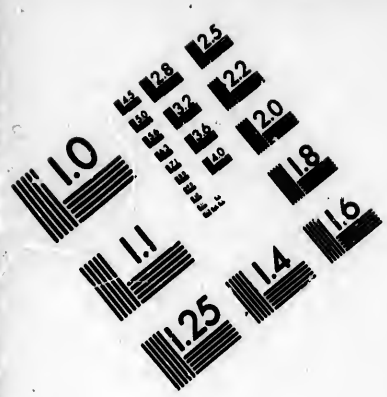

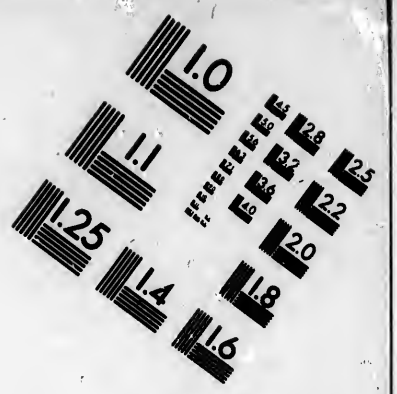

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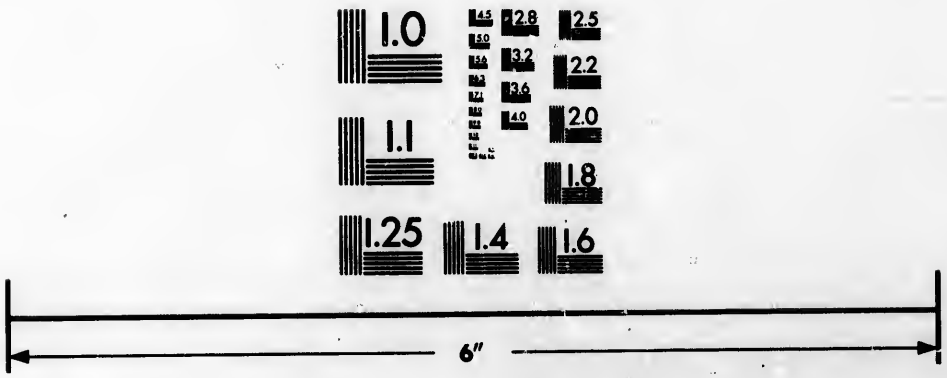

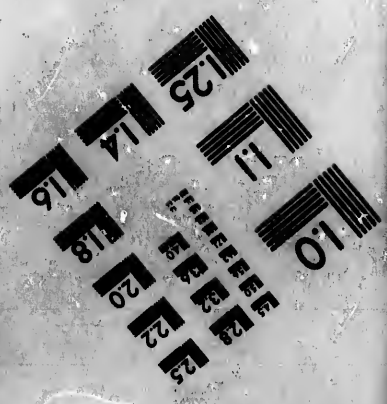

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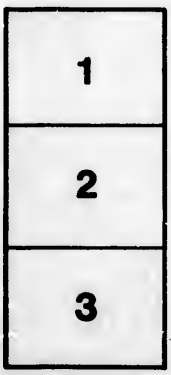

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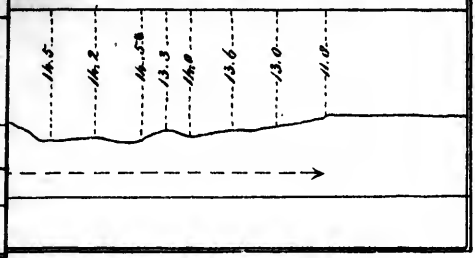
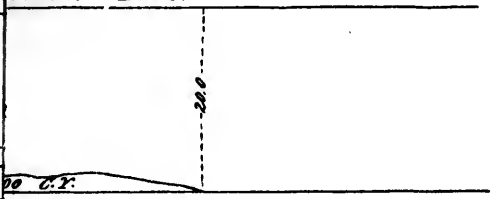
CH CUTTING" SYSTEM.



OWER BAR.



00 C.Y.

VER BAR

00 C.Y.

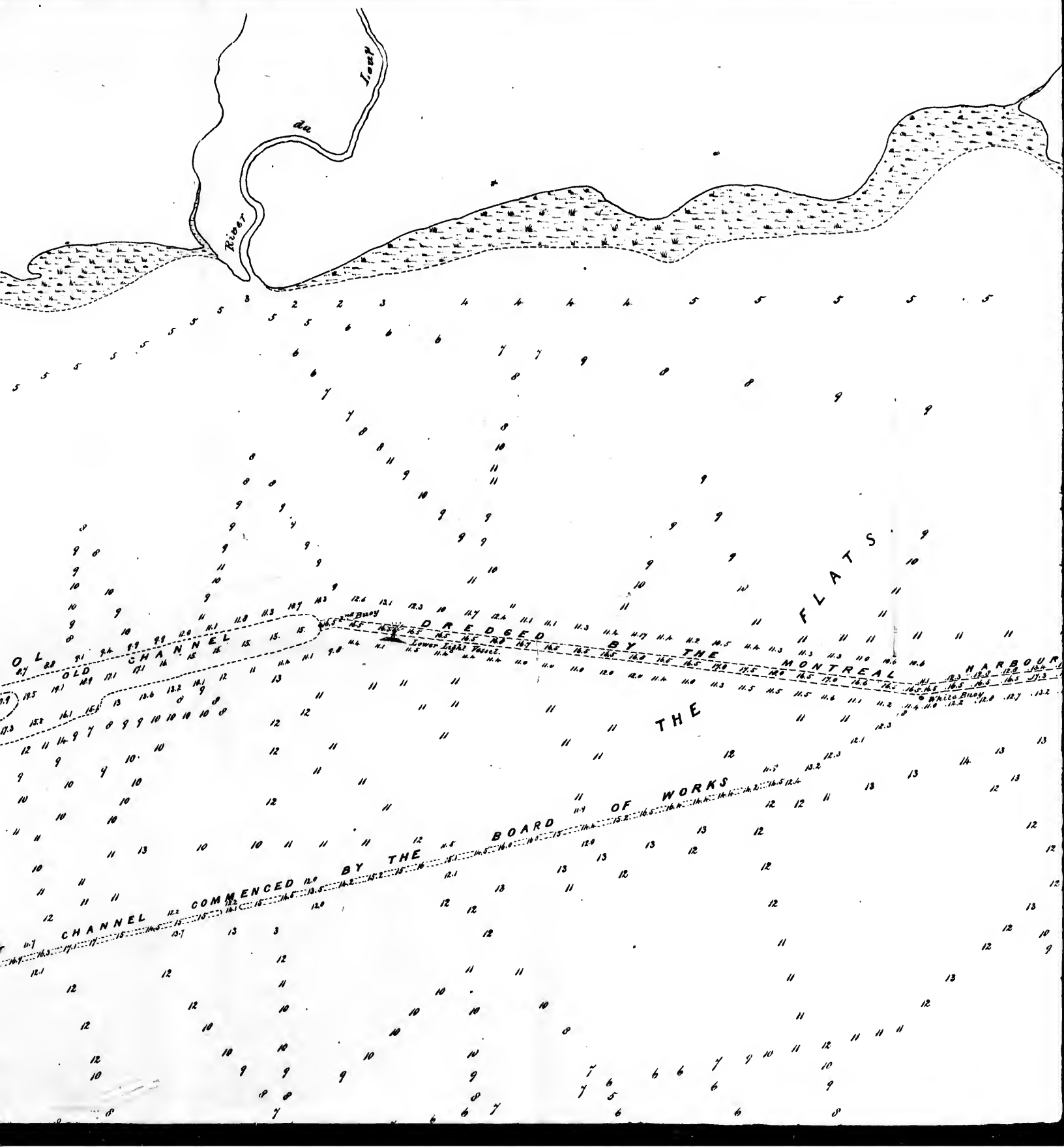
Keefer.

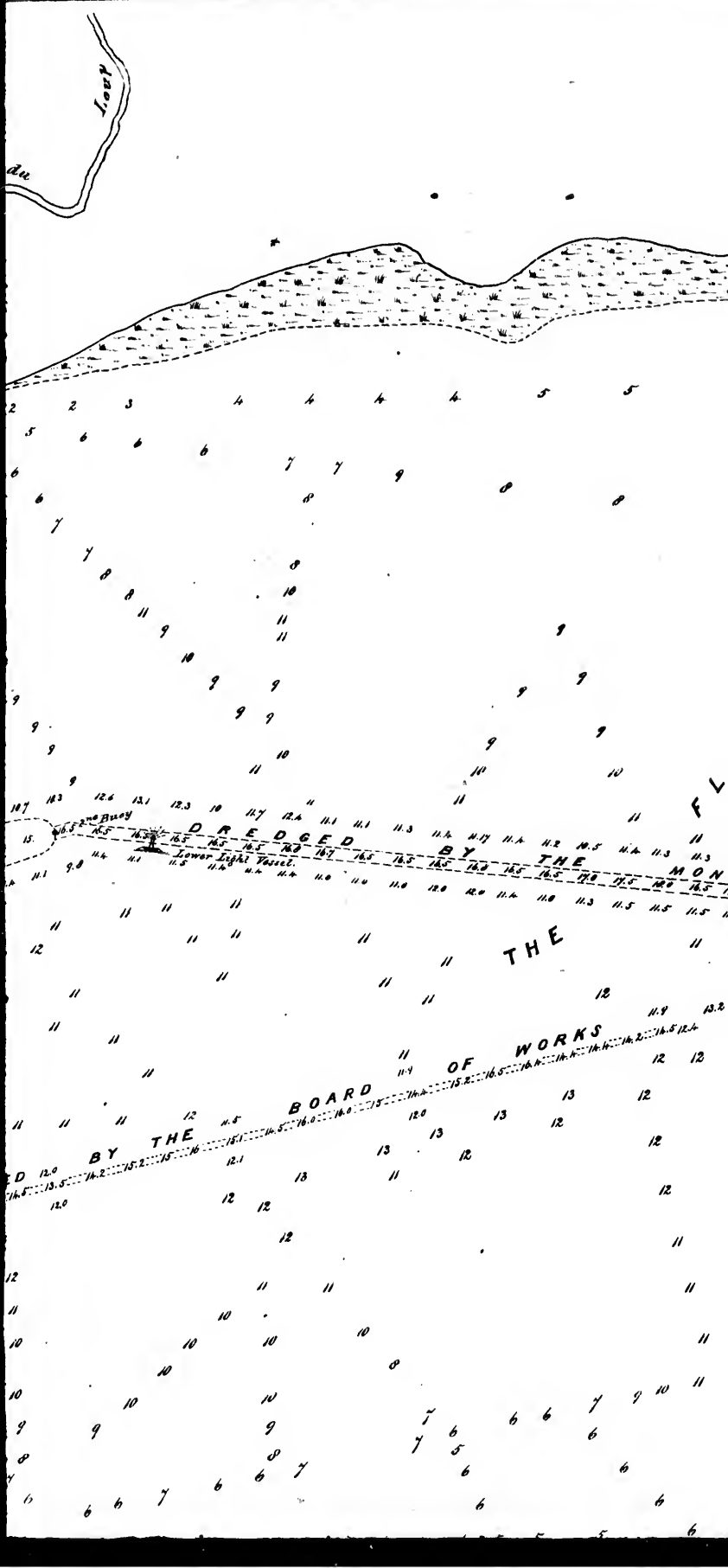
Harbour Commissioners,

St James 'Street.

Montreal March 1st 1855.


R. Mashinaw
EAGLE I.
Bank of La Carpe
UPPER POOL
Upper Light Vessel
UPPER BAR
BANK.
FRANCIS
STRAIGHT
CHANNEL
CHANNEL
FLAT I.


Rivet du Loup
OLD CHANNEL
DREDGED BY THE MONTREAL HARBOUR
FLATS
THE
CHANNEL COMMENCED BY THE BOARD OF WORKS
Lower Light Vessel.
White Buoy


Jetty
2nd Buoy
Lower Light Vessel.
DREDGED BY THE BOARD OF WORKS
DREDGED BY THE


Machiche
R. Machiche
FLATS
THE MONTREAL HARBOUR
COMMISSIO
White Buoy
ORKS

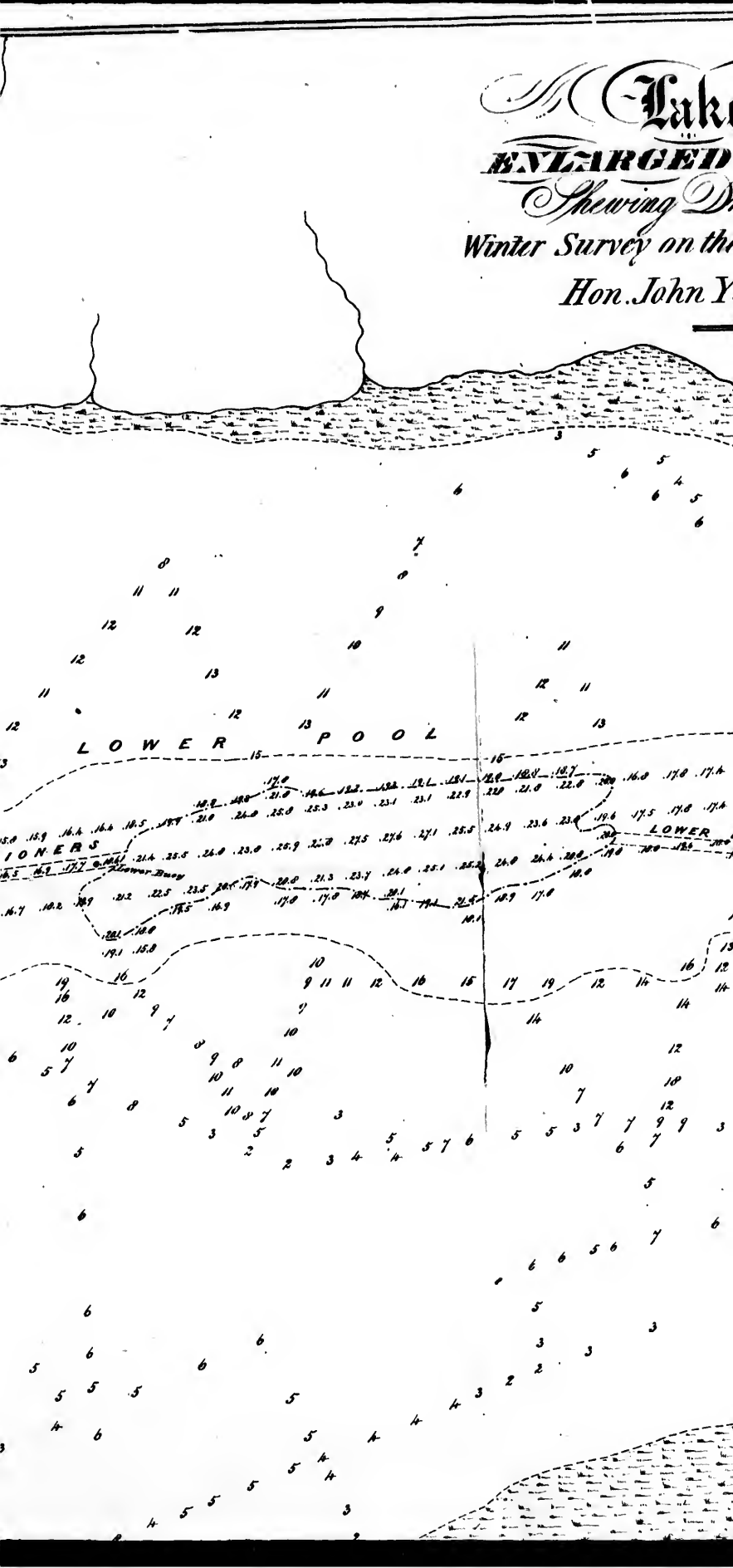
Lak

ENLARGED

Shewing D

Winter Survey on the

Hon. John Y



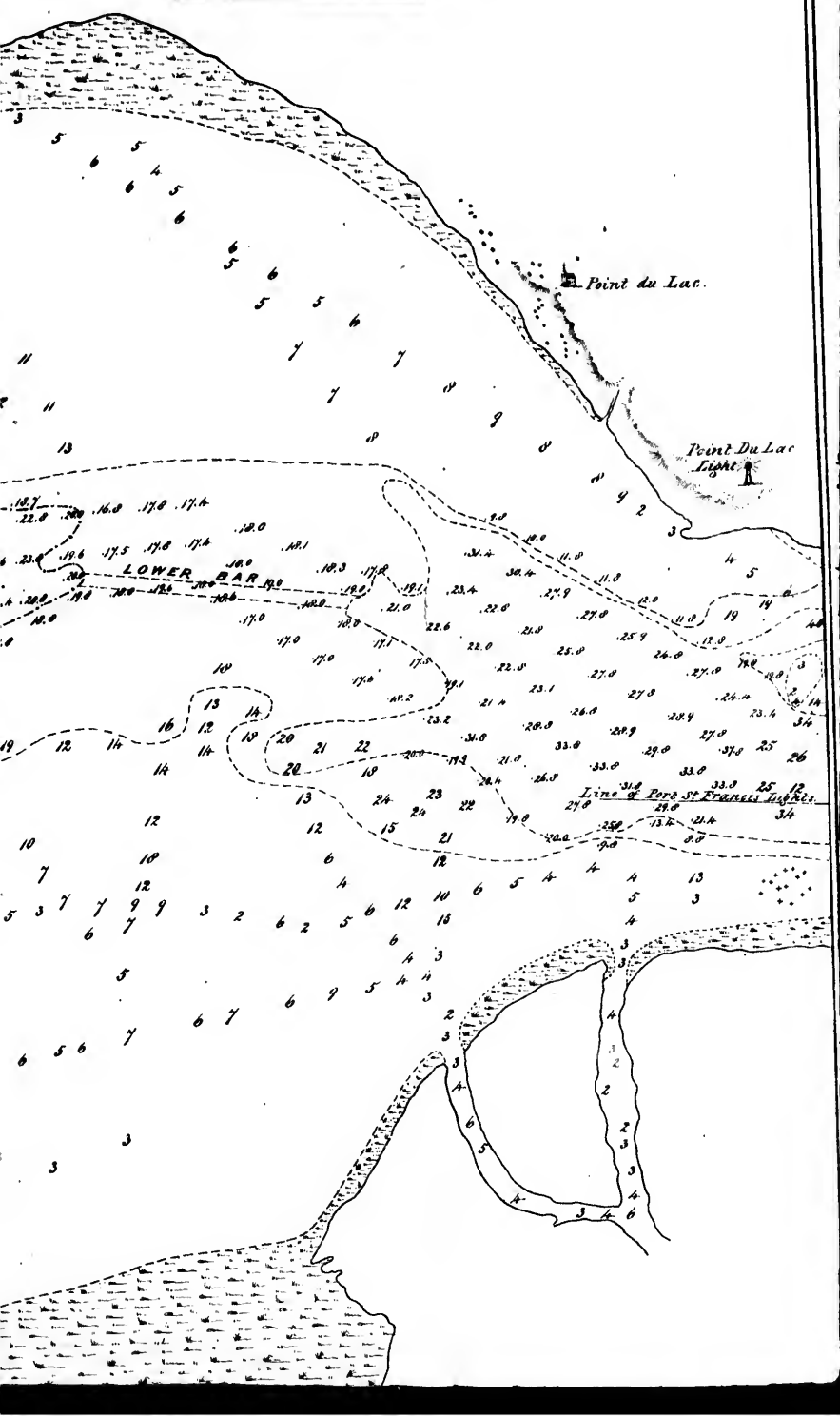
Lake St. Peter

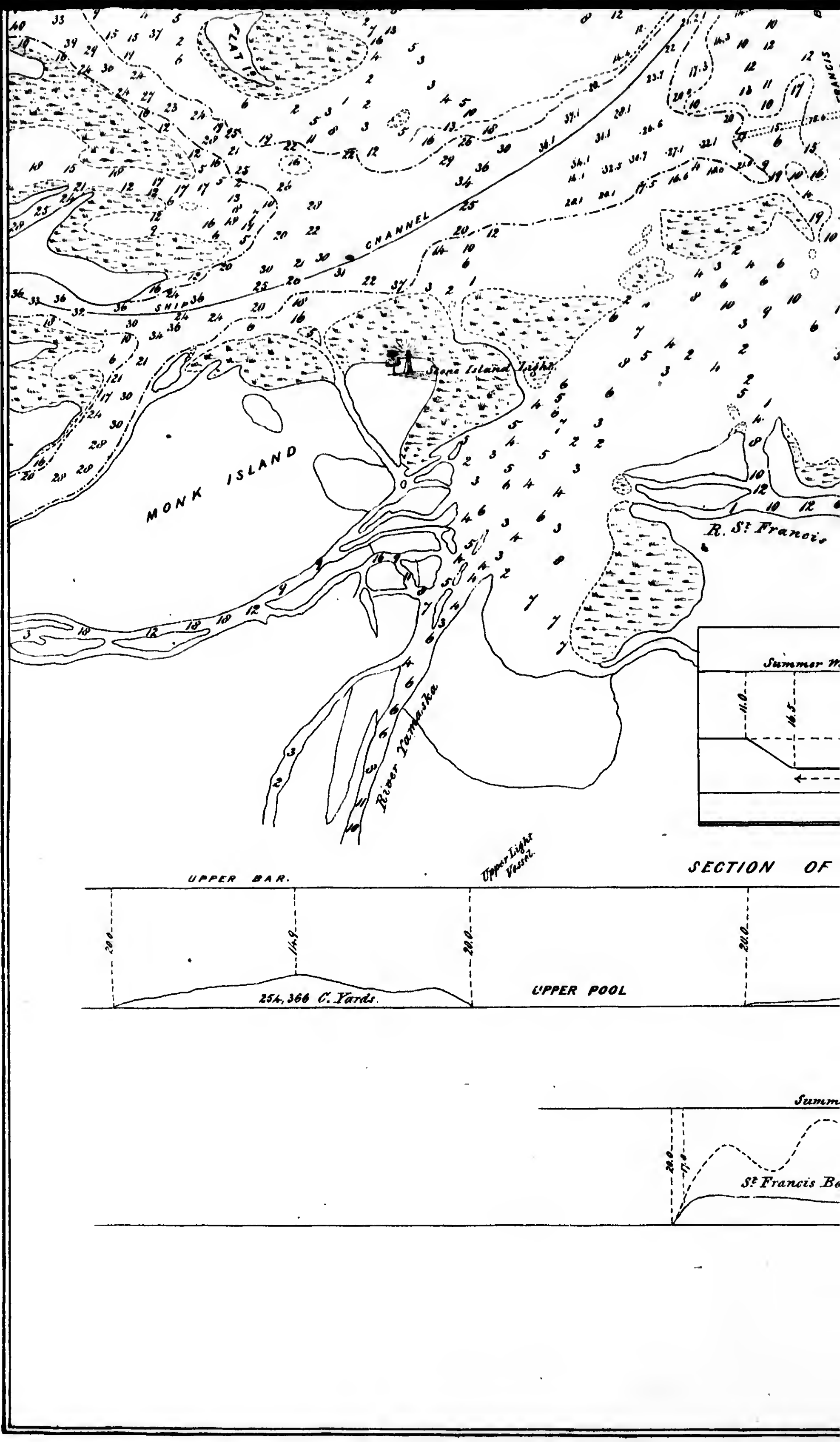
ENLARGED FROM BAYFIELD.

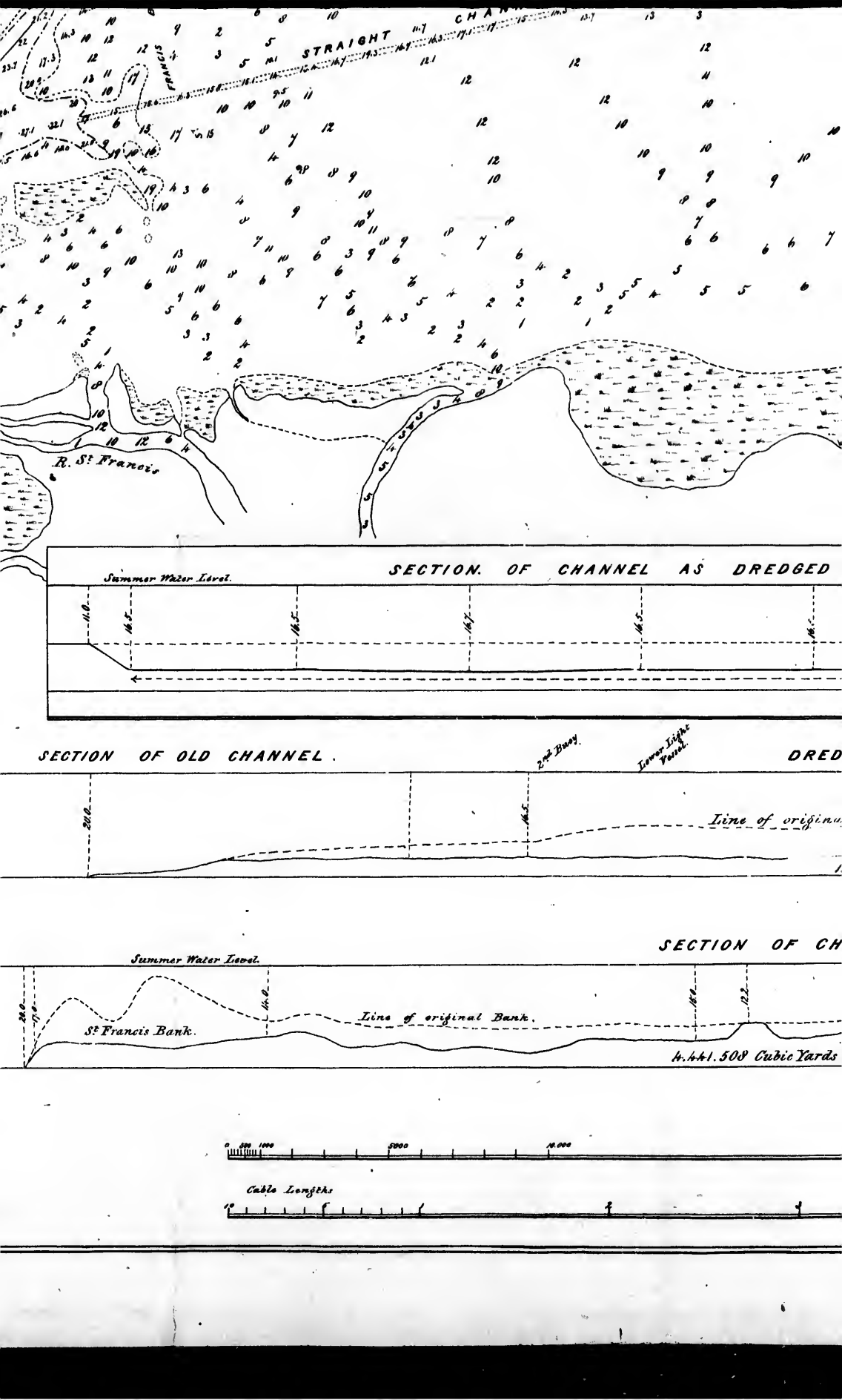
Shewing Dredging Operations.

