

1878

ANNUAL REPORTS

OF THE

HARBOUR COMMISSIONERS

OF MONTREAL

FOR THE YEAR 1878.



Montreal :

PUBLISHED BY ORDER OF THE HARBOUR COMMISSIONERS.

1879.

Hemingway Collection
1915

With the Compliments of

Mr. John Kennedy.

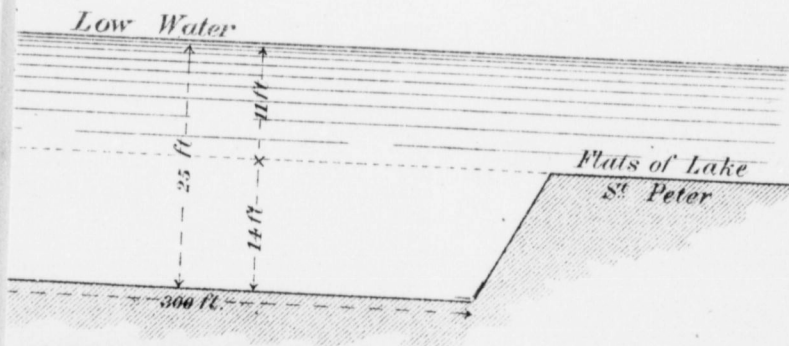
CHANNEL DREDGING.

Montreal to Quebec	- - - - -	160 Eng. Stat. Miles.
Channel begun in 1844 and continued to 1847.		
in 1851 and continued to 1866.		
25 feet depth resumed in 1875.		
Channel at low water before dredging	- - - - -	11 feet.
affected up to 1866	- - - - -	9 "
1866	- - - - -	20 "
1878	- - - - -	22 "
dredged Channel	- - - - -	300 "
of dredging	- - - - -	31 miles.
of dredging	- - - - -	\$1,200,000

PLANT EMPLOYED.

Edges (single set of buckets, endless chains.)
 e (employed part of time.)
 pling Barges.

Scows, 80 to 90 c. yds. capacity.
 Dredges varies with the nature of work, from
 urds Shale to 3,000 cubic yards soft Clay.



LAKE ST. PETER.

of Excavation at Low Water.

*dredging in Lake St. Peter, 16½ Statute Miles.
 25 feet depth, 8,000,000 cubic yards nearly.*

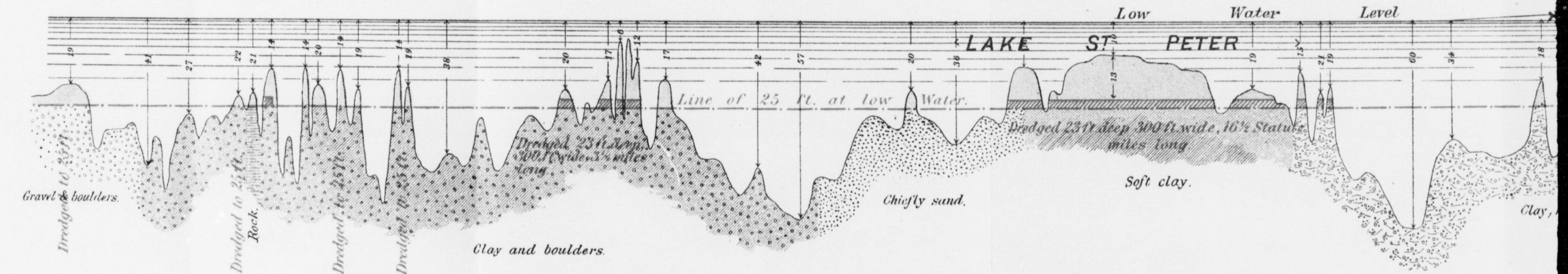
PROFILE OF THE RIVER ST LAWRENCE BETWEEN MONTREAL AND QUEBEC

SHewing THE DEEPENING OF THE SHIP CHANNEL

by the Harbour Commissioners of Montreal.

JOHN KENNEDY Chief Engineer.

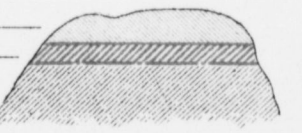
MONTREAL
 Pointe aux Trembles
 Yarences 13 1/2 miles
 Cap St. Michel
 Pointe Marie
 Verchers 22 miles
 Contrecoeur
 Lavallée 30 1/2 miles
 Ordinary Freshets
 Sorel 45 miles
 St. Francis
 Lightship No 1
 Lightship No 2
 Machiche
 Lightship No 3
 Pointe du Lac
 Port St. Francis 75 m.
 Three Rivers 83 m.
 Beaucevoir 86 m.



Harbour Commissioners' Offices
 Montreal, March 1879

Scales—6 Eng. miles to an inch horizontal

Dredging done to 23 ft. depth at low water shewn thus
 Do. yet to be done to 25 ft. depth " "



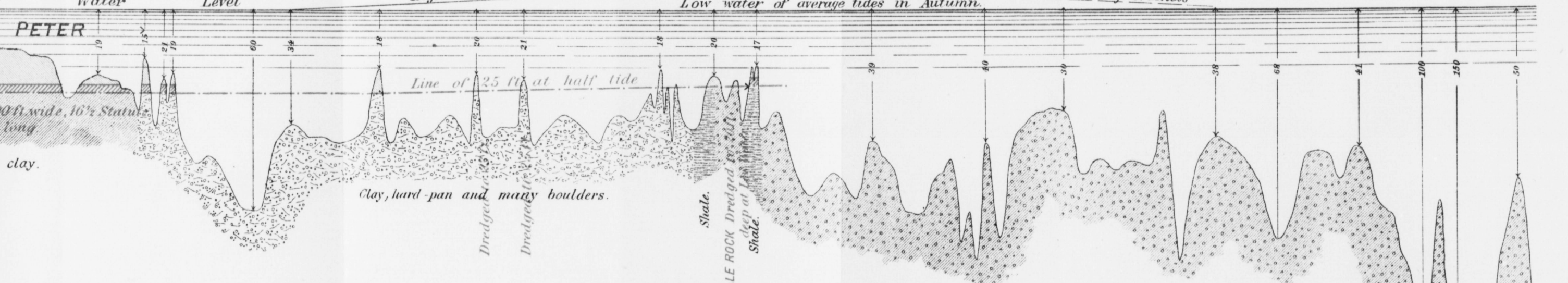
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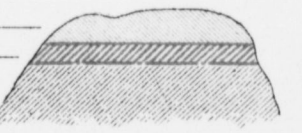
JOHN KENNEDY Chief Engineer.

Machiche
 Lightship No 3
 Pointe du Lac
 Port St. Francis 75 m.
 Three Rivers 83 m.
 Beaucevoir 86 m.
 Champlain
 Baieaux 99 1/2 m.
 Cap Levrault
 Cap la Roche 108 1/2 m.
 Cap Charles
 Grandlacs
 High water
 La Riviere
 Rochelieu Rapid 120 m.
 Port Neuf 123 1/2 miles
 Platon
 Keureuil
 Freshets
 St. Antoine 138 1/2 m.
 St. Nicholas
 Carouge 151 miles
 Pointe Pizéau
 QUEBEC 160 miles



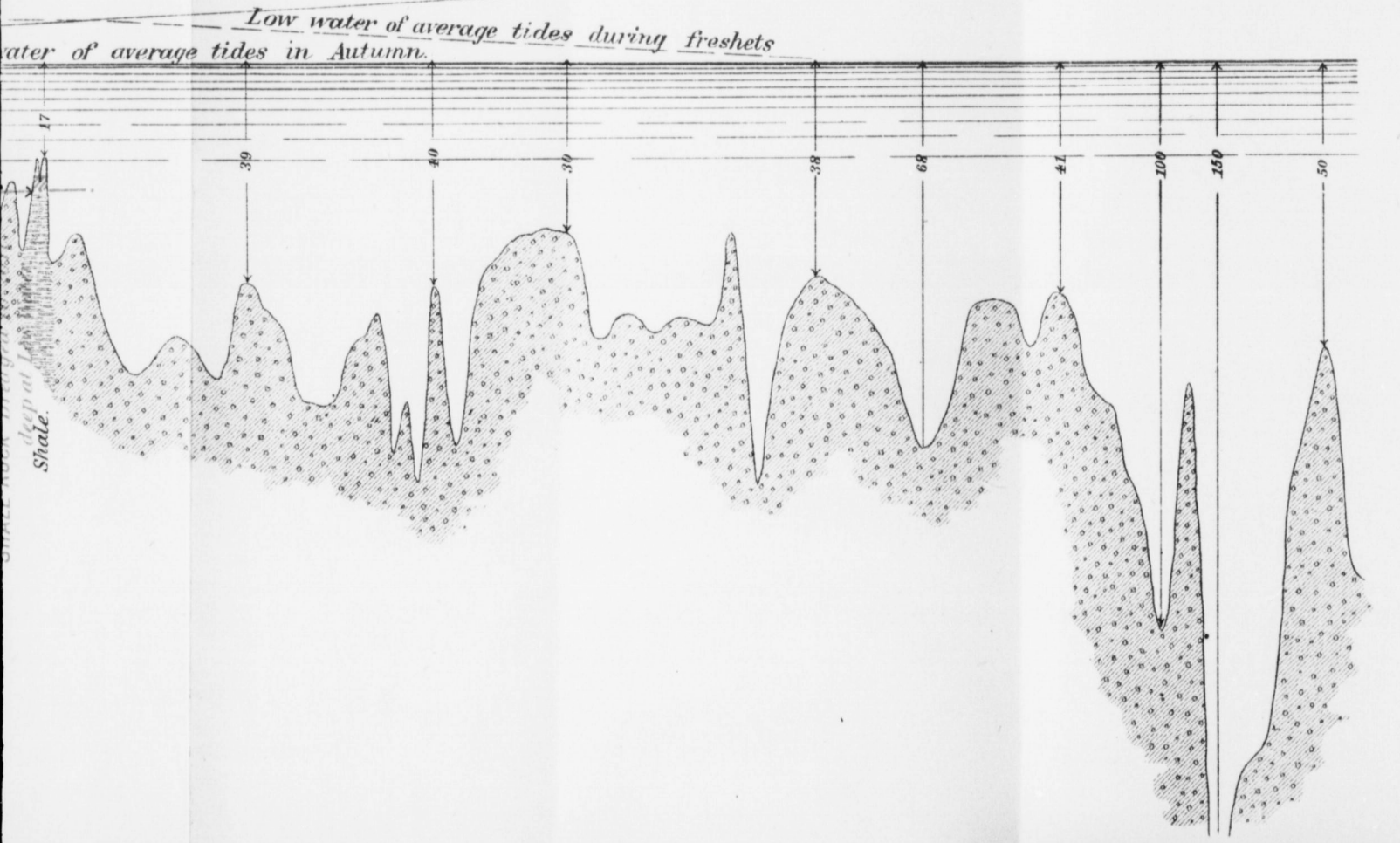
6 Eng. miles to an inch horizontal—30 ft. to an inch vertical

Dredging done to 23 ft. depth at low water shewn thus
 yet to be done to 25 ft. depth " "



QUEBEC

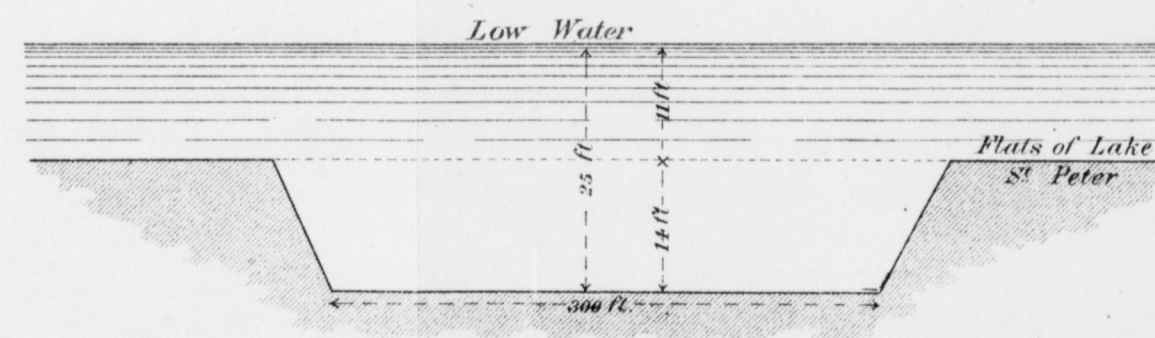
Cap Charles
 Grandlacs
 High water
 La Riviere
 Rochelieu Rapid 120 m.
 Port Neuf 123 1/2 miles
 Platon
 Keureuil
 Freshets
 St. Antoine 138 1/2 m.
 St. Nicholas
 Carouge 151 miles
 Pointe Pizéau
 QUEBEC 160 miles



SHIP CHANNEL DREDGING.

Distance from Montreal to Quebec	160 Eng. Stat. Miles.
Dredging the Ship Channel began in 1844 and continued to 1847.	
Dredging resumed in 1851 and continued to 1866.	
Dredging to attain 25 feet depth resumed in 1875.	
Depth of Ship Channel at low water before dredging	11 feet.
Increase of depth effected up to 1866	9 "
Depth attained in 1866	20 "
Depth attained in 1878	22 "
Least breadth of dredged Channel	300 "
Aggregate length of dredging	31 miles.
Expenditure for 20 feet depth	\$1,200,000

- PLANT EMPLOYED.**
- Eight Elevator Dredges (single set of buckets, endless chains.)
 - One Spoon Dredge (employed part of time.)
 - Two Boulder Grappling Barges.
 - Eight Tug Boats.
 - Five Coal Tenders.
 - Nineteen Hopper Scows, 80 to 90 c. yds. capacity.
 - Daily capacity of Dredges varies with the nature of work, from 150 cubic yards shale to 3,000 cubic yards soft clay.



