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SCHMES SHOWING THE POSSIBILITIES OF ST. JOHN, N.B.,
AS A GREAT PORT ; AND HOW THE INTERIOR OF
NEW BRUNSWICK CAN BE OPENED UP
TO OCEAN TRAFFIC.

(Accompanied by Maps.)

By J. S. ARMSTRONG, M. Can. Soc. C. E.

To be read in the autumn of 1907.

The works herein described are nearly all engineering works, but it is not proposed in this paper to go specially into the engineering details. It is intended rather to indicate briefly the general nature of the works proposed and the results contemplated.

The accompanying map No. 1 shows St. John and its immediate surroundings—the harbour as at present in use between St. John and Carleton, or St. John West, and the harbour extensions that may be added.

The present harbour area, though affected by great rise and fall of tide, gives, or can be made to give, adequate facilities for present use; but if St. John is to be one of the great ports of the continent, and at any rate the great winter port of the Dominion, large additions to its area and improved facilities will have to be supplied.

In passing, it may be mentioned that the Transportation Commission (1904), expressed the opinion that St. John harbour was so

small that there would be more than enough business for several such ports.

The map was originally made to show only the proposed canal, opening up a practicable way for ocean vessels of the largest class to St. John River waters, and more especially to the harbour area above the "reversing falls."

It also showed the "flats" of Courtenay Bay (bare at low water), which may be reclaimed by a breakwater.

Other possible works are now added, and the several independent schemes or objects may be described under the following heads:—

- (1) The St. John Canal and Dock scheme, with railway connection.
- (2) The Courtenay Bay reclamation and bridge or breakwater.
- (3) The Marsh Canal and Docks.
- (4) The South Bay Docks.
- (5) The Customs-Free Port.
- (6) Extensions in the present harbour.
- (7) The shutting in of the present harbour by a sea dike, with a lock or locks and sluice ways.
- (8) Other objects attained by the Canal—the opening up of the centre of the Province to ocean traffic.

The first and most important scheme is that of the St. John Canal and Dock work with its accessory works.

As shown on the map there is a rise and fall of tide in the present harbour of from twenty to twenty-five feet; the extreme reaches 30 feet occasionally. This variation in water level necessitates expensive wharf work, and is a hindrance to quick and convenient handling of cargo; so much so, that under similar circumstances in Liverpool and other ports of England, and at Quebec, work in the open tideway has been abandoned nearly altogether, and almost all loading and discharging is done in wet docks, constructed at enormous cost.

In the narrows, above the falls, we have a wet dock area of over 500 acres, where there is but small rise and fall of tide; where the water never freezes so as to affect navigation; an area entirely land-locked, with deep water close in to the banks so that all the shores can be lined with wharves at moderate cost. The only exceptions to the freezing and the deep water are two or three coves in which dredging will be required, and in which ice will not be troublesome when they are deepened and opened out, while they give sheltered space for a number of piers.

This harbour area has bluffs overhanging part of its shores on to which the railways can be brought, and grain or coal can be shot directly from the cars to the holds of vessels, being cleaned and weighed in passage, or passed into storage bins on its way to the

NOTES AND AMENDMENTS TO THE ADVANCE PROOF OF
"SCHEMES SHOWING THE POSSIBILITIES OF
ST. JOHN, N. B."

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At the end of Scheme 1 add as follows:

If the canal is built a number of most interesting engineering problems will be crowded into this short half mile of work:

(1) The proper location and facilities for the entrance from the harbour: whether the approach should be further to the left in a cross current or in an eddy as shown: along the face of continuous wharf work or along the ends of several dock piers.

(2) The arrangement of sea walls, guiding the currents and counter currents and reclaiming useful lands, not adapted for ordinary dock use.

(3) The very high dock gates, possibly 45 or 50 feet, adapted to hold back the water pressure from either side.

(4) The partition wall separating the twin locks; a chance for reinforced concrete work, to take up as little width as possible.

(5) The fitting of one of the locks for use as a dry-dock, and of the repair shops connected therewith.

(6) The double track bascule bridge for the railway crossing.

(7) The bascule or pocketed bridge rolling on the dock gates, perhaps combined with an 'elevator-tower-bridge' for the Navy Island traffic bridge crossing.

(8) The unique hydraulic installation with turbines and waterways in the canal walls and the power storage arrangements.

(9) The large cutting in short space with a great variety of material and perhaps a tunnel to carry the railway along the canal.

(10) The coaling berth with elevated storage and high level railway approach.

(11) The waiting basin at the upper end of the canal with guard pier near the edge of the falls.

In line 7 of Scheme 2, page 5, add:

These breakwaters would be made in part with material from the canal excavation and in part perhaps by accumulating the drifting sands.

After Scheme 4, page 6, add:

The piers shown are supposed to be pile-work structures with arrangements to guide the currents as described. The little crosses represent blocks of warehouses, 200 feet square each.

Above paragraph, at bottom page 12, add:

Map 4 shows the position of Turbleton and railways present and prospective. Special attention is called to the B line from Quebec to St. John through Metgormette, Mattawamkeag and St. Stephen, following the valley of the upper Penobscot River in part of its course.