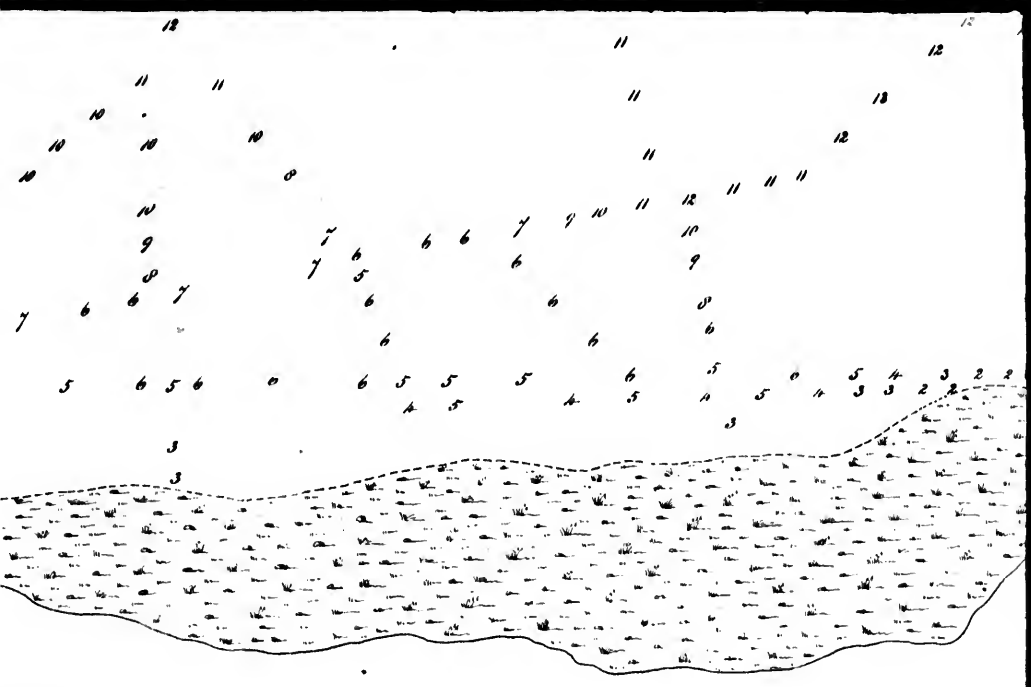
and Survey on the Ice, for Harbour Commissioners.

Hon. John Young, Chairman.

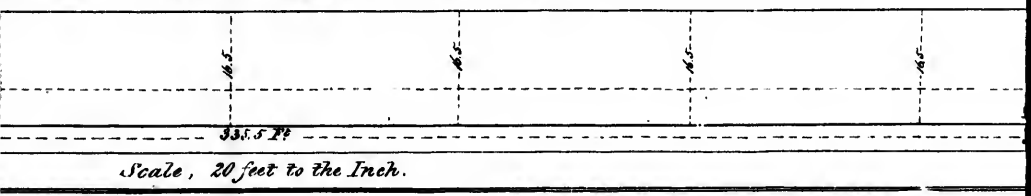



SHIP CHANNEL
Stone Island Light
MONK ISLAND
R. St Francis
River Yamaska
SECTION OF
UPPER BAR.
Upper Light Vessel.
UPPER POOL
254,366 C. Yards.


STRAIGHT
FRANCIS
R. St Francis
Summer Water Level.
SECTION. OF CHANNEL AS DREDGED
SECTION OF OLD CHANNEL.
2nd Buoy.
Lower Light Vessel.
Line of original
Summer Water Level.
St Francis Bank.
Line of original Bank.
4.441.508 Cubic Yards
Cable Lengths



ED BY HARBOUR COMMISSIONERS, "RADIUS CUTTING" SYSTEM.



Scale, 20 feet to the Inch.

EDGED BY THE HARBOUR

White Buoy.

inual Bank, or Flats of L. St Peter.

1.998.283 C. Yards, to dredge for 20 ft. Water.

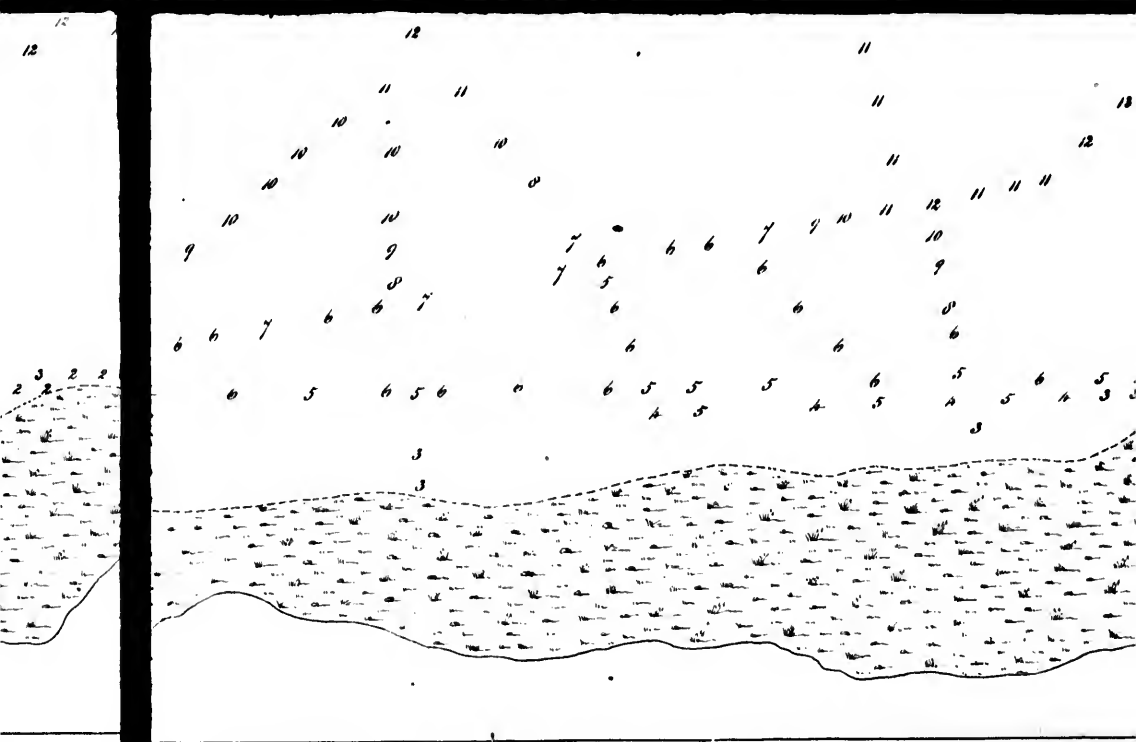
CHANNEL DREDGED BY THE BOARD OF WORKS.

rds to dredge for 20 ft. Water.

40.000. 40.000 40.000

SCALES FOR CHART.

1 5 6 7



REDGED BY HARBOUR COMMISSIONERS, "RADIUS CUTTING" SYSTEM.

335.5 Ft

Scale, 20 feet to the Inch.

RBOUR DREDGED BY THE White Buoy HA

of original Bank, or Flats of L. St Peter.

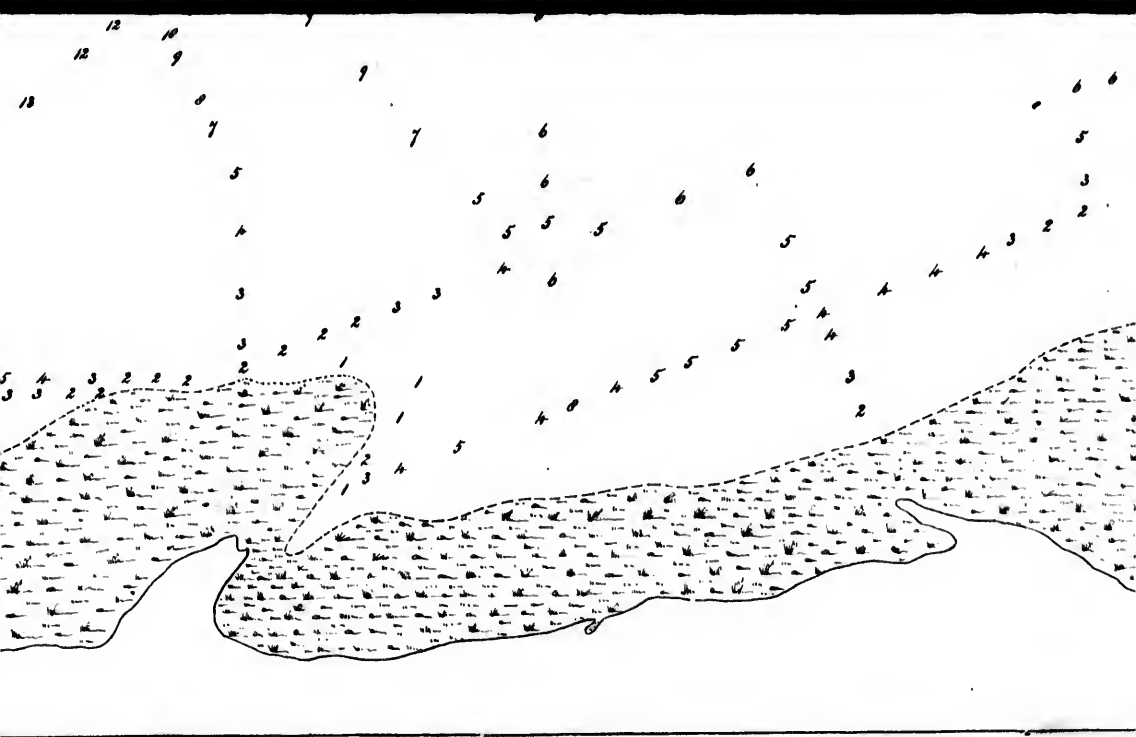
1.998.283 C. Yards, to dredge for 20 ft. Water.

OF CHANNEL DREDGED BY THE BOARD OF WORKS.

Cubic Yards to dredge for 20 ft. Water.

40.000 30.000 30.000

SCALES FOR CHART.



SECTION OF BOARD

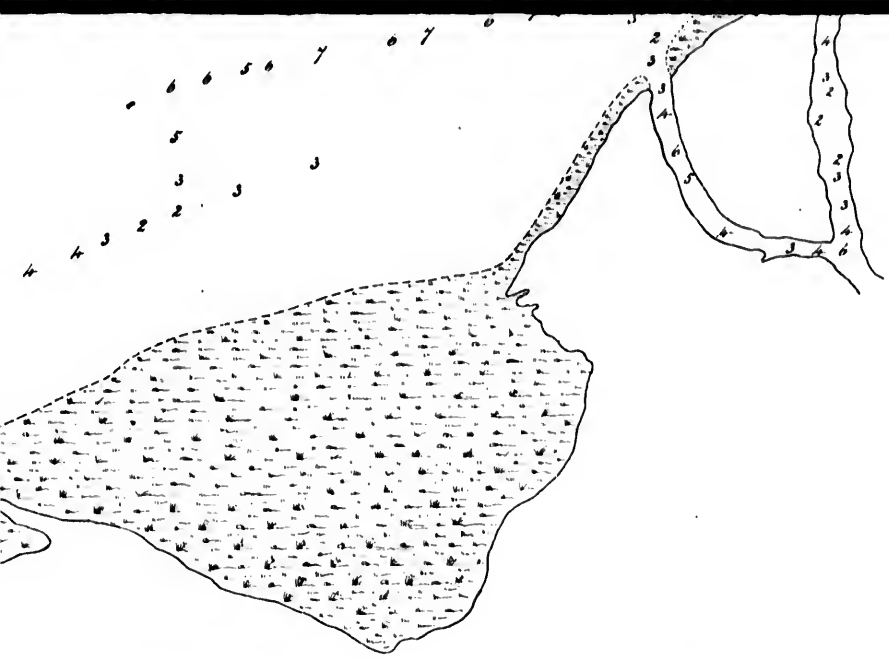
HARBOUR COMMISSIONERS.

Horizontal Scale 2500,

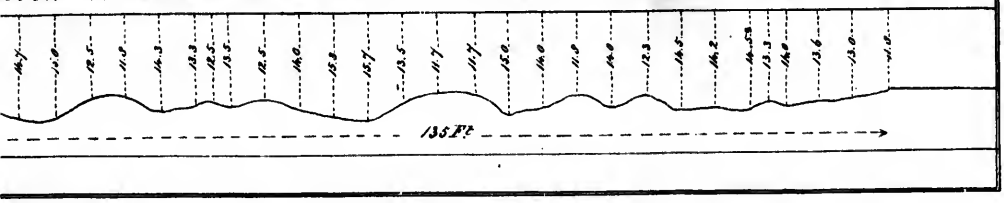
Lower Buoy

LOWER POOL.

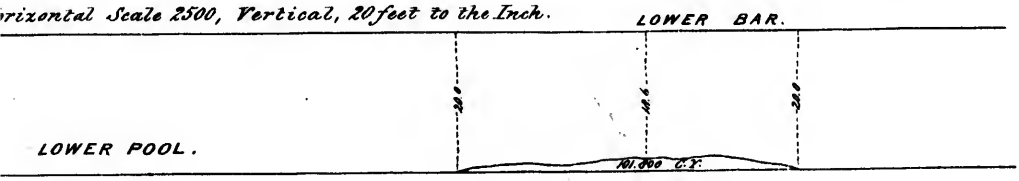
40.000 50.000 40.000 FEET

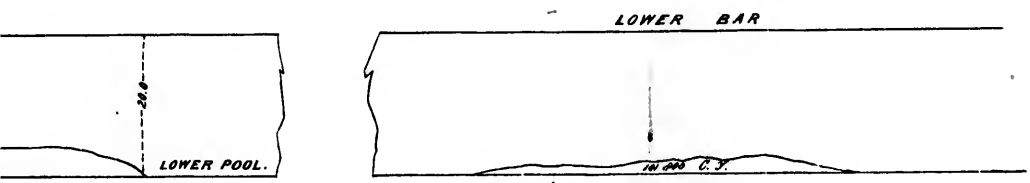


TION OF BOARD OF WORKS CHANNEL, "TRENCH CUTTING" SYSTEM.



rizontal Scale 2500, Vertical, 20 feet to the Inch.





Thos. C. Keefer.

Engr. Harbour Commissioners,

29 Great St. James' Street.

Montreal March 1st 1855.

40.000 FEET

10 NAUTICAL MILES.

REPORT

OF THE

HARBOUR COMMISSIONERS OF MONTREAL,

FOR THE YEAR ENDED DECEMBER 31ST, 1854.

To His Excellency Sir EDMUND WALKER HEAD, *Baronet, Governor General of British North America, Captain General of the same, &c., &c., &c.*

MAY IT PLEASE YOUR EXCELLENCY :—

The law under which the Harbour Commissioners of Montreal exercise their functions requires that they shall annually lay before the Governor General an account of their Receipts and Expenditure, and also "a statement of their proceedings in the execution of their duty;" and, in accordance with this provision, I have now the honor by their direction to transmit herewith an account of their Receipts and Expenditure for the year ended on the 31st December last.

Instead, however, of the ordinary statement of proceedings, I am instructed by the Harbour Commissioners rather to lay before Your Excellency a general view of

their financial affairs, their past labours, and their prospective duties, in the hope that such a statement may induce Your Excellency to take an interest therein, and to aid them in such manner as may be expedient in their important undertakings; an interest which they deem it the more important to secure at the present moment, as they are applying to Parliament for authority to borrow a large additional sum of money, for the purpose of improving the ship channel between Montreal and Quebec, and providing increased accommodation for sea-going vessels in the Harbour of Montreal.

Referring in the first place to the ship channel abovenamed, it may be well to state for Your Excellency's information, that in former years the water in the ship channel of Lake St. Peter fell to about 11 feet in depth upon the "flats," from the month of July down to about the end of the season of navigation, a circumstance which proved highly detrimental to the trade of Montreal, and added materially to the cost of transportation to and from the interior above it, as it rendered it necessary to carry the bulk of the cargoes of sea-going vessels, both inward and outward, in lighters between Montreal and Quebec, during that time.

With the view of remedying this evil, the Legislature, in 1843, voted a sum of money for deepening the channel referred to, to 14 feet at low water, instead of 11 feet, and at the same time directed the Board of Public Works to commence operations for that purpose. Unfortunately, however, this Board undertook to make an entirely new channel through a shallow part of the Lake, instead of following that which natural causes had already formed, the object which they sought to attain in thus deviating from the natural channel, being to obtain a straight one instead of one slightly curved. They continued working at this straight cut for four seasons, and expended thereon about £74,000, when the House of Assembly ordered an examination to be made into the progress of the work, and on receiving

the Report of its Committee resolved that the operations should be suspended, as they seemed to be a total failure, and the money wasted.

Three years or more then elapsed without anything practical being done to improve the navigation of Lake St. Peter, although the Board of Trade of Montreal, and many influential citizens did not cease to exert themselves during that time to induce the Government to resume the all-important undertaking. Meantime the interests of Montreal were suffering from this inaction on the part of Government, and the citizens it may be said had well-nigh lost hope of ever seeing the work resumed. But at this juncture the Honorable John Young, the present Chairman of the Harbour Commissioners of Montreal, proposed a plan for carrying it out, which was briefly as follows: That the Harbour Commissioners of Montreal should be authorized to undertake the work, and to borrow a certain sum of money for the purpose, the interest on the sums borrowed as well as a Sinking Fund of 2 per cent per annum to be provided for, first, by a tonnage duty of not exceeding one shilling per register ton, on all vessels drawing 10 feet of water and upwards, such duty to be levied for each time of passing the Lake; secondly, by the surplus revenues of the Harbour of Montreal, in case said tonnage duty should prove insufficient for the purpose; and thirdly, in order to meet all contingencies, by the provision that the Governor General should have authority to empower the Harbour Commissioners to levy such additional percentage on all their Harbour and Lake dues as would in his opinion afford them a sufficient revenue to meet every legal charge upon it. This plan was approved and adopted by the Government, and an Act of Parliament procured in accordance with it. Mr. Young was also appointed a Harbour Commissioner, to enable him to carry out his views, and the first step taken by the Harbour Board was at his suggestion to appoint a Board of Engineers to examine Lake St. Peter, and report upon the best course to be pursued for the purpose of ob-

taining therein a ship channel with 16 feet in depth at low water, being 2 feet deeper than the channel contemplated by the Commissioners of Public Works. The gentlemen selected for this important duty were Messrs. McNeil and Child, eminent Civil Engineers of the United States, and Mr. Gzowski, a well-known Civil Engineer of Canada; and these gentlemen, accompanied by W. E. Logan, Esq., Provincial Geologist, who kindly lent his services to determine the nature and origin of the materials constituting the obstacles to be removed, made a minute survey of the old and new channels, and after careful deliberation thereon recommended the Harbour Commissioners *not* to resume operations in the straight cut attempted by the Board of Public Works, but on the contrary to follow the channel already formed by natural causes, which, they reported, presented no obstructions but sand and clay, which could easily be removed by dredging. That recommendation was adopted by the Harbour Commissioners, and the most complete success has been the result; so much so that in three seasons and a-half of about 180 working days each (the whole time employed thus far) the ship channel through the "flats" of Lake St. Peter has been deepened to *sixteen feet six inches* at low water (11 feet,) with a width varying from 250 to 300 feet. The channel above that point to the entrance of the Harbour of Montreal has also been improved so as to give a depth of 15 feet throughout at low water, the entrance referred to being at the same time deepened to about 17 feet with a sufficient width to enable ships to be towed through it in safety with ordinary good management. These important improvements have been effected at a cost of £23,513 for outfit, and £50,507 for operations; the latter amount including, it may be remarked, not only the cost of dredging, but also that of the preliminary surveys for both the original undertaking and the still more important project of deepening the channel to 20 feet at low water. For details of these operations, as well as the expenditure incurred, I beg respectfully to refer Your

Excellency to the Report, herewith transmitted, of the Harbour Commissioners' Engineer, T. C. Keefer, Esq., in which the subject is very fully stated and discussed.

Having anticipated the remarkable success already mentioned, the Harbour Commissioners, in September, 1853, thought it desirable to ascertain what obstacles existed in the River St. Lawrence to deepening the channel to 20 feet at low water, being satisfied that carrying their operations in Lake St. Peter to that depth was merely a question of time and money, which could easily be determined. They accordingly directed their Engineer, Mr. Keefer, to make such a survey of the River and Lake between Montreal and Quebec as would enable him to report what impediments existed, and what the probable cost of removing them would be. By the end of October, 1853, Mr. Keefer, (assisted by Captain Bell, under whose superintendence the operations have hitherto been conducted,) had made such progress with the survey, that he was able to report the entire *practicability* of deepening the channel to 20 feet at low water, from Montreal, at, comparatively speaking, a moderate cost, provided a channel on the south side of the River, between *Varennes* and *Lavaltrie*, (to which Captain Bell had previously drawn the attention of the Harbour Commissioners,) were adopted for improvement, instead of the old channel hitherto used by Pilots on the north side of the River.

The Harbour Commissioners, after due deliberation upon this question, resolved that it was expedient to adopt the course recommended by Mr. Keefer, and to carry the deepening to 20 feet at low water, throughout the channel, provided the Board of Trade of Montreal approved of their doing so. A resolution to this effect was accordingly submitted to the Board of Trade, and unanimously approved of; the citizens also at a public meeting held at about the same time sanctioned it without a dissenting voice.

Mr. Keefer continued his investigations, and finally, on

20th October last, reported that the cost of deepening the channel from Montreal to Quebec to 20 feet at low water, by adopting the south side of the River as already mentioned, would be about £90,000 currency, in addition to what has been already expended, and that the work could be completed, with the dredging power now possessed by the Harbour Commissioners, in the course of the working season of 1858.

The Harbour Commissioners then resolved to proceed with the work without delay, and it is with the view of carrying out this great improvement, that they are now applying to Parliament through the Honorable the Attorney General East to borrow £100,000 on the same terms and conditions as apply to the sum of £70,000 already borrowed and expended.

The Harbour Commissioners are also applying, in the same Bill, for authority to borrow £100,000 for extending Wharf accommodation in the Harbour of Montreal. But, although asking for this power, they have as yet come to no definite conclusion as to what portion of the sum shall be borrowed, or how expended.

The question of improving the Harbour is one on which public opinion is much divided. The late Board of Harbour Commissioners, as far back as the 26th Dec., 1851, at Mr. Young's suggestion, directed Messrs Gzowski and Keefer, Civil Engineers, to make a thorough survey of the Harbour with the view of ascertaining its capabilities, more especially with reference to providing Docks, in connection with which permanent Warehouses might be erected so as to economise the handling, warehousing and transhipment of goods; they were, at the same time, particularly instructed to investigate the feasibility of carrying a Canal through Craig Street, with the view of uniting the Lachine Canal with Hochelaga Bay, and connecting docks and warehouses with it. The Report of these gentlemen, however, led the Harbour Commissioners to believe that such a Canal, *as a local work*, was utterly impracticable owing to the enormous expense

which it would involve; on the other hand, it showed that Docks and permanent Warehouses in connection with them could be secured at Point St. Charles, at a comparatively moderate expense, and also that similar works could be constructed near Hochelaga Bay to be supplied with water from the Lachine Canal, by iron pipes carried through Craig Street.

The Harbour Commissioners gave this matter much consideration, and after mature reflection felt inclined to adopt the former project as the basis of all their future Harbour improvements, provided this conclusion met with the support of the Board of Trade of Montreal, and the Government. The former, however, declined committing itself to the scheme, while the citizens at large opposed it by resolutions passed at a public meeting. Under these circumstances, the Harbour Commissioners thought it their duty not to press the matter, but rather to hold Harbour improvements in abeyance until public opinion could be better ascertained, as to where such new accommodation should be provided. It cannot, however, be overlooked that the question of enlarging the Harbour must ere long be taken up and decided upon. The present accommodation is admitted on all sides to be too contracted and too shallow for the class of vessels which the deepening of the channel has already brought into use, and doubtless its inconveniences will year by year be more seriously felt, not only from the continued deepening of the channel, and the general progress of the country in wealth and population, but also from such increase of the transit trade as may reasonably be looked for ere long from the opening of the River St. Lawrence to the vessels of the United States.

In view of these circumstances, the Harbour Commissioners some time since reported to Government, that, in their opinion, their number should be increased to five, and that the Board of Trade of Montreal should be allowed to elect the additional two annually. But as they found that that was not approved, they would as another alterna-

tive recommend that the Mayor of Montreal, and the President of the Board of Trade, should be constituted *ex officio* members of the Harbour Commission, in addition to the three members appointed by the Governor. By this latter system the citizens at large, as well as the trading community in particular, would secure a voice in controlling the affairs of the Harbour, and directing where future improvements should be carried out. To this matter Your Excellency's attention is more especially invited at the present moment, as the question is on the eve of engaging the attention of the Legislature.

I will now respectfully draw Your Excellency's attention to the financial affairs of the Harbour Commissioners.

The total Harbour debt, independent of that for improving the ship channel in Lake St. Peter, reduced to currency, and represented by debentures, amounts to £131,683, the interest on the whole of which, except £10,000, is guaranteed by the Province, and is as follows:

£3,700 at 4½	per cent	per	annum,
114,283 at 5	"	"	"
3,700 at 6	"	"	"
7,400 at 7½	"	"	"
2,600 at 7⅝	"	"	"

The total debt incurred on account of Lake St. Peter, and represented by debentures, is £70,000 currency; of this neither principal nor interest is guaranteed by the Province. The rate of interest is as follows:

£2,000 at 6½	per cent	per	annum,
5,000 at 6⅞	"	"	"
11,150 at 7	"	"	"
28,950 at 7½	"	"	"
1,100 at 7¾	"	"	"
4,800 at 7⅞	"	"	"
17,000 at 8	"	"	"

The income of the year ended on the 31st December last was as follows:

Gross receipts from Harbour dues,.....	£18,017	1	9
Gross receipts from Lake dues,.....	2,385	19	6
Total,.....	£20,403	1	3

The expenditure during the same year out of revenue was as follows:

Expenses of management and collection,	£1,559	18	10
Do for repairing and macadamizing Wharves,.....	619	12	9
Do dredging in the Harbour,.....	1,295	8	9
Interest on Harbour debt,.....	6,196	12	6
Do on Lake debt,.....	3,652	13	10
Expenses of Water Police,.....	925	9	10
	£14,249	16	6
Surplus carried to "Rest" account,.....	6,153	4	9
Total,.....	£20,403	1	3

Compared with 1853, the foregoing statements give the following results: the receipts from Harbour dues show an increase of £2121 18s. 8d; those from Lake dues a decrease of £55 6s.

The total expenditure shows a decrease of £431 4s. 5d.

The surplus carried to the credit of "Rest" shows an increase of £2114 5s. 9d., in favor of the year 1854.

With reference to expenditure, it may be remarked that dredging in the Harbour, strictly speaking, does not form an appropriate charge upon revenue, being in its nature an improvement to be provided for by loan, the same as new wharves, or the deepening of the ship channel. This dredging, however, has for some years past been provided for out of revenue, simply because that source afforded ample means for the purpose.—The expenditure for the Water Police is a charge which the Harbour Commissioners have always remonstrated against as unfairly imposed upon

their revenue. This police force originated from disturbances at the Lachine Canal, where disorderly persons attempted to prevent the use of horses in loading and discharging boats, and maltreated several captains and crews who refused to submit to their dictation. It was then felt that a public force was necessary both around the Basins of the Lachine Canal, and in the Harbour of Montreal, for the purpose of putting down this species of violence and intimidation, and protecting life and property; and the Government of the day decided on organizing such a force under what is known as the Durham Act, at the same time procuring an Act of Parliament making it lawful for the Harbour Commissioners to pay the cost of it out of any surplus revenue they might have at their disposal. This arrangement should in justice, however, have been only temporary; for the Canal, where two thirds of the force have always been employed, is a Provincial work, the revenues of which go entirely into the Provincial Treasury, while, on the other hand, the Harbour of Montreal is a local work, the revenues of which are sufficiently burdened with charges of a more appropriate character. But, with the view of illustrating a point to which it is considered expedient to draw Your Excellency's attention, let it be assumed that the cost of this force will for the future be a permanent charge upon revenue, and at the same time that the cost of dredging will be transferred to the account for deepening and enlarging the Harbour, and Your Excellency will observe that, by taking the income and expenditure of 1854 as a fair criterion for the next few years, the surplus of revenue over expenditure, (less the future interest upon new loans,) will be upwards of £7,400, or sufficient to meet the interest upon a new loan of £106,000, at 7 per cent per annum, being £16,000 more than will be required for deepening the ship channel to *twenty feet at low water*, according to Mr. Keefer's estimate; after the completion of which it may be added the

Harbour Commissioners will be left with a stock on hand of steamers, dredges and scows, which will doubtless be worth at least half of what will have been expended upon them.