LAKE ST. PETER.
 Section of Excavation at Low Water.

Length of Dredging in Lake St. Peter, 16 1/2 Statute Miles.
 Quantity for 25 feet depth, 8,000,000 cubic yards nearly.

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SIR,

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Receipts and Expenditure

OF THE

HARBOUR COMMISSIONERS OF MONTREAL,

FOR THE YEAR 1878.

HARBOUR COMMISSIONERS OF MONTREAL,
Secretary's Office,
MONTREAL, 22nd January, 1879.

WM. SMITH, Esq.,
Deputy Minister of Marine and Fisheries,
Ottawa.

SIR,

I have the honour, by desire of the Harbour Commissioners of Montreal, to send you herewith, for the information of the Honourable the Minister, statements showing the receipts and expenditure of this Trust for the year ended the 31st December, 1878.

The receipts from all sources were as follows, viz. :—

INWARDS.

From Collector of Customs, Montreal, on Goods subject to
specific Wharfage \$ 59,215 87

OUTWARDS.

Wharfages collected upon Sailing Vessels, Steamers and
their Cargoes..... 103,046 31

\$162,262 18

Carried forward.....

\$162,262 18

Brought forward

\$162,262 18

LOCAL TRAFFIC.

Wharfage on Goods Inwards.....	\$ 6,808 12
" " " Outwards.....	1,382 52
Harbour Dues on Barges.....	18,497 06
" " Steamers.....	5,168 27
Commutation " ".....	20,304 98
Received for Piling Lumber on Wharves.....	3,402 00
" " Wood ".....	1,617 15
" for Storing Coal ".....	1,220 01
" " Weigh Scales ".....	1,060 00
" " Rent of Small Offices on Wharves.....	717 75
" " Penalties.....	170 00
	<hr/>
	60,347 86

Net Revenue.....

\$222,610 04

FROM DOMINION GOVERNMENT.

Received on account of New Channel Operations..... 115,000 00

SUNDRY AMOUNTS RECEIVED FOR CREDIT OF NEW CHANNEL OPERATIONS.

Sincennes, McNaughton Line, Timber, &c.	\$347 24
" " " Rent.....	260 00
Hodgson, Murphy & Sumner, Discount on Account.....	2 82
F. Paull, Oak.....	7 00
M. Frechette, ".....	77 47
Beauchemin & Fils, ".....	49 50
M. Girard, ".....	35 66
Various parties, ".....	28 80
Schooner <i>Fabeola</i> , Scrap Iron.....	2 92
Beauchemin & Fils.....	11 10
	<hr/>
Board of Engineers, General average Case of Reports.	822 51
Windmill Point Wharf, Overpaid Ryan, returned.....	60
Rent of Old Building.....	5 40
" Offices in New Building.....	1,310 00
Fines collected.....	2,500 00
Interest on Bank Accounts, Consolidated Bank.....	85 00
	<hr/>
	7,507 29
Carried forward	<hr/>
	\$349,840 84

SUNDRY

J. Worthin
Municipal
Peck, Ben
J. Paxton
R. Brison,

Received by
"

The

New Channel
Board of Eng
General John
R. Bruce Bell
Dominion Go
New Dredging

Construc

Windmill Point
Victoria Pier,
Military Basin
Section 29....
King's Basin...
Longue Point

New Building.
Harbour Dredg
Harbour Expens
Buoys and Bea
Printing, Advert
Paris Exhibition
Interest on Harb
Travelling and I

\$162,262 18

6,808 12
 1,382 52
 18,497 06
 5,168 27
 20,304 98
 3,402 00
 1,617 15
 1,220 01
 1,060 00
 717 75
 170 00

60,347 86

\$222,610 04

115,000 00
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 260 00
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 7 00
 77 47
 49 50
 35 66
 28 80
 2 92
 11 10

822 51

60

5 40

1,310 00

2,500 00

85 00

7,507 29

\$349,840 84

Brought forward

\$349,840 84

SUNDRY AMOUNTS RECEIVED FOR CREDIT OF HARBOUR
 DREDGING.

J. Worthington & Co., Towing SCOWS	\$1,134 00	
Municipality of St. Lambert, Blasting	29 30	
Peck, Benny & Co., Scrap Iron	424 20	
J. Paxton & Co., Coal Oil Barrels	8 50	
R. Brison, Damage to Dredge	10 00	
		<u>1,606 00</u>

HARBOUR REPAIRS, AS UNDER.

Received by J. T. Therien, Sale of Old Plank	27 00	
" " " Gravel	3 60	
		<u>30 60</u>

TOTAL RECEIPTS

\$351,477 44

The expenditure was as follows, viz. :—

New Channel Operations	\$159,348 40
Board of Engineers	4,951 63
General John Newton	2,439 41
R. Bruce Bell	1,436 60
Dominion Government Interest	46,945 05
New Dredging Plant—Two Flat Scows	2,640 94

Construction Account, as under:

Windmill Point Wharf	\$3,315 09
Victoria Pier,—new work	5,302 03
Military Basin	3,876 41
Section 29	7,496 96
King's Basin	6,672 78
Longue Pointe Wharf	1,799 21
	<u>28,462 48</u>

New Building	499 06
Harbour Dredging	19,075 77
Harbour Expenses	25,726 93
Buoys and Beacons	3,740 72
Printing, Advertising and Stationery	1,839 28
Paris Exhibition Plans	597 12
Interest on Harbour Debt	111,779 22
Travelling and Incidental Expenses	411 70
	<u>\$409,894 31</u>

Carried forward

\$409,894 31

Brought forward.....	\$469,894 31
Wharfages Returned.....	241 42
Harbour Repairs.....	19,004 32
Harbour Survey.....	277 59
Lamps and Lighting Wharves.....	1,270 85
Chain Tug.....	382 20
Harbour Railway.....	326 59
	<hr/>
TOTAL EXPENDITURE.....	\$431,397 28

A comparison of the receipts from Wharfage with those of last year shows an increase of \$2,897,—viz., \$2,143 in sea-going traffic, and \$754 in the local traffic. This the Commissioners consider a satisfactory exhibit, in view of the general depression of business, and the large decrease shown at other important ports.

For particulars of the work done in the Harbour during the past year, I beg to refer you to the Report of the Chief Engineer, a copy of which is forwarded you.

In connection with this Report, I would draw attention to the reduction in the average cost of dredging, from 45 cents per cubic yard in 1875 to 23 cents per cubic yard in 1878. This is, of course, partially owing to the decrease in the price of labour, coal and other supplies, but more largely to the greatly increased efficiency in the working of the dredges.

I also enclose copies of the Annual Reports of the Harbour Master, with comparative statements of the trade of the Port, and of the Superintendent of Pilots.

The deepening of the Ship Channel between Montreal and Quebec is progressing favourably. A channel 22 feet deep at low water, and of a minimum width of 300 feet, has been obtained, and was officially inspected and tested, on the 18th and 19th November last, by the Commissioners, accompanied by several Branch Pilots and various officers of the Trust. A full report on this work up to the close of the fiscal year has been forwarded to the Department of Public Works, under whose supervision these operations are being carried on.

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\$469,894 31
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 1,270 85
 382 20
 326 59

 \$431,397 28

The Report of the Board of Engineers on Harbour Improvements, with plans, was, as was expected, received in January, and copies forwarded to the Department, as well as generally distributed. No action on the Report has yet been taken, as any considerable addition to the wharf accommodation is not at present required.

In September, after some negotiation, an understanding was reached between the Commissioners and the Department of Agriculture and Public Works, Quebec, whereby accommodation was given for the business of the Quebec, Montreal, Ottawa and Occidental Railway on the wharves. The Board agreed to construct the necessary tracks and sidings, to be and remain the property of the Trust, but to permit the use of them by the Railway at a stipulated yearly rental, subject to revision at the close of each season of navigation, and also subject to such conditions, rules and regulations as the Commissioners may from time to time require to be observed. This arrangement does not include any interchange of traffic with the Grand Trunk or any other Railway, and the Commissioners retain full power to remove the tracks or change their location whenever advisable. A small charge will be made for each car coming on the wharves.

On the 20th November, application was made by the Quebec Government for the right of way over part of the Harbour property, for access to the proposed Railway Terminus at the Quebec Gate Barracks. After giving the matter very careful consideration, the Commissioners have consented to grant the request for a single track, skirting the river bank in rear of the wharves as far as Monarque Street, on certain conditions, subject to the approval of the Governor-General in Council; but final action in this matter seems, for the present, to be deferred.

I have the honour to be,

Sir,

Your most obedient servant,

H. D. WHITNEY,

Assistant Secretary.

(Signed)

REPORT ON THE WORKS
FOR THE
Improvement and Maintenance of the Harbour of Montreal
FOR THE YEAR 1878.

JOHN KENNEDY, M. Inst. C.E., *Chief Engineer.*

HARBOUR COMMISSIONERS OF MONTREAL,
Chief Engineer's Office,

Montreal, 13th January, 1879.

H. D. WHITNEY, ESQ.,

Assistant Secretary,

Harbour Commissioners of Montreal.

SIR,

I beg to submit for the information of the Board of Harbour Commissioners, the following Report upon the works in the Harbour of Montreal during the year 1878.

The principal works of the year are the deepening of the Ship Channel through the Harbour up to the lower entrance of the Lachine Canal, in order to keep pace with the deepening of the Channel in the River below; the deepening of the Basins in Sections 12 to 14, and 18 to 23 inclusive, to afford increased accommodation for vessels taking advantage of the full depth of water in the Channel; the enlarging of the approach to Windmill Point; the widening and renewal in deep water of the wharf on two sides of Kings Basin (Section 15), and on part of the upper side of Victoria Pier, (Section 20); the construction of a wharf in place of the Timber Basin opposite the Jail, (Section 29); the construction of a new wharf at Longue Pointe;

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and the laying down of a Railway track four-fifths of a mile in length, from the end of the Quebec, Montreal, Ottawa and Occidental Railway track below the Longueuil Ferry wharf, to a little distance below the old Military Hospital, in order to facilitate the interchange of traffic between that and other Railways and the Harbour.

The following are the chief details:—

Sections 6 to 11 (Wind Mill Point, Wharf and Basin).—The upper end of the crib-work wharf, 200 feet in length, which was built up to low water mark in 1877, has been carried up to the full height and completed. The back-filling has also been made up to the proper level, and of the breadth of the Harbour property, and the roadway from Black's Bridge has been much improved.

The water approach from the foot of the old Lachine Canal to the lower end of the Basin has been greatly widened and improved by dredging, so as to afford sufficient room for vessels to swing end on to the current when passing round the lower corner of the wharf at the entrance of the Basin. A few boulders and small ridges, which were left in the previous year's dredging in Sections 9 and 10, have also been dredged out.

The expenditures are: Crib-work, \$1,290; back-filling, \$2,011; dredging, \$8,722; total, \$12,023.

Sections 12 and 13 (Queens Basin)—The greater part of the area of the Basin has been deepened to between 24 and 25 feet deep at low water. The wharfing is founded at a depth of only about 20 feet, and the deep dredging, therefore, cannot be carried entirely to the face, but it has been brought in sufficiently close to the main breast wharf to allow of vessels lying alongside without serious inconvenience.

Section 14 (Metcalf and Elgin Basins).—About half the area of the upper or Metcalf Basin has been dredged from a former depth of about 19 feet to an average of 23 feet, and the remaining portion is yet to be done; expenditure \$696.74

The central part of Elgin Basin, with the exception of a few points yet to be completed, has been deepened to 23 feet at

low water, and the dredging, as in the other cases, is carried as close to the wharves as can be done without endangering their foundation; expenditure \$447.91

Section 15 (King's Basin).—For the past three or four years nothing but the most urgent temporary repairs have been done to the dilapidated wharves surrounding the King's Basin, in order that any permanent works might be made so as to form part of the general scheme of Harbour Improvements, which might be recommended by the Board of Engineers. After it was found that the proposed scheme contemplated the ultimate filling up of the Basin, various methods of dealing with it were considered by the Commissioners, and a suggestion to widen the inshore wharf and the lower side of the Albert Pier, by a facing of open pile work was sanctioned. Work was commenced in the early part of the summer, and an effective breadth of 30 feet was added to the shore wharf, and 29 feet to the pier, changing the character of both from being little more than roadways with shallow water, to moderately roomy wharves with 20 to 23 feet of water alongside. An open pile work wharf would have been inadmissible in a part of the Harbour less protected from ice movement, and even here is subject to some risk of damage from very severe shoves, but this is more than counter-balanced by the great saving in first cost as compared with dredging and crib-work. The total expenditure for a frontage of 696 feet has been \$6,680.

Sections 19 and 20 (Victoria Pier and Bonsecours Basin).—The re-facing of the upper side of Victoria Pier, which was done at the outer end in 1861, was this year continued inward 200 feet to the line of the inshore wharf on the lower side of the Pier. The continuation is 38 feet in width, corresponding with that formerly done, and is of the usual crib-work, sunk in 23 feet of water. In order to make the improvements of the Victoria Pier more fully available, the central part of the Basin has been dredged to a depth of 25 feet, with the exception of some insignificant lumps that yet require to be cleared off. Cost of

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crib-work \$4,650; back-filling \$606; dredging in Basin and for crib-work \$5,549; total, \$10,805.

Sections 20 to 23.—The approach and entrance to the Military Basin at the Victoria Pier side, the upper part of the Basin at the inshore side, and along the breast-wharf in Sections 22 and 23, have been dredged out to 25 feet at low water, with exception of a few points which remain to be cleared off; expenditure \$5,723.

