten years; and from the experience I have now gained on our works relating not only to the construction of its various locks, dams, &c., but to the trade it will induce hereafter to augment throughout the country it is traversing, I believe our canal to be of much greater importance to the whole Province than ever supposed by its former or present promoters, and that the profits to be derived from it will greatly exceed the estimates and expectations of its most sanguine friends. I certainly was quite surprized to see the improvement in trade and form on those canals in the States, which I take as models for our works, since my first inspection in 1847.

It now requires but little study to perceive the vast benefits which must result from a line of water communication, passing through the centre of the Province, and having for its terminus the cities of Halifax and St. John, also commanding the commerce of the Basin of Minas, and part of the Bay of Fundy; no other work of art can injure its trade, impair its utility, or lessen its revenues.

The foregoing extracts from Mr. Fairbanks's Report. are published in compliance with the terms of a resolution passed at the Special Meeting of the Company, held on the 19th instant, for the purpose of receiving Mr. Talcott's Report,—and which resolution provided for the publication of that Report, with the Extracts appended. And the Directors would call the attention of Shareholders to the various points of agreement between the two Reports, which shew that Mr. Talcott not only approves the plans and confirms generally the views of Mr. Fairbanks, respecting this work, but also in the main agrees with him as to the probable cost of its completion.