From the foregoing it will be seen by Your Excellency, that without taking into consideration any increase of revenue from extension of trade, or the revision of the tariffs of Harbour and Lake dues, the resources of the Harbour Commissioners are ample to meet all the charges upon them, and also to provide for the interest of what it is contemplated to borrow, to carry out one of the greatest improvements that can interest the citizens of Montreal, or the people of Canada generally.

On this point it may perhaps not be out of place here to draw Your Excellency's attention to the policy which past Governments have maintained with reference to this important work. It has been already stated, that Government commenced the deepening of the channel in Lake St. Peter, but failed in it. This commencement, however, seems to show that it was looked upon as a work of high necessity in the interest of the Province at large. Nor can it reasonably be viewed in any other light, for without the deepening of the channel, the St. Lawrence must ever have remained defective as a high way for the trade of the interior to and from the sea. But notwithstanding that the work must be admitted to bear that Provincial character, yet public aid has hitherto been denied it in the hands of the Harbour Commissioners, even to the extent of affording the Provincial guarantee for the interest only on the sums of money that have been borrowed for the purpose of carrying it to completion. Had this guarantee been given (a mere nominal thing under the circumstances of the case, as is shown above by the comparison of revenue and expenditure,) money could have been borrowed in England to a sufficient extent at 5 per cent. per annum; whereas by witholding it, the Harbour Commissioners have been limited to the local money market of Montreal, where

alone the validity of the security was fully understood and appreciated,—a policy the consequence of which is indicated by the high rates of interest at which money for the work has hitherto been borrowed.

There now remains but one topic to which it is considered necessary to draw Your Excellency's attention, viz: the question of lighting and buoying the channels, new and old, between Montreal and Quebec. At present the lighting of the channel is under the management of the Trinity House of Montreal, and the expense is defrayed out of the consolidated revenue of the Province; on the other hand, the buoys necessary to designate the channel, from Montreal to the lower end of Lake St. Peter, are provided by the Harbour Commissioners of Montreal, and the cost thereof is defrayed out of any funds they may have at their disposal; while from the latter point down to Port Neuf, near Quebec, they are provided and managed in the same manner as the lights. Previously to the commencement of operations by the Harbour Commissioners, for deepening the ship channel in Lake St. Peter, buoys as well as lights were provided by the Government, and superintended by the Trinity House of Montreal.

It will not be denied, however, that the channel referred to has not hitherto been so thoroughly marked out by lights and buoys as the safety of vessels navigating therein required; proofs of this assertion might be abundantly adduced, if necessary, by referring to the disasters which have occurred in late years to the passenger and other steamers plying between the above named cities. Nor can it be expected that this state of things will be improved after the new channel, differing widely in many places from that hitherto followed, is opened up for general use, unless a more complete system of lighting and buoying is adopted than what has hitherto been thought sufficient.

Under these circumstances the question has arisen, how is this better system to be brought about? This question

was fully discussed some months since between the Harbour Commissioners and a Committee of the Board of Trade appointed to confer with them upon their Harbour Bill now before Parliament, and they unanimously agreed that the duty of providing lights and buoys for the future between Montreal and Quebec, and superintending the same, should be confided to the Harbour Commissioners of Montreal, and that in consideration thereof they should be empowered to levy a small tonnage duty upon vessels navigating the Lake and River, drawing less than 10 feet of water, and a clause to that effect was accordingly inserted in the Bill above named. This proposed tonnage duty, Your Excellency will observe, is not intended *as a means in aid of deepening the channel*, but on the contrary *to provide funds for defraying the cost of the necessary outfit of lights and buoys, and the superintendence and maintenance of the same from year to year*, than which nothing could be more reasonable, unless, on the other hand, Government deems it best to continue this service on its past footing, instead of adopting the amendment proposed as a remedial measure.

In the latter case the Harbour Commissioners will only hope that no pains will be spared by Government to render the navigation as safe and easy as may be practicable, and that immediate steps will be taken to provide the extra lights and buoys which will be required for the new channel in the spring of 1856.

All which is nevertheless most respectfully submitted for Your Excellency's consideration.

I have the honor to be,
Your Excellency's
Most obedient humble servant,

JOHN GLASS,
Secretary.

Harbour Commissioners' Office,
Montreal, 5th March, 1855.

ENGINEER'S REPORT.

MONTREAL, 1*st March*, 1855.

TO THE HONORABLE JOHN YOUNG,

Chairman Harbour Commissioners, Montreal.

SIR,—I have the honor to acknowledge the receipt of Mr. Glass' letter of 6th January, transmitting the reports of Capt. Bell, Superintendent to the Commission, with a request that I should report upon the same—review the past progress of the works—and give my views with reference to future operations.

The documents published in February, 1853, give a clear and connected history of the operations of the Harbour Commissioners up to that date. Since then, two working seasons have elapsed—the scale of operations has been materially enlarged by a decision to carry a depth of *twenty* feet at low water through Lake St. Peter, instead of one of *sixteen* feet, which was the maximum aimed at in the instructions to the Board of Engineers in October, 1850; and the question of the enlargement of the Harbour of Montreal has been presented in a manner which indicates that this work cannot be much longer postponed. Moreover a survey of the River has defined the nature and extent and demonstrated the practicability of the removal of *all* the obstacles to the attainment of a depth of twenty feet at low water, above and below Lake St. Peter.

Under these circumstances the present appears to be a proper occasion for reviewing the proceedings of the past, as the best means of explaining, as well as of vindicating the arrangements for the future.

I will endeavor, (at the risk of repetition,) to present the question so that strangers, without the aid of charts, may be able to appreciate the extent and importance of the work.

The rapids of the River St. Lawrence terminate at the City of Montreal,—from which point to the sea the *current* of the River offers no obstruction to the ascent of ocean craft.

The influence of the tides is felt within fifty miles of Montreal, but their regular rise and fall is not perceptible until we descend about one hundred miles below this City. At the first point below this City, where the influence of the tide has been observed, the river expands into a lake about twenty miles in length by nine in width, called Lake St. Peter. This lake is crossed by three "banks" or "bars" which enclose between them two "pools" in which the depth exceeds twenty feet; the first of these pools is one and a quarter miles in length, and 800 feet in average width, and the lower one, four and a-half miles in len th and nearly half a mile in width. The ship channel is in the general direction of these pools, and near the centre of the Lake; between it and either shore there is a broad margin of shoal water, averaging two miles in width on the north and three and three-fourth miles on the south of this channel.

The main "bank," which divides these two pools, is known as the "flats of Lake St. Peter," and measures, from a depth of twenty feet at low water in one pool to the same depth in the other, *eight and seven-eighth miles.* The top of this bank is very level, having a uniform depth of eleven feet at low water, for a distance of four and a-half miles measured on the line of the ship channel. Across the head of the upper and the foot of the lower pools are two bars which separate the main channel,

entering and leaving the Lake, from the two pools above described. The least depth on the Upper Bar, (or *Batture du Lac*,) was twelve feet at low water, and the distance across this bar, between the depths of twenty feet at low water, is nearly one and a-half miles. The depth on the Lower Bar (opposite Nicolet River) is sixteen and a-half feet, and its extent, between twenty feet soundings on the line of the channel, is one and a-fourth miles.

The aggregate length of dredging at the Upper Bar, the Flats, and the Lower Bar, for a depth of twenty feet at low water, will be about eleven and a-half miles, measured on the line of the old ship channel.

The average depth in the channel of the River St. Lawrence, between Montreal and Lake St. Peter, with the exceptions hereafter to be described, may be taken at thirty feet. Below Lake St. Peter the depth in the channel is generally thirty to forty feet, increasing, as we approach Quebec, to sixty and one hundred feet and over, with the exception of that portion of the River opposite Ste. Anne de la Pérade, where there is a general depth of twenty-four feet at low tide, and where the bed of the River is strewn with huge rocks or boulders. Here there is a narrow bar of blue clay with only sixteen feet water upon it at low tide. At this latter point there is a tide of six and a-half feet at springs, and four feet at neaps, so that, at high water, there is no obstruction to a twenty feet draught.

It is not to the purpose here to discuss the origin of the Flats of Lake St. Peter, further than this question bears upon the important one of the permanency of the artificial channel now in progress through the lake.

If the fine clay of which the flats are formed has been swept out of the numerous channels formed by the islands above Lake St. Peter, this has taken place at so remote a period, that the supply from which the flats were then formed has been exhausted,—and the River, having cut out its required dimensions of channel, has protected these from further encroachments by a lining of stones,

sand, or gravel. The action of the ice upon the bed and slopes of the River lines the shores with a facing of boulders—just as the ocean and the lakes heave up shingle and sand as barriers to their own further inroads on the land.

The direct action of the ice, in this climate, has more influence on the permanence of any artificial channel, than this indirect action in staying the descent of detritus. Wherever large masses of ice are grounded upon a yielding substratum they act as temporary islands, diverting the course of the current, increasing its intensity, and concentrating its energy on the open spaces between the grounded bergs of ice. To this cause is to be attributed the "shifting of the channel" through sand bars on which the ice rests: but, notwithstanding the descent of those immense quantities of ice which "pack" and "ground" so as to alter the current during winter below Montreal, it is satisfactory to know that no difficulty is to be apprehended from such action of the ice in Lake St. Peter. The winter level of the Lake is raised six feet and upwards, before it freezes over, by the accumulation of ice and the consequent obstruction made to the discharge of the River below the Lake. The ice forms of even thickness, and as the depth near the channel is seldom less than eighteen or twenty feet the winter current is consequently weaker than the summer one. The dredged channel through the Lake occupies nearly a central position, both with respect to length and breadth; it is therefore too far removed from the mouths of the lateral rivers flowing into the Lake to receive their detritus; and as regards any deposits from so clear a stream as the St. Lawrence, these could only reach the excavated channel by the aid of such a current as would carry them on through the Lake.

The oldest known charts shew that little change has taken place in Lake St. Peter, and from more than half a century's experience we may come to the conclusion that the maintenance of the artificial channel now in

progress is not seriously threatened by the action of any natural causes. An examination of the old dredging done by the Board of Works in 1844, '45, '46, and '47, after a lapse of seven to ten years, shews that the ridges left between the "trench cuttings" are still well defined,—and no perceptible change either for better or worse is to be discovered in this part of the Lake.

STRAIGHT AND NATURAL CHANNELS.

With respect to the question of the route for an artificial channel through Lake St. Peter, that may now be considered as settled; and, as there is now a navigable channel, two hundred and fifty and three hundred feet wide with sixteen and a-half feet depth at low water, over the flats, where there was formerly only eleven feet, the propriety of the route adopted by the Harbour Commissioners need not be vindicated. The recent determination, however, in favor of a twenty feet navigation, instead of one of sixteen feet, (which was the maximum where the question of the "straight" and "natural" routes was discussed,) may fairly be claimed as one of the most important results of the decision in favor of the "old channel." To explain this it is necessary to refer to the history of the operations in the Lake.

It will be remembered that in 1844 the Government commenced to dredge a straight channel about ten miles in length, from a point below Stone Island, (at the head of the Lake,) to the head of the lower pool heretofore described. This would have avoided both the Upper Bar and the Flats, and have shortened the route through the Lake nearly one mile. After working until September, 1847, when £73,955 had been expended for outfit and operations, in removing what now appears to have been less than 350,000 cubic yards, measured in excavation, the scheme was abandoned. In 1850, the two dredges were transferred to the Harbour Commissioners of Montreal, who commenced operations in the following year, in the "old," or "natural" channel, and up to 1st January, 1855, have dredged 1,818,110 cubic yards, mea-

sured in the scows, (or 1,298,650 cubic yards, measured in the cut,) and removed by harrow 85,436 cubic yards, at a total cost of £74,000 for operations and outfit,—in which is included a sum of £10,000, as the value of the two dredges obtained from the Board of Works.

In the one case, four years of time and nearly £74,000 in money were expended without any practical result,—the straight channel remaining now as when abandoned; in the other, each successive season since the commencement has increased the draught and tonnage of sea-going vessels arriving at Montreal. This difference in result is owing chiefly to better management, and to a superior system of dredging established by Captain Bell, Superintendent to the Harbour Commissioners; and in some measure to the adoption of the old channel, where by taking advantage of the existing pools of deep water a less length of dredging is required, and therefore an additional depth to the channel is sooner given.

Although the "straight channel" would have shortened the route through the Lake, yet as it was wholly an artificial one there was a greater amount of work to be done in it. Captain Bayfield, in 1846, estimated the dredging in the straight channel, for a depth of only fourteen feet at low water, 260,000 cubic yards more than that required to produce the same result in the old channel. In extending the work, however, to a depth of twenty feet, the economy of the old channel is much more apparent. The number of cubic yards to be removed, in order to give three hundred feet in width with twenty feet water in the "straight" channel, is no less than 1,180,000 *more* than is required to produce the same result in the "old" channel;—which, at 7½d. per cubic yard, (or one-half of Captain Bayfield's estimate,) makes a difference of £36,875 in favor of the route chosen by the Harbour Commissioners.

ANNUAL PROGRESS IN LAKE ST. PETER.

The Harbour Commissioners commenced operations on the 12th June, 1851, with one dredge and the harrow, and

on the 3rd of November, in same year, a channel seventy-five feet wide, two feet deep, and four miles in length, was cut through the highest part of the flats. On the 8th of November the ship "City of Manchester" was loaded down to *fourteen* feet—the depth on the Flats then being *twelve* feet—and taken through the lake without slacking speed. Thus, in less than five months, *two feet* were added to the draught of sea-going vessels trading with Montreal. In the spring of 1852 the harrow was employed during high water, in May and June, upon the Upper Bar, the depth upon which was thereby increased about three feet, leaving a channel one hundred and fifty feet wide and fifteen feet deep at low water—or four feet deeper than the flats. Two dredges worked on the flats from the latter part of May until the 16th of November, by which time they had widened the channel (from seventy-five) to one hundred and fifty feet, and deepened it (from two) to four feet. The length of the channel of 1851 was also increased (from four miles) to five and a half miles,—this additional length of dredging being required in consequence of the increased depth. Thus at the close of the second season, or in less than eleven months of actual work, a channel of one hundred and fifty feet in width and four feet of additional depth was cut through the "Flats" and the Upper Bar, at a cost of £47,250 for operations and outfit, (in which £10,000 is allowed for the dredges;) or, in other words, a channel of the same width and one foot greater depth, than that which the Government had failed to secure in the new route with a far greater expenditure of time and money. The Harbour Commissioners were notified, in November, 1852, by the Superintendent, that he was then prepared to take a vessel through the Lake, drawing four feet more water than any which had hitherto left Montreal at that season of the year. Throughout the season of 1852 the sea-going vessels made use of the new channel, and many of them were loaded down two feet deeper than the water on the flats.

A vessel of sufficient capacity could not be obtained (at that late season of the year,) to test the capacity of the channel in November, 1852, but this was done on the 24th of August, 1853, by the Barque "California," which was loaded down to sixteen feet two inches, when there was only twelve feet on the flats, and taken from Montreal through the Lake without delay or difficulty.

At the close of the season of 1853 the channel of 1852 was deepened, throughout, one foot six inches, giving sixteen and a-half feet at low water; and a part of it was widened (from one hundred and fifty feet) to two hundred and fifty, and three hundred feet.

The operations of 1854 in the Lake have been confined to widening the channel, and there is now, with the exception of about ten days work, a channel through the Flats two hundred and fifty to three hundred feet wide, and having in it sixteen and a-half feet at low water. This has been effected at a total cost of £74,000, including £10,000 as the value of the two dredges obtained from Board of Works. Thus, within the same period of time, and for the same sum of money as has been expended on an ineffectual attempt to obtain a channel *one hundred and fifty* feet wide, with *fourteen* feet water on the straight line, one of *two hundred and fifty* and three hundred feet in width, with *sixteen and a-half* feet at low water, has been given through the Flats, and one of one hundred and fifty feet in width, with fifteen feet water through the Upper Bar.

OBSTRUCTIONS ABOVE AND BELOW LAKE ST. PETER.

No subsequent testing of the channel, to that by the "California" in 1853, has since been made, for the following reasons:

About thirty miles below Montreal, between Lavaltrie Island and Isle Platte, a broad shoal stretches across the River, consisting of blue clay covered with gravel and boulders. The original depth over this shoal, on the line of the channel, was the same as on the flats of Lake St. Peter, viz: eleven feet at low water.

While the dredges obtained from the Board of Works were employed in the Lake, the Harbour dredge was brought down from Montreal, in 1851, and on the 18th August, 1852, she had cut a channel through this shoal two hundred and fifty feet wide, and four feet deep. This dredge was then removed to a small bar opposite Isle du Lorier, or St. Laurent, (a little below Varennes,) which she reduced to the same depth, in that year. When the "California" was taken down, drawing four feet more water than usual, it was found that she "touched" at Pointe aux Trembles, Varennes, Isle à la Bague, Ste. Sulpice, and Lavaltrie Island, although the Pilots maintained that she followed the deepest channel in the River. Before any additional advantage, therefore, could be gained for the trade by increasing the depth in Lake St. Peter and at Isle Platte, it became necessary to ascertain the nature and extent of *all* the obstructions between these points and Montreal; and, particularly, whether the channel known to the Pilots, and defined by the River lights and beacons, was really the best that could be obtained.

It will be apparent, that so long as the flats of Lake St. Peter were the guage of the draught of vessels ascending the St. Lawrence between Quebec and Montreal, no vessel drawing *more* than eleven feet at low water had ever navigated the River above the Lake. The channel known to the Pilots, therefore, had never been tested for any increased draught, and as soon as this was done, (in consequence of the deepening in the Lake,) the Pilots' channel became obsolete,—because their actual experience of the River did not extend to a draught greater than eleven feet at low water.

On the sixth of September, 1853, I was requested to report the best means of dealing with the obstructions revealed by the "California" on her passage outward, in the preceding month; and, in reply, recommended an examination of the River, for the purpose of comparing the existing channel with others indicated on Bayfield's

Charts, and of ascertaining *what scale of navigation was within the reach of the Commission*, in case that, from the success of previous operations in the Lake, it might prove desirable to continue these to a greater depth than originally proposed. This recommendation was adopted, and immediate steps were taken for carrying it out, so that the examination was completed, and on the 25th of October I reported the result.

It was found that between Varennes and Lavaltrie Island, and between Cap Madeleine, (below Three Rivers,) and Isle Bigot, the route lighted and marked by the Pilots did not afford more than sixteen feet at low water, and was not in the main channel—or the deepest part of the St. Lawrence.

The obstructions at Pointe aux Trembles were found to be clay, and of trifling extent; but, from Varennes to Lavaltrie, the north channel at present navigated is studded with numerous "*pouls*" caused by loose rocks or boulders, having narrow channels with sharp turns between them, and exposed to cross current of the Ottawa, the greater part of the waters of which flow over into the south channel, and pass by Verchères. The channel south of the Verchères Islands was then examined, and found to have a depth of thirty to sixty feet, with the exception of one point opposite Cap St. Michel, where this channel appears to have been partly closed up by a land slide, which, together with the fact that the north channel has had hitherto sufficient water for any vessel which could pass Lake St. Peter, account for its disuse. The bank at Cap St. Michel was bored, and found to be clay, much more easily removed than the "*pouls*" of the north channel. In every respect the south channel is superior to the north one; its greater depth giving less current, and its bold shore and high banks making it more easy of navigation at night or in a fog.

Below Three Rivers the south channel, in front of Becancour, gives a depth of thirty to forty feet, without any obstructions requiring more than lights, buoys, and

beacons. By adopting this channel, the shifting sand bar known as the "Provenché Shoal" will be avoided. This is of great importance, as this sand bar appears to have been formed by the River St. Maurice, and is still acted upon by it, making it doubtful whether a channel could be maintained, for a greater depth than heretofore used, without continual dredging. That the present ship channel over the shoal is not the channel of the St. Lawrence is evident from the fact that the dark waters of the St. Maurice are found in it unmixed with the blue water which flows by Becancour.

The only place below this where twenty feet draught can not be used at all times of tide is at Pointe à Levraut, (opposite Ste. Anne,) where the bar of blue clay before alluded to is found—insignificant in extent and over which vessels can always pass, drawing twenty feet, by waiting for the tide.

MODE OF DREDGING.

On comparing the operations and expenditure of the Board of Works in the four seasons from 1844 to 1847 inclusive, with those of the Harbour Commissioners in the four seasons from 1851 to 1854, we cannot fail to be struck with the difference in the cost of dredging per cubic yard, as much as with the immediate and beneficial results to the trade, arising from the later management. While much is no doubt to be ascribed to the selection of the old channel by the Harbour Commissioners, it cannot be doubted that the system of dredging established by Captain Bell, had it been applied to the straight route, would have resulted in opening that channel to the trade long before the period at which it was abandoned by the Board of Works.

The importance of this system, as well as its bearing on future operations, is such as to call for a description of its advantages;—while the fact that a greater amount of work has been done and a greater result produced in less time and at less cost by the Harbour Commis-

sioners, under Capt. Bell's system and superintendence, than in any other dredging operations heretofore undertaken—makes it a subject of the highest interest to the profession, as well as to corporations or other public bodies or departments requiring a large amount of dredging to be done.

Under the old system the dredge was moored to its work by two chains laid out forward in the direction of the channel to be excavated. In going ahead a ditch was cut the width of the buckets, (and of a depth proportional to the hardness of the material,) as far as the length of the chains would permit; the buckets were then lifted, and the dredge dropped back to the place of beginning, when the process was repeated by cutting a similar and parallel trench until the proposed width of channel was attained. Between these parallel trenches a ridge from one to two feet in width was left,—it being impossible to cut these trenches without leaving a ridge to sustain the "tumbler," which otherwise would have carried the buckets out of cutting into water, bringing them up empty. After the channel had thus been "grooved" or "fluted" by the "trench cutting" system, the removal of the intermediate ridges was commenced. To steady the buckets upon the narrow space guys were employed, and in working ahead to feed the buckets the direction of these guys was necessarily altered whereby the dredge immediately lost her hold of the bottom. The bucket frame was then lifted, the vessel again steadied upon another ridge, and, after all, the bottom instead of being uniform in depth was left like the teeth of a saw. When it is remembered that these operations were carried on in a wide lake exposed to wind and sea, with a current of about one mile per hour, the great loss of time in raising and lowering the buckets, in "dropping back," "guying out," and "steadying" over the ridges, the cost of fuel, wages and provisions during this loss of time, —the cost of these items for each dredge with her tender being about £30 per diem,—and the utter impossibility

of doing anything like true work under such circumstances—will be appreciated; nor can we resist the conclusion that, under such a system, with any appropriation which Parliament would sanction, failure was inevitable where a channel ten miles in length and three hundred feet in width, with sixteen feet at low water, was attempted.

When making the Survey of the Lake upon the ice, in March, 1854, I caused to be measured and sounded the channel excavated by the Board of Works, taking cross sections at every five hundred feet. I annex a cross section of the bottom in this channel, taken in January of this year, and also one (taken at the same time) of the channel dredged by Captain Bell, by which the difference in execution of the two systems is strikingly illustrated. The condition of the Board of Works channel, after the e of seven years, is satisfactory so far as it indicates little change has taken place, judging from the clearness with which the ridges are still defined, although from the great discrepancy in the measurement of the excavation done, as made in 1854 upon the ice, compared with the returns made after the suspension of the works in 1847 and 1848, would go to shew either a large error in one of the measurements, or an extensive "silting up" in this channel. I cannot learn that any measurement was made, on the suspension of this work, in the manner since done by me, but have understood that the quantities supposed to have been removed were arrived at by calculations as to the contents of the buckets, scows, and the "average work" of the dredges.

I find the quantity removed in the Board of Works channel to be 332,044 cubic yards, instead of 734,945 cubic yards, which is the sum of the two returns in the Reports of the Commissioners of Public Works in 1847 and 1848. The difference may in some measure be accounted for by the assumed length of dredging, as determined by the buoys and a nautical survey, proving considerably more than the actual length as measured on the ice. I found that the distance across the Flats,

between known points in the old channel, measured half a mile less (in a distance of six and a-half miles) on the ice than on the charts. A similar miscalculation may have been made in estimating the Board of Works channel; but this would only account for a portion of the discrepancy. If we deduct the whole of the outfit (making no charge for depreciation,) it would still appear that about £33,500 were expended "in operations" in the new channel. Taking the present measurement of 332,044 cubic yards, and setting off any work done in piling groins, &c., against the depreciation of outfit, the actual cost of that dredging, measured in the cut, cannot be set down at less than two shillings currency per cubic yard.

To have secured a channel on the "straight line," of the same dimensions and with the same water as that which has now been made by the Harbour Commissioners on the old route, would have required the removal of 1,750,000 cubic yards, in addition to the 332,044 removed, which at the same rate of cost (two shillings per cubic yard) would have amounted to £175,000, making the total cost of the new or straight channel £249,000 against £74,000, the actual cost including outfit, of an equally efficient channel upon the old route.

But, inasmuch as the amount of excavation in the new channel would exceed that required in the old, (for the three hundred feet in width, and sixteen and a-half feet in depth of water,) by about 750,000 cubic yards—if the cost of this amount be deducted, the figures would stand £174,000 against £74,000, as the cost of an equal amount of work in the two channels. If, as appears from present measurements, 2s. per c. yard was the actual cost in the straight channel, the difference of £100,000 is the measure of the amount of economy in favor of the improved system of dredging adopted in the old channel, which system I now proceed to describe.

The system employed by Captain Bell, on assuming the charge of operations in the Lake, is that known as "radius cutting," as distinguished from the ordinary or "trench

cutting" method. The dredge is moored on chains leading from the bow and stern in the direction of the channel, and also by four chains at right angles to the channel, one out from each quarter of the vessel. In this position, she may be compared to a *turtle*, chained by the head, tail, and the four legs, and floating over the channel to be cut. Instead of cutting a continuous trench, by hauling ahead on the bow chain, the buckets take a feed of two or three feet, after which this chain remains taught, and the dredge is breasted over, by means of the side chains, broadside on, from one side of the channel to the other, the buckets crossing the whole width of a channel of 150 feet, and leaving the bottom true and even. When the opposite side of the channel is reached she is heaved forward for another feed, and recrosses the channel in the same manner, cutting from left to right and from right to left alternately. Her bucket frame, sweeping across the channel, acts as a huge plane with revolving cutters; thus, from the very nature of the system, there is a guarantee that when she has once gone over the ground no obstruction above the level to which the buckets were lowered *can* have been left behind. The four side winches are worked by the engine. The adaptation of the old Board of Works dredges to this mode of working is due to Captain Bell, and to this arrangement chiefly I attribute the great advance made in dredging. I am not aware of any similarly efficient gearing in use elsewhere.

In the "trench cutting" method, it is necessary to heave ahead on the bow chain in order to feed the buckets while the latter are cutting. This strain is avoided in the "radius cutting" plan, where the bow chain is only wound up when the dredge has crossed the channel, and remains of the same length while the buckets are cutting. Again, the irregularity of the working of the buckets, when removing the ridges in the trench cutting system, was productive of greater wear and tear on the machinery than occur in the improved method where they are constantly in full work.

COST OF DREDGING.

In order to estimate the cost of the dredging, accurate surveys were made on the ice early in 1854, and soundings were taken at Pointe aux Trembles, Cap St. Michel, and Lavaltrie, as well as in Lake St. Peter, by which the quantities to be removed for successive draughts of water have been calculated; the estimate is appended to this Report.