Section 29.—The piece of beach opposite the Jail, formerly reserved for a Timber Basin, has been wharfed across in line with the wharf above, leaving an off-set of 35 feet at the junction with the wharf below. The off-set thus formed affords slack water for mooring a crib or two of timber, and a slip has been provided for convenience in hauling out.

The mouth of the Colborne Avenue outfall sewer was prolonged to the face of the new wharf by appropriate crib-work, at the cost of the City Corporation, and instead of the former half-open mouth discharging sewage deposit into the Basin below water line, and fetid gases above, the new opening is submerged, and all discharge is swept away by the swiftest part of the Current St. Mary.

The wharf is of the usual crib-work, is in 14 feet depth of water, and 470 feet length of frontage, (including the off-set). Cost of timber-work, (exclusive of sewer extension) \$5,952; back-filling \$1,986; dredging \$722; total \$8,660.

Longue Pointe Wharf.—A new crib-work wharf 55 feet front, and 17 feet depth of water at lowest level, has been built at a distance of 300 feet above the Parish Church. Cost of timber-work, back-filling, and approach \$1,873; dredging \$199; total \$2,072.

Harbour Railway.—In accordance with an agreement with the Provincial Government of Quebec, a track belonging to the Harbour Commissioners has been laid down at the back part of the space along the wharves, a distance of 4,800 feet, from Section 33 to 25 inclusive, (or from immediately below the

Longueuil Ferry to near Panet Street) in order to allow the Quebec, Montreal, Ottawa and Occidental Railway, (and other railways with which arrangements may be made) to exchange freight with vessels in that part of the Harbour.

Ship Channel through the Harbour.—Although the deepening of the Channel in the Harbour belongs, strictly speaking, to the general deepening of the Ship Channel throughout the River, and is chargeable to that work, the Harbour dredging plant, from being best adapted to the purpose, is being employed to do this section, and for this reason, as well as from its close connection with the Harbour work proper, it may appropriately be mentioned here.

The dredging of the Main Channel lying between the line of the outermost ends of the wharves and the opposite shoals, was commenced last year off the Victoria Pier and on the Island Shoal; but this year, in order to keep pace with the other sections of the work, a force of two to four dredges was engaged upon it, and by the close of the summer the whole distance where dredging was required between the head of the Current St. Mary and Lachine Canal, was deepened to 25 feet at low water, with the exception of such spots as may have been omitted by the dredges and remain to be found by careful soundings and examinations.

An increase in the breadth at the bends at Victoria Pier and at the Island Shoal, also remains to be made.

LACHINE CANAL.

As intimately connected with the improvement of the Harbour, and the interests of the Port, it may be noted that the enlargement of the Lachine Canal by the Dominion Government is being steadily carried on, and is fast approaching completion.

The construction of the new entrance and lower basin at Windmill Point has been pushed forward throughout the summer, and is now practically completed. In the early part of the season the Harbour Wharf in Section 11 was cut through,

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and by the close of navigation the crib-work forming the sides of the entrance and the embankments, paving &c.—separating the basin from the Wind Mill Point Wharf—had been very nearly finished.

HARBOUR REPAIRS.

The repairs for the year have been confined to light works of maintenance, which, though considerable in the aggregate, are scarcely worthy of note in detail.

The supply of macadamizing stone (2,816 cubic yards), timber, deals, &c., has, as usual, been by contract. The work has been done by the Commissioners' own men.

Early in the spring proposals were received from the Gas Company for lighting the wharves with gas, but, in view of the considerable outlay required to lay down pipes, and the promise afforded by the recent rapid improvement in electric lighting, it was deemed best by the Board to continue the petroleum lamps for the present.

Fifteen additional lamps were erected, making a total of sixty-six lamps, and all were provided with two burners, instead of one, as before.

The total expenditure for Harbour Repairs during the past year has amounted to \$18,974, and compares as follows with the three previous years:—

1875.....	\$16,449
1876.....	35,711
1877.....	26,077
1878.....	18,974

DREDGING.

Dredging has, as usual, been carried on with the Commissioners' own plant. That employed in the Harbour work proper has consisted of one to five spoon dredges, two clam-shell derricks for unloading scows; three screw tugs, sixteen flat

scows, two to six dumping scows, and one floating shop for machinery repairs. Two new flat scows of seventy cubic yards capacity were built during the winter at the Commissioners' works, Sorel, at a cost of \$1,320.50 each, and have been added to the stock.

In consequence of the delay which it was feared the new works might cause in the opening of the Lachine Canal in spring, and in order to take advantage of the Commissioners' shops for machinery repairs, the dredges, derricks and tugs were wintered at Sorel, with the exception of one dredge and one tug, which were quartered in Cantin's dry-dock on the Canal for repairs to their hulls. The scows were, as usual, wintered at Boucherville.

The season's work is remarkable as being, so far as is known, the longest on record. The four dredges, with the tugs and derricks which wintered at Sorel, were enabled by the unusually early breaking-up of the ice, to leave Sorel on the 3rd April, and commenced work on the 8th April, and the same number were enabled by the lateness of the fall to continue work till the 9th December, thus making a continuous working season of eight months. The dredge and tug which wintered in dry-dock were detained for the opening of the Canal till the 10th May, and one dredge, in consequence of an accident, was laid up on the 29th November.

One dredge was engaged twenty days in deepening the Ship Channel at Varennes; one for fourteen days at Point aux Trembles; and two to four spent an aggregate of 450 $\frac{3}{4}$ days in the Ship Channel within the Harbour; making a total of 484 $\frac{3}{4}$ days in Ship Channel work. In the Harbour work proper there were spent 528 $\frac{3}{4}$ days; making an aggregate of 1,013 $\frac{1}{2}$ days' service for all the dredges for the season, or an average of 202 $\frac{7}{10}$ days each. The nominal working time is ten hours per day, which gives 9,795 hours total time of service within the Harbour, but the actual working time, after deducting time lost for repairs, changing positions, waiting for scows, detention by vessels, short

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days in autumn, and all other causes, is reduced to 8,613 hours; or an average of $87\frac{93}{100}$ per cent. of the gross time of service, as against $88\frac{86}{100}$ for 1877, $84\frac{6}{10}$ for 1876, and $82\frac{3}{10}$ for 1875. The falling-off of nearly one per cent., as compared with 1877, is more than accounted for by the unusual loss of time suffered by the dredges engaged in the Channel in the Harbour, they being obliged to move off and sometimes lie several hours waiting for the larger vessels to enter or leave the different basins. An aggregate of 155 hours, or $1\frac{88}{100}$ per cent., is due to this alone.

The cost of the fleet for work in the Harbour was \$48,748, which includes wages, fuel, stores, and the proportion of general charges for insurance, spring outfit, repairs, and all other charges, except interests and depreciation.

The total quantity of dredging done was 211,731 cubic yards, and the average cost is, therefore, twenty-three cents per cubic yard for dredging, towing and unloading the material; 97,110 cubic yards, or forty-six per cent., being unloaded by steam derricks, and the remainder dumped from hopper scows.

Compared with the three previous years, the results are as follows:—

YEAR.	COST.	CUBIC YARDS DREDGED.	COST PER CUBIC YARD. CENTS.
1875	\$68,979	151,719	45
1876	55,462	156,982	35½
1877	45,103	173,449	26
1878	48,748	211,731	23

The following are the different parts of the Harbour at which dredging has been done, and the cost of the same:—

Sections 9 to 11 (Windmill Point).—Enlarging and deepening the approach to the Basin and clearing small lumps and boulders from the lower end. Hard pan, boulders and gravel; fifteen to

twenty-eight feet water (actual depths at dates of dredging); 26,993 cubic yards, costing \$8,722, or $32\frac{20}{100}$ per cubic yard.

Sections 12 and 13 (Queen's Basin).—Deepening three to five feet; hard pan, gravel and boulders; twenty to twenty-seven feet water; 10,775 cubic yards, costing \$3,907, or $36\frac{1}{4}$ cents per cubic yard.

Section 14.—Deepening in Metcalfe Basin; about four feet hard pan and stones; twenty-two to twenty-five feet depth of water; 4,710 cubic yards, costing \$697, or $14\frac{70}{100}$ cents per cubic yard.

Deepening in Elgin Basin; sewage deposit, gravel, hard pan and boulders; twenty to twenty-seven feet of water; 1,760 cubic yards, costing \$448, or $25\frac{45}{100}$ cents per cubic yard.

Section 18 (Market Basin).—Clearing out deposit, sand and stones; twenty to twenty-four feet water; 1,025 cubic yards, costing \$348, or 34 cents per cubic yard.

Sections 19 and 20 (Bonsecours Basin and Victoria Pier).—Deepening centre and lower side of Basin and preparing site for crib-work; sand and gravel; twenty to twenty-seven feet of water; 27,860 cubic yards, costing \$5,549, or $19\frac{20}{100}$ cents per cubic yard.

Sections 20 to 22 (Military Basin).—Deepening Basin; sand gravel and mud; twenty to twenty-seven feet of water; 27,170 cubic yards, costing \$5,574, or $20\frac{20}{100}$ cents per cubic yard.

Section 23 (Commissioners' Wharf).—Clearing alongside of wharf; gravel, stone, ballast, &c.; twenty-four to twenty-six feet of water; 420 cubic yards, costing \$149, or $35\frac{25}{100}$ cents per cubic yard.

Section 29 (Opposite Jail).—Dredging foundation for new wharf; clay, gravel, boulders and builders' rubbish; ten to fifteen feet of water; 3,375 cubic yards, costing \$722, or $21\frac{25}{100}$ cents per cubic yard.

Longue Pointe.—Dredging foundations for new wharf; quicksand, gravel and boulders; eight to eighteen feet of water; 600 cubic yards, costing \$199, or $33\frac{15}{100}$ cents per cubic yard.

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Ship Channel in the Harbour.—Deepening between the head of Current St. Mary and the Lachine Canal; sand, gravel and boulders; twenty to twenty-seven feet of water; 107,043 cubic yards, costing \$22,433, or $20\frac{96}{100}$ cents per cubic yard.

CHAIN-TUG "A. G. NISH."

The Chain-tug was wintered in the Lachine Canal, and soon after coming out in the spring was fitted up for service, and placed on her station about the middle of June, and continued till 29th November. She was kept throughout the summer in continual readiness for service, in charge of a fireman and watchman, with arrangements for summoning a crew at any moment when needed, but her services were not called for.

I am, Sir,

Your obedient servant,

(Signed),

JOHN KENNEDY,

Chief Engineer.

ABSTRACT OF DREDGING DONE IN DIFFERENT PARTS OF THE
HARBOUR OF MONTREAL IN 1878.

PLACES WHERE DREDGES WORKED.	Dredges.	Quantities dredged at each place.	Dredged Totals.	REMARKS.		
<i>Sections 9 to 11:</i> Windmill Point	Dredge No. 4 " No. 5 " No. 6	Cubic yds. 888 7,980 18,125	Cubic yds. 26,993	Hard pan and boulders.		
<i>Sections 12 and 13:</i> Queen's Basin	" No. 2 " No. 4 " No. 6	2,170 7,435 1,170	10,775		{ Hard pan, gravel and boulders.	
<i>Section 14:</i> Metcalf's Basin	" No. 6 " No. 7	630 4,080				4,710	Hard pan and stones.
<i>Section 14:</i> Elgin Basin	" No. 2 " No. 5 " No. 6	280 1,120 360	1,760	{ Sewage deposit, gravel, hard pan and boulders.		
<i>Section 18:</i> Market Basin	" No. 6	1,025			1,025	Sand and stones.
<i>Section 19:</i> Bonsecours Basin	" No. 2	27,860	27,860	Sand and gravel.		
<i>Section 20 to 22:</i> Military Basin	" No. 2 " No. 6 " No. 7	4,840 7,715 14,615			27,170	Sand and gravel.
<i>Section 23:</i> Commissioners' Wharf	" No. 2	420					420	Gravel and stone ballast.
<i>Section 29:</i> New Wharf	" No. 2	2,925	3,375	{ Clay, gravel, builders' rubbish, &c.		
<i>Sections 12 to 20:</i> Ship Channel & Island Shoal	" No. 4 " No. 5 " No. 6 " No. 7	30,258 38,480 3,025 35,280			107,043	{ Sand, gravel and boulders.
<i>Longue Point</i>	" No. 2	600					600	{ Quicksand, gravel and stones.
Gross Total					211,731	

ABSTRACT OF DREDGING DONE BY EACH DREDGE IN THE HARBOUR OF MONTREAL IN 1878.

DREDGES.	Commenced Working.	Stopped Working.	Time of Service.	PLACES AT WHICH WORK WAS DONE.	Quantities Dredged at each place.	Totals Dredged.	REMARKS.
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ABSTRACT OF DREDGING DONE BY EACH DREDGE IN THE HARBOUR OF MONTREAL IN 1878.