Another proposed piece of railway (left out of the map) would run from Moncton to Pugwash by the Gulf Shore, giving improved connection with Cape Breton.

When the western boundary of New Brunswick is a straight line it runs due north so the map should be looked at diagonally.

In Scheme 6, after the words "may be in rock," add a note:

Note.—This has since been tested and little or no rock found. These piers and those opposite on the east side should be built making an obtuse angle with the channel running out as shown on Map No. 1 instead of as shown on Map 2. Mr. E. T. P. Shewen, M. Can. C. E., has proposed that this line of docks on the west side should be swung back to give extra room in the harbour at this point, but the writer would rather advocate carrying the dredging further in on the east side thus giving extra harbour room while keeping the piers on the west side as long as practicable and insuring good railway yard room behind.

On page 14, in the sixth line, after the word "harbour," add:

The C. P. R'y will probably relocate their line from the Cantilever Bridge to the I. C. R. station, obtaining a reasonable grade, and if it were carried nearer the head of the timber ponds, running through a short tunnel, where shown, it would give space for a second long wharf near the I. C. R. terminus.

The railway should be carried along near the water front on the East Side of the present harbour, perhaps elevated over Water Street.

The east side of Dock Street, or its continuation, Mill Street, should be carried on in a straight line parallel to George Street, from Union to Pond Street, thus widening out and giving space for starting an elevated roadway on the hill leading to the station, to run along Mill Street over the railway tracks, widening again at the corner of Main Street, to let it descend to and connect with the present level of the street. Other improvements as shown in Map 2 (especially, etc.).

Note.—All the terminal railways within the port limits should be vested, by lease or otherwise, under one company or commission,

under the control of the General Railway Commission, so that there would be no conflict of interest in the national port.

In speaking of this as the Canadian Pacific Railway Dock or Wharf it should be noted that only a small part of the wharf on the harbour front, the elevator, and some other easements belong to the C. P. R'y. The docks are really owned by the City of St. John, though at present used largely by the C. P. R'y.

On page 16, after the word "traffic," in the fourth line of Scheme 8, add:

See Map 3.

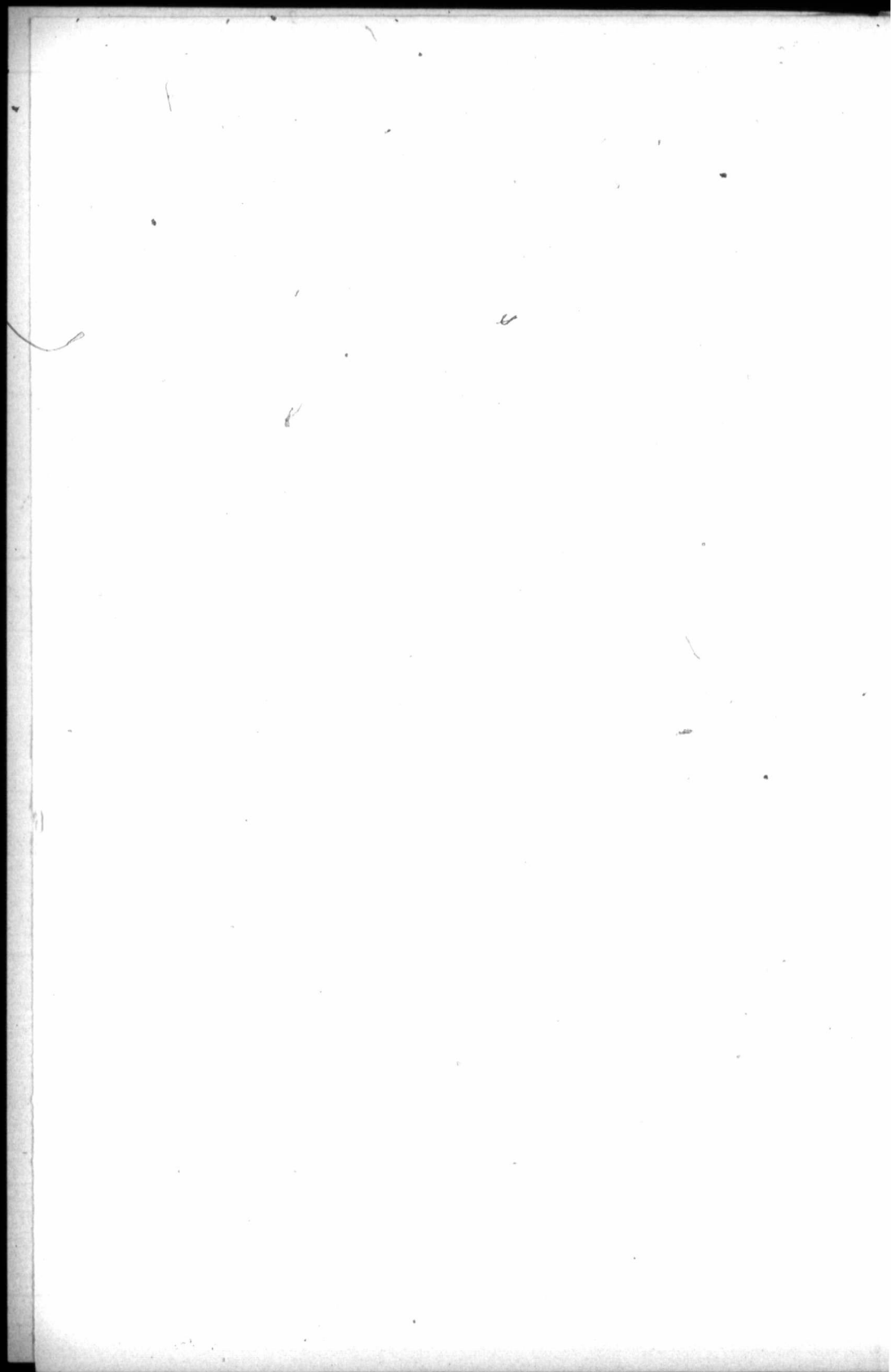
After the words "from St. John," near the end, add:

The regulating works might take the form of a submergeable dam and bridge foundation with a lock connecting with Gagetown Canal and a wide by-pass or sluice-way, variably closed, to the desired extent, by a submerged rolling cylinder so that lumber rafts could be passed without delay or injury.

If St. John is to hold undisputed supremacy as the winter freight port of the Dominion the back country in its neighborhood must be built up.

In Scheme 8, page 16, fill in the blanks, 12th and 15th line from foot, with "45" and "10" respectively.

CANADIAN SOCIETY CIVIL ENGINEERS
Montreal, September 20, 1907.



vessels without elevating; while other lines of railway can follow the wharves on either bank, giving access to dock and storage areas along the extended shore line, and wide fields can be found for yarding cattle just behind the shipping point, wherein they could recuperate after a long railroad journey in readiness for their new experience on the sea.

The canal would run through a high rocky ridge with Douglas Avenue (one of St. John's main thoroughfares), slightly raised and carried across on a fixed bridge high enough for the masts of steamships to pass under—perhaps not the topmasts.

The railway, and other avenues would be carried across on bascule or drawbridges at or near the lock gates.

The length of the canal from high water to high water will be about fourteen hundred feet, and with its approaches on the basis of a prism eighty feet wide at the bottom, would necessitate about a million yards of excavation, more than three-quarters of which would be in rock.

To make the canal effective, a lock, or preferably twin locks, would be provided. The exact location, and whether the locks should be constructed in the solid rock cutting or built in the open, are matters for special study. A factor in favour of having them outside the canal cutting is the prospect of a low-level railway and general traffic bridge being carried across the head of the harbour at Navy Island, at the outside point of which the gates of the locks could be located. This location would provide level space for machine and repair shops and other works at the outside harbour end, including convenient accommodation for water wheels to use the intermittent power that would thus be rendered easily available.

This power, in connection with hydraulic and electric storage, could be made to work the dock gates, elevators, all sorts of dock machinery and the lighting plant, with perhaps a balance of power to be otherwise disposed of. The quantity of water thus used might be large, but the head would be low and variable. This variability and low head make it probable that no other scheme for utilizing on a large scale the fall of waters at the mouth of the River St. John can be a financial success.

If twin locks are provided they would be, side by side, say 700 or 800 feet long by 80 feet wide at the gateways, and with 32 feet of water on the sills at half tide. The above arrangements would allow of the largest merchant steamships passing in and out for six hours twice in the twenty-four, and smaller vessels for longer periods.

For a short time, when the tide is about two-thirds high, the waters of the harbour and river are at the same level, and the gates might be opened under very strict supervision and vessels be passed in and out without lockage. The gates would necessarily be very

large, and to allow this they would have to be capable of being handled very rapidly. They should *be so* capable in any case.

NOTE 1. It may be explained that the tide rises higher and falls much lower than the ordinary level of the river. The outlet at the falls is narrowed greatly, and has a dike of hard rock running across it about 15 to 20 feet below river level, causing the "reversing falls."

NOTE 2. The probable reasons why ice does not form in this upper harbour area, comprising the narrows and Indiantown basin, is that the water is very deep therein and in an immense area above, and a body of comparatively warm water comes to the surface from under the ice on the one hand, while on the other the tidal water from the sea is also much above freezing point, so in their ebb and flow they prevent the formation of ice.

The second, or twin lock, is a necessary precaution against accident to the one in use, and a convenience for rapid work when traffic becomes large. It could be arranged so as to be used as a dry dock, that could be entered at all times from the river level, and if the tide were low at the time a large portion of the water could be run off rapidly without any expense for pumping, so that a vessel while waiting for the tide could have an examination made of her bottom, and if work on it were required she could remain a longer time. The lock could also be arranged with grooves so that the floating bulkheads, which should be held in reserve for use at the entrances in case repairs to the locks themselves were required, could be used in one or more intermediate grooves; thus two moderate-sized vessels could use the dock at the same time, entering and leaving when ready, and in this way it would be adapted for the use of the very largest merchantmen afloat or for a very moderate-sized vessel.