I have analysed the cost of dredging in Lake St. Peter, from which it will be seen that the cost per cubic yard, *measured in the scows*, for raising and depositing at the distance of half a mile, is under five pence. This price excludes the cost of outfit, which for work already done has amounted to £18,000. The cost of new outfit for the 20 feet draught will amount to about £19,000. As this machinery is available for many years work it is only the depreciation which is needed to shew the whole cost of dredging. If, however, we assumed that the present outfit, (the charge for repairs being embraced in the above annual cost of dredging,) will be annihilated on the completion of the work, that is when about 6,000,000 cubic yards, measured in the scows, has been dredged, the charge per cubic yard, on account of this outfit, would be under three half pence per cubic yard. As, however, one of the dredges embraced in the above calculation is perfectly new and has not yet commenced work, and both the others are being lengthened and strengthened, there is every reason to believe that the dredging fleet, on the completion of the channel three years hence, will be in a thoroughly efficient state. I consider, therefore, that an allowance of *one penny per cubic yard* will be at least a sufficient charge for the depreciation of the outfit, which, added to the average of 4½d., makes the total cost of dredging 5½d. per cubic yard, measured in the scow. If an allowance of forty per cent. be made for the difference between the measurement in the scows and that in the cutting, which

allowance I find to be ample, the highest cost of raising and depositing (at a distance of half a mile) a cubic yard of solid excavation will be about 7¾d.,—a price lower than the same work could be done, under the most favorable circumstances, upon dry land, and far below the cost of dredging, and depositing under such circumstances on any work known to me. No account has been taken of the interest on loans for carrying on the work, which interest is paid out of revenue;—an addition of three half-pence per cubic yard, upon the quantities already dredged, covers this item,—making the whole cost 9¼d. per c. yard measured in excavation.

It must be admitted that the material is as favorable for dredging as it possibly could be, and the one circumstance most conducive to economy is that the buckets are always in full work. On the other hand, the working season is short—the price of coal is high, and there has been much detention from wind and high water. In order to show the actual working time and the delays from every source, I have prepared tables taken from the Superintendent's books which shew the extent of daily interruption and explain the cause of it.

The investigation and analyses exhibited in the tables are presented for the purpose of sustaining the estimate I have made of the probable cost of completing the channel through the Lake. The principal item which influences the cost, and in which any important fluctuation may be expected, is the price of coals. In this, as well as the items of labor, provisions, &c., I have provided for the extreme high rates of 1854, which are not likely to be exceeded, and from which some diminution may reasonably be expected. It will be seen that the actual cost of dredging in 1854 was four pence half-penny per cubic yard measured in the scows, and as the quantity remaining to be removed is measured "in excavation" and not "in spoil," I assume seven pence half-penny

per cubic yard as a fair estimate of the probable cost, exclusive of interest, depreciation, or outfit.

In January and February, 1854, I measured "in excavation" the whole amount of dredging done by Captain Bell, and found it to amount to 815,000 cubic yards, at a total cost of £22,000, or about six pence half-penny per cubic yard, exclusive of outfit, interest, or depreciation. The return by scows up to this time was as follows:

In 1851	from	10th July	to	14th November,	1	dredge filled	1124½	scows,
1852	"	22rd May	to	16th "	2	" "	7159	"
1853	"	21st May	to	23rd "	2	" "	7943	"

giving a total of 16,226½ scows, at seventy cubic yards per scow, equal to 1,135,855 cubic yards.

The return by scows of 1,135,855 cubic yards, as corresponding with the measurement of 815,000 cubic yards of solid contents, missing from the channel, shews that the excess of the measurement "in spoil" is forty per cent., or that fifty yards "in excavation" will measure seventy yards in the scows.

The number of scows filled in 1854 was 9663, equal to 676,410 cubic yards, making the total quantity dredged to close of 1854, 1,812,265 cubic yards measured in scows, or 1,294,475 cubic yards measured in excavation, and if to this be added 85,436, the amount removed by harrow, we have a total of 1,379,911 cubic yards, measured in excavation, removed for an outlay of £74,000 (including the full value of outfit,) or nearly thirteen pence per cubic yard. The cost exclusive of outfit is £42,300, or about seven pence per cubic yard.

A similar measurement and calculation, applied to the straight or Board of Works channel, shew the present result of the operations there to have been attained at a cost per cubic yard, *four times greater* than that in the old.

In the four full months of 1854, July, August, September and October, the two dredges averaged twenty-five working days each month, and filled 7,523 scows, (raising together seventy-five scow loads daily,) which at

seventy cubic yards per scow, gives 526,610 cubic yards in one hundred days, or 5266 cubic yards per diem. In 1846 the daily work of these same dredges in the "straight" channel was reported as "most satisfactory," when removing on the average 2321 cubic yards per diem. In the last year of operations in the straight channel the work of the dredges was considerably improved, and they were reported as averaging together forty-four scow loads, or about 3000 cubic yards, daily.

In order to show the remarkable superiority of the foregoing performance of dredges working on the radius cutting principle, I give some data of the ordinary method furnished by a friend in Plymouth, England:

"A forty-horse-power dredge at Holyhead, (with a "double set of buckets,) working in thirty-five feet of "water, raised one hundred and ten tons in forty minutes.

"A Government dredge of thirty-horse-power, now working here, is said to raise ninety tons of mud per hour, "—depth of water from four to twenty feet. This machine was built at Southampton.

"Another, belonging to a contractor, has been "working here for three years; it is called a thirty-"horse-power (cylinder two feet six inches, stroke three "feet 6 inches,) and has raised sixty tons of mud per "hour, but its average work in that material, during three "hours, has been only 2000 tons per week.

"One of the Clyde dredges (sixteen-horse-power, cost "£2800,) raised in twelve hours, 160 tons of hard clay.

180 " of gravel.
230 " of sand.
250 " of mud.
300 " of soft clay.

"It consumed in twelve hours one ton of coal, or eleven "and three-quarters pounds per horse-power per hour.

"Twelve men worked the machine; fourteen the punts.

"A twenty-horse-power dredge, built at Newcastle, "raised 2000 tons of mud per week, at a cost of six "pence per ton, (unloading included.)"

The Holyhead *double* dredge raised at the rate of one hundred and sixty-five tons per hour. The Clyde single dredge raised at the rate of twenty-five tons per hour. The other performances are under one hundred tons per hour. These may be considered the best work of the dredges quoted. The new forty-horse-power double machine, started in the Clyde in 1851, has raised for the last year 106,848 cubic yards in 1822 hours working time—less than sixty yards, or about one hundred tons per hour.

The ordinary work of the dredges in Lake St. Peter is to raise two hundred and eighty-nine tons per hour, estimating the material dredged to weigh one hundred and twenty pounds per cubic foot, while the best work of these single dredges has been to raise four hundred tons per hour for the whole day: that is, they have filled fifty-six scows in ten hours, each scow containing seventy yards in spoil, or fifty of the solid deposit.

I have also prepared a statement shewing the number of vessels, their dimensions and crews, from which the magnitude of the operations may be estimated; and for the purpose of comparison, I give some statistics of dredging in the Clyde, where the largest operations of this kind have been carried on. From these it will be seen that a greater amount of work has been done in one year at a much less cost in Lake St. Peter than has been done in any one year in the Clyde, or elsewhere.

A table showing the fluctuations in the depth of water on the Flats of Lake St. Peter, for the last four years, is appended, for the purpose of showing the dates and duration of the period of low water.

SURVEY AND ESTIMATE.

I have already explained the more important objects of the exploration of the different channels, obstructions, &c., above and below Lake St. Peter, made in September and October, 1853, and the subsequent winter survey, on the ice, in the Lake and at points above it; but in vindication of the expenditure for such a step, I will here allude more fully to it.

When I assumed the office of Engineer to the Commission, we were in possession of no other information with regard to our operations in the Lake than was to be obtained from Bayfield's Charts, and the annual Reports of the Superintendent. In consequence probably of the failure of previous operations in the straight channel, there was some doubt thrown on the statements made as to the depth and width of the channel already dredged on the old route, and although I had satisfied myself of the correctness of the Superintendent's Reports, yet, as the work extended over many miles of surface,—was all under water and not easily tested without considerable time and labor,—I considered it indispensable that there should be placed on record a chart shewing *the exact position* of the work done, as well as its extent. Moreover, without such a chart, none of the future changes which might arise out of our operations, could be traced and estimated ; nor without an actual measurement of the excavation, as determined by the dimensions of the channel, could we establish the ratio of the measurement as computed from the number of scows filled, or ascertain the actual cost of the work done, so as to refer it to a standard by which the value of the work remaining to be done could be estimated. Thus, it is clear that the work remaining to be done must be measured "in excavation," while that already done, had been measured in the scows ; and as every hundred yards measured in the bottom makes about one hundred and forty yards when measured in the scows, forty per cent. must be added to the price per cubic yard of that already dredged, (when measured in the scows) in order to obtain the value of that remaining to be dredged. In all preceding measurements and reports referring to Lake St. Peter, I cannot find that this obvious distinction between the two modes of measurement has been taken into consideration, and this single circumstance alone may account for many of the discrepancies in the returns, and failures in the estimates for the straight or Board of Works channel.

Lastly, it was highly important, before the full width or depth was given to the proposed channel, to ascertain whether it was uniform in depth and width, and straight in its direction, in order that any necessary trimming or widening could be taken wholly off of one side, or both, as would prove requisite; and most especially was it desirable that the direction of this new channel should be accurately ascertained *with reference to the deep pools* with which it communicated. The boundaries of these pools had hitherto been loosely defined by the few soundings to be found in Bayfield's Charts, but for the purposes of a work of this magnitude it was important that their contour should be fully developed, which has now been done in the most accurate manner by surveys and soundings on the ice; and the result shews the correctness of the alignment of the dredged channel with reference to deep water above and below it.

The charts of the shoals at Pointe aux Trembles, Cap St. Michel and Lavaltrie, with the measurements and soundings made on the ice, shew the nature and extent of the dredging required. From the strength of the current at these places this result could not have been arrived at as certainly or as economically by means of boats.

The large chart of the St. Lawrence between Montreal and Quebec has been prepared for the purpose of enabling the public to see at a glance the general capacity of the channel, and to shew that the attainment of a draught of twenty feet at low water is as practicable as it is desirable.

From the estimate annexed it will be seen that the cost of a channel three hundred feet wide, through all the obstructions met with between Montreal and Quebec, is estimated as follows:

For a depth of 18 feet at low water,	£41,743	5	1
Additional for 19 feet " "	21,907	19	0
" " 20 feet " "	25,009	5	3
Total,	£88,660	9	4

Or say £90,000, including the bar at Pointe à Levraut, &c., and adding expenditure already made by the Commission, (including £19,000 for new outfit for the twenty feet line,) at £93,000, we have a total of £183,000 as the cost of adding *nine* feet to the draught of vessels coming to Montreal. Of this expenditure £40,000 is for outfit, which will be in good order on the completion of the work.

However large these figures may appear the sum in my judgment bears no proportion to the magnitude of the object to be attained.

CLYDE NAVIGATION.

As the best introduction to the commercial bearing of the deepening of the channel of the St. Lawrence between Montreal and Quebec, I give a short statement of what has been done in the Clyde.

One hundred years since, vessels drawing three feet three inches to three feet six inches only, could ascend the Clyde to Glasgow. In 1773 certain improvements were commenced, for the purpose of assisting the action of the tide, and, in 1806, vessels drawing eight feet six inches could ascend to Glasgow. In 1824, when the first steam dredge (No. 1*) commenced work, the depth had been increased to eleven feet. The second dredge was started in 1826, a third in 1830, a fourth in 1836, a fifth in 1841; and, in 1850, a depth of seventeen and a-half feet at neap tides had been gained. The value of the working machinery for the improvement of the Clyde was estimated at £39,000 sterling, in 1845, since when an additional sum of about £18,000 has been expended in new plant. The total expenditure for the River and Harbour, by the Clyde Trustees, within the last hundred years, has been about £2,000,000 sterling.

In deepening the Clyde about 6,000,000 cubic yards have been removed, 2,000,000 of which were previous to

* In 1851 a new double dredge of forty-horse-power was substituted for No. 1.

the commencement of the dredges in 1824, chiefly by the scour of the tide, aided by dykes and jetties. Of the remaining 4,000,000, about 3,500,000 have been removed since 1840, at an average cost of about thirteen pence sterling per cubic yard. The annual expenditure for dredging, since 1840, averages about £15,000 sterling—the sum of £212,537 sterling having been expended for this purpose since that date.

The depth secured is twelve feet at low and eighteen feet at high water, and the width of the excavated channel in the narrowest parts is less than one hundred feet. To preserve this depth an annual dredging of 160,000 to 180,000 cubic yards, and an outlay of about £8000 stg. per annum, for dredging and repairs, are required on a river eighteen miles in length. A single bank near Bowling accumulates so rapidly that it has cost £1200 a-year to keep it down. The cuts through the several banks are three hundred feet wide—the same width as proposed in Lake St. Peter. The "plant" consists of five dredges, aggregate power one hundred and sixteen horses, one eighty horse-power tug (iron,) two hundred and sixty-two punts, forty boats, a diving bell, and thirty-four buoys with screw moorings.

The financial and legislative history of the Clyde navigation is not less interesting.

In 1758 the first Act was obtained for improving the River upon Smeaton's plan. A lock was to be built, with a dam across the channel at Marlinford (four miles below Glasgow,) by means of which four and a-half feet depth of water was to be secured upward to the Harbour. Fortunately this plan was not carried out, and in 1768 Mr. Golborne recommended the plan of jetties, &c., to assist the action of the tide. In 1770 an Act was got to deepen the whole stretch of the river, from Dumbarton up to Glasgow, to a depth of seven feet at neap tides. Powers were given in this Act *to levy dues upon shipping* to be applied towards improving the River, and in the same year a revenue of £147 sterling was drawn. In 1771 the revenue, amounted to £1071 sterling.

In 1809 an Act was got to deepen to nine feet at neap tides, and *to borrow* £30,000 *on the credit of the trust.* Previous to this the monies necessary to carry on the work had been advanced by the Town of Glasgow, but at this time had all been repaid out of the trust revenues. In 1824, when the first steam dredging machine was set at work, the River had been deepened to eleven and a half feet, the revenues had reached £3500, the size of the ships was increasing, and Glasgow owned one hundred and eleven vessels, amounting to 14,000 tons. In 1825 a fourth Act was got for deepening to thirteen feet at neap tides, and in fifteen years therefrom vessels of three hundred and four hundred tons, drawing twelve and thirteen feet water, were numerous in the Harbour, although they could not pass the River in neap tides. The number of vessels had increased three-fold, their tonnage five-fold, and the revenues had increased five fold, amounting to upwards of £40,000 per annum. In 1840, therefore, an Act was obtained defining bold lines of River and Harbour improvement, and for deepening to seventeen feet at neap tides.

In 1846 an Act was obtained for increased Harbour accommodation; the number of vessels belonging to the Port then amounted to 512, and their tonnage to 134,603 tons. The trust revenues had risen to £51,198 sterling; the total amount drawn since 1770 being £906,554 sterling, and the total expenditure £1,253,951 sterling.

In 1850 the revenues amounted to £64,000 sterling. The customs of the Port of Glasgow have risen from £3000, in 1811, to £640,000 in 1850.

It has been remarked, that under the first Act obtained for the improvement of the Clyde, (that is, for the construction of the lock and dam upon Smeaton's plan,) no dues were to be levied until after the works were completed, thus requiring a heavy outlay of capital before any return could be made—conditions which placed the work in a position similar to that held by our railways. The second Act, however, which authorized the levying of dues on ship-

ping, created an immediate fund, and the primary cause of the *financial* success of the Clyde improvements is ascribed to the system of removing ford after ford, and gradually deepening the channel as the revenues increased.

The revenues of the Clyde Trust for the year ending 1st July, 1854, were:

From	Tonnage dues,	£50,772	4	3	
"	Quay "	11,582	1	4	
"	Shed "	8,798	0	6	
"	Crane "	923	11	2	
"	Weighing "	1,943	10	11	
					£74,019 8 2
And from miscellaneous sources,.....					12,560 17 9
Making a total of.....					£86,580 5 11

The progressive gross revenues since 1850 have been:

In 1850,.....	£64,243
" 1851,.....	68,875
" 1852,.....	76,077
" 1853,.....	77,919
" 1854,.....	86,580

The gross receipts since 1842 have been £774,703; the expenditure in the same period has been £1,422,438 of which the following are items:

Interest on loans,.....	£270,823
Land for enlargement of Harbour,	349,685
" " widening of River,....	100,798
Construction of works in Harbour,	222,517
" " " " River,...	33,895
Dredging in River and Harbour,.	126,012

The debt has increased from £219,119, in 1842, to £811,480, in 1854, the interest on which is £29,742. The surplus revenue of

1851 was,.....	£17,574
1852 "	19,065
1853 "	19,899
1854 "	21,623

I have quoted at this length from the history of the Clyde improvement, because there is a manifest analogy in the position and action of Glasgow and Montreal. Mr. Walker, C. E., reporting to the Clyde Trustees in 1852, says: "Mr. Ormiston states that 'many of the Glasgow outward-bound ships load at Glasgow to about 15 feet 6 inches, and either call at Greenock, or anchor at the Tail of the Bank, where they load up to about 18 feet; seldom, if ever, above 19 feet.'"

That "the lighter ships have, (with the exception of the very largest,) nearly all left Greenock and Port Glasgow, and have come up to Glasgow," and "that, although Greenock has fewer vessels, the tonnage of these is greater. Vessels drawing 22 feet are common enough, and 2 feet more is not extraordinary." "This," he observes, "shows that all vessels come up to Glasgow, which possibly can, and the larger ones might reasonably be expected to follow, if encouragement were given them, as Greenock and Port Glasgow are, after all, only the deep sea port of Glasgow."

IMPORTANCE OF THE WORK.

It may be argued that there is little comparison between the population and commerce of Montreal and Glasgow; and it may be doubted whether the Clyde improvements have made Glasgow, or Glasgow the commerce of the Clyde; yet it is evident that the one cannot now exist without the other, and also that Montreal is in a much better position than Glasgow was when the Clyde improvements were commenced. In the trade of the St. Lawrence and its great Lakes, we have a future most promising, and a commerce within our own reach, which must be as far before that of the Clyde as the area of the valley of the one River exceeds that of the other.

The commerce of the Lakes *west of Buffalo* is now estimated at $200,000,000, of the Mississippi $150,000,000, and the steam commerce of the Ohio at $80,000,000. The Mississippi and Ohio are connected with the Lakes

by canals and numerous railways, made and making, the yearly tendency of which is to draw up commerce from the lower Mississippi to the St. Lawrence, giving this commerce an outlet to the Atlantic States, and the seaboard, viâ Buffalo, Oswego and Ogdensburgh, in preference to the natural route viâ New Orleans. Moreover the propeller is rapidly taking the place of the sailing vessel, and (the St. Lawrence being now open to American trade) the day cannot be far distant when Montreal will become an entrepôt, during the season of navigation, for that trade which is rapidly overgrowing the capacity of the enlarged Erie Canal, and of all the railways which debouche on the Atlantic—from Portland to the Capes of Virginia. The lake propeller will then meet the ocean screw steamer at the head of ship navigation on the St. Lawrence—wherever that may be. This point must either be Quebec or Montreal, and it may be supposed that it is a matter of indifference to the Province at large which becomes the favoured locality, and that therefore the deepening of the St. Lawrence between these two cities is a local or Montreal question. This consideration appears to have influenced the Legislature, in 1847, in abandoning the Provincial attempt to deepen Lake St. Peter. The subsequent granting, however, of powers to levy dues *upon the trade of the St. Lawrence* for this purpose was an acknowledgement of the Provincial importance of the work, and it may not be out of place here to endeavour to show how Canada is interested in extending her deep seaport one hundred and fifty miles further into the interior. This involves the consideration of the problem, "where can the sea and inland trade of the St. Lawrence most economically meet? whether should the lake propeller (the smaller craft) descend to the lowest possible point, to meet the Atlantic ship, or whether the latter (the larger vessel) should ascend to the highest possible point?

If we were considering only the *through* traffic, it would become simply a question whether three or four

lake craft could make the additional voyage from Montreal to Quebec cheaper and quicker than one ocean vessel could ascend the additional distance between Quebec and Montreal; and, *the relative facilities for transhipment at the two ports.* But practically the ocean vessel may wish to discharge part of her cargo at Quebec, and a still greater portion for local consumption or distribution by railways at Montreal, the remainder only being in transitu for more western ports. If it be assumed that the delivery to the railways could be done at Point Levi instead of Montreal, there would be only the Montreal goods subjected to an extra transhipment, and the additional cost of railway,—over water borne—transport between Quebec and Montreal on the railway delivery.

There are, however, two local considerations which affect the general question, which are of much importance and, in my judgment, conclusive as to the superior advantages under which the Provincial import trade can be carried on through Montreal as compared with Quebec; and where the imports are landed, the exports can be most advantageously shipped, excepting, of course, the timber trade and its peculiar requirements.

The ocean trade is limited to a certain number of voyages which may be made between May and November, and the number of these long voyages cannot be influenced by the comparatively trifling addition of the ascent to Montreal. It may be assumed, therefore, that the same number of ships will do the same business whether they come to Montreal, or stop at Quebec, but this cannot be said of the inland voyage. A greater number of inland craft, therefore, will be required to bring down the same amount of produce per annum, if taken to Quebec than if left at Montreal.

Practically, when lighterage is avoided, the same rate of freight may be expected to obtain between Montreal and European ports as for Quebec, and thus Canada West is brought virtually 160 miles nearer the Atlantic; and Lake Erie has a sea port, on her own waters, at least one hundred miles nearer than New York.

The second consideration is the relative advantages of Quebec and Montreal, for the particular trade now enjoyed by each.

The all-important advantage of a high tide will ever give Quebec the preference as the timber shipping port. This trade can be best accommodated by vessels anchoring in the stream, their cargo being floated to them by every tide, while the broad beaches laid dry by every ebb serve as dressing gound on which the timber is prepared for shipment. The great demand for space for such a peculiar traffic will make coves more profitable than wharves; and without expensive docks a large commercial business cannot be carried on to the same advantage as in the undisturbed level of the tideless Harbour of Montreal.

From Captain Bell's Report it will be seen that a depth of sixteen and a-half feet throughout may be obtained for vessels ascending to Montreal, in September, 1855, and one of eighteen feet in the same month of 1856, provided the south channels at Becancour and Verchères are lighted and buoyed.

The completion of the channel to a depth of twenty feet *may* be effected in 1857, but need not be delayed beyond the summer of 1858.

To Captain Bell's Report with respect to lights and buoys, I have nothing to add. On the completion of the deep channel permanent instead of floating lights will probably be established in the Lake.

The requirements in the Harbour of Montreal, I propose to make the subject of a separate Report so soon as the plans for the same are matured.

I have the honor to be,
Sir,
Your obedient servant,
THOS. C. KEEFER,
Eng. Harbour Com.

IMPROVEMENT OF ST. LAWRENCE NAVIGATION BETWEEN MONTREAL AND QUEBEC.

Estimate for a channel 300 ft. wide with a depth of 18 ft., 19 ft. and 20 ft. at low water.

Locality.	For 18 feet depth.					Additional for 19 feet.					Total for 19 feet.			Additional for 20 feet.					Total for 20 feet.			
	Cubic yards.	Rate.	£	s.	d.	Cubic yards.	Rate.	£	s.	d.	£	s.	d.	Cubic yards.	Rate.	£	s.	d.	Yards.	Cost.		
		s. d.					s. d.								s. d.					£	s.	d.
Lake St. Peter.....	1,117,561	0 7½	34,923	15	7½	575,632	0 7½	17,988	10	0	52,912	5	7½	661,256	0 7½	20,664	5	0	2,354,449	73,576	10	7½
La Valtrie.....	57,541	1 10½	5,394	9	4½	40,087	1 6	3,006	10	6	8,400	19	10½	51,346	1 3	3,209	2	6	148,974	11,610	2	4½
Cap St. Michel.....	12,341	2 2½	1,375	10	1¾	9,318	1 9	815	6	6	2,190	16	7½	12,661	1 3	791	6	3	34,320	2,982	2	10½
Pointe aux Trembles	198	5 0	49	10	0	488	4 0	97	12	0	147	2	0	1,969	3 0	344	11	6	2,655	491	13	6
Pointe Levraut, &c..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,339	15	7½
	1,187,641		41,743	5	1¾	625,525		21,907	19	0	63,651	4	1¾	727,232		25,009	5	3	2,540,398	90,000	0	0

At all points above Lake St. Peter the estimated price per cubic yard is reduced as the quantities are increased.

THOS. C. KEEFER, Engineer,
Montreal Harbour Commission.

Montreal, 1st March, 1855.

STATEMENT shewing the cost of Dredging in LAKE ST. PETER for each Year, from 1851 to 1854.

Year.	Vessel.	Fuel.	Wages.	Board.	Oil and Tallow.	Cordage	Repairs	Incidentals, Salaries, Winter outfit.	Cost of dredging exclusive of outfit.	No. of Scows filled.	No. of Cubic Yds. lifted, 70 Yds. per Scow.	Per Yard measured in Scow.	Cost of outfit.	Per Yd. including outfit.
												s. d.		
1851	Dredge No. 2.	£277	£500	£122	£51	£45	£586	£1193	£4034	1124½	78715	1 0½	.....	.....
	Tender.	588	375	187	83	27								
		865	875	309	134	72	586	1193	4034	1124½	78715	1 0½	.....	.....
1852	Dredge No. 2.	399	485	168	68	63	131	267	3475	3721	260470	3½	.....	.....
	Tender.	1100	417	169	84	33	91							
	Dredge No. 3.	287	519	168	68	63	99	267	3537	3438	240660	3½	.....	.....
	Tender.	1125	573	168	84	33	83							
		2911	1994	673	304	192	404	534	7012	7159	501130	3½	.....	.....
1853	Dredge No. 2.	553	587	222	68	74	302	1015	5916	4117	288190	4¼	.....	.....
	Tender.	1920	614	235	85	38	203							
	Dredge No. 3.	401	569	223	68	74	315	1015	5092	3826	267820	4¼	.....	.....
	Tender.	1383	562	197	84	38	163							
		4257	2332	877	305	224	983	2030	11008	7943	556010	4¼	.....	.....
1854	Dredge No. 2.	592	580	238	68	84	206	1096	5984	4986	349020	4	.....	.....
	Tender.	1657	722	246	84	44	367							
	Dredge No. 3.	530	597	240	68	84	215	1096	6255	4677	327390	4½	.....	.....
	Tender.	1932	724	264	85	44	377							
		4711	2623	988	305	256	1165	2191	12239	9663	676410	4¼	.....	.....
Totals.	Dredge No. 2 & Tender.	7086	4280	1587	591	408	1886	3571	19909	13948½	976395	4¼	£9606	7d.
	Dredge No. 3 & Tender.	5658	3544	1260	457	336	1252	2377	14884	11941	835870	4¼	8411	6¾
	Grand total.	12744	7824	2847	1048	744	3138	5948	34293	25889½	1812265	4¼	18017	6¾

Cost of Coal per Chaldron, in 1851, £1 7s. 6d.; in 1852, £1 5s. 0d.; in 1853, £1 17s. 6d.; in 1854, £2 0s. 0d.

Cost of Dredging at LAVALTRIE ("Isle Platte") and in the HARBOUR OF MONTREAL, for each Year, from 1851 to 1854.

Cost of Coal per Chaldron, in 1851, £1 7s. 6d.; in 1852, £1 5s. 0d.; in 1853, £1 17s. 6d.; in 1854, £2 0s. 0d.

Cost of Dredging at Lavaltrie, ("Isle Platte,") and in the Harbour of Montreal, for each Year, from 1851 to 1854.

Year.	Vessel.	Fuel.	Wages.	Board.	Oil and Tallow.	Cordage	Repairs	Incidentals—Salaries, Winter outfit, &c.	Cost of dredging exclusive of outfit.	No. of Scows filled.	No. of Cubic Yds. lifted, 30 Yds. per Scow.	Per Yard measured in Scow.	Cost of outfit.	Per Yd. including outfit
1851	Dredge No. 1 & Tender	£192	£441	£147	£52	£45	£519	£353	£1749	510	15300	s. d. 2 3¼	.....	.....
1852	Dredge No. 1.	240	617	142	56	37	145	134	1731	1248	37440	11	.....	.....
	Tender.....		360											
	Total.....	240	977	142	56	37	145	134	1731	1248	37440	11	.....	.....
1853	Dredge No. 1.	382	492	165	56	44	423	217	2464	1200	36000	1 4¼	.....	.....
	Tender.....		253	123	41	21	30	217						
	Total.....	382	745	288	97	65	453	434	2464	1200	56000	1 4¼	.....	.....
1854	Dredge No. 1.	330	728	182	55	50	193	282	2592	970	29100	1 9½	.....	.....
	Tender.....		260	137	41	24	28	282						
	Total.....	330	988	319	96	74	221	564	2592	970	29100	1 9½	.....	.....
	Grand total.....	1144	3151	896	301	221	1338	1485	8536	3928	117840	1 5½	2795	1s. 11d.