DREDGES.	Commenced Working.	Stopped Working.	Time of Service.	PLACES AT WHICH WORK WAS DONE.	Quantities Dredged at each Place.	Totals Dredged.	REMARKS.
Dredge No. 2...	10th May	9th Dec.	Days. 168	Sec. 12 and 13, Queen's Basin..... " 14, Elgin Basin..... " 19, Bonsecours Basin..... " 21 and 22, Military Basin..... " 23, Commissioners' Wharf..... " 29, New Wharf..... Longue Pointe.....	Cubic yds. 2,170 280 27,860 4,840 420 2,925 600	Cubic yds. 39,695	Hard pan, gravel and boulders. Sewage deposit, gravel, hard pan and boulders. Sand and gravel. Gravel and stone ballast. Clay, gravel, builders' rubbish, &c. Quicksand, gravel and stones.
" No. 4...	8th April	9th Dec.	210½	Sec. 8, Windmill Point..... " 12 and 13, Queen's Basin..... " 12 to 20, Ship Channel.....	888 7,435 30,258	88,581	Hard pan and boulders. Hard pan, gravel and boulders. Sand, gravel and boulders.
" No. 5...	8th April	7th Dec.	209	Sec. 11, Windmill Point..... " 14, Elgin Basin..... " 15 and 17, Ship Channel and Island Shoal..... " 29, New Wharf.....	7,980 1,120 37,589 450	48,069	Hard pan and boulders. Sewage deposit, gravel, hard pan and boulders. Sand, gravel and boulders. Clay, gravel, builders' rubbish, &c.
" No. 6...	8th April	29th Nov.	202	Sec. 8 to 11, Windmill Point..... " 12 to 13, Queen's Basin..... " 14, Metcalfe Basin..... " 14, Elgin Basin..... " 19, Market Basin..... " 20 and 22, Military Basin..... " 13, Ship Channel.....	18,125 1,170 630 360 1,095 7,715 3,625	32,050	Hard pan and boulders. Hard pan, gravel and boulders. Hard pan and stones. Sewage deposit, gravel, hard pan and boulders. Sand and stones. Sand and gravel. Sand, gravel and boulders.
" No. 7...	8th April	9th Dec.	190	Sec. 14, Metcalfe Basin..... " 16 to 20, Ship Channel..... " 20 and 22, Military Basin.....	4,080 35,280 14,615	53,975	Hard pan and stones. Sand, gravel and boulders. Sand and gravel.
Grand Total.						211,731	

In addition to the 979½ days' service included in the above table, dredge No. 1 worked 190 days in the Ship Channel at Varennes, and Dredge No. 2 worked 14 days at Pointe aux Trembles, or together 54 days, which, with the 979½ days in the Harbour, makes an aggregate of 1,013½ days' service for all the dredges. Of the 979½ days in the Harbour, 45¼ days were spent in the Ship Channel within the Harbour, and 524½ days in Harbour work proper.

HARBOUR COMMISSIONERS' DREDGING PLANT EMPLOYED IN THE HARBOUR OF MONTREAL IN 1878.

DESCRIPTION OF VESSELS.	HULL.			ENGINES.				Capacity of Bucket.	Depth to which Dredge can Work.	REMARKS.
	Length over all.	Breadth of Beam.	Depth of Hold.	When Built.	Kind of Engine.	No. of Cylinders.	Diameter of Cylinders.				Length of Stroke.	Pressure of Steam.
DREDGES:										
Spoon Dredge No. 2	77.0	26.6	6.3	.....	} Horizontal non-condensing	1	12	16	40 to 70	40
" " No. 4	77.3	27.0	6.6	1872		1	14	16	40 to 70	40
" " No. 5	77.6	27.0	6.6	1873		1	14	16	40 to 70	40
" " No. 6	77.0	27.0	7.6	1874		1	14	16	40 to 70	40
" " No. 7	77.3	27.0	7.0	1874	1	14	16	40 to 70	40	
DERRICKS:										
Clam-shell Derrick No. 1	56.8	23.9	5.9	.....	} Horizontal non-condensing	1	8	12	60 to 70	.....
" " No. 2	57.0	23.6	5.9	1872		2	7	12	60 to 90	.....
" " No. 3	61.9	24.0	5.9	1875		1	10	12	60 to 90	.....
TUG-BOATS:										
St. Louis	67.0	15.0	8.7	1875	} Vertical non-condensing	1	16	20	85 to 95	.....
St. Peter	71.6	16.6	8.6	1875		1	20	22	80 to 90	.....
St. Paul	65.6	15.0	8.0	1875		1	16	18	80 to 100	.....
BARGES:										
Staghound, Floating Shop	103.4	21.5	7.6	1869	.....	.....	.....	.....	.....	.....
SCOWS:										
2 to 6 Dumping Scows	80.0	16.0	7.6	.....	.....	.....	.....	.....	.....	.....
3 Flat Scows	70.0	18.0	5.0	1875*
2 " "	75.0	20.0	5.9	1876
2 " "	75.0	20.0	6.0	1878
9 " " various sizes and ages

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REPORT

OF THE

HARBOUR MASTER OF THE PORT OF MONTREAL

FOR THE YEAR 1878.

—
Capt. A. M. RUDOLF, *Harbour Master*.

—
H. D. WHITNEY, ESQ.,

Assistant Secretary of the Harbour Commissioners,
Montreal.

SIR,

I have the honour to submit the following as my Annual Report for 1878, with the accompanying Comparative Statements, showing the dates of the opening and closing of navigation; of the first arrival from sea and the last departure for sea; of the numbers, tonnage and classification of sea-going vessels; the greatest number in port at one time and at what date; also, the number and tonnage of Inland vessels, the greatest number in port at one time and at what date, as well as the number, tonnage and classification of vessels from the Maritime Provinces for the past ten years.

On the 1st January the Harbour was almost free from ice, with the exception of some small quantities that were lying upon the shores. The Longueuil Ferry steamer was running her regular trips during the forenoon, and in the afternoon left the Harbour, with a party of about 300 people, on a pleasure excursion to Boucherville, returning at about 5 p.m. On the 2nd, the weather being cold, ice formed rapidly, and

2 to 6 Dumping Scows ..	80.0	16.0	1.6	1875	.....
3 Flat Scows.....	70.0	18.0	5.0	1876	.....
2 " "	75.0	20.0	5.9	1876	.....
2 " "	75.0	20.0	6.0	1878	.....
9 " "	.....	.....	.....	.....	.....
various sizes and ages }	.....	.....	.....	.....	.....

the water began to rise; the Longueuil Ferry steamer made several trips during the morning, and at 3 p.m. left port for Boucherville, to lay up for the winter. She was the last vessel of the season. After that date, the ice increased daily, and the water kept rising. On the 10th it was level with the wharves; on the 17th people crossed on the ice to and from Longueuil; on the 24th teams crossed at the same place; on the 29th the water reached its highest point, $34\frac{1}{4}$ feet on No. 1 Lock sill of the Lachine Canal, or $17\frac{1}{4}$ feet above the usual summer level. On the 31st, the river was full of ice and stationary, and of sufficient strength to admit of a road being made from St. Lamberts to the city. The 7th of January was the coldest day of the winter, the thermometer at 8 a.m. registering 15° below zero.

On the 1st February teams crossed the ice from St. Lamberts to the city; on the 18th a road was made to Laprairie, and on the last day of the month these roads were considered unsafe, the people were warned, and the roads abandoned. The weather in February was generally mild and pleasant, only one day the temperature being below zero. That occurred on the 15th, the thermometer at 8 a.m. marking 1° below. The water fell during the month $4\frac{1}{8}$ feet.

The weather in March was changeable but generally mild, the 1st of the month being the coldest day, the thermometer at 8 a.m. marking 3° . The cold snap strengthened the ice in the river, and on the 2nd teams again crossed to St. Lamberts and Laprairie, and on the 12th were again abandoned, being considered unsafe. On the 16th the first open water was seen in the middle of the river, near Victoria Bridge. The first shove of the ice took place opposite the city on the 18th, the whole body moving downwards, which put a stop to crossing to Longueuil. The water then began to fall rapidly, leaving a large quantity of ice upon the wharves in front of the city; on the 20th it was level with the wharves; on the 22nd the channel was clear as far as Pointe aux Trembles; on the 29th the steamer *Montarville*

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came up into Harbour, blew her whistle and returned to Boucherville; on the 30th the brigantine *Corinne* arrived in port from Boucherville in tow of the steamer *François*, where they had wintered. The water fell this month 9 feet 4 inches.

The weather in April was mild and pleasant; the lowest temperature was on the 13th—thermometer at 8 a.m. marking 41°. On the 3rd the Longueuil Ferry commenced running her regular trips; on the 4th several schooners arrived in port from Boucherville, also two tug steamers, four dredges and a derrick, belonging to the Harbour Commissioners, and the steamer *Chambly* from Sorel. The water still kept falling, leaving considerable quantities of ice upon the shores. On the 10th it reached its lowest point, 18 $\frac{1}{2}$ feet on the lock sill of the Lachine Canal, or 1 $\frac{1}{2}$ feet above summer level. On the 11th it began to rise again, and kept well up during the whole season of navigation.

The first arrival from sea was on the 13th of April, the steamship *Venezia*, from Cow Bay, C. B., laden with coal; and on the 28th the ships *Glenfinart* and *Lake Michigan* arrived in port, being the first vessels from Europe. From that date vessels arrived daily and business fairly commenced. The arrivals from sea were considerably greater up to the month of September than during the previous year, but in the latter part of the season they had greatly fallen off, but still leaving a balance in favour of this year of 3 vessels and 20,407 tons.

The number and tonnage of inland vessels have fallen short of the previous year—viz., 831 vessels and 83,735 tons.

Great improvements have been made in the Harbour this year, in deepening and widening the channel, and building and repairing wharves, which will, no doubt, prove to be of great advantage to the trade of the port.

The dredges were at work in the Harbour up to the 9th December, doing good work in the basins and around the wharves, which was much needed. Part of the Harbour Plant was sent to Sorel on the 9th December, and the balance on the

10th December to the same place (on account of the accumulations of ice in the basins), there to lay up for the winter.

The ferry steamer *Laprairie* left port on the 16th of December for Boucherville, the ferry steamer *Longueuil* on the 19th, and the ferry steamer *St. Lamberts* on the 23rd. All for the same place, to lay up for winter.

The Lumber Trade to South America is again reviving; 20 vessels of the aggregate tonnage of 11,013 tons, carrying 8,680,000 feet of lumber, loaded at this port this season—against 10 vessels of the aggregate tonnage of 4,387 tons, carrying 3,400,000 feet of lumber in 1876.

Five hundred and sixteen (516) sea-going vessels visited the port this year, of the aggregate tonnage of 397,266 tons, 249 of which were built of iron, of the aggregate tonnage of 311,968 tons, and 267 were built of wood, of the aggregate tonnage of 85,298 tons, composed of the following nationalities, numbers and tonnage:—

NATIONALITY.	No.	TONNAGE.
British	482	382,056
Norwegian	17	7,839
American	6	2,054
Belgian	2	1,902
Austrian	3	1,304
German	4	1,255
Italian	1	534
Swedish	1	322
Total	516	397,266

These vessels were navigated by 12,610 seamen.

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On the last of the year the river was full of drift ice, and the water $4\frac{9}{12}$ feet above the summer level.

Submitting the foregoing for the consideration of the Harbour Commissioners,

I am, Sir,

Your most obedient servant,

A. M. RUDOLF,
Harbour Master.

HARBOUR OFFICE,
31st December, 1878.

TONNAGE.

2,056

7,839

2,054

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PORT OF MONTREAL.

Comparative Statement, showing the Number and Tonnage of Inland Vessels that Arrived in Port the past Ten Years, with the Dates of the greatest number in Port at one time.

Years.	Number of Vessels.	Tonnage.	Greatest Number in Port at one time.
1869.....	5,866	721,324	259.... November 5.
1870.....	6,345	819,476	255.... October 6.
1871.....	6,878	824,787	281.... " 6.
1872.....	7,150	936,782	309.... June 8.
1873.....	6,751	933,462	296.... " 8.
1874.....	6,855	956,837	301.... " 14.
1875.....	6,178	811,410	256.... August 4.
1876.....	6,083	786,083	262.... November 9.
1877.....	6,333	847,978	258.... October 3.
1878.....	5,202	764,243	261.... " 15.

(Signed)

A. M. RUDOLF,
Harbour Master.

HARBOUR OFFICE,
31st December, 1878.

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PORT OF MONTREAL.

Comparative Statement, showing the Dates of the Opening and Closing of Navigation, First Arrival from Sea and Last Departure for Sea, the past Ten Years.

Years.	Opening of Navigation.	Close of Navigation.	First Arrival from Sea.	Last Departure for Sea.
1869....	April 25.....	Dec. 6.....	April 30.....	November 24.
1870....	" 18.....	" 18.....	" 22.....	" 27.
1871....	" 8.....	" 1.....	" 22.....	" 29.
1872....	May 1.....	" 8.....	May 5.....	" 28.
1873....	April 25.....	Nov. 26.....	" 4.....	" 21.
1874....	" 25.....	Dec. 13.....	" 11.....	" 21.
1875....	May 3.....	Nov. 29.....	" 9.....	" 22.
1876....	April 27.....	Dec. 10.....	" 8.....	" 23.
1877....	" 17.....	Jan. 2, 1878	April 29.....	" 24.
1878....	Mar. 30.....	Dec. 23.....	" 20.....	" 24.

(Signed)

A. M. RUDOLF,
Harbour Master.

HARBOUR OFFICE,
31st December, 1878.

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E. RUDOLF,
Harbour Master.

PORT OF MONTREAL.

Comparative Statement, showing the Number, Tonnage and Classification of Sea-going Vessels that Arrived in Port from the Maritime Provinces the past Ten Years.

Years.	Steamships	Tonnage.	Ships.	Tonnage.	Barges.	Tonnage.	Brigs.	Tonnage.	Brigantines.	Tonnage.	Schooners.	Tonnage.	Total No. of Vessels.	Total Tonnage.
1869.....	27	11,970	..	.....	23	9,433	4	952	29	4,977	142	10,740	225	38,072
1870.....	45	17,731	2	2,034	28	13,411	3	768	29	4,007	156	12,486	257	59,437
1871.....	42	18,469	4	3,488	19	8,449	8	1,714	27	3,939	133	9,213	233	45,262
1872.....	68	39,378	3	2,364	32	16,067	3	523	48	7,545	147	11,572	301	77,450
1873.....	91	59,061	6	4,790	36	18,595	6	1,422	36	4,824	98	8,056	273	96,748
1874.....	104	53,903	3	2,046	26	15,681	3	622	42	6,636	108	10,493	286	88,781
1875.....	120	69,544	3	1,874	27	13,180	2	331	35	5,397	92	8,526	279	98,852
1876.....	87	47,199	1	739	30	15,451	4	993	25	4,220	67	7,322	214	75,924
1877.....	72	39,277	5	4,306	25	13,566	3	758	18	2,744	37	3,924	160	64,375
1878.....	42	21,812	2	1,132	32	15,749	3	954	21	4,196	65	6,683	165	50,526

HARBOUR OFFICE,
31st December, 1878.