For a number of miles up the river into the Long Reach, so called, open water often extends almost all winter, and there would be little difficulty in keeping navigation open all the year in quite an extended area beyond the line shown on map No. 1 as "Edge of ice."

Present and possible lines of railway and docks are indicated in a general way on map No. 1, and more in detail on map No. 2, showing the high and low level service on the bluffs and wharves.

The general features of the river are shown by the sketch map No. 3.

No recent and general survey of the river has been made, and the exact nature or depth of mud at the approaches to the canal are unknown, but from the configuration of the shores one would suppose that at the outer end of the canal there would be rock foundation for the locks at or above the desired depth, while in the cove

at the other end the rock may run below the level of the necessary dredging.

The Admiralty made a survey of the main river as far as Fredericton nearly a hundred years ago.

The harbour area in the narrows is not wide, but it is about as wide as the present harbour of St. John. It forms an ideal land-locked harbour; the only defects to be guarded against in its use are the currents, which at certain points and certain times of tide are strong. For a few days during freshet special precautions would be necessary.

In a general discussion like this (before special surveys and studies have been made), it is not possible to anticipate or define all the conditions to be met.

If the Dominion Government would, for a time, establish a self-registering tide gauge above the falls its records in comparison with those of the one in the present harbour would give accurate data for working out many problems connected with the project.

Proposed wharves are shown on the maps which may or may not be found practicable, and do not need special description here, except that the guard pier shown at the mouth of Marble Cove, on map No. 2, would probably be a reinforced and thoroughly-braced pile structure, so as not to shut in the waters of the cove too much and cause them to freeze badly.

SCHEME No. 2.

Courtenay Bay is an area of sand flats, to the east of St. John proper, always bare at low water, bordered generally by flat or gently sloping land to the north and east.

Enclosed as shown by the outer bridge or dike, it comprises six hundred acres, through which, at low tide, a small creek flows.

The reclamation works contemplated by the plan are a pair of breakwaters nearly meeting at the creek. The opening would be spanned by a drawbridge, and possibly with the protecting moles shown, would form the entrance to the area from the sea. Then there would be added a well-regulated waterway up the creek, probably with branches to manufacturing sites. These waterways are supposed to be dredged out and walled at the sides, and the reclaimed spaces could be used for steel works, shipbuilding, etc., or for railway yards.

It has been proposed by some to use this area for a wet dock. The objections that occur to the writer in regard to that proposition are that it would require a very high and long watertight wall founded in what are apparently deep sands (untested as yet), and the large enclosed area of perfectly still water would freeze over in the winter, and would be hard to keep open.

Again, it has been proposed to dredge out a large part of this area and build piers, as in the present harbour, but this seems objectionable without having the breakwater, as in the reclamation scheme, as the position is exposed to the prevailing winds and storms, and would be hard to keep dredged out as an open roadstead.

The reclaimed areas, with tidal channels, would be more easily maintained, and would be of great value where there is so little level land as about St. John.

SCHEME No. 3.

The Marsh Canal is a continuation of one of the above-mentioned channels, carried through the level marsh to Drury's Cove, where a comparatively narrow ridge of rock separates the waters of the river and the marsh. The marsh is drained, and the tide waters are kept out of it by an "aboideau," or dike with trapped sluiceways, allowing only the marsh waters to flow through when the tide is low enough to permit.

The level of the marsh is very nearly that of high tide and about ten feet higher than low water summer level in the river.

A lock would be required at the lower end of the marsh and another at Drury's Cove. Probably most of the excavation through the marsh would be mud dredging, but the locks could be founded in or on rock.

This work would open up a large area for manufacturing sites, with facilities for transportation by water as well as by rail. If this canal were made large enough, it would be an alternative route to the river, but it—and especially its approach from the river side—would freeze in the winter.

On the map the Intercolonial Railway is shown diverted to the north side of the marsh. This is not a necessity but might be found expedient to give factories on that side of the canal the best facilities.

Against this scheme it may be said that the level marsh is none too large for future railway yards and terminal facilities.

SCHEME No. 4.

The South Bay Docks in connection with the next scheme are located in the river above and to the west of the narrows.

A tentative arrangement of wharves of considerable extent is shown with an enlarged waterway or short cut from the Bay to the narrows behind Green Head Island, through which a current could be maintained, so facilitating the removal of the ice which would form here in the winter.

A large amount of probably easy dredging and filling would be required to make this area available for the purpose designed.

SCHEME No. 5.

The Customs-Free Port needs some explanation as to its objects and how it would be managed.