Cost of Coals per Chaldron, in 1851, £1 7s. 6d.: in 1852, £1 10s. 0d.; in 1853, £2 5s. 0d.; in 1854, £2 0s. 0d. The tender burned wood.

In 1852 the tender to Dredge No. 1, was chartered for a portion of the season at a cost of £360, every thing being found the boat by the Proprietor.
The work of 1851 and '52 was at Lavaltrie and Isle de Lorier,—of 1853 and '54, in Montreal Harbour, where the material is very hard, and thickly interspersed with large "boulder" stones.

Details of Dredging Vessels employed by the Montreal Harbour Commission in the Improvement of the Navigation of the River St. Lawrence.

No. of Boat.	Length over all.	Length of Keel.	Breadth of Beam.	Diameter of Cylinder.	Length of Stroke.	Pressure of Steam.	No. of Strokes per Min.	Consumption of coal per Hour.	Nominal H. P. of Engines.	Principle of Engines.	Length of Bucket Frame.	No. of Buckets on Frame.	Capacity of Buckets.	No. discharged per Min.	Least depth of Working.	Greatest depth of Working.	Men.		
																	Tender.	Dredge.	Scows.
No.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Lbs.	No.	Lbs.	No.		Ft. In.	No.	Cubic feet in each.	No.	Ft. In.	Ft. In.			
1	97 3	93 0	25 3	2 3	2 6	5	38	225	20	Side Lever....	60 0	34	4	19	7 0	22 0	10	9	4
2	126 7	123 0	25 0	2 Cylinders	4 0	16	40	510	30	Direct action.	49 2	28	6	28	7 0	18 0	18	13	4
3	125 0	125 0	24 8	1 4 each.	4 0	16	40	510	30	Direct action.	49 2	28	6	28	7 0	18 0	17	13	4
4	130 0	126 0	25 0	2 3½	2 6	5	40	—	22½	Side Lever....	64 3	36	4	18	7 0	30 0	17	9	4
Spoon Dredge.	55 7	50 7	23 4	2 Cylinders 6 in. each.	1 2	60	60	151	12	High Pressure. Direct action.	Bucket Handle 38 6	1	40½	1	1 6	25 0		3	2

In the above Statement, the Power of Dredges Nos. 1 and 4 is calculated according to the actual pressure of Steam carried.—The Power of Dredges Nos. 2 and 3 is made up according to "Watt's" calculation of 6 lbs. pressure upon the square inch of the Piston, but they, carrying steadily 16 lbs., of course work up to much more than their nominal Horse Power.—Dredges Nos. 2 and 3 are now being lengthened, to enable them to work in 30 ft. of water.—When finished, the Bucket Frame of each will be 63 ft. 3 in. from centre to centre of shaft, and will then have 34 Buckets.

A Tender and two hopper-bottomed Scows are attached to each Dredge, for towing away and depositing the material lifted.—The Tender to Dredge No. 1, which also attends upon the Spoon Dredge, is a 15 Horse Power Horizontal Engine, carrying a pressure of 15 lbs. upon the square inch, and consumes 382 lbs. of coal per hour.—The Tender to Dredge No. 2 has two Beam Engines of 32 Horse Power each, carrying 20 lbs. of Steam, consumes 1539 lbs. of coal per hour.—The Tender to Dredge No. 3 has also two Beam Engines of 30 Horse Power each, carrying 20 lbs. of Steam, consumes 1282 lbs. of coal per hour.—The Tender to Dredge No. 4 is in course of construction, and is to be fitted with two Horizontal Engines of 24 inch Cylinder, and 6 ft. stroke each, to carry a pressure of 30 lbs. of Steam. No. 4. is the new dreege, and has not yet been worked.

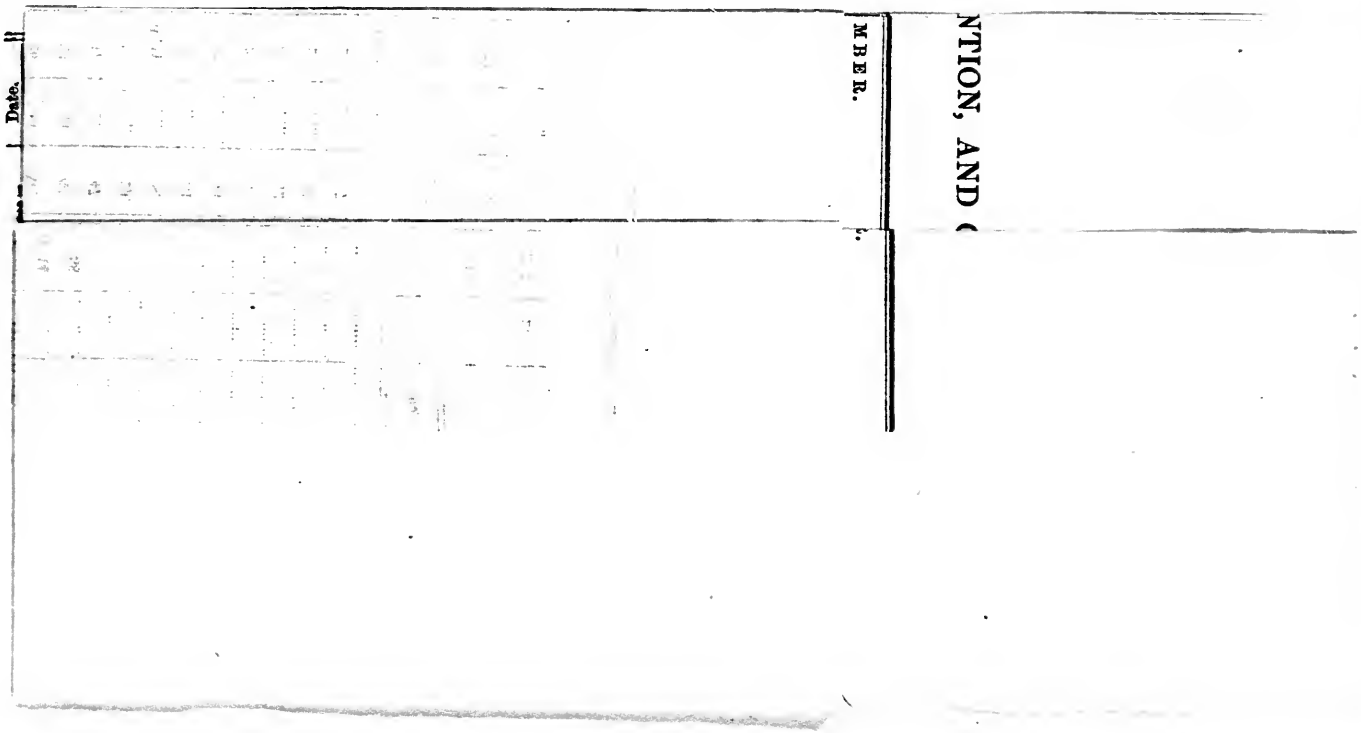
JOHN BELL,
Superintendent.

1st March, 1855.

24 inch Cylinder, and 6 ft. stroke each, to carry a pressure

1st March, 1855.

JOHN BELL,
Superintendent.



STATEMENT SHEWING THE WORKING OF THE DREDGES IN "LAKE ST. PETER," THE NUMBER OF SCO
FROM THE COMMENCEMENT IN 1851 TO THE CLOSE C

DATE.	MAY.								JUNE.								JULY.								AUGUST.							
	1851.		1852.		1853.		1854.		1851.		1852.		1853.		1854.		1851.		1852.		1853.		1854.		1851.		1852.		1853.			
	Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.			
			No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.			No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.		No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.		No. 2.	No. 3.	No. 2.	No. 3.		
			Scows.	Scows.	Scows.	Scows.	Scows.	Scows.			Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.		
1											27								31	A. 15	30	38	36	21	R. 1		S.	S.	43	47		
2						16						51							W. 2	W. 2	40	36	S.	S.	A. 13		R.	46	40	29		
3						24						37							W. 5	W.	S.	S.	33	41	S.		39	20	46	26		
4						43					W.	W.							S.	S.	28	36	31	7	W. 1		37	10	56	56		
5						46					23	Rep.							W. 13	W. 15	A. 2	A. 15	31	43	W. 5		24	30	31	57		
6						22					S.		38		W. 11	W. 11			C.	35	47	45	40	41	A. 16		R.	26	R.	46		
7						38					26		40	37	34	31			23		49	23	31	42	17				S.	S.		
8						S.					24		24	43	W.	W.			35		W. 24	W. 24	45	39	23		S.	S.	51	R. 38		
9						42					W. 4		28	28	W.	W.			31		W. 25	W. 30	S.	S.	26			13	43			
10						25					18		40	46	34	25	R. 1		A. 5	21	S.	S.	D.by S. 3	39	S.		10	4	51			
11						29					24		39	40	S.	S.	R. 13		S.	S.	43	48	41	42	R.		13	26	38	54		
12						21					30	26	S.	S.	46	41	A.		21	22	29	43	43	23	26		44	15	31	32		
13						32					S.	S.	W. 29	W. 19	33	41	S.		W. 10	16	40	47	44	43	R. S		34	51	34	33		
14											30		43	50	40	27	R. 1		24	21	47	47	40	43	R.		36	29	S.	S.		
15						S.					20		35	43	40	37	R.		34	28	55	33	36	39	R.		S.	S.	47	41		
16						W.					31	37	40	45	37	44	R. 6		34	31	37	34	S.	S.	25		36	R.	39	30		
17					High Water.	W. High Water.					38	37	40	R.	25	36	R. 13		29	15	S.	S.	41	32	S.		46	R.	25	24		
18											33	13	31		S.	S.	R.		S.	S.	20	46	33	47	24		21	R.	W. 4	W. 7		
19				2							32	35	S.	S.	38	46	R.		20	27	44	47	29	R. D. 18	A. 15		27	7	23	W. 16		
20				W.							S.		39.		33	36	S.		15	A. 2	W. 11	W. 11	37	43	20		33	40	32			
21				W.	5						41		35	R. to Str.	37	36	R.		13	18	47	38	24	26	20		40	41	S.	S.		
22			7	4							A. 17		38		W. 21	W. 19	A. 7		27	15	42	43	33	A. 23	W. 19		S.	S.	26			
23			S.	S.								23	35		26	44	A.		26	23	50	31	S.	S.	W. 5		40	24	21	5		
24			4	W. 7								26	A. 17		40	39	R. x		28	15	S.	S.	40	42	S.		47	41	29			
25				W. 9							W. 18	W. A. 5	43	24	S.	S.	R.		S.	S.	36	35	43	45	W. 16		39	9	25			
26			7	22							W. 18	W. 17	S.		39	29	R.		19	23	24	W. 12	W. 16	W. 16	W. 13		32	53	44	52		
27				31							S.	S.	34	16	46	39			27	21	38	53	47	45	20		41	50	W. 6	W. 5		
28				35							35	30	46	44	39	35			27	R. 6	47	51	53	45	R. 17		35	46	S.	S.		
29				W. 18							29	2	47	26	A. & B. 20	A. & B. 5			26	R.	51	54	29	27	12		S.	S.	45	46		
30			S.	S.							35	18	23	29	W. 23	R. D. 3			23	R.	40	46	S.	S.	W.		R.	46	40	53		
31				38															26	18			W. 22	W. 16	S.		R. 5	50	A. 29	40		
Total No. of Scows filled each month.			18	166	5	338					554	337	784	473	607	643	42		601	383	964	970	952	882	332		684	648	901	779		
Total No. of working days each month.			3	9	1	11					21	14	22	14	21	21	7		26	21	26	26	26	26	23		21	23	26	21		
Average Scows per day for each month.			6	18.4	5	30.7					26.3	24	35.6	33.7	33.1	30.6	6		23.1	18.2	37.0	37.3	36.5	33.9	15.		32.5	28.4	34.6	37.		

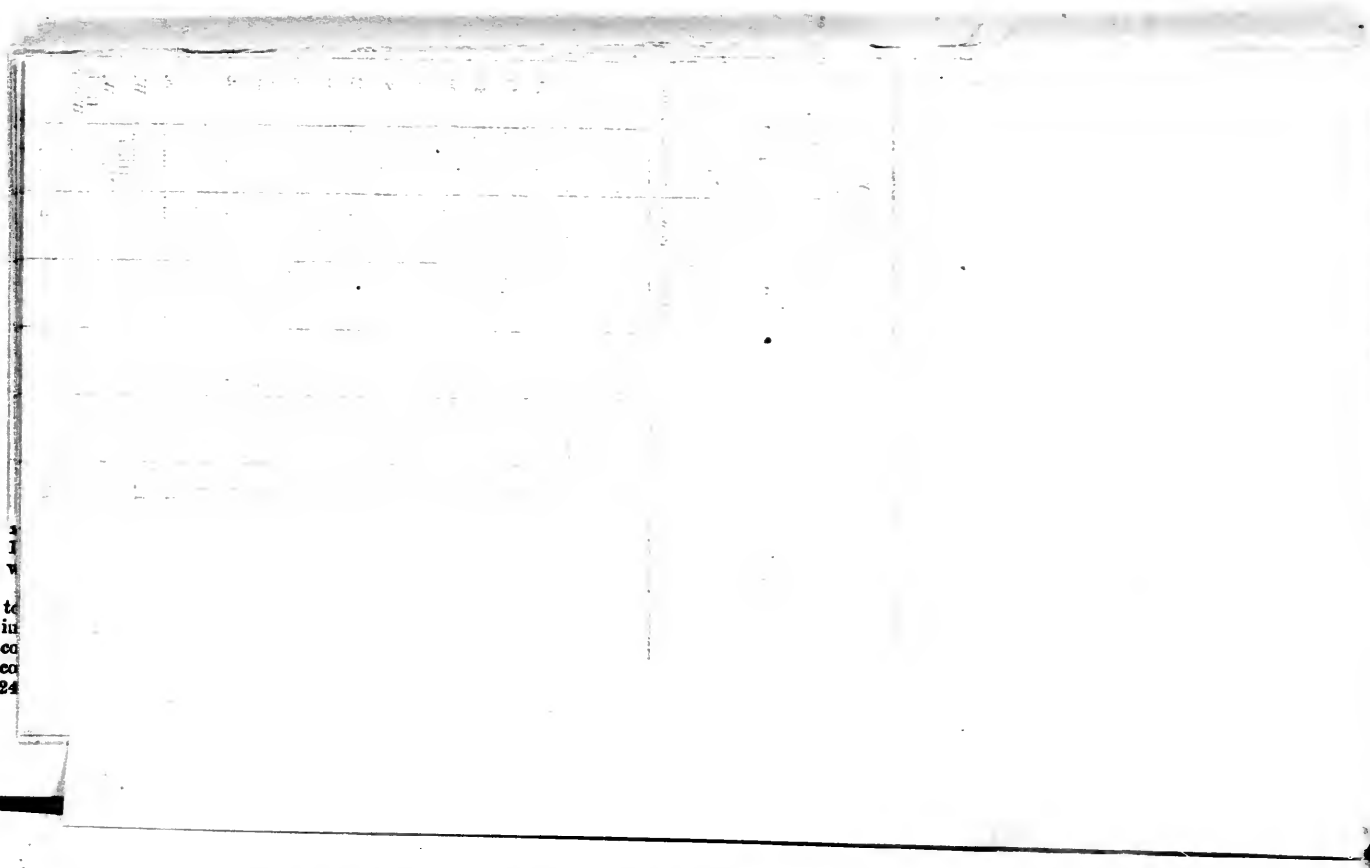
1851.—77 Working Days, 1124½ Scows filled, 14.59 Average per Working Day. 1852.—238 Working Days, 7159 Scows, 27.74 Average per Working Day. 1853.—243 Working Days, 7943 Scows, 32.68 Average per Working Day. 1854.—275 Working Days, 9655 Scows, 35.16 Average per Working

NOTE.—W. signifies Wind, A. signifies Anchors, B. signifies Buoys, R. D. signifies Repairing Dredge, R. S. signifies Repairing Scows, D. by S. signifies Detained by Ships, T. A. signifies Tenders Absent.

THE NUMBER OF SCOWS FILLED, THE DETENTION, AND CAUSE OF THE SAME, FOR EACH DAY 1851 TO THE CLOSE OF THE SEASON OF 1854.

AUGUST.							SEPTEMBER.								OCTOBER.								NOVEMBER.							
	1852.		1853.		1854.		1851.		1852.		1853.		1854.		1851.		1852.		1853.		1854.		1851.		1852.		1853.		1854.	
	Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.		Dredges.	
	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.		No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.		No. 2.	No. 3.	No. 3.	No. 5.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.	No. 2.	No. 3.
Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.	Scows.
.....	S.	S.	45	47	32	43	A. 14	.....	55	44	41	51	W. 5	W. 9	A. 11	.....	28	45	35	.....	S.	S.	.....	.....	20	W. 23	23	36	31	28
.....	R.	40	40	28	34	37	W. 1	.....	45	24	44	56	31	A. 21	R. 19	.....	20	45	S.	.....	36	37	.....	.....	W.	W.	A. 23	44	24	36
.....	39	20	40	28	52	46	11	.....	W. 16	W. 14	34	R.	S.	S.	19	.....	S.	S.	W. 9	.....	40	42	.....	.....	17	W. 18	28	35	33	34
.....	37	16	56	58	28	30	S. R. 13½	.....	45	37	S.	S.	45	40	20	.....	38	31	27	.....	W. 18	R. D.	.....	.....	29	27	W. 7	W. 5	W. 14	W. 21
.....	24	30	31	37	46	39	20	.....	S.	S.	25	R.	47	46	S.	.....	23	17	W.	.....	36	R. D.	.....	.....	38	38	30	29	S.	S.
.....	R.	28	R.	46	S.	S.	A. 9	.....	W. 15	W. 16	39	40	28	45	R. 2	.....	16	40	W.	.....	37	R. D.	.....	.....	31	42	S.	S.	T. A. 6	T. A.
.....	.....	.....	S.	S.	W.	W.	S.	.....	47	44	A. 18	44	37	40	R.	.....	36	31	W.	.....	37	36	.....	.....	S.	S.	W. 7	W. 8	27	29
.....	S.	S.	51	R. 28	40	R. D.	S. R.	.....	31	53	46	17	46	49	R. 11	.....	W. 15	W. 14	31	.....	S.	S.	.....	.....	35	41	W. 13	W. 18	38	R. S. 22
.....	.....	13	45	.....	47	50	S. R. 15	.....	31	44	30	37	28	38	20	.....	24	W. 17	S.	.....	31	42	.....	.....	35	46	W. 5	W. 9	W. 19	R. S.
.....	10	4	51	.....	47	44	S. R. 10	.....	39	46	W.	W.	S.	S.	A. 13	.....	S.	S.	34	.....	38	46	.....	.....	32	28	W. 5	W. 0	37	R. S. 23
.....	13	26	52	54	55	51	R.	.....	38	R. 15	S.	S.	37	41	21	.....	35	41	31	.....	W. 21	23	.....	.....	44	32	37	38	A. 18	R. S. 24
.....	44	15	31	52	42	25	W. 12	.....	S.	S.	19	W. 20	41	37	S.	.....	W. 17	W. 15	W.	.....	42	44	.....	.....	W.	W.	36	37	S.	S.
.....	34	51	34	55	S.	S.	W. 5	.....	30	R.	W.	W.	33	T. A. 13	W. 11	.....	24	32	W. 11	.....	28	36	.....	.....	25	37	S.	S.	W. 20	R. S. 18
.....	36	29	S.	S.	R. D. 17	32	S.	.....	30	R. 10	30	31	32	T. A.	10	.....	32	31	27	.....	26	32	.....	.....	S.	S.	35	39	31	40
.....	S.	S.	47	41	T. A.	46	20	.....	31	38	W.	W.	41	T. A. 5	22	.....	32	38	W. 13	.....	S.	S.	.....	.....	35	38	7	10	45	54
.....	30	R.	39	30	55	38	A. 19	.....	R. 14	28	42	35	33	A. 19	20	.....	W. 16	W. 15	S.	.....	20	31	.....	.....	W.	W.	40	40	43	38
.....	40	R.	23	24	34	27	A.	.....	28	51	W. 5	W.	S.	S.	A. 18	.....	S.	S.	W. 8	W. 19	37	44	.....	.....	.....	10	W.	W.	37	40
.....	21	R.	W. 4	W. 7	46	Dby 8 12	21	.....	42	40	S.	S.	47	43	22	.....	19	28	.....	43	45	45	.....	.....	.....	.....	30	35	13	33
.....	27	7	33	W. 16	33	25	R. 16	.....	S.	S.	45	33	32	45	S.	.....	W. 10	W. 13	.....	31	37	37	.....	.....	.....	.....	38	20	.....	S. 33
.....	32	40	32	.....	.....	S.	20	.....	49	W. 20	26	40	W.	W.	R. 19	.....	34	17	.....	41	34	39	.....	.....	.....	.....	S.	S.	.....	42
.....	40	41	S.	S.	46	20	S.	.....	W. 3	W.	36	30	41	44	21	.....	34	40	.....	42	32	31	.....	.....	.....	.....	14	W. 14	.....	10
.....	S.	S.	28	.....	44	39	W. 10	.....	W.	W.	17	11	47	40	A & W 19	.....	20	31	.....	W.	S.	S.	.....	.....	.....	.....	29	38	.....	.....
.....	40	24	21	5	40	51	W. 17	.....	40	20	30	.....	29	23	A. 13	.....	28	30	S.	S.	30	34	.....	.....	.....	.....	.....	.....	.....	.....
.....	47	44	29	.....	50	51	A. 7	.....	42	50	W. 11	.....	S.	S.	W.	.....	S.	S.	W.	W.	32	33	.....	.....	.....	.....	.....	.....	.....	.....
.....	39	9	25	.....	63	35	A. 16	.....	41	44	S.	.....	33	31	W. 10	.....	34	29	.....	.....	42	37	.....	.....	.....	.....	.....	.....	.....	.....
.....	32	33	45	52	41	32	20	.....	S.	S.	23	.....	45	46	S.	.....	36	24	35	21	38	39	.....	.....	.....	.....	.....	.....	.....	.....
.....	41	50	W. 4	W. 5	S.	S.	T. A. 3	.....	41	31	31	.....	45	40	A. 18	.....	34	37	37	26	36	43	.....	.....	.....	.....	.....	.....	.....	.....
.....	33	46	S.	S.	38	45	S.	.....	40	20	W.	.....	42	40	A. 18	.....	33	37	28	41	38	29	.....	.....	.....	.....	.....	.....	.....	.....
.....	S.	S.	42	46	41	48	19	.....	34	43	23	.....	38	35	17	.....	32	39	32	37	S.	S.	.....	.....	.....	.....	.....	.....	.....	.....
.....	R.	40	40	53	51	T. C. 7	R. 10	.....	41	43	23	.....	27	A. 17	21	.....	W.	W.	S.	S.	34	44	.....	.....	.....	.....	.....	.....	.....	.....
.....	R. 5	36	A. 29	40	47	50	.....	.....	.....	.....	.....	.....	.....	.....	23	.....	S.	.....	37	42	42	41	.....	.....	.....	.....	.....	.....	.....	.....
.....	684	648	901	779	1089	961	321½	.....	802	773	664	469	905	517	429	.....	670	740	395	342	907	861	.....	.....	332	391	404	404	430	505
.....	21	22	26	21	25	25	23	.....	25	23	22	13	25	24	25	.....	25	23	15	10	26	23	.....	.....	11	12	18	18	16	17
.....	32.5	29.4	34.6	37.	43.5	38.4	14	.....	34.4	33.5	30.1	35.3	36.2	34	17.1	.....	26.8	29.8	26.3	34.2	34.8	37.4	.....	.....	30.1	32.5	22.4	25.7	27.2	29.7

, 9055 Scows, 35.16 Avorage per Working Day.



Depth of Water on the "Flats" in LAKE ST. PETER, from 1851 to 1854.

Depth of Water on the "Flats" in Lake St. Peter, from 1851 to 1854.

Date.	May.				June.				July.				August.				September.				October.				November.			
	1851.	1852.	1853.	1854.	1851.	1852.	1853.	1854.	1851.	1852.	1853.	1854.	1851.	1852.	1853.	1854.	1851.	1852.	1853.	1854.	1851.	1852.	1853.	1854.	1851.	1852.	1853.	1854.
	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In	Ft In
1	.....	.....	.....	2 4	.....	17	18 9	.....	.....	.....	14 9	14	14 6	.....	11 6	12	12 3	12	11 3	10 10	12	.....	.....	.....	12 6	12 6	11 6	11
2	.....	.....	17	.....	.....	.....	.....	.....	.....	.....	14 6	.....	14 6	.....	11 6	.....	12 4	12	11 3	11	12 6	12	.....	10 6	12 6	.....	11 6	11
3	.....	.....	.....	.....	.....	17	18 3	.....	.....	.....	.....	13 9	14 6	.....	11 3	11 9	12 5	12	11 3	10 9	11	.....	12	10 6	12 6	12 6	11 6	11 3
4	.....	.....	17	.....	.....	.....	18 9	.....	.....	.....	14	13 9	14 9	.....	11 6	11 9	12	.....	.....	11	11	.....	.....	10	12 6	12 6	11 6	11 6
5	.....	.....	17 3	.....	.....	.....	.....	16 6	.....	.....	14	13 6	15	.....	11 9	11 9	11 10	.....	.....	11	11	12	.....	10	12	12 6	11 6	
6	.....	.....	17	.....	.....	.....	18 3	16 6	.....	.....	14	13 6	15	13	12	.....	11 8	11 6	.....	.....	11	12	.....	10 3	11 9	12 6	.....	11 3
7	.....	.....	17	.....	.....	.....	18 3	16 6	.....	15	13 6	13 3	14 0	.....	12 4	.....	11 8	11 6	11 9	11	10 9	12 3	.....	10 6	11 9	.....	.....	11 3
8	.....	.....	.....	.....	.....	16	18	.....	.....	.....	13 3	13	14	.....	12 4	11 6	11 7	11	11 10	11	10 6	12 3	12	.....	12	12 6	.....	11
9	.....	.....	17 3	20	.....	.....	18	.....	.....	.....	13	.....	13 9	.....	12	11 6	11 6	10 9	11 9	11 6	10 6	12 6	.....	11	.....	12 9	12	11 9
10	.....	19 6	17	20	.....	15 8	18	.....	15	.....	13	13	13 9	.....	12	11 6	11 5	10 9	.....	.....	10 6	.....	12	11 3	.....	12 9	12	11 6
11	.....	.....	17	20	.....	15 8	18	.....	14 8	.....	13	13	13 9	12	11 10	11 6	11 6	11 4	.....	11 6	10 6	12 6	12 6	11	.....	13	12	11 9
12	.....	.....	.....	.....	.....	16	.....	16 6	14 8	.....	13	13	13 9	12	11 8	12	11 9	.....	11 3	11 3	10 6	.....	.....	11	.....			
13	.....	.....	.....	.....	.....	.....	17 9	16 6	14 8	15 6	13	12 4	13 9	12 3	11 8	.....	11 9	.....	.....	11	10 9	12 9	12	11	.....	13 3	.....	11 9
14	.....	.....	.....	.....	.....	.....	17	16	15	15 6	12 9	12 4	13 9	.....	.....	12	11 9	.....	11	11	10 6	12 6	12	.....	.....	.....	12 3	11 6
15	.....	.....	.....	20	.....	.....	16 9	16	15	15 6	12 9	12 9	13 6	.....	.....	12	11 9	.....	11	11	11	12	6	11 9	.....	13 3	12 3	11 9
16	.....	.....	.....	.....	.....	16 6	16 6	15 9	15	15 6	12 6	.....	13 6	.....	11 10	11 6	11 6	.....	11 9	10 9	11 3	2 6	.....	11	.....	.....	12 6	12
17	.....	.....	18 6	.....	.....	.....	16 6	15 6	14 6	15	.....	12 6	13 3	.....	.....	11 6	11 3	12 2	.....	10 6	11	.....	11 9	11 3	.....	13 3	.....	12
18	.....	.....	18 9	20	.....	.....	16 3	15 3	14	.....	12 3	12 6	13 3	15	12 3	11 6	11	.....	.....	10 6	11	12	11	11 9	.....	13 3	12 9	12
19	.....	19 3	.....	.....	.....	17	.....	15 3	14	16	12 3	12 6	13	14	12 3	11 6	10 9	.....	12 6	10 3	11	12 9	11 6	11 9	.....	.....	12 9	
20	.....	.....	.....	.....	.....	.....	16	15	14	16	.....	12 6	12 10	12 3	14 4	.....	10 6	.....	12 3		11	12 9	11 6	11 6	.....	.....	.....	
21	.....	.....	19 6	.....	.....	16	15 6	15	13 6	16	13	12 9	12 8	12 6	.....	11 6	10 9	.....	12	10	11	12 2	11 6	11 4	.....	.....	13	12 6
22	.....	19	.....	20	.....	.....	15 3	15	13	.....	13	12 9	12 8	.....	12 2	11 9	11	.....	11 9	10	11	12 6	11 9	.....	.....	.....	13 6	12 9
23	.....	.....	20	.....	.....	.....	15 3	14 9	13	15	13	.....	12 6	.....	12	11 3	11	11 5	11 9	.....	11	12 3	.....	11 6	.....	.....	.....	13
24	.....	18 6	19 6	.....	.....	16	15 6	14 9	13	.....	.....	12 6	12 6	.....	.....	11 3	11	11 6	11 6	.....	11 6	.....	.....	11 9	.....	.....	.....	.....
25	.....	18 3	20	.....	.....	.....	15 9	.....	13 6	.....	12 6	12 3	12 3	11 9	12	11 3	11	11 3	.....	11	11 6	12	11	11 9	.....	.....	.....	.....
26	.....	.....	.....	.....	.....	16	.....	14 3	13 9	14	12 6	12 6	12 6	12	11 10	11	11 3	.....	11 6	11	11 9	12 3	11 6	11 6	.....	.....	.....	.....
27	.....	.....	20 6	.....	.....	15 6	14		13 9	.....	12 3	12 6	12 6	12 6	11 6	.....	11 9	11 2	11 3	11	12	12	11 3	11 6	.....	.....	.....	.....
28	.....	.....	20 6	.....	.....	16	15	14	14	.....	12	12 6	12 6	12 3	.....	11	11 9	11	11 3	10 9	12 6	.....	11 6	11 4	.....	.....	.....	.....
29	.....	.....	20 3	.....	.....	16	.....	14	14	.....	12	12	12 4	.....	11 4	10 9	12	.....	11 6	11	12 3	12	11 4	.....	.....	.....	.....	.....
30	.....	.....	19 9	.....	.....	16	14 9	14	14 3	.....	11 9	12	12 4	12	11 3	10 6	12	.....	11 6	10 9	12	.....	.....	11	.....	.....	.....	.....
31	.....	17	19	19 3	.....	.....	.....	.....	14 3	.....	.....	12	12 4	.....	11 3	10 9	.....	.....	.....	.....	12 6	.....	.....	11	.....	.....	.....	.....