(Signed)

A. M. RUDOLF,
Harbour Master.

PORT OF MONTREAL.

Comparative Statement, showing the Number, Tonnage and Classification of Sea-going Vessels that Arrived in Port, the past Ten Years, with the Dates of the Greatest Number in Port at one time each Year.

1878.....	42	21,812	2	1,132	32	15,749	3	15,000	108	18	2,444	34	3,324	100	64,513
1875.....									954	21	4,196	65	6,683	165	50,526

HARBOUR OFFICE,
31st December, 1878.

(Signed) A. M. RUDOLF,
Harbour Master.

PORT OF MONTREAL.

Comparative Statement, showing the Number, Tonnage and Classification of Sea-going Vessels that Arrived in Port, the past Ten Years, with the Dates of the Greatest Number in Port at one time each Year.

Years.	Steamships.	Tonnage.	Ships.	Tonnage.	Barques.	Tonnage.	Brigs.	Tonnage.	Brigantines.	Tonnage.	Schooners.	Tonnage.	Total No. of Vessels.	Total Tonnage.	Greatest Number in Port at one time.
1869..	117	117,965	66	64,484	103	45,710	18	4,735	49	9,243	204	17,726	557	259,863	61, November 4.
1870..	144	133,912	78	73,175	157	75,797	16	4,183	62	10,351	223	19,428	680	316,846	62, June 20.
1871..	142	146,927	99	92,502	170	82,363	26	6,539	47	7,839	180	15,551	664	351,721	89, October 27.
1872..	215	217,713	67	62,775	182	87,199	20	5,221	68	11,504	175	14,388	727	398,800	84, " 30.
1873..	242	245,237	72	65,823	164	75,594	18	4,660	59	8,581	147	12,583	702	412,478	84, August 28.
1874..	266	262,996	50	46,938	167	80,677	15	3,928	64	10,688	169	19,093	731	423,423	76, July 6.
1875..	256	255,435	40	39,895	138	63,167	17	3,833	53	9,801	138	13,981	642	386,112	63, August 18.
1876..	240	262,829	40	37,303	146	66,002	18	4,700	35	5,848	123	14,498	692	391,180	61, July 24.
1877..	247	261,764	41	41,994	108	56,909	10	2,560	25	4,987	78	8,735	513	376,859	59, October 19.
1878..	207	269,878	44	47,577	113	58,711	9	2,610	34	6,537	109	11,953	516	397,266	45, June 3.

HARBOUR OFFICE,
31st December, 1878.

(Signed) A. M. RUDOLF,
Harbour Master.

REPORT
OF THE
SUPERINTENDENT OF PILOTS.

JOS. LEVEILLÉ, *Superintendent of Pilots.*

HARBOUR COMMISSIONERS OF MONTREAL,
Office of the Superintendent of Pilots,
Montreal, 19th December, 1878.

H. D. WHITNEY, ESQ.,
Assistant Secretary,

Harbour Commissioners of Montreal.

SIR,

I have the honour to submit, for the information of the Harbour Commissioners of Montreal, the following report on my work, in connection with placing and maintaining the Buoys in the River St. Lawrence between Montreal and Quebec, for the season of 1878.

The steamer *Richelieu* was employed by me fifty-four days in the service, and the steamer *John Young* four days, in the autumn, taking up the buoys. In connection with this work I made about ten trips down the river, of more or less length, according to the amount of work to be done.

It is unnecessary to give a detailed account of these trips, as the nature of the work is already known. It consists in placing the buoys wherever it is necessary and maintaining them in the best possible order, that they may be sure guides to pilots going up or down in charge of ships. As the buoys are

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often dragged by rafts or vessels, and the chains attached to them get too long or too short, according to the height of the water, they must be frequently inspected, so that those out of position may be replaced, the chains lengthened or shortened, as the case may be—those that are too old replaced by new ones, and such as are not conspicuous enough re-painted; in fact, to keep them in such good order that they may be of the greatest possible service.

I have pleasure in stating that the number of buoys moved out of position this season was much smaller than in previous years. As I have said before, the new buoys are much less likely to be carried away than the old.

The most important of my trips are the first and the last. The first is to replace the buoys taken up in the fall and to put everything in order for navigation. I left this year on the 15th April. I found all the buoys left last autumn, except seven,—five at Cap la Roche and two at Flat Island, which were carried away by the ice. This is a very small proportion to the number left in place,—sixty-seven. During the summer I found three of these buoys, so there were only four actually lost. Nearly all the buoys, however, were out of position; I replaced them, and put new ones in the place of some that were damaged; I also put some additional ones down during the summer, as the water fell. The total number I had this fall was 153, of which 122 were wooden, thirteen iron, and the remainder (twenty) casks, apart from the seven buoys in the Harbour. Of these I have left down for winter (in safe positions) fifty-eight wooden and twelve iron buoys, a total of seventy. I took up sixty-four wooden buoys, all the barrels (twenty), and one iron buoy, that of Becancour.

During the summer I raised two old iron buoys; one in Lake St. Peter and the other at Pointe aux Trembles. The latter was twenty feet in length, and, therefore, difficult to raise. It had been lying at the bottom for five or six years. I put down three new iron buoys in Lake St. Peter, and when doing so thought it advisable to anchor them by the other end opposite that which

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has heretofore been used, as by this means a weight of 200 lbs. is sufficient, while the other way required a weight of 1,800 to 2,000 lbs., and at the same time they are more conspicuous. I hope to be as successful with those in the Lake as with those at No. 3 Light Ship and Nicolet, which have not been disturbed, and with which the pilots are well pleased.

I employed anchors for the buoys at Cap la Roche only, every where else I used cast-iron weight (commonly called picasses.) These are much less expensive. I bought fifty fathoms of chain for the buoys, which was sufficient for all my wants. The beacons were all in order, and only a few had to be re-painted.

There are in the Sorel Ship Yard some thirty to thirty-five anchors (found in the River), and also about 140 buoys; the latter will be used as occasion requires. They need to be renewed every two or three years, and there are always some damaged ones to be replaced. This year I only lost six, but I renewed several.

All the buoys employed between the Richelieu Rapids and Three Rivers have been stored in the latter place, to avoid an unnecessary trip to Sorel.

I have the honour to be,

Sir,

Your obedient servant,

JOS. LEVEILLE,

Superintendent of Pilots.

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REPORT

UPON THE

DEEPENING OF THE SHIP CHANNEL BETWEEN MONTREAL & QUEBEC, FOR THE YEAR 1878.

JOHN KENNEDY, M. Inst. C.E., *Chief Engineer.*

HARBOUR COMMISSIONERS OF MONTREAL,
Chief Engineer's Office,
Montreal, 25th February, 1879.

H. D. WHITNEY, ESQ.,
Secretary.

SIR,

I beg to submit, for the information of the Harbour Commissioners, the following report upon the work accomplished during the year 1878 in deepening the Ship Channel of the River St. Lawrence between Montreal and Quebec.

At the close of 1877 the dredging had so far advanced that it became possible, with another year's work, to attain a depth of $22\frac{1}{2}$ feet at low water at all points above the reach of tidal assistance, and thus to give navigation the benefits of the first step of $2\frac{1}{2}$ feet in the contemplated increase to 25 feet. The work of the past year was, therefore, arranged with this object in view, and it was attained; and proof of the fact was made by the Commissioners, accompanied by their officers and a

number of pilots, in a trip through the Channel on the 18th and 19th November, as set forth in the appended certificate.

The total cost of the year's work is \$149,016.70, of which \$24,125.45 is the cost of working three spoon dredges drawn for a time from the Montreal Harbour Works, and the balance of \$124,811.25 is the cost of working the usual Ship Channel fleet, composed of eight elevator dredges, and two stone-lifters and their tenders. These amounts, as usual, include repairs of all kinds, fitting out, fuel, stores, wages, salaries, insurance, and all working expenses incident to the dredging fleet, except interest and depreciation.

The total quantity of dredging done is 1,084,636 cubic yards, and the cost averaged over the whole work will, therefore, be 13⁸/₁₀ cents per cubic yard scow measurement, after deducting the usual allowance of 25 per cent. for imperfect filling.

The similar items for previous years are as follows:—

Years.	No. of Dredges.	Quantity Dredged, cubic yards.	Total cost.	Average cost per cubic yard.
1875	7 to 8	820,733	\$134,744	16 ⁷ / ₁₀ cts.
1876	8	922,808	130,744	14 ¹ / ₁₀ "
1877	8 to 9	1,262,308	137,830	10 ⁸ / ₁₀ "
1878	8 elevators....	966,973	\$124,891	12 ² / ₁₀ " }
	1 to 3 spoons..	117,663	24,125	20 ⁵ / ₁₀ " }
		1,084,636	\$149,016	13 ⁸ / ₁₀ " }

It will be observed that, notwithstanding the unusual length of the working season, the cost of working the elevator dredges, or Ship Channel fleet proper, is decidedly lower than in any previous year, while the quantity of dredging done is considerably less than in 1877, and the average cost per cubic yard

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higher; and further, that the cost of the work done by the spoon dredges is much higher than that by elevators.

As regards the gross expenses, the reduction occurs to some extent in the items of fuel and stores, but more largely in those of repairs to machinery and hulls, from the fact that the condition of the vessels was such as to need fewer repairs than ordinary. The falling off in the quantity dredged is due to the more difficult character of the work of the last year. In 1877 there were, for instance, only 18,173 cubic yards of rock dredging, as against 37,027 cubic yards in 1878; and of the difficult boulder clay at points below Lake St. Peter there were 7,708 cubic yards in 1877, as against 62,106 cubic yards in 1878. The difference between the average cost of dredging by the spoon and elevator dredges is also due to the difference in the character of the material dealt with; that in which the spoon dredges worked being altogether the more difficult, and in fact, such as the elevator dredges could not raise with economy, and hence the necessity of employing the spoon dredges from the Harbour Works.

Operations have been carried on at Cap Charles, Cap la Roche, Cap Levraut, Champlain Point (or Pointe Citrouille,) Champlain, Becancour Shoal, Port St. Francis and vicinity, Lake St. Peter, Contrecoeur Channel, Pointe Marie, Varennes, Pointe aux Trembles and Montreal.

The work accomplished, and the cost of the same at the different localities, are as follows:

Cap Charles.—At the close of 1877, there remained to be removed, in order to make the cut through the Grondine Shoal fully available, a few points of rock and a mass of boulders lying at the up stream margin of the shoal. In mid-summer, when the water had fallen to a favourable level, a dredge and stone lifter were set to work, and cleared the whole away. The quantity removed was 2,025 cubic yards of shale rock and small boulders, and 281 cubic yards large boulders, (grappled with the stone lifter) making a total of 2,306 cubic yards, and costing

\$3,091.46, or an average of \$1.34 per cubic yard. The cost is slightly greater than in 1877, the increase being due to the shallow and irregular cutting, and the large proportion of boulders.

Cap la Roche.—Very good progress has been made in the important work of cutting the new straight channel through the shale rock shoal. The south half breadth of the channel, or 150 feet in width, has been cut to 20 feet at low water from where work closed in 1877 through to deep water on the up stream side, a total distance of 1,400 feet; and the north half has been cut to the same depth from the lower side of the shoal to a distance of 1,100 feet, or very nearly through to deep water. The upper slope of the shoal, in the line of the south half of the channel, has been cleared of boulders up to deep water, a distance of 950 feet, and the boulders have also been cleared from the down stream side of the shoal, on the south half of the channel throughout, a distance of 900 feet. To make the south half width of the channel available to 20 feet at low water, there yet remains only a few week's work in completing the removal of boulders; and the deepening of the whole breadth of 300 feet to 20 feet at low water, may be looked for before low water arrives in the coming summer. The material met with in the shoal is the same as in the previous year, and consists of shale rock of various degrees of hardness, free of fine surface deposit, but overlaid with boulders of all sizes, up to 30 or 40 tons in weight. Two dredges were employed a little over half the working season in dredging the shale, and two stone lifters nearly the same time; one assisting the dredges, and the other working independently. The shale rock is dredged up without blasting, a few exceptional shots being put in unusually hard veins, or to widen the banks where the dredges find difficulty in maintaining the full breadth of channel.

The quantities raised during the year are 33,180 cubic yards shale rock (measured loose in the scows), and 1,169 cubic yards boulders, costing in all \$22,787, or an average of 66½ cents per

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cubic yard In 1877 the cost was \$1.36 per cubic yard, or something over double; but in that year are included the cost of dredging test pits and other items incident to the commencement of the work, while in 1878 the work was regular, and the dredge buckets and other appliances had been improved and adapted to the special requirements of the work as ascertained in the previous year's operations.

Cap Levraut, or St. Anne's Shoal.—As mentioned in last Report, the surveys which had recently been made between Cap Levraut and Batiscan, indicated the possibility of obtaining a straight line between those points without increase of dredging, and further examination in 1878 confirmed the indication.