England with its free trade has many free ports, and on the Continent of Europe, before Germany was consolidated, there were several "Free Towns", (small republics under their own Governments), which at the time of the consolidation held out strongly for their ancient rights, and as a compromise had a portion of their area, including harbour space, set off and practically walled in from the surrounding country and formed into a free port. Into these inclosures it is allowable for vessels to come and go, importing and exporting merchandise of all sorts free from all Customs dues of the country in which they are situated; duty is paid on dutiable merchandise only when it is taken into other parts of the said country for home consumption. Hamburg is the chief of these towns, and under changed conditions, without one-sided free trade in the country surrounding it, its commerce has been built up at such a rate, and to such an extent, that in certain lines it vies with, and even surpasses London itself in the quantities of goods imported into it, and stored till exported, or taken out for home consumption. Thus within a generation Hamburg has increased in wealth and population amazingly.

I quote the following from a U. S. Consular report of 1896:

"Hamburg, with its territory has an area of about 97,500 acres. According to the treaty of May 25, 1881, with the German Empire, the area of the free port was reduced to 2,500 acres, of which 750 were water and 1,750 acres land." All the residential portion of Hamburg was shut out from the free port.

"Some of the points of the treaty between the German Empire and Hamburg consummating the Customs union were about as follows:—

"The free town of Hamburg is prepared to join the Customs district of the Empire with its entire territory, with the exception of the district hereafter mentioned and described."

"For this district, which permanently remains to the City of Hamburg as a free port, article 34 of the Constitution of the Empire retains its validity, with the effect that the free port privileges of this district can neither be suspended nor restricted without Hamburg's consent."

"The free-port district comprises the North Elbe at Hamburg, the harbours and quays there, together with a part of the adjoining streets and blocks of houses, and the island in the River Elbe opposite the town, including the island of Steinwarder. Inside of this free port district, which is to be guarded by Customs officers exclu-

sively from outside, the movement of vessels and merchandise is exempt from Customs control, and the unlimited construction of industrial establishments is permitted."

Other large districts are to be added as required for use.—"The blocks of buildings belonging to the free port shall not be used as dwellings (with the exception of those necessary for warehouse keepers and for port, customs, and police officers) nor for retail trade."

"For the customs despatching system, in the Hamburg Customs ports special regulations will be issued in which the facilitation and simplification of the customs despatching will be given as much consideration as possible."

In consideration of a population of 800,000 becoming subject to customs dues— "The German Empire will pay towards the cost of buildings, establishments, arrangements, and expropriation a maximum sum of \$9,500,000.00."

A part of Hamburg had been a free port from time immemorial in the sense that its inhabitants or the traders from outside paid little or no duties on goods brought in.

"In the eleventh and twelfth centuries, importers and dealers were compelled to have large public sales at stated periods of the year. These regular fairs were held in order to advertise the city and to attract buyers. There were no customs duties on imports, but the Hamburg government compelled the master of the vessel and the owner of the goods brought in to declare the approximate value, and on this value a small tax was levied for the maintenance of a navy, to protect the commercial fleet against pirates."

Great changes were made at the time Hamburg joined the Customs Union.— "Everything in what may be termed the new free port was built with the object of inducing shippers all over the world to send their goods here for storage, for awaiting better markets, and for subsequent distribution, on a most liberal scale, and was made as attractive as possible for the purposes intended. The result was a concentrated succession of harbours, canals, piers, warehouses, etc., combining all the modern improvements and facilities, and together forming a harbour which, regardless of the question of exemption from customs taxation, might be used with advantage as a model by many of our younger growing seaports."

Some of the facilities mentioned are as follows:—"The hydraulic station has four connected horizontal steam engines, each of which furnishes 120 indicated horse power and two deferential pumps, the plungers of which are coupled direct to the steam piston, and can supply 1,906 cubic feet of water per hour at a pressure of 750 lbs. per square inch. This installation is capable of supplying the power for the working of two hundred and sixty windlasses, and fifty

elevators in the warehouses, and thirty-six cranes on the canal, including the necessary reserves. Most of the windlasses have a maximum raising power of 1,420 lbs., while some few raise as many as 1,908 to 2,860 lb. at a time. On an average the elevators can raise a weight of 2,640 lbs."

These were only a part of the plant in 1896.

"Hamburg has become the great door through which German export is finding its way to the world's markets. There is no important manufacturer in Germany who has not a representative in Hamburg. The same may be said of Bohemia and other industrial Provinces of Austria, and to some extent of Russia. These representatives are called export agents, and are the middlemen between the producer and the exporter. They have, in their large and comfortable establishments, continuous expositions of goods and samples of goods likely to be popular with buyers beyond the seas."

Copenhagen, though not one of these German free towns, has a free port, instituted at great cost, within its environs.

The kingdom of Denmark saw its trade in the Baltic threatened by the building of the German canal at Kiel and the rising German competition, and to ward off the danger, instituted the free port, which it is believed has proved a great success.

The object of instituting a free port at a place like St. John, N.B., is to provide a place where dutiable goods of all descriptions could be brought in large quantities, stored, assorted, blended, and perhaps manufactured to a certain extent, and exported again or shipped to any part of the country on the shortest notice, in any quantities required, free from interference from customs officers, till so shipped.

Thus English goods, for instance, could be held there under warrant or otherwise, and the store could be drawn on in large or small and assorted quantities without the uncertainty and long delay that now attend their importation over seas. Advances from the banks or trust companies could be arranged for at low rates on goods stored, and thus larger quantities could be carried in stock. Shipbuilding might be carried on, as is done in some of the free ports.