CLYDE NAVIGATION.

STATEMENT, SHOWING THE TOTAL QUANTITY OF MATERIAL DREDGED IN THE RIVER CLYDE AND HARBOUR OF GLASGOW, AND ITS COST, From JUNE 1840 to JUNE 1854—a period of Fourteen Years.

End of the Financial Years.	Total Cubic Yds., considering 8 Yards p. Punt.	Cost of Dredging and Depositing in River and Harbour, Diving, &c.			Price per Cubic Yard.	Cost of Repairs of Dredging Machines, Punts, Bell, &c.			Per Cubic Yard for Repairs, &c.	TOTAL SUM Paid for Dredging and Depositing, including Repairs of Machines, Punts, Diving Bell, &c.			Per Cubic Yard for both.	TOTAL COST For Dredging & Depositing in River & Harbour, including Repairs & New Plant, Diving Bell, &c.			Per Cubic Yard for all.	Leaving for New Plant Supplied.			Prices of Coal p. waggon of 24 cwt., at the Glasgow W. W.
		£	s.	d.	d.	£	s.	d.	d.	£	s.	d.	d.	£	s.	d.	d.	£	s.	d.	s. d.
1841,.....	141,248	9,111	17	5	15.5	6,114	10	10	10.4	15,226	8	3	25.9	18,642	18	3	31.7	3,416	10	0	6 6
1842,.....	205,872	11,709	14	0	13.6	6,120	16	9	7.2	17,830	10	9	20.8	21,202	8	3	24.7	3,371	17	6	6 8
1843,.....	247,768	10,576	9	6	10.2	4,223	14	5	4.1	14,800	3	11	14.3	15,504	16	11	15.0	704	13	0	6 6
1844,.....	226,152	9,357	3	9	9.9	3,503	19	3	3.7	12,861	3	0	13.6	12,861	3	0	13.6	...	...	...	5 8
1845,.....	233,944	8,980	19	10	9.2	3,010	19	0	3.1	11,991	18	10	12.3	14,023	18	10	14.4	2,032	0	0	6 8
1846,.....	199,520	8,904	9	11	10.7	2,463	13	9	3.0	11,368	3	8	13.7	11,368	3	8	13.7	...	...	...	{7 0 / 11 0
1847,.....	262,416	8,387	0	9	9.9	2,447	15	11	2.9	10,834	16	8	12.8	10,834	16	8	12.8	...	...	...	13 6
1848,.....	154,288	7,117	13	11	11.1	2,073	7	10	3.2	9,191	1	9	14.3	9,191	1	9	14.3	...	...	...	9 0
1849,.....	213,168	9,538	12	3	10.7	2,248	14	3	2.6	11,787	6	6	13.3	11,887	6	6	13.4	100	0	0	6 0
1850,.....	278,864	9,143	8	8	7.9	1,735	10	2	1.5	10,878	18	10	9.4	11,140	13	5	9.6	261	14	7	5 0
1851,.....	293,256	12,205	3	10	10.0	2,033	6	8	1.7	14,238	10	6	11.7	20,006	16	5	16.4	5,768	5	11	5 8
1852,.....	376,472	13,841	17	8	8.8	2,566	13	6	1.7	16,408	11	2	10.5	25,149	9	1	16.0	8,740	17	11	6 6
1853,.....	339,464	8,787	7	11	6.2	4,050	11	7	2.9	12,837	19	6	9.1	14,049	5	4	9.6	1,211	5	10	7 3
1854,.....	303,072	10,380	15	6	8.2	3,627	13	6	2.8	14,008	9	0	11.0	16,674	14	10	13.2	2,666	5	10	
	3,415,504	138,042	14	11	9.70	46,221	7	5	3.23	184,264	2	4	12.93	212,537	12	11	14.93	28,273	10	7	

CLYDE NAVIGATION.

	3,415,504	138,042	14	11	9.70	46,221	7	5	3.23	184,264	2	4	12.93	212,537	12	11	14.95	28,273	10	7

CLYDE NAVIGATION.

STATEMENT showing the Quantity of Material dredged by the Clyde Navigation Dredging Machines during the last ten years; also, the Hours the Engines of the Dredgers worked during the said period.

YEARS.	(Old) No. 1. Single Machine. 12 H. P.		(New) No. 1. Double Machine. 40 H. P.		No. 2. Single Machine. 16 H. P.		No. 3. Single Machine. 16 H. P.		No. 4. Single Machine. 20 H. P.		No. 5. Single Machine. 24 H. P.		TOTAL.	
	Hours.	Cb. Yds.	Hours.	Cb. Yds.	Hours.	Cb. Yds.	Hours.	Cb. Yds.	Hours.	Cb. Yds.	Hours.	Cb. Yds.	Hours.	Cb. Yds.
1844-45,.....	1,895	44,584	.....	.....	2,236	58,976	1,777½	41,560	1,271	32,632	2,021	56,192	9,200½	233,944
1845-46,.....	1,171½	*26,912	.....	.....	1,534	38,016	1,738	39,184	1,913	46,104	1,967	49,304	8,323½	199,520
1846-47,.....	.....	.....	.....	.....	1,527½	45,944	1,841½	44,760	2,225½	66,000	1,857	45,712	7,451½	202,416
1847-48,.....	.....	.....	.....	.....	941½	28,864	1,076½	29,176	1,983½	45,592	1,781½	50,656	5,783	154,288
1848-49,.....	.....	.....	.....	.....	1,858	62,176	2,121½	71,336	923½	28,360	1,767½	51,296	6,670½	213,168
1849-50,.....	.....	.....	.....	.....	2,371½	83,288	1,427	58,632	1,552	52,688	2,189½	84,256	7,540	278,864
1850-51,.....	.....	.....	.....	.....	2,243½	74,200	2,376½	80,704	2,376	59,256	2,483	79,096	9,479	293,256
1851-52,.....	.....	.....	1,655½	†69,384	2,547	95,464	2,423	62,576	2,408½	61,072	2,654	87,976	11,688	376,472
1852-53,.....	.....	.....	1,846½	104,448	2,282	70,640	1,944½	40,488	1,667	46,536	2,421½	77,352	10,161½	339,464
1853-54,.....	.....	.....	1,822	106,848	1,879½	59,336	1,272	43,648	1,065	40,736	1,664	47,504	7,702½	303,072
Total,.....	3,066½	71,496	5,324	280,680	19,420½	616,904	17,998½	517,064	17,385	478,976	20,805½	629,344	34,000	2,594,464
Coal consumed in 10 hours,.....			36 Cwt.		20 Cwt.		20 Cwt.		20 Cwt.		24 Cwt.			

* Five months work. † Nine months work.

NOTE.—The number of Cubic Yards has been made up from the number of Punts filled by the Dredgers, and on the supposition that each Punt load will measure eight Yards in the Deposit.

The Clyde dues are 1s. 6d. sterling per ton on iron, —about 1s. 10d. on flour, and 1s. 6d. on ashes. The Montreal Harbour and Lake St. Peter dues combined are less than half these rates.

The number of persons employed by the Montreal Harbour Commissioners in Dredging operations in 1854, was 111. In 1855, the number will be about 145. The value of the five Steam Dredgers with the four Steam Tenders, and the Scows, is £50,000.

SUPERINTENDENT'S REPORTS.

REPORT ON OPERATIONS OF 1853.

SOREL, 12*th December*, 1853.

SIR,—As our operations for the season of 1853 are now closed, I hasten to lay before you, for the information of the Harbour Commissioners, a statement of the result of our past year's work.

On the 2nd May, Dredge No. 3, with necessary attendance, was taken to the Lake, and commenced to widen the channel made last year. She continued to work up to the 17th, when the water becoming too high to excavate to advantage, I was under the necessity of stopping her. On this day No. 2 and scows were also taken to the Lake, but for the same reason was not able to work until the 7th June. On that day the water had so far receded as to allow us to commence our dredging operations. During the time of high water, the St. Peter was employed with the Harrow, and the crews of the St. Lawrence and dredges were employed laying down the buoys, &c., &c.

Dredge No. 2 continued widening up to the 7th, and No. 3 up to the 25th July, at which time they commenced to deepen the channel made last year. They continued to deepen until the 22nd September, when they finished from the bend up to head of channel. No. 2 was then taken down to the lower end, and again commenced to widen. On this day No. 3 was stopped for the purpose of allowing the St. Peter to be used for the surveying of the St. Lawrence from the Harbour of Montreal to below the Pointe à Levrar, on which duty she was employed

until the 26th October. During this time the crew of Dredge No. 3 were employed planting pickets on the south side of channel, to remain as marks for the proposed winter survey.

The number of effective working days of the two dredges amount to 108: in this time they removed 522,665 square yards, making the channel for five miles 16½ feet at low water, and for 1½ miles 16 feet at low water, varying from 150 to 300 feet in width. (See accompanying sketch.) The accidents to dredging machinery this season have been very few; in fact, with the exception of the breaking of the St. Lawrence's shaft, which only detained her 8 days, we have scarcely had a single accident. At the same time we have had a large proportion of lost time in comparison to the last two seasons. This is owing to the long continuance of heavy winds during summer, and the dredges being constantly working in deep water, the sea has more effect upon their machinery then when they are working in shallow water. When on this subject I should remark, as the channel is increased in depth our loss of time will increase in proportion. To obviate this detention as much as possible, and as Dredge No. 2 will only stand another year without having a thorough repair, I should recommend the Commissioners to lengthen this vessel next winter sufficiently to make her work to advantage in 28 feet water, instead of 18 feet, which is the greatest depth they can at present work in. When giving her the necessary repairs, she can be lengthened with a very little extra expense. You will then have a vessel that is able to work in Lake St. Peter at any time during the season of navigation. In the event of extending your deepening beyond 18 feet at low water, the vessels in their present shape will only be able to work about a month in each season, during the lowest water.

The effect of next year's operation will, of course, depend upon the Commissioners themselves, whether they will continue widening the channel to the depth of 16½

feet at low water, or continue deepening as well as widening. If they adopt the latter method, I have no hesitation in saying, that with proper management and particular attention being paid to certain points, they can have a channel of 18 feet at low water, clear through Lake St. Peter, by the close of the season 1854.

Dredge No. 1 was taken up to the Harbour of Montreal on the 23rd April, and immediately commenced to clean out "Jacques Cartier" Basin. On the 1st June she finished in this place, having made it so as vessels can lay there at any time during the season of navigation, drawing 10 feet of water. Previous to this, vessels could not make use of this basin during the summer months, as it was entirely dry at low water. From this she cut a channel through the shoal below the entrance to the King's Basin, which was afterwards found to be of immense advantage to vessels moving from the lower wharf to the upper. On the 27th June she finished with this channel, and the water having fallen sufficiently to allow her to commence on the shoal opposite the "Bonsecours" Market, she moored out there on the 28th. From this to the upper part of the Island Wharf she was employed for the remainder of the season, and succeeded in making a channel clear through there of 250 feet wide and 18 feet at low water. There can yet be considerable improvement made in this channel, by removing one point which will make it perfectly straight, and do away with the necessity of heavy ships crossing the current, which was the principal cause of the accidents that took place there during the past season. I should recommend the Commissioners to effect this improvement next year, by placing Dredge No. 1 upon it early in the spring.

The Spoon Dredge commenced on the opening of the navigation in the basin opposite the Bonsecours Market, where she removed a large amount of material, which now allows barges and steamboats to discharge and load at this wharf with facility. From thence she went into the Jacques Cartier Basin, and cleaned out the two

corners which the buckets of No. 1 Dredge could not reach. From thence she was moved up to the second basin above Island Wharf, and cleaned it out to the depth of 19 feet at low water. From thence she was taken into Elgin Basin, and put it down to the same depth. I may mention that this vessel (notwithstanding the great detention they have had from breakage,) has done a large amount of work, and I should recommend that the engineer should be employed, after the 1st January next, to have the machinery put in good order during the winter, and also duplicates made of those parts most liable to give way, so that they will be ready to put in in case of accident.

The new dredge now in course of construction will, if we are not detained for the machinery, be ready by the 1st September next, when it will be necessary to place her at "Isle Platte," and during the remainder of the season she will be enabled to deepen the channel there to 17 feet at low water. The scows and steamboat necessary to attend upon this vessel will have to be prepared by that time. It would be prudent also to make arrangements for the purchase of her chains and anchors in England this winter, so that they could be out by spring vessels, as I doubt much whether the quantity that will be required for her efficient working could be had here when wanted.

The repairs necessary to be done to our vessels this winter are not very extensive; the buckets and links of the dredges being the principal things to be repaired. For this purpose we will require, after the 1st January, 2 blacksmiths and their helpers, 4 second engineers, 6 firemen, 2 carpenters, 2 watchmen, and a few labourers, to keep the vessels free from snow and water. Altogether, our weekly pay-lists will amount to about £25, until the 1st March; after that time it will, of course, considerably increase, as we will then have to commence and prepare the vessels for the opening of the navigation.

I considered it prudent, after the close of our operations

this year to have the different scows hauled out for examination. I consequently made arrangements with Messrs. McCarthy, ship builders here, to do this portion of the work, which I am happy to say, is already accomplished; the principal repairs necessary to be done to them is caulking.

It will be necessary, during the winter, to procure from some of the farmers about here, 4 or 500 poles for marking our dredging operations in the Lake during summer.

The quantity of coals used by the vessels this season is 2043 chaldrons. The total quantities received and what we had on hand last spring amount to 2649 chaldrons; thus leaving at "Isle aux Corbeaux" at the present time, 606 chaldrons, or sufficient to keep the vessels going until the month of July, 1854.

I remain, Sir,

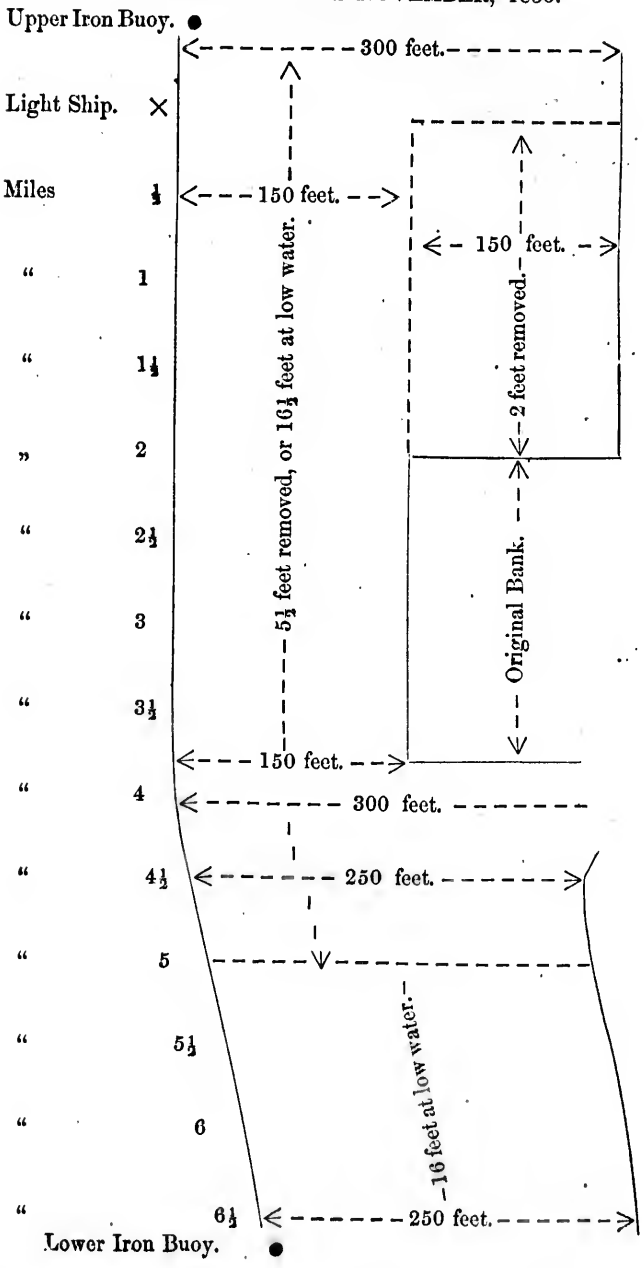
Your most obedient servant,

JOHN BELL.

Superintendent.

John Glass, Esq.,
Secretary,
Harbour Commissioners,
Montreal.

STATE OF CHANNEL NOVEMBER, 1853.



REPORT ON OPERATIONS OF 1854.

SOREL, *9th December*, 1854.

SIR,—I beg leave to lay before you for the information of the Harbour Commissioners a statement of the amount of improvement effected in the navigation during the past season in Lake St. Peter and the Harbour of Montreal.

Dredge No. 1 left Sorel for the Harbour on the 27th April. On her arrival in Montreal, the Harbour Commissioners, seeing that the opening of the Lachine Canal was likely to be detained, owing to the accumulation of earth caused by the placing of a culvert across the Canal, and the construction of a Stone Pier for the Railway Bridge, acceded to the request of the Commissioners of Public Works, and placed this vessel at their disposal for a few days, to remove those impediments; consequently she was taken into the Canal on the 3rd of May, and on the 16th, having made the necessary improvements there, she commenced her operations in the Harbour, deepening the Market Basin to 12 feet at low water, thus making it available for all river craft.

On the 26th June having finished this Basin, and the water being too low to admit of our pursuing the cutting towards the end of the Victoria Pier, I decided to remove this dredge, and placed her on the shoal in the centre of the entrance to "Prince's" Basin. They wrought on this place until the 10th July; during that time they had removed several large stones, and got the place in such a position that they could work to advantage; when, on that day, the Brig "Robinson" was wrecked upon the upper part of this shoal. While laying there she caused

such an alteration in the set of the current, that it was impossible for the dredge to work while the ship was in that position. Consequently, on the 13th of the same month, I instructed Captain Hart to lift his anchors, and move the dredge outside the Island Wharf, to finish the widening and deepening of the ship channel at that place: this he continued to do for the remainder of the season, or up to the 17th November, when an accident occurred to the lower tumbler of the dredge, which compelled them to stop for the winter, not, however, before they had the channel finished to a depth of 18 feet at low water, from deep water at the "Victoria Pier" up to the entrance of the "Sydenham" Basin; here there is a small piece of about 30 feet by 50 to be removed and deepened 2 feet, when this is accomplished, which can be done in about 15 days, the channel entering the Harbour of Montreal will be completed to a depth of 18 feet at low water, and no portion of it less them 250 feet wide.

In effecting those improvements this dredge has removed 29,100 square yards of material, and the stones that the crew have removed by hand, as the buckets of the dredge came upon them, amount on the aggregate to 3,108 tons weight, or an average of 20 tons of stones per day (over and above the material lifted by the buckets,) for every working day in the season. When you take into consideration the great loss of time there is attending the removal of those stones, as also the great detention that was caused by not being able to procure men to work on board of the vessel during the time of the *cholera*, the results of this vessel's season's operations are, in my opinion, highly satisfactory.

The spoon dredge being also loaned, on the opening of the navigation, to the Commissioners of Public Works, to effect some improvements in the Lachine Canal, we had not the benefit of this vessel's services in the Harbour, until the begining of June, when she commenced to deepen the "Prince's Basin," increasing its depth to 14 feet at lowest water; this being completed I started her t'

work in "Elgin Basin," where, after removing a small bank at the entrance, she made this basin available for ships drawing 18 feet, at lowest water. From thence she was removed to "Queen's Basin" to deepen some small spots near the centre which at low water interfered with its easy navigation. We succeeded in removing a portion of those impediments, but before completing them entirely the cold weather having set in, I was compelled to stop operations for this year.

Lake St. Peter.—Owing to the long continuance of high water in the spring of the year, we were prohibited from commencing operations in the Lake until the 5th June, during this time I employed our people at "Isle aux Corbeaux" in building a wharf and portable railway, to facilitate the discharging of our fuel at this place, also, in preparing Buoys for marking off the channel in Lake St. Peter and elsewhere. On this day, however, both dredges were moved to the Lake, and commenced widening the channel to a uniform width of 300 feet, and deepening it to a depth of 16 feet 6 inches, at low water. During the season, and up to the 18th November, (on which day I removed Dredge No. 2 to prepare for being hauled out and lengthened, during the winter.) this vessel removed 4,994 scow loads of material equal to 299,640 cubic yards. Dredge No. 3, not being removed from the Lake until the 23rd November, excavated 327,670 cubic yards, thus making the total amount of material removed from Lake St. Peter, during the past season, amount to 627·310 cubic yards, and with the exception of about eight days work at the lower end of the upper reach in the channel, it is completed to a width of from 250 to 300 feet, and 16 feet 6 inches deep at low water. (See accompanying sketch.)

In summing up the amount of improvement effected by the past season's operations, I may mention in the first place that the Harbour improvements consist in the deepening of the Market Basin to a depth of 12 feet at low water, removing a portion of the shoal entering

"Prince's Basin, deepening the ship channel from the lower part of the Island Wharf to the entrance of "Sydenham Basin" to a depth of 18 feet at low water, clearing out the "Prince's Basin" to a depth of 14 feet, deepening the "Elgin Basin" to a uniform depth of 18 feet, and in partially removing the obstructions in "Queen's Basin," thus making the channel entering, and the upper portion of the Harbour of Montreal, safely navigable for vessels drawing 17 feet at lowest water.

Lake St. Peter.—The improvements effected by our past season's operations in this place consist in widening the original channel, and deepening it to a depth of 16 feet 6 inches at low water. At the end of the season 1853, the channel through Lake St. Peter was for 2 miles 250 feet wide, and for the remaining 4 miles 150 feet and 16 feet 6 inches deep; at the end of the present season the channel for two miles is 250 feet wide, and for the remaining 4 miles 300 feet wide, and deepened to a uniform depth of 16 feet 6 inches, with the exception of half a mile 150 feet wide at the lower end of the upper reach, from which 18 inches has yet to be removed.

To place the Channel in the position I now represent it to be, there required to be removed, by calculation, 625,185 cubic yards; the amount lifted by account of scows, amounts to 627,310 cubic yards, thus proving our measurements in every way to be correct.

I may also remark in conclusion that during the season of low water I succeeded in establishing marks for the different points where Buoys and Beacons are required to be placed, to ensure the safe navigation of the South Channel, when it is found necessary to open it for the passage of vessels of large draft of water.

I have the honor to remain,

Sir,

your most obedient servant,

JOHN BELL,

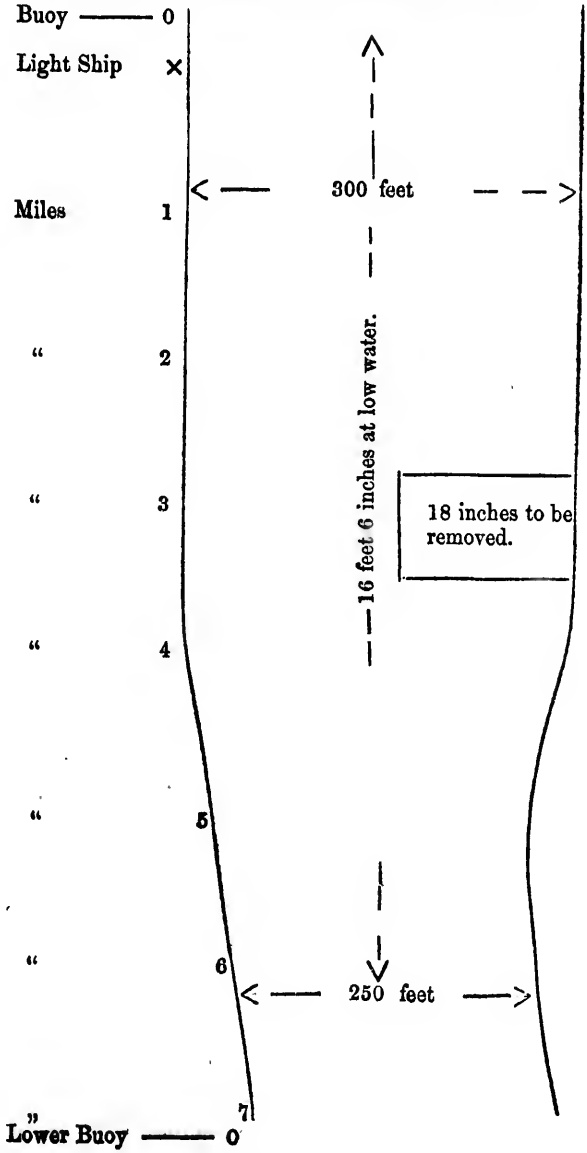
Superintendent.

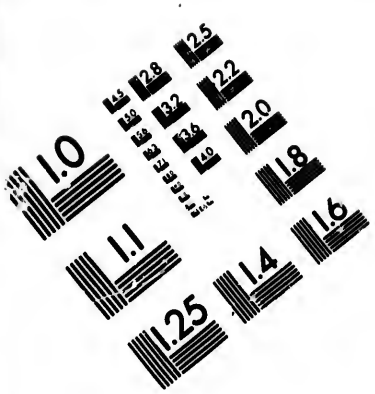
John Glass, Esq.,

Secretary, Harbour Commissioners,

Montreal.