Dredging was therefore commenced upon the new line early in the summer, and a force was employed upon it equal to one dredge for the whole season, and a stone lifter one-third of the season. The lower part of the work, consisting of a small shoal at the bend, was found to be very tough clay covered with large boulders, making difficult and expensive dredging; but the upper part was of softer clay, with fewer boulders, and dredged much more easily. About three-fourths of the upper part, extending over one-third of a mile, is completed to 25 feet in depth; the north halfbreadth, or 150 feet of the channel through the shoal at the bend, is taken out to 22½ feet deep, and the greater part of the remaining half is also down to the same depth.

Total quantity raised, 42,105 cubic yards of clay and small boulders, and 372 cubic yards of large boulders, costing in all \$16,326, or an average of 39½ cents per cubic yard.

Champlain Point and Champlain Village.—In order to determine upon lines for the improvement of the channel on the north side of the Gentilly Shoal and for the entrances from deep water at each end, which would involve the least amount of dredging, and be easily lighted from shore, the whole locality was carefully surveyed and the surveys connected with those previously made at Batiscan below and Becancour above. A favourable straight line was thus obtained, leading from deep

water below Dubord's Shoal to Point Champlain (or Pointe Citrouille). Two dredges were placed upon it in the latter part of the season, and by the close had removed sufficient to afford a channel of fair breadth and $22\frac{1}{2}$ feet deep at low water. The lower part of the work consisted of cutting through a sandy arm of the Gentilly Shoal, reaching diagonally across to Champlain Point, while the upper part at Champlain Village was the trimming off of several small shoals near the light-house, which were found to be covered with boulders embedded in gravel and clay, and formed very difficult dredging.

Total quantity dredged at both places 11,415 cubic yards, costing \$5,271, or an average of $46\frac{1}{10}$ cents per cubic yard.

Becancour.—The most tedious and expensive dredging met with during the year—not excepting the shale rock at Caps Charles and La Roche—was in completing the depth of $22\frac{1}{2}$ feet on the Becancour Shoal, begun in 1877. Half the area had in that year been cut away; and in the early part of the past summer, the remainder, consisting, as before, of a mass of boulders cemented with clay, was removed.

Quantity dredged this year 1,326 cubic yards, costing \$1,860, or an average of \$1.40 per cubic yard.

Port St. Francis and Nicolet Traverse.—In the early part of the summer all the deep water from above the bend of the channel at No. 3 Light Ship to below the St. Francis Lights was carefully surveyed, and the results showed that, by moving the traverse about 600 feet to the north and cutting through a small projection of the Pointe du Lac shoal, opposite the English Bank, a straight, roomy channel could be obtained with much less dredging than by improving the present traverse. In the neighbourhood of Port St. Francis the present channel proved to be at least as good in its general direction, and much the most economical of any available, but for a 25-foot depth it required to be widened and straightened, by cutting away the south ends of the Iron Shoal and Force Shoal.

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middle of September, and by October 3rd the end of the Iron Shoal was cut off, and by November 6th the other was also cut away sufficiently to allow of a $22\frac{1}{2}$ feet draught at low water, with greatly increased room. The shoals, like those at Champlain, are covered with boulders of all sizes packed together; and as the depth to be moved was very little, the dredging, estimated by the cubic yard, was necessarily expensive.

Total quantity of dredging at both points 7,260 cubic yards, costing \$4,860, or an average of 67 cents per cubic yard.

Lake St. Peter.—At the close of 1877 the dredges had deepened the regular portions of the channel up to points between $1\frac{1}{2}$ miles below and $1\frac{1}{5}$ miles above No. 1 Light Vessel, making the average ending a little below the Light, and leaving for this year the straight piece of channel about two miles long between that and deep water above, and also the working out of the bends at Nos. 1 and 3 Light Vessels, and the general trimming-up of the whole work of previous years.

Three dredges were started on the 10th and 11th April last, and the work was carried on with one to three dredges until October 12th, when the whole channel in the Lake was completed to $22\frac{1}{2}$ feet deep at low water, with a width of 300 feet.

The average rate of dredging for the year has been 1,393 cubic yards per dredge per day, as against 1,692 cubic yards in 1877; the dredging of this year largely consisting of irregular work in detached pieces, while that of 1877 was nearly altogether in the ordinary straight channel. In the neighbourhood of No. 1 Light Vessel a layer of sand was found above the clay, but at all other places the dredging was of the well-known soft clay which forms the bottom of the lake.

The aggregate dredging of the past summer is 601,072 cubic yards, costing \$32,263, or $5\frac{1}{3}$ cents per cubic yard.

Contrecoeur Channel.—Early in the summer a survey was made of the vicinity of the junction of the Contrecoeur Channel and Contrecoeur Traverse, and upon the information obtained a dredge was set to cut through the most advantageous part of a

shoal which obstructed both channels. Late in the fall, when the dredges were, as usual, withdrawn from Lake St. Peter and the river below, three were placed in the main cutting of the Contrecoeur Channel and one at Ile St. Ours, to deepen to 25 feet, and continued at work till the close of the season.

Total quantity dredged, 108,135 cubic yards, costing \$12,935, or an average of 12 cents per cubic yard.

Pointe Marie.—The portion of the main shoal dredged to 23 feet in 1877 was, in the past summer, deepened to 25 feet at low water, and a smaller shoal immediately below was also cut down to the same depth.

Quantity dredged 23,325 cubic yards, at a cost of \$3,365, or 14½ cents per cubic yard.

Varenes.—In the early part of the summer, the *Pouillier de Varenes* was cut down to a depth of 25 feet at low water by one of the spoon dredges from the Montreal Harbour; and in the fall, when the elevator dredges were moved from the lower part of the river, one was set to complete the bend near Ile Ste. Therese lower Light, and nearly finished it.

Total quantity dredged, 13,020 cubic yards, costing \$2,416, or 18½ cents per cubic yard.

Pointe aux Trembles.—At the commencement of the season one of the rock-cutting elevator dredges was set to take out a point of shale rock which projected into the north side of the channel, opposite the village, and a spoon dredge from the Montreal Harbour was, in July, set to clear away some groups of boulders at other points opposite and above the village. The ordinary dredging at the bend was continued with two elevator dredges until July 4th, when one of them was withdrawn, and the other (the old No. 1) left to complete the work to 22½ feet depth, which she did on the 20th November.

Total quantity dredged, 132,908 cubic yards, of which a small proportion was rock, and costing \$21,408, or 16½ cents per cubic yard.

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from the head of the Current St. Mary to the foot of the Lachine Canal, and between the extremities of the wharves and the outlying shoals, has been dredged from a former depth of 19 or 20 feet at low water to 25 feet (with possibly the exception of a few points which may yet be found on a closer examination of the bottom than could be made in the autumn). The material chiefly consisted of gravel and boulders of all sizes, such as could not economically be worked with the elevator dredges, and it was, therefore, taken out with the spoon dredges of the Harbour; one to three being employed throughout the summer, and the cost of working being charged to the Ship Channel.

Total quantity raised 107,043 cubic yards, costing \$22,433, or an average of 20²/₁₀ cents per cubic yard.

DREDGING PLANT.

The strength of the working fleet was increased over that of the previous year by the employment of three of the Montreal Harbour dredges during the greater part of the summer, thus making the strength of the fleet as follows:—

- One Clyde built Elevator Dredge, No. 1 (old).
- One " " " No. 3 (later date).
- Six large Elevator Dredges, Nos. 8 to 13.
- Three Spoon Dredges, the greater part of season.
- Two side-wheel Tug Boats.
- Seven screw Tug Boats.
- One Stone Lifter with hand gear, No. 1 (old).
- One " " with steam power, No. 2 (new).
- Five Barges (Coal Tenders and Smiths' Shops).
- Nineteen hopper-bottom Scows.
- Two flat Scows.

Further details of the various vessels are given in the appended Tables.

No. 1 Dredge was, on account of her unsound condition, wintered in dry dock at Montreal, and was accompanied by

one Tug; the other Dredges, six of the Tugs, the two Stone Lifters, and one Scow were quartered at Sorel; and the remaining Tugs, the Coal Barges and Scows at *Chenal du Moine*, during the winter of 1877-78, and the usual repairs were made at the Commissioners' Yard and Shops. The fleet, as a whole, was in good order, so that, as already remarked, extensive repairs were not necessary. Among the larger repairs may be mentioned the strengthening of the bucket frames of Dredges 8, 9, 11, 12 and 13; two new lower tumblers were made and others repaired; 230 buckets have been repaired, a large proportion having been re-riveted, and a considerable number supplied with new lips; 2,050 links have been more or less repaired, and two new ones made; 1,916 link pins have been re-forged, and 770 new ones made.

The tug *Delisle* had part of the fire-box and legs of the boiler renewed; a pair of large steel grips were made for Stone Lifter No. 1, and the bow winch of No. 2 was improved and over-head frame raised.

The year is remarkable as having afforded a working season of eight months, from the 8th April to the 9th December, the longest, it is believed, which has occurred in the history of the Ship Channel dredging. By the 6th of April the ice had cleared away sufficiently to allow of two dredges leaving winter quarters at Sorel for stations above, and by the 19th all the elevator dredges were at work, except the old No. 1, which was wintered in dry dock in the Lachine Canal, and was, therefore, detained till after the opening of the Canal on 9th May. In the fall, No. 1 Dredge was obliged to leave for winter quarters in the Canal on the 20th November, but the others, wintering at Sorel, remained at work until the 7th and 9th of December.

The spoon dredges were drawn from the Montreal Harbour to the Ship Channel works, and returned as circumstances required, from 8th April to 7th December, the aggregate service amounting to 562 $\frac{3}{4}$ days.

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The gross time of the eight regular Ship Channel dredges, from the time of leaving winter quarters until returning, was 1,616 days, or an average of 202 days each, and the time of actual dredging, after deducting delays and stoppages of every kind, was 12,330½ hours, or a general average of 7½ hours per day per dredge throughout the working season. The nominal working time was, as usual, twelve hours in summer, and reducing to nine hours in autumn, and as the dredges worked up to within a fortnight of the shortest day of the year, the short days formed no inconsiderable part of the whole. The work of each dredge will be found in the appended Tables.

BUOYS, BEACONS AND LIGHTING.

The Buoys and Beacons have been maintained in the usual manner, and changes have been made where required to mark out the improved channel. Two new moveable beacons have been erected on Ile à L'aigle, to mark out the channel passing the south-east side of Ile Ste. Therese, and two on Ile Delorier, to mark that passing the lower side of Cap St. Michel.

Preparations are also made for the erection of two large beacons on Ile Ste. Therese, to mark the Point aux Trembles Channel, and two at Champlain, to mark the new line from Champlain to Champlain Point, should light-houses not be provided.

I regret to have to record that the steamer *Richelieu*, hitherto used by the Commissioners in the maintenance of the buoys, was sunk, and will, it is feared, prove a total loss, in consequence of a collision with the steamer *Rocket*, on the night of the 22nd October last, near Cap Madelaine Lights.

The alterations in the line of the Ship Channel incident to its improvement, have, at several places, left it either without lights or with lights in wrong positions. It will be remembered

that I took the liberty of calling the attention of the Board to the matter last fall, after which the Commissioners made it a subject of investigation in a trip through the channel in November last, with a view to asking Government to make the requisite changes and additions.

I am, Sir,

Your most obedient servant,

(Signed),

JOHN KENNEDY,

Chief Engineer.

ABSTRACT OF
THE SH

PLACES WITH
DREDGES WORKED

Cap Charles.....

Cap la Roche.....

Cap Levraut & vic

Champlain (or Ch
ille) Point.....

Champlain

Becancour.....

Pt. St. Francis

Lake St. Peter

Contrecoeur Channe

Pte. Marie.....

Varenes

Pte. aux Trembles.

Montreal Harbour..

Total earth, gravel,

Total rock and Bould

Gross Total

ABSTRACT OF DREDGING DONE AT DIFFERENT PLACES IN 1878, IN DEEPE NING
THE SHIP CHANNEL BETWEEN MONTREAL AND QUEBEC TO 25 FEET.

PLACES WHERE DREDGES WORKED.	Dredges.	Quan- tities dredged at each place.	Totals.		REMARKS.
			Earth.	Rock.	
Cap Charles.....	Dredge No. 11. S. Lifter No. 1. " No. 2.	Cub. yds. 2,025 133 148	Cub. yds.	Cub. yds.	
Cap la Roche.....	Dredge No. 11. " No. 12. S. Lifter No. 1. " No. 2.	17,670 15,510 619 550	.....	2,306	Shale, rock and boulders.
Cap Levraut & vicinity...	Dredge No. 3. " No. 8. " No. 12. " No. 13. S. Lifter No. 1. " No. 2.	8,190 3,015 8,910 21,990 100 272	..... 42,105	34,349	Shale, rock and boulders. Hard clay and boulders.
Champlain (or Citrou- ille) Point.....	Dredge No. 10.	7,770	.....	372	Large Boulders.
Champlain.....	Dredge No. 3	3,645	7,770		Coarse sand.
Becancour.....	Dredge No. 3. S. Lifter No. 1.	1,320 6	3,645		{ Boulders, gravel and hard clay.
Pt. St. Francis.....	Dredge No. 9. " No. 10.	6,195 1,155	1,326		{ Boulders and very hard clay.
Lake St. Peter.....	Dredge No. 3. " No. 8. " No. 9. " No. 10.	81,840 266,835 167,842 84,555	7,260		Boulders and hard clay.
Contrecoeur Channel.....	Dredge No. 9. " No. 10. " No. 11. " No. 13.	15,555 72,120 9,090 11,370	601,072		Soft clay.
Pte. Marie.....	Dredge No. 8. " No. 11.	18,960 4,365	108,135		Clay and stones.
Varenes.....	Dredge No. 3. Spoon do No. 7.	4,920 8,100	23,325		{ Clay, with a few boulders.
Pte. aux Trembles.....	Dredge No. 1. Spoon do No. 2. Dredge No. 12. " No. 13.	70,230 2,520 9,758 50,440	13,020		{ Clay, overlaid with boulders.
Montreal Harbour.....	Spoon (No. 4. No. 5. Dredges (No. 6. No. 7.	30,258 28,480 3,025 35,280	132,908		{ Clay, with boulders and shale rock at certain points.
Total earth, gravel, &c.....			107,043		{ Sand, gravel and boul- ders.
Total rock and Boulders.....			1,047,609		
Gross Total.....				37,027	
				1,084,636	

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DREDGING PLANT EMPLOYED IN DEEPENING THE SHIP CHANNEL BETWEEN MONTREAL AND QUEBEC IN 1878.