None but caretakers and Government officials are usually allowed to reside within the limits of the free port. Meals are supplied at licensed restaurants from stores that have paid duty on all dutiable importations, and the boundaries are strictly guarded, and perhaps walled.

To emphasize the advantages of a customs free port I quote from a pamphlet published by the Customs Reform Association of Copenhagen before a free port was instituted there:—"Of all the hindrances to business transactions there is none equal to customs

control for waste of time and trouble, especially as regards goods imported for subsequent re-exportation. The result is no gain to the revenue, but simply an aggravation of the difficulties caused by foreign competition.

" A free port is a harbour with an adjacent area of land, which the State declares to be emancipated from customs control. In its eyes it constitutes a slice of foreign territory, with which the customs authorities have no concern. Within the privileged district goods may be imported, stored, handled, worked upon, and finally re-exported, without those authorities having any voice in the matter. Not only could business now successfully carried on under customs restrictions be put upon a still more favourable footing by the help of such a port, but many which are at present incapable of forming remunerative undertakings would be changed into profitable enterprises.

" A free port (in this sense), is not one exempt from dues, but only from customs. The same port dues may be charged as in the ordinary portion of the harbour, of which the free port forms a part. Its object, however, would be defeated were not the said dues to be kept as low as possible.

" Bonded warehouses undoubtedly afford considerable facilities for both inland and foreign trade; at the same time they are but make-shifts when compared with a free harbour. All the advantages they offer are shared to a greater extent by the other, and any possible disadvantages connected with the latter exist tenfold in bonded warehouses. These are, in fact, merely portions of a free harbour, hampered by restrictions and expenses unknown to the latter; the continued customs inspection (or waiting for inspection), the limited business hours, the contracted space render all transactions difficult.

" At the time of the entry of Hamburg into the German Customs Union, attention was drawn to the fact that the mercantile importance of the town lay, not in its situation, but in its free harbour. Goods were actually brought far out of the most direct and, in other respects, cheaper route to their destination, in order to profit by the conveniences afforded at Hamburg for the various operations, inspection, sampling, sorting, repacking, etc., to which they could there be subjected in freedom from customs interference.

" That distance is far from being the only consideration in the fixing of freights may be seen from the timber freights between the Baltic and England. The distance to the Firth of Forth, to Hull, or to Yarmouth, for instance, from the Baltic, are nearly the same; yet freights to Hull are, as a rule, 10 per cent. higher, and to Yarmouth 20 per cent. higher than to ports in the Firth of Forth, while freights to Swansea and Cardiff are no higher than to places on the

east coast, in spite of the great difference in distance. The reasons for the above are: (1), the shipping expenses are greater at Hull than in the Firth; (2), that while from these two places return cargoes may be obtained, there are none to be found at Yarmouth; (3), that from Cardiff and Swansea there is an important export trade across the ocean.

Paraphrased.

An example of the pernicious influence of the customs system of bonded warehouses is that the customs authorities make a prior claim for the satisfaction of duties owed by the person warehousing, not merely in respect of the goods named in the warrant, but also of all goods imported by him. It may, therefore, happen that the amount of duty owing exceeds the value of the goods in question, and the warrants become worthless. In a free port no such prior claim could be asserted, and the useful institution of warrants could be introduced.

"An example or two may be given here of the loss of trade caused (to Copenhagen), by the want of a free harbour. Take, for instance, saltpetre, which pays a duty. We do not use enough of it to import whole shiploads direct from South America; these go, therefore, to Hamburg, London, or other free ports, are there divided and distributed. Had we a free port the distribution could take place here. We should save the Hamburg charges for ourselves, reap the benefit, and secure freights for our vessels. If we take an original shipload of 1,000 tons, of which 300 only are required here, under present circumstances only 300 tons enter our port; with a free port 1,000 would enter and 700 go out, leaving a profit to the port nearly six times as great. Take, again, the wine trade. A great wine business, when wines from all parts of the world can be stored, blended, and otherwise prepared to suit the tastes of the markets, can only be carried on with the help of a free port. Such a trade would be invaluable for our steamship companies, and might make an opening for our own fruit wines. For this purpose, however, it is necessary that customs operations should be limited to those articles really consumed, *i.e.*, which are actually imported for consumption in the country.

"During the negotiations attending the entry of Hamburg into the Customs Union, one of the principal firms there expressed themselves as follows:

"Since the abolition of the excise duty upon spirit, our business has increased so much that but a small portion of our turnout is consumed in the country. Our position as a free port has alone sufficed to lend this importance to our trade with Great Britain, France, Holland, Spain, Portugal, Italy, and several transatlantic

places. Even if a return of duties were possible to be made, the waste of time involved would prevent prompt attention to foreign customers; orders for instance, received (to no matter what extent), from England or France are expected to be executed within 24 hours.

"Another large firm declared that the trade in train-oil would be entirely ruined by the inclusion of the port of Hamburg in the Customs Union.

"The same opinion was expressed by other firms with respect to the transit trade in the direction of Denmark, Norway, Sweden, and Russia. The drug trade to Russia, Austria, Switzerland, Italy, France, and Holland was greater even than to Germany itself, some portion even going to transatlantic places; but it would be impossible without a free port. The same was said in regard to coffee and tea.

"Over and over again the free port was quoted as the principal source of the mercantile greatness of Hamburg."

The Dominion of Canada should have one or more free ports on the Atlantic and the Pacific. St. John, N. B., and Vancouver, B. C., are eminently well situated for the location of such ports. They have rapid communication with all parts of the Dominion and the United States by rail, with ever open harbours for the commerce of the world. If the Dominion Government could see its way to establish such Customs-Free Ports it would be of great benefit to the whole country. If, in addition to this, the harbours were made national free harbours in the sense of shipping being largely freed from tonnage dues, and the customs preference was confined to goods imported direct through Canadian ports, moderate geographical disabilities would be of little count, and there would be little dread of outside competition.

If there proved to be insuperable difficulty in making a free port in an old established port, Turbelton Bay and River Inhabitants Basin, in the southern corner of Cape Breton, is the best unappropriated site for a national harbour. It is one of the most easily approached harbours on the Atlantic seaboard, free, or easily kept free, from ice in the winter, and never blockaded by drift ice, well sheltered from the prevailing storm winds, and always accessible through wide waterways, with no outlying dangers in its approach save one rock, that should be so guarded by light, etc., that it would be the guide to the entrance. Connected with Guysboro and the Halifax and Eastern Railway by a car ferry, it would form a fine terminus.

From an Imperial point of view, this Customs-Free Port, with large stocks of British manufactured goods carried at the lowest cost, ready for immediate delivery, is of the utmost importance. Without it, and adequate advertising in printed matter sent broad-

cast over Canada in literature that Canadians will be interested in, the manufacturers in the British Isles cannot hope to hold their own against those of the United States, even with a very considerable preference. The public want prompt delivery after they have decided to order, they want goods that they know something about. Manufacturers cannot afford to have personal representatives everywhere; with this point in view it should be made easy for Canadians to have English periodicals at reasonable prices, subject to reasonable (from their point of view), postage charges, carrying up-to-date advertisements as well as Imperial reading matter.

The location shown for the Customs-Free Port is not the only one that might be chosen about St. John, but it is a good one in that there is a large amount of room, in and about it, for immediate use and future extensions. The one objection that might be raised is that South Bay freezes over in the winter, but this can be remedied. It is a large but comparatively shallow cove, and when the docks and waterways are dredged out the warm currents, referred to in a note above, can be guided through it, and this, with ice-breakers and other means, will keep it sufficiently clear of ice. The inner part of the bay is shown as if it were built over with blocks of warehouses and roadways built over waterways for barge transport between; thus this part could be covered over and closed in so that there would be little tendency for the water to freeze. The dock spaces between the piers in the outer part would be cleared of ice by currents running into and through the waterway to the narrows.

The dredging would probably be largely in silt, that could be moved by suction dredges and deposited where required.

The arrangement of piers, etc., is different in the lantern view and map—and, of course, is a tentative one.

A double deck arrangement for railway tracks on the wharves, with car elevators at intervals, would seem to be a good one, to save shunting room for sorting out empties and keeping the coming and going stream of cars separate.

SCHEME No. 6.

Improvements and extensions in the present harbour.

A number of extra piers are shown to the south of the Canadian Pacific Railway dock on the west side of the harbour. For these extensive dredging, of an expensive nature, will be required, a large part of which may be in rock. When Negrotown Head breakwater is extended to Partridge Island, at the mouth of the harbour, closing the west channel, this tier of piers or wharves can be continued to the Island. Other wharves may be added, as shown, north of the Canadian Pacific Railway dock, replacing the antiquated lumber

wharves at present occupying the "flats." One of these new wharves is about being constructed.

Lines of shore wharfing could be carried up the sides of the river channel, between Navy Island and the bend below the bridges.

Considerable improvements can also be effected on the eastern side of the harbour, especially by carrying a tier of piers down on the "foulground" to the south of the city (east), when the further protection is gained by the closing of the west channel, above referred to, and possibly by running another breakwater from Partridge Island eastward to the edge of the main channel.

In addition to this wharf accommodation, it is proposed to locate extensive railway yards on the beach behind the tier of wharves south of the Canadian Pacific Railway wharf, and to locate a dry dock in the pond back of the Canadian Pacific Railway dock.

NOTE.—(Carleton is, in part, built over tidal flats. These flats were diked in forming a mill pond long ago used to supply power to a tide mill.)

All these improvements should be made under a connected and well-considered plan.

In the writer's opinion, several mistakes are being made for the want of such a general plan.

(1) The location of the dry dock is deemed bad, as it will occupy ground that should be devoted to terminal facilities. It lies at the head of a most important tier of wharves, to which it cramps the approach. In fact, all the low ground in Carleton should eventually be given up to railway purposes.

(2) The idea of putting in a swing bridge, as proposed, at the head of the Canadian Pacific Railway dock, in the approach to the dry dock, instead of a drawbridge, seems unreasonable, as it wastes dry dock room, and precludes the multiplication of tracks to the piers that will eventually be built to the north.

(3) There is an angle in the north face of the Canadian Pacific Railway wharf at about midlength, and it is proposed to build the next wharf nearly parallel to this face, with corresponding bend, and three hundred feet distant, so that it will be difficult for large vessels to get to the head of the slip or pass through to the dry dock entrance when all the loading berths but one, at the head of the Canadian Pacific Railway wharf, are occupied with large vessels. A sketch of a possible case is shown. This break in the line of face makes it impossible to use the line of wharf to the best advantage, as vessels of all lengths have to be accommodated, and each part of the face may not be long enough for three vessels, while there is waste room with two. The writer suggested the arrangement shown on map—leaving the triangular water space at the head of the Canadian Pacific Railway dock—thus giving a

long, straight wharf almost the full length to Union street. The line of pier would then be in accord with a general plan. It would mean a little more dredging at once.

Further, in the plan adopted, instead of the outer part of the new pier being exactly parallel with the Canadian Pacific Railway wharf, it is proposed to make the slip one hundred feet wider at the outer end than at the bend. This will improve the entrance slightly, but may interfere with a general plan for future developments.

Pile work, as ordinarily used for wharf building, does not seem to be successful in Bay of Fundy waters, on account of the great rise and fall of the tide and the nature of the banks into which the piles must be driven, consequently crib work or other solid construction is always used, though expensive. Some cases where pile work has been tried and failed are as follows:

At the Fort Laurance end of the Chignecto Marine Transport Railway a temporary wharf was built on piles. When it was scarcely finished, some weight was put on the bank behind, and the whole bank slid off upsetting the pile structure into the bed of the river.

In a similar manner it was attempted to build part of the Canadian Pacific Railway wharf in St. John. Before it was finished, and without any added weight behind, the bank gave way in much the same manner.

The explanation would seem to be that the silt banks, with running water at the foot when the tide is out, stand at a steep angle—greater than their ordinary angle of repose. When piles are driven into them they are disturbed and water probably follows down the pile, loosening the cohesion and together wedging off a prism.

To guard against this it would be necessary to cut down the bank to or beyond the angle of repose, and to brace the piling from the new surface up.

SCHEME No. 7.

Shutting in the present harbour.

This scheme has been advocated by Superintendent Osborne, late of the eastern division of the Canadian Pacific Railway. By it, it is proposed to shut in the harbour of St. John, including Courtenay Bay, and an area outside the present harbour, by watertight dikes extending from Partridge Island either way to the mainland, with a lock, or locks, at the channel entrance, and with a sluiceway at the eastern side, so regulated that there would not be more than about a five foot rise and fall of tide in the part shut in. The railways would run out on the dike and make connection with the docks on the inside; a great amount of dredging would be rendered

unnecessary, and deep water would be retained over a large area, where wharves at comparatively moderate expense could be constructed. This is a magnificent scheme, and would make a fine harbour if it could be properly carried out without too great cost or too many drawbacks. Its cost would be very great; the dike would average fifty feet high above the present bottom, the depth to which might increase very largely by scour while the work progressed, as the foundations are uncertain; it would have to contend with ice formation in the winter, as in large sections of it there would be little or no current; it would have a tendency to back up the water of the river, perhaps flooding valuable lands, and would gradually silt up and eventually necessitate very extensive dredging, and, further, it would necessitate extensive protection works at the lock entrance, with an adequate artificial harbour of refuge outside for coasting vessels.

SCHEME NO. 8.

Further effects of the canal.

The canal, from the head of the present harbour to the St. John River proper, besides opening up the new harbour above the falls, will open up a large part of the centre of the Province to ocean traffic. When opened it will allow the largest ocean steamships to pass up the St. John River in wide, deep waters — waters which average a quarter of a mile wide and over 40 feet deep for 20 miles, or about to Oak Point. Should the traffic warrant keeping this stretch open in winter the ice would not be an insuperable barrier, as there is often open water through parts of it during the winter months. It would give an opportunity for new manufacturing cities to spring up.

In a more restricted channel, with but little improvement, vessels drawing twenty-five feet could go miles further up to the Spoon Island granite quarries and into the Belleisle, which is a long, deep, lake-like river expansion. Again, vessels drawing 20 feet could go to Gagetown, miles up and into the Washade-moak and Grand Lake, tapping the coal fields of New Brunswick.

Above Gagetown large regulating works, raising the summer water level eight or ten feet, would be required to carry vessels drawing twenty feet as far as Fredericton, the capital of the Province, 79 miles by river from St. John.

Then, again, access would be given to the Kennebecasis with wide, deep waters running close in shore, making Rothesay, Clifton, and other villages into possible sea ports, and carrying ocean navigation 30 or more miles in this direction.

The St. John Valley, below Fredericton, is capable of raising and exporting thirty thousand head of cattle annually.