STATE OF CHANNEL NOVEMBER, 1854.





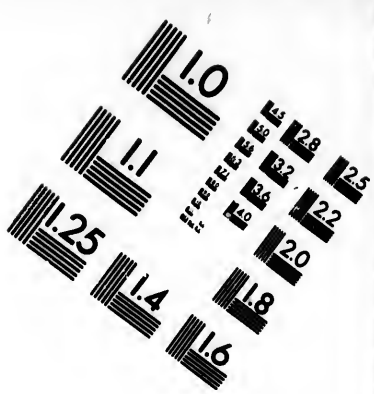
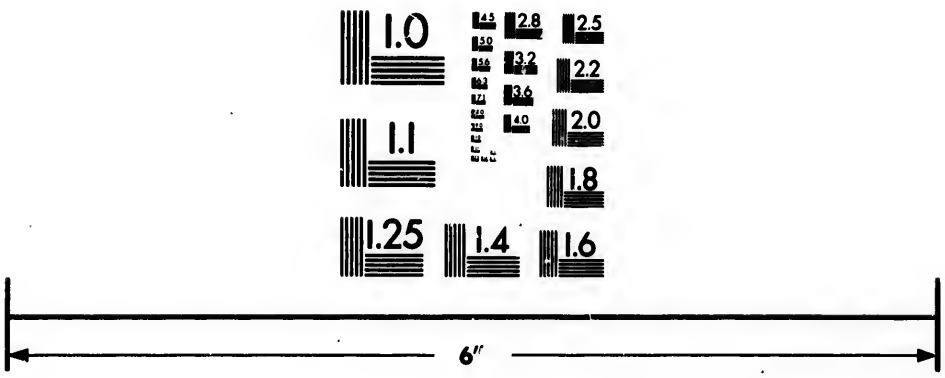
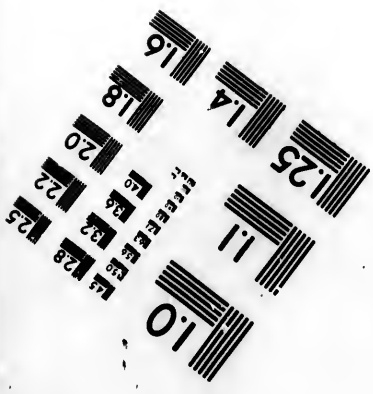


IMAGE EVALUATION TEST TARGET (MT-3)





Photographic Sciences Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

REPORT ON FUTURE OPERATIONS.

SOREL, 11*th December*, 1854.

SIR,—As it is necessary in constructing such extensive works as are now under the control and management of the Montreal Harbour Commissioners, to have a definite course of proceedings decided upon, wherefrom the person conducting those operations can, (if I may use the expression,) take his departure, and shape his course in accordance with the decision arrived at, and, as my ideas upon this subject may be of some use in assisting you to arrive at a correct conclusion, I respectfully beg leave to submit them to you, for the consideration of the Harbour Commissioners.

The channel through Lake St. Peter, as you are aware, is, (with the exception of a small piece at the end of the upper *reach*,) deepened to a depth of 16½ feet at low water, and from 250 to 300 feet wide. On the opening of the navigation, next spring, I should place both dredges to remove this small portion left this fall, which they will accomplish in about eight days. From thence I should place Dredge No. 3 at the lower entrance to our present channel, and commence the 18 foot cut, 300 feet wide. Dredge No. 2 I should place on the "*Batture du Lac*," that is the small Bar above the upper light vessel, and cut a channel of the same dimensions as the one already made through the Flats, this can be done by the month of July next, thus giving the fall ships next year the benefit of 1½ feet more water than what they have hitherto had.

No. 2, when finished with the Upper Bar, would also commence in the channel through the Flats, and bring along the 18 feet depth the full width.

To improve the navigation of the St. Lawrence above Lake St. Peter, simultaneously with that place, it will

be necessary, on the opening of the navigation, to place the new dredge at "Isle Platte," and improve the channel there by deepening it 2 feet. This can be effected by probably the month of August next, and for the draft of water that vessels will then be able to pass with, the north channel will be too shallow in passing St. Sulpice, "Isle à la Bague," and "Isle de Lorier," consequently, it will then become necessary to open up the south channel for vessels of a larger draft of water.

To prepare for this alternative, I propose in the spring to place Dredge No. 1 at "*Cap St. Michel*," near the upper entrance to the south channel, to remove a small bank in the center of the channel there, this being the only obstruction to be removed to render this channel available for vessels drawing 20 feet, at low water.

This improvement can be accomplished, (if we are not detained by high water,) by the month of August also, and when done, Dredge No. 1 will again commence operations in the Harbour, and further improve the channel entering it.

The spoon dredge I should propose to again start in Queen's Basin, and deepen on the upper side of Nelson Pier; from thence I should send her into Sydenham Basin, and make further improvement there: those two places will occupy this vessel for the whole of next season.

By following up this plan of operations, the St. Lawrence, as far as the Harbour of Montreal, will be available by the month of September next for vessels drawing 16 feet 6 inches, at low water, and by the same month in 1856, the 18 foot channel will be completed.

There is another subject connected with our River improvements, to which the Commissioners will have to give their early attention, that is the *Buoying* and *Lighting* of the different channels we are now improving. When they are prepared to discuss this subject, I will, if you desire it, lay before you my views as to how those different marks should be placed, to practically answer the purpose for which they are intended.

It may not be out of place here, in conclusion, to lay before you a statement of what our winter operations will principally consist of, and the number of men we shall require. First on the list is the new dredge. At this vessel we will require to keep with the Engineer, three carpenters, and four laboring men, with the assistance of our other Engineers, until such time as they have to commence on board their own vessels: with this force until the 1st March, (and from that out a few extra laboring men,) this vessel will be ready for the opening of the navigation.

The two Lake dredges, as you are aware, are hauled out for the purpose of being lengthened, to enable them to dredge in 30 feet of water. The carpenter work Messrs. McCarty will immediately proceed with, and, in the second week in January, I propose to start the Engineers with their assistants and firemen on to each vessel, to examine the boilers, and repair them where bad; those with six laboring men on each vessel to do the necessary lifting and hauling, will constitute the force required for this part of our operations.

The Engineers of Steamers St. Peter and St. Lawrence will commence at the same time, with their firemen and assistants, to do the necessary repairs to those vessels. The engine in the *Oregon* will want some repairs which will have to be commenced about the same period; I propose also to make some improvements in her boiler by enlarging it, to enable her to burn coal.

The Engineer of Dredge No. 1 will commence on this vessel about the 1st February, and will require with him his firemen, and a couple of laboring men, to do the work necessary to be done on board.

The four scows used in the Lake will each want to be newly planked on one side, and all above water re-caulked; to effect those scow repairs, we will want after the middle of January about four carpenters and as many caulkers.

To prepare the necessary iron work for all those different repairs, we will require three blacksmiths and their

helpers, thus, bringing up the number of men to be employed and paid weekly from the middle of January to the 1st March, (after which time they will have to be considerably increased) to firemen, laborers, and assistant Engineers, 40 men, carpenters and caulkers 12, blacksmiths and helpers 6, or a total number per day, 60 men, which will cause our pay list for wages to amount to about £65 per week.

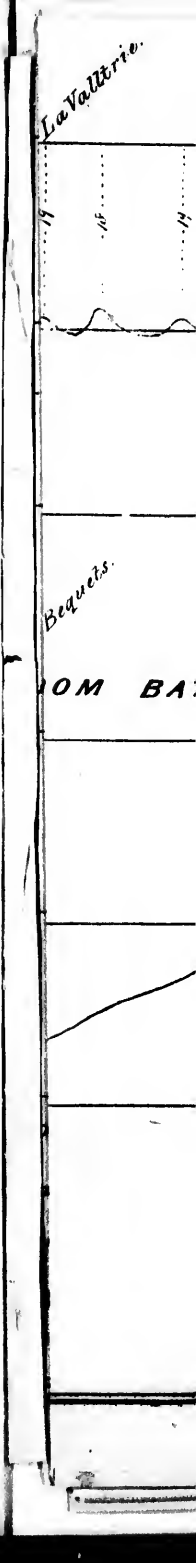
I remain, Sir,

Your most obedient servant,

JOHN BELL,

Superintendent.

John Glass, Esq.,
Secretary,
Harbour Commissioners,
Montreal.


La Vallière.
Bequets.
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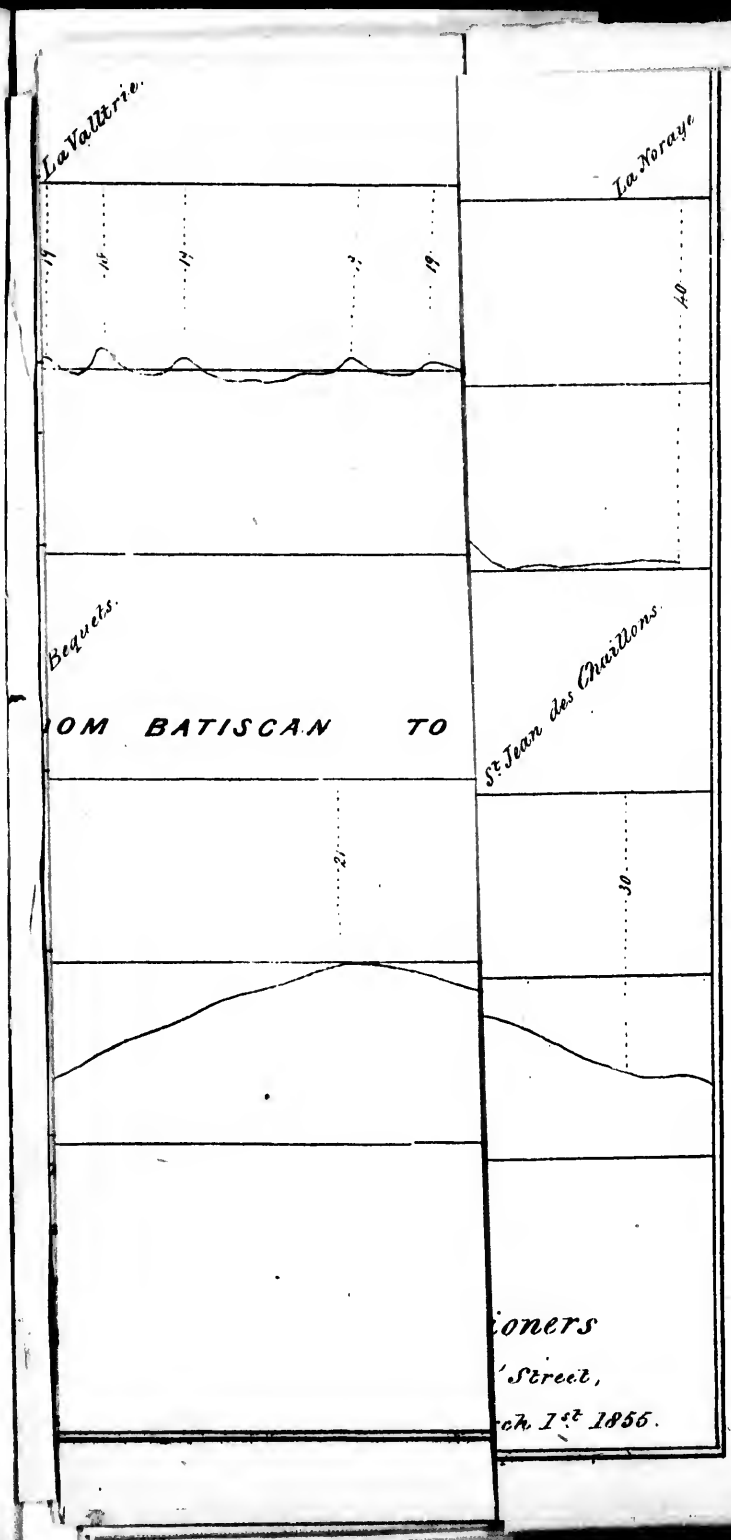
La Vallerie.
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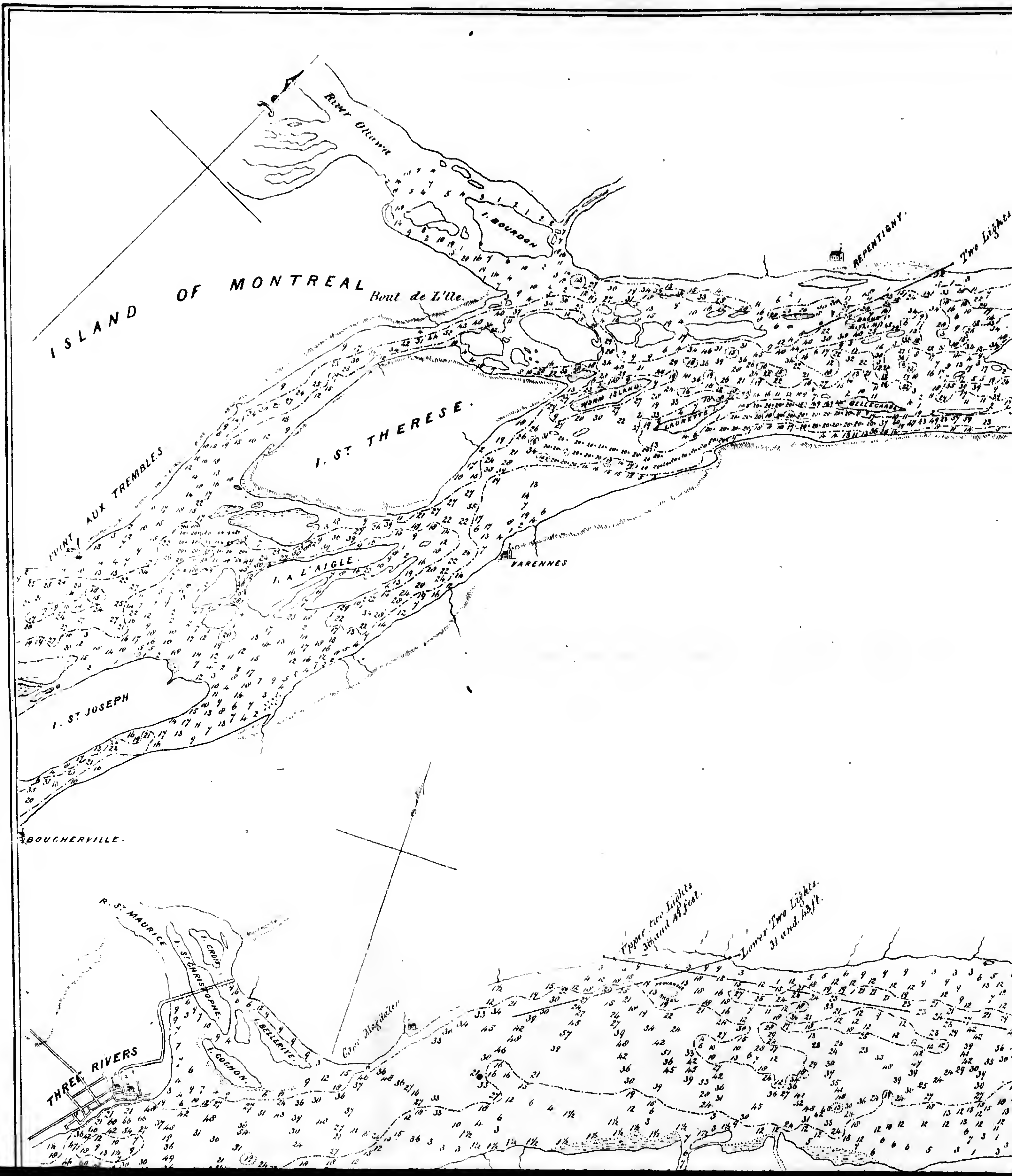
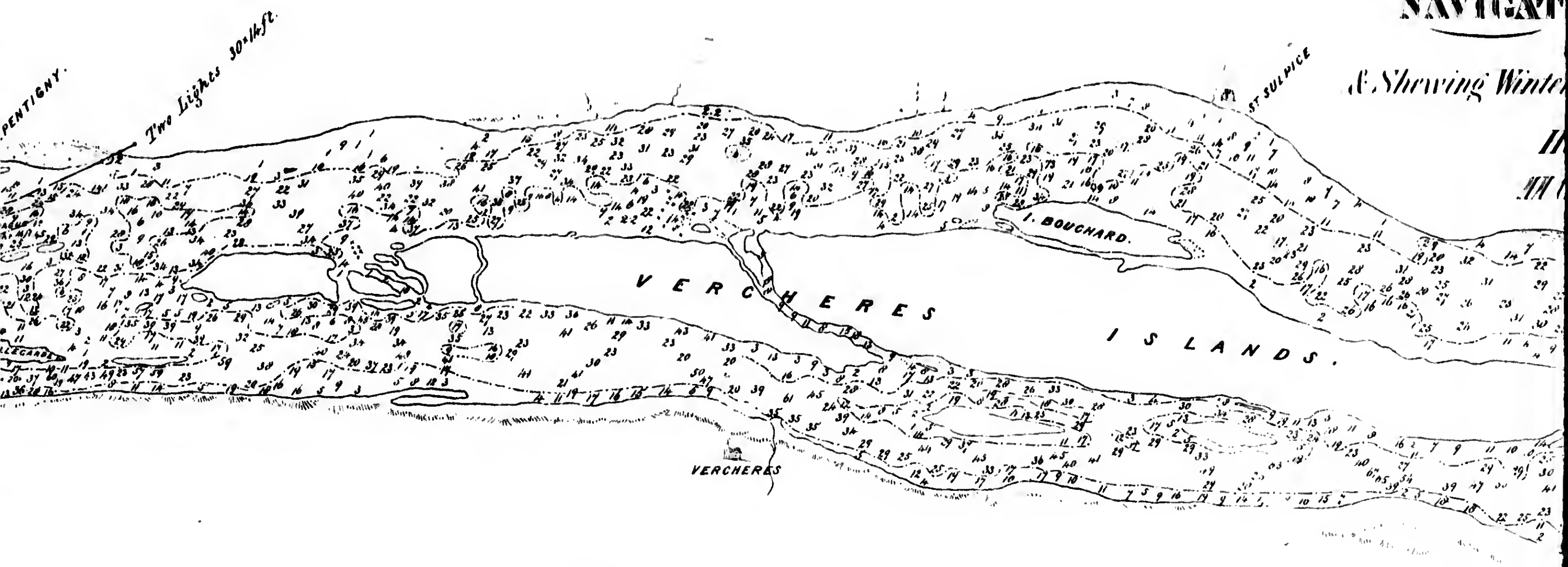

River Ottawa
I. BOURDON
ISLAND OF MONTREAL
Bout de L'Ile.
REPENTIGNY.
Two Lights
I. ST THERESE.
WORM ISLAND
LAURETTE
BELLEGARDE
POINT AUX TREMBLES
I. A L'AIGLE.
VARENNES
I. ST JOSEPH
BOUCHERVILLE.
R. ST MAURICE
I. CROIX
I. ST CHRISTOPHE.
I. BELLERIVE.
I. COCHON.
THREE RIVERS
Cape Magdalen
Upper two Lights. 36 and 49 feet.
Lower Two Lights. 31 and 43 ft.

River S…

NAVIGAT…

…Shewing Winte…

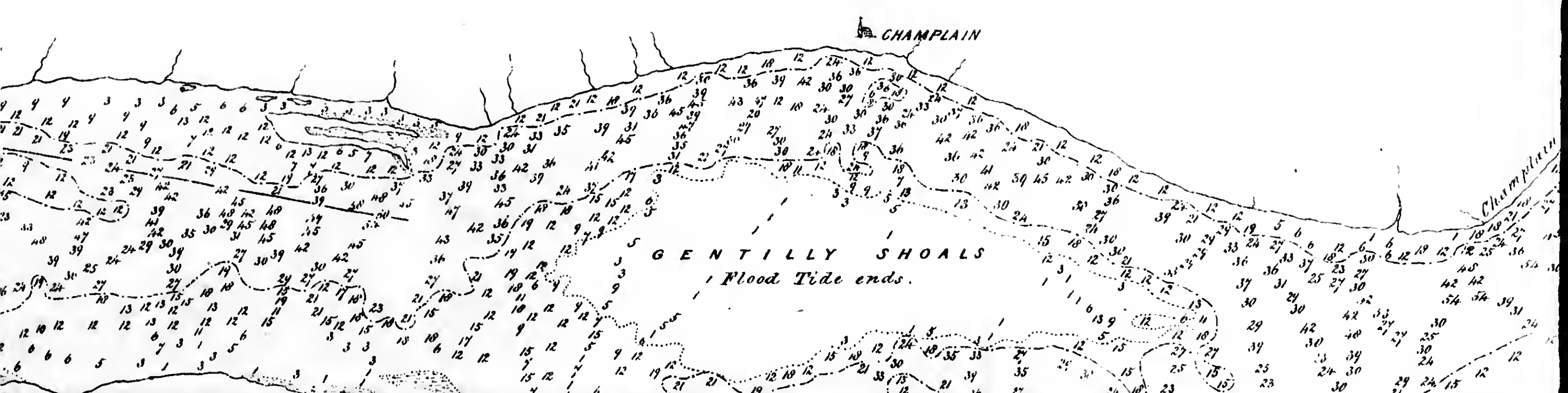


NOTE.

Soundings marked 20× were taken through the Ice and signify a greater depth than 20ft. at low Water, the length of the sounding pole being insufficient to mark the full depth.

Line of 20ft. marked ._._._._._._._._._.

All Soundings are in Feet.



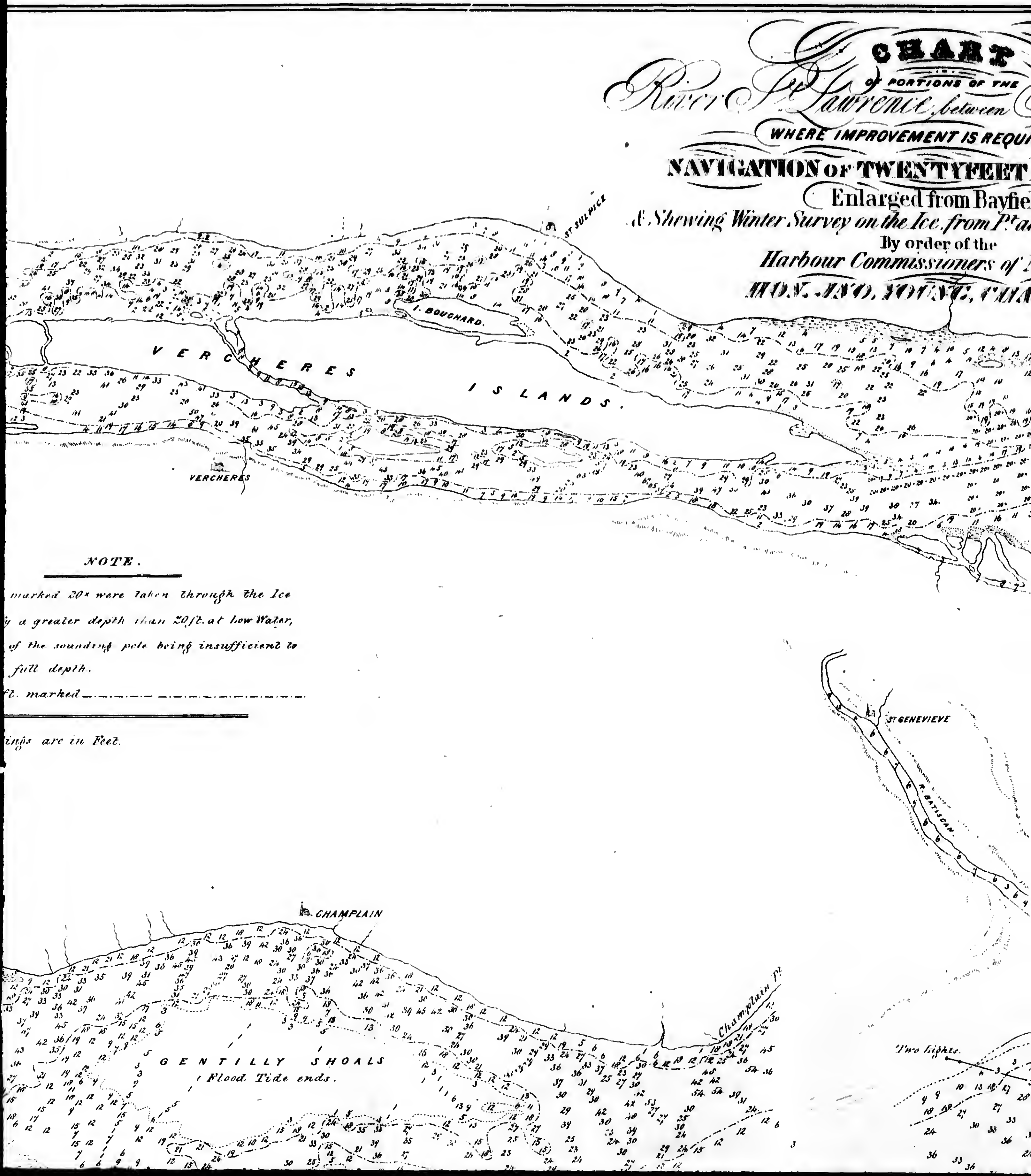


CHART
OF PORTIONS OF THE
River St Lawrence between
WHERE IMPROVEMENT IS REQU
NAVIGATION OF TWENTY FEET
Enlarged from Bayfie
& Shewing Winter Survey on the Ice from Pt a
By order of the
Harbour Commissioners of
HON. JNO. YOUNG, CHA
ST SULPICE
I. BOUCHARD
VERCHERES
ISLANDS.
VERCHERES
NOTE.
marked 20× were taken through the Ice
a greater depth than 20 ft. at low Water,
of the sounding pole being insufficient to
full depth.
ft. marked
ings are in Feet.
ST GENEVIEVE
R. BATISCAN
CHAMPLAIN
Champlain Pt
GENTILLY SHOALS
Flood Tide ends.
Two lights.

CHART

PORTIONS OF THE

R. St. L. between Montreal & Quebec.

OVEMENT IS REQUIRED FOR A

VENTY FEET AT LOW-WATER.