DESCRIPTION OF VESSELS.	HULL.				ENGINES.				Capacity of Bucket.	Depth to which dredge can work.	REMARKS.	
	Length over all.	Breadth of Beam.	Depth of Hold.	When Built.	Tonnage Register.	Kind of Engines.	No. of Cylinders.	Diameter of Cylinder.				Length of Stroke.	Pressure of Steam.
DREDGES.												
Elevact Dredge No. 1	130.0	ft. in. 27.0	ft. in. 9.0	1832	.....	Side lever cond'g.	1	27	30	5 to 7	94	1859. Wooden Hull, rebuilt in 1869.
" " No. 3	135.0	29.0	10.0	.....	.....	Two coupled vertical direct acting condensing engines to each dredge.	2	26	30	10 to 25	4	.....
" " No. 8	135.0	29.0	10.0	1874	.....	.....	2	20	32	35 to 60	4	.....
" " No. 9	135.0	29.0	10.0	1874	.....	.....	2	20	32	35 to 60	4	.....
" " No. 10	135.0	29.0	10.0	1874	.....	.....	2	20	32	35 to 60	4	.....
" " No. 11	135.0	29.0	10.0	1874	.....	.....	2	20	32	35 to 60	4	.....
" " No. 12	135.0	29.0	10.0	1874	.....	.....	2	20	32	35 to 60	4	.....
" " No. 13	135.0	29.0	10.0	1874	.....	.....	2	20	32	35 to 60	4	.....
STEAMERS AND TUGS.												
Richelieu	139.0	18.1	7.4	.....	65.00	Parkyn's Patent Independent beam engines.	2	24 1/2	36	25 to 30	.....	Iron Hull—sunk.
John Young	125.0	22.0	8.1	1875	103.32	.....	2	30	96	45 to 50	.....	Wooden Hull.
M. F. Parsons	75.0	15.0	6.6	1864	92.42	.....	1	18 1/2	20	80 to 90	.....	.....
St. Francis	80.0	17.0	7.9	1875	57.35	Direct acting non-condensing engines.	1	20	22	80 to 87	.....	.....
St. John	80.0	17.0	7.3	1874	51.45	.....	1	20	22	80 to 87	.....	.....
John Pratt	96.0	19.2	7.3	1874	51.45	.....	2	14	16	70 to 80	.....	.....
Dellisle	62.5	14.9	7.5	1869	17.01	.....	1	15	20	80 to 90	.....	.....
John Brown	75.0	15.0	7.0	1837	28.00	Vertical non-cond. "	1	18	20	60 to 70	.....	.....
St. James	75.0	17.0	8.2	1875	54.51	.....	1	16	20	70 to 80	.....	.....
BARGES.												
Waverley	110.0	20.11	7.1	1870	176.00	.....	.....	.....	.....	.....	.....	Wooden Hull.
Dreadnought	104.2	21.5	7.4	1869	136.42	.....	.....	.....	.....	.....	.....	.....
Henry Thomas	100.8	22.9	7.7	1865	143.40	.....	.....	.....	.....	.....	.....	.....
Hope	98.0	20.0	6.6	1864	98.00	.....	.....	.....	.....	.....	.....	.....
Car line	103.8	22.6	8.3	1872	132.95	.....	.....	.....	.....	.....	.....	.....
Stone Lifter No. 1	65.0	22.0	6.0	1858	.....	.....	.....	.....	.....	.....	.....	.....
" " No. 2	75.0	24.0	7.9	1877	.....	.....	.....	.....	.....	.....	.....	.....
SCOWS.												
2 Hopper-bottomed.	80.0	16.0	7.0	1870	.....	.....	.....	.....	.....	.....	.....	.....
13 " "	80.0	16.0	6.9	1874	32 10 46	.....	.....	.....	.....	.....	.....	.....
2 " "	54.5	18.0	7.0	1875	47 and 48	.....	.....	.....	.....	.....	.....	.....
2 " "	58.0	19.9	7.3	1876	49 and 50	.....	.....	.....	.....	.....	.....	.....

NOTE.—Three spoon dredges belonging to the Montreal Harbour Works were, in addition to the above, temporarily employed upon the Ship Channel.

(OFFICIAL RECORD
The undersigned
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NOTE.—Three spoon dredges belonging to the Montreal Harbour Works were, in addition to the above, temporarily employed upon the Ship Channel.

TEST OF 22 FEET CHANNEL,

MADE

NOVEMBER 18th and 19th, 1878.

ON BOARD THE STEAMER "JOHN YOUNG,"

November 18th and 19th, 1878.

(OFFICIAL RECORD.)

The undersigned, on Monday, November 18th, embarked on the steamer *John Young*, having spars gauged to a depth of 23 feet 6 inches attached to each side, and left the Harbour of Montreal at eight o'clock a.m., passing through the Ship Channel, as improved in the Harbour, at Point aux Trembles, Varennes, Vercheres, Contrecoeur, Lake St. Peter, the Nicolet Traverse, and Port St. Francis, over the Pouillier Becancour, the new cut between Champlain and Champlain Point, and Batiscan Traverse to Cap Levraut, without meeting any obstruction. As the gauge on the Flats in Lake St. Peter indicated 12 feet, this establishes a Ship Channel of 22 feet at lowest water throughout the whole distance thus traversed, or an increased depth of 2 feet beyond that hitherto available. At Cap Levraut and down to Cap Charles, by taking advantage of highest tide, no difficulty now exists, and below that point to the Harbour of Quebec the Channel is free from danger at a much greater depth than 22 feet at any condition of the tide, so that a reliable new Ship Channel of 22 feet now exists throughout between Montreal and Quebec.

- (Signed),
- THOMAS CRAMP,
Chairman Harbour Commissioners.
 - HUGH McLENNAN,
ADOLPHE ROY,
EDWARD MACKAY,
Harbour Commissioners.
 - JOHN KENNEDY, *Chief Engineer.*
 - A. M. RUDOLF, *Harbour Master.*
 - THOMAS McKENZIE,
Superintendent of Dredging.
 - JOSEPH LEVEILLÉ,
Superintendent of Pilots.
 - A. NAUD, *Branch Pilot.*
 - PIERRE GAGNON, *Branch Pilot.*

I certify to the foregoing statements, so far as it relates to the Channel from Montreal to Three Rivers, at which place I was obliged, by other engagements, to leave the steamer *John Young* and return to Montreal.

(Signed). J. L. BEAUDRY, MAYOR OF MONTREAL,
Harbour Commissioner.

I certify to the foregoing statement, so far as it relates to the Channel from Sorel (where I joined the *John Young*) to all points below.

(Signed). C. L. ARMSTRONG, *Consulting Officer.*

I certify to the foregoing statement, so far as it relates to points below Three Rivers, at which place I joined the *John Young*.

(Signed). P. M. MATHIEU, *Branch Pilot.*

Certified,

(Signed). H. D. WHITNEY,
Assistant Secretary.

PILOTA

WM. SMITH,
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SIR,

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REPORT
OF THE
PILOTAGE DISTRICT OF MONTREAL,
FOR THE YEAR 1878.

HARBOUR COMMISSIONERS OF MONTREAL,
Secretary's Office,

MONTREAL, 2nd January, 1879.

WM. SMITH, ESQ.,

Deputy Minister of Marine and Fisheries,
Ottawa.

SIR,

By direction of the Harbour Commissioners of Montreal, I beg to transmit herewith, for the information of the Honourable the Minister of Marine and Fisheries, the following Report of the Pilotage District of Montreal, for the year ended the 31st December, 1878, as required by the 24th section of the Pilotage Act of 1873.

On the 15th and 16th of January last, an examination of Apprentices was held by the Commissioners, at which Alexis Gauthier and Louis Z. Bouillé received their licenses as Branch Pilots, and at a subsequent examination, held on the 14th November, Joseph Toupin was also licensed.

Pilots Onesime Naud the elder, aged 74, and Joseph Barnabe dit Lafreniere, aged 65, were, after examination, granted a license to pilot for one year.

Two Pilots have died during the year—viz., Eusebe Toupin, aged 53, on the 5th April last, and Leandre Mayrand, aged 55, on the 31st August.

The following is a list giving the name and age of each

Pilot for and above the Harbour of Quebec, acting under the authority of the Harbour Commissioners of Montreal, with the earnings of each, during the season of navigation of 1878 :—

No.	NAME.	AGE.	EARNINGS.	REMARKS.
1	Onesime Naud.....	74	\$ 497 66	
2	P. Marcel Mathieu.....	58	1,050 36	
3	F. A. Mayrand.....	58	263 84	
4	Joseph Leveille.....	60	.....	From 1st July.
5	Hector Hamelin.....	60	621 59	Superintendent of Pilots.
6	Zepherin Bouillie.....	49	882 92	
7	P. Gaillardet.....	62	372 66	
8	Joseph Barnabé dit Lafrenière.	65	453 80	
9	Cyrille Belisle.....	50	484 20	
10	Adolphe Lisée.....	48	947 80	
11	George Raymond.....	48	1,214 98	
12	Augustin Naud.....	51	660 87	
13	Hubert A. Belisle.....	47	441 84	
14	Athanase Dufresne.....	44	1,701 40	
15	Jean B. Dorval.....	46	441 97	
16	L. N. Bouillé.....	51	1,000 00	Pilot Steamer <i>Montreal</i> .
17	Edouard Naud.....	55	473 87	
18	Pierre Gagnon.....	50	1,015 54	
19	George Belisle.....	38	602 19	
20	Onesime Naud, No. 1.....	37	1,192 45	
21	J. Octave Hamelin.....	44	542 01	
22	Joseph Chandonnet.....	37	1,757 13	
23	Louis A. Bouillie.....	38	468 47	} Suspended from 12th Oct., pending enquiry into conduct.
24	Prudent Boudet.....	36	1,435 68	
25	Elzear Belisle.....	43	472 62	
26	Joseph Pleau.....	40	528 13	
27	Celestin Brunet.....	35	686 74	
28	Louis Belisle.....	32	1,324 45	
29	Damase Caien.....	37	440 77	
30	Ulric Groleau.....	30	603 93	} Suspended for one year from 8th Nov.
31	Alfred Frenette.....	38	496 17	
32	Alfred St. Armand.....	34	496 74	
33	Phillipe Belanger.....	39	524 99	
34	Victor Gagnon.....	39	583 42	
35	Narcisse Perrault.....	40	470 01	
36	Treflé Toupin.....	30	480 32	
37	Cléophas Auger.....	31	578 77	
38	Francois Desjordy.....	33	439 85	
39	Ferdinand La Branche.....	32	1,498 75	
40	David Perrault.....	36	507 18	
41	Alexis Gauthier.....	31	634 30	
42	Louis Z. Bouillie.....	29	624 32	
	Leandre Mayrand.....		\$29,919 69	To date of death.
			496 43	
	Total earnings.....		\$30,416 12	

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This amount, \$30,416 12, was derived from the following sources, viz.:—

BRITISH :		
Steamships.....	\$19,508 31	
Sailing Vessels	8,887 43	
	<hr/>	\$28,395 74
FOREIGN :		
Steamships.....	\$ 189 37	
Sailing Vessels	1,831 01	
	<hr/>	2,020 38
Total.....		<hr/> \$30,416 12

The following list shows the name and age of each Apprentice serving his time under the authority of this Trust:—

No.	NAME.	AGE.
1	Leon Croteau.....	39
2	Jean Arcand.....	26
3	Alphonse Cossette.....	30
4	Delovie Naud.....	26
5	Norbert Arcand.....	24
6	Ulric Toupin.....	25
7	Nestor Arcand.....	23
8	Gideon Groleau.....	27
9	Wilbrod Gauthier.....	27
10	Nere Belisle.....	30
11	Louis Mayrand.....	32
12	Hubert Perrault.....	32
13	Odilon Portelance.....	27
14	Laurent Gauthier.....	29
15	Tancrede Bouillie.....	25
16	Leboire Perrault.....	34
17	Jean Naud.....	23
18	Joseph Hurteau.....	19
19	Wilfred Raymond.....	25
20	Adolphe Richard.....	31
21	Narcisse Paquet.....	24
22	George Dufresne.....	28
23	Joseph Langlois.....	24
24	Honoré Dusseau.....	25
25	Joseph Dusseau.....	22

With one exception, the casualties to vessels on the river during the past season have been of a minor character, and unaccompanied by any serious loss or damage.

The following is an account of the same:—

On the 3rd June, as the barque *Minerva* was leaving her berth at the Island Wharf, in the Harbour of Montreal, in tow of the tug *Champion*, owing to her not having enough steerage way, she was driven in by the wind and current towards the wharves, and the tug, in endeavouring to get her out, broke the tow-line, and the barque drifted broadside on to the bows of the steamers *Quebec* and *Canada*, lying at the Richelieu Pier, and was considerably damaged. The Pilot in charge, D. Perrault, was summoned before the Commissioners, and the evidence of the Captain and other officers and men of the barque was taken, as well as that of several eye-witnesses of the accident. As there was great difference of opinion among the witnesses as to the cause of the disaster, the Commissioners did not inflict any penalty, but, being of opinion that if the vessel had been worked with the tug alongside instead of ahead the collision would have been avoided, they ordered that he be reprimanded for not having fully considered all the circumstances of the case before starting.

During the afternoon of the 11th June, the SS. *Valetta*, Pilot A. Dufresne, grounded off Cap St. Michel, but succeeded in getting off next day, with the aid of a tug, without sustaining any injury. An investigation was held, at which the evidence went to show that the buoy at Ile Delorier was slightly out of position; so the case was not pressed against the Pilot, although the Commissioners considered he should not have been guided by the buoy alone, but should have taken the land-marks as well.

The ship *Glenfinart*, Pilot Alexis Gauthier, went aground a little above Lanoraie, on the night of the 20th June, in consequence of the Upper Lavaltrie Light not being lit, the lower light, and its reflection on the smooth water, being mistaken for the two lights. The vessel was not damaged, and got off after lightering. No complaint was made against the Pilot.

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On the 2nd August, the SS. *Copia* went aground in the Contrecoeur Channel, on her way to Quebec. The vessel received no damage, but was delayed several days by having to lighten. As she proceeded without making any report of the accident or complaint against the Pilot, Hector Hamelin, the investigation was necessarily postponed until her return. She safely reached her destination, and started on her return voyage to this port, but has since been reported as missing.

On the 12th October, the agents of the SS. *Semiramide* made certain charges against Pilot L. A. Bouillie. Owing to his absence from the city no investigation has yet been held, but he has been placed under suspension in the meantime.

On the morning of the 8th November, the steamships *Moravian* and *Phœnician*, in charge of Pilots Adolphe Lisée and Ulric Groleau respectively, came into collision at Cap à la Roche, and both vessels, and a portion of the cargo of the *Phœnician*, received very serious injury.

The result of a preliminary enquiry into the matter showed that Pilot Groleau was in fault, he having violated Article No. 133 of the Harbour By-Laws, by not keeping his vessel, which was coming up, below Cap à la Roche, allowing the *Moravian* to pass down. Pilot Groleau then waived a formal trial and admitted he was in the wrong, and the Commissioners have since decided that he be suspended for one year from the date of the accident.

The maintenance of the buoys (eleven in number) in the Richelieu River, between St. John's and Rouse's Point, and those in the Riviere des Prairies (eight), which is a charge on the revenues of the Trust, have, as usual, been properly attended to, and thoroughly inspected by the Superintendent of Pilots.

Several cases of encroachment on the beach and river, by the building of wharves or piers, have been brought before the Commissioners during the past season, and the necessary steps have been taken to maintain the rights and jurisdiction of the Trust.

TARIFF OF PILOTAGE NOW IN FORCE IN THE PILOTAGE DISTRICT
OF MONTREAL.

QUEBEC TO MONTREAL, OR VICE VERSA.

	Upwards.	Downwards.
Pilotage of vessels in tow of a steamer, for each foot of draught of water. }	\$2 00	\$2 00
Pilotage of vessels propelled by steam, for each foot of draught of water. }	2 50	2 50
Pilotage of vessels under sail, for each foot of draught of water. }	4 20	2 80
Moving a vessel from one wharf to another in the Harbour of Montreal, or from foot of current into the Harbour. }	5 00	5 00

The amount received for poundage, being five per cent. on the earnings of the Pilots, was \$1,532 83 for the year, including, also, that received on vessels coming only to Three Rivers. Besides this, there was received as interests on investments the sum of \$1,857 92, and several small items, amounting to \$43 50, making a total of \$3,434 25.

The disbursements were \$2,147 70, paid as pensions to old and infirm Pilots and the Widows of Pilots.

I have the honour to be,

Sir,

Your most obedient servant,

(Signed)

H. D. WHITNEY,
Assistant Secretary.

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MEMORANDA

AS TO THE

IMPROVEMENT OF THE SHIP CHANNEL

BETWEEN

MONTREAL AND QUEBEC,

AND THE

CONSTRUCTION OF THE HARBOUR OF MONTREAL.

(Prepared for the Official Handbook of the Paris Exhibition in 1878.)

SHIP CHANNEL.

The River St. Lawrence, from the Gulf of St. Lawrence to the immediate vicinity of Quebec, is from 10 to 35 miles in width, is of great depth, and possesses every natural advantage for navigation by vessels of any size.

From Quebec to Montreal, a distance of 159 English miles, the river is generally from one to two miles in width, with a depth of 45 to 100 feet for a distance of 45 miles above Quebec, and above that—except in shoal places subsequently mentioned—it is of a depth of about 30 to 50 feet. At about two-thirds of the distance above Quebec the river widens out into Lake St. Peter, which is 20 miles in length by 9 miles in width, and with a general depth of only 11 to 18 feet at lowest water.

The tide, which rises 14 feet at Quebec, is gradually lost in

ascending, until it becomes imperceptible at the lower end of Lake St. Peter. The average current of the river between Montreal and Quebec may be taken at two miles per hour, and is nowhere such as to affect navigation.

From Montreal to Lake Ontario, a distance of 183 English miles, the lower 100 miles is broken by a series of rapids, around which is a system of Canals with locks 200 feet by 45 feet, with 9 feet depth (now being enlarged to 270 feet, by 45 feet by 14 feet) enabling the vessels of the Great Lakes to descend and exchange cargoes with the sea-going vessels below.

The shoal places in the St. Lawrence, between Quebec and Montreal, which formerly prevented large vessels from reaching the latter city, are the following :—

Lake St. Peter.—With the exception of the deeper channels of the river, which project into the extremities of the Lake, and two long deep pools situated in the line followed by the greatest current, the bottom of Lake St. Peter may be considered as a great smooth shoal of soft clay, overlaid at certain places with a layer of sand. The central portion, several square miles in extent, called "The Flats," is almost perfectly level, with a depth of about 11 feet of water at the lowest stage, and deepening to about 16 or 18 feet near the extremities of the Lake, when it suddenly drops to 25 or 30 feet deep below water surface. The shortest distance between 20 feet depths of water at the extremities is, in a straight line across the Flats, 14 English miles, and the aggregate breadth of the bars separating the pools is $11\frac{1}{2}$ miles.

At Lavaltrie, about thirty miles below Montreal, is a broad shoal of clay, covered with boulders and gravel, $5\frac{1}{4}$ miles in length, between the lines of 25 feet water, and with only 11 feet at the shallowest parts.

From Varennes to Cap St. Michel, a distance of 2 miles, there is a succession of shoals of clay and stones, covered with 16 to 25 of water.

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At *Pointe aux Trembles*, 10 miles below Montreal, about 2 miles of a bottom of clay and boulders is covered with 18 to 25 feet of water.

At *Cap la Roche*, 50 miles above Quebec, a shoal three-fourths of a mile in width stretches across the river, formed of shale rock overstrewn with large boulders, and having in summer a depth of 20 to 25 feet of water, according to the condition of the tide.

At *Cap Charles*, immediately below, is a similar shoal of rock, but only one-third of a mile in width, and with 17 to 24 feet of water upon it.

At several other places there were shoals of smaller extent, reaching wholly or partly across the main channel.

Operations for the removal of these formidable obstructions to deep draft navigation were first commenced in 1844, when the Government Board of Public Works placed two dredges in Lake St. Peter, to cut a channel of 150 feet wide and 14 feet deep at low water, in a straight line through "The Flats." Work was continued with some interruptions for four summers, when it was suspended.

After a lapse of four years, or in 1851, operations were resumed, but under the charge of the *Harbour Commissioners of Montreal*, who adopted a route further to the north, following the deflections of the natural or "Old Channel," and taking advantage of the pools of deep water.

The dredging of the shoal near Lavaltrie and Varennes was commenced in the same year, and the work was carried on with such vigor and success that by the end of 1852 vessels drawing 15 feet, or 4 feet more than formerly, could at the lowest stage of water reach Montreal.

In 1855 the plant was increased, and the work continued until 1866; when an aggregate length of about 31 miles of river had been dredged, and the whole Ship Channel between Montreal and Quebec had been made to at least 300 feet in width and 20 feet in depth at the lowest water. The total

expenditure, including the purchase of plant, was, up to that date, \$1,200,000

In 1875 the deepening of the Channel was again commenced, with a view of making it first to 22 feet, and afterwards continuing it to 25 feet deep, and by the end of the present year (1878) the former depth will have been attained.

The submerged canal in the bottom of Lake St. Peter will, when completed, be $16\frac{1}{2}$ miles in length, with bottom level 25 feet below low-water surface, 14 feet maximum depth of cutting, and 300 feet width, involving the removal, since 1851, of nearly 8,000,000 cubic yards.

The plant engaged in the work consists of eight dredges (with a single set of buckets on an endless chain, and having a daily capacity varying with the material from 150 cubic yards of shale rock to 3,000 cubic yards of soft clay); two stone-lifting barges, and eight tug boats, together with the necessary scows, coal barges, &c., the whole costing about \$580,000.

MONTREAL HARBOUR.

The City and Harbour of Montreal are situated on the north side of the River St. Lawrence, 986 miles from the Straits of Belle Isle, immediately below the Lachine Rapids, or in other words, at the head of navigation in that part of the river level with the sea, and the highest point to which the larger sea-going vessels can ascend to meet the vessels of the Great Inland Lakes.

Up to 1825 the only wharves in existence were two on the shore between what is now the Custom House Square and the

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foot of the Canal, having a total frontage of about 1,120 feet, and in water about 2 feet deep at the lowest stage.

In 1825, (the year following the opening of the first Lachine Canal,) the upper wharf was replaced by the "Canal Wharf," which was extended to 1,260 feet in length, and placed in about 5 feet of water.

In 1830, the *Harbour Commissioners of Montreal* were constituted for the management of the Harbour, and by them the construction of the first regular system of wharfage was undertaken.

Between 1830 and 1832, several of the present wharves, including the Island Wharf, and those immediately above and below it, were built of piles, with from 5 to 20 feet water in front of them. They replaced the remainder of the original shallow water wharves, and extended the wharfage to an aggregate frontage of 4,950 feet, or nearly a mile.

No further additions were made until 1840, but in that and the following six years extensions were made both above and below those of 1830 to 1832, and increasing the total frontage to 7,070 feet, or 1.55 miles.

The basins of the enlarged, or present Lachine Canal, which was opened in the spring of 1848, supplied a considerable extent of wharfage; and, with the exception of the construction of two wharves, with a frontage of 1,370 feet, in ten feet water in the then lower part of the Harbour, no further extensions were made in the Harbour proper until 1856, which was shortly after the dredging operations in the river below were sufficiently advanced to allow of vessels reaching Montreal with a draft of 13 feet at low water, instead of only 11 feet as before.

It was then also determined to continue the deepening of the Ship Channel to 20 feet, and a regular line of large steamers between Montreal and Liverpool having been already established, the necessity for deep water wharfage arose, and in 1856 the Hochelaga Wharf in 20 feet water was built at the lower limits of the City, and below the Current St. Mary.

The deepening of the shallow upper parts of the Harbour, and the re-building of some of the old wharves to a greater depth, were also undertaken about the same time.

The deepening and improvement of the central part of the Harbour, and its extension upward and downward have been regularly carried on to the present time as the deepening of the Ship Channel and the increase of trade demanded.

At the end of 1866, when vessels drawing 20 feet were first enabled to reach Montreal, the wharfage was of the following extent:—

For 20 feet draught of water	1.39 miles
Under 20 feet draught of water	1.78 “
	—
Total	3.17 “

At the present date (1878) the extent is as follows:—

Wharfage for 24 feet draught of water ..	1.20 miles
Wharfage for 20 feet draught of water ..	2.15 “
Wharfage for 10 to 20 feet draught of } water.....	1.07 “
	—
Total	4.42 “

As already stated, the earlier wharves were built of piles, placed in a close row in front and well secured, and backed with earth and stone filling in rear; but since 1846 they have been exclusively built of crib-work, strongly framed of pine and other suitable timber, and filled and backed with stone ballast, or with ordinary dredging from the Harbour.

All the wharves are entirely submerged in winter, and owing doubtless to this the timber is of unusual durability. Some pile wharves of 1830, which are in deep water, and therefore did not need to be superseded, are still in use. The crib-work wharves are found to suffer no serious decay for about

15 or 20 years, the top and the bottom. The total Harbour is, of interest on wharves and cargoes.

The following table shows the number of inland vessels

Year.	SE.
1868..	
1869..	
1870..	
1871..	
1872..	
1873..	
1874..	
1875..	
1876..	
1877..	
1878..	

15 or 20 years, and then only to a depth about half-way between the top and the low water line.

The total capital expenditure in the construction of the Harbour is, up to the present time, about \$2,000,000; the interest on which is met by dues levied upon the vessels and cargoes.

The following is the number and tonnage of sea-going and inland vessels which arrived in Port in the past ten years:—

SEA-GOING VESSELS.			INLAND VESSELS.		
Year.	No.	Tonnage.	Year.	No.	Tonnage.
1868....	478	198,759	1868....	5,822	746,927
1869....	557	259,863	1869....	5,866	721,334
1870....	680	316,846	1870....	6,345	819,476
1871....	664	351,721	1871....	6,878	624,787
1872....	727	398,800	1872....	7,150	936,782
1873....	702	412,478	1873....	6,751	983,462
1874....	730	423,423	1874....	6,855	956,837
1875....	642	386,112	1875....	6,178	811,410
1876....	602	391,180	1876....	6,083	786,083
1877....	513	376,859	1877....	6,333	847,978
1878....	516	397,266	1878....	5,202	764,243

JOHN KENNEDY,
Chief Engineer.