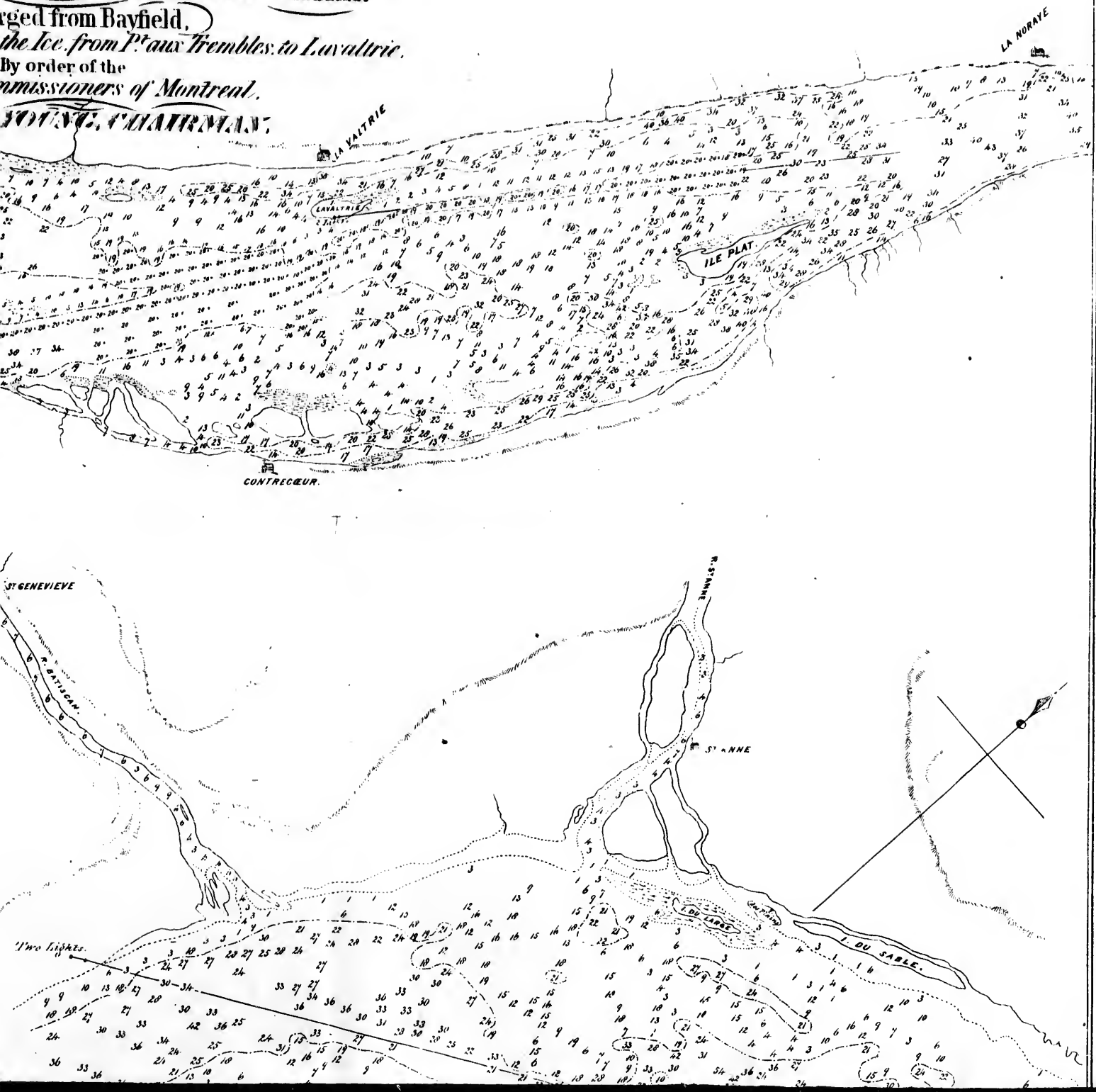
rged from Bayfield,

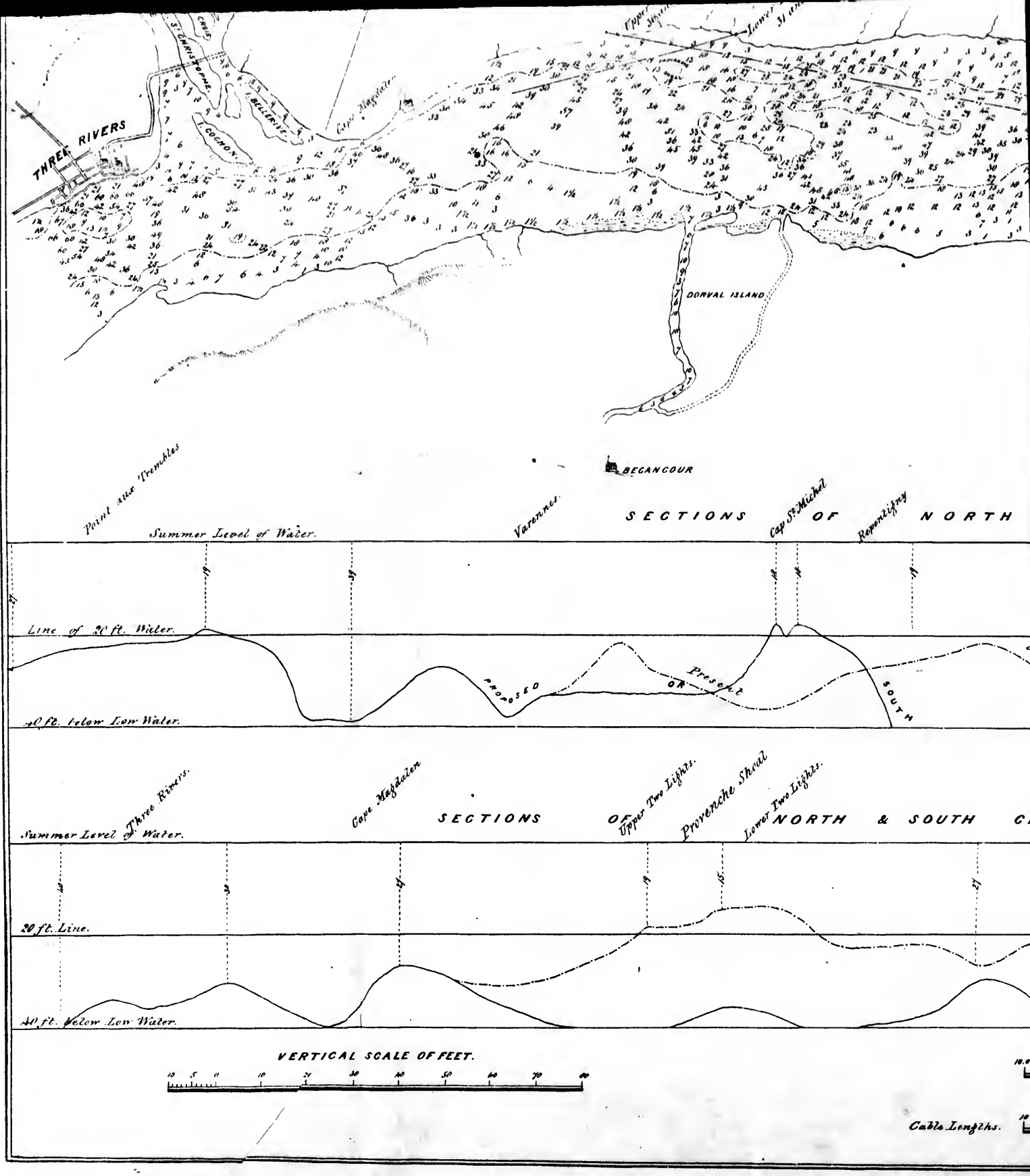
the Ice, from Pte aux Trembles to Lavaltrie.

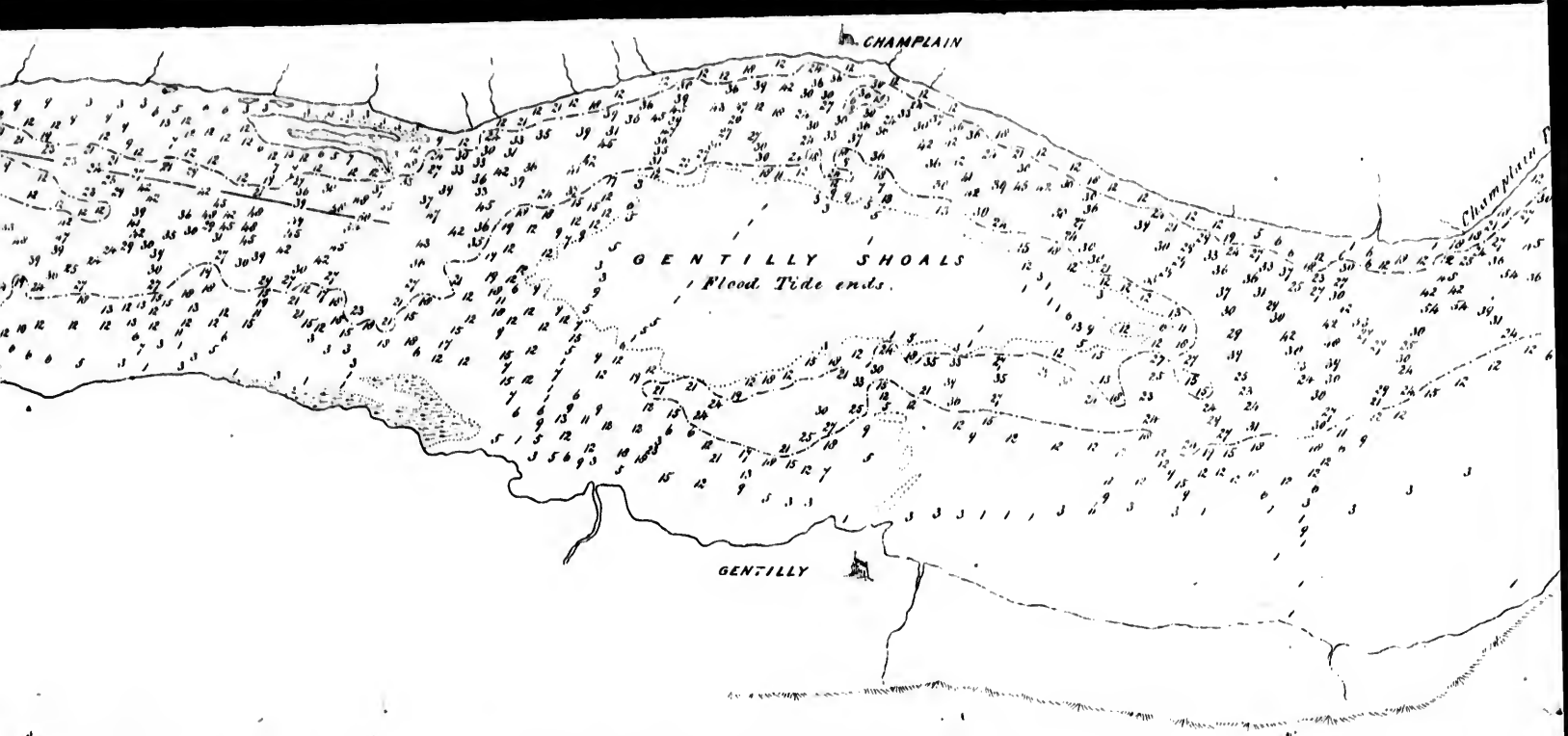
By order of the

mmissioners of Montreal.

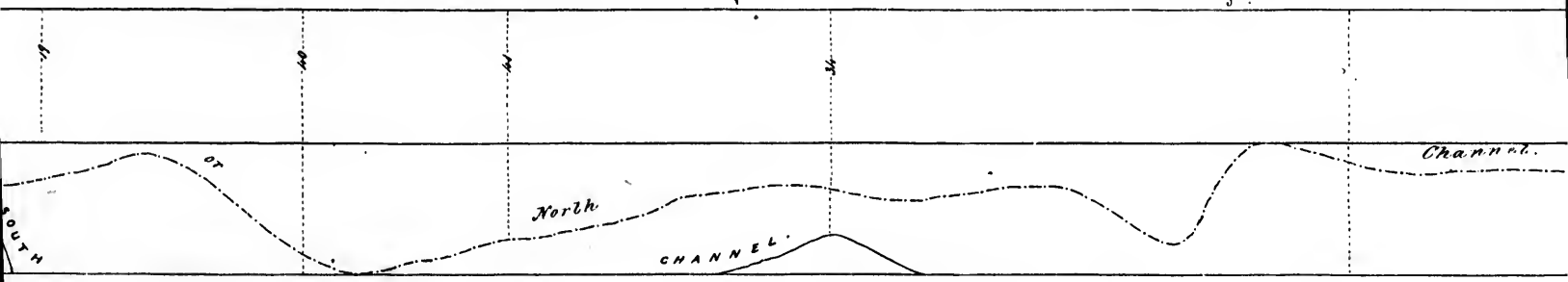
...OTTE, CHAIRMAN.



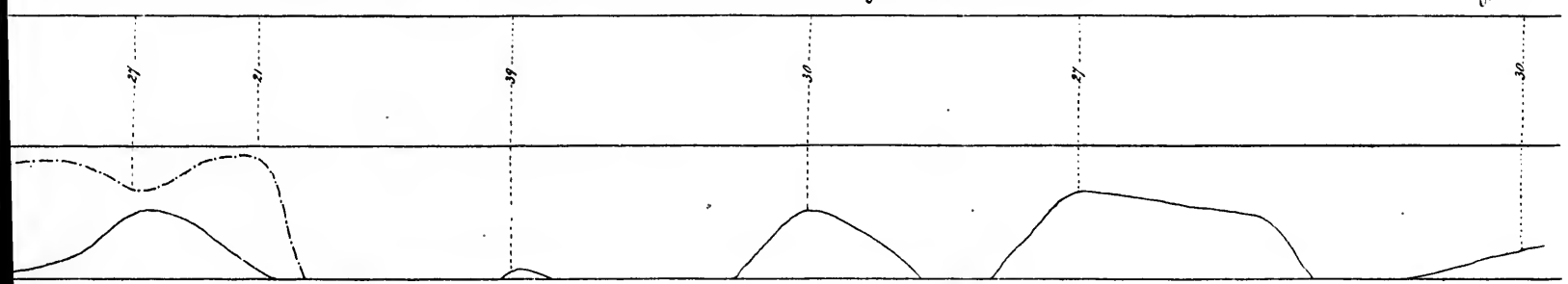

THREE RIVERS
ST. CHRISTOPHE
BELLERIVE
I. COCHON
Cape Magdelen
DORVAL ISLAND
BECANCOUR
Point aux Trembles
Varennes
Cap St. Michel
Repentigny
SECTIONS OF NORTH
Summer Level of Water.
Line of 30 ft. Water.
40 ft. below Low Water.
PROPOSED
OR
Present
SOUTH
Three Rivers.
Cape Magdalen
SECTIONS OF
Upper Two Lights.
Proverache Shoal
Lower Two Lights.
NORTH & SOUTH CH
Summer Level of Water.
20 ft. Line.
40 ft. below Low Water.
VERTICAL SCALE OF FEET.
10 5 0 10 20 30 40 50 60 70 80
Cable Lengths.



NORTH & SOUTH CHANNELS FROM POINT AUX TREMBLES TO



SOUTH CHANNELS FROM THREE RIVERS TO CHAMPLAIN POINT.



SCALE OF FEET.

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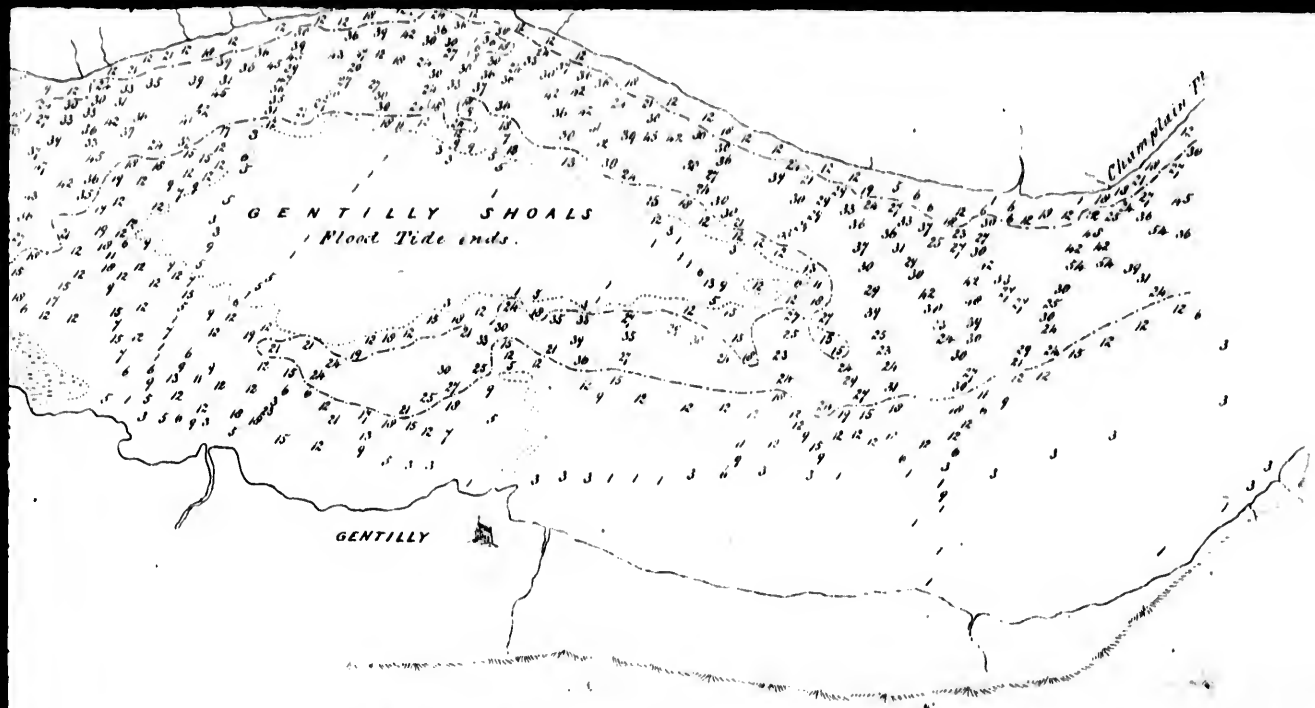
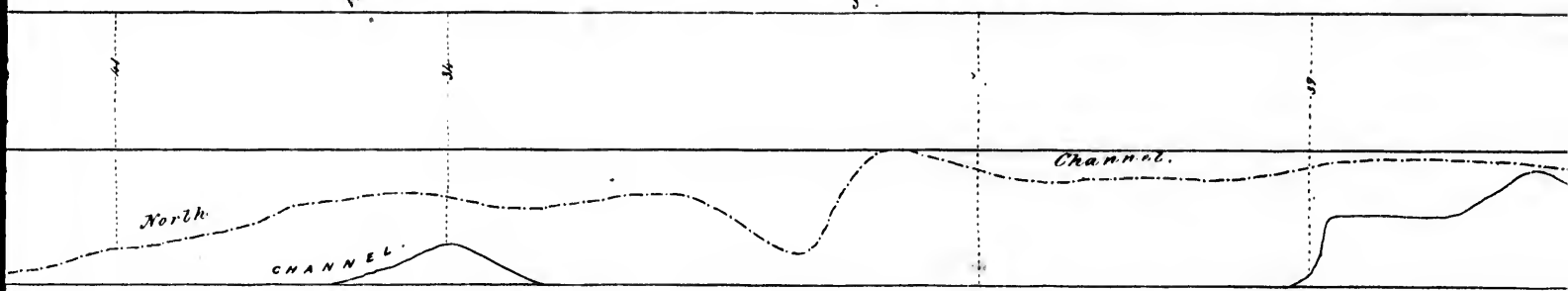
SCALE OF NAUTICAL MILES.

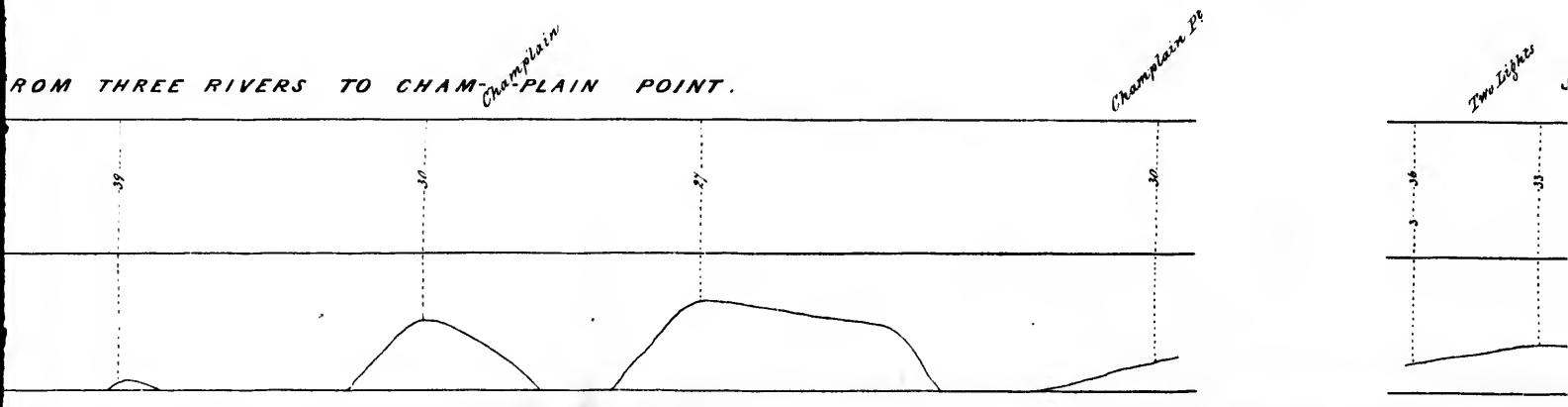
Cable Lengths. 10 5 0 1 2 3 4 5



TH CHANNELS FROM POINT AUX TREMBLES TO LANORAYE.



ROM THREE RIVERS TO CHAM-PLAIN POINT.



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SCALE OF NAUTICAL MILES.

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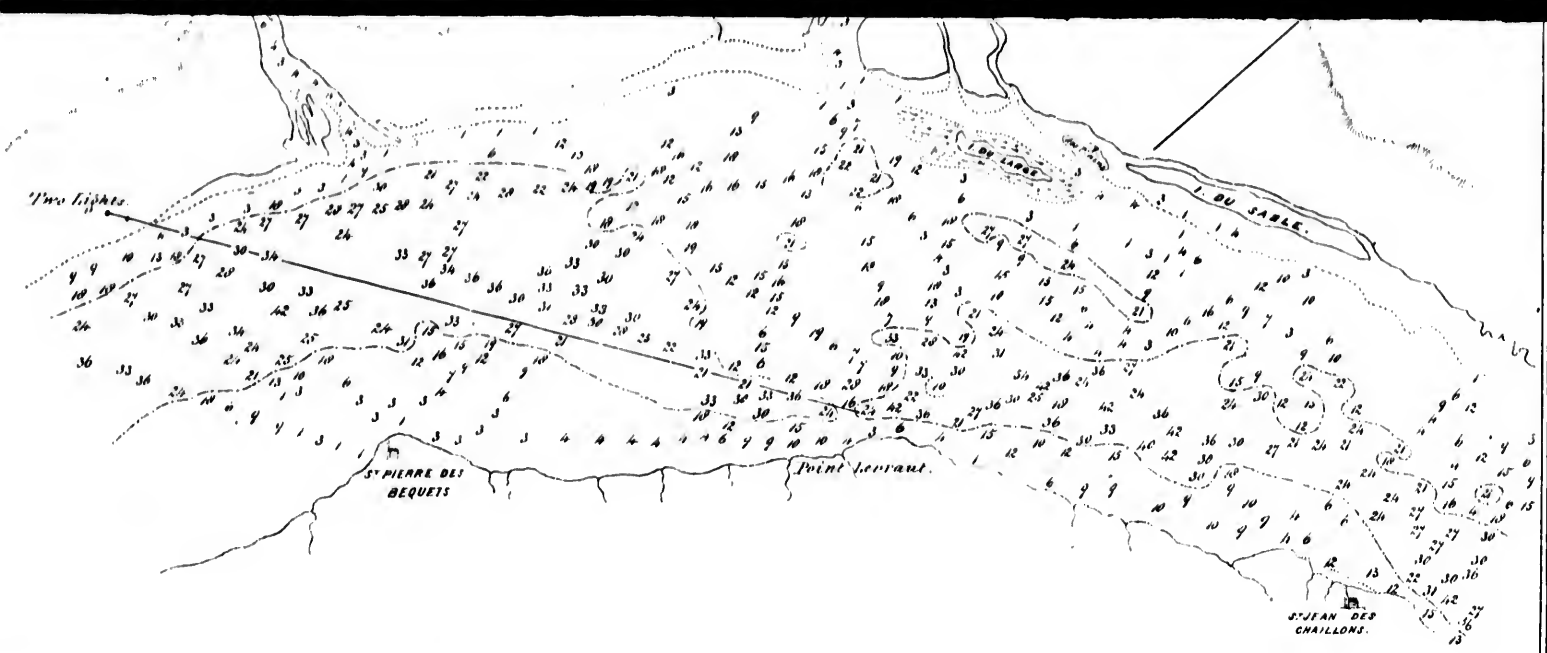

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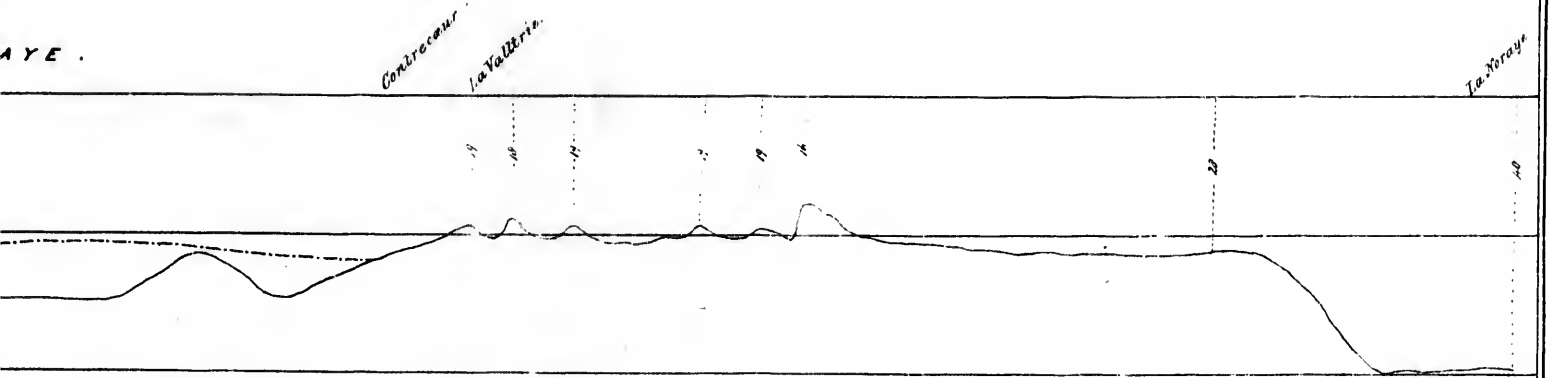
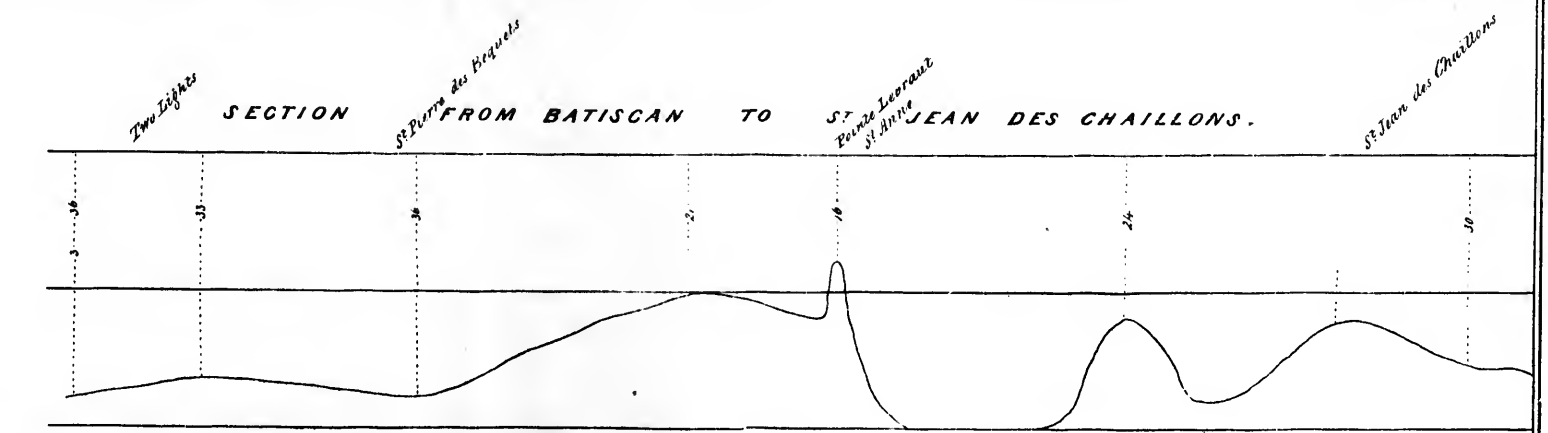


SECTION FROM BATISCAN TO St JEAN DES CHAILLONS.



40.000

Thos C. Keefer.

Engr Harbour Commissioners

29 Great St James Street,

Montreal March 1st 1